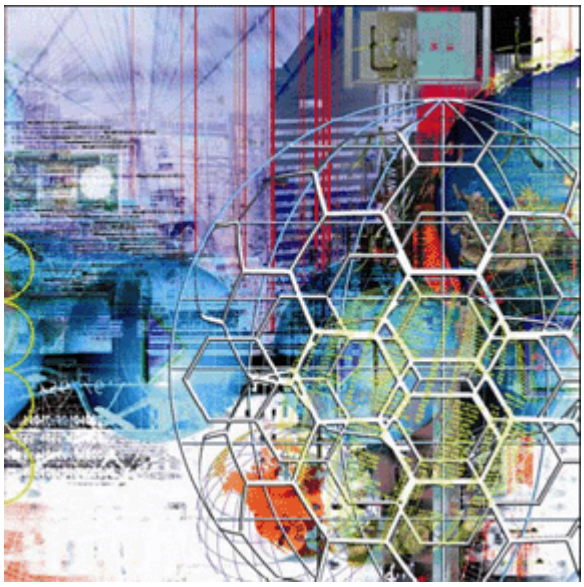
Implementing local Spatial Information Infrastructures;

Are Municipalities INSPIREd?

By Wilbert Kurvers



Graphic: Infrastructure (Bull)

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Declaration of originality

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to the Manchester Metropolitan University or to any other institution for assessment for any other purpose.

Signed: W.G. Kurvers _____

Maastricht, The Netherlands (3 September 2007)

Acknowledgments

Around six years ago, I got in touch for the first time with GIS and I became fascinated by the power of visualising and integrating information. When I had a chance to get a job in this sphere of work, I immediately accepted. It is therefore no surprise that I started with the UNIGIS education to learn more about this topic.

This thesis is the conclusion of a training in which I have learnt a lot.

I have experienced that GIS can be a catalyst to start up joint initiatives, not only at the local level, but also at the regional and even international levels.

In this research, I have tried to find answers to practical problems I face in my effort for improving the exchange of information and for strengthening cooperation links between governments.

For attaining this result, I am greatly indebted to several individuals.

I want to thank my supervisors, Rob van de Velde and Henk Scholten of the Free University of Amsterdam and Melvyn Woodcock of the Manchester Metropolitan University. A special word of gratitude to Rob who made sure I continued to see the wood for the trees and that the structure and construction are scientifically well–founded.

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The years of study have also had consequences for my family. Mathil, Lieke, Tim and Nellie, it would not have been possible to successfully complete this study without your support.

Abstract

Municipalities are under pressure to improve the services they provide to companies and citizens. An efficient information exchange is a requirement for supporting local processes such as e.g. the spatial planning process.

At the European level, INSPIRE is being developed but the question is whether the municipalities are willing and able to implement a Spatial Information Infrastructure?

Theory shows that organisational rather than technological aspects will determine whether the municipalities will be able to implement a Spatial Information Infrastructure (SII). Based on the key factors for SII implementation, this research has developed a model to determine SII maturity of the studied municipalities from an organisational perspective. Besides, different models were applied to measure whether the municipalities are willing to implement SIIs as well as to measure the current implementation status in the municipalities.

Based on these three studies, we have determined whether the municipalities are willing and able to implement a SII.

The conclusion is that municipalities in the Dutch province Limburg (as a whole) are not willing and/or able to implement a Spatial Information Infrastructure. Research in the adjacent German Kreis Heinsberg yields similar results.

Indeed, the principal obstacles when implementing a SII have turned out to be of an organisational rather than of a technological nature. Finance and culture were important aspects.

At the same time, municipalities had insufficient knowledge of what a SII is and what it can mean for the municipalities.

Particularly the smaller municipalities have difficulties to implement a SII. Collaboration, possibly in a shared service centre, could be a solution to share the necessary knowledge and experience and gain efficiency. For ensuring the success of INSPIRE also at the local level, actions should be taken now in view of the detected bottlenecks!

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1. Introduction

1.1. Background

Dutch municipalities are experiencing considerable pressure to improve the services they provide to citizens. The objective is to digitally provide 65% of the services in 2007 (Andere Overheid, 2003). The Andere Overheid ("A different government") programme, covering among other things the introduction of base registrations, front- and backoffice, requires major efforts in the field of (GEO)ICT. New laws such as WKPB[1] and WRO/BRO[2] demand a lot of the maintenance of and access to (Spatial-)information.

Evolutions on the European level, the Århus Treaty[3], the directive on the Re-use of Public Sector Information[4] and the framework directive INSPIRE[5] will demand considerable efforts as well. Are the municipalities able to cope with these changes?

For responding this question, it is necessary to ensure access to and share the often still segregated available information. There are some occasional cooperation initiatives using Spatial Information Infrastructures (SIIs) to exchange information based on the data at source concept. Nonetheless, the development of a Spatial Information Infrastructure is complex and so far little research has been performed in this field (Van Loenen, 2006; Crompvoets, 2006).

Municipalities are busy digitalizing and ensuring exchangeability of their spatial plans, which is obligatory within the framework of the new Spatial Planning Act (WRO). A Spatial Information

[1] Wet Kenbaarheid Publiekrechtelijke Beperkingen (Disclosure of Impediments under Public Law Act) 17-6-2004 (331).

[2] Wet Ruimtelijke Ordening / Besluit op Ruimtelijke Ordening (Spatial Planning Act) (28.916) 23-2-2006: expectations are that this act will enter into effect 1 July 2008.

[3] Directive 2003/4/EG EP and Council of 28-1-2003 on public access to environmental information.

[4] Directive 2003/98/EG EP and Council of 17-11-2003 on the re-use of public sector information (Wet Openbaarheid van Bestuur (Freedom of Information Act)).

[5] INSPIRE Directive 2007/2/EC EP and Council 14-3-2007 on the creation of a spatial information infrastructure in the EU.

Infrastructure can add considerable value to this process. Spatial Planning is the central topic of this research, covering the concrete user demand for implementation of a SII.

1.2. Research question

Research carried out by Grothe and Scholten (1996), Colijn (2000) and Peters (2003) shows that the use of Spatial Information in Dutch municipalities has increased considerably, with an increase as well in the number of municipalities that has a specific division or officer responsible for setting up, implementing and maintaining GIS applications during the measured period of time. In 2003, points out Peters, 30% of the municipalities used GIS municipality-wide and 54% mentioned working on this.
An interpolation of these numbers suggests that at the moment, most municipalities have implemented GIS throughout the organisation. Colijn and Peters also mention a link between the size of a municipality and GIS use. The bigger the municipality, the more chance it uses GIS.

For satisfying the demand regarding information exchange, the logical next step would be implementation of a Spatial Information Infrastructure. Spatial Information Infrastructures (SIIs) offer a solution for granting access to spatial information (INSPIRE, 2006). In view of the development of geographical information systems at the municipal level, expectations are that at this moment a number of municipalities are involved in granting access to their geographical information through internet technology. But are most municipalities fully aware of the advantages of a SII? Colijn (2000) mentioned that many municipalities did not know the NCGI, the National Clearinghouse Spatial-Information, one of the principal components of a national SII (GSDI Cookbook).
Masser (2005) has made several studies of the worldwide dissemination of SIIs, by means of Rogers' Diffusion of Innovation model (1995). In this descriptive model, 'communication channels', communication on development, play an important role. Besides, a Spatial Information

Infrastructure is mainly seen as a technically very complex matter with a major impact on the ICT environment.
However, the acceptance of technology is not the most important issue when implementing new technologies (Pijpers et al, 2002); more important is the personal motivation or willingness.
This leads to the question whether the municipalities are willing to implement a SII?

In view of the complexity mentioned by Van Loenen and Crompvoets, another question is whether the implementation of a SII is indeed the solution for municipalities. Looking at studies on GIS use, one of the determinants is the degree to which the municipalities have made progress in their GIS development or whether they have meanwhile started to implement a SII. An additional consideration is that at the moment, the 'Andere Overheid' programme already overwhelms the municipalities with many things.
From an organisational perspective, implementation of a SII can be considered as an organisational development (Van Loenen, 2006). In this sense, many organisational factors will determine whether the municipalities are able to implement a SII. This leads to the following question: are the municipalities able to implement a SII?

Together, the 'willingness' and 'ability' determine whether a municipality can successfully implement a SII. Joining these two elements, we can formulate the research question:

Are municipalities willing and able to implement Spatial Information Infrastructures?

The purpose of this research is to find out whether the municipalities will have problems when implementing a SII and, if so, based on the research results and the gained knowledge, to make recommendations so the municipalities would be better able to satisfy the demand for information exchange.

Crompvoets and Van Loenen have seen that little research has been done on the implementation of SIIs. Hence, this study will test both a series of subquestions and carry out explorative research on the implementation of SIIs in municipalities.

1.3. Subquestions research

Masser mentioned communication channels as a crucial element for the development of a SII. Research performed by Colijn and Peters shows that the number of municipalities in the Netherlands using geographical systems is increasing, though many municipalities do not know the National Clearinghouse Spatial-Information. Also because of the complex nature of this field, small municipalities have insufficient knowledge of SIIs. This gives rise to the subquestion:

1. Is the value added of Spatial Information Infrastructures unknown to municipalities?

Masser characterises the implementation of SIIs as something that is not only of a technical nature, but also of an institutional nature. Rajabifard et al (2003b) consider that the development of a successful SII is a socio-technical exercise rather than a purely technical matter. Borrero (1998) even points out that the principal constraints when implementing a SII are of an organisational rather than a technical nature. This gives rise to the subquestion:

2. Are the principal obstacles when implementing a SII rather of an organisational than a technical nature?

Nedović-Budić and Pinto (2000) have observed that the use of geographical information systems for spatial planning at the municipal level does not get off the ground. They mention ‘People issues’ as the central culprit, followed by issues such as technology and costs. They also refer to the availability of up-to-date data as a major stumbling block.

Spatial Planning processes are complex, involving many organisations. Chain cooperation implies specific demands as regards the way in which parties cooperate and exchange information. Verschuur and Mettau (2001) mention culture as an important organisational factor in the SP phases. Also people issues partly find their origins in cultural aspects, which gives rise to the subquestion:

3. Does culture play an important role in implementation of a SII?

Rajabifard (2002) points out that, among other things, rapid technological developments provoke quick changes in Spatial Information Infrastructures. Because of the emergence of Internet and web technology based services, technically speaking it has become easier to access information. Carrera and Ferreira (2007) mention the web service approach as the most excellent way in which municipalities can exchange information cheaply, efficiently and in a sustainable manner.
Hence, technology should no longer be a bottleneck. Nevertheless, considering the supposed problems at the municipal level mentioned by Duivenboden, Van Loenen en Nedović-Budić & Pinto, the following subquestion will be investigated:

4. Is technology a bottleneck for implementing a SII in municipalities?

In 2007 and 2008, the European INSPIRE framework directive will be turned into a national law, obliging the municipalities to implement a Spatial Information Infrastructure between 2009 and 2013 and to grant access to their spatial plans.
Probably, it will be difficult for small municipalities to comply with this directive (Duivenboden, 2005; Van Loenen, 2006). In the research of Duivenboden and Van Loenen, small municipalities are specifically mentioned as a target group that will probably have problems to implement SIIs. Colijn and Peters already mentioned the relationship between the size of the municipality and the degree of GIS implementation. This gives rise to the following subquestion:

5. Do smaller municipalities have more difficulties to implement SIIs as compared to the bigger ones.

The municipalities covered in this study are located in the border area with Germany. The lack of up-to-date cross-border information hampers cooperation links with municipalities on the other side of the border as well as economic developments in the region. Often, no information is available or there is no information on who is the owner of what information. The language barriers, the cultural differences and the differences in laws and regulations further increase the need for information. Among other factors, the limited availability or usefulness of cross-border Spatial Information is the result of use barriers such as copyrights and funding, differences in the data content such as legends, data models and semantic differences (Annoni, 2000). Besides, there are differences in scale units, coordinate systems and file formats (Bulens et al., 2006). A Spatial Information Infrastructure can play an important role in this.
INSPIRE recognises the importance of ensuring access and harmonising spatial information across country borders (Annoni and Graglia, 2005). For taking adequate advantage of the value added of a SII also across the border, it is important to know up to what extent the neighbouring German municipalities are able to grant access to Spatial-Information. Annoni and Graglia recognise the isolated SIIs as a bottleneck for information exchange. This gives rise to the following subquestion:

6. Are the neighbouring German municipalities able to grant access to Spatial-Information?

Based on the theory and the studied municipalities, this study will try to answer the different subquestions.

1.4. Recommendations Municipalities

Implementing a SII is complex. This research examines the aspects affecting the municipalities' willingness and ability to implement SIIs. Subquestions are used to do more specific research. Based on an analysis of the research results, recommendations will be issued for the municipalities as regards the implementation of SIIs. Assuming that Duivenboden and Van Loenen are right in expecting that small municipalities have problems to implement SIIs, it is a good idea for this research to also have a look at possible solution directions. Studying the theory of SII implementation, possibly recommendable solution directions will appear. The purpose of this research is to find out whether there are possibilities for the (small) municipalities to be better able to implement SIIs.

1.5. INSPIRE recommendations

The framework directive INSPIRE entered into force on 15 May 2007 and at the moment of writing this thesis, the implementation guidelines are being drafted. Local public entities are the principal GIS users and can only benefit fully from this if the INSPIRE Spatial Information Infrastructure is not only implemented at the national and regional levels but also at the local level (Masser, 2007). The municipalities are given increasing responsibilities in policy development and execution. They have become the window for (European) citizens and companies. Hence, the municipalities are an important target group of INSPIRE.

INSPIRE can also be a solution for the cross-border bottlenecks. Albeit that spatial plans are not a part of the INSPIRE datasets prioritised for harmonisation (Annex 1-3[6]), they are extremely important for spatial development in the border regions. The result of this research is a series of recommendations towards the development of INSPIRE at the local level.

[6] INSPIRE implementing rules data harmonisation Annex-1-3 datasets (INSPIRE, 2006)

1.6. Reader guide

This chapter has described the problem and has defined the research question. Besides, a series of subquestions were formulated to help focus the research.

The second chapter reviews the available literature and describes models that can be applied in the study. Given the broadness of the topic, different domains of science are discussed. One of the applied models is inferred from the theory.

Chapter three describes the research set-up. Different models are needed to be able to answer the research question.

Chapter four describes the results of the three studies and based on an analysis of the coherence between the three models, we determine whether the municipalities are willing and able to implement a SII.

Chapter five draws the conclusions of the study and gives an answer to the research question and subquestions. Recommendations are also given for both the municipalities and INSPIRE.

2. Theoretical framework

2.1. Introduction

This chapter outlines the theoretical framework on which the research is based, covering different domains of science: both GEO/ICT and Spatial Planning, and Organisational Science, Change Management and Sociology.

The research question 'are municipalities willing and able to implement Spatial Information Infrastructures?' is broken down in parts, with the first part being a description of the development of Spatial Information Infrastructures (SIIs). The complexity of SIIs is 'reduced' by separately naming the SII components. This is done by using the Rajabifard model (2002). For every component, a more in-depth study is made of the relationship with INSPIRE and the consequences for the municipalities. We should underline that Spatial Information Infrastructures encompass many aspects and that a description of all aspects of SIIs is not among the objectives of this study; rather, this study is limited to the aspects that, in our opinion, are relevant for this research.

Secondly, the research has a look at the implications for municipalities of the implementation of Spatial Information Infrastructures, mentioning collaboration as a possible form of organisation.

A (theoretical) analysis is made of the concept 'willingness' in relation to the implementation of SIIs, covering different models. Rogers' Diffusion of Innovation model (1995) that has been used on several occasions to describe the diffusion of SIIs, as well as the Technology Acceptance Model (Davis, 1989), which seems adequate for predicting the future use of innovations.

For examining whether the municipalities will be 'able' to implement SII, a description is made of the SII innovation phases (Van Loenen, 2006), thereto using Nolan's organisational development model.

By linking the innovation phases to the critical implementation factors of a SII, a SII maturity matrix is prepared from an organisational perspective. Also with regard to the concepts of 'willingness' and 'being able to' we must note that several research domains are covered and that because of

the enormous amount of information available, mainly for reasons of practical use this study has had to limit to the, in our opinion, most relevant parts.
Finally, the need for the municipalities to implement SII is clearly shown in the topic of Spatial Planning, and more specifically the Digital Exchange in Spatial Processes (DURP) process.
This thesis interchangeably uses both the terms 'Geo-Data Infrastructure' (GDI) and 'Spatial Information Infrastructure' (SII). Whereas the term GDI was more widely used in the past, today SII is the commonly used term. This thesis uses both terms in their time (temporal) context.

2.2. Spatial Information Infrastructrures (SIIs)

2.2.1. Development

As from the mid-eighties, the first forms of Spatial Data Infrastructures (GDI) appear (Masser, 1999). The principal reason underlying this evolution is that spatial is expensive and a GDI ensures access to spatial data. This avoids having to gather and manage the same data more than once (Rajabifard et al, 2003). In the US, Executive Order 12906 issued by president Clinton (Clinton, 1994) was the go-ahead by excellence for setting up a national GDI. Research by Masser (1999) and Crompvoets and Bregt (2003) shows that different countries in the world followed this initiative of starting up a national GDI. In the Netherlands as well, the RAVI (Council for Real Estate Information) started with a first form of GDI already in 1996 (Bregt, 2003).

Also at the European level, several initiatives were undertaken to set up a European GDI.
The EU started up the GINIE programme (2001-2004) aimed at realising a 'Geographic Information Network In Europe' (Craglia et al, 2003). Next, in July 2004 the European Parliament adopted a proposal for preparing a legal directive. Recently, in November 2006, the European Parliament and Council have reached a consensus on the directive for implementation of an 'INfrastructure for

SPatial Information in Europe' and INSPIRE will enter into force on the 15th May 2007 (INSPIRE, 2007).

INSPIRE has been developed in conjunction with the European member states. Its intended purpose is to ensure availability of relevant good-quality spatial information in support of joint (policy) objectives with an area-focused dimension or, as the case may be, impact.
While the GINIE mainly centred on a strategic level, the INSPIRE also focuses on the tactical and operational levels (Marchesini, Feb 2003).
The EU countries have two years to turn the directive into national legislation and to make preparations for the implementation that is projected to take place between 2009 and 2019.

2.2.2. Definition

When one first thinks of infrastructure, one is likely to think of technology. But an infrastructure is both a technical and social construction (Star and Ruhleder, 1996).
An infrastructure is not only embedded in other structures (Borgman 2000), but it is transparent and complies with its tasks invisibly. It becomes most visible when it no longer functions, e.g. when there is a power cut.
According to Borgman, a Geo-Data Infrastructure is a 'technical framework of information and communication technology, information content, services and people, which all interact in complex and often unpredictable ways'.

The Executive Order (Clinton, 1994) defines the national Geo-Data Infrastructure as the technology, policies, standards and persons needed to collect, save, process, distribute and enhance the use of geographical information.

Masser (1998) mentions the following superior objective of GDI initiatives: promoting economic developments, enhancing a better public administration and guaranteeing a sustainable environment.

According to Van Loenen (2006), the definition of a SII has developed from a purely technical one to a definition covering also information content and people: ‘a framework that constantly supports the efficient and effective development, processing and use of the needed geographical information in or between organisations’.

The INSPIRE Directive (2007) defines it as exchange, sharing, access and use of interoperable spatial data and spatial data services across the various levels of public authority and across different sectors.

GDI is an initiative that has been defined in many ways (Rajabifard et al, 2003). The common factor is the intention to create an environment in which all stakeholders can collaborate with one another and interact with technology to reach their objectives on different political / administrative levels. Rajabifard et al conclude that GDIs are explained in different ways because the stakeholders come from different disciplines or backgrounds.

Research also shows that by nature a GDI is multi-levelled, composed of hierarchically linked GDIs on the corporate, local, provincial, national, regional and international levels. At the same time, GDI developments show that a GDI is a dynamic entity on the provincial level; the identity and complexity change and become increasingly complex over time (Chan and Williamson, 1999). Therefore, a GDI should not be viewed as a simple entity but as a hierarchy of infrastructure models that are linked to one another through business processes.
In view of this complexity and dynamic nature of GDIs, Coleman and McLaughlin (1998) argue that you can best define a GDI by describing the components.

2.2.3. GDI components

According to the Australia New Zealand Land Information Council (ANZLIC, 1998), a GDI consists of four basic components: an institutional framework, technical standards, fundamental datasets and clearinghouse networks. In this interpretation, an 'institutional framework' is viewed as the whole of policies, standards and administrative agreements for building, maintaining and ensuring user access to datasets.

In Coleman and McLaughlin's opinion (1998), the missing element in this is the human component; they mention the interaction between geodata providers and users as an important component in GDI development.

Looking at the interaction between the GDI components, different categorisations can be used to describe the differences in nature and dynamics within the GDI framework.

Rajabifard (2002) mentions the interaction between people and data as one category and access network, policy and standards as the second category covering the main technical components. The nature of both categories is dynamic because of the changes in user groups and their needs, which also results in changes in their need and demand for data.

Besides, technology develops very quickly so at the same time there can be changes in the need for mediating on the rights, restrictions and responsibilities between people and data.

This suggests that an integral GDI can be composed not only of spatial data, value added services and end users, but that it is also connected to important issues such as interoperability, policies and (access) networks, reflecting the dynamic nature of the GDI concept (see Figure 2.1).

Crompvoets (2006) has applied the model in his research on the worldwide development of national clearinghouses for classifying the research results.

By describing a GDI on the basis of a description of the components, it becomes possible to determine the extent to which GDI components are already present or are being developed when

looking at a municipality. This way, the model becomes a measurement instrument for determining the IST situation of municipalities.

In this sense, it is necessary to first describe the components from the theoretical framework.

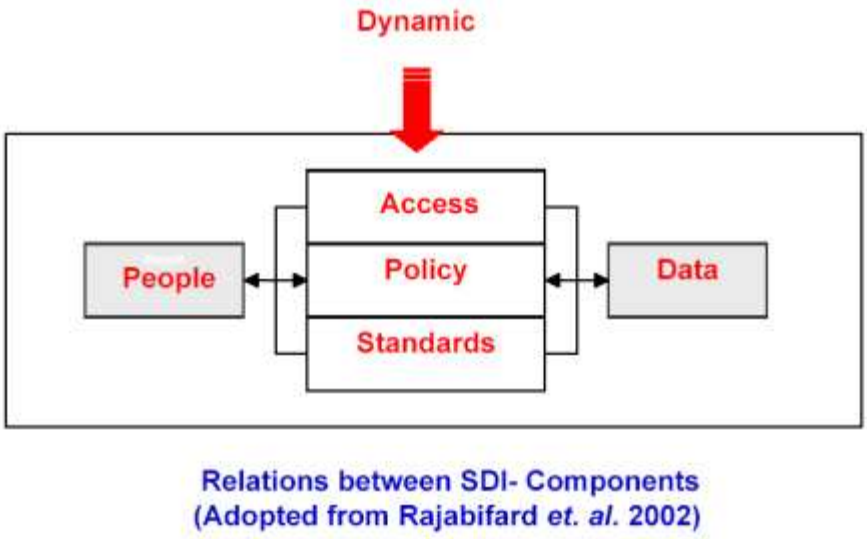

Figure 2.1 SDI-Components

People:

These are all stakeholders both on the supply side and on the user side of a SII.

Suppliers:

Many people are involved in the development and implementation of a SII.

The first are the parties taking charge of coordination of the SII. In the case of municipal SIIs, this could be the province, a large municipality or several municipalities working together.

Another important party are the stakeholders as the supporting surface and as the resource providers to build up and maintain the SII. Political support is a very important aspect (Van Loenen, 2006).

Geo and ICT divisions support the technical implementation and accessibility of the data. The Spatial Planning (SP) divisions are the source holder of the spatial plans and are responsible for the content and quality.

Besides the municipalities themselves, the reference data providers (national data producers) and (external) suppliers of thematic information such as other governments are also on the supply side in the SII network.

SII users:

McLaughlin and Nichols (1994), as quoted by Van Loenen (2006), state that users of the SII "will probably be the most mentioned group and yet actually the least considered".
Rajabifard et al (2003) underline that user needs are the driving force behind the development of a SII. Rajabifard states that the nature and characteristics of GDI developments are defined from different views on users' needs. They mention partnerships, social systems, the dynamic nature and the stakeholders as different determining views.

Data:

The types of datasets we distinguish in a SII are reference data (framework datasets) and thematic data. The purpose of reference data is to recognise the geographical location in the environment. The most common reference datasets are topographical datasets, administrative boundaries and cadastral property maps (Onsrud, 1998). Air photos and satellite images can be considered under this category as well.
The INSPIRE Position Paper Reference Data (2002) mentions two main ideas on which the reference data concept is based:

- It is a series of datasets used by all parties involved in geographical information for referencing their own data as part of their work. It is therefore a general basis for referencing thematic data.
- It offers a universal link between applications and hence, a mechanism for people to share knowledge and information.

The usability of data without underlying reference data is often limited, points out Van Loenen.

On the other hand, he observes that as more information is added to reference data the use value improves, while the proportionate cost of adding information is low as compared to the value of the initial basis of reference data. Micus (2001) refers to this as ‘the paradox of the value creation’. Municipalities are also source holders of the Large-scale Base Map of the Netherlands and, among other things, they use it to reference their spatial plans.

The second important type of data is the thematic datasets. In a municipal SII, not only the municipal spatial plans (zoning plans) are important, but it is also important to have access to landscape plans, environmental information and other thematic information; at the same time, a SII enables comprehensive access in the organisations to information from multiple sources.

INSPIRE has referred to datasets that should be harmonised, the so-called Annex 1 and 2 data. The central idea is to align datasets at the European level.
At the national level, agreements will be reached on the extent to which local datasets must be harmonised, with direct consequences for the municipalities.
The DURP programme (2007) has defined exchange standards which contain a detailed description for the topic of Spatial Planning on how the information must be standardised from a content perspective.
The new Spatial Planning law will enforce this as an obligation.
For the Large-scale Base Map of the Netherlands, different harmonisation routes are meanwhile ongoing and the aim is to determine the map as a primary registration.

<u>metadata:</u>

An important aspect of data is their ‘fitness for use’ or quality. What is the required precision, on what scale level have the data been collected and how up-to-date are they?

INSPIRE also refers to data quality as an important issue. The data must be of an acceptable quality. INSPIRE advises to use ISO standards when defining quality principles and procedures. The quality of data is described in the metadata.

Metadata is commonly defined as "data about data" (Kildow 1996; ANZLIC 1996). Metadata describes the dataset and contains information not only on the quality of the dataset but also on the source holder, the content of the dataset, user conditions etc. INSPIRE goes a step further and defined it as ‘data about a resource’. Metadata is ‘the information and documentation, which makes data understandable and shareable for users over time’ (INSPIRE, 2003).
Metadata is necessary for finding geographical information in a SII.
At present, municipalities do not yet keep metadata. For being able to find municipal information in a Spatial Information Infrastructure, the municipalities also will have to describe and publish metadata.

Access Network:

The access network refers to portal functionality, metadata systems and the webmap servers that grant access to the geographical information using internet technology.
Geo-portals, gateways to geographic content and capabilities, are a key element in SIIs, state Maguire and Longley (2005). It is a web environment in which users and suppliers can aggregate, share content and reach consensuses.
Masser et al (2003) refer to an access network as a network of nodes through which:
- data can be found and accessed for applications;
- it is possible to publish information on data collection, user needs, data inventories, and data quality, in which an access network supports the documentation of datasets;
- redundancy in the data development and processing can be minimised.

Crompvoets (2006) states that the emergence of the world wide web and web services is an important technological indicator of a new SII phase. INSPIRE has also identified this element, which it refers to as Web services.

Web services:

IBM (IBM 2000; IBM 2001) defines web services as 'self-contained, modular applications that can be described, published, located, and invoked over a network, generally, the Web'.

The geographical base services operate in accordance with the publish-find-bind paradigm (Figure 2.2). In this paradigm (W3C, 2002) metadata are published by the supplier on a metadata catalogue service (Publish). In the catalogue, users can Find data and through a Bind, the data can be bound from the source and used.

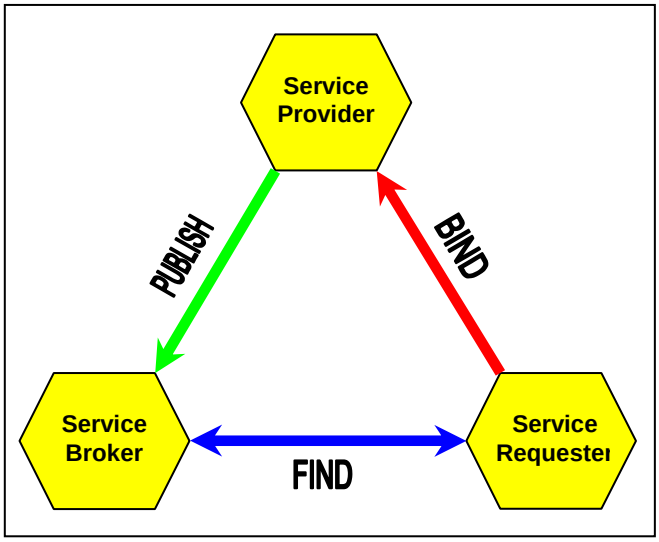

Figure 2.2 The publish-find-bind paradigm

The EU Joint Research Center (JRC, 2005) that guides the development of INSPIRE defines the following central types of web services within INSPIRE:

- Discovery Services; to find datasets and services based on the corresponding metadata.
- View Services; to view geographical data, put layers on top of one another and view the legends.
- Upload Services; to upload data, metadata and services to, e.g., a central portal to make the information available from there.
- Download Services; to make copies of the dataset or a part of the dataset.

- Transformation Services; to transform datasets to be able to use them in combination with other data.

A municipal SII will also need to have these services at its disposal. Transformation services are needed to be able to exchange geographical information across borders

Technology is one of the most important, or even the most important, driving force behind the development of SIIs (Borgman, 2000, Williamson, 2003). Based on a service-oriented architecture (SOA), it becomes possible to link the existing (vendor-specific) systems in the municipalities in a SII (INSPIRE Position Paper, 2002, Architecture and Standards). A central point here is the agreements on the standards to be used.

Standards:

When talking about standards, we are talking about agreements on technology, data content and organisation aimed at interoperability and optimisation of the SII. For ensuring the interoperability between datasets and access mechanisms in a SII, standards are essential (Smith and Kealy, 2003).

At the moment, on the European level in the INSPIRE Implementing Rules the standards to use are being defined for information content (harmonisation), metadata, data policy and web services, giving rise to adjustments or additions in the standards.

The organisations defining and managing the standards are the International Standardisation Organisation (ISO), Open GIS Consortium (OGC) and World Wide Web Consortium (W3C) etc. Using standard web technology, the general ICT standards (W3C) become increasingly important and the specific Geo and ICT standards fit in increasingly better with one another.

Figure 2.3 clearly shows the coherence between the standardisation and harmonisation tasks as mentioned in INSPIRE.

Standardisation and harmonisation are necessary to achieve well-functioning integrated services.

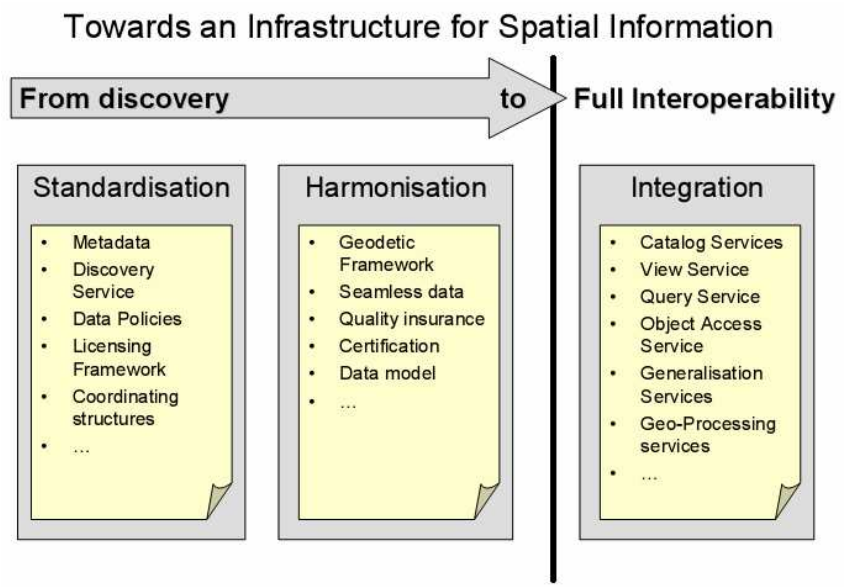

Figure 2.3 Standardisation and Harmonisation lead to Integration (INSPIRE, 2004)

The starting points underlying the INSPIRE standardisation and harmonisation process are:

- Data should be collected once and maintained at the level where this can be done most effectively.
- It must be possible to combine seamlessly spatial information from different sources across Europe and share it between many users and applications.
- It must be possible for information collected at one level to be shared between all the different levels, e.g. detailed for detailed investigations, general for strategic purposes.
- Geographic information needed for good governance at all levels should be abundant and widely available under conditions that do not restrain its extensive use.
- It must be easy to discover which geographic information is available, fits the needs for a particular use and under what conditions it can be acquired and used.
- Geographic data must become easy to understand and interpret because it can be visualised within the appropriate context and selected in a user-friendly way.

Policy:

This is the whole of policies in relation to SIIs, with agreements on use rights and authorisations etc.

According to Van Loenen (2006), policies may exist in different contexts. Some may focus on typical technological or human resource issues of a single organisation, while other issues are addressed in a much broader legal or political environment, for example privacy, access to public information, or security issues.

One of the policies in INSPIRE was the free availability (based on viewing) of all spatial information for everyone.

This showed the power of the Mapping Agencies in Europe. The holding on to existing funding models has led to the compromise agreement stating that source holders can continue to charge copyrights for geographical information.

This will also bring consequences for the Large-scale Base Map of the Netherlands, in which participation of the municipalities as partial source holders is significant.

Following the ANZLIC, Van Loenen (2006) mentions the Institutional Framework (all organisational aspects of the participating institutions) as a complementary component of a Spatial Information Infrastructure and he also adds the ‘availability of financial resources’ as an important component.

2.2.4. Funding:

Research performed by Crompvoets (2006) on the development of ‘National Spatial Data Clearinghouses’ (Access Networks) shows that costs and funding of a SII are by far the principal reason explaining the stagnation of SII developments. In different EU countries, among which the Netherlands, the funding model of the National Mapping/Cadastral Agency is based on the concept of the sale of datasets covering the costs of collection and maintenance of the data.

Giving up this concept may have an adverse impact on data quality. In the Netherlands, more than 94% of the costs are covered by government entities (Nobbe et al, 2006). Expectations are that by releasing the information for market parties, economic benefits will exceed the currently perceived 6%. The possibility of decreasing the passing on of money between governments is being studied.

INSPIRE is building the European SII based on the national SIIs and the starting assumption is that the national, provincial and local levels will all contribute to cover the costs of implementation and maintenance.

To date, it is not yet clear how the European contributions will be concretely managed. The funding proposal in the 'INSPIRE Position Paper' Implementing Structures and Funding (2002) shows that local level activities are given little priority, which lowers the chance of EU funding for lower-level governments.

For municipal SIIs, funding is a major issue. Considering the need for municipalities to grant access to information and work (together) more efficiently, the benefits of a SII seem to be more significant than the costs provided the SII is embedded in the regular municipal processes. The Dutch Ministry of Public Housing, Spatial Planning and Environmental Management (VROM) has examined the cost-benefit ratio of DURP for municipalities and has concluded that the benefits are indeed higher than the costs (VROM, 2005). The INSPIRE estimated benefits are at least 6 times the estimated costs (INSPIRE, 2003)

2.2.5. SII Generations

The developments of national Geo-Data Infrastructures can be divided into a first and a second generation (Masser, 1999, 2005). The first generation appeared as from halfway the eighties while the second generation became active around the year 2000.

Rajabifard et al (2003) have summarised the points of agreement and the differences between the first and second generations in the following table:

Similarities & Differences	1st Generation	2st Generation
Nature	Explicitly National	Explicitly National within the hierarchical context and therefore more flexible for cross jurisdictional collaboration
Development Motivation	Integration of Existing Data	Establishing the Linkage between People and Data
Expected Outcomes	Linkage into a Seamless Database	Knowledge Infrastructures, Interoperable Data and resources
Development Participants	Mainly Data Providers	Cross-Sectoral (providers, integrators, users)
Funding / Resources	Mainly no specific or separate budget	Mostly include in National Mapping program, or having separate budget
Driving / coordinating Agency	Mainly National Mapping Organisations	More independent organisational committees / Partnership groups
Awareness	Low awareness at the beginning, gradually learning more	More aware, knowing more about SDI and its requirements
No of SDI Initiatives	Very Limited	Many more
SDI Development Model	Predominantly Product-based	Increasingly Process-based, or hybrid Product-Process approach depending on the jurisdiction
Relationships with the other SDI levels and International Initiatives	Low	Much more
Measuring the Value of SDIs	Productivity, savings…	Holistic socio-cultural value as well, measuring the expense of not having

Table 2.1 Similarities and differences between GDI generations (Rajabifard et al, 2003)

According to Masser (2005), current trends in GDI development are not only related to the shift from a product to a process-oriented approach identified by Rajabifard, but also a shift from the development to the implementation of Spatial Information Infrastructures. He characterises both aspects as follows:

From a product to a process model

From data producers to users

From database creation to data sharing

From centralised to decentralised structures

From formulation to implementation

From coordination to governance

From single-level to multilevel participation

From existing to new organisational structures

Van Loenen (2006) believes that the future SII will be a hybrid solution: a combination of product and process orientation. He mentions the European INSPIRE initiative as an example of this theory.

2.2.6. Hierarchy

Australian scientists (Rajabifard, Feeney, Williamson, 2003) see a strongly hierarchical division in GDIs. They distinguish GDIs on the corporate, local, provincial, national, regional and international levels. Here, regional in fact means bi-national. As a result of the development on different political and administrative levels, a model for GDI hierarchy has been developed (Rajabifard, 2002).
In Figure 2.4 Rajabifard represents the relationship between SII hierarchy, organisation structure and model.
Masser (2005) also has a clear vision with regard to the hierarchies he discerns, simplifying Rajabifard's model to three levels:

- Global and regional GDIs; the level on which mainly ideas and experiences are exchanged;
- National GDIs: the level on which strategic initiatives are developed;
- Local GDIs: both at the municipal and provincial levels, the central axis are operational needs in daily decision-making.

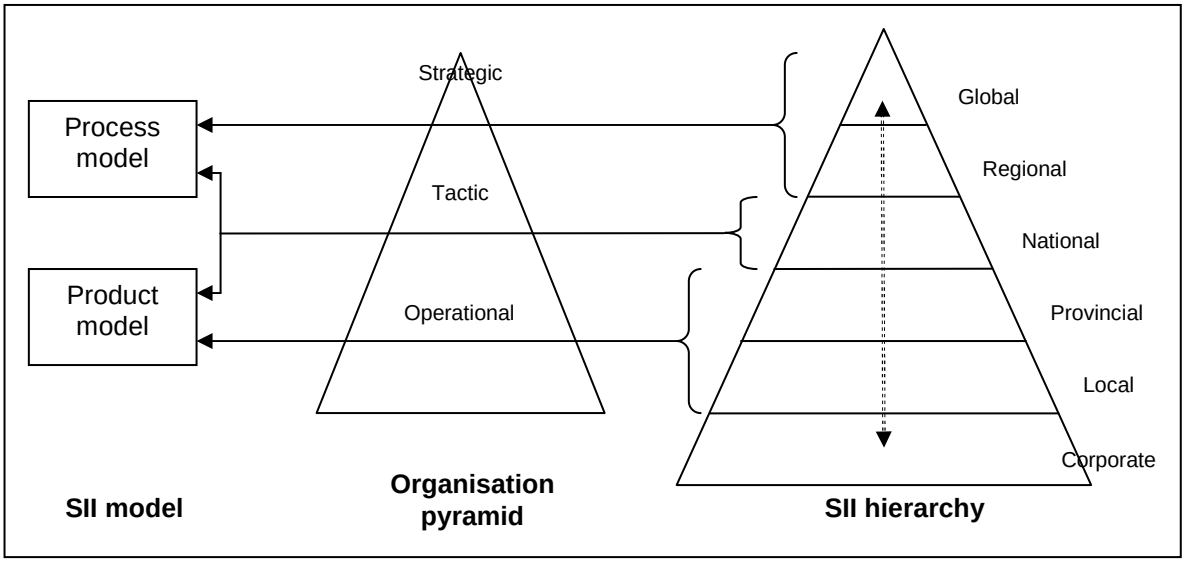

Figure 2.4 Relationship between SII hierarchy and SII models (Rajabifard et al, 2002)

The example is national datasets, which have an important impact on the higher and lower levels. From the perspective of technical standards, a national SII also has a direct impact on the provincial and local SIIs and its position is important towards the higher levels in terms of decision-making on strategies and standards.

One of the characteristics of hierarchy is the fact that the upper level contains parts of the lower level and the lower level the whole upper level (Car, 1997). Also, any element in the hierarchical structure has two different faces, one looking at parts of the lower levels and another one looking at the entire level above, which is also known as the Janus Effect (Koester 1968, quoted by Car, 1997).

It is therefore important that when municipalities implement a SII they ensure hooking on to national initiatives or using nationally developed standards.

Besides, the most detailed database maintenance and updating takes place on the national level. In Masser's opinion, the input of local governments has a major impact on the SII development process on the national level.

Spatial Information Infrastructures influence each other not only from a vertical point of view. There is also horizontal influencing, as national, provincial and local SIIs watch what their neighbours are doing and learn from one another. The horizontal relations between SIIs within one SII level are stronger if they are nearby or adjacent. Elements that are nearby interact more as compared to elements that are farther away within the same level (Simon, 1973). In organisational science this is called 'Near Decomposability'.
Municipalities have greater needs for exchanging information with nearby municipalities, even on the other side of the border, as compared to the municipalities at a greater distance.
This is also true for the Province of Limburg where two thirds borders on another country.

2.3. SII Implementation

Taking into account the research question - are municipalities willing and able to implement Spatial Information Infrastructures? – the previous paragraph outlined the theoretical framework of a SII and examined Rajabifard's model as a measurement instrument to measure the available components of a SII in municipalities. This paragraph has a closer look at issues that are important for implementation of a SII.
One issue influencing the willingness to implement a SII is culture. It is of the utmost importance to take into account the culture dimensions as defined by Hofstede (1997), especially in an international setting. A second issue that will be examined is collaboration.

Within the framework of INSPIRE (INSPIRE, 2007), implementing rules have been developed which describe how the Spatial Information Infrastructure should be implemented.
Municipalities can use the information (services) provided by others in their own processes.
They are obliged themselves to make available their information such as zoning plans as an information service.

What are the recommendations from the SII perspective and what are the implications of implementing a SII for a municipality?

Looking at Rajabifard's SII components we see that the municipality is both a user and supplier of information. Using internet technology, a user can view the necessary data with his standard web browser through e.g. a geo-portal and use these in combination with other information.

For offering geographical data and metadata, a technical infrastructure is required to publish the information as well as having the know-how for managing this. Publishing and management can be interpreted in different manners from an organisational point of view.

In terms of functionality, we can divide the municipal SII into:

- Information from others:
    - Find information, e.g. through portals.
    - Consult information and use it in one's own work processes, e.g. the development of spatial plans.
- Own information:
    - Publish data as a service.
    - Ensure data can be found by publishing Metadata.

Especially the second functionality, ensuring that the own information can be found and accessed, requires considerable efforts. Often, datasets will not become available for everyone. This is related to privacy regulations, copyrights or because the information is of confidential nature, e.g. plans that are still in the development phase.

In many cases, access to the information is granted first within the organisation and only afterwards (possibly in an adapted form) to the outside world so as to avoid that 'external parties' ask questions that cannot be readily answered or to avoid sharing information that is difficult to interpret or that contains mistakes.

Access to the information is granted through:

1. the Intranet - local use.
2. the Extranet - with chain partners (often fellow governments).
3. the Internet - for everyone; citizens, companies and fellow governments.

The municipality can opt to set up its own infrastructure and access possibilities for the three media, but it can also choose to work with other parties for options two and/or three.

2.3.1. The Culture aspect

Hofstede (1997) has studied culture aspects in 50 countries, on the basis of which he mentions four dimensions of culture:

Power distance:

Hofstede sees social inequality between persons in the sense of differences in strongly hierarchical and flat organisations, between authority and non-authority, differences between the less and more well-off.

Avoid insecurity:

Differences in how people cope with insecurity, cultures that avoid insecurity take no risks, they adopt a minimum of innovations, they have big institutions focusing on security and stability, they are conservative and plan with considerable detail.

Male versus female:

Aggressive success-oriented cultures as opposed to caring cultures that focus on the quality of life, with networks and relations being a social value.

Collective versus individual:

A culture of individualists versus collective cultures in which group values prevail.

Van der Toorn and de Man (2001) have studied the role of culture on the development of GDIs, but mainly from the perspective of developing countries.

The role of culture in the implementation of SIIs is not unimportant in the case of municipalities.

Some culture aspects playing a role are, for example, accountability and initiative. Is accountability important in the organisation? Do higher levels appreciate initiative or do they consider this as something troublesome? Culture also determines to what extent detailed agreements must or can be reached.
Is an agreement an agreement or must agreements be written down and signed by the participating governments? For example, bigger municipalities often adopt a more formal way of working as compared to the smaller ones. In the case of cross-border collaboration and information exchange, the cultural aspects will play an even more important role.

2.3.2. Collaboration

Korsten et al (2004) observe that the municipalities are giving increasingly more attention to different forms of collaboration. “They are trying to take advantage of the scale advantages of larger organisations while maintaining the benefits of relatively smaller municipalities with a recognisable administration near citizens”. In their research on ICT innovation in municipalities, Duivenboden and Rietdijk (2005) also conclude “particularly the smaller municipalities are obliged to work more intensely in collaboration with adjacent municipalities and other chain partners”. Besides scaling-up, Louweret et al (2006) mention cost-cutting and enhanced effectiveness as important arguments for collaboration in the field of ICT.
Jacoby et al (2002) mention partnerships as a critical element for developing a SII, which can be both within one’s own jurisdiction and with other jurisdictions.
Municipalities are already working together in different fields. Collaboration with neighbouring municipalities and cross-border municipalities for the implementation of a SII seems an adequate way for making the most of the above-mentioned benefits.

There are different forms of collaboration, both in terms of the degree of collaboration and in terms of the structure. One example is the collaboration with other municipalities, which could be among

small municipalities or a bigger adjacent municipality working together with the surrounding municipalities. These collaboration modalities are often of a less formal type.
There are more structural types of collaboration as well, e.g. the Shared Service Center (SSC). Louweret et al (2006) define a SSC as follows: a shared service is a results-based cooperation link, regardless of whether or not it is centralised in one organisation unit, which is responsible for providing specific specialised services to the separate parent organisations, based on an agreement and at a standard price.
Geographical information can be outsourced to a shared service center as well (Castelein, 2006), in which case GIS is the enabling technology in support of the different work processes of the different organisations.
Strikwerda (2004) discerns different forms in which a SCC is organised. He mentions five models for SSCs, as wide apart as from an internal collaboration to an outward-facing external service organisation.
In this study, it is important to examine the degree to which municipalities are willing to work together.

2.4. Willingness to implement SII

In order to measure the willingness and define whether the municipalities are able to implement a SII, first of all we will have a look at the implementation aspects from the viewpoint of willingness. Moreover, the implementation of a SII is an innovating process.
Considering the theory of the development of SIIs, we see that the Diffusion of Innovation model is the most widely applied model for describing the SII innovation process. However, the model focuses to little on the individual willingness for implementing a SII. That is why we have a closer look at the Technology Acceptance Model as a model for measuring willingness.

2.4.1. The Innovation Process Model

Both Masser and Rajabifard use Rogers' Diffusion of Innovation model (1995) to describe the diffusion of Geo-Data Infrastructures.

Rogers' definition of diffusion is "the process by which an innovation is communicated through channels over time among the members of a social system".

This definition contains four elements on which the model is based: Innovation, communication, time and social system:

Innovation:

An innovation is an idea, practices or object that is perceived as new by an individual or other unit of adoption (Rogers, 1995).

Rogers mentions five characteristics of an innovation, namely relative advantage, compatibility, complexity, trialability and observability.

Communication:

The second element is communication channels. Diffusion is a special form of communication, where the message consists of information about the new idea. The diffusion process is chiefly a social process in which different means of communication are used to get the messages from advocates to the 'ignorant'.

The insecurity reduction process related to the adoption of an innovation is the essence of the Diffusion of Innovation theory (Pijpers et al, 2002).

Time:

Rogers mentions time as the rate at which an individual or receiving party adopts new ideas relatively sooner as compared to other members of the system.

Rogers has defined categories of the degree of adoption, pointing out that most innovations follow the S curve shown below. Every category reflects the percentage number of adopters in each category.

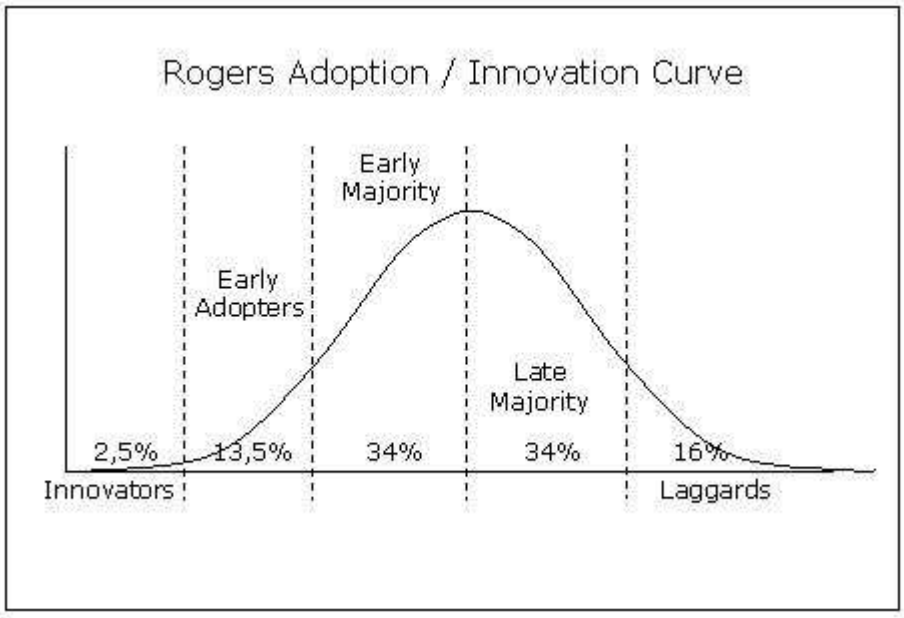

Figure 2.5 Adoption Innovation Curve (Rogers, 1995)

Social system:

The fourth element is the Social System in which the innovation takes place. Rogers defines this as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. The culture of the organisation plays an important role in this.

Until now the Diffusion of Innovation model (DOI) is the mostly used model for studying the diffusion of SIIs, it has two disadvantages making it less suited for this study among municipalities: The model describes the diffusion and acceptance of innovations on a macro level while this research takes place on a smaller-scale and more detailed level.

The DOI is a good basis to examine the acceptance of an innovation over time; nonetheless, it is less apt for gaining a clear understanding of the acceptance on an individual level. It mainly refers

to the acceptance of technology. But technologically outstanding systems have never been a decisive factor for ensuring acceptance and use (Pijpers, 2001).

Besides the DOI model, different models are available which could be used to measure whether the municipalities are willing to implement a SII.
The Technology Acceptance Model (Davis, 1989) has proven that in the introduction, acceptance and use of ICT systems, good results are achieved for predicting and explaining users' behaviour (Pijpers et al, 2002)

2.4.2. The Technology Acceptance Model

The Technology Acceptance Model (TAM) was developed by Davis (1989) to predict the adoption of technology at the organisational level. The model has been used in different studies when introducing new information technologies (Pijpers et al, 2001).
As compared to the DOI model, this model focuses less on technology and more on people's behaviour. The TAM is based on the thesis that future technology use depends on someone's behavioural intention.
The behavioural intention on willingness of the municipalities is what we want to determine in this study, and the TAM seems to be an adequate model for measuring willingness.

The TAM (see Figure 2.6) shows that the Perceived Usefulness is directly affected by the Perceived Ease of Use and that the Perceived Usefulness predicts the expected Attitude Towards Use.
Attitude is herein defined as the desire to start using the new technology.
Attitude and Perceived Usefulness impact the intention to start using the new technology, which is a prediction of future usage or acceptance of the innovation.

Perceived Usefulness is the degree to which a person believes that an innovation is better than what is currently available. In the context of a SII, it is the degree to which the municipal user believes that the SII has benefits or will enhance his or her performance.
Perceived Ease of Use is the degree to which a person believes that using the new concept will be free of effort. In relation to the SII this could be whether the SII is easy to work with.

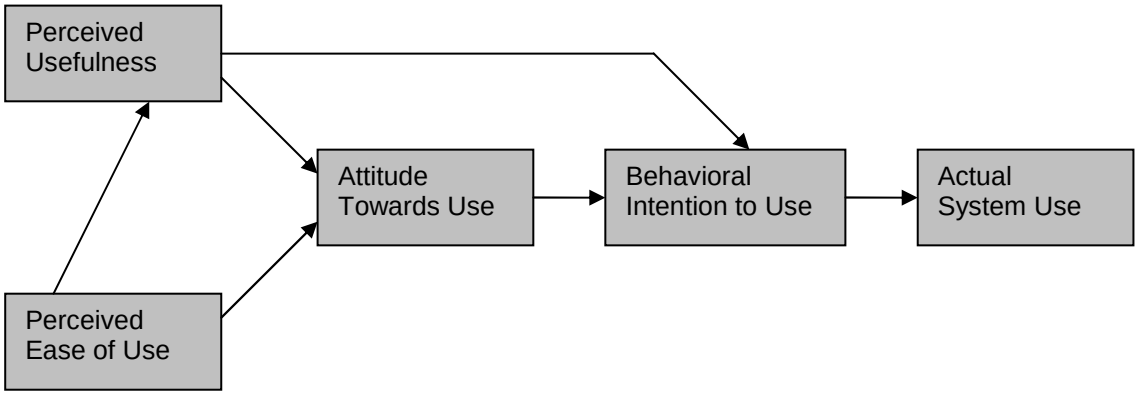

Figure 2.6 Technology Acceptance Model (Davis, 1989)

In different studies that applied the TAM, other factors besides the perceived usefulness and perceived ease of use have been added for predicting future usage. However, Miller et al (2003) state that despite adding these 'external' factors, Perceived Usefulness and Perceived Ease of Use are the main factors impacting the Intention to Use.

2.5. Are the municipalities able to implement a SII?

After determining whether the municipalities are willing to implement a SII, we will have a closer look at the aspects of implementation that are important when defining whether the municipalities are able to implement a SII. Within this framework, we will examine the organisational side of implementation, explaining the Nolan model. For measuring the municipalities' ability to implement

a SII, the Nolan model is linked to five critical organisational factors for implementation, which leads to an organisational maturity matrix.

2.5.1. The Organisational Development Model (Nolan)

From an organisational perspective, Nolan's four-stage model (1979) has been amply applied to define the development stage of an organisation.
Nolan distinguishes between four stages: initiation, expansion/contagion, formalisation or control, and finally, integration.
Different researchers have adapted the model to specific applications such as e-government development in municipalities (Layne and Lee, 2001).
The Dutch Quality Institute (INK, 2003) has used the Nolan stages to develop a management model for ICT, recognising the phases of Activity, Process, System and Chain. The INK considers a fifth phase: Transformation, though this phase is in practice never achieved.

Most organisation growth models are based on simple organisations such as municipalities (Graafland, 1997) but a SII is a network organisation.
Van Loenen (2006) states that what is important for an individual organisation is also important for a network organisation.
He defines four development phases or stages of a Spatial Information Infrastructure, which he calls Stand alone, Exchange, Intermediary and Network.

1. Stand-alone:

This phase is called Stand-alone because the different SII organisations build their own infrastructure with organisation-specific data models and standards. The organisation has an inward focus and there is no geo 'awareness', which means that initiatives are not based on a multidisciplinary approach and that collaboration possibilities are ignored.
In this stage, only a few visionaries see the potential of a SII.

At the same time, top management lacks commitment and an outward focus.

Changes are considered to be unnecessary and enjoy little support.

The culture in the organisations is conservative.

2. Exchange and standardisation:

In the second phase, two factors incite to changes: the growing pressure on the organisations to work more efficiently and the new technology.

Outsourcing offers possibilities to focus more on the key competitions.

Common objectives lead to the first steps of collaboration, especially from a cost perspective.

Citizens' increased desire for information requires integration of the underlying processes in the organisations. E-government requires collaboration with other organisations.

Joint objectives and the recognition of win-win situations are crucial.

At the end of this phase, there is a preliminary vision, a SII will be built.

Change enjoys support in the knowledge that it is needed.

3. Intermediary:

In this 'intermediate phase', implementation of the vision is the central element.

There is an accepted leader and the organisations have a more outward focus, which gives rise to a network organisation. The tasks and responsibilities have been made explicit.

There is awareness as regards the possibilities of a SII, not only in terms of efficiency but also in terms of better information and enhanced decision-making. The focus is no longer only on creation and exchange but goes beyond that on the use of information.

The need for change is evident and enjoys ample support.

The extent to which the organisations are prepared to work together and top management's guidance of the change are critical factors at this stage.

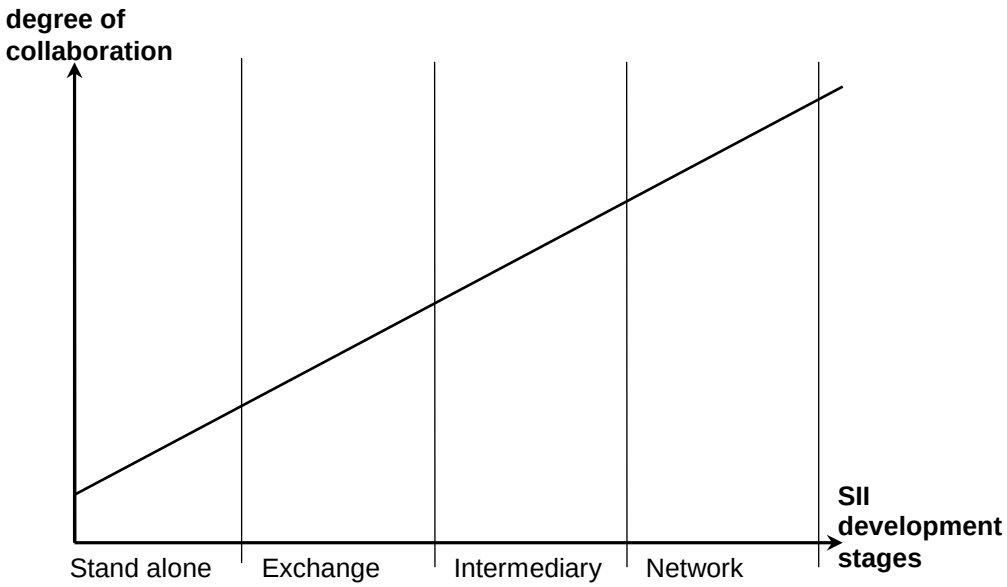

Figure 2.7 SII development stages (Van Loenen, 2006)

The degree of collaboration increases phase after phase.

4. Network:

The SII has become a network organisation with a clear vision and equal parties.

There is shared leadership and integrated information from different sources.

Information is managed only at the source and international standards are taken into account.

The SII vision and the change objectives are clear and enjoy ample support. Top managers are directly involved in the process and the technological changes are implemented effortlessly.

There are proactive collaboration links between the organisation in different topics and new developments such as INSPIRE are considered opportunities.

2.5.2. Organisational Maturity Matrix

Based on findings of Kok and Van Loenen (2005), Van Loenen (2006) identifies six critical organisation aspects for going from one stage to the next: leadership, a vision, communication

channels, the strength of the GI-Community to organise itself, awareness and sustainable resources.

By linking the Nolan stages as described by him to the critical organisation aspects, Van Loenen develops a development matrix from an organisational perspective.

However, a closer look at the description of Nolan's stages reveals that the critical aspects do not correspond to the organisational aspects identified in those stages.

In a first instance, this seems inconsistent. Nevertheless, Van Loenen clusters leadership and management's involvement. He does mention the willingness to change or culture as important factors in the phase description, but he does not include them in the matrix. Van Loenen does however add Communication Channels based on the research by Masser (2005) on SII diffusion, in which Masser uses the Diffusion of Innovation Model. From Van Loenen's perspective on the national level and to a large extent from the viewpoint of Spatial Information providers this is a logical line of thought.

Rajabifard and Williamson (2001) mention six key factors for speeding up SII development, three of which are related to organisation: Awareness on the application of spatial information and SII, the involvement of politicians and collaboration between different stakeholders.

Longhorn (2004), Graglia et al (2003) and Rajabifard et al (2003) add that awareness also refers to the value of Spatial Information in relation to decision-making on several levels. They also mention strong leadership as a complementary factor.

Hofstede (1997) clearly mentions that in addition, culture should not be ignored, especially on the municipal level and in view of the international context. Crompvoets (2006) adds funding as the most important factor resulting from his research.

Looking at Van Loenen's description of the Nolan stages from a SII perspective, we see that these factors for development of a SII - awareness, political commitment, collaboration, leadership, culture and funding – are indeed the key concepts catching the eye in the phases.

From the description of the phases, we can add the concepts of ‘vision’ and ‘clear objectives’ to awareness because of their strong affinity. We can add the willingness to change to culture as a connected factor. The degree of willingness to change is a result of research with the Technology Acceptance Model.

Contrary to Van Loenen’s model, this results in the following development matrix from an organisational perspective.

aspect	**1. Stand alone / initiation**	**2. Exchange / standardisation**	**3. Intermediate phase**	**4. Network**
A. SII awareness / vision / clear objectives	Focus on the internal organisation	Synchronisation on shared objectives	Focused on implementation of the shared objective	Shared vision Focusing on innovation
B. Leadership / coordination	Focus on the individual	Leadership requested	Accepted leader	Shared leadership
C. Involvement management / politics	No involvement	Management involved	Management directs development	Management actively involved
D. Culture / willingness to change	Holding on to existing patterns	Awareness of needed changes	Clear and accepted need for change	Ample support Clear advantages
E. Collaboration	Focus on internal collaboration	Advantages of collaboration are clearly understood	Development towards network organisation	Network organisation
F. Funding	On an ad hoc basis	Project related	Funding assured for a certain period of time	Sustainable, passing on of costs

Table 2.2 Maturity of a SII from an organisational vision

This model is applied to determine the SII maturity of the municipalities from an organisational perspective. Combined with the determined degree of implementation, this gives us the 'degree to which the municipalities are able' to implement a SII.

2.6. Spatial Planning

Rajabifard et al (2003) state that user need is the motive by excellence for developing Spatial Information Infrastructures. In his research on GIS use in Dutch municipalities, Peters (2003) concluded that the virtual window Bouwen en Wonen ("Building and Living") is one of the principal entities demanding comprehensive geographical information.
But this is not the only reason for choosing Spatial Planning as a field of application in relation to SIIs.
The data exchange in the field of Spatial Planning implies specific demands. In this context, looking at examples of SII implementation, a SII may offer solutions. Moreover, changing laws assign more responsibilities to the municipalities, which in turn enhances the need for a municipal SII.

On 1 July 2008, expectations are that the new Spatial Planning Act (WRO, 2007) will enter into force. The starting points of this law are less rules, decentralise as much as possible and implementation-oriented. This is aimed at simplifying the decision-making process in spatial planning, taking into account juridical security and democracy.
This law obliges municipalities to prepare digital and exchangeable spatial plans and grant access to citizens.
The Digital Exchange in Spatial Processes (DURP, 2006) programme has researched the need for a central portal in which all SP data from the different levels can be made accessible for different parties. The principal advantages of such a portal would be:
More efficient internal work processes as time is gained and costs are lowered.
Quality improvement: the quality of the own data/work will improve.

Up-to-date and complete data are also mentioned as extremely important factors.

There are many examples in which a Geographical Information Infrastructure is applied in the field of Spatial Planning for supporting the mentioned core concepts of juridical security, democracy, efficiency, up-to-datedness and completeness.
Steudler (2003) concludes that in Spatial Planning processes often many parties are involved and because in a SII information is compatible and can be shared among the organisations, a SII results in an enormous efficiency gain, both in terms of needing less people and in terms of a gain of speed in the process. Grant and Williamson (2003) also mention the high reliability of a SII and the important role of cadastral information.
Thompson et al (2003) add the concepts of spatial accuracy and security.

Kingston (2002) also concludes that a SII is a good complement when citizens participate during the development of spatial plans, thus complying with the wish of a more democratic decision-making process and involving citizens in politics.

Also as regards the up-to-datedness and completeness, a Spatial Information Infrastructure offers a value added. The data are supplied on the basis of the data at source principle. This means that the data are managed only where they can be managed and updated the best, i.e. at the source holder or file owner. This ensures the best possible degree of up-to-datedness and completeness.

Zoning plans are legally binding and are the cornerstone of the Netherlands spatial policy (ARL, 2003). Their political function is to give juridical security to citizens as regards spatial developments in a certain area.
In the local zoning plan procedure, citizens, companies and civil society organisations play an important role. Other organisations could be involved as well in the procedure such as water boards, regional boards and the fire department.

They work together in the zoning plan process chain, in which the municipalities perform a key function.

We can assert that the spatial planning process is complex, involving many parties.
Van Duivenboden et al (2004) conclude in 'The course of the Chain' that ICT can play an important catalysing role for improving work processes in the zoning plan chain.

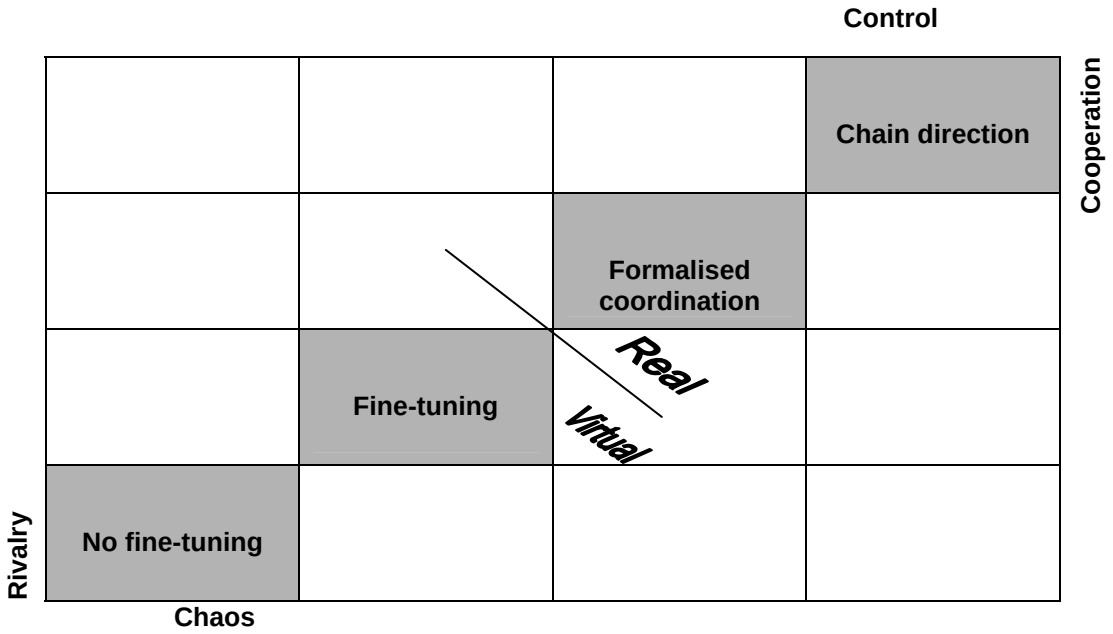

Figure 2.9 Chain quadrant (de Wit et al, 2000)

After studying process chains, de Wit et al (2000) distinguish different degrees of chain control. They call the chains without any fine-tuning virtual chains and the chains with defined agreements real chains.
They consider that chain direction is the optimal form of chain cooperation with maximum cooperation and control. On the other side of the quadrant (see Figure 2.9) we see 'no fine-tuning' where rivalry and chaos between the chain partners predominate.
According to Bekkers (1998) the limits of organisations change in the chain both in terms of nature and in terms of direction when using ICT.

From a process perspective, Verschuur and Metteu (2001) see an integration of processes, mentioning administrative agreements as an important organisational point of attention.
Hofstede (1997) already referred to the degree to which agreements are needed as an aspect that to a large extent is defined by culture. In the organisational development matrix in the previous paragraph, we can find the specific organisational characteristics for spatial planning processes both under the heading Cooperation and under the heading Culture.
This confirms the choice for applying the defined organisation maturity model in the field of spatial planning.

2.7. Coherence of the research models

The research question ‘are municipalities willing and able to implement Spatial Information Infrastructures?’ covers such a wide spectrum that different models will be used to find an answer to this question.
The first model we discussed was the Rajabifard model that distinguishes the components for describing a SII. This way, the model offers the possibility of measuring the current degree of SII implementation in the municipalities.
For examining the level of willingness, the Technology Acceptance Model offers good possibilities as this model can be used to predict individual acceptance of the new technology. But willingness is not enough for also being able to implement a SII, in which other aspects also play a role. With the organisational development model gathered from this chapter, a model is presented based on the four-phase Nolan model and the key factors for SII implementation to determine whether the municipalities are able to implement a SII from an organisational perspective.
Because when implementing a new technology, both individual and organisational aspects play an important role.

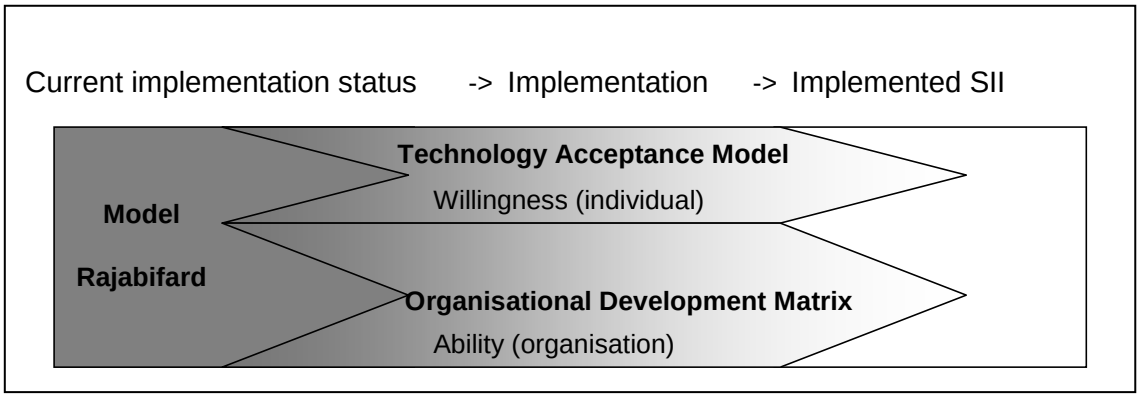

Figure 2.10 Coherence of the research models

The coherence of the three research models is reflected in figure 2.10. The Rajabifard model is used to determine the current implementation status, the Technology Acceptance Model measures the willingness to implement a SII and the Organisational Development Matrix is used for determining the degree to which the municipality is able to implement the SII.

The study has not analysed the possible consequences of the harmonisation required by INSPIRE for municipal datasets. This is because at the moment of the study the Implementing Rules for Data Harmonisation are not yet known and because the DURP programme (2007) is already focusing on a standardisation and harmonisation of spatial plans in the Netherlands.

2.8. Conclusion

In this chapter, we have explored the theoretical background of Spatial Information Infrastructures, both in general by means of the components of the Rajabifard model and specifically by looking at the implementation aspects of the 'being willing and able' to implement a SII.
The Technology Acceptance Model seemed to be a good model for forecasting the future use and hence, the willingness. By linking the critical components for the dissemination of a SII with the Nolan phases, it was possible to derive an organisational development matrix to determine whether

the municipalities are able to implement SIIs. Besides the coherence of the research models is explained.

Finally, we have discussed the topic of Spatial Planning, in which aspects such as efficiency, reliability, juridical security and democracy are important in support of the SP chain, and which clearly shows the municipalities' user need for implementing SIIs.

3. Research set-up

3.1. Introduction

In the previous chapter, we have discussed the theoretical background of Spatial Information Infrastructures and we have named the aspects that are important in implementation. In this sense, we have given an overview of the research on the implementation of SIIs as well as a description of different models that can be used during the research. We have also examined more closely the relationship between SII and Spatial Planning.
The purpose of the research is to define whether the municipalities are willing and able to implement SIIs. At the same time, we will verify whether the subquestions can be answered to the studied municipalities; our final goal is to make recommendations that will contribute to a successful SII implementation in (small) municipalities.

In previous research on SII use in Dutch municipalities (Grothe and Scholten, 1996; Colijn, 2000; Peters, 2003) all Dutch municipalities were studied by means of a questionnaire.
Colijn's research (2000) showed that many municipalities were unacquainted with the NCGI, the National Clearinghouse Spatial-Information, one of the principal components of a national SII (GSDI Cookbook).
Even though Kirwan (2005) is of the opinion that all GI professionals in the Netherlands are well aware of GI developments, this will probably not be the case in the smaller municipalities.
That is why this research chose to not only use a questionnaire but to carry out the research in different steps, one of the steps consisting of personally informing the interviewees about SII.
As pointed out by Rogers (1995) in his Diffusion of Innovation model, communication on the innovation is extremely important for acceptance of the new technology. The willingness to implement a SII can be measured the best if one knows what SIIs are all about. This is especially true for managers and politics who are part of the factors determining whether municipalities are able to implement SIIs.

Because of this extra step, the research was labour intensive and time consuming. Considering the time available for the research, we chose not to examine all four hundred Dutch municipalities but to rather limit the research to one province, i.e. the province of Limburg. Another possibility would have been to examine a random sample of Dutch municipalities. Besides, taking into account the 'Near Decomposability' effect (Simon, 1973), adjacent municipalities were invited together with a view to possible future cooperation.

3.2. Research area

The chosen research area is the Province of Limburg. As a result of the municipal re-division in Mid-Limburg, on 1 January 2007 eleven municipalities came to form part of four new municipalities. The Province of Limburg now consists of 40 municipalities. The number of inhabitants varies from 4,000 to 120,000. Considering the location of the Province of Limburg, two thirds of which borders on another country, a SII is an important instrument, not only to exchange information with surrounding Dutch municipalities but also to strengthen cross-border cooperation based on a good information-exchange.

	Number of inhabitants 1-1-06	Number of municipalities in Limburg
Small municipalities	< 20,000	24
Medium-sized municipalities	20,000 – 50,000	11
Big municipalities	> 50,000	5

Table 3.1 Municipalities by number of inhabitants (CBS, 2007)

To answer the subquestion 'are the neighbouring German municipalities able to grant access to Spatial-Information?', the research was also performed in the adjacent German municipality of Kreis Heinsberg.

Given the developments of SII in the adjacent German state North Rhine – Westphalia,

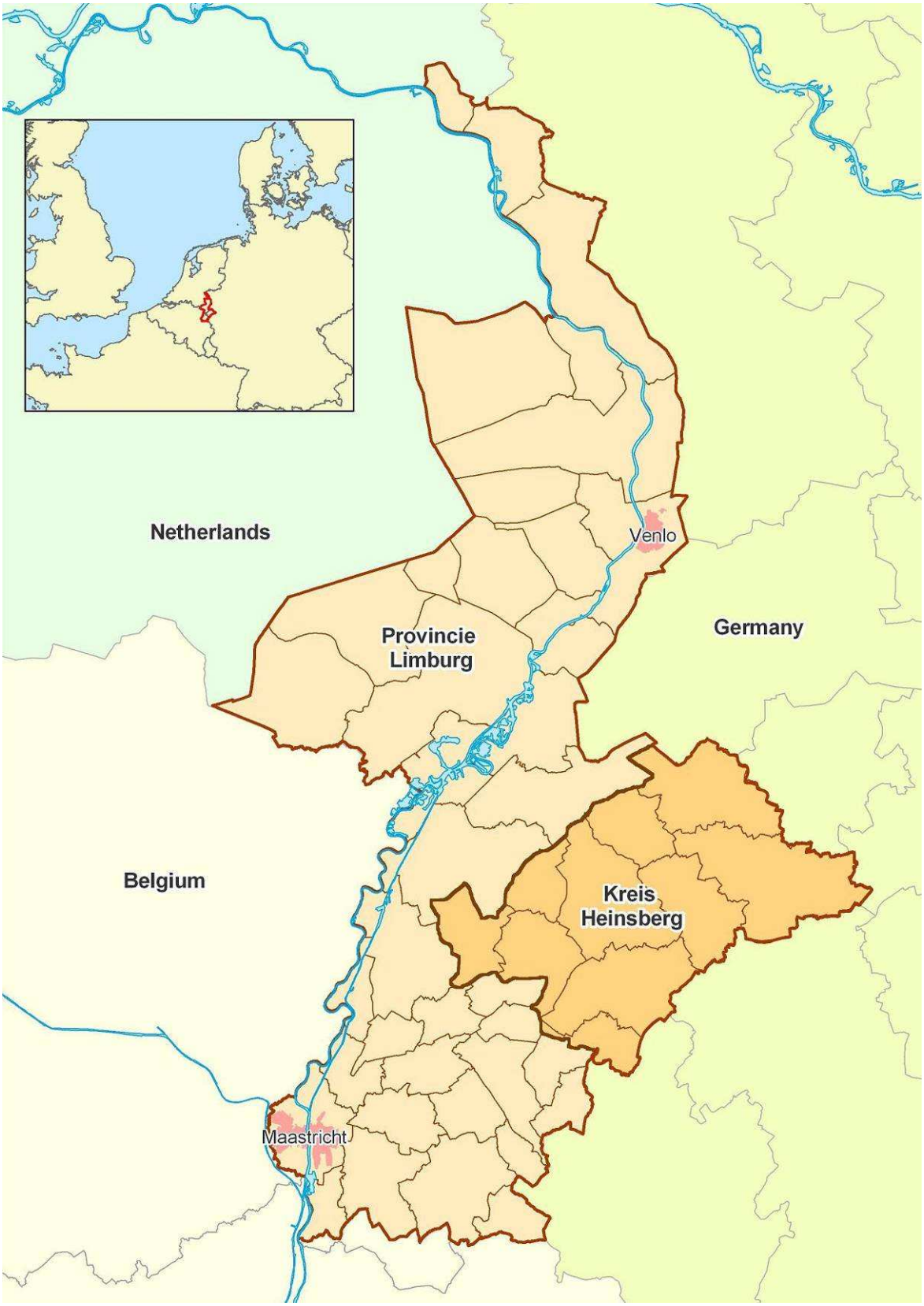

Figure 3.1 Map of the research area (Provincie Limburg)

(GDI NRW) the SII awareness should be higher in the German municipalities as compared to the municipalities in the Netherlands. Heinsberg is composed of 10 Gemeinden and Städte with between 9,000 and 44,000 inhabitants.

However there is a difference between the Netherlands and Germany as regards administrative levels . The Kreis (County) is an additional administrative level between the municipality and the province.

3.3. Research set-up

The research covered 6 steps:

1. Measure the current status of SII implementation with the aid of the SII model of Rajabifard et al (2002).
2. Inform the municipalities on what a SII is and what this could mean for the municipalities.
3. Determine the willingness to implement a SII, using theTechnology Acceptance Model (Davis, 1989).
4. Determine SII maturity from an organisational perspective.
5. Process and analyse the research results.
6. Determine whether the municipalities are willing and able to implement a SII.

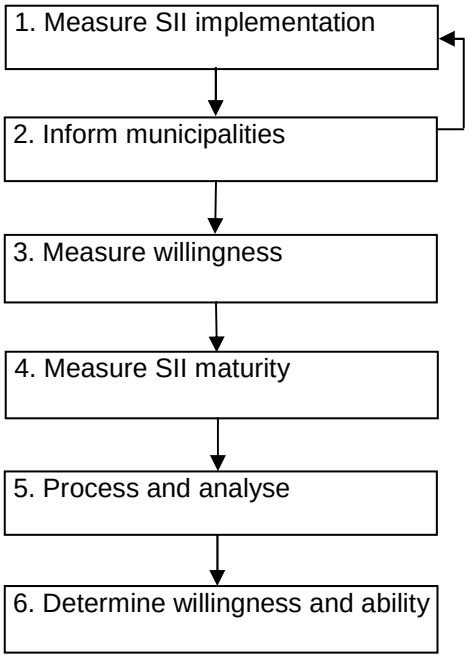

Figure 3.2 Research set-up

3.3.1. Measure the status of SII implementation

For determining the current status of SII implementation, Rajabifard et al's model (2002) was used. This model has been used frequently to measure the degree of SII implementation. Crompvoets (2006) has recently used it to determine the worldwide development and impact of national clearing

houses. All municipalities in Limburg and Kreis Heinsberg received a questionnaire with questions related to the SII components distinguished by Rajabifard.
This questionnaire was sent to the employees who are responsible for the provision of geographical information and to the known contact persons of the DURP programme.
We opted for open-ended questions so as to overcome the unfamiliarity with SIIs and to give the municipalities a chance to indicate the developments which they are working on. Moreover, the information meeting was taken advantage of to give the municipalities an opportunity to further explain their answers.

For checking whether the questionnaire worked and whether the answers would be as expected, in a pilot phase the questionnaire was first sent to the seven municipalities in Heuvelland. As a result of this pilot phase, the questions were defined even more clearly and a couple of specific questions on the DURP process were added. The questionnaire is included in Annex 2.

As some time went by between measurement of the status of SII implementation in the municipalities and the other two investigations, while preparing the other studies (through a web form) we decided to ask the municipalities that returned the form in the first study on SII implementation to update the previously filled out questionnaire in case the situation had changed. The municipalities that did not answer the questionnaire the first time were also asked once again to participate in the survey.
The intervening time was too short to measure progress, though it did yield some indications.
For linking the studies, it was desirable to perform them at approximately the same moment.

3.3.2. Inform municipalities on SII

To avoid measuring the willingness and degree of SII maturity while the interviewees had no idea of what SII is, meetings were organised in which a clear explanation was given of what a SII is and what it can mean for the municipalities. With a view to future cooperation, the municipalities were

clustered in terms of a large municipality and the surrounding smaller municipalities. The municipalities in Heinsberg were invited as one group. By analogy with the big municipalities, the Kreisverwaltung Heinsberg was present.
The invitation for the meeting was sent together with the questionnaire for measuring the SII implementation status and during the meeting, municipal employees explained the filled out questionnaires, aimed at somehow levelling differences in the interpretation.

3.3.3. Determine willingness to implement SIIs

To determine the municipalities' willingness to implement SIIs, Davis' Technology Acceptance Model (TAM, 1989) was used.
For this research the GEO employees and DURP contact persons were contacted, just like in the research on the status of SII implementation. A questionnaire was used that could be filled out through an internet form. Participants could indicate on a 1 to 5 scale up to what point they agreed or disagreed with certain affirmations. To avoid habit creation, some affirmations were formulated in a negative form.
The used questionnaire is included in Annex 3

3.3.4. Determine SII maturity

For determining the SII maturity from an organisational perspective, a questionnaire with affirmations was developed. For each key factor (Table 3.2 aspect A - F), per phase different affirmations were defined that apply to that phase. Based on the applicability of an affirmation, it is possible to define the position and hence, the degree of development in the Organisational Development Matrix.
As practically speaking, it could be possible that in the case of e.g. key factor A awareness, vision and clear objectives score differently and are therefore positioned in different phases, we chose to

use a sliding scale of five positions, varying from fully disagree to fully agree. The average value determines the position in the matrix (see Table 3.2).

The affirmations are included in annex 4.

aspect	**Phase 1** **Stand alone / initiation**	***Phase 2*** **Exchange / standardisation**	**Phase 3** **Intermediate phase**	**Phase 4** **Network**
A. **SII awareness / vision / clear objectives**	Focus on the internal organisation	Synchronisation on shared objectives	Focused on implementation of the shared objective	Shared vision Focusing on innovation
B. **Leadership / coordination**	Focus on the individual	Leadership requested	Accepted leader	Shared leadership
C. **Involvement management / politics**	No involvement	Management involved	Management directs development	Management actively involved
D. **Culture / willingness to change**	Holding on to existing patterns	Awareness of needed changes	Clear and accepted need for change	Ample support Clear advantages
E. **Collaboration**	Focus on internal collaboration	Advantages of collaboration are clearly understood	Development towards network organisation	Network organisation
F. **Funding**	On an ad hoc basis	Project related	Funding assured for a certain period of time	Sustainable, passing on of costs

Table 3.2 Phase division SII maturity matrix

One of the key factors of the matrix is the involvement and support of management and politics. By the way, the management vision is also a determinant for the other key factors. As few councillors participated in the information meetings and as it turned out to be difficult to explain to the GEO and DURP employees what a SII is and what this could mean for them, we have not approached

Councillors and management through questionnaires but we have interviewed them, going through the questionnaires together with the interviewee. To make clear what a SII is a PowerPoint presentation with many pictures of applications is used. The municipalities to be interviewed were defined at random, taking into account a balanced division in terms of the number of inhabitants. We have also contacted two municipalities that did not return the questionnaires. A total number of 10 interviews took place with councillors/management of the municipalities in the research area, which is a good basis for assessing the level of support and involvement.

3.3.5. Process and analyse the research results

The next step consisted in processing and analysing the research results.
In this step, it was important to take into account the coherence between the different studies, as reflected in figure 3.3.
The municipalities' willingness to implement SIIs is an isolated measure that at the same time provides input for the Organisational Development Matrix and, as such, it is part of the measure to weight SII maturity from an organisational perspective. This manifests itself in key factor D – willingness to change.

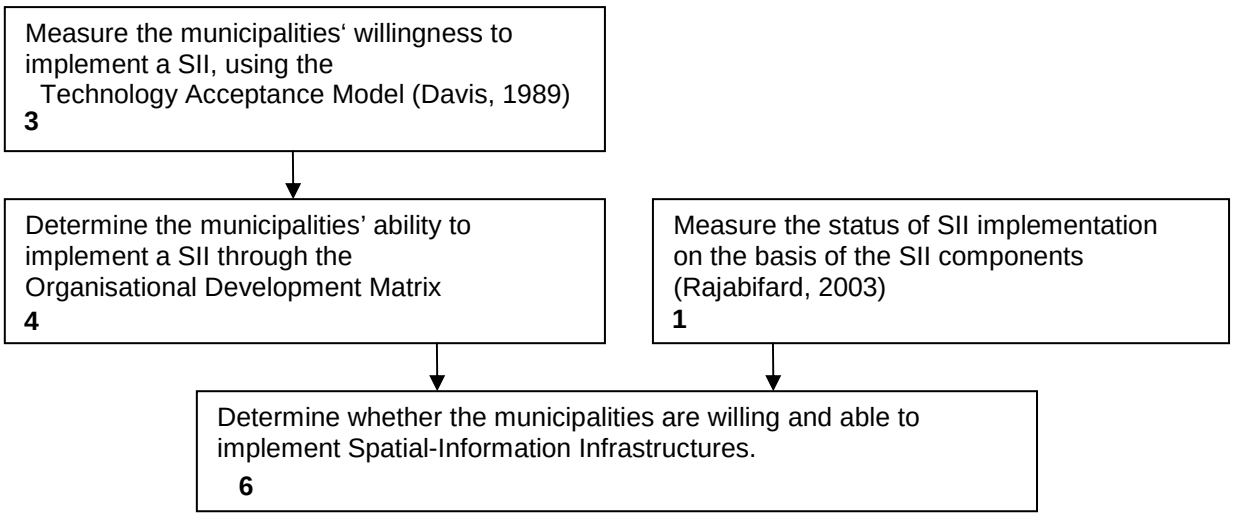

Figure 3.3 Coherence of the studies

Measuring the current status of SII implementation is independent of the other two measurements though it does provide input for step 6, i.e. determining whether the municipalities are willing and able to implement SIIs.

3.3.6. Determine municipalities' willingness and ability to implement SIIs

Based on the results of the three different studies, it is possible to determine whether the municipalities are willing and able to implement SIIs on a case-by-case basis.
Study 3 (TAM) in figure 3.2 shows the willingness and determines the position in the Development Matrix 4 (SII maturity), indicating whether the municipality is able to implement a SII.
The position in the matrix is tested against the measured value from the SII implementation status measurement 1, whereby the measured difference between the first and second time the SII status was measured can be an indication of growth of the development.
The status of SII implementation is a quantitative analysis which in most cases will be consistent with the determined position of SII maturity, thus constituting an objective confirmation.

3.3.7. Interviews with SII&SP experts

For fine-tuning the results and verifying the recommendations, interviews were conducted with SII&SP experts.
We spoke with programme leaders of the DURP programme from the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM), the Association of Netherlands Municipalities (VNG) and Provinces. We also spoke with the DURP project leader in the Province of Limburg and the persons responsible for SII of the Foundation GEONOVUM and VROM as the organisations in charge of implementation of INSPIRE in the Netherlands.
The list of interviewees is attached in annex 1.

3.4. Summary

This chapter has described the research set-up. Three studies have been carried out:

- One to measure the status of SII implementation in the research area, i.e. municipalities in the Province of Limburg and in the Kreis Heinsberg.
- A study to determine the willingness to implement a SII with the help of the Technology Acceptance Model.
- And a study to determine SII maturity from an organisational perspective with the aid of the SII Development Matrix defined in the previous chapter.

For every study, a solid explanation was given on how it was performed and a more in-depth analysis was also made of the coherence between the three studies.

In addition, management / councillors of municipalities were interviewed to receive their feedback on the statements in the Organisational Development Matrix, and interviews were also conducted with area experts to verify the research results.

4. Research findings

4.1. Introduction

The previous chapter provided a description of the research set-up. The study covered six steps and was carried out in the Province of Limburg. For answering the partial subquestion ‘are the neighbouring German municipalities able to grant access to Geo Information?', the study was also carried out in the Bezirk Heinsberg.
First, we are describing the response in the studies. Next, the results of each study are described based on which - using a model – it was determined whether the municipalities are willing and able to implement SIIs.

4.2. Response in the studies

Out of the 40 municipalities in Limburg, 36 municipalities (90%) filled out the questionnaire on the inventory of the SII status. The respondents were contacted personally on several occasions, and every municipality was also supposed to explain the filled out questionnaire in the information session, which has most certainly contributed to a higher response rate.
Three of the four municipalities that did not respond are municipalities with less than 10,000 inhabitants. In two municipalities, it turned out that the questionnaire was not returned because the person responsible for this task was about to leave or had left the organisation shortly before.
The other two municipalities interviewed within the framework of analysing the existing management support pointed out that the wrong persons were approached.

Both other studies, i.e. the web form with the questions of the TAM study and of the Organisational Development Matrix, were filled out by 37 respondents from 30 different municipalities.

The table below shows that the bigger the municipality, the higher the response percentage. As compared to previous studies among Dutch municipalities carried out by Colijn (2000) and Peters (2003) a response rate of 75% is considered high.

Category	Number of municipalities		response municipalities		resp/number
	abs.	%	abs.	%	
> 50,000	5	13%	5	17%	100%
20,000 <> 50,000	11	28%	9	30%	82%
< 20,000	24	60%	16	53%	67%
totaal	40	100%	30	100%	75%

Table 4.1 Response to the web form Organisational Development Matrix and TAM

Looking at the background of the respondents, we see that most are related to 'Spatial Planning' (see figure 4.1 below).

If we classify the 37 respondents according to municipal size, we see that most (48%) are from a small municipality (< 20,000 inhabitants), also see graph below.

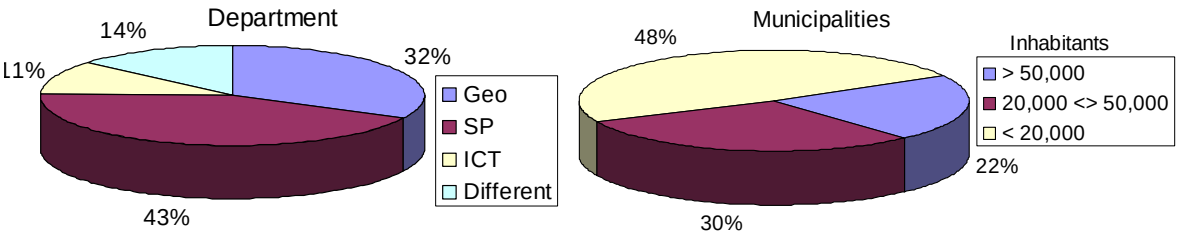

Figure 4.1 Distribution of respondents by work department and municipality size.

4.3. SII implementation status in the municipalities

The SII implementation status was studied by using the Rajabifard (2003) model that describes the SII components separately. Below, the results of the study are described (briefly) per SII component.

In addition, we have mentioned the results of the additional questions related to the DURP (Digital Exchange in Spatial Processes) process. The results of the inventory are further detailed and classified by the number of inhabitants of the municipalities in annex 6.

Data:

Twenty-two out of the 36 municipalities that responded have one or more digital (object-oriented) and exchangeable zoning plans, i.e. more than half of the municipalities of Limburg. When analysing the relationship between the total number of plans and the number of digitally exchangeable plans, on average 22% of the plans are digitally exchangeable. However, even though a new digital object-oriented plan replaces several analogue plans, this percentage is lower as various municipalities have not specified any value.
In general, the municipalities take advantage of the update of a zoning plan to prepare a new digitally exchangeable plan.

Network:

Less than half or 15 municipalities have granted access to their spatial plans on their intranet and 5 municipalities publish their plans on the internet. Twenty-one municipalities have a Mapserver. Twenty-four municipalities mention they have planned developments in this field. One remarkable aspect in this sense is that of the municipalities that do not have a Mapserver, 5 have not planned any developments. Considering the size of these municipalities, four out of the five municipalities are small (< 20,000 inhabitants).

Human Resources:

Twenty-six municipalities have employees with GIS knowledge.
For granting access to the spatial plans, 17 municipalities have one or more employees. Comments show that some municipalities that are not yet granting access to their spatial plans have not (yet) discussed this task. We can therefore not draw any conclusions regarding this number of 26. In relation to the research of Peters (2003) that concludes that 64.4% of the

municipalities have a specific division or employee in charge of the set-up, implementation and maintenance of GIS applications, the 72% of municipalities that have employees with GIS knowledge is in keeping with the expectations.

Policy:

All municipalities want to make their spatial plans available to their employees and practically all of them also want to make them available to citizens as well. Even though they wish to grant citizens access to the plans, from the information sessions and interviews it is clear that the municipalities are afraid that the provision of so much detailed information to citizens may raise questions that, in view of possible shortcomings in the plan or misinterpretations, might frustrate the plan development process.

Various municipalities have pointed out that in a first phase, they want to grant access to the plans only for internal use, and in a later phase grant access to citizens as well.

Even though in their analysis of the status of the national Spatial Information Infrastructure, Crompvoets and Van Loenen (2007) note that so far there are no signs in the Dutch municipalities of a change to a low-threshold policy for making available Spatial-Information, the information sessions have shown that the municipalities want to make the plans available for everyone free of cost and without any restrictions.

Technology:

Most municipalities, i.e. 27 out of the 36, mention that they have GIS software. The software packages vary from desktop GIS to intranet/internet viewers. The information sessions and interviews confirm that there is a limited understanding of what a Spatial Information Infrastructure is and of what technological components it is made up. Of the packages that do not support a service-oriented architecture (SOA), it is assumed that the software supports open standards and can be integrated with other applications.

Standards:

Therefore, the practically unanimous answer to the question whether the used GIS software complies with Open Standards was yes.

From a data content point of view, people seem to be more aware of the standards.

Thirty municipalities use the content standard for the harmonisation of spatial plans, i.e. the Information Model Spatial Planning (IMRO, 2003), as a starting point for drafting or contracting out the development of zoning plans.

Process:

During the information sessions and interviews, it was repeatedly difficult to clearly explain what a Spatial Information Infrastructure is and in what way it can support the spatial planning process. People mainly had difficulties to imagine the way in which the own information should be made accessible and the relationship with the GIS software used in the municipality. Most municipalities said that their plans would be digital and exchangeable within the next five years.

As the legal update obligation is 10 years, some more time will be needed before all plans reach that point. Another notable factor was that many municipalities have contracted out the digital development of their plans to an external agency.

For being able to compare the results and apply them in the model, every SII component per municipality was given a value of 1-4 (see annex 7).

4.4. Information meeting with the municipalities

Clustered by central municipality and the surrounding municipalities, information sessions have taken place to inform the municipalities of what a SII is and what it can mean for them. They were asked to explain the situation per municipality based on the filled out SII status list. In total, 29 municipalities participated with one or more persons in the meetings.

During the explanations, it became clear that the municipalities have a positive attitude towards implementation of a provincial SII and that they are prepared to make a contribution to this. The Spatial Planning participants considered that the availability of up-to-date spatial information from different sources is a major plus-point.
It was also clear that there is a considerable lack of clarity among Geo and ICT employees on the consequences for their own environment when implementing a SII, particularly as regards technology.

In his research on the dissemination of SII, Masser found that the communication on or knowledge of new developments are crucial for ensuring acceptance.
In the study on SII maturity, the respondents were asked if they know what a SII is and whether sufficient information is available in their organisation for implementing a SII.
Eighty-one percent of the respondents said they know what a SII is and 46% believe they have sufficient knowledge to implement a SII.

4.5. Willingness to implement a SII (TAM)

The Technology Acceptance Model (Davis, 1989) was used for determining whether the municipalities are willing to implement a SII.
Thirty-seven respondents from 30 different municipalities assessed the affirmations of the Technology Acceptance Model (TAM), indicating the extent to which they agree or disagree with each of them.
We have applied the same phrasing and scale as in Davis original research.
The research findings are included in the table below.

Descriptive Statistics	Min	Max	Mean	Std. Deviation
Perceived Usefulness				
Using SII in my job would enable me to accomplish tasks more quickly.	3	5	4.16	.688
Using SII would improve my job performance.	2	5	3.97	.763
Using SII in my job would increase my productivity.	3	5	3.68	.709
Using SII would enhance my effectiveness on the job.	3	5	4.05	.705
Using SII would make it easier to do my job.	3	5	4.05	.621
I would find SII useful in my job.	3	5	4.11	.699
Perceived Ease of Use				
Learning to operate SII would be easy to me (Portal).	2	5	3.59	.927
I would find it easy to get SII to do what I want to do (invert).	1	4	2.70	.909
My interaction with SII would be clear and understandable (Viewer).	2	5	3.81	.811
I would find SII to be flexible to interact with.	2	5	3.54	.836
It would be easy for me to become skilful at using SII.	2	5	3.57	.801
I would find SII easy to use.	2	5	3.54	.767

Table 4.2 Technology Acceptance Model research results in Dutch municipalities

The respondents assessed the expected usefulness with an average high score of 4. A deviation of around 0.7 shows that the dispersion in the answers was limited.
Also the expected user-friendliness was assessed positively (average of 3.5), except for the second affirmation, albeit that the deviations were slightly higher with values up to 0.9.
The second affirmation of the expected user-friendliness had been phrased in a negative manner to avoid habit formation when answering the questions. Before comparing the results with the other affirmations, they were inverted.

As regards reliability of the model, just like in Davis' model the Cronbach's alpha was used to measure reliability and validity of the applied scales. This analysis based on the statistics

programme SPSS showed a Cronbach's alpha of 0.91 for expected usefulness and of 0.63 for expected user friendliness. The nearer these values are to 1, the more reliable the applied scale. In the Davis' model these values were 0.98 and 0.94, respectively.
It turns out that the second affirmation on expected user-friendliness 'It will be difficult for me to have the SII do what I want it to do' is the one bearing the least relationship with the other affirmation in 'expected user friendliness'. In Davis' original research, this affirmation is less deviant.
Nunnally (1978) recommends an alpha of 0.70 as the threshold value for a reliable and valid scale division. Nonetheless, Davis et al. (1989) state that when applying the TAM, 'expected usefulness' is a significantly stronger factor for future use as compared to 'expected user friendliness'.

4.6. SII maturity

For determining each respondent's position in the matrix, first of all we have inverted the answers to the negatively phrased questions.
Next, we have added the number of positive answers per key factor, whereby the average determines the position in the phase matrix.

Adding up the scores per key factor gives us an idea of the municipality's position, but as all factors are important, a graph is a better way to quickly assess the municipality's status and where further developments are needed.
The figure below (4.2) shows the answers of the respondents in a graph.

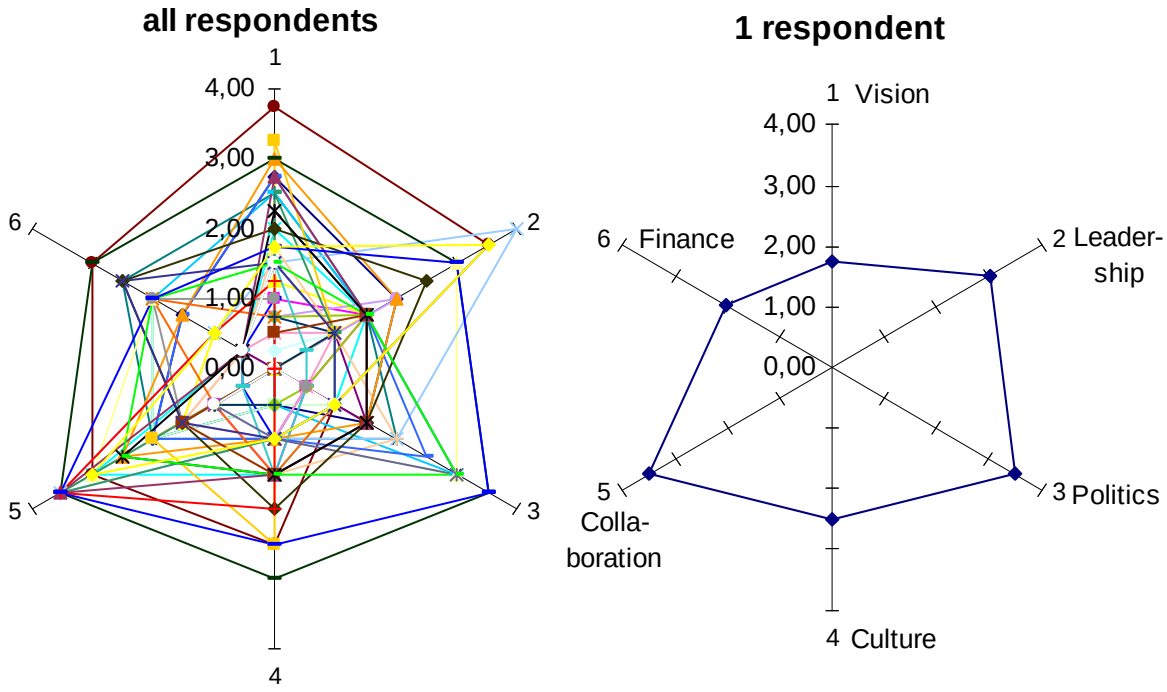

Figure 4.2 Organisational Development Matrix: Dutch municipalities reflected in a graph

The graph covering all respondents shows us that the separate observations vary considerably. It is difficult to draw any further conclusions.

For one (random) respondent (on the right) we see that Leadership, Politics and Collaboration are in phase four, Culture and Funding in phase three and Vision in phase two. It is therefore this respondent's view that Vision is the element requiring most development as yet in his/her organisation.

The table below (4.3) shows the research findings per development factor in a statistical manner.

Organisational Development Matrix							
		SII awareness / vision / clear objectives	Leadership / coordination	Involvement management / politics	Culture / willingness to change	Collaboration	Funding
N	Valid	37	37	37	37	37	37
	Missing	0	0	0	0	0	0
Mean		1.7432	1.5135	1.3243	1.1216	1.9730	1.0946
Median		1.5000	1.5000	1.0000	1.0000	2.0000	1.0000

Mode	1.50	1.50	1.00	1.00	1.00	0.00
Std. Deviation	0.86097	1.01712	1.04227	0.77644	0.99265	0.96348
Minimum	0.25	0.00	0.00	0.00	0.00	0.00
Maximum	3.75	4.00	3.50	3.00	3.50	3.00

Table 4.3 Findings of the Organisational Development Matrix in Dutch municipalities

Of the key implementing factors, on average the highest score is assigned to the willingness to collaborate. On average, the lowest score is assigned to Funding. In his research on the development of National Spatial Data Clearinghouses, Crompvoets (2006) also found that funding was the principal obstacle for development of a SII.

In interviews with municipal managers and directors, it became clear that even though Spatial Information is not often discussed in official meetings, people are aware of the obvious value added of a SII for the municipalities. In the municipalities that do not have any regular resources at their disposal, the directors have pointed out that there would be financial support for good proposals. They see collaboration as a possibility to gain efficiency. Smaller municipalities consider this is the only possible way to realise a SII. But it was also clear that, among other things as a result of the recent municipal redivision, the collaboration with some municipalities is a politically sensitive matter. All interviewed managers/councillors support the implementation of a SII in Limburg, whereby the Province is seen as the instance for coordinating this activity beyond municipal borders (leadership role).

Having a closer look at the municipalities in which different respondents answered the questions, we have noticed that in the case of 4 of the 7 municipalities there are significant differences between the answers given within the same municipality. These differences cannot be attributed to certain key factors and do not seem to be the result either of the ‘Don’t know’ option.
In the 7 municipalities we see that the respondents from the Spatial Information and Real Estate departments have given most positive answers while most negative answers come from the Spatial Planning department.

These differences within the same organisation also represent the strong differences there can be in the personal perspective different persons have of organisational aspects of a SII.

4.7. Determination of the municipalities willingness and ability to implement a SII

Together with the results of the TAM, the position in the SII maturity matrix shows the degree to which the municipality is able to grow towards SII implementation starting from the current SII status.

For determining whether the municipalities are willing and able to implement a SII, the three studies are connected as per the model shown in figure 4.3.

Determination of ‘being willing:

When determining ‘willingness', a positive TAM score means that the respondent is expected to be willing to use the development. This implies that according to the TAM method all municipalities will start using a SII. However, being willing to use a SII does not automatically mean that the municipality is also willing to actually implement a SII (regardless of the degree to which it is able to do so). In this model, the starting point was a value of 1 or higher, which shows that the municipalities are sufficiently motivated to implement a SII.

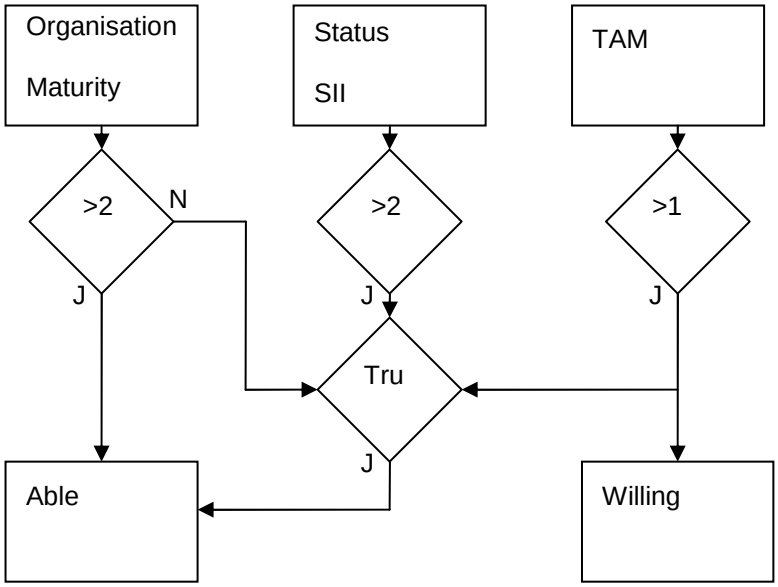

Figure 4.3 Model to determine willingness and ability

Determination of 'being able':

The position in the SII maturity matrix (which is also called the organisational development matrix) shows whether the municipality is able to implement a SII from an organisational perspective. Looking at the position of different municipalities and the experience with these municipalities, we can conclude that an average value of 2 or more is sufficient to affirm that the municipality is able to implement a SII. Still, it is a good idea to also have a look at the separate key factors as a low value in one of these factors may mean that this municipality might be faced with a problem when implementing the SII.

In case the value is under 2, it is important to first have a look at the found SII implementation status. If it shows a value under 2, the municipality will not be able to implement the SII. If it is higher than 2, than we can consider that the municipality is able to implement a SII provided its willingness is also high (see figure 4.3).

In case of several respondents from one municipality the mean value is used to report by municipality.

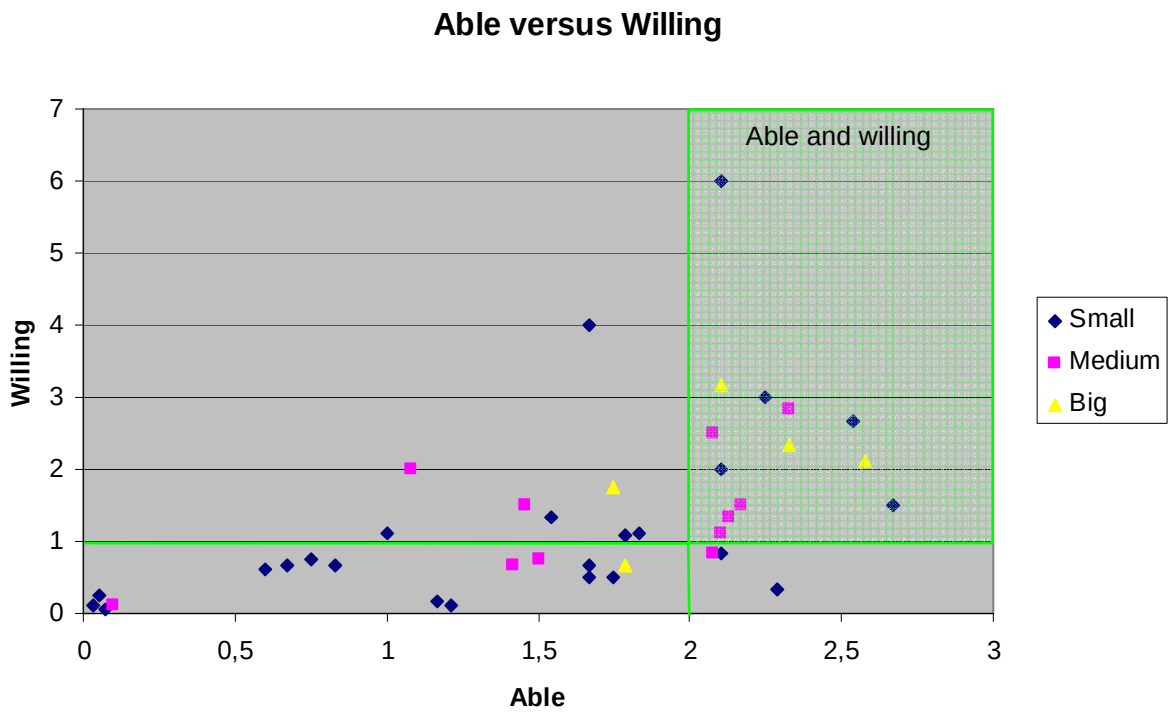

Figure 4.4 Graph on 'willingness' and 'ability' of the municipalities of Limburg

As shown in the graph of figure 4.4, approximately half (21) of the 40 municipalities are sufficiently willing to implement a SII. Fifteen municipalities (38%) seem to be able to implement a SII. Moreover, we can conclude that the scores in smaller municipalities are lower as compared to the bigger ones.

The four municipalities that did not respond and for which it is not possible to make an assessment based on the other studies are all, but one small municipalities. As expected, these municipalities cannot be considered as being able to implement a SII.

As a result of the studies and the used model, we see that 13 municipalities or around one third are both willing and able to implement a SII. Consequently, 27 of the 40 municipalities, i.e. two thirds are either unwilling or unable to implement a SII!

Having a closer look at the values of the three studies (annex 7), we see in many cases similar values in the SII implementation status, the Organisational Development Matrix (ODM) and the TAM. In other words, if the score of the SII status is low or high, then in most cases the score in the other two studies will also be low or high.

This is in keeping with the assessment made on beforehand that the measured SII implementation status is an objective confirmation of the position in the SII maturity matrix.

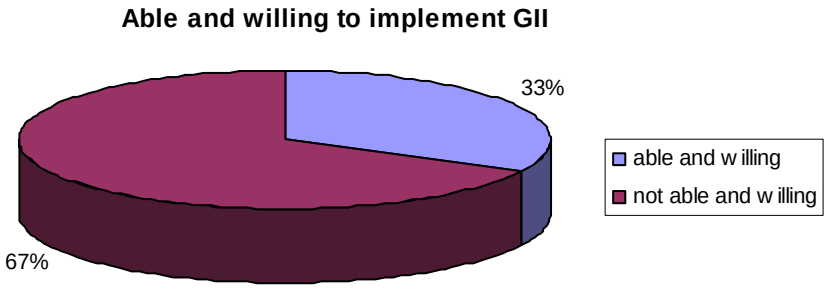

Figure 4.5 Number of municipalities in Limburg that are wiling and able to implement SIIs

4.8. Results of the study in Kreis Heinsberg

Response: In Kreis Heinsberg, all 10 municipalities returned the SII status list and five municipalities filled out the web form. The two biggest and the three smallest municipalities did not fill out the web form.

SII status study: The total score of the SII status study shows that none of the 10 municipalities obtained 2.00 for the degree of implementation.

This is because the Dutch municipalities have standardised object-oriented digital plans as a result of the DURP programme. A second reason is that many German municipalities are not willing to make their zoning plans available to citizens.

Information meeting: In the Kreis Heinsberg, a joint information session took place with representatives from the Kreisverwaltung. Nine of the 10 municipalities attended this meeting.

TAM: The results of the five German municipalities that participated in the TAM study are consistent with the results on the Netherlands side. The score for the expected user friendliness is also lower here than the score for the expected usefulness. Four municipalities out of five are sufficiently willing to implement SIIs.

SII maturity: As only five of the 10 German municipalities took part in the study, we can only reach limited conclusions. It catches the eye that the key implementing factor Funding has a very low score, null in four of the five municipalities. Also the score for political support is lower as compared to the Dutch municipalities. None of the municipalities reaches the threshold value of 2.00.

Willingness and ability to implement a SII:

Four of the five municipalities in Kreis Heinsberg that participated in the web study are willing to implement a SII. In view of the score under 2.00 both in the organisational development matrix and the SII implementing status, none of the ten municipalities can be considered as being able to implement a SII.

Please see annex 5 for further details on the research among German municipalities.

4.9. Interviews with area / field experts

Discussions were held with area experts to hear their feedback on the research findings and gather their recommendations. They acknowledged the results.

As a result of these conversations, the research questions, findings and recommendations were phrased more clearly so as to minimise differences in the interpretation.

Annex 1 includes a list of the interviewees.

4.10. Summary

This chapter has described the research findings. The research response was relatively high, though it was clear that the smaller the municipality, the lower the response rate.

The results on the current SII implementation status were described for each component of the Rajabifard model and have clearly underlined the importance of the information meetings.

The results of the TAM study have clearly shown that most respondents understand the usefulness of a SII, but with a lower score for expected user friendliness.

The SII maturity was determined on the basis of the organisational development matrix and by translating the results into a graph, it became clearly visible what aspects require further development.

For determining whether the municipalities are willing and able to implement a SII, a model was developed to answer the research questions based on the results of the three studies.

One third of the municipalities can be expected to be willing and able to implement SII.

Research in the German Kreis Heinsberg has shown that none of the studied municipalities is able to implement a SII.

Besides, we interviewed both councillors and managers of the municipalities and area experts. All directors support the development of a Spatial Information Infrastructure in Limburg. The experts gave feedback on the research, the results and the recommendations.

5. Conclusion and recommendations

5.1. Introduction

For determining whether the municipalities are willing and able to implement a SII, we have first reviewed the available literature, with an analysis of the models that could be used and preparation of the research set-up. Next, the study was carried out in the Province of Limburg and in the Kreis Heinsberg, based on three research models to collect the needed information and to analyse the research findings.

This chapter describes the conclusions of the study and answers the defined subquestions.

In addition, some thought will be given to the study and some critical aspects such as one's own influence on the research findings and the subjectivity of persons are gone into. There is also an indication of the areas requiring further research.

A series of recommendations is provided as well to enable the municipalities to better implement a SII. Some recommendations are also given on the implementation of INSPIRE, the framework directive that entered into force on 15 May 2007 for implementing a Spatial Information Infrastructure in Europe.

5.2. Conclusion

Spatial Information Infrastructures (SIIs) are complex and in Rajabifard's opinion (2003) they can best be explained by describing the different components. Through this component-based model it was possible to make an inventory per component of the progress made by the studied municipality in implementation of a SII. At the same time, the SII Organisational Development Matrix developed during this study turned out to be a good method to measure the SII maturity of the studied municipalities from an organisational perspective based on the key SII implementation aspects.

Thirdly, the Davis' Technology Acceptance Model (1989) showed that the municipalities have a clear understanding of the personal usefulness of a SII, though they have more difficulties to imagine the user friendliness of these infrastructures. The expected usefulness and user friendliness together predict the expected use and hence the personal implementation willingness.

Based on the inventory of the current SII implementation status in the municipalities, the measurement of the willingness to implement SIIs and the determination of SII maturity from an organisational perspective, it was found that around half (21) of the 40 municipalities in Limburg are willing to implement a SII and slightly over one third (15) is also considered able to do so. Approximately one third (13) of the municipalities is both willing and able to implement a SII. Based on these results, we can conclude that at the moment the municipalities in Limburg (as a whole) are **not** willing and able to implement SIIs.

Looking at the degree of implementation, we see important differences. When considering all SII components separately, especially the smaller municipalities have not yet made a lot of progress and despite the imminent legal obligations, some have not even planned any developments so far.

Also in terms of SII maturity from an organisational perspective, the smaller municipalities' score is lower than that of the bigger ones. Despite the significant diversity of the positions in the organisational development matrix per key factor, the average score was between 1 and 2, with the lowest score for funding. Crompvoets (2006) already pointed out that funding was a bottleneck in SII development.
On average, collaboration occupied the highest position in the matrix. The municipalities consider that collaboration is the way by excellence for taking advantage of developments with a minimum own effort. Some municipalities said they were already involved in collaboration links in the field of Spatial-Information.

One of the causes explaining the lack of sufficient willingness to implement a SII is that there is too little information on what a SII is and what it could mean for the municipalities.
Besides, it is unclear what the consequences are for the already existing Geo environment or the municipalities are reluctant to deal with these consequences. Interviews with municipal councillors show that they do indeed understand the advantages. All interviewed managers/councillors had a positive attitude towards implementation of a provincial Spatial Information Infrastructure.

SII can offer a significant value added when applied in the field of Spatial Planning (Steudler, 2003). Though the municipalities will be obliged to draft new spatial plans in a digital form, the maximum update term of 10 years means that it will take years before all plans are available in a digital format. The study has found that the municipalities that already have digital plans often contract out this task. Another noticeable aspect was that the respondents from Spatial Planning departments had a more negative score in the Organisational Development Matrix. It is unclear what is the underlying cause explaining this, maybe the long duration of the DURP programme has something to do with this.

5.3. Subquestions research

During the literature review and execution of the study, we have examined up to what extent the previously identified subquestions could be answered for the studied target group. The results for every subquestion are detailed below:

1. Is the value added of Spatial Information Infrastructures unknown to municipalities?

The answers from the organisational development model to questions on the vision on a SII show that many municipalities did not know what a SII was and what it could mean for them. This was confirmed in the information sessions with the municipalities and in discussions with the municipal

managers and councillors. It was necessary to first inform the municipalities and councillors with a PowerPoint presentation with images on the application aimed at making the value added clear. Eighty-one percent of the respondents give a positive answer to the question whether they know what a SII is, though we must mention that most of them attended the prior information session. Hence, it is impossible to give a clear single answer to the question 'Is the value added of Spatial Information Infrastructures unknown in the municipalities'? But we can conclude that SIIs and therefore the value added thereof are insufficiently known in the municipalities.

3. Does culture play an important role in implementation of a SII?

Theory has shown that culture is one of the key factors for implementation of a SII (Hofstede, 1997). In spatial planning, where chain collaboration is part of the Spatial Planning process, this was reflected in the chain quadrant (de Wit et al., 2000) where control and cooperation are at square angles to chaos and rivalry (figure 2.9).

The big differences in the answers in the Organisational Development Model to questions related to cultural aspects such as the inward focus, agreements in the infrastructure, the access to information islands and the role of the ICT department show also in this research that culture indeed plays an important role in the implementation of SIIs.

At the same time, some municipalities were in favour of publicly sharing their spatial plans with citizens while others said that sharing spatial plans with citizens raises rather than answers questions.

4. Is technology a bottleneck for implementing a SII in municipalities?

The Dutch e-government architecture is based on a service-oriented architecture (NORA, 2006) and in all meetings it was clear that all municipalities with some ICT knowledge consider that a SII is an appropriate step in their own developments. The answers to the research question 'are web services part of your architecture vision?' are both positive and negative. A further analysis of the answers showed that employees from the spatial planning department gave more negative answers. It was impossible to link this to the size of the municipalities.

From a practical point of view, most municipalities have an operational Geo-ICT environment and the consequences of implementation for the already existing geographical information systems were unclear. Security was also an issue.

The finding that suppliers say that their products are in conformity with Open GIS Standards though it turns out that this is not so in practice renders things even more difficult. Moreover, not all suppliers are fully aware of the need to quickly adjust their products.

The average score for the direct question ‘is technology a bottleneck for implementation of a SII?’ was 2.94 i.e. ‘don’t agree / don’t disagree’. Both in terms of size of the municipality and in terms of work department of the respondent, it was impossible to lay links.

In summary, even though technology will be a bottleneck less and less, at the moment there are many people who still experience technology as such.

2. Are the principal obstacles when implementing a SII of an organisational rather than a technical nature?

Pijpers et al. (2002) already concluded that technology acceptance was not the most important issue when implementing a new technology. Also Nedović-Budić and Pinto (2000) mentioned that in the case of geographical information systems in spatial planning, technological problems were not the central issue. It turned out that personal motivation was more important.

The analysed theory on SII implementation showed that six key factors for SII implementation from an organisational perspective could be inferred.

These factors, which are all of a non-technological nature, determine whether the municipality is able to implement a SII.

Even though many people still consider technology as a bottleneck, the principal obstacles for SII implementation are of an organisational rather than a technological nature.

5. Do small municipalities have more difficulties to implement SIIs as compared to the bigger ones?

Looking at the results of the study, it is the smaller municipalities that are not willing or able to implement SIIs.

The fact that the municipalities that did not react are in general small municipalities confirms this idea. The response showed that the bigger the municipality, the higher the response.

Another worrying factor is that the municipalities that do not yet have a map server and that have not planned any development are small municipalities. A positive factor is that the small municipalities consider that collaboration is a possibility to comply with the requirements. Besides, the smaller municipalities seem to be more flexible and might therefore be able to more quickly implement a SII as compared to the big ones. The bigger municipalities often operate in silos (van Duivenboden et al., 2005).

It is therefore impossible to simply answer the question of whether it is more difficult for small municipalities to implement SIIs in an assenting manner, though it is a fact that small municipalities cannot do things alone and need help because of their lack of sufficient knowledge and experience.

6. Are the neighbouring German municipalities able to grant access to Spatial-Information?

For answering the research question, the study on the willingness and ability to implement SIIs was also carried out in the German Kreis Heinsberg.

In the organisational development matrix, the score assigned to funding was significantly lower as compared to the Dutch municipalities. This is one of the factors why none of the five municipalities that filled out the web form is able to implement a SII, though four out of the five were willing to do so.

Looking at the current implementation status, the lack of digital object-oriented spatial plans and the policy for granting citizen access to these plans turned out to be structurally different from the Dutch municipalities. Nevertheless, as is the case in the Dutch municipalities, half of the municipalities have a mapserver. Still, based on the measured implementation status, we can consider that none of the ten municipalities is able to implement a SII.

In the meeting it became clear that Germany has been working for a longer time on SII development and that people are more aware of what a SII is and what it can mean for the municipalities. It was also clear that the Kreis, the government level above municipalities, has a clear vision of implementing a SII together with the municipalities. This vision had also been shared already with the municipalities at a governmental level.
Just like in Limburg in the Netherlands, it was found that the municipalities themselves will not be able to implement a SII. Collaboration also seems to be a solution here and the Kreis could assume a leadership role so that the German municipalities will be able to grant access to the Spatial Information provided funding is available.

5.4. Reflection on the research

In the study on organisational maturity, we have found differences between different respondents from the same municipality. This raises the question whether the research results and hence the conclusions are reliable?
The reason of these differences could be that the wrong persons participated in the research. The fact is that someone's personal opinion is subjective and that the determination of the position in the SII maturity matrix is based on a qualitative analysis.
Further research is needed to find out the reason for these differences.

The TAM is a qualitative analysis as well. The TAM measurement showed a unanimous positive score as regards the question on expected usefulness. The answer to the question on expected user friendliness was less unanimous. The second affirmation within ease of use should be changed to get a higher correlation. This measurement should be repeated with a hands-on prototype so that the respondents could have a better idea of a SII.
The measurement of the current implementation status is a quantitative analysis and has a higher level of reliability.

The used threshold values to determine whether a municipality will be willing or able are the author's assessments based on knowledge of the municipalities and experiences in SII implementation in the border area. But there is no comparable scientific research or model against which this could be tested.

There are different reasons why expectations are that this research will not be representative for the rest of the Netherlands. The first one is the ongoing development of a cross-border Spatial Information Infrastructure in which seven of the municipalities in Limburg as well as the province and Kreis participate. The second one is that as an employee of the province of Limburg the researcher has had an influence on the response and possibly the answers to the questions from the TAM and the organisational development model have been more positive.
Expectations are that the results in the rest of the Netherlands will be 'less positive', which also requires further research.

In the research covering the German municipalities, a limited number of border municipalities was contacted, only in the Kreis Heinsberg. Further research is required to find out whether the results are representative for all German municipalities bordering on Limburg.

5.5. Solution directions for the municipalities

Implementing a SII is not something that can be done from one day to the next and begins with communication on the value added of a SII for the municipalities. This both at the level of Spatial Planning, Geo and ICT employees and at the level of the municipal management and government. In the meetings with municipalities and councillors, it was clear that showing examples of SIIs is extremely important.
Other necessary factors are coordination and leadership to focus the implementation process from a perspective that goes beyond the municipal level. The interviewed councillors pointed out that the Province/Kreis/Bezirk is the most adequate level for assuming this role. Agreements at the

governmental level are also needed to ensure the exchange of information and enable chain collaboration.

A service-oriented architecture is a requirement for meeting the e-government obligations, which implies that the implementation of a SII becomes easier technically speaking.

Funding is a crucial factor and resources are needed to implement a SII. The research has shown that even though funding is considered a problem, money can always be made available for good projects. This was confirmed in the interviews. Also collaboration and the use of European structure funds (Interreg, 2007) were mentioned as possibilities for limiting this problem.

We found that mainly the smaller municipalities lack knowledge and experience with SIIs. One way to compensate this drawback is make use of a shared service centre or by taking advantage of the infrastructure of a big municipality. An improved collaboration is the best way to enhance the municipalities' ability to implement a SII.

5.6. INSPIRE recommendations

An important part of this study consisted of informing the municipalities of what a SII is and what this can mean for them. An ongoing communication with the municipalities is also needed from INSPIRE. Masser (2007) refers to this as networking which he considers is a 'social learning process'. In this sense, it is important that it is not only clearly explained to the municipalities that they will be obliged to harmonise and grant access to the information in keeping with the implementation rules, but rather that they are made to understand this need. Only if and when the municipalities themselves see the advantages, they will cooperate in the implementation. Similar to the obligation of drafting digital spatial plans. By contracting this out and maintaining an update regime of 10 years, the intended effect will not be achieved for the time being.

Funding turned out to be the principal bottleneck in SII implementation: invest in local developments. Central and local developments must run in a parallel manner rather than consecutively.
Central facilities are not the solution in this. The policy officer or spatial planner must be able to use the available information in his workplace in his own application combined with local information. This is the best way to support work processes or chain collaboration.

The municipalities cannot do this alone and collaboration is the manner by excellence to implement a SII.
Foment collaboration and invest in knowledge to adequately advise the municipalities. Use the governmental layer beyond the municipal level with expertise in the field of SII that knows the municipalities and can play a coordinating role in the implementation, e.g. Provinces (the Netherlands), Kreisen and Bezirken (Germany). Because of the differences between the administrative levels in the EU the responsibility for implementation on the local level has to be covered well.

Furthermore, examples are needed of functioning SIIs focusing on policy content issues.
This way, it can be possible to obtain both official and political support for implementing SIIs at the local government level.

Granting access to and using information in the Spatial Information Infrastructure is the first important step, particularly in a cross-border situation. Harmonisation of the data is the next step. An attempt must be made to avoid that the harmonisation will take years with no data being available in that time.
Avoid investing public funds in geographical information that is not made available free of cost.

INSPIRE will have to focus more on local governments. The top-down and bottom-up approaches must be in balance. In view of the bottlenecks identified in this study, it is important to avoid thinking that ‘the municipalities will catch up later’. Actions should be taken now!

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Annex 1 - List of the interviewees

Politicians Municipalities:

Gemeente Maasgouw	Councillor	P. Prejean
Gemeente Kessel	Mayor	A. Swachten
Gemeente Beek	Councillor	J. Bijen
Gemeente Kerkrade	Mayor	J. Som
Gemeente Eijsden	Mayor	M. Pelzer
Gemeente Leudal	Councillor	P. Verlinden
Gemeente Meerlo-Wanssum	Councillor	C. Brugman-Rustenburg
Gemeente Venlo	Councillor	P. Freij
Stadt Wegberg	Mayor	H. Klein
Kreisverwaltung Heinsberg	Councillor	J. Niessen (Kreisrechtsdirektor)

Experts field of study:

DURP Program:

Geonovum:	T. Overduin (former Dutch provinces)
Association of Netherlands Municipalities (VNG)	P. van Teeffelen
Ministry of Housing, Spatial Planning and the Environment	Y. Schilp

INSPIRE

Geonovum	M. Reuvers
Geonovum	R. Beltman
Ministry of Housing, Spatial Planning and the Environment	N. Hooyman
Landes Vermessungs Ambt North Rhine Westphalia	J. Riecken

Annex 2 - Questionnaire Status SII Implementation

Questions addressed to municipalities for acquiring a better understanding of the status of their spatial infrastructure and DURP (digital exchange in spatial processes) process.

Data:

How many zoning plans do you have at the moment?:
- Digital, IMRO-coded:
- Digital (scan):
- Not yet digital:

Network:

Are your spatial plans accessible on the:
- intranet?:
- internet?:

Is a Map server available?
Have you planned any developments in this field?
Do all employees have internet access (Internet Explorer)?

Human resources:

The number of employees with GIS knowledge?
Are any of your employees responsible for ensuring access to spatial plans?

Policy:

Do you want the spatial plans to be accessible to municipal employees?
Do you want the spatial plans to be accessible to citizens?
To what extent are you working on this at the moment?

Technology:

Do you use GIS software?
If so, what type?
On how many work places is this software available?
Does this system meet open standards?

Process:

Has an action plan been prepared for implementing DURP?
Does the municipality use an (own) manual for drawing up zoning plans?
Does the municipality have any software for preparing DURP plans?
for consulting DURP plans?
Is DURP included as a condition when entrusting someone with the task of drawing up zoning plans?
When can you exchange the first DURP-plan with the Province of Limburg?
When do you think all zoning plans will be DURP-proof?

Annex 3 - Questionnaire Technology Acceptance Model

Questionnaire TAM (Davis) to investigate the willingness of municipalities to implement SIIs by determining the perceived usefulness and the perceived ease of use.

Perceived Usefulness

Using SII in my job would enable me to accomplish tasks more quickly

Using SII would improve my job performance

Using SII in my job would increase my productivity

Using SII would enhance my effectiveness on the job

Using SII would make it easier to do my job

I would find SII useful in my job

Perceived Ease of Use

Learning to operate SII would be easy to me (Portal)

I would find it easy to get SII to do what I want to do

My interaction with SII would be clear and understandable (Viewer)

I would find SII to be flexible to interact with

It would be easy for me to become skilful at using SII

I would find SII easy to use

Annex 4 - Questionnaire Majority Development Matrix

This questionnaire is used to determine the SII majority from an Organisational perspective.

aspect	**1. Stand alone / initiation**	**2. Exchange / standardisation**	**3. Intermediate phase**	**4. Network**
A. SII awareness / vision / clear objectives	Focus on the internal organisation	Synchronisation on shared objectives	Focused on implementation of the shared objective	Shared vision Focusing on innovation
B. Leadership / coordination	Focus on the individual	Leadership requested	Accepted leader	Shared leadership
C. Involvement management / politics	No involvement	Management involved	Management directs development	Management actively involved
D. Culture / willingness to change	Holding on to existing patterns	Awareness of needed changes	Clear and accepted need for change	Ample support Clear advantages
E. Collaboration	Focus on internal collaboration	Advantages of collaboration are clearly understood	Development towards network organisation	Network organisation
F. Funding	On an ad hoc basis	Project related	Funding assured for a certain period of time	Sustainable, passing on of costs

Questions: 5 choices: fully agree - fully disagree

A.

Phase 1
- Spatial information is (still) used to a limited extent in our organisation.
- When developing our Spatial Information provision, we take into account national/international data models and standards.
- Internal developments come before outward-oriented developments.
- The value added of a Spatial Information Infrastructure (SII) is unknown within our organisation.

Phase 2
- Technology is a bottleneck when implementing a SII.
- There is a clear plan for the realisation of DURP.
- Geographical information may play an important role in our organisation for making decisions on spatial problems.
- We consider spatial information as a means of communication towards citizens and other organisations.

Phase 3
- There is geo-awareness and there are multidisciplinary initiatives being taken.
- Geographical information plays an important role when making decisions on spatial problems.
- Spatial Information integrates information from different topics within our organisation.
- Web services are part of our architecture vision.

Phase 4
- Our organisation has a clear vision on spatial information provision or Spatial Information Infrastructures.
- We have defined clear objectives on what we want to achieve with a SII in the future.
- We are part of a network organisation and use comprehensive information from several sources both from within and outside our organisation.
- We are on the forefront of innovations.

B.
We believe that leadership and coordination of the Spatial Information Infrastructure are important and that there must be one project leader who is in charge.
In our organisation, the DURP project leader must be involved in the development.

Leadership is needed for implementing a common SII, in which we can play an important role.
Our DURP project leader should play an active role in SII development.

There is an accepted leader and there are explicit tasks and responsibilities as regards the Spatial Information Infrastructure.
Our DURP project leader plays an active role in ensuring digital access to zoning plans in the SII.

We want to coordinate exploitation of the information infrastructure with other organisations.
Together with other stakeholders, we direct the SII in support of the zoning plan chain.

C.
Management / politics are not involved in the development of our Spatial Information provision.
Management is aware of the need for implementing DURP.

Management is as yet little committed to development of an outward-oriented Spatial Information Infrastructure.
The board views DURP as a chance to enhance communication with citizens.

The board wants us to exchange digital zoning plans with our environment.
Because of management's minimal involvement, development of a SII is given little priority.

Our management is actively involved in development of the SII.
Management and board are actively involved in DURP development.

D.
Not everyone will appreciate the creation of access to information (islands) within our organisation.
Our ICT department holds on to existing patterns and there is little support for the technical implementation of a Spatial Information Infrastructure.

Agreements on information exchange with other organisations must be defined.
Our organisation has an inward focus (in terms of Spatial-Information) and most colleagues do not yet consider an outward focus is a priority.

Within our ICT department as well, there is support for the technical implementation of a Spatial Information Infrastructure.
The parties require strict agreements at management level for ensuring adequate operation.

Everyone is aware of the advantages of a SII for spatial planning, which is why everyone supports implementation.
There is ample support for development of a SII and everyone is prepared to collaborate.

E.
Our focus is on internal collaboration.
Collaboration within our own municipality is not evident, with other municipalities it is even harder.

Collaboration of the ICT department with other departments is good.
We consider that collaborating with other municipalities is a possibility to share knowledge and experience in the field of GEO.

Collaboration with the Province and other municipalities is an excellent opportunity to implement a Spatial Information Infrastructure.

We consider that collaboration is very important and we make active efforts to enhance collaboration links.

Collaboration with other organisations is a matter of course for us and our work processes run through different organisations.
We are a network organisation.

F.
It is very difficult to obtain funding for expanding our geo-infrastructure.
Financial resources for adjustments / expansion of our geographical information provision are available on an ad hoc basis.

For worthwhile GIS projects, we can always get funding.
A project covering the development of a Spatial Information Infrastructure may get financial support from us during the project.

We have regular funding at our disposal for maintaining our Spatial Information provision.
There are sufficient resources for completely carrying out the DURP programme.

There are sustainable resources available for developing SII.
We pass on the costs of our geographical information provision to our users.

Annex 5 - Results of the study in Kreis Heinsberg

In Germany, the E-Government programme X-Planung was started to prepare digitally exchangeable (object-oriented) spatial plans and make these available to citizens. However, this programme has not yet been extended to North Rhine – Westfalia, the German state bordering on the Netherlands.
But we can affirm that the level of standardisation of spatial plans is high. Even though this programme that is similar to the Dutch DURP programme is not active in the studied region, the questions that were asked are the same as in the Dutch study.

In Kreis Heinsberg, all 10 municipalities returned the SII status list and five municipalities filled out the web form. The two biggest and the three smallest municipalities did not fill out the web form.

Results of the SII status study in the German municipalities:
Data: Even though as compared to the Netherlands, there is no legal obligation to create digital spatial plans (except for INSPIRE) it turned out that only one out of the ten municipalities did not have digital plans. Most municipalities have *Bebauungs Pläne* in the form of scans or AutoCad files. Only one municipality has object-oriented digital development plans. The *Flächenützungsplan* was available in a digital form in almost all cases.
Network: Half of the German municipalities have a mapserver, though only a few municipalities have granted access to their spatial plans. But most municipalities are busy developing this.
Human resources: The bigger municipalities have employees with GIS knowledge who can make the spatial plans accessible; this is not the case in the small municipalities.
Policy: Practically all municipalities want to make their plans available to their own employees. As opposed to the municipalities in Limburg, only a few municipalities also want to make this information accessible for citizens.
Technology/Standards: An enormous diversity of GIS software is being used, which complies with open standards to a very limited extent.

Process: It is remarkable that only the smallest municipality says it knows the X-Planung programme, the others do not know it.
Four municipalities expect they will be able to make all their plans available in a digital form this year and half of the municipalities mention they will be able to start with the exchange in 2 to 3 years from now.

The total score of the SII status study shows that none of the 10 municipalities obtained the threshold value for the degree of implementation.
This is because the Dutch municipalities have standardised object-oriented digital plans as a result of the DURP programme. A second reason is that many German municipalities are not willing to make their zoning plans available to citizens.

TAM: The results of the five German municipalities that participated in the TAM study are consistent with the results on the Netherlands side. The score for the expected user friendliness is also lower here than the score for the expected usefulness. Four out of five municipalities are sufficiently willing to implement SIIs.

SII maturity: As only five of the 10 German municipalities took part in the study, we can only reach limited conclusions. It catches the eye that the key implementing factor Funding has a very low score, null in four of the five municipalities. Also the score for political support is lower as compared to the Dutch municipalities. None of the municipalities reaches the threshold value of SII maturity.

Willingness and ability to implement a SII:

Four of the five municipalities in Kreis Heinsberg that participated in the web study are willing to implement a SII. In view of the score under 2.00 both in the organisational development matrix and the SII implementing status, none of the ten municipalities can be considered as being able to implement a SII.

Annex 6 - Results questionnaire Status SII implementation

	Data				Network					People		Policy			Technics				Process						
Municipality	count	IMRO	Digital	Not Digital	SP on the intranet	Sp on the internet	mapserver	developments	internet access	count GIS	task grant access	for employees	for citizans	working on	GIS software	type GIS software	werkstation	open standards	plan DURP	Manual	creating plans	viewing plans	condition	exchange	DURP proof
1	80	5	25	50	y	n	y	y	y	25	n	y	y	y	y	ArcView	2	y	y	n	n	y	y		
2		0	0	?	n	n	y	y	y	?	y	y	y	y	y	Flexiweb	all	n	n	y	?	?	y	2007	?
3	70	5	30	35	y	y	y	y	y	8	y	y	y	y	y	Flexi/GWS Bentley	all	y	y	y	n	y	y		
4		6		?	n	n	n	y	y	3	n	y	y	y	y	GiskitPlan/NedView	150	y	y	y	y	y	y	2007	2010
5	211	8	90	13	y	n	y		y	3	y	y	y	y	y	Geomedia	3	y	y	y	y	y	y	2006	2012
6	100	4		96	y	n	y	y	y	?	y	y	y	y	y	Flexi/Micro/Omega	120	y/n	y	n	y	y	y	2007	
7	97	0	97	0	n	n	y	y	y	3	n	y	y	y	y	ArcView/Nedview/Mapguide/Mapinfo/Igos	15	n	n	y	y	y	y	2007	2010
8	79	7	2	70	n	n	?	y	y	3	n	y	y	y	y	Roplan	2	y	y	y	y	y	y	2006	
9	70	10	60	0	y	n	y	y	y	45	y	y	y	y	y	NedBrowser	all	y	y	y	y	y	y	2006	2007
10	170	0	0	170	n	n	n	y	y	3	y	y	y	y	y	ArcView 3.3/9.2	17	y?	n	n	n	n	y	2008	
11	50	20	0	30	n	n	y	y	y	1	y	y	y	y	y	ArcGis/GisPlan	14	y	y	y	y	y	y	2006	2010
12	15			15	n	n	n	y	y		y	y	y	y	n				n	n	n	n	y	2008	2010
13	?	0	0		n	n	n	y	y	1	?	y	y	y	y	NedViws/NedOffice	5/all	n	?	y	?	?	y	?	2016
14	105	3	0	102	y	n	y	y	y	1	y	y	y	y	y	NedBrowser/Nedview/IGOS	all	y	n	n	y	y	y	2006	2012
15	38	0	5	33	y	y	n	n	y	5	?	y	y	y	y	Geoweb/DG-Dialog/ArcView	all/5/2	y	n		n	y	y	2007	2017
16		1	4		y	n	y	y	y	3	y	y	y	y	y	NedView	50	y	y	y	y	y	y		
17	41			41	n	n	n	y	y	1	n	y	y	y	n				n	n	n	n	n	2007	2012
18	8	2	0	6	n	n	n	y	y	1	y	y	y	y	y	ArcGIS/ArcView/GISKit Viewer	12	y	y/n	n	n	y	y		
19	16	1	7	8	n	n	?	n	y	3	n	y	y	y	y	NedView	30	n	y	y	n	n	y		2010
20	14	1	9		y	y	y	y	y	2	y	y	y	y	y	NedBrowser	145	y	y	y	n	y	y	2007	?
21	10	1		9	y	n	y	y	y	?	?	y	y	y	y	Gis4Web(Mapguide)/ArcView	5xAV	?							
22					y	n	y	y	y	10	y	y	y	y	y	Flexiweb	all	n	y/n	y	n	y	y	2007	2011
23					n	n			y	1		y	y	y	y	ArcView 3.3	2	n	n	n	n	n	y		
24	5	0	5	0	y	n	y	y	y	1	y	y	y	y	y	ArcView/GIS4Wev(MapGuide)	1/all	y	n	n	n	y	y	2007	2011
25	24	8	0	16	n	n	y	y	y	5	n	y	y	y	y	ArcView/Map4all/GISVG	5	n	n	n	y	y	y	2006	2009
26	14	7		7	y	n	y	y	y	2	y	y	y	y	y	Flexiweb	all	y	y	y	n	n	y	2006	2009
27	?	1	1	?	y	y	y	y	y	0	n	y	y	y	y	NedBrowser	all	y	n	n	n	y	y	?	2010
28	4	1	2	1	y	y	?	n	y	1	y	y	y	y	y	Nedplan	1	y	y	y	y	y	y	2006	?
29	?	0	0	all	n	n	y	y	y	1	y/n	y	y	n	y	GIS4Web(Mapguide)	all	y	n	n	n	y	y	2007	?
30	14	6	0	8	n	n	n	n	y	2	n	ya	n	n	n				y	n	y	y	y		
31	18	3	6	9	n	n	y	n	y	n	n	y	y		n				n	n	n	y	y	2007	2015
32				9	n	n	n	n	y	?		y	y	y	n	NedView			y	y	n	y	y		
33	8	1	2	5	n	n	?	?	y	?	n	?	?	n	n				n	?	?	?	y	2006	2010
34	10	0	0	10	n	n	y	y	y	1	y	y	y	n	y	Nedview	5	?	n	y	n	n	y	?	?
35	30	0	9	21	n	n	y	y	y	5	n	y	y	y	y	Nedview	all	y	?	n	?	?	?	?	?
36	4	2		2	n	n	n	n	y	2	n	y	y		y	ArcView	10	y	n	n	n	n	y	2008	2009

Annex 7 - Research findings three models in Limburg and Heinsberg

count	Status SII Implementation							SII Organisation Development Matrix							TAM		
Inhabi-tants	Data	Network	People	Policy	Technology	Process	**Total**	Vision	Leadership	Politics	Culture	Collaboration	Finance	**Total**	Usefulness	Ease of use	**Total**
Limburg																	
Big	2	2	3	3	2	2	**2,33**	3.00	2.50	3.00	3.00	2.00	2.00	**2.58**	2.33	1.67	**2.00**
Big	0	1	3	3	2	0	**1.50**	2.00	1.50	1.00	2.00	2.50	1.50	**1.75**	2.83	0.67	**1.75**
Big	3	3	3	3	2	3	**2.83**	2.50	3.00	2.50	1.50	3.00	1.50	**2.33**	2.83	1.83	**2.33**
Big	-	1	2	3	2	3	**1.83**	1.75	1.50	2.00	2.00	3.00	0.50	**1.79**	2.00	-0.67	**0.67**
Big	3	2	3	3	3	2	**2.67**	1.75	0.00	2.00	2.50	2.00	2.50	**1.79**	3.50	2.83	**3.17**
Medium	2	2	3	3	1	2	**2.17**	2.50	1.50	2.50	2.00	2.00	2.00	**2.08**	0.33	1.33	**0.83**
Medium	1	1	2	3	2	2	**1.83**	2.00	2.00	1.50	2.00	3.00	2.00	**2.08**	3.00	2.00	**2.50**
Medium	2	1	1	3	2	2	**1.83**	1.50	3.00	1.50	1.50	4.00	2.50	**2.33**	4.00	1.67	**2.83**
Medium	3	2	3	3	2	3	**2.67**	1.75	4.00	1.00	1.50	3.00	1.50	**2.13**	1.67	1.00	**1.33**
Medium	0	0	2	3	1	0	**1.00**	1.50	1.00	0.50	2.50	2.50	0.50	**1.42**	1.33	0.00	**0.67**
Medium	2	1	2	3	1	3	**2.00**	-	-	-	-	-	-	**-**	-	-	**-**
Medium	0	0	1	3	0	1	**0.83**	1.50	2.00	0.00	1.00	2.00	0.00	**1.08**	2.00	2.00	**2.00**
Medium	0	0	1	3	1	1	**1.00**	1.75	1.00	1.50	1.50	2.50	0.50	**1.46**	2.00	1.00	**1.50**
Medium	-	-	-	-	-	-	**-**	-	-	-	-	-	-	**-**	-	-	**-**
Medium	1	1	2	3	1	2	**1.67**	3.00	1.50	2.00	1.50	3.00	2.00	**2.17**	1.67	1.33	**1.50**
Medium	1	1	1	3	1	1	**1.33**	2.00	1.50	0.50	2.00	2.50	0.50	**1.50**	2.00	-0.50	**0.75**
Small	2	2	2	3	1	2	**2.00**	3.25	1.00	0.00	2.50	2.00	0.50	**1.54**	0.00	12.00	**6.00**
Small	0	0	1	3	0	0	**0.67**	-	-	-	-	-	-	**-**	-	-	**-**
Small	2	0	2	3	1	1	**1.50**	2.50	2.00	1.00	1.00	2.50	1.00	**1.67**	4.00	4.00	**4.00**
Small	2	0	2	3	1	1	**1.50**	1.00	0.00	0.50	1.50	1.50	1.50	**1.00**	1.67	0.33	**1.00**
Small	2	3	2	3	1	1	**2.00**	2.25	1.50	1.50	1.50	2.00	0.00	**1.46**	2.00	-0.33	**0.83**
Small	2	2	1	3	1	0	**1.50**	2.25	0.50	1.00	2.00	2.50	2.50	**1.79**	1.33	0.83	**1.08**
Small		2	2	3	1	1	**1.50**	2.75	1.00	1.00	1.50	3.00	0.00	**1.54**	1.67	1.00	**1.33**
Small		0	1	3	0	0	**0.67**	-	-	-	-	-	-	**-**	-	-	**-**
Small	0	2	2	3	1	1	**1.50**	2.50	3.00	3.00	2.50	2.50	2.50	**2.67**	2.00	1.00	**1.50**
Small	3	1	1	3	1	2	**1.83**	-	-	-	-	-	-	**-**	-	-	**-**

count	Status SII Implementation							SII Organisation Development Matrix							TAM		
Inhabi-tants	Data	Network	People	Policy	Technology	Process	**Total**	Vision	Leadership	Politics	Culture	Collaboration	Finance	**Total**	Usefulness	Ease of use	**Total**
Small	3	2	2	3	1	1	**2.00**	2.25	2.50	2.50	3.00	2.50	2.50	**2.54**	3.00	2.33	**2.67**
Small	2	3	1	3	1	0	**1.67**	-	-	-	-	-	-	**-**	-	-	**-**
Small	2	2	2	3	0	3	**2.00**	2.50	2.00	1.00	1.50	3.50	0.50	**1.83**	0.83	0.17	**0.50**
Small	0	1	2	2	1	11	**2.83**	1.20	1.50	1.00	1.00	3.50	0.50	**1.45**	0.00	4.00	**2.00**
Small	3	0	1	1	0	2	**1.17**	-	-	-	-	-	-	**-**	-	-	**-**
Small	2	1	0	2	0	1	**1.00**	1.75	0.00	1.00	2.00	1.50	1.00	**1.21**	0.00	0.00	**0.00**
Small	0	0	0	3	0	1	**0.67**	-	-	-	-	-	-	**-**	-	-	**-**
Small	-	-	-	-	-	-	**-**	-	-	-	-	-	-	**-**	-	-	**-**
Small	2	0	0	0	0	1	**0.50**	0.50	0.00	0.00	0.50	3.00	1.00	**0.83**	1.33	0.00	**0.67**
Small	-	-	-	-	-	-	**-**	-	-	-	-	-	-	**-**	-	-	**-**
Small	0	1	2	2	1	1	**1.17**	1.75	1.50	3.00	1.50	3.50	2.50	**2.29**	1.33	-0.67	**0.33**
Small	1	1	1	3	1	0	**1.17**	1.50	3.00	2.50	1.50	3.50	1.50	**2.25**	4.00	2.00	**3.00**
Small	2	0	1	2	0	1	**1.00**	1.50	3.50	1.00	1.00	2.50	1.00	**1.75**	1.33	-0.33	**0.50**
Small	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heinsberg																	
Medium	1	1	2	1	1	0	**1.00**	-	-	-	-	-	-	-	-	-	-
Medium	1	1	2	1	1	2	**1.33**	-	-	-	-	-	-	-	-	-	-
Medium	1	0	1	2	1	1	**1.00**	1.50	0.50	1.50	1.00	2.50	0.50	**1.25**	2.00	1.33	**1.67**
Medium	2	2	2	2	2	1	**1.83**	1.75	2.50	0.50	1.00	3.00	0.00	**1.46**	2.00	1.33	**1.67**
Medium	2	1	1	2	1	1	**1.33**	2.75	2.50	1.00	2.00	3.00	0.00	**1.88**	0.33	0.67	**0.50**
Medium	1	1	1	2	2	2	**1.50**	2.50	1.50	0.50	0.50	1.00	0.00	**1.00**	2.33	1.33	**1.83**
Small	2	2	1	1	1	1	**1.33**	0.50	0.00	1.50	2.00	0.50	0.00	**0.75**	1.33	2.00	**1.67**
Small	1	0	0	0	1	2	**0.67**	-	-	-	-	-	-	-	-	-	-
Small	0	0	0	0	0	0	**0.00**	-	-	-	-	-	-	-	-	-	-
Small	1	2	1	1	2	2	**1.50**	-	-	-	-	-	-	-	-	-	-

Annex 8 - Results Willing and Able

Results model to define the willingness and ability to implement a Spatial Information Infrastructure.

Municipality		**Status SII implementation**	Vision	Leader-ship	Politics	Culture	Colla boration	Finanance	**SII organi-sation maturity matrix**	**TAM**	**Willing**	**Able**
NL - Municipalities												
1	Big	2.33	3.00	2.50	3.00	3.00	2.00	2.00	2.58	2.00	**Yes**	**Yes**
2	Big	1.50	2.00	1.50	1.00	2.00	2.50	1.50	1.75	1.75	Yes	No
3	Big	2.83	2.50	3.00	2.50	1.50	3.00	1.50	2.33	2.33	**Yes**	**Yes**
4	Big	1.83	1.75	1.50	2.00	2.00	3.00	0.50	1.79	0.67	No	No
5	Big	2.67	1.75	0.00	2.00	2.50	2.00	2.50	1.79	3.17	**Yes**	**Yes**
6	Med	2.17	2.50	1.50	2.50	2.00	2.00	2.00	2.08	0.83	**Yes**	**Yes**
7	Med	1.83	2.00	2.00	1.50	2.00	3.00	2.00	2.08	2.50	**Yes**	**Yes**
8	Med	1.83	1.50	3.00	1.50	1.50	4.00	2.50	2.33	2.83	**Yes**	**Yes**
9	Med	2.67	1.75	4.00	1.00	1.50	3.00	1.50	2.13	1.33	**Yes**	**Yes**
10	Med	1.00	1.50	1.00	0.50	2.50	2.50	0.50	1.42	0.67	No	No
11	Med	2.00	-	-	-	-	-	-	-	-	?	Yes
12	Med	0.83	1.50	2.00	0.00	1.00	2.00	0.00	1.08	2.00	Yes	No
13	Med	1.00	1.75	1.00	1.50	1.50	2.50	0.50	1.46	1.50	Yes	No
14	Med	-	-	-	-	-	-	-	-	-	?	?
15	Med	1.67	3.00	1.50	2.00	1.50	3.00	2.00	2.17	1.50	**Yes**	**Yes**
16	Med	1.33	2.00	1.50	0.50	2.00	2.50	0.50	1.50	0.75	No	No
17	Small	2.00	3.25	1.00	0.00	2.50	2.00	0.50	1.54	6.00	**Yes**	**Yes**
18	Small	0.67	-	-	-	-	-	-	-	-	?	No
19	Small	1.50	2.50	2.00	1.00	1.00	2.50	1.00	1.67	4.00	Yes	No
20	Small	1.50	1.00	0.00	0.50	1.50	1.50	1.50	1.00	1.00	Yes	No
21	Small	2.00	2.25	1.50	1.50	1.50	2.00	0.00	1.46	0.83	No	No
22	Small	1.50	2.25	0.50	1.00	2.00	2.50	2.50	1.79	1.08	Yes	No
23	Small	1.50	2.75	1.00	1.00	1.50	3.00	0.00	1.54	1.33	Yes	No
24	Small	0.67	-	-	-	-	-	-	-	-	?	No
25	Small	1.50	2.50	3.00	3.00	2.50	2.50	2.50	2.67	1.50	**Yes**	**Yes**
26	Small	1.83	-	-	-	-	-	-	-	-	?	?
27	Small	2.00	2.25	2.50	2.50	3.00	2.50	2.50	2.54	2.67	**Yes**	**Yes**
28	Small	1.67	-	-	-	-	-	-	-	-	?	?
29	Small	2.00	2.50	2.00	1.00	1.50	3.50	0.50	1.67	0.50	No	No
30	Small	2.83	1.20	1.50	1.00	1.00	3.50	0.50	1.45	2.00	**Yes**	**Yes**
31	Small	1.17	-	-	-	-	-	-	-	-	?	No
32	Small	1.00	1.75	0.00	1.00	2.00	1.50	1.00	1.21	0.00	No	No
33	Small	0.67	-	-	-	-	-	-	-	-	?	No
34	Small	-	-	-	-	-	-	-	-	-	?	?
35	Small	0.50	0.50	0.00	0.00	0.50	3.00	1.00	0.83	0.67	No	No
36	Small	-	-	-	-	-	-	-	-	-	?	?
37	Small	1.17	1.75	1.50	3.00	1.50	3.50	2.50	2.29	0.33	No	Yes
38	Small	1.17	1.50	3.00	2.50	1.50	3.50	1.50	2.25	3.00	**Yes**	**Yes**
39	Small	1.00	1.50	3.50	1.00	1.00	2.50	1.00	1.75	0.50	No	No
40	Small	-	-	-	-	-	-	-	-	-	?	?

Municipality		**Status SII implementation**	Vision	Leader-ship	Politics	Culture	Colla boration	Finanance	**SII organi-sation maturity matrix**	**TAM**	**Willing**	**Able**
DU - Municipalities												
1	Med	1.00	-	-	-	-	-	-	-	-	?	No
2	Med	1.33	-	-	-	-	-	-	-	-	?	?
3	Med	1.00	1.50	0.50	1.50	1.00	2.50	0.50	1.25	1.67	Yes	No
4	Med	1.83	1.75	2.50	0.50	1.00	3.00	0.00	1.46	1.67	Yes	No
5	Med	1.33	2.75	2.50	1.00	2.00	3.00	0.00	1.88	0.50	No	No
6	Med	1.50	2.50	1.50	0.50	0.50	1.00	0.00	1.00	1.83	Yes	No
7	Small	1.33	0.50	0.00	1.50	2.00	0.50	0.00	0.75	1.67	Yes	No
8	Small	0.67	-	-	-	-	-	-	-	-	?	No
9	Small	0.00	-	-	-	-	-	-	-	-		No
10	Small	1.50	-	-	-	-	-	-	-	-	?	?