

ASSESSING THE USABILITY OF MUNICIPAL SPATIAL DATA INFRASTRUCTURE

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**ASSESSING THE USABILITY OF
MUNICIPAL
SPATIAL DATA INFRASTRUCTURE**

Master of Science Thesis

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ABSTRACT

Every day (governmental) organisations and specifically municipalities are using their spatial data for the purposes of meeting legal obligations and requirements (laws), supporting business processes and providing better services to their residents. The access to the spatial data, sharing and using them organized by means of municipal Spatial Data Infrastructure. To manage the afore-mentioned purposes; municipalities are in need of a comprehensive, reliable and easily accessible spatial data, in other words, a well-functioning Spatial Data Infrastructure.

The main aim of this research is to find a methodology to assess the usability of the Spatial Data Infrastructure through users' perspective within the local government (municipalities) in The Netherlands.

To reach that goal usability framework and assessment approach created and elaborated. ISO usability aspects definition (Effectiveness, Efficiency and Satisfaction) and SMART (Specific, Measurable, Achievable/Accepted, Realistic, and Time-bound) assessment indicators used and found to create usability framework. Questionnaires implemented as assessment approach depending on literatures and interviews.

This research found that evaluating GIS (Geographic Information System) is the best method to assess users' perspectives in the municipalities. As GIS is the window by which users look through at SDI and GIS considered as the underpinning technology for SDI. It has a significant role in facilitating data collection and storage as well as facilitating decision-making based on spatial data processing and analysis.

In this research, readers will also find a description of the municipal SDI situation depending on the five Geowares concept (Humanware, Dataware, Orgware, Software and Hardware) applied on the study area (municipalities of Maassluis and Westland).

The assessment result should encourage municipalities to invest more in developing their SDI to support the afore-mentioned purposes of using spatial data. This method can be applied to aid in the development of GIS and SDI within a local government. This research leads the way to further researches in this field as well.

KEYWORDS

SDI, Spatial Data Infrastructures, Municipal SDI, Local SDI, GIS, Geographic Information System, Geo, Geo-information, Spatial data, Data classifications, Usability, Assessment, Usability assessment, SDI assessment, SDI usability assessment, Effectiveness, Efficiency, Satisfaction, User satisfaction, Geowares, Humanware, Dataware, Orgware, Software, Hardware, Metadata, Maassluis municipality, Westland municipality, Stroomlijn, IBORgis, Basic Registrations.

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1. INTRODUCTION

Every day almost everyone uses Geo-information regularly, quite often without being aware of it (Swisstopo, 2017).

Experience shows that 80 percent of municipal information is Geo-information or spatial data. This means that most of the information can be related to a place on Earth and thus can be displayed on a map (Visser, 2008). Furthermore, between 60 to 80 percent of all political, economic and private decisions are space oriented (Swisstopo, 2017). As a consequence, the use of Geo-information within the municipalities has become pervasive. Municipalities use Geo-information for their daily work processes such as: land use, construction permits, residence tax assessment, sewerage system improvement and maintenance plans and green maintenance (Sneller, 2009). Municipalities get access to (and share) Geo-information using Spatial Data Infrastructures (SDIs) and Geo-information is being processed and used by using Geographic Information Systems (GIS).

Geographic Information System (GIS) is a computerised system to capture, analyse, store, manipulate, manage, and present geographically referenced data, in other words, GIS lets us visualize, question, analyse, and interpret data to understand relationships, patterns, and trends (ESRI.com, 2017). This YouTube video on GIS for municipalities (In Dutch, GIS voor Gemeenten: <https://www.youtube.com/watch?v=hRHfnzk1xDw>) explains the importance of GIS for municipalities in the Netherlands.

Spatial data infrastructure (SDI) is a dynamic, hierarchic and multi-disciplinary concept that includes people, data, access networks, institutional policy, technical standards and human resource dimensions (Rajabifard, 2008). SDIs were initially developed as a mechanism to facilitate access and the sharing of spatial data to use within a GIS environment (Rajabifard, 2008).

Generally, municipalities deal with activities in the neighbourhood of the residents and perform tasks on behalf of the national government (De Gemeente, 2017). The purpose of using spatial data by the municipalities are: to meet legal obligations and requirements (laws), to support business processes and to provide better services to their residents (De Groot, 2011). To manage the mentioned purposes municipalities are in need of comprehensive, reliable and easily accessible spatial data, in other words, a well-functioning SDI (adapted from Boos & Mueller, 2009).

There are a lot of municipal legal obligations and laws where SDI can play an essential role. For example, Dutch municipalities have to maintain five of eleven basic registrations (Digitale Overheid, 2017). To meet this obligations the use of SDI becomes for a municipality a necessity, both as data provider and as data consumer. Via municipal GIS, many spatial datasets are/will be shared to support business process as well.

In order to support the aforementioned municipal tasks and processes efficiently, the existing SDI should meet a certain usability level.

According to ISO-9241 International standard (ISO 9241-11, 1998), Usability is the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use. The aspects of the usability (effectiveness, efficiency and satisfaction) of the municipal SDI will be dealt with in this research.

Given very large expenditure of human and capital resources nowadays on the development of spatial data products, both for public good and commercial purposes, it worth investigating if SDIs are made as 'usable' as possible for the municipal tasks. Clearly, with a better understanding of usability we might be able to increase the number of 'successes' and reduce the incidence of 'failures' in the development and application of spatial datasets (Hunter et al., 2003).

1.1. Research objective

The overall objective of this research is to assess the usability of municipal SDI from the user perspective in support of the municipal goals. The research will focus on two case studies/municipalities in the Netherlands: Maassluis and Westland municipality.

Currently such an insight in the usability of municipal SDI's is missing. In addition, Maassluis and Westland are in need of customer satisfaction survey for their internal GIS and knowing how SDI (may) support current municipal vision and goals.

1.2. Research questions

In order to address the overall research objective, the following questions need to be answered:

1. What are the characteristics of municipal SDI?
2. What are the legal obligations, business processes and services for the municipality and residents which are supported by using SDI?
3. How to assess the usability (measure usability aspects from the user perspective) of municipal SDI?
4. What is the usability of SDI in Maassluis and Westland municipalities?

1.3. Organisation of the report

The structure of this report is as follows: in chapter 1 the research objective and questions are explained, chapter 2 clarifies the methodology, chapter 3 covers characteristic of municipal SDI and the five Geowares (Humanware, Dataware, Orgware, Software and Hardware) concept, chapter 4 and 5 describes the study area and their present SDI situations depending mainly on the five Geowares concept, chapter 6 researches the municipal

demands from SDI, chapter 7 is about theoretical approach on how SDI usability can be assessed, chapter 8 is on needed questionnaires details, chapter 9 presents, visualises and analyses the collected data from the questionnaires, chapter 10 discusses research process and questionnaires results, and as a final point Chapter 11 delivers the conclusions and recommendations for further researches. At the end of this thesis report the reader can find used references, links and appendices. The appendices are about basic definitions, search strategy, abbreviations, interviews, questionnaires, organograms of the study area and a diagram on data and applications architecture.

2. METHODOLOGY

In order to achieve the objective of this thesis the following methodology will be used to answer the research questions:

2.1. Research Question 1:

What are the characteristics of municipal SDI?

In order to answer this research question the following SDI aspects will be explained:

1. SDI (hierarchy),
2. Municipal SDI relationships and influences,
3. SDI model of the municipality,
4. Geographic Information System (GIS) and its Architecture, and
5. The present SDI situation of the study area (municipality of Maassluis and Westland).

To explain aspects 1 to 4 needed literature will be found via the search strategy, which is explained in Appendix 1.

Aspect 5 will be described based on interviews. The target groups for the interview will be Geo-information specialists / advisers and spatial data administrators in the municipalities of Maassluis and Westland. A concepts will be prepared to describe SDI components and organisational Geowares: Humanware, Dataware, Orgware, Software and Hardware (adapted from ssc.wur.nl, 2017). The concentration will be on Internal municipal GIS/ SDI because the users are using spatial data through Internal GIS/ SDI. The five Geowares concept will be discussed with the interviewers part by part to reach the desired and correct result. Personal and/ or telephone interview will be used.

2.2. Research Question 2:

What are the legal obligations, business processes and services for the municipality and residents which are supported by using SDI?

Each of the following topics mentioned in the question (legal obligations, business processes and services for the municipality and residents) will be explained based on Interviews, documents of various (geo-related/ governmental) organisations in the Netherlands and my personal library and experience. Furthermore, the same strategy as in Appendix 1 will be used so that more will be known about SDI support for municipalities.

The target groups for the interview will be GIS (super) users. In the system administration of Maassluis intranet GIS the administrator is able to see statistic information on usage per user. Also based on the usage a log file can be exported. Depending on that log files the GIS (super) users can be found. GIS (super) users of Westland will be found by asking (or by using

the same log file method if it is available). During the interviews, the topics mentioned in the research question will be discussed in detail. Personal and/ or telephone interview will be used. Having no less than five interviews per municipality is preferable (adapted from Hajimia, 2014).

2.3. Research Question 3:

How to assess the usability (measure usability aspects from the user perspective) of municipal SDI?

To answer this question an assessment approach (method) needs to be developed. To develop an assessment approach the following steps will be used:

1. Needed literature will be found depending on Appendix 1 – Search Strategy;
2. The goal of the literature research is to:
 - a. define the usability,
 - b. observe how to evaluate usability aspects (effectiveness, efficiency and satisfaction),
 - c. collect different methodologies/ theories on assessing usability (aspects),
 - d. read the existing SDI assessment theories/ methods, and
An important decision that has to be taken beforehand relates to how the assessment has to be carried out and this will vary between different assessment approaches (Rajabifard, 2008).
 - e. find out the indicators that can be used to assess the usability (Nedović-Budić et al 2008);
3. Choosing a set of SMART (Specific, Measurable, Achievable/Accepted, Realistic, and Time-bound) indicators to assess each of the usability aspects in consideration with the following criteria:
 - a. applicability on municipal (local) SDI,
 - b. the influence of municipal demands from SDI (Research Question 2), and
 - c. the goals of the study area (Maassluis and Westland municipality).
4. Considering the following on user perspective:
 - a. Finding the target groups (GIS users) among the staff members of Maassluis and Westland municipalities,
 - b. Preparing communication method and facilities (such as e-mail addresses),
 - c. Approaching them in a suitable and understandable language,
 - d. Explaining the importance of the research and encouraging participation.

2.4. Research question 4:

What is the usability of SDI in Maassluis and Westland municipalities?

A questionnaire based on chosen SMART indicators found in Research Question 3 will be prepared and conducted to answer this research question. Questionnaire will be used because it is an effective method to assess depending on user perspectives.

The formulation of the questions will depend on the outcome of Research Question 3 for an assessment approach (Questionnaire). The questions will be formulated in such a way that the indicator values from Research Question 3 can be measured.

The target groups are the staff members (GIS users) of Maassluis and Westland municipalities. The dissemination of the questionnaire will be made by means of e-mails addresses.

In the system administration of Maassluis intranet GIS the administrator is able to see statistic information on usage per user. Also based on the usage a log file can be exported. Depending on that log files the GIS (super) users can be found. Their e-mail addresses are available because I am a staff member of the same municipality. In Westland municipality, smaller quantity selected GIS users will be asked to fill the questionnaire indirectly, via personal relations.

Online survey of SurveyMonkey (www.surveymonkey.com) will be used to conduct the questionnaire.

The outcomes/results will be represented in diagrams/ tables and analysed to answer the research questions.

3. CHARACTERISTIC OF MUNICIPAL SDI

3.1. Spatial Data Infrastructure (SDI)

Nebert (2004) considers SDIs as concepts that help to denote the relevant base collection of technologies, policies and institutional arrangements that facilitate the availability of and access to spatial data. The SDI provides a basis for spatial data discovery, evaluation, and application for users and providers within all levels of government, the commercial sector, the non-profit sector, academia and citizens in general.

Goodchild et.al. (2010) defines SDI as an infrastructure that allows the exploitation of geospatial principles, geospatial functions and geospatial data within and across applications and scientific domains, transforming the way in which production, use, development, research and education are conducted by the geospatial community (Morales, 2011).

According to Rajabifard (2011), SDI is an enabling platform for data and service discovery, access, integration, and usage to support decision-making processes.

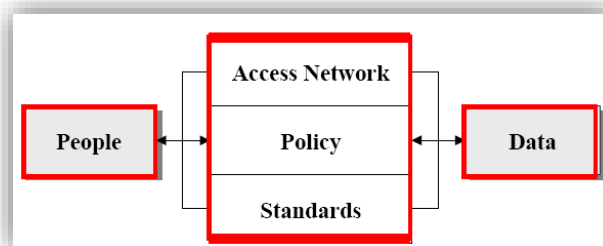


Figure 1: Schematic representation of an SDI (adapted from Rajabifard and Williamson, 2001)

According to Rajabfard and Williamson (2001) the core components of SDI are: policy, access networks, technical standards, people and spatial data, see figure 1. People are stakeholders, data/service providers, users, etc. and their relationships. Data is the spatial or non-spatial which is generated, exchanged or consumed in the context of SDI. Access network refers to communication links that connects stakeholders and data with each other and allows for communication and utilization of data/services by people or other services. SDI Policies are generally tools to monitor and control the relationships among stakeholders and the way they utilize data/services in the context of SDI. In order to facilitate the communication and exchange of spatial and non-spatial data in the context of SDI, numbers of protocols and standards are developed and being utilized. The development of these standards are however a dynamic process and they may change based on the dynamic needs of people, country context, and structure of information systems (Rajabifard, 2011).

Analysing people's demands for data may help to improve data sharing by using access network, policy and standards.

3.2. SDI Hierarchy

Spatial Data Infrastructures do exist at different levels, varying from Global SDIs to Corporate SDIs. Figure 2 shows the hierarchical order of these SDIs. In general, it can be said that the higher the level of the SDI, the lower the detail of the data.

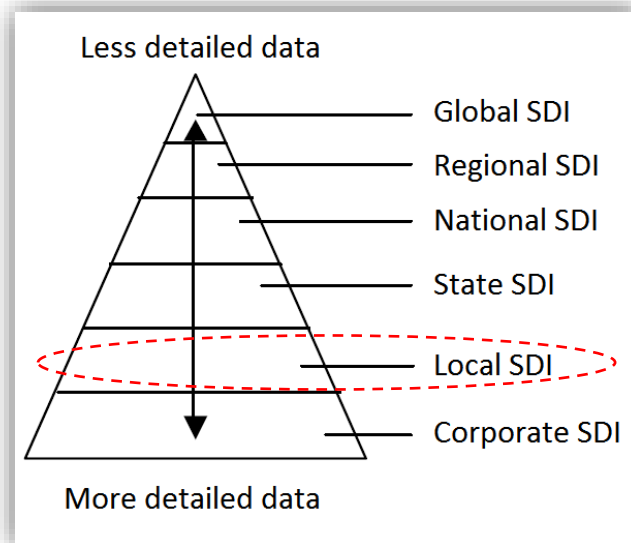


Figure 2: SDI Hierarchy, (adapted from Rajabifard and Williamson, 2001)

According to figure 2, Municipalities are considered as a Local SDI. Relations with other SDIs are mostly vertical relations. Many upwards data and laws/ instructions relations to National SDIs like the cadastral services (<https://www.kadaster.nl>), national statistics service (<https://www.cbs.nl>) and the Dutch National SDI (<https://www.pdok.nl>). Occasionally municipalities receive data from State SDI, e.g. from provinces (e.g. province of South Holland, <https://www.zuid-holland.nl>) and water boards (in Dutch: Hoogheemraadschap, e.g. Delfland water board, <https://www.hhdelfland.nl>).

There are also a lot of spatial data exchanges downwards to many commercial companies (Corporate SDI) to support all kinds of municipal projects. The following are some of the exchanged datasets: Basic Register of Large scale Topography (in Dutch: Basisregistratie Grootschalige Topografie, BGT (Digitale Overheid, 2017)), aerial photos, sewage information, etc.

Horizontally there are some relations with other (neighbour) municipalities (such as Vlaardingen municipality (<https://vlaardingen.nl>), Schiedam municipality (<https://www.schiedam.nl>), Rotterdam municipality (<https://www.rotterdam.nl>), Westland municipality (<https://www.gemeentewestland.nl>) and Midden-Delfland municipality (<https://www.middendelfland.nl>)) to work together on different projects and associated concerns.

3.3. Municipal SDI relationships and influences

It is good to be aware of the way these SDIs do influence each other. Rajabifard (2001) made a schematic overview of the impact that different SDI levels have on each other in terms of Policy, Fundamental Datasets, Technical Standards, Access Network and People, Table 1.

	Local SDI	State SDI	National SDI	Regional SDI	Global SDI
Policy	L → S L → N L → R L → G	S → L S → N S → R S → G	N → L N → S N → R N → G	R → L R → S R → N R → G	G → L G → S G → N G → R
Fundamental Datasets	L → S L → N L → R L → G	S → L S → N S → R S → G	N → L N → S N → R N → G	R → L R → S R → N R → G	G → L G → S G → N G → R
Technical Standards	L → S L → N L → R L → G	S → L S → N S → R S → G	N → L N → S N → R N → G	R → L R → S R → N R → G	G → L G → S G → N G → R
Access Network	L → S L → N L → R L → G	S → L S → N S → R S → G	N → L N → S N → R N → G	R → L R → S R → N R → G	G → L G → S G → N G → R
People	L → S L → N L → R L → G	S → L S → N S → R S → G	N → L N → S N → R N → G	R → L R → S R → N R → G	G → L G → S G → N G → R

→ Direct impact → Indirect impact — No impact
 L= Local SDI; S= State SDI; N= National SDI; R= Regional SDI; G= Global SDI

Table 1: Behaviour and Inter- Relationships of SDI (Rajabifard, 2001)

From this one derive that the municipalities have huge impact on State SDI (e.g. provincial SDI) and in terms of fundamental datasets on National SDI. On the other hand, State SDI also has direct impact on Local SDI with regards to, Policy, Technical Standards and Access Network. The National SDI also has some impact to the Municipal SDI.

3.4. SDI model of the municipality

Figure 3, indicates that the municipalities work at the operational level according to the Product Based Model.

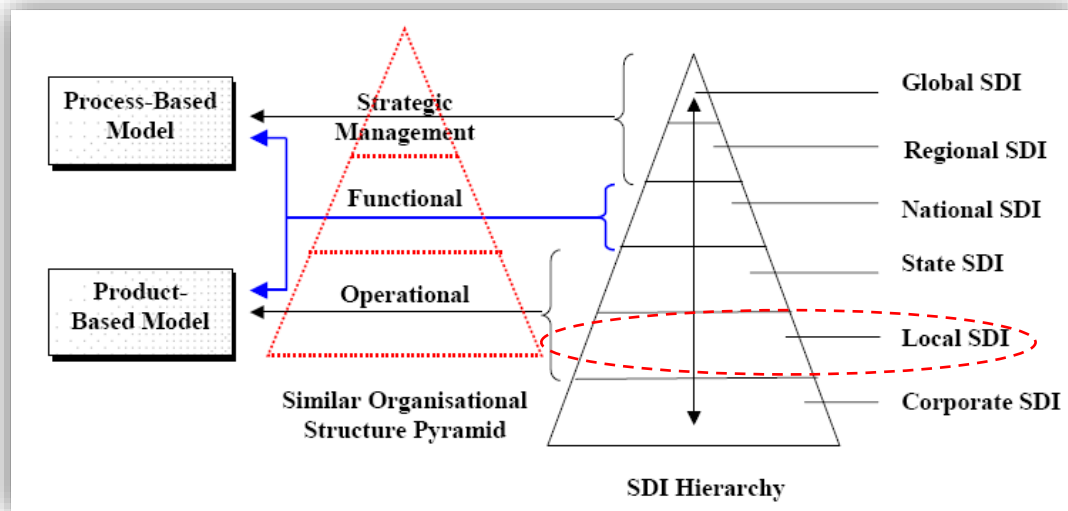


Figure 3: Organisational Perspective on SDI Hierarchy (Rajabifard, 2001)

3.5. Geographic Information System (GIS) and its Architecture

The Definition and architecture of GIS can be found in Appendix 1.

3.6. SDI technological components

Figure 4 shows the technological components, according to Murakami et al (2011), in this vision, SDI's are developed in components instead of one monolithic block, using technical standards (ISO/TC211 and OGC), these techniques enhance their capability to share geospatial data (Van Alphen, 2013).

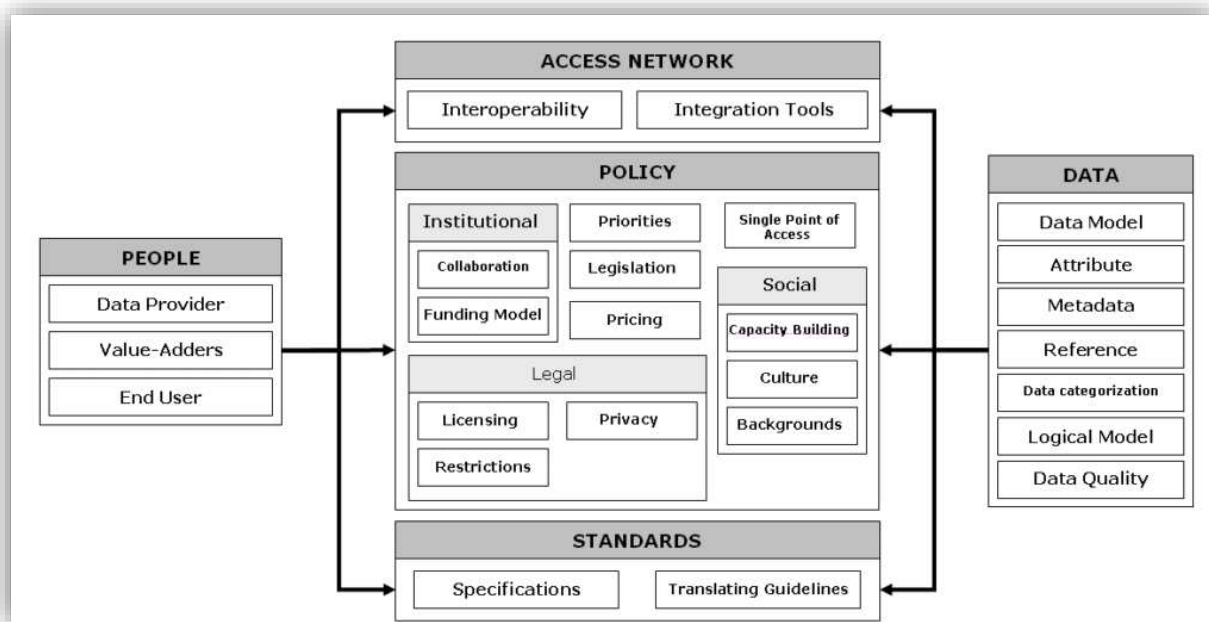


Figure 4: SDI-technological components (Murakami et al., 2011) via (Van Alphen, 2013)

3.7. Describing SDI situation according to the five Geowares

The five Geowares model (Humanware, Dataware, Orgware, Software and Hardware) can describe the most aspects, component or dimensions of SDI for any organization, figure 5. Comparing figure 1 with figure 5, the People component will be dealt with in Humanware, Data component in Dataware, Policy component in Humanware, Dataware and Orgware, Standards component mostly in Dataware. Technology and network components will be dealt with in software and Hardware.

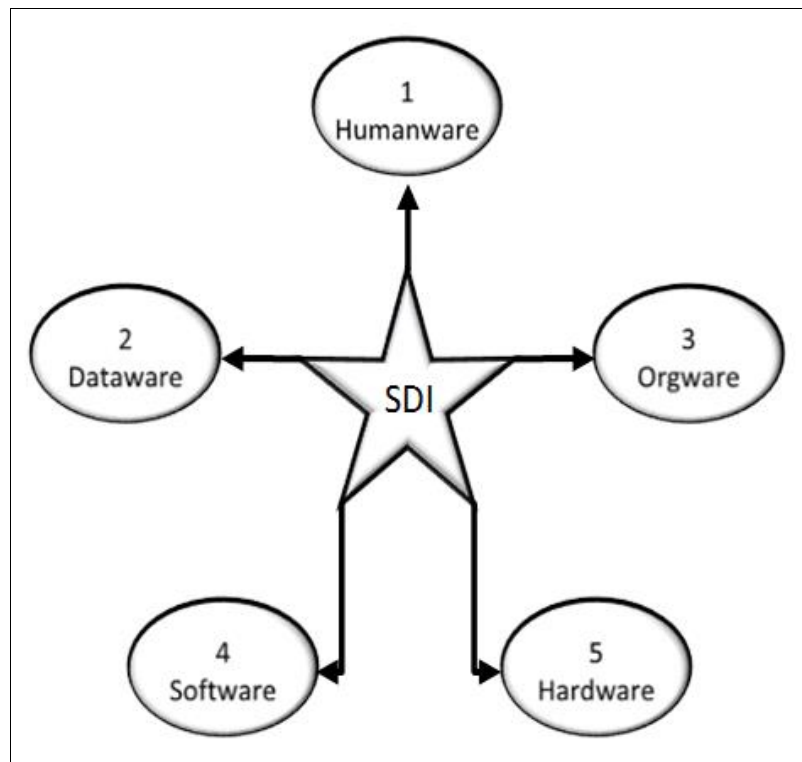


Figure 5: The five Geowares

3.7.1. Humanware (People)

As can be seen in figure 5 Humanware is on the top of the SDI components. Humanware component importance in SDI is as importance as head for a person.

Human is the most important component of SDI because human are the creators, deciders, supporters, managers, developers, users, etc.

Humanware can be categorised to:

1. Stakeholders
2. Administrators, developers and analysers
3. Data owners and administrators
4. ICT System administrators
5. Data users

Stakeholders are the managers and financial supporters of SDI/ GIS for an organisation. Their role is very important to support the use and development of SDI.

Administrators, Developers and Analysers role is important in maintaining, updating and developing the existed GIS system.

Data owner and administrators are responsible for the availability, integrity and confidentiality of data.

ICT System administrators have an advisory, supportive and facility-providing role.

All of the mentioned Humanware categories and other SDI components are intend to support users to use spatial data. Municipal (spatial) data users are the people who use spatial data for the purposes of meeting legal obligations, business process and providing better services for the residents. Depending on data accessibility, the users can be categorised to different groups. In the next paragraphs on Dataware, these categories will be explained.

3.7.2. Dataware (Data)

Dataware is the second important component of SDI because the whole concept of SDI runs on using data by people.

In line with the previous mentioned definition of SDI, several studies have proposed the following components of a Spatial Data Infrastructure: Datasets, Institutional framework, Policies, Access network (Technology), Standards, People (Human resources) and Financial resources (Van Loenen 2009) via (de Vries, 2013), figure 6. In the figure the important and core role of Datasets (Dataware) between other components of SDI is clear.

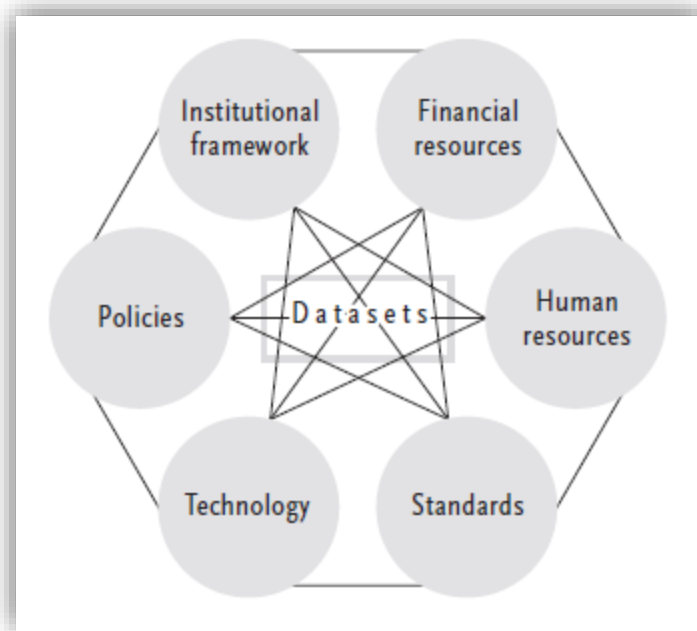


Figure 6: Components of SDI ((Van Loenen 2009) via (de Vries, 2013))

3.7.2.1. Data classification

As it is discussed and obvious municipalities have lots of spatial data. Data classifications can be done in different ways. Data can be classified depending on an appropriate level of security to the following five accessibility levels:

1. **Public**
This level of data and information is accessible to all employees, hired external staff, residents and community.
2. **Internal**
This level of data and information is accessible to all employees and hired external staff.
3. **Special**
This level of data and information is accessible to special employees and hired external staff by the data owner.
4. **Confidential**
This level of data and information is accessible to authorized employees, hired external staff and external organisations according to laws and regulations.
5. **Secret**
This level of data and information is accessible to a limited selection of authorized staff and almost never made available by means of GIS (Adapted from van Kampen, 2013).

3.7.2.2. Metadata

What geographic information is available? Where is it to be found and how timely or reliable is this information? Metadata is leading the way in our information management to avoid duplication of production and management. Metadata ensures that geographic information be easily found. Metadata describes the characteristics of Geo-information. With the growth of the Geo-information usage, the management of Geo-information becomes more important (Geonovum, 2017).

With metadata geographic dataset described in a way that search may be directed to questions such as: who, what, where, when, why and how. The metadata contains details about the owner of the geographical data, quality, theme, etc., and how it can be accessed and used (Geonovum, 2015).

Thus, metadata is very important to organisations especially in Geo-information field. From my experience many municipalities have not pay enough attention to metadata until now.

According to PDOK Geodatastore, figure 7, the following information important and practical to have on each spatial dataset: Title, Description, Subject, Keywords, Description of origin, Region, Open Data License, Scale and Image/Picture (PDOK, 2017).

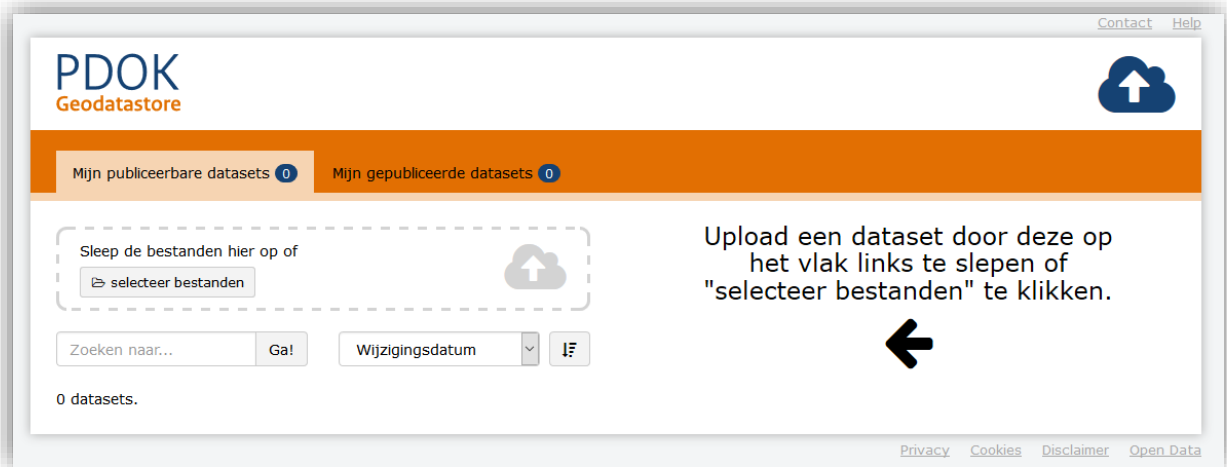


Figure 7: PDOK Geodatastore

Using ISO 19115 (Geographic information – Metadata) or Netherlands metadata profile op ISO 19115 geography has more detail but the above-mentioned description of PDOK is more practical (ISO, 2014 & Geonovum, 2013).

3.7.3. Orgware

Almost each municipality has its own management organogram. Making an organogram for the Geo-information group in relation with other teams, departments, neighbour municipalities, companies, governmental agencies and organisations is a very good method to describe this component. This visualisation is a significant support for the Geo-information group to control, its policy and to check its legal relations with other organisations.

3.7.4. Software

This component deals with the needed information on software used by the Geo-information group.

3.7.5. Hardware

This component deals with information on Hardware used to operate Geo-information activities and especially municipal GIS. Figure 8 explains the six components of GIS according to Longley et al. (2005). Network (wired or wireless) can be considered as a part of Hardware and Software, access to the network and procedure will be managed by Humanware.

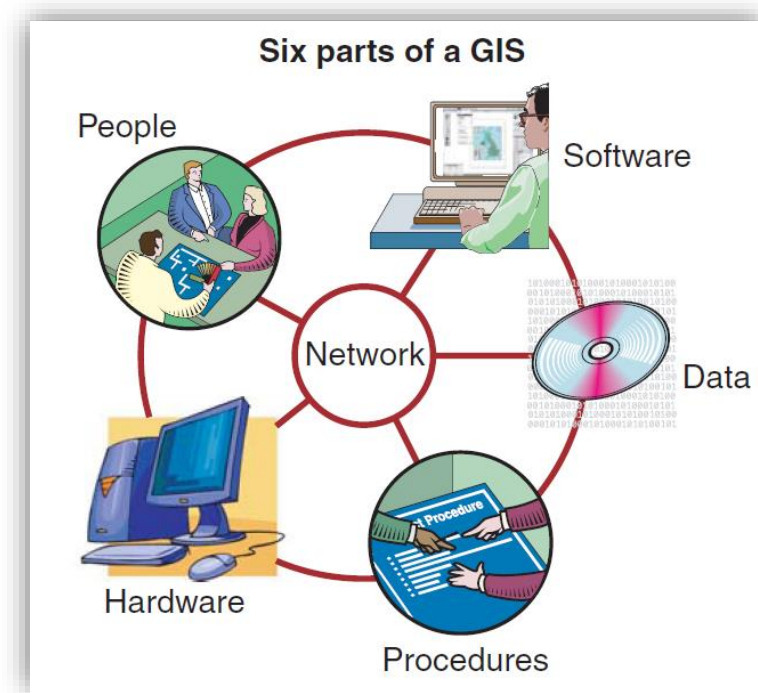


Figure 8: The six components of GIS (Longley et al. (2005))

4. SDI SITUATION OF MAASSLUIS MUNICIPALITY (Main case)

In this chapter and the following chapter the SDI situation of the study area will be described to answer sub-question 5 of research question 1. The description is from my experience and interviews. The usability assessment will be applied on this municipality primarily.

To make it feasible, I wrote concepts of the chapters (4 and 5) and discussed with the interviewers part by part to reach the desired and correct result.

For this chapter the following staff members in Maassluis municipality were interviewed:

1. Mr. S. Erftemeijer, Information manager
2. Mr. E. Schwencke, Project manager and ICT specialist
3. Mr. L.D. Kerkhof, Geo-information Specialist
4. Mr. A.P. van Kampen, ICT Team leader

Figure 9 shows the location of the study area (municipalities of Maassluis and Westland).



Figure 9: Study area location (imergis.nl, 2017)

The study area goals and demands from SDI will be considered to formulate the questions of the assessment method and answering research questions.

Maassluis is a city where approximately 32000 people reside, figure 10. In the days passed Maassluis was a small fishery village. Today, it is a modern lively city with a historic centre and its sixteenth and seventeenth century premises as its main features. The city aims high and there is lots of plans for the future. A lot of consideration and effort is placed on the improvement of the shopping areas in the city centre but and also near the Koningshoek shopping mall. The locations can be easily reached through the A20 connection. The

Westland and the city of Rotterdam are very close to Maassluis. Maassluis has a lot to offer to practitioners of sports, boredom is no option (Maassluis.nl, 2017).

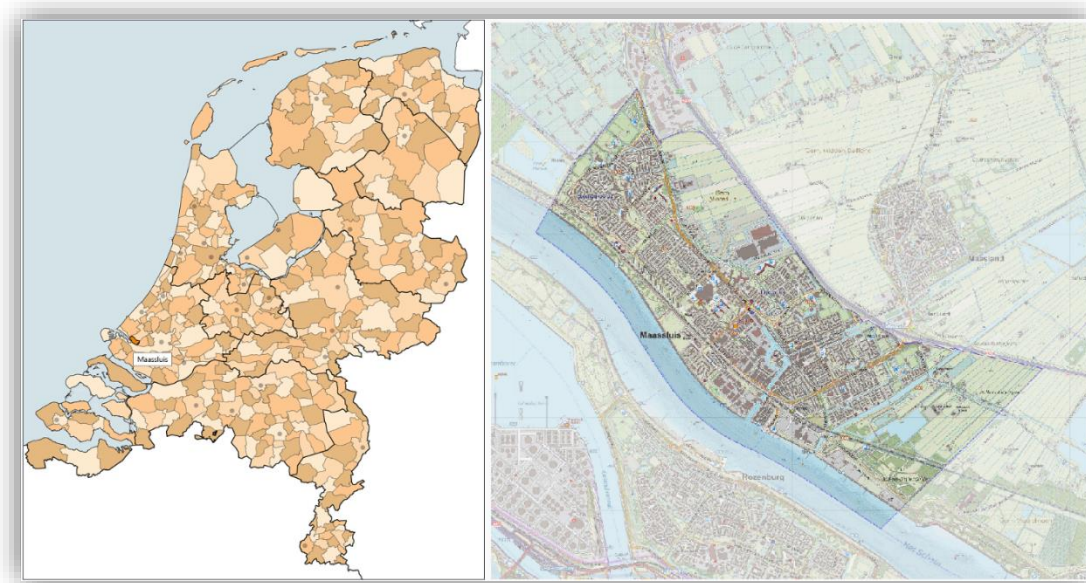


Figure 10: Maassluis location (Gemeentenatlas.nl, 2017)

4.1. Vision and mission

Maassluis is a city with a lot of social activities, beauty and self-catering. For Maassluis to be a sustainable city, the vision of the future must continuously be addressed and better future-proven policies made. This is of course on the environment and the changing demographics, e.g. the dual aging and cultural diversity, the facilities (shops, schools, cultural and sports), the mobility and accessibility.

The challenge is not only in the achievement of social, financial or sustainable objectives, but also in the achievement of these three objectives simultaneously. These choices must be social, solid and sustainable (Maassluis.nl, 2017).

4.1.1. Maassluis Sustainability vision

According to Brundtland "Sustainable development is a development which meets the needs of the present generation without compromising the ability of future generations to meet their needs" (UNECE, 2013).

The Sustainability Policy Officer (Ms. A. Pronk) explained Maassluis Sustainability vision on 2 May 2017 as follows:

The sustainability policy of Maassluis municipality has a balance between people, planet and prosperity, so that people can live healthy and happy lives in Maassluis even after one hundred years from now. If the goals of planet or prosperity are not met, people will suffer. That is why, the vision of the Maassluis municipality summarized in three parts:

1. *People*

The inhabitants of Maassluis municipality are the most important. Happy, healthy and satisfied residents who contribute to all policy plans, goals and ambitions.

2. *Planet*

In all what we do, we must take into account the impact on our planet, so that Maassluis residents can also meet their needs in 100 or 200 years. We only have one planet and we have to handle it with respect. The municipality of Maassluis wants to minimize the impact on the earth.

3. *Prosperity*

Goals, activities and investments cannot be achieved without healthy financially business operations. Both in the short and long term, we need to deal with financial resources wisely and responsibly, otherwise there will be no more Maassluis municipality in the future. Furthermore, prosperity is about the local economy. The aim is an attractive city for both businesses and tourists, in order to increase work opportunities.

4.2. Maassluis SDI

The municipality Geo-information specialists aim to support organisational objectives by providing high quality services (fast, actual and reliable spatial information from the same source) for the staff members and to serve inhabitants, companies and social organisations. The present Geo-information products offered by the Geo-Information group of Maassluis municipality can be divided into Geo-information support for internal use and collaboration in external geo-related projects.

4.2.1. Internal GIS/ SDI

The most important Geo-information group product is Internal GIS (or Inter-organisational GIS), figure 11. The internal GIS of the municipality supports organisational objectives by providing high quality service (fast, actual and reliable spatial information from the same source) for the staff members to serve inhabitants, companies and social organisations. All of Maassluis municipality staff can access the available Geo-information by the internal web service. This is a computerised program offering maps (such as Basic Register of Addresses and Buildings (BAG), Basic Register of Large Scale Topography (BGT), land use plans, cadastral maps, etc.) and information linked to these maps can be viewed in a fast and reliable way by staff members. This is necessary for the staff to consult from their workplaces. Think, for example, of cadastral information: with a click of the mouse on the cadastral map can the owner, the sale date and the size of the parcel been seen.

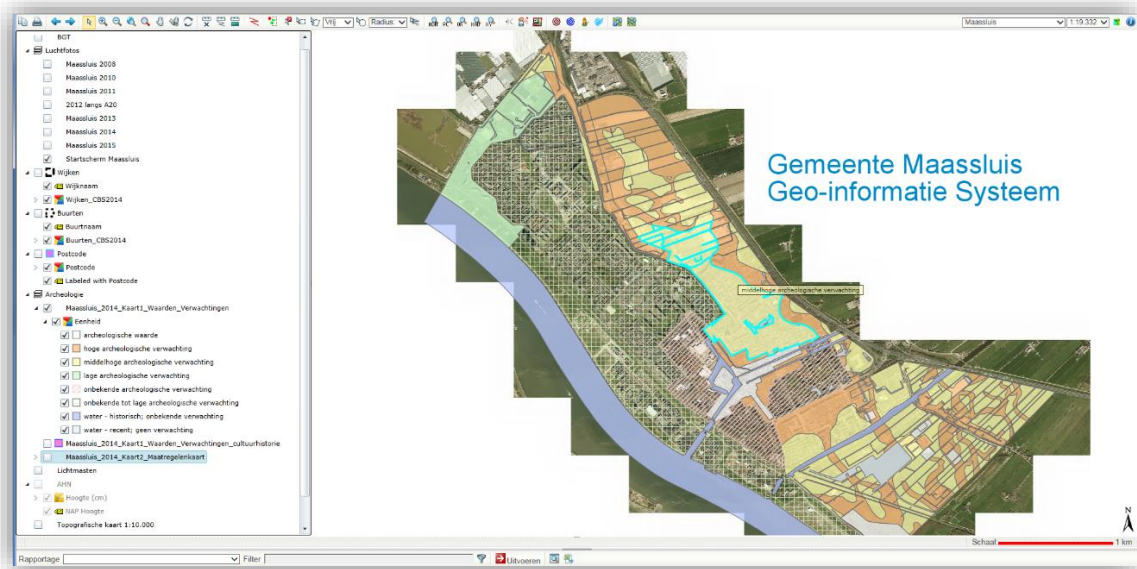


Figure 11: Maassluis Municipality Intranet GIS viewer (Stroomlijn)

4.2.1. External GIS

In the past there was also an Internet Geo-portal to serve external parties like citizens, companies and organisations. The portal is made with the support of the Maassluis municipality staff and an external company. The portal provided different kinds of Geo-information (information on city facilities and municipal services). This project was stopped in 2016 because of technical security problem observed by Faalkaart.nl and little usage observed through log files by Maassluis commination team, figure 12.

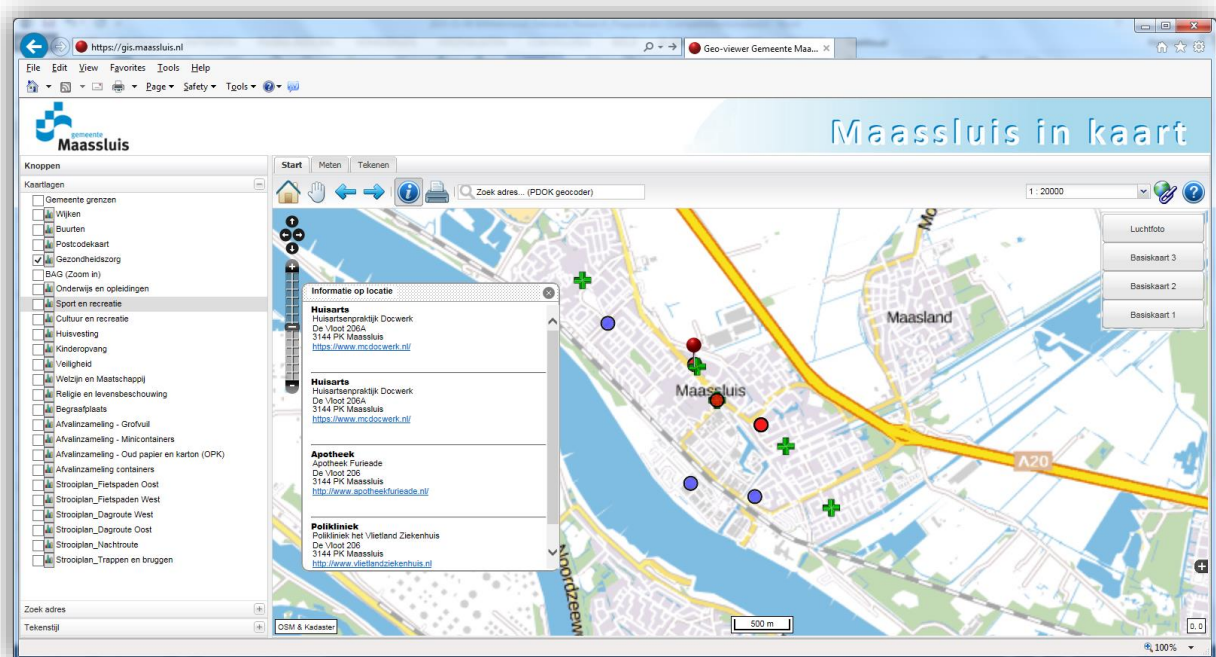


Figure 12: Maassluis Municipality Internet GIS viewer (Maassluis in kaart)

4.3. The five Geowares in Maassluis municipality

4.3.1. Humanware

Geo-information group in Maassluis consists mainly of two Geo-information specialists and a team leader.

Humanware is according to afore-mentioned categories are:

a. Stakeholders

The stakeholders are team leaders, heads of service departments, head of other departments, municipality general director, Mayor and Aldermen (in Dutch: Burgemeester en Wethouders, B&W) and City Council (in Dutch: Gemeenteraad) members.

Team leader (ICT)

- More than 27 years of experience with ICT
- MSc (Management of) Information Technology
- MBA General Management
- Dealing with management issues.

Data owners and administrators can be also considered as stakeholders as they are responsible for meeting legal obligations such as BAG and BGT (Erftemeijer, 2017).

b. Administrators, developers and analysers

Work activities are shared mainly between Geo-information specialists, one of them dealing mostly with data and the other one with developments, analyses and technical issues:

GIS Specialist

- About 12 years of experience with GIS
- BSc in Civil Engineering
- MSc GIMA student
- Dealing with developments, analyses, technical, organising and process management issues
- CAD Experiences

Geo Specialist

- More than 27 years of experience with Geo-data
- Intermediate vocational education in survey (in Dutch: middelbaar beroepsonderwijs, MBO)
- Dealing mainly with Geo-datasets
- CAD Experiences

c. Data owners and data administrators

They are internal staff members or external organisations who supply spatial data for municipality Internal GIS and they are responsible for the data quality as well.

d. ICT System administrators

Support staff dealing with ICT helpdesk, system administrator and network administrators.

e. Data users

All the staff members are allowed to access the GIS viewer (Stroomlijn) with different authorisation accessibilities according to afore-mentioned data classification.

4.3.2. Dataware

In Maassluis municipality internal GIS is possible to manage access to spatial data per user, depending on Microsoft active directory service of Windows domain networks. To control data accessibility depending on afore-mentioned data security levels some groups are made. Each group has an access to several specific (spatial) data. Each user can be a member of one or more groups. The internal staff members have access to Data accessibility level Public and Internal but for the Special and Confidential levels users who need permission to be permitted. There are work instructions accordingly an appropriate accessibility levels (groups) will be offered to each user.

Metadata

For most available datasets in the Internal GIS of Maassluis municipality a simple metadata table information is provided. In the metadata table the following information can be found: dataset name, data administrator, description and actuality.

During this research the following issues is observed:

1. The metadata is not complete. Only main datasets have a metadata,
2. Not all the attribute of PDOK Geodatastore have been used,
3. Accessibility level (Public, Internal, Special and Confidential) is not yet published,
4. Work instruction on process of getting access to Special and Confidential datasets is not yet published,
5. It is not easy to look up or consult of a metadata for a selected visualised dataset, and
6. The datasets of Maassluis are not published yet through PDOK Geodatastore service (<https://geodatastore.pdok.nl/web/dut/index>) so that the data can be discoverable through <http://nationalegeoregister.nl> and <http://data.overheid.nl>.

4.3.3. Orgware

Geo-information Group has direct and indirect relations with other (governmental) organisations, (neighbour) municipalities, commercial companies and the rest of the municipality groups, teams and departments. The relation with each of the (part of) organisations is shown in figure 13. The relations are officially managed according to contracts and/ or memorandums of understanding.

The stakeholders, ICT group, information managers, data administrators and data owners do support the Geo-Information group, whilst internal users are being supported and served by the Geo-information group.

- **The stakeholders** providing necessary budgets for the Geo-information Group
- **ICT group and information managers** Providing ICT-support for the Geo-information Group
- **Data administrators and data owners** providing good quality data sets
- **All Internal users** (about 300 staff members) are allowed to use the products offered by the Geo-information Group, mainly Intranet GIS.

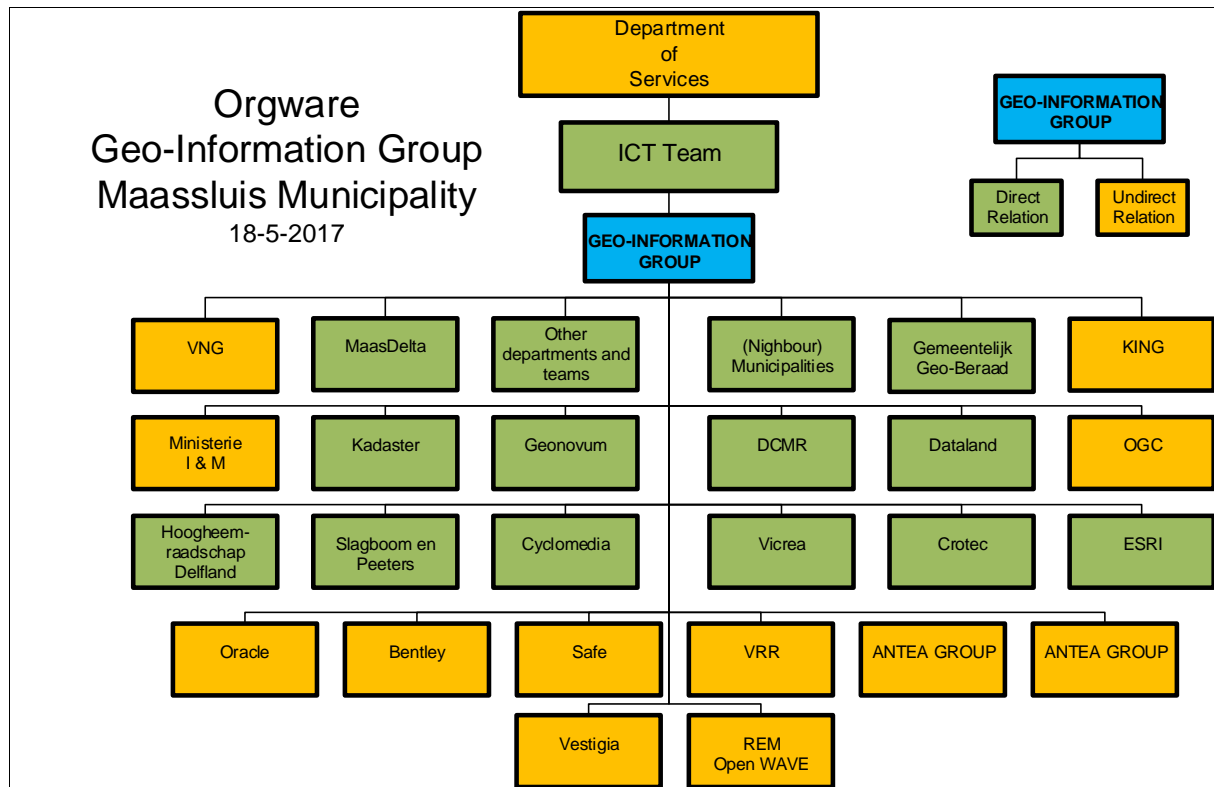


Figure 13: Orgware Geo-information group – Maassluis municipality

4.3.4. Software

The following are the software, which mainly used by Geo-information Group of Maassluis municipality:

1. Vicrea Neuron Stroomlijn, <https://www.vicrea.nl>,
2. Cadcorp, <https://www.cadcorp.com>,
3. FME, <https://www.safe.com>,
4. Oracle, <https://www.oracle.com>,
5. QGIS, <http://www.qgis.org>,
6. ArcGIS, <http://www.esri.com>,
7. GBI6, <http://www.anteagroup.nl>,
8. Microstation, <https://www.bentley.com>,
9. Bentley Map; <https://www.bentley.com>,
10. Neuron Stelsel Registratie BAG, <https://www.vicrea.nl>,
11. Neuron Stelsel Registratie WKpB, <https://www.vicrea.nl>,
12. Crotec C-SAM beheer BGT, <http://www.crotec.nl>,
13. Bluebeam Revu, <https://www.bluebeam.com>,

14. REM Openwave, <https://www.rem.nl>,
15. TopDesk, <http://www.topdesk.com>,
16. Nen converters, <https://giskit.nl>, and
17. Other supportive software.

4.3.5. Hardware

Figure 14 shows the detail of Hardware used by Geo-information Group of Maassluis Municipality.

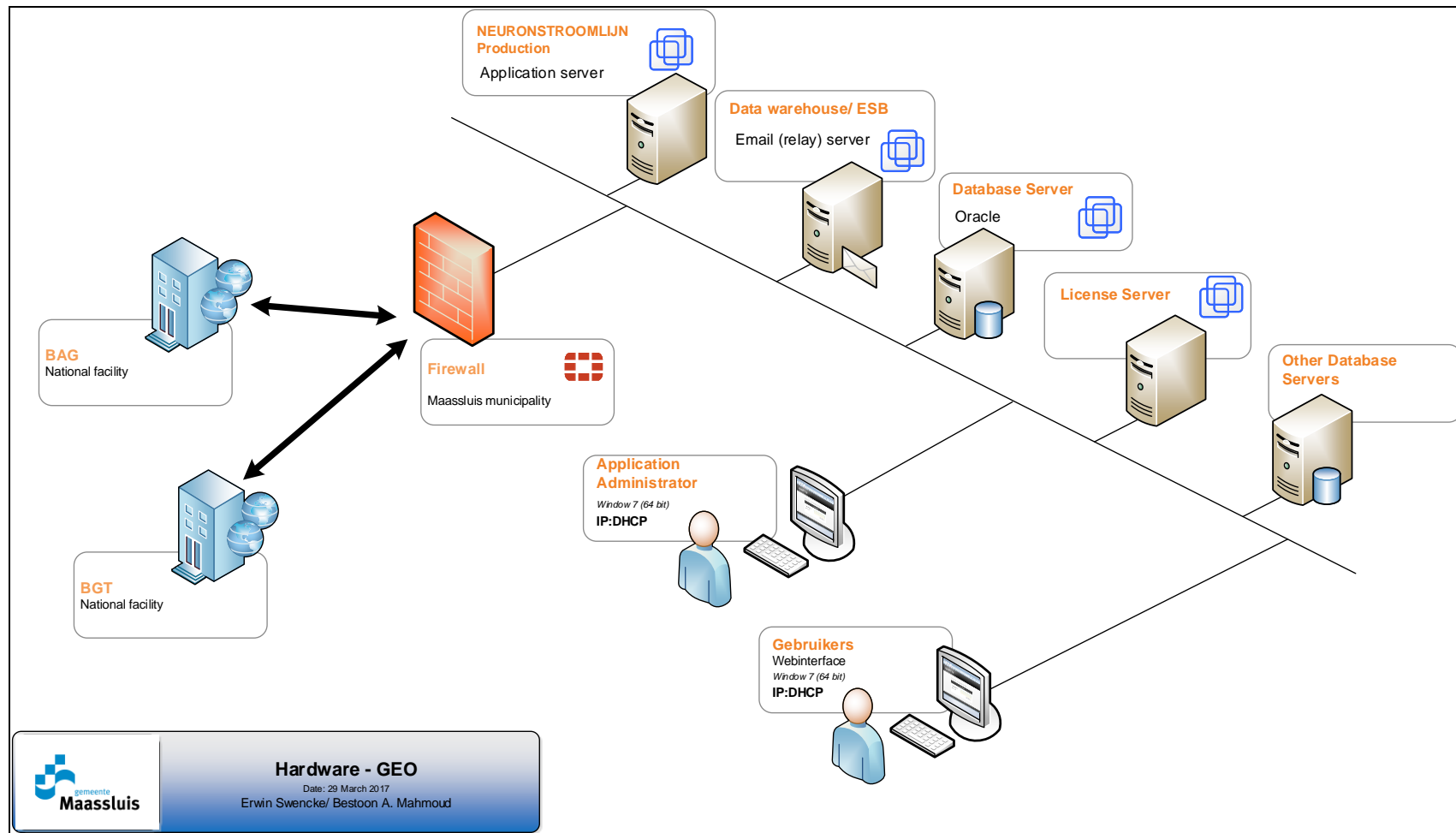


Figure 14: Hardware Geo-information group – Maassluis municipality

5. SDI SITUATION OF WESTLAND MUNICIPALITY (Subcase)

For this chapter the following staff member of Westland municipality were interviewed:

1. Mr. S. Wiersma, Geo-information Specialist
2. Mr. N.D. Dao, Geo-information Specialist
3. Mrs. A. Peyrer, Advisor Green, Water & Ecology
4. Mr. H. van Dalen, Areal Administrator
5. Mr. D.M. Snel, Information Advisor

Westland municipality is located in the province of Zuid-Holland, figure 15. By December 1st 2016, the municipality had 105781 residents (Westland.incijfers.nl, 2017). The Municipality is due to its activity in the greenhouse industry classified as the "glass city 'and' the garden of Europe". Westland is the largest greenhouse farming community (2.500 hectares) leading the field in consultation, innovation and developing sustainability.



Figure 15: Westland municipality location (gemeentenatlas.nl, 2017 & Vraag 'an de burgerman, 2009)

5.1. History

In 2004 the municipality of Westland was formed by a merger of the municipalities of De Lier, 's-Gravenzande, Monster, Naaldwijk and Wateringen. Until November 2006, several GIS applications were in use such as Stragis, which depends on MapInfo (<http://www.pitneybowes.com>), and Stragisweb, which depends on MapServer (<http://mapserver.org>). Both (Stragis and Stragisweb) applications were provided by Syncera company (nowadays <https://www.roxit.nl>). Traditionally, CAD programs are being used a lot by the municipality. However, since November 1st 2006, by the establishment of the Geo-information group, the use of GIS started and is continuously increasing. Westland

municipality has over 1000 staff members. Many of whom are involved with Geo-information. To support them, an internal and external GIS viewer is developed. Thus, the Geo-information products offered by the Geo-information Group can be divided into internal GIS-support (within the Municipality) and GIS-services for external communication.

5.1.1. Internal GIS

The staff members can access the available Geo-information by the internal GIS viewer (called IBORgis), figure 16. This is a web application offering many types of maps and data such as land use plans and cadastral maps and the information “behind” those maps can be also viewed by staff members.

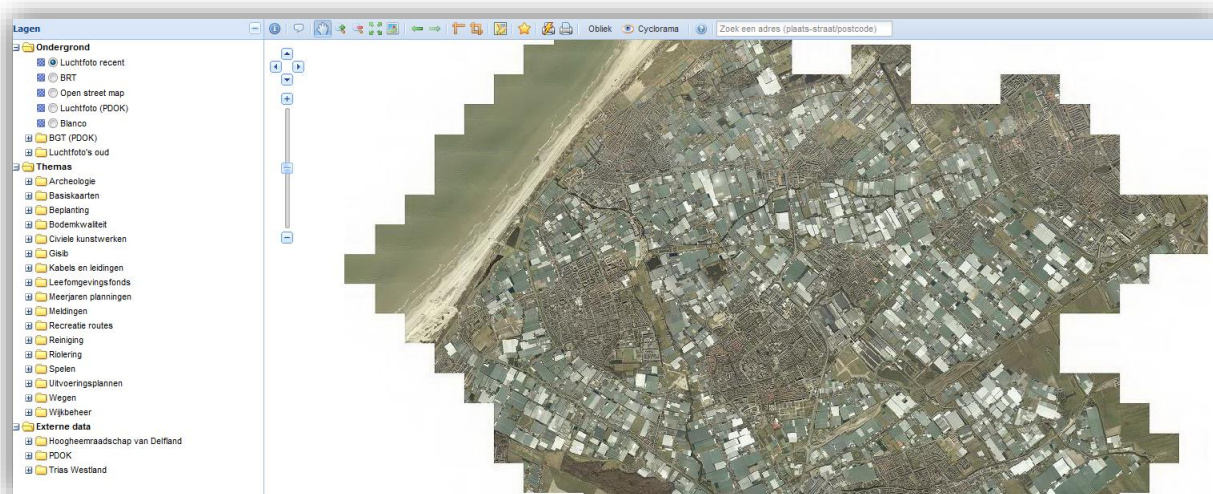


Figure 16: Internal GIS viewer (IBORgis) of Westland municipality

Westland municipality has until now another Internal GIS developed in 2006 (Intergraph – GeoMedia) nowadays called Hexagon Geospatial – GeoMedia (<http://www.hexagongeospatial.com>), figure 17. Westland is intend to replace it with IBORgis.

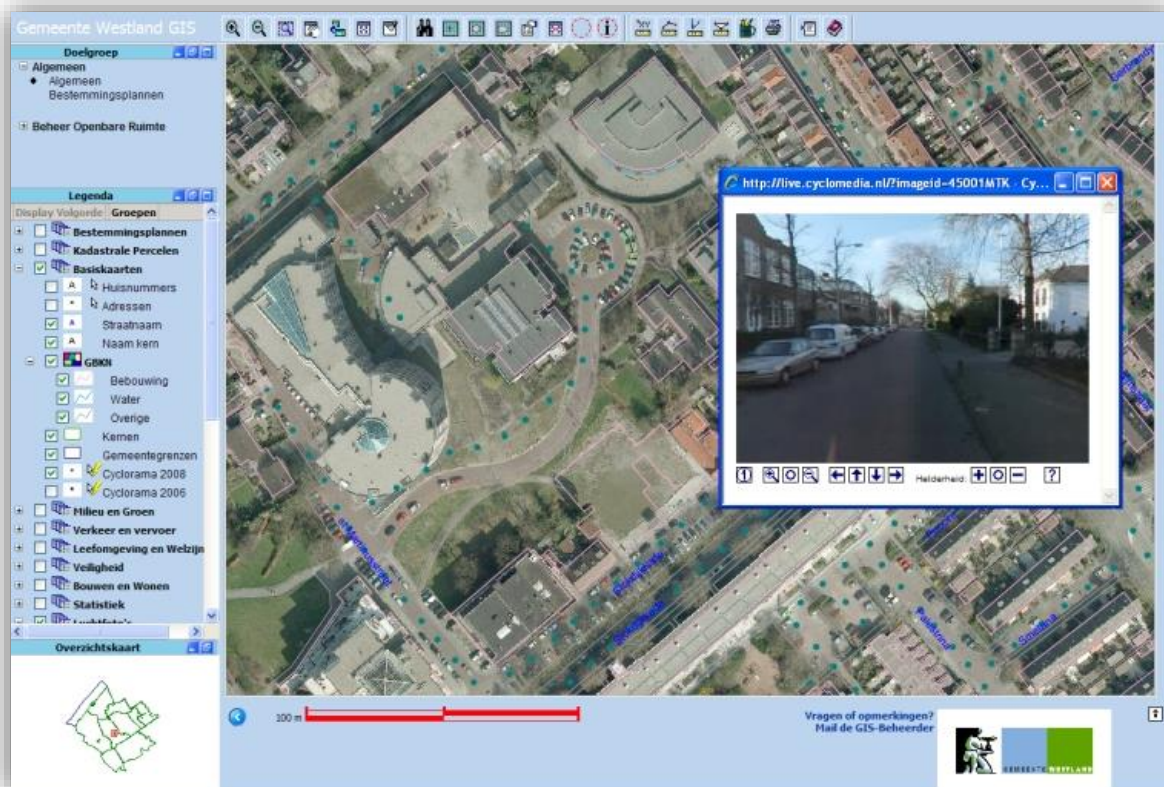


Figure 17: Internal GIS of Westland municipality viewer (GeoMedia)

5.1.2. External GIS

To serve external parties like citizens, commercial companies and other organisations Westland municipality made a Geo-portals to publish spatial data, e.g. In this portal (<https://www.gemeentewestland.nl/over-westland/bij-mij-in-de-buurt.html>) information on municipality facilities and up to date temporary changes because of road work can be seen, figure 18.

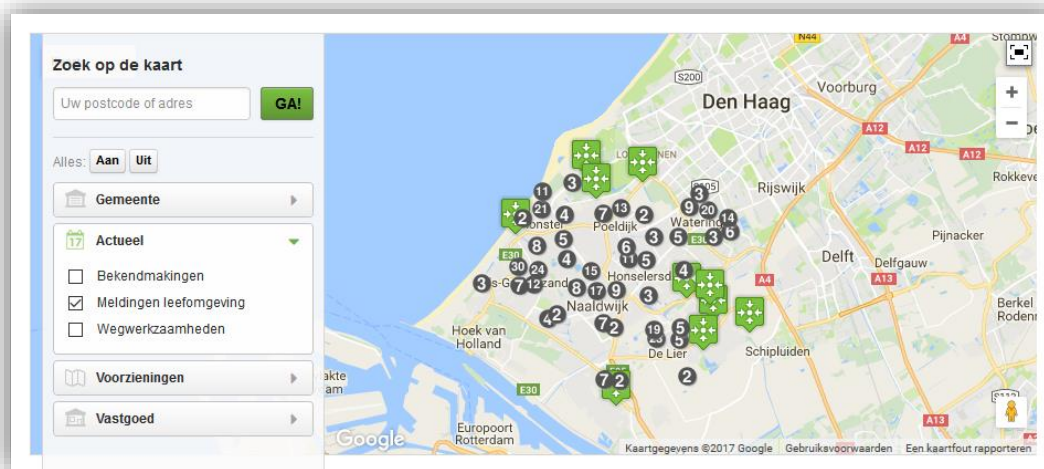


Figure 18: Public Web Service from the municipality of Westland

The Municipality of Westland also published all the constructions files from 1st of October 2010 via the following geoportal: <https://bouwdossiers.sciconcept.nl>.

5.1.3. Apps

Westland municipalities use many mobile applications to serve the residents, the following are some of them:

- Better outdoors (IN Dutch: Buiten beter, <http://www.buitenbeter.nl>), this app helps municipalities to create a clean, safe and good environment for residents through resident's participations (attention and feedback). Via this App, it is possible for citizens to fill in a (location-based) feedback-form. This can be a general remark or a complaint for something. This feedback-form is stored in a database and will be send to the right department to undertake action if needed.
- About your neighbourhood - App (in Dutch: Over uw buurt, <https://overuwbuurt.overheid.nl>)

This is a digital service of the government. The government offers its services and messages more often online. In this way, the residents remain constantly aware of reports from the government.

5.2. The Five Geowares in Westland municipality

During the next sections, the actual situation of Humanware, Dataware, Orgware, hardware, software, and within the municipality of Westland will be described.

5.2.1. Humanware

Currently Geo-information specialists are scattered in the organisation clusters and teams. There are basic registration staff, there are also geo-specialist in another dealing with management of public space (in Dutch: Beheer openbare ruimte, BOR). There are information advisor and data administrators. The data analyser is specialised in working with databases and is involved with the development and introduction of new services and products. There is also a data administrator to manage spatial datasets.

According to the Geo-information specialist (Data analyser), it is estimated that from a total number of (over 1000) Westland municipality staff members about 400 are dealing frequently (on daily bases) with Geo-information via Internal GISs (GeoMedia and IBORGis). These staff members can be the data administrators or can be working for the ICT or Communication Teams.

All staff members of the Basic registers administrator have diverse education, their own specialisation and therefore their own tasks and responsibilities.

Information Advisor (1)

- Management
- More than 18 years of experience with ICT and GEO-ICT

Geo-information specialist (Data analyser) (1)

- More than 15 years of experience with GIS
- Postgraduate diploma in Geo-information
- Oracle database skills
- Staff member of 2nd Line Team 2.2 (Appendix 4 – Organogram of Westland municipality)

Geo-information specialist (Data administrator) (1)

- More than 27 years of experience with management of spatial datasets.
- Intermediate vocational education in survey (in Dutch: middelbaar beroepsonderwijs, MBO)
- Administrator for spatial datasets such as BGT and Aerial photos
- CAD Experiences
- Staff member of 2e Lijn Team 2.2 (Appendix 4 – Organogram of Westland municipality)

5.2.2. Dataware

There are about 200 datasets in use by Westland municipality. Some examples are:

1. Land Use plans (In Dutch: Bestemmingsplannen, instruction for what allowed to be built in a particular place),
2. Cadastral Parcels (the boundaries between cadastral parcels and the associated administrative data),
3. Basic Register of Addresses and Buildings (in Dutch: Basisregistratie Adressen en Gebouwen, BAG),
4. Basic Register of Topography (in Dutch: Basisregistratie Topografie, BRT),
5. Municipality legal boundaries,
6. Cyclorama 360 degree (photo's every 10 m on the streets),
7. Nature value map (indicates where ecologically sensitive areas with restrictions to it),
8. Trees (information about the trees),
9. Notifications on Public Space (complains and maintenance of public area's facilities),
10. Conventional Explosives (map registered with conventional explosives in the soil),
11. Sewerage (information about sewage systems: intersections, lines, etc.),
12. Aerial photos (each year from 2005 until now),
13. More years planning (future reconstruction / maintenance planning For the coming five years for the Infrastructure),
14. Public facilities and services (Facilities and services), etc.
15. PDOK datasets,

Appendix 7 explains Data flow and applications architecture in Westland municipality.

5.2.3. Orgware

Geo-information specialist and staff are scattered in the organisation clusters, Appendix 4 – Organogram of Westland municipality. There is a lot of interaction with other departments

within the municipality. Figure 19 explains the relations of basic registers group with different organisations.

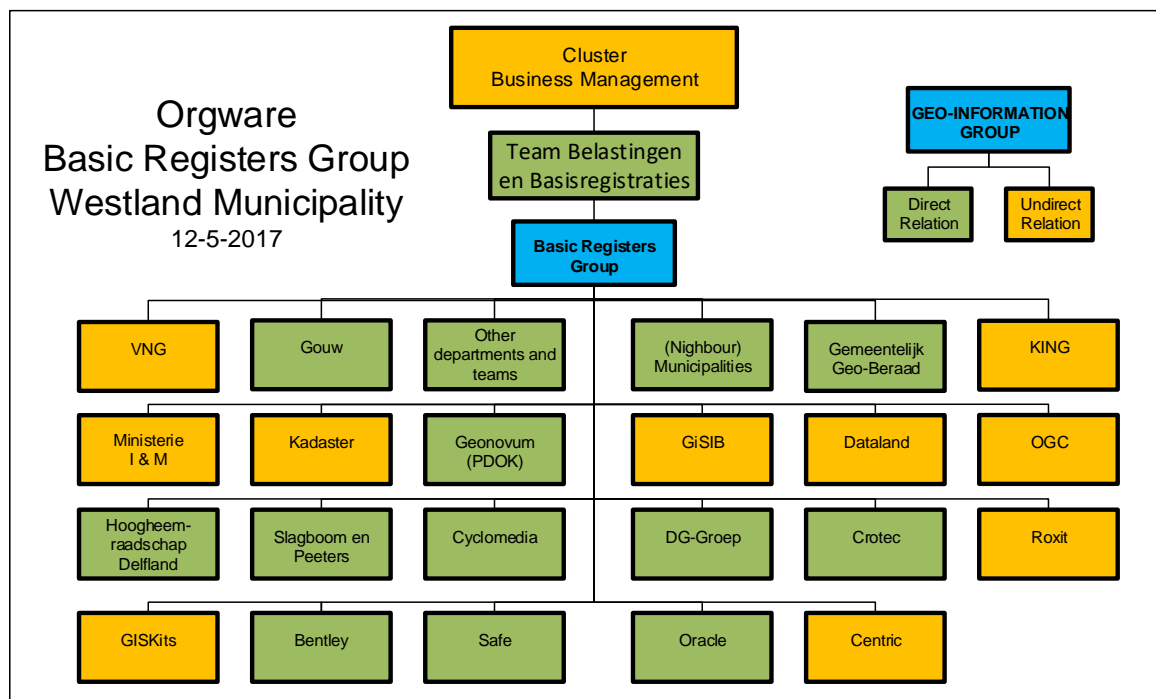


Figure 19: Orgware basic registers group in Westland municipality

5.2.4. Software

The Internal GIS (IBORgis) of Westland municipality is designed form open source products depending on Heron Mapping Client (<http://heron-mc.org>) and GeoServer, <http://geoserver.org>). The programming language Python is also used (<https://www.python.org>). The staff member are using also commercial software packages, like, Oracle (<https://www.oracle.com>) and FME (<https://www.safe.com>).

5.2.5. Hardware

By figure 20, it is shown that there is within the municipality one central Citrix Server and more further specified to the Geo-information Group there are two GIS Oracle Data Servers (of which one is functioning as a testing environment) and one GIS Web Server. Geo-information specialists have their own workstation and many other staff members have flexible workstation.

The GIS Oracle Data Server is the database server for storage and querying of all the geo-related data. The GIS Web Server is supporting the web-based services. The workstations can be divided into workstations being used by the GIS Specialists and workstation used by the GIS Admin. With the GIS Admin computer, the whole system is managed. It is in use to test products before being published on the GIS Web Server. The GIS server consists of two virtual machines, one for Windows and other one for Linux.

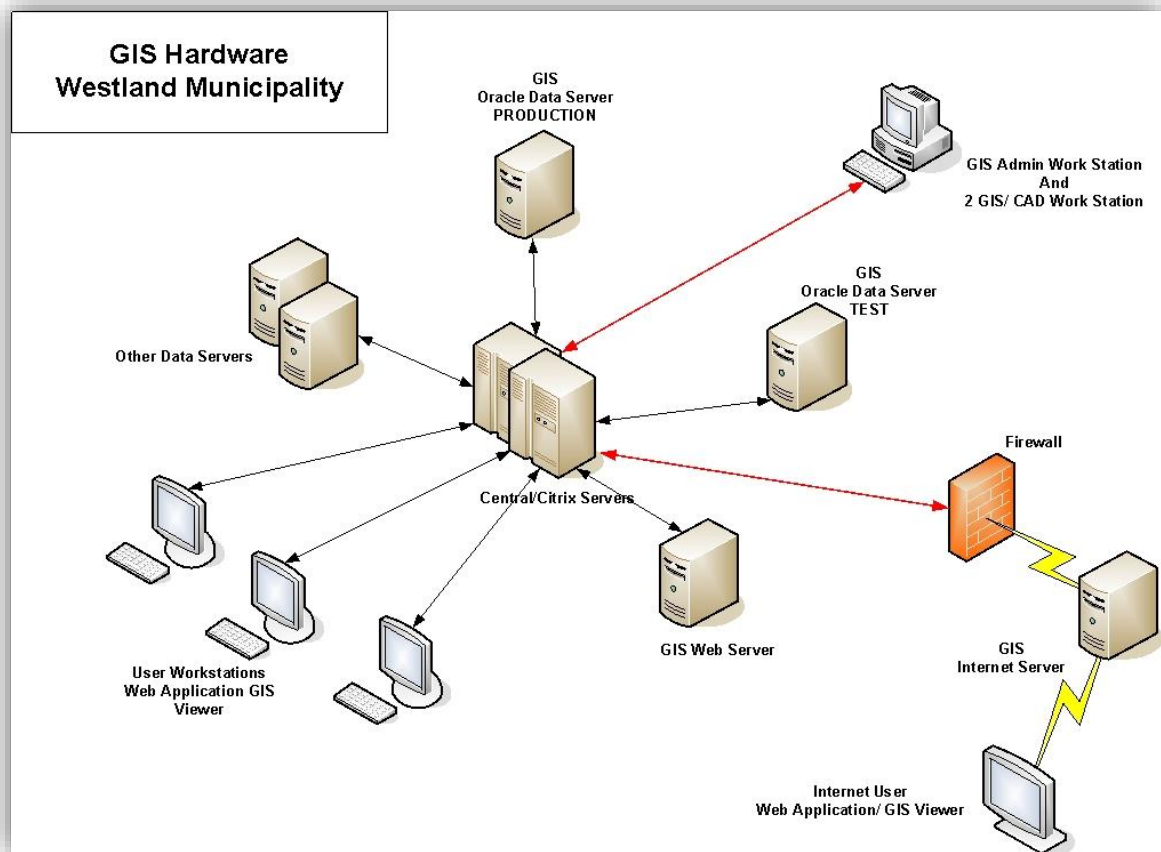


Figure 20: GIS-hardware scheme for the municipality of Westland

6. MUNICIPAL DEMANDS FROM SDI

To make it feasible, I wrote the concept of this chapter and discussed with the interviewers part by part to reach the desired and corrected description.

For this chapter the following staff members are interviewed:

1. Mr. S. Erftemeijer, Information manager, Maassluis municipality
2. Mr. L.D. Kerkhof, Geo-information Specialist, Maassluis municipality
3. Mr. H. Over de Vest, Project manager, Maassluis municipality
4. Mr. F. van der List, Functional software administrator, Maassluis municipality
5. Mr. S. Wiersma, Geo-information Specialist, Westland municipality
6. Mr. N.D. Dao, Geo-information Specialist, Westland municipality
7. Ms. A. Pronk, Policy Officer – Sustainability (in Dutch: Beleidsmedewerker duurzaamheid), Maassluis municipality
8. Mr. K Luijten, Policy Officer – Environment (in Dutch: Beleidsmedewerker Milieu), Maassluis municipality
9. Mrs. S. Brons, Tax team leader, Maassluis municipality
10. Mr. M List, External Staff, Maassluis municipality
11. Mr. Martijn Snel, Information Advisor, Westland municipality
12. Mr. P. Mostert, Green Administrator (BOR), Maassluis municipality
13. Mr. M. Okay, Trainee, Maassluis municipality

Generally, municipalities deal with activities in the neighbourhood of the residents and perform tasks on behalf of the national government (De Gemeente, 2017). This means, almost every activity of the municipalities is connected or can be connected to a location.

Figure 21 illustrates the great relationship between a person and a location. A person lives in a house and the house (building) which has to have an address. The building can be used for business. The building is on a cadastral parcel and the parcel is on the topography (Hoff, 2010 and Besemer et al, 2006) and municipalities are dealing with all the mentioned data and information.

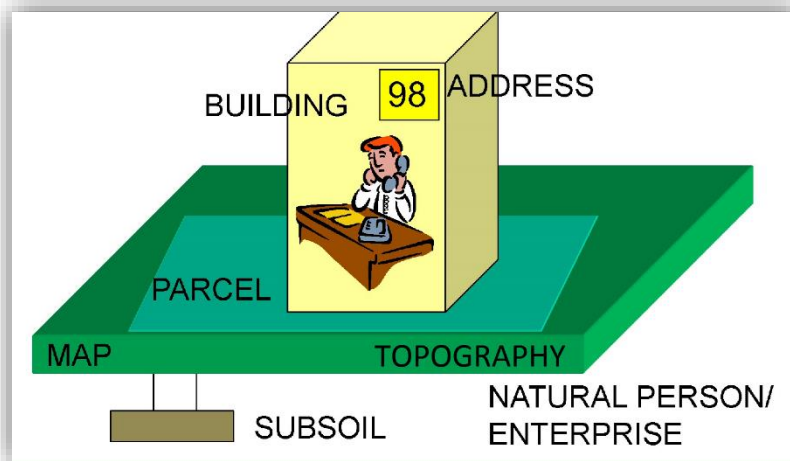


Figure 21: Person+Geo-information = Great coherence (Hoff, 2010 & Besemer et al, 2006) via (Hooyman, 2012)

In 2011, I interviewed De Groot (verbal discussion), who was at that time BAG project manager, we discussed the role of Spatial data and SDI in the municipalities. In that discussion we agreed to categorise the vital demands of the municipalities from SDI and the purpose of using spatial data by the municipalities to: meet legal obligations and requirements (laws), support business processes and provide better services to their residents. To manage the mentioned purposes municipalities are in need of comprehensive, reliable and easily accessible spatial data, in other words, a well-functioning SDI (adapted from Boos & Mueller, 2009).

Furthermore, everyone should use the same spatial information and from the same source to apply the motto of collect once and use many time, spatial information (data and services) to be made available to people with accessibility authorisation, visualising available geographic information, supporting awareness for geographic information and supporting vision and mission (goals) of the municipality. Municipalities are in need of SDI to enhance the quality of services provided by the municipality to citizens, businesses and civil society, in terms of up to date, central, reliable and timely consultation of data with spatial components from one source. For the Government it is imperative to have access to the mentioned datasets quickly, accurately and with an obvious method in other words with GIS and SDI.

6.1. Legal obligations

SDI plays essential role for the municipalities to meet many legal obligations and laws, for example, Dutch municipalities have to maintain (or participate in maintaining) the following five basic registers from eleven basic registers of the government depending on SDI (Digitale Overheid, 2017), figure 22:

1. Basic Register of Addresses and Buildings (in Dutch: Basisregistratie Adressen en Gebouwen, BAG),
2. Basic Register of Cadastre (in Dutch: Basisregistratie Kadaster, BRK),
3. Basic Register of Topography (in Dutch: Basisregistratie Topografie, BRT),

4. Basic Register of Large Scale Topography (in Dutch: Basisregistratie Grootschalige Topografie, BGT) and
5. Basic Register of Underground (in Dutch: Basisregistratie Ondergrond, BRO), in development.

Basic registrations are high-quality datasets, with explicit guarantees to maintain that quality, containing vital and/or multiple information required with regard to the body of legal tasks and for diverse reasons about persons, institutional matters and events, which is recognised by the law as the only officially recognized registration of such information and which is used throughout the country by all government bodies and, if possible, private organizations, unless otherwise excluded by substantial reasons such as the protection of privacy (Besemer et al, 2006).

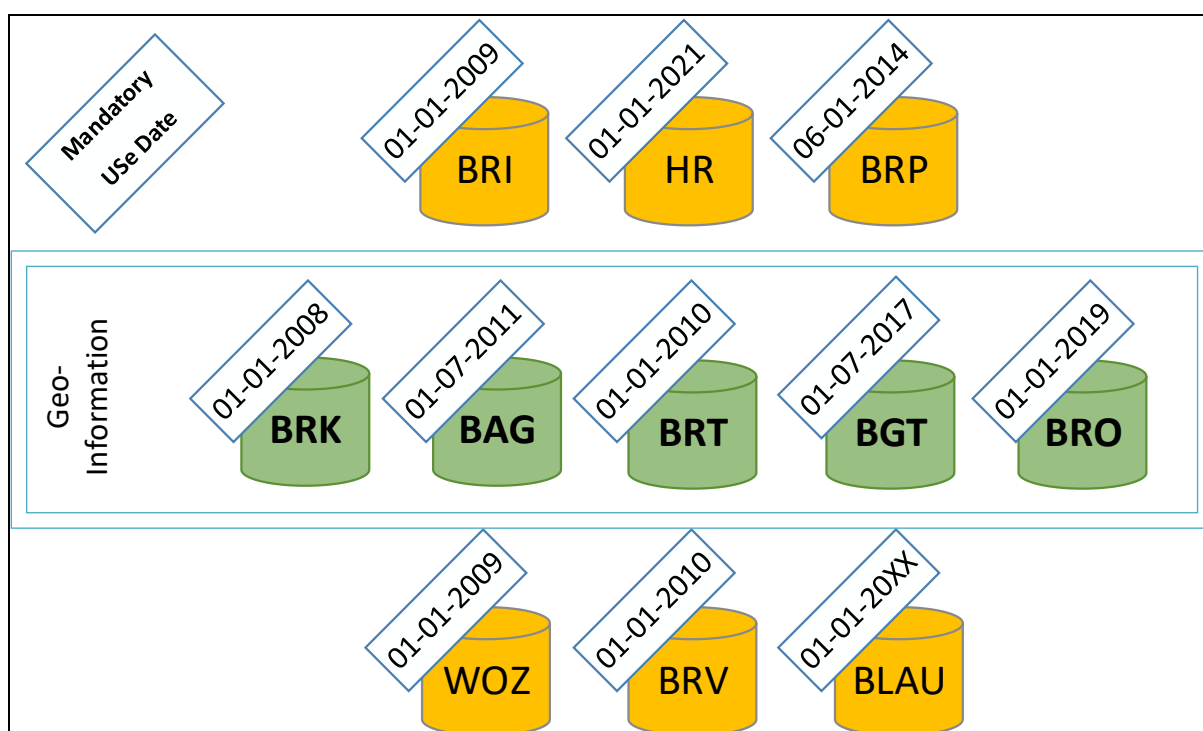


Figure 22: The five Geo-information Basic Registers and mandatory use (DA2020, 2017 & Jonker, 2011)

To meet legal obligations the use of SDI is for a municipality a necessity, both as a data provider and as data consumer.

There are lots of other legal obligations and laws, which SDI can play an important role for the municipalities to meet its obligations and laws, such as:

- a. Basic Register of Real Estate Assessment (in Dutch: Basisregistratie Waarde Onroerende Zaken, WOZ),
- b. Law of underground information exchange networks (in Dutch: Wet informatie-uitwisseling ondergrondse netten, WION).
- c. Law of limits public accountability (in Dutch: Wet kenbaarheid publiekrechtelijke beperkingen, Wkpb),

- d. Law of General Provisions environmental (in Dutch: Wet algemene bepalingen omgevingsrecht, WABO),
- e. Planning Act (in Dutch: Wet ruimtelijke ordening, WRO),
- f. Environmental Act (in Dutch: Omgevingswet, OW), With the Environmental Act, the government wants to simplify and merge the spatial development rules. It is expected that the Environmental Act will come into force in 2019 (rijksoverheid.nl, 2017).

6.1.1. Basic registrations' connections

At present, there are legal obligations from the Netherlands government for laying more than twenty connections between basic registers. The connections (situation on 31 December 2015) are visualized in figure 23 (digitaleoverheid.nl, 2017).

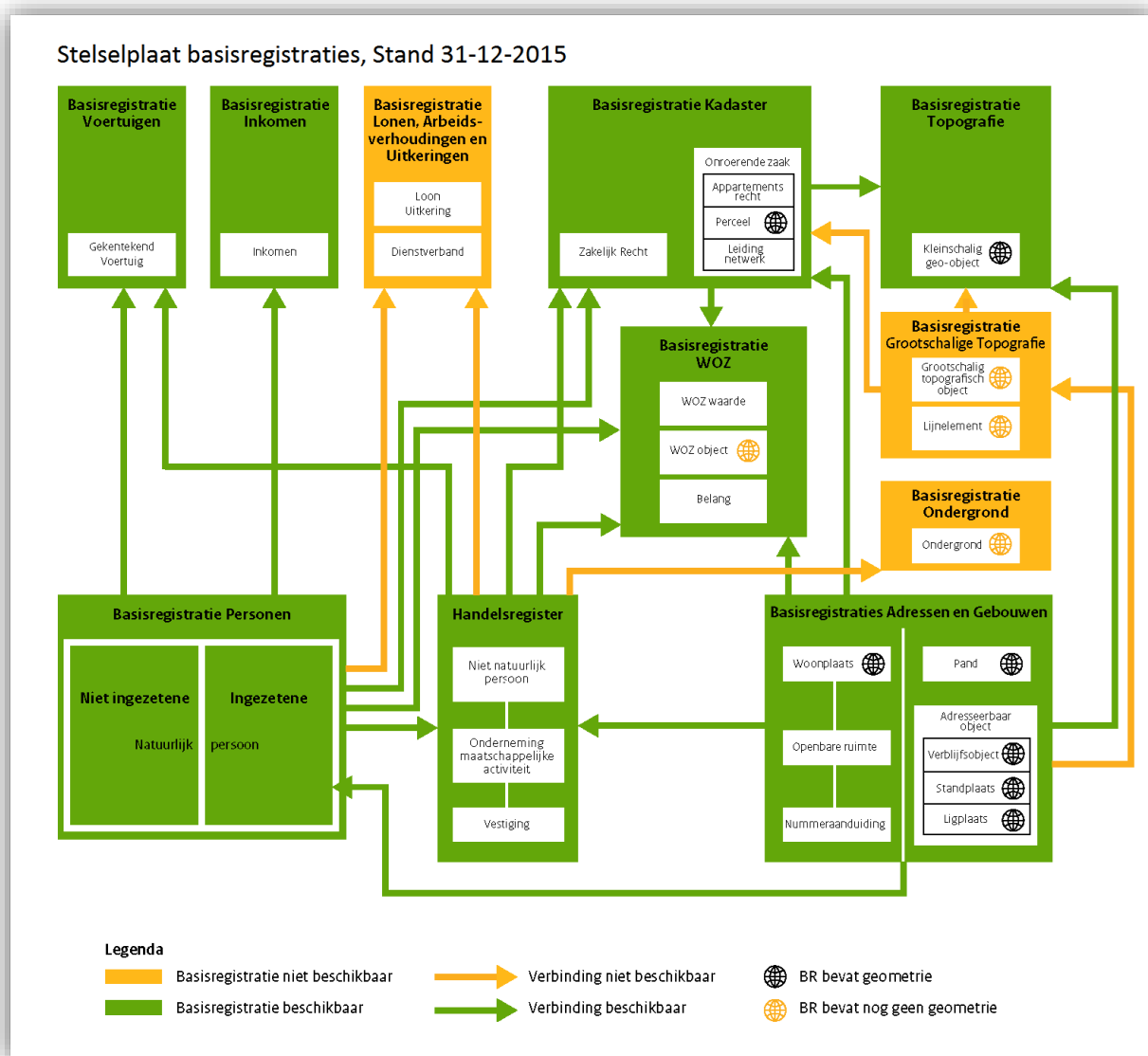


Figure 23: Connection obligations between basic registrations (digitaleoverheid.nl, 2017)

This YouTube video on Basic Registers (In Dutch, Stelsel van Basisregistraties: <https://www.youtube.com/watch?v=eTTc-YwbOW4>) explains the importance of the connections between the basic registers.

6.2. Business processes

There are lots of needed maps and spatial datasets used by the municipality staff daily supported by SDI and can be offered through GIS. This is making GIS essential in supporting the municipalities' business processes. The diversity and quantity of the business processes are huge and needs a complete new research. First, the available spatial datasets, which are provided to the users through internal GIS, will be described. After that depending on interviews and questionnaire, some examples will be given on business processes that will be supported with the mentioned datasets.

We can categorise these datasets to basic datasets and thematic datasets:

6.2.1. Basic datasets

The source of several of the following basic datasets is the legal obligations:

- a. Afore-mentioned Basic registers and laws (6.1 Legal obligations),
- b. Basic register of persons (in Dutch: Basisregistratie personen, BRP),
- c. Municipal and Districts/ Neighbourhoods boundaries (in Dutch: Wijken en buurten), the information is also available nationally through <https://www.cbs.nl>,
- d. Postcode regions,
- e. Arial photos (Orthogonal)
- f. Geo-oblique photos (at an angle of 45 degree),
- g. Cycloramas (A circular picture of a 360° scene),
- h. Land use plans (In Dutch: Bestemmingsplannen, Instruction for what allowed to be built in a particular place), the information is also available nationally through: <http://www.ruimtelijkeplannen.nl>,
- i. Digital elevation map of the Netherlands (in Dutch: Actueel Hoogtebestand Nederland, AHN, <http://www.ahn.nl>,
- j. Chamber of commerce register (in Dutch: Handelsregister, HR),
- k. Open Street Maps,
- l. OpenTopo, <http://opentopo.nl>,
- m. Actual weather information web services (in Dutch: Buienradar, <https://www.buienradar.nl>),
- n. Municipal tax information, e.g. Sewage, Real estate, Dog owners (in Dutch: Hondenbezitters), etc.,
- o. Permissions according to WABO, the same information is also nationally available through: <https://www.omgevingsloket.nl>, and
- p. Nature value map (indicates where ecologically sensitive areas with restrictions to it),

6.2.2. Thematic datasets

Besides the mentioned basic datasets there are lots of thematic datasets are made for specific business processes of the municipality departments. These datasets are intended to support the tasks carried on by the staff members and provided through intranet GIS. These datasets support business process much smarter and compacter, furthermore they are strictly needed.

The following are some examples of important thematic datasets:

- a. Crisis and safety management (e.g. emergency drinking water points, wind, siren locations, reception locations, vulnerable objects, hectometre, waterway marking, monitoring, safety contours, etc.),
- b. Public space management (e.g. Sewage, Green, roads, lighting, playground, multi-year planning, etc.),
E.g.: Consulting roads data to know what kind and quantity of road material must be replaced to estimate costs in the redevelopment (in Dutch: herinrichting) projects. Using image materials is helping the mentioned task if the needed information not found in the roads dataset.
- c. Environmental data (e.g. air quality, noise, waste collection points, memorial, soil quality etc. (More information <http://www.dcmr.nl> & <http://www.bodemloket.nl>)
- d. Statistics,
- e. Archeologic data and maps,
- f. Public facilities and services,
- g. Disables facilities (in Dutch: Mindervaliden voorzieningen),
- h. Salt spray plans (in Dutch: Strooiplan) for safe roads in the winter,
- i. Road work temporary changes,
- j. Firework prohibited areas.
- k. Notifications on Public Space (complains and maintenance of public area's facilities),
- l. Many other datasets provided by PDOK (www.pdok.nl),

6.2.3. Examples on Business process:

The following are some examples on business process, which will be supported with the mentioned datasets or SDI:

The BAG administrator (Mr. L.D. Kerkhof) explained on 8 May 2017 the BAG important of follows:

All the buildings and addresses in the Netherlands are collected in BAG (Digitaleoverheid.nl, 2017). All the government services and organisation must use the address's data of BAG, also all other basic registers, laws, governmental instructions must depend on the addresses from BAG if they are in need of using addresses. A resident cannot register him/ herself in the BRP (Basic register of persons) at the municipality if the address, which he/she wants to register on, is not registered in BAG. An owner of a parcel is in need to register his/her ownership in BRK and BRK must depend on BAG for the address of the owner. A resident cannot register his/ her business by the Chamber of Commerce in basic register HR without a registered address in BAG, etc. If an address actually exist and not found in BAG, a feedback request (in Dutch: terugmelding) should be made by the municipality for investigation on

that address. Thus, addresses always must be first registered in BAG. That is why BAG information is very important to the municipality staff which can be provided though an internal GIS for them. For more information see this YouTube video (In Dutch, BAG in 5 minuten: https://www.youtube.com/watch?v=m_YmHUqAR0o) which explains BAG in five minutes.

Staff members can consult cadastral information (BRK) such as the owner, the sale date and the size of the parcel, etc.

Table 2 is the answers of Internal GIS users on question 4 (Can you briefly describe a (important) task that you can carry out by using Stroomlijn?) of the questionnaire conducted from 9 to 16 May 2017 in Maassluis municipalities:

No.	Dutch (Original text)	English (Translated)
1	locatie zoeken	Searching for location
2	Info over archeologische warden grondgebied Maassluis; voorts beeld van de monumenten	Archeologic value information on Maassluis territory, Furthermore image of the monuments
3	gebruik van kadasterpercelen - pandopmetingen -cyclomedia fotos en obliekfotos	Using cadastral parcels, house measurements, Cyclorama photos and Geo-Oblique photos
4	Het matchen van de verschillende belang hebbenden, als we een project op een bepaalde locatie willen realiseren.	Matching various stakeholders if we want to realize a project at a particular location.
5	Eigendommen controleren, luchtfoto's en streetview voor oriëntatie, maken van kaarten voor besprekingen	Checking ownerships, aerial photos and street view for orientation, making maps for discussion
6	Kadastralegegevens met oppervlakte, opmeten op basis van objectafbakening lucht -en straatfoto,s,	Cadastral data with area, measurement depending on object boundaries, aerial photos and cyclorama photos
7	Achterhalen eigendom, nagaan hoe openbare ruimte is ingericht	Retrieve ownerships, checking public space
8	Uitvoering Wet WOZ	Implementation Law WOZ
9	Ik bekijk de kaart en meet evt wat zaken na.	I look at maps and possibly do some work tasks with it.
10	Gebied visualiseren	Visualise region/ area
11	Snel situatie buiten bekijken zonder naar buiten te hoeven gaan	View outside situation quickly without having to go outside
12	Kadastrale situatie in beeld brengen. Het aantal adressen bepalen voor het bezorgen van bewonersbrieven	Visualise cadastral situation. Finding addresses for sending letters to residents.
13	kadastrale grensbepaling	Cadastral boundary determination
14	Eigenaar opzoeken, locatie, luchtfoto, straatbeelden, kadaster, etc.	Searching for owners, location, aerial photos, street views, cadastral information, etc.
15	Kadastrale nummers vinden om in de te verlenen vergunning te gebruiken	Finding cadastral numbers to use in granting license/ permission
16	Zoeken naar informatie over een gebied, pand	Search for information on a region/ area, house/ property
17	Eigendomsgrenzen, omgevingsfoto's, ligging riool	Ownership boundaries, environmental photos, sewer location

18	Eigendommen vaststellen	Find ownership
19	Beoordeling kapaanvragen -snel een simpele tekening maken -beoordeling aanvragen wijkdeals	cutting tree requests, Making a simple drawing quickly, Request on neighbourhood agreements (an agreement between municipality and the residents on subject or an area),
20	Handhaving door locatiebepaling en foto's en achterhalen kadastrale gegevens voor aanschrijvingen	Enforcement by location and photos and retrieval of cadastral data for subscriptions
21	wanneer er in een advies wordt gesproken over een bepaald perceel en de ligging hiervan ten opzichte van andere percelen/ zaken dit zelf bekijken in stroomlijn	When an advice is discussed about a particular parcel and its location relative to other parcels / business, I want to check that in Stroomlijn
22	Nakijken wie de eigenaar is van grond	See who is the owner of land
23	Nakijken waar zich kadastrale percelen bevinden wanneer er facturen van derden binnenkomen die hier betrekking op hebben	See where there are cadastral parcels when related bills enters from a third side
24	De relaties tussen WOZ en Bag uitleggen, uitzoeken, controleren	Explaining , finding out and checking the relationships between WOZ and BAG
25	Object controles uitvoeren	Perform object controls
26	Voornamelijk kadastrale gegevens en globespotter gebruiken voor bijhouden beheerprogramma	Mainly using cadastral data and Globe spotter (Cyclorama) for updating management program
27	Controle van de gegevens uit het Handelsregister	Checking data of Chamber of commerce register (in Dutch: Handelsregister, HR)
28	Basisregistraties raadplegen	Consulting basic registers
29	Nazoeke van een adres een woonbestemming heeft, kadastrale gegevens en foto's	Searching for an address, a residential destination, cadastral data and photos
30	Eigendomsgrenzen achterhalen, informatie over locaties waar iets aan de hand is, foto's (lucht en straat) combineren met Geo informatie	Finding ownership boundaries, information about places where something is going on, combining photos (aerial and street) with Geo-information
31	plantoetsing en handhaving toetsingen	Checking plan and enforcement
32	Ik kijk alleen, maar gebruik het niet voor mijn werk	I just look but do not use it for my work

Table 2: Business process supported with SDI

6.3. Better Services for the residents

Almost every task of the municipality is to serve the residents. As explained above SDI is helping the municipalities to meet legal obligations and support them with their business processes. The SDI can also provide important information related to the location of the resident's interest.

According to Hessing & Mulder (2006), people would like to know the following three neighbourhood information before they move to their new place of living (figure 24):

- Services in the neighbourhood/ municipality,
- Houses for sale and rent,
- Potential risks and nuisance.

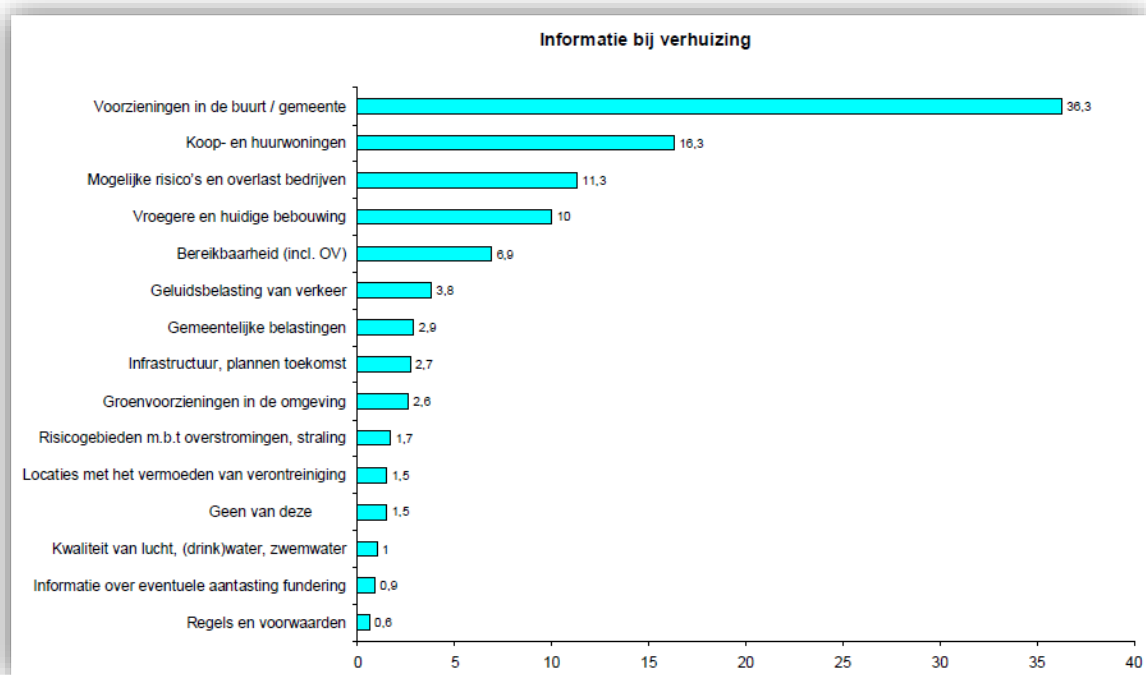


Figure 24: Information needed by Rehousing (Hessing & Mulder, 2006)

There following are some open datasets which municipalities can publish and provide to their residents. Some of them are mentioned by <https://data.overheid.nl>:

1. Road works temporary changes or closed roads because of infrastructural project of other reasons such as Events,
2. Waste Calendar and containers places (Underground, Glass, plastic and paper),
3. Sports and recreation places,
4. Green spaces and public spaces such as parks,
5. Tourist Information,
6. Monuments and Art in public space,
7. Shops and their opening hours,
8. Parking spaces,
9. Dogs outlets areas,
10. Polling stations,
11. Public facilities and services,
12. Archaeology data and maps,
13. AED (Automated External Defibrillator) locations,
14. Salt spray plans (in Dutch: Strooiplan) for safe roads in the winter,
15. Road work temporary changes,
16. Firework prohibited areas.
17. Municipal notifications for the residents (in Dutch: Bekendmakingen), this is also nationally available through: <http://www.officielebekendmakingen.nl>,
18. National government also provides many datasets, e.g. via <https://geozet.koop.overheid.nl/overuwbuurt/overheidnl> and <http://pdokviewer.pdok.nl>.

Thus, there are a lot of spatial data which can be provided to the public. Most of the information provided to the public (through external GIS viewer on Internet) is useful for municipal internal use by the staff members as well.

7. THEORETICAL APPROACH ON USABILITY ASSESSMENT OF SDI

This chapter deals with assessment, usability, SDI, municipal goals and SMART indicators, all together.

7.1. Multi-view SDI assessment framework

Grus et al. (2008) developed a framework for assessing Spatial Data Infrastructures. It is a useful and an important document for my research because my research deals with one of the concepts mentioned in (Grus et al. 2008) and that is (Local) SDI assessment depending on user's perspectives, figure 25.

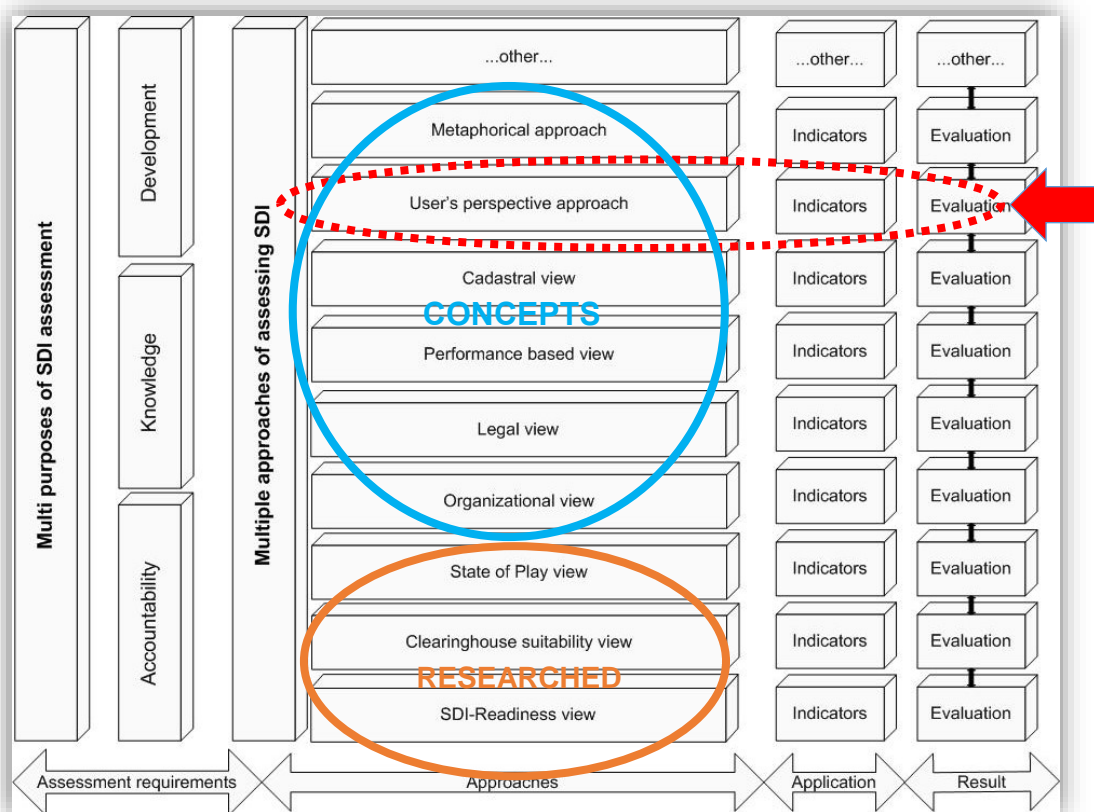


Figure 25: Multi-view SDI assessment framework (Grus et al, 2008)

Chelimsky (1997) distinguishes three general classes of evaluation purposes that cover all of the specific purposes: the accountability purpose, the developmental purpose and the knowledge purpose of evaluation (Grus et al. 2008). According to table 3 (Grus et al. 2008) the assessment of this kind of researches have two purposes (accountability and knowledge). Nevertheless, my research has also the development purpose because of the

study area demands. In this research, the users will evaluate the performance and accordingly, the user's opinions will help development and improvement.

Assessment approach	Goal Description	Method	Applicability	Assessment purpose class
SDI-Readiness	To assess if the country is ready to embrace the SDI development	Survey	Applicable	Developmental Knowledge
Cadastral	To measure five evaluation areas of LAS	Survey	Needs improvement	Knowledge Accountability
Organisational	To measure the SDI development from the institutional perspective	Case study	Applicable	Developmental
Performance-Based	To measure the SDI's effectiveness, efficiency and reliability	Not available	Needs improvement	Accountability
Clearinghouse Suitability	To measure the development and impact of SDI clearinghouses worldwide	Survey, key informants	Applicable	Developmental Knowledge
State of Play	To measure the status and development of SDIs	Document study, survey, key informants	Applicable	Developmental Accountability
User's perspective	To measure the SDI's effectiveness from the user's perspective	Case study	Needs development	Accountability, Knowledge
Metaphorical	To analyse organisational and management aspects of the SDI	Literature review	Needs development	Knowledge
Legal	To measure compliance, coherence and quality of the SDI legal framework	Case studies	Needs improvement	Knowledge

Table 3: Assessment approaches proposed for the multi-view assessment framework (Grus et al. 2008)

According to Grus et al. (2008) there are researched conducted on: SDI-Readiness view, Clearinghouse suitability view, State of Play view and Organisational view approaches but the rest of the approaches in the figure 25 are concepts and need development. My research is dealing with one of the concepts and that is **user's perspective approach**.

7.2. Usability

There are numerous resources dealing with usability. According to Oxford dictionary the usability is the degree to which something is able or fit to be used (oxforddictionaries.com, 2017).

Usability is a term derived from "user-friendly" and denotes the ease with which a particular tool is used for a specific purpose. Usability can also refer to the methods of measuring usability and the study of the principles behind an object's perceived efficiency or elegance. Usability means "making products and systems easier" to use, and matching them more closely to the user's needs and requirements (Suarez, 2010).

Speicher (2015) found a formalism to define usability and that is a quintuple comprising the elements: **level of usability metrics, product, users, goals and context of use**. ISO/IEC 25010 is concerned with software engineering and product quality and, among other things, refers to three different **levels of quality metrics**:

- Internal metrics, which measure a set of static attributes (e.g., related to software architecture and structure).
- External metrics, which relate to the behaviour of a system (i.e., they rely on execution of the software).
- In-use metrics, which involve actual users in a given context of use

It is important to define the **product** which will be tested for usability. Usability will change per product type or whether you assess the whole product or a part of it. The characteristics of participants (**Users**) in a usability study such as inexperienced users, experienced users and novice users is also another important element to be considered. In **Goals**, the concentration is on the product ability to support the achievement of tasks. The last element is **context of use** which describes the setting in which you want to evaluate the usability of your product. In particular, context is strongly connected to device-related differences, e.g. a desktop PC vs. a touch device (Adapted from Speicher, 2015).

The international standard, ISO 9241-11, provides guidance on usability and defines it as: The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use where:

- Effectiveness is accuracy and completeness with which users achieve specified goals.
- Efficiency is resources expended in relation to the accuracy and completeness with which users achieve goals.
- Satisfaction is freedom from discomfort, and positive attitudes towards the use of the product.

According to (Reeve and Petch, 1999) there are generally three ways in which organisations have conventionally been envisaged as being likely to benefit from investments Information Systems technology, these are:

- Efficiency benefits
- Effectiveness benefits
- Competitive advantage benefits.

We can involve competitive advantage in user satisfaction because every user wants to have the best possible facilities in a reasonable cost in time and money (it is obvious that time can be converted to money as well).

In a similar vein, ISO/IEC 9126: Software engineering—Product quality (International Organisation for Standardisation, 2001) categorizes usability as a fundamental characteristic of good software and defines it as being:

“The capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions.

- Understandability: the capability of the software product to enable the user to understand whether the software is suitable, and how it can be used for particular tasks and conditions of use.
- Learnability: The capability of the software product to enable the user to learn its application.
- Operability: The capability of the software product to enable the user to operate and control it.” (Hunter et al., 2003)

7.3. Usability assessment process considerations

There are a lot of considerations and limitations which have effects on the process of SDI evaluation. The following are the important ones:

7.3.1. User’s perspective consideration

SDIs were initially developed as a mechanism to facilitate access and the sharing of spatial data to use within a GIS environment (Rajabifard, 2008). GIS considered as the underpinning technology for SDI and it has significant role in facilitating data collection and storage as well as facilitating decision-making based on spatial data processing and analysis (adapted from Mansourian et al., 2004). Furthermore, the internal GIS or inter-organisational GIS in the municipality is the windows which the users looking through at SDI. That is why, the best method to assess SDI in the municipalities is through the users of inter-organisational GIS.

Municipalities have many necessary systems depending on Geo-information for the purpose of meeting legal obligations, supporting business processes and providing services for the residents, such as: BAG, BGT, BRK, HR, WRO, WION, WKpB, WOZ, WABO, Public space management (GBI), Environmental data, Notifications on Public Space, etc. The mentioned systems have their own infrastructures and because they are depending on Geo-information or spatial data we can call them municipal SDIs. Those systems or SDIs provide spatial datasets to Internal GIS/SDI. The users can use provided spatial datasets through the internal GIS. This research is on usability based on user's perspective, that is why, the concentration of this research was on Internal GIS/ SDI.

Concisely, Municipal SDIs is not just Internal GIS/SDI but Internal GIS/SDI is the most suitable municipal SDI that can be used for this research on usability based on user's perspective.

The assessment method of this research part will evaluate the Internal GIS in both of the Maassluis and Westland municipalities from the user perspective. The concentration is on evaluating users’ satisfaction on the internal GIS or SDI.

7.3.2. Municipal vision consideration

Every four years municipalities have their policy programs (in Dutch: Collegeprogramma) which is program of intentions and agreements on the policy that the municipality will conduct after the municipal elections in the next four years. The program will be created as

soon as possible after the elections. I noticed one thing is common in the policy programs and visions of the municipalities and that is achieving sustainability goals. If municipal SDI supports sustainability goals, it will also supports municipal goals as well.

Normally, staff members' activities should support municipal visions and goals. Since last year, every staff member of Maassluis municipality must have at the end of the year an activities planning agreement for the following year. The planning agreement describes result-oriented promises on tasks/activities which support: department objectives, organization-wide objectives, generic competencies, specific competencies and personal development plan (in Dutch: Persoonlijk ontwikkelingsplan, POP). A personal development plan (POP) is an agreement between staff member and employer about staff member's personal development, staff member takes care of his/her own learning process, the employer facilitates time and money (Carrièretijger, 2017). Accordingly, if SDI support staff members' tasks, it will support municipal visions and goals.

7.3.3. Selecting assessment approach

In a limited time questionnaire is the one of the best methods to evaluate a system. Questionnaire helps to collect data in the same time from many participants as well. That is why questionnaire is the assessment method which will be depended on to answer research question 4.

7.4. Indicators to assess usability

Hornbaek (2004) investigated and summarized practices in measuring usability, he analysed the usability measures in 180 studies published in core HCI (Human-Computer Interaction) journals and proceedings (Suarez, 2010). Hornbaek (2004) chose also the ISO standard as a basis for usability aspects classification because its three groups of measures are widely accepted to concern distinct measures and because it is instrumental in establishing a first overview of the measures used.

Usability cannot be directly measured, through operationalisation of the usability construct, we find aspects of usability that can be measured. The choice of such measures not only fleshes out what usability means, it also raises the question if that which is measured is a valid indicator of usability (Hornbaek, 2004).

From several detailed tables explained and summarised by Hornbaek (2004) on measuring usability aspects (effectiveness, efficiency and satisfaction) employed in the 180 studies he reviewed, I found (and adapted) some indicators which are suitable (and applicable) for my research and study cases, table 4.

Usability aspect	Indicator	Description
Effectiveness	Task completion	Do the available datasets support users to complete their tasks?
	Accuracy	Questions on accuracy of the provided datasets
	Completeness	Completeness of available datasets to support the staff members to complete tasks?
Efficiency	Time	System speed How long users use the system per session
	Input rate	Searching facilities
	Communication	Support quality
	Learning measures	Help documents Demonstrations by the administrators
Satisfaction	Standard questionnaires	Using standard questionnaires for measuring satisfaction
	Preference	Measures to know which interface users prefer or need to use.
	Ease-of-use	Measures of general satisfaction with the interface
	Want to use again	Users' attitude towards using the interface again

Table 4: Practices for measuring the usability (adapted from Hornbaek, 2004 and Suarez, 2010)

7.5. Selecting usability framework

Figure 26 is designed, to show the important indicators to be considered for assessing usability of the municipal SDI, depending on:

1. The usability definition according to ISO 9241-11.
This international standard used as the foundation stone for the figure and for the assessment. The assessment depends on the usability aspects mentioned in that standard (Effectiveness, Efficiency and Satisfaction),
2. Indicators from Hornbaek (2004) and Suarez (2010)
3. Reeve and Petch (1999) which describes usability like ISO 9241-11 with a difference in using competitive advantage benefits (Cost) instead of satisfaction.
4. An idea from a diagram by Sans (2014), and
5. Appropriateness and application feasibility for the study area (municipalities).

The following are differences and similarities between the indicators in table 4 and figure 26:

1. In Effectiveness, Accuracy and Completeness changed to Quality and Quantity.
2. In Effectiveness:
 - a. Time changed Temporal Efficiency,
 - b. Input rate changed to Human Efficiency (Human Efficiency is more general),
 - c. Communication changed to Support Efficiency (Support Efficiency is more general), and
 - d. Learning measures included in Satisfaction indicator (Comfort).
3. In Satisfaction:

- a. I took out Standard questionnaires to deal with it depending on Sauro and Lewis (2016),
- b. Preference and Control are not changed,
- c. Ease-of-use changed to Comfort (Comfort is more general),
- d. Want to use again changed to Acceptability.

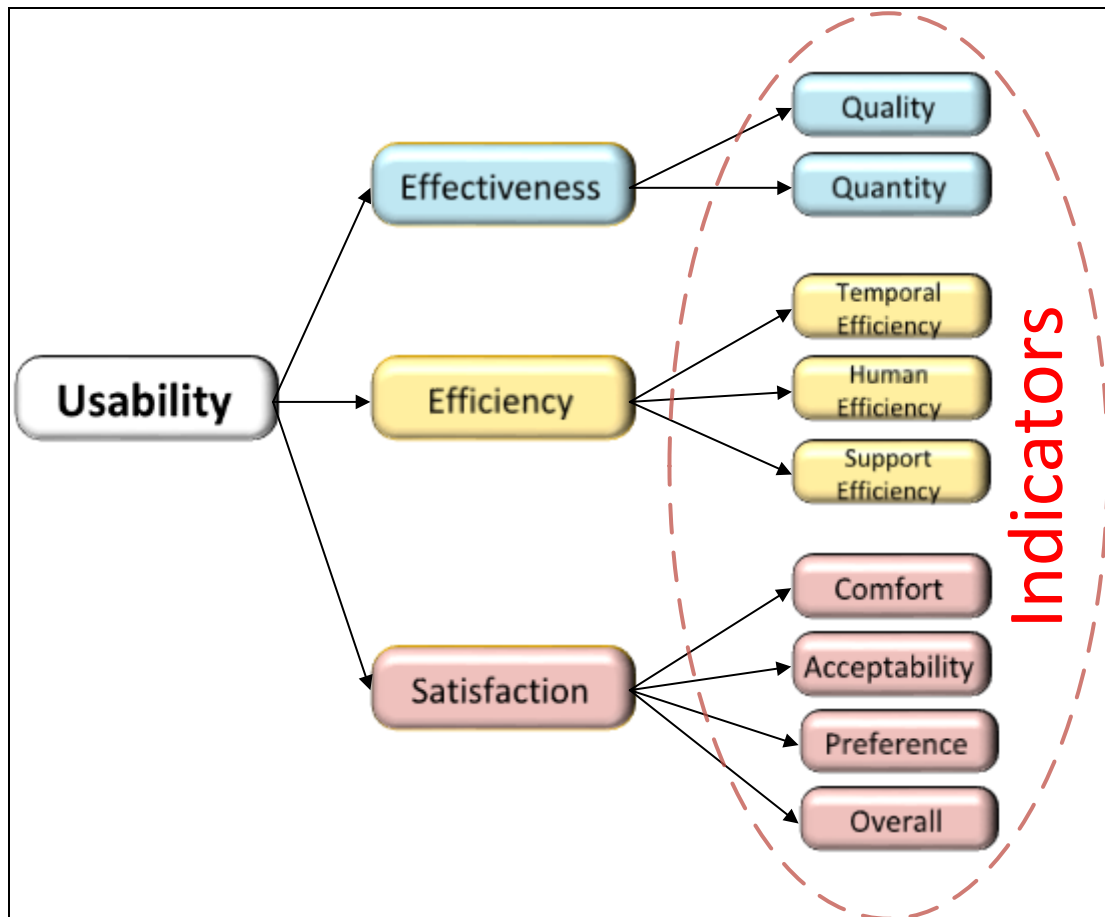


Figure 26: Usability assessment indicators (Adapted from Hombaek, 2004, diagram idea from Sans, 2014)

8. QUESTIONNAIRE

8.1. Usability questions

To find appropriate questions for the questionnaire and make this subjective topics objective measurable depending on the indicators in figure 26 the following references are mainly used:

1. The Post-Study System Usability Questionnaire explained by Sauro and Lewis (2016) which has lots of reasonable suggested questions suitable to use in my research, e.g. table 5. Sauro and Lewis (2016) deal with Standardized usability questionnaires designed for the assessment of perceived usability, typically with a specific set of questions presented in a specified order using a specified format with specific rules for producing scores based on the answers of respondents.

The Post-Study System Usability Questionnaire Version 3		Strongly agree							Strongly disagree		NA
		1	2	3	4	5	6	7			
1	Overall, I am satisfied with how easy it is to use this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	It was simple to use this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	I was able to complete the tasks and scenarios quickly using this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	I felt comfortable using this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	It was easy to learn to use this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	I believe I could become productive quickly using this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	The system gave error messages that clearly told me how to fix problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	Whenever I made a mistake using the system, I could recover easily and quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	The information (such as online help, on-screen messages, and other documentation) provided with this system was clear.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	It was easy to find the information I needed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11	The information was effective in helping me complete the tasks and scenarios.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12	The organization of information on the system screens was clear.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13	The interface* of this system was pleasant.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14	I liked using the interface of this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15	This system has all the functions and capabilities I expect it to have.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16	Overall, I am satisfied with this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*The "interface" includes those items that you use to interact with the system. For example, some components of the interface are the keyboard, the mouse, the microphone, and the screens (including their graphics and language).

Table 5: Post-Study System Usability Questionnaire (Sauro and Lewis, 2016)

2. Den Bosch questionnaire (GeoWeb Tevredenheidsonderzoek, 2015) and
3. Demands of the study area (Maassluis municipality).

Table 6 explains the link between usability aspect, indicators/ measures and chosen questions for the questionnaire.

Usability aspects (ISO 9241-11)	Indicators/ measures	Considerations	Questions in my Questionnaire	Explanations
Effectiveness <i>accuracy and completeness with which users achieve specified goals</i>	Quality	Accuracy (exactitude, credibility and trustworthy of the available datasets to accomplish tasks).	<ul style="list-style-type: none"> How satisfied are you with the quality of offered data? 	One of the strengths with which the internal GIS of municipalities has is data quality. There are many characteristics of data quality such as correctness, integrity and up to datedness (van der List, 2011), in other words: accuracy, exactitude, credibility and trustworthiness. Dealing in detail with the quality of data is out of the scope of this research we only need a general opinion of the user on data quality offered through Internal GIS.
	Quantity	Completeness (sufficient varieties of datasets to support user's tasks).	<ul style="list-style-type: none"> How satisfied are you with the amount of offered data? or Is there enough data (information) to support your work? 	To know if the user has sufficient varieties of datasets to support his/her tasks.
Efficiency <i>resources expended in relation to the accuracy and completeness with which users achieve goals</i>	Temporal efficiency	<ul style="list-style-type: none"> Time spent on getting what the user needs from the system 	<ul style="list-style-type: none"> How much time you spend with Stroomlijn per session? How satisfied are you with the working speed of Stroomlijn? 	<p>Is the time spent on getting what the user needs from the system reasonable? In other words, the amount of time a user spends with the system to complete a task. GIS administrators can set the time out for open session. Depending on the answers they can set up that time to be more suitable for most of the users. Time out setting is important to support users have enough time to complete their tasks.</p> <p>The working speed of the system also has an effect on spent to complete tasks. We want to know if the user is satisfied with that speed.</p>
	User efficiency	Use easiness Facilities Printing extract pdfs	<ul style="list-style-type: none"> How satisfied are you with Stroomlijn ease of use? How satisfied are you with printing and PDF-extracting? 	<p>To be able to know how the users think about the easiness of the system.</p> <p>Facilities of the system are also important issues to be evaluated.</p>
	Support efficiency	Policy for support Knowing what to do if the system gave error messages to fix problems	<ul style="list-style-type: none"> Our support policy is: First, contact TopDesk and in case of acute problems contact the system administrators, how satisfied are you with that policy? What kind of contact you prefer with the helpdesk of Stroomlijn? (Calling ICT helpdesk, Making 	<p>To know if the users agree and accept the policy.</p> <p>To find out the preferable method with which users want to be supported.</p>

		Find information needed (Searching)	TopDesk call, Calling Administrators, or e-mailing Administrators) ▪ How satisfied are you with searching information in Stroomlijn?	Is the user satisfied with finding information facilities? Printing en extracting pdf files
Satisfaction <i>freedom from discomfort, and positive attitudes towards the use of the product</i>	Comfort	Adequacy of help facilities, such as: GIS administrator support help documentation Intranet news messages Interface suitability	▪ How satisfied are you with the Demonstration, Explanation, and Support of the Stroomlijn administrators? ▪ How satisfied are you with the Stroomlijn manual that you can consult? ▪ How satisfied are you with the Intranet message-news on Stroomlijn? Where do you usually work? (At the office, Outside, Both)	To find out the opinion of the user administrators activities/ actions. To find out the quality of the help document. To find out the usefulness of this kind of actions To find out of system capability meet users' requirements and to know which interface (Desktop of mobile) most users need to use.
	Acceptability	Believing that using the system help to be more productive or make work tasks easier	▪ To what extent does Stroomlijn help your productivity? ▪ Would you recommend Stroomlijn to your closest colleague?	To know if the Stroomlijn helps users to be more productive. In general people recommend good and useful things to each other
	Preference	Interfaces	▪ Where do you usually work?	To find if the organisation in need to pay more attention to staff member (users) who work outside.
	Overall	Overall rating	▪ What rating do you give to Stroomlijn	To know how the users rate the system (good or bad / useful or useless).

Table 6: Link between usability aspect, indicators/ measures and questionnaire

8.2. Other questions

As mentioned in the introduction, Maassluis want also to have its own benefits from this questionnaire. Maassluis want to use this evaluation to decide on replacing the software part of its Internal GIS (Stroomlijn).

To stimulate cooperation with Maassluis municipality and make the questionnaire suitable for the study area the following questions are added to the questionnaire, table 7.

Indicator	Question	Explanation
Target group	<ul style="list-style-type: none"> Are you using Stroomlijn? 	To make it clear that the target group is the user of the internal GIS (inter-organisational GIS, Stroomlijn).
Municipal demands from SDI	<ul style="list-style-type: none"> Can you briefly describe a (important) task that you can carry out by using Stroomlijn? 	Information gathered from this question will be used in answering research question 2 (Municipal demands from SDI – Business processes).
Sustainability	<ul style="list-style-type: none"> To what extent does Stroomlijn provide an integral view of social, ecological and economic data? 	This is to know if Stroomlijn supports the sustainability and sustainable development which is almost the goal of every municipality.
Alternatives	<ul style="list-style-type: none"> Do you use alternative Map viewer instead of Stroomlijn? Map viewer Such as Google Maps, Open Street Map, etc. Which Map viewer do you use with Stroomlijn? In addition to Stroomlijn, you may also use other (often-commercial) Map viewers. Which Map viewers are they? If you use other Map viewer(s), what do you use? 	<p>To find out the users' need to use other map viewers instead of Stroomlijn.</p> <p>What are those map viewers and why they use them?</p> <p>These questions are important for further developments of Internal GIS/SDI and usability of Spatial data.</p>

Occupation	<ul style="list-style-type: none"> What is your occupation? Supervisor or Staff member 	To gather general information on the numbers of supervisors (most of the time they are the decision makers) and staff members (most of the time they are the users) who responded.
Suggestions	<ul style="list-style-type: none"> Do you have any comments or suggestions? or What other data or function you want to see in the (new) GIS? 	This is an opportunity for the users to send their suggestions and notes to be used for more development of municipal SDI facilities.

Table 7: Other questions

Prepared and used questionnaires for both of the municipalities (Maassluis and Westland) can be found in Appendix 5.

8.3. Survey software

Online survey software & questionnaire tool of SurveyMonkey (www.surveymonkey.com) used to conduct the questionnaire.

8.4. Target groups and Dissemination

The users' e-mail-addresses and authorisation to use them for this purpose are needed to implement the questionnaires.

The best suitable method to assess SDI in the municipalities is through the users of inter-organisational GIS and inter-organisational GIS in Maassluis called "Stroomlijn". The target group in Maassluis municipality is the staff members (Stroomlijn users). In the system administration of Maassluis intranet GIS the administrator is able to see statistic information on usage per user. Also based on the usage a log file can be exported. Depending on that log files the GIS (super) users can be found. Their e-mail addresses are available because I am a staff member of the same municipality. The dissemination of the questionnaire made through sending an email to the users who have used the system for more than 50 times, they were 59 users. I also published the questionnaire through the Intranet website of Maassluis. The response time set to be one week. During the response time, thirty-four users filled in the questionnaire, Appendix 5 (A, B & C).

In Westland municipality staff members contact information was not available. An arrangement was made with two staff members to disseminate the questionnaire to some 40 users of internal GIS (IBORgis) on 12 May 2017 with a response time set for one week. They sent the questionnaire to 10 users on 16 May 2017 and five of them filled the questionnaire as of 22 May 2017, Appendix 5 (D & E)).

9. RESULT PRESENTATION

9.1. Maassluis questionnaire

Thirty-four users of internal GIS (Stroomlijn) in Maassluis municipality filled the questionnaire (Appendix 5) from 9 May 2017 to 16 May 2017, figure 27.

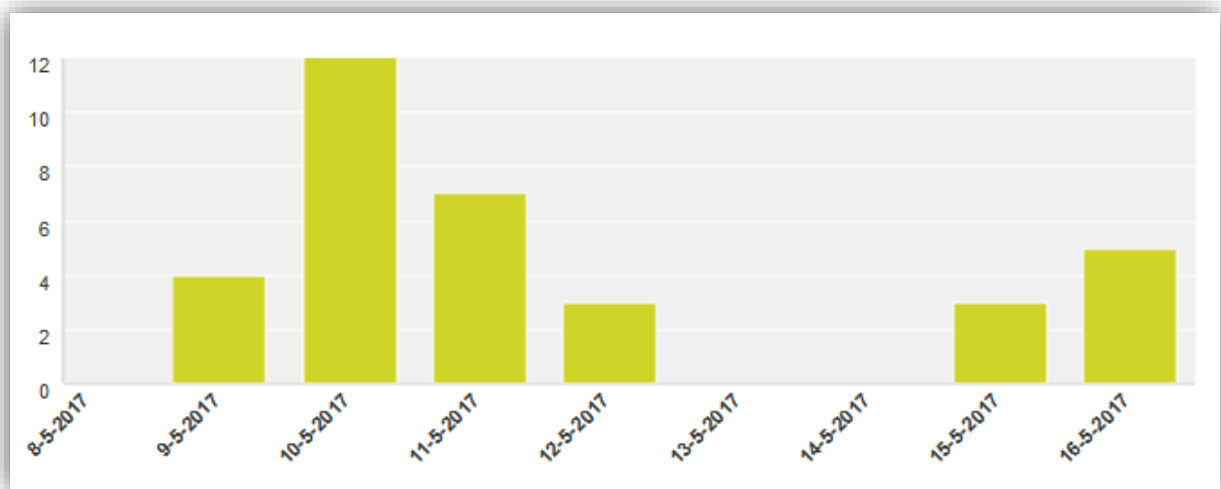


Figure 27: Maassluis questionnaire responses

The questions of the questionnaire arranged logically to be filled by the users but to analyse them, they were categorised depending on the indicators in tables 6 and 7 as follows:

9.1.1. Effectiveness – Quality

- *How satisfied are you with the quality of offered data? (Question no. 11 in the Questionnaire)*

Data quality scored very high, 77% of the responses were satisfied and very satisfied, figure 28, table 8; there was only one person with a dissatisfied response. This is an expected result because government (including municipalities) has lots of concerns about the data quality.

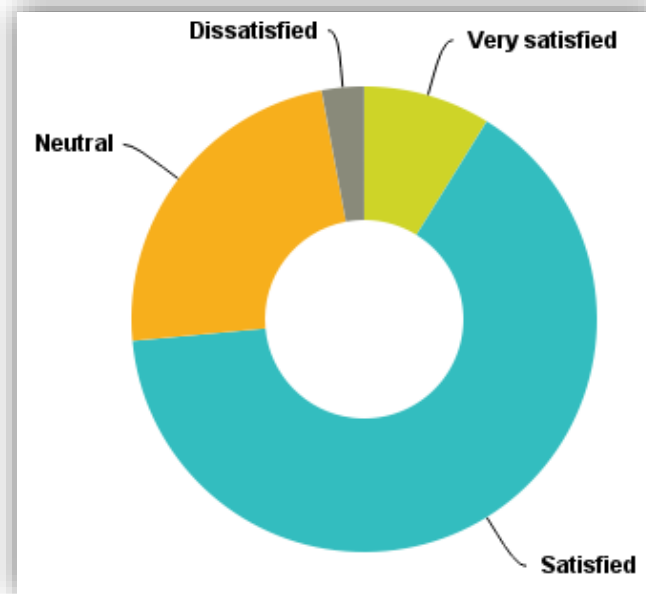


Figure 28: Data quality

Data quality	Percentage	No. of reactions
Very satisfied	9%	3
Satisfied	68%	22
Neutral	24%	8
Dissatisfied	3%	1
Very dissatisfied	0%	0

Table 8: Data quality

9.1.2. Effectiveness – Quantity

- *How satisfied are you with the amount of offered data? Or Is there enough data (information) to support your work? (Question 10)*

Most of the respondents (71%) were satisfied with the amount of offered data, figure 29 and table 9. The rest of the respondents (29%) are neutral and dissatisfied; which means they are missing datasets and this should be investigated.

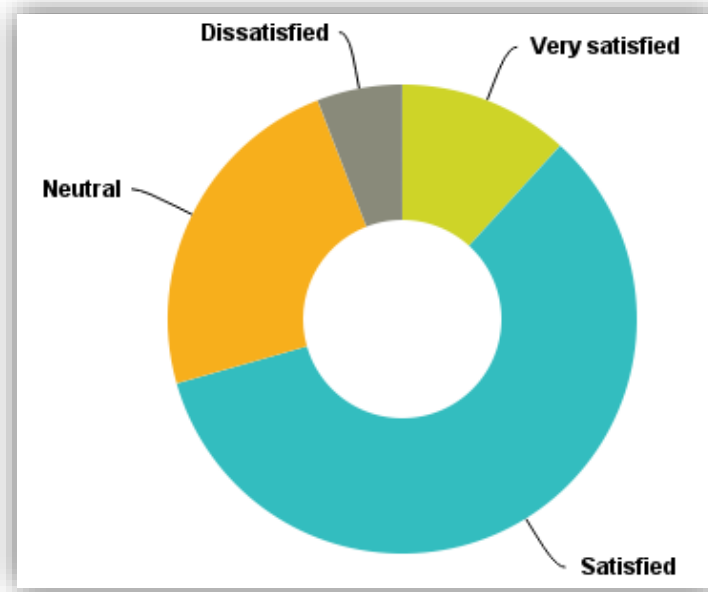


Figure 29: Data quantity

Data quantity	Percentage	No. of reactions
Very satisfied	12%	4
Satisfied	59%	20
Neutral	23%	8
Dissatisfied	6%	2
Very dissatisfied	0%	0

Table 9: Data quantity

9.1.3. Efficiency – Temporal efficiency

- *How much time you spend with Stroomlijn per session? (Question 2)*

Most of the users (82 %) spend less than an hour per session. It means the users obtained information needed within relatively reasonable time and the administrators could set up time out session of 45 minutes. This depends on the performance of the system. Thus, with better performance the session time will decrease, figure 30 and table 10.

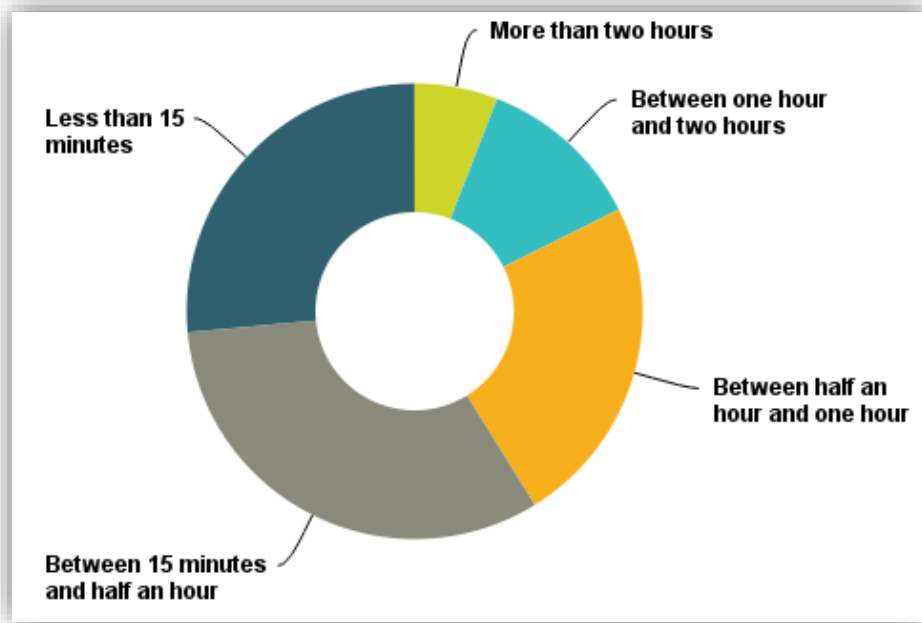


Figure 30: Time per session

Time per session	Percentage	No. of reactions
More than two hours	6%	2
Between one hour and two hours	12%	4
Between half an hour and one hour	24%	8
Between 15 minutes and half an hour	32%	11
Less than 15 minutes	26%	9

Table 10: Time per session

- *How satisfied are you with the working speed of Stroomlijn? (Question 7)*

Most of the users were not satisfied with the speed of Stroomlijn, figure 31 and table 11.

This is also an important point of attention which supports replacement of the system. In the past, many attempts were conducted to increase the speed of the system.

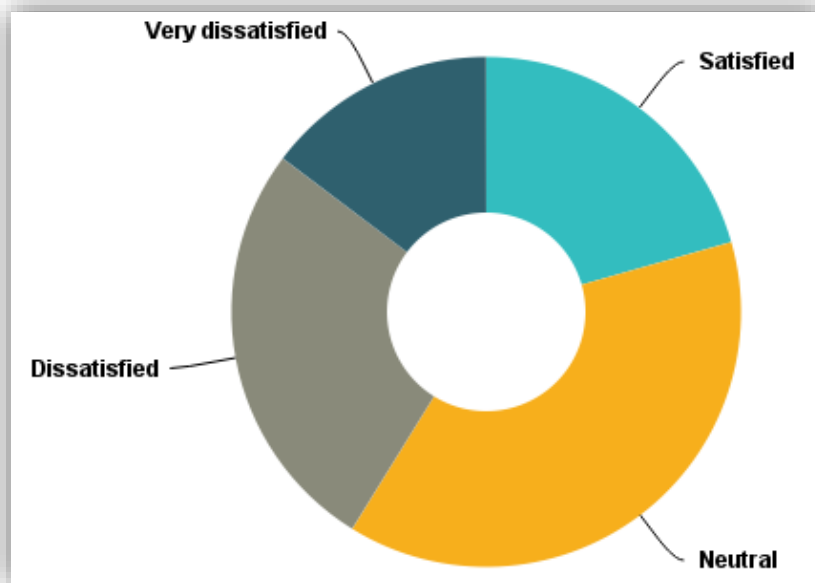


Figure 31: Stroomlijn speed

Speed	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	21%	7
Neutral	38%	13
Dissatisfied	26%	9
Very dissatisfied	15%	5

Table 11: Stroomlijn speed

9.1.4. Efficiency – User efficiency

- *How satisfied are you with Stroomlijn ease of use? (Question 6)*

Although 53% agree that Stroomlijn is easy to use, 15 % were very dissatisfied with the easiness of use, figure 32 and table 12. The responses to this question supports the intention of the organisation to replace the system.

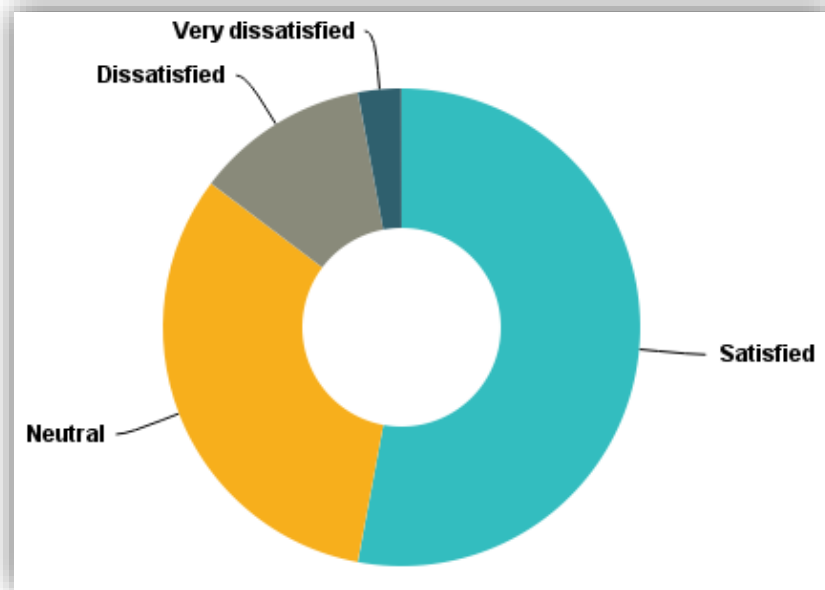


Figure 32: Ease of use

Ease of use	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	53%	18
Neutral	32%	11
Dissatisfied	12%	4
Very dissatisfied	3%	1

Table 12: Ease of use

▪ *How satisfied are you with printing and PDF-extracting? (Question 9)*

The number of neutral and (very) dissatisfied users are more than satisfied. There is no very satisfied user, figure 33 and table 13. This point supports the replacement of the system as well.

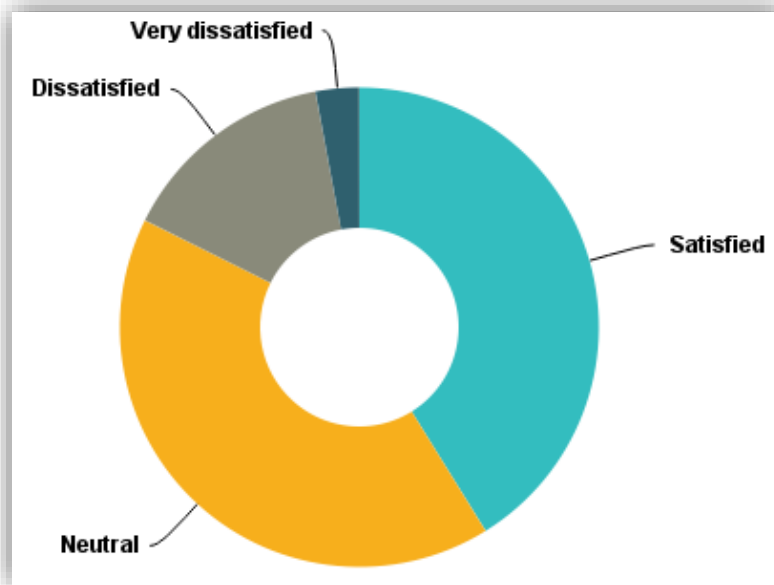


Figure 33: Printing and PDF_Extracting

Printing and PDF_Extracting	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	41%	14
Neutral	41%	14
Dissatisfied	15%	5
Very dissatisfied	3%	1

Table 13: Printing and PDF_Extracting

9.1.5. Efficiency – Support efficiency

- *Our support policy is: First, contact TopDesk and in case of acute problems contact the system administrators, how satisfied are you with that policy? (Question 12)*

Figure 34 and table 14 show that most of the responses to this question are neutral. Satisfied users of this policy treble dissatisfied users. On the one hand, users know the importance of TopDesk (<http://www.topdesk.com>); on the other hand, they were not comfortable with a digital request (via TopDesk) per problem. In general, there is not a big resistance on this policy.

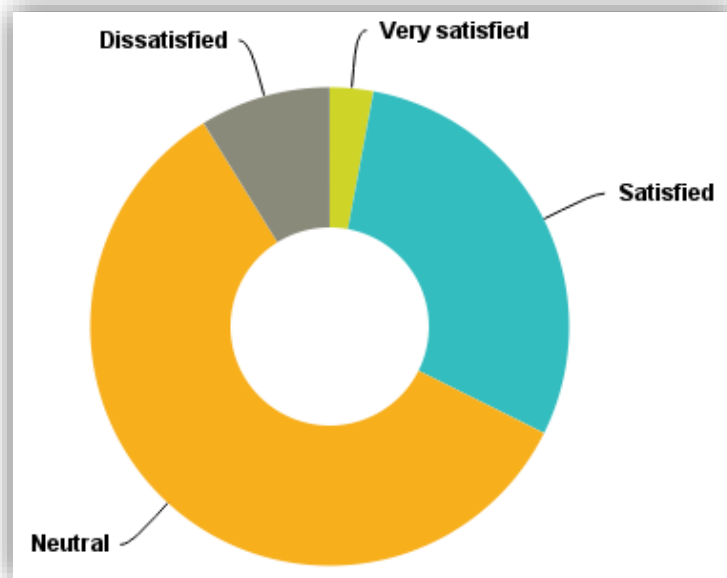


Figure 34: Support policy

Support policy	Percentage	No. of reactions
Very satisfied	3%	1
Satisfied	29%	10
Neutral	59%	20
Dissatisfied	9%	3
Very dissatisfied	0%	0

Table 14: Support policy

▪ *What kind of contact you prefer with the helpdesk of Stroomlijn? (Question 13)*

Most of the users prefer to call or e-mail administrators to seek support more than calling ICT help desk. The users last prefer choice is to make a digital request (via TopDesk), figure 35 and table 15.

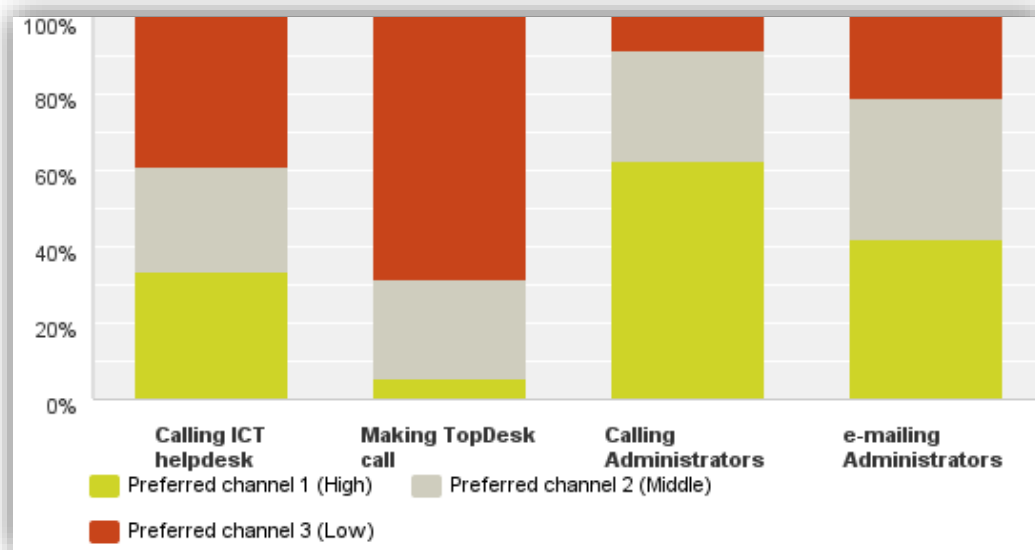


Figure 35: Preferable method of support

Support policy	Preferred channel 1 (High)	Preferred channel 2 (Middle)	Preferred channel 3 (Low)
Calling ICT Helpdesk	33% 6	28% 5	39% 7
Making TopDesk call	5% 1	26% 5	69% 13
Calling Administrators	63% 15	29% 7	8% 2
e-mailing Administrators	42% 8	37% 7	21% 4

Table 15: Preferable method of support

▪ *How satisfied are you with searching information in Stroomlijn? (Question 8)*

Most of the users were satisfied (62%) with the search facilities of the system figure 36 and table 16; but there are also dissatisfied users. Further research needs to find out why (12%) of the users are dissatisfied.

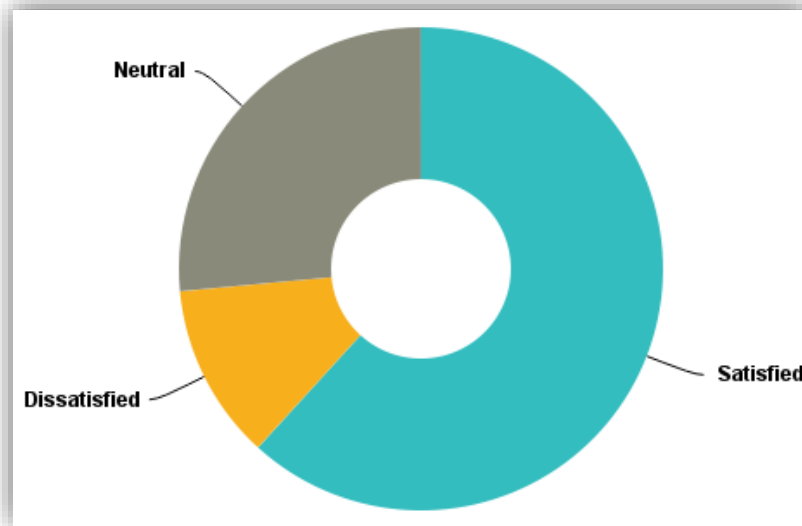


Figure 36: Search facility

Search facility	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	62%	21
Neutral	26%	9
Dissatisfied	12%	4
Very dissatisfied	0%	0

Table 16: Search facility

9.1.6. Satisfaction – Comfort

- *How satisfied are you with the Demonstration, Explanation, and Support of the Stroomlijn administrators (Bestoon & Bart)? (Question 14)*

Most of the user (76%) is satisfied with the Demonstration, Explanation, and Support of the Stroomlijn administrators. There were no dissatisfied responses to this question, figure 37 and table 17.

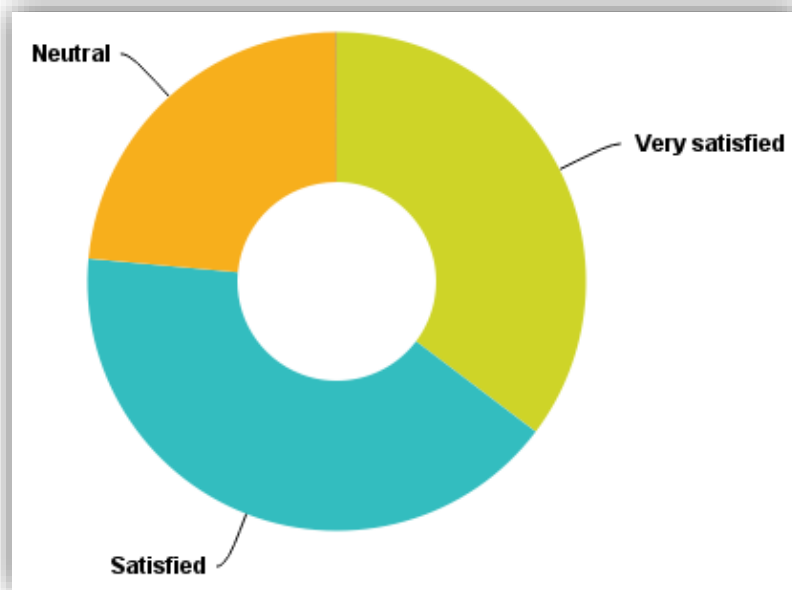


Figure 37: Administrators

Administrators	Percentage	No. of reactions
Very satisfied	35%	12
Satisfied	41%	14
Neutral	24%	8
Dissatisfied	0%	0
Very dissatisfied	0%	0

Table 17: Administrators

▪ *How satisfied are you with the Stroomlijn manual that you can consult? (Question 15)*

Most of the users have neutral responses (55%). There were also (33%) satisfied responses. Dissatisfied responses record just 12%, figure 38 and table 18. This means that the help documentation is acceptable and adding new methods of explanation (e.g. videos) may increase the number of satisfied users.

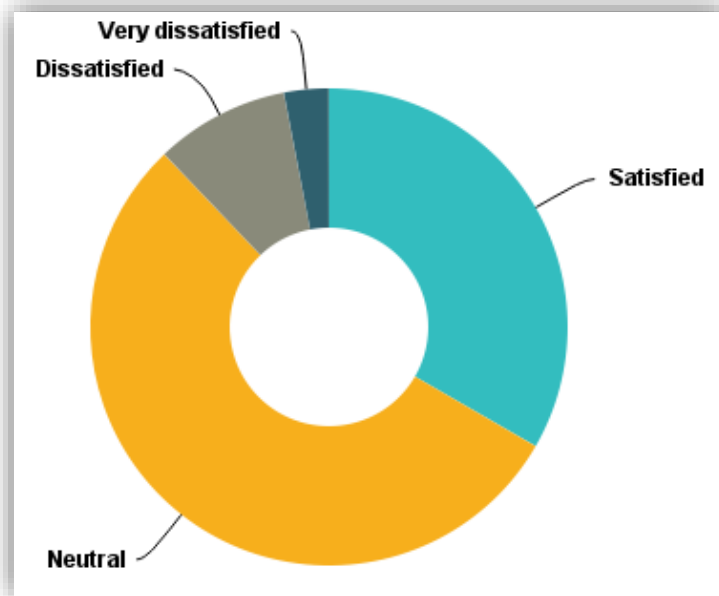


Figure 38: Help documentation

Help documentation	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	33%	11
Neutral	55%	18
Dissatisfied	9%	3
Very dissatisfied	3%	1

Table 18: Help documentation

▪ *How satisfied are you with the Intranet message-news on Stroomlijn? (Question 16)*
 Again neutral responses scored the highest (53) thus by looking at satisfied responses (41%) one can conclude that intranet messages are acceptable, figure 39 and table 19. It is not clear why there is a minority dissatisfied responses (6%).

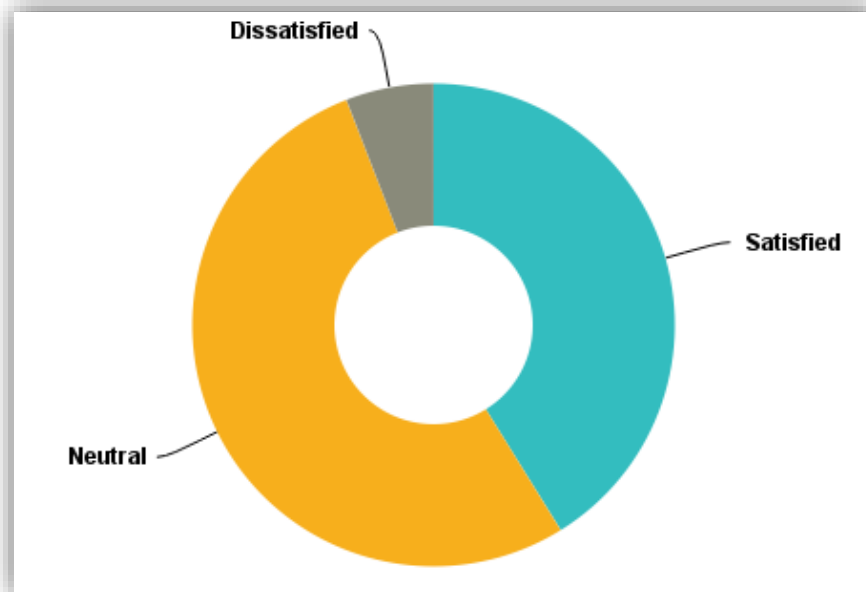


Figure 39: Intranet messages

Intranet messages	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	41%	14
Neutral	53%	18
Dissatisfied	6%	2
Very dissatisfied	0%	0

Table 19: Intranet messages

9.1.7. Satisfaction – Acceptability

- *To what extent does Stroomlijn help your productivity? (Question 3)*

Most of the users (71 %) say that Stroomlijn helps them to be more productive, figure 40 and table 20. Supporting user to be more productive is one of the important targets of SDI.

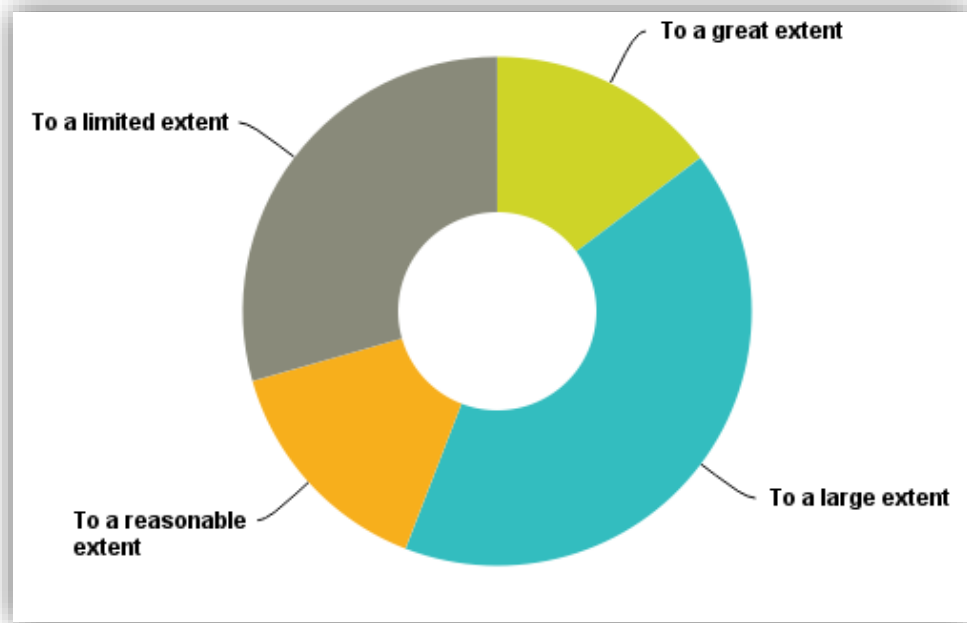


Figure 40: Productivity

Productivity	Percentage	No. of reactions
To a great extent	15%	5
To a large extent	41%	14
To a reasonable extent	15%	5
To a limited extent	29%	10
Not at all	0%	0

Table 20: Productivity

- *Would you recommend Stroomlijn to your closest colleague? (Question 18)*

The majority responses on this question is yes (94%). This means that Stroomlijn has good added value to the organisations and it is important to the users, figure 41 and table 21.

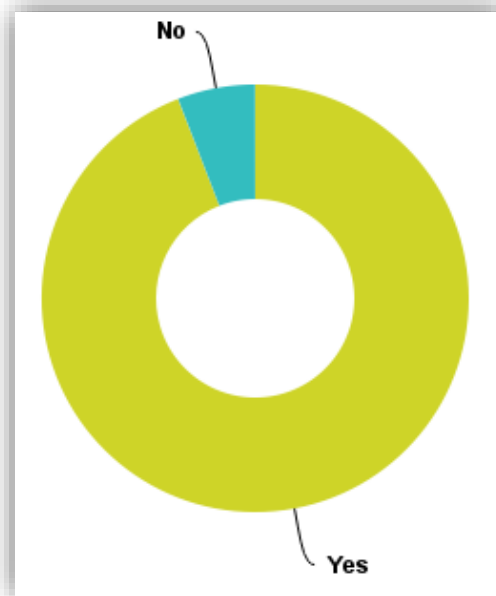


Figure 41: Recommendation

Recommendation	Percentage	No. of reactions
Yes	94%	32
No	6%	2

Table 21: Recommendation

9.1.8. Satisfaction – Preference

▪ *Where do you usually work? (Question 23)*

Most of the users who filled the questionnaire work full or part time at the office (97%), figure 42 and table 22. This indicates the importance of desktop interface access to the system. Depending on the importance of the outside staff members' task, they should be supported to use and access the system from outside. At this moment, staff members who work outside can access the system through Citrix Apps (<https://www.citrix.nl>).

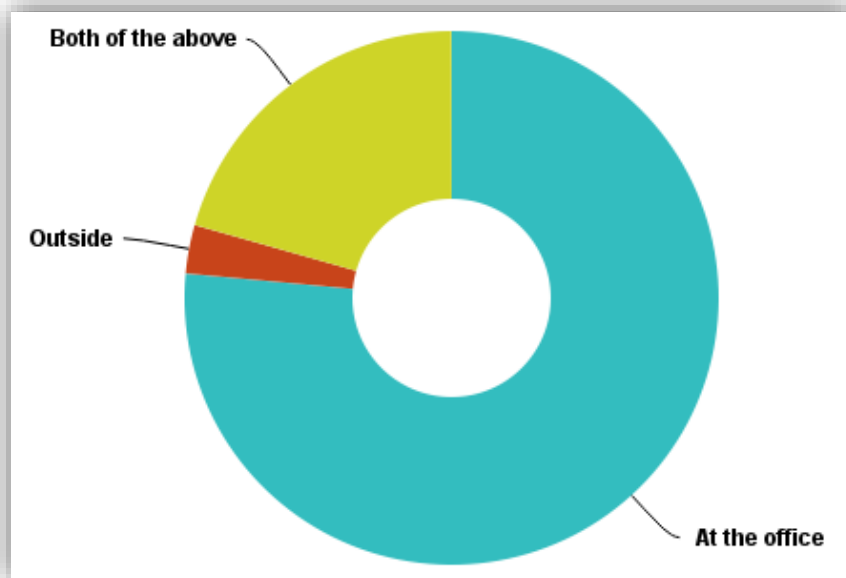


Figure 42: Work place

Work place	Percentage	No. of reactions
At the office	76%	26
Outside	3%	1
Both	21%	7

Table 22: Work place

9.1.9. Satisfaction – Overall

- *What rating do you give to Stroomlijn? (Question 17)*

The users gave the system an overall satisfactory rating of 6.8, figure 43.

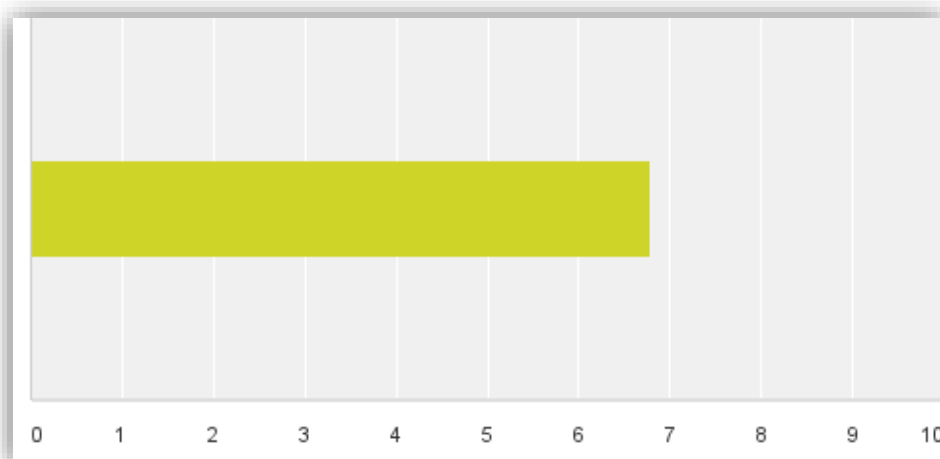


Figure 43: Overall Rating

9.1.10. Other questions - Target group

- *Are you using Stroomlijn? (Question 1)*

All respondents were users of Stroomlijn, figure 44. This is necessary because the purpose of the questionnaire was to assess depending on users' perspectives.

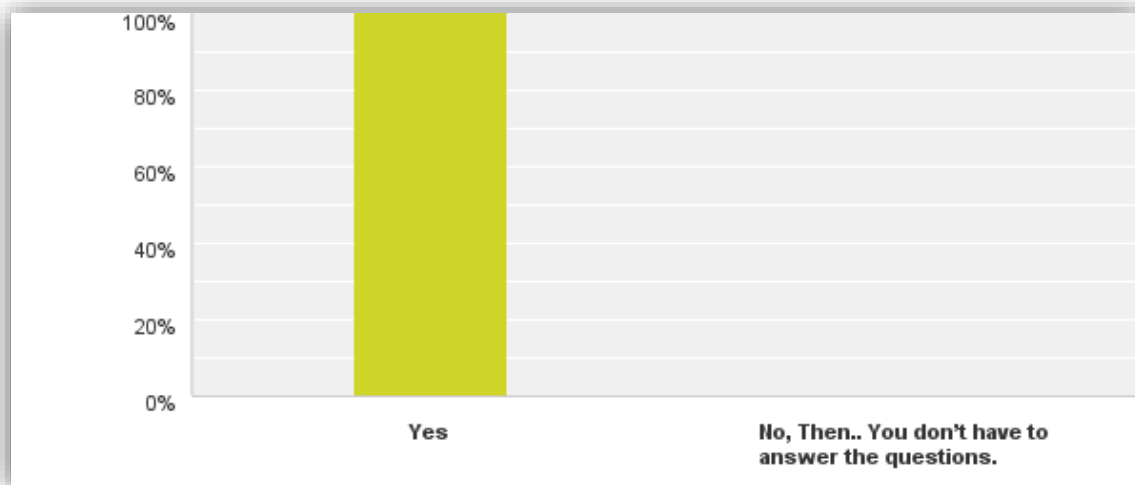


Figure 44: Maassluis questionnaire responses

9.1.11. Other questions - Municipal demands from SDI

- *Can you briefly describe a (important) task that you can carry out by using Stroomlijn? (Question 4)*

The main purpose of this question was to support answering research question 2 (Business process supported with SDI), the responses on this question shown in table 2, chapter 7, MUNICIPAL DEMANDS FROM SDI. Moreover, the responses explain the system importance for the organisation's processes.

9.1.12. Other questions - Sustainability

- *To what extent does Stroomlijn provide an integral view of social, ecological and economic data? (Question 5)*

According to most users (82 %) of the Internal GIS have an integral view of social, ecological and economic data. This means Stroomlijn supports sustainability which is the goal of the municipality, figure 45 and table 23. There is also (18 %) of the users who do not agree. This is worth dealing with. A choice is providing more (or missing) datasets which support sustainability goals of the municipality.

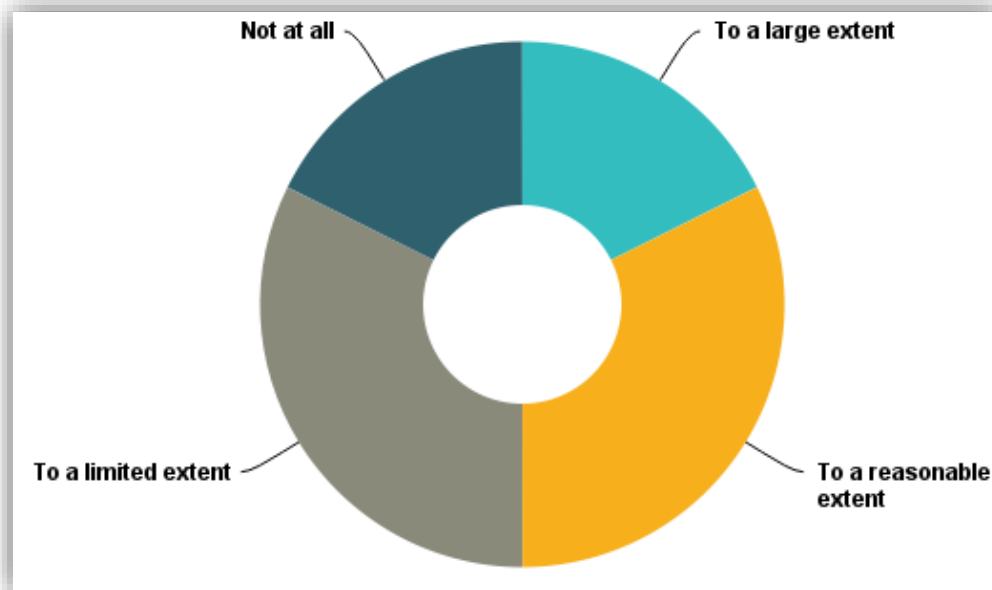


Figure 45: Sustainability

Sustainability	Percentage	No. of reactions
To a great extent	0%	0
To a large extent	18%	6
To a reasonable extent	32%	11
To a limited extent	32%	11
Not at all	18%	6

Table 23: Sustainability

9.1.13. Other questions - Alternatives

- *Do you use alternative Map viewer instead of Stroomlijn? Map viewer Such as Google Maps, Open Street Map, etc. (Question 19)*

Most of the users use alternative map viewers, figure 46 and table 24.

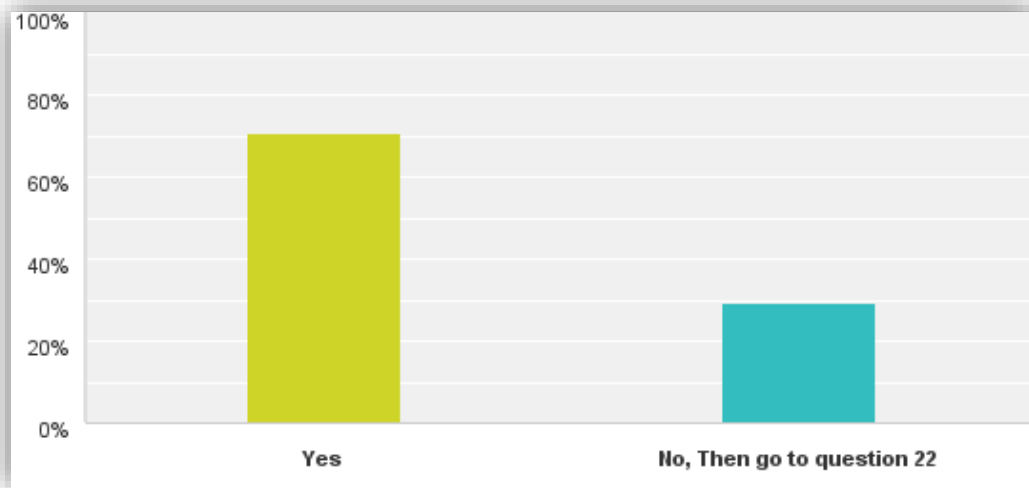


Figure 46: Using alternatives

Using alternatives	Percentage	No. of reactions
Yes	71%	24
No	29%	10

Table 24: Using alternatives

- Which Map viewer do you use with Stroomlijn? In addition to Stroomlijn, you may also use other (often-commercial) Map viewers. Which Map viewers are they? (Question 20)

According to the responses Google maps is mainly used as an alternative map viewer. Other alternatives (including Open Street Map) scored low. Users use Google maps mainly for the purposes of Navigation and quick location search. Open Street Map exists already as a web service in Stroomlijn, figure 47 and table 25.

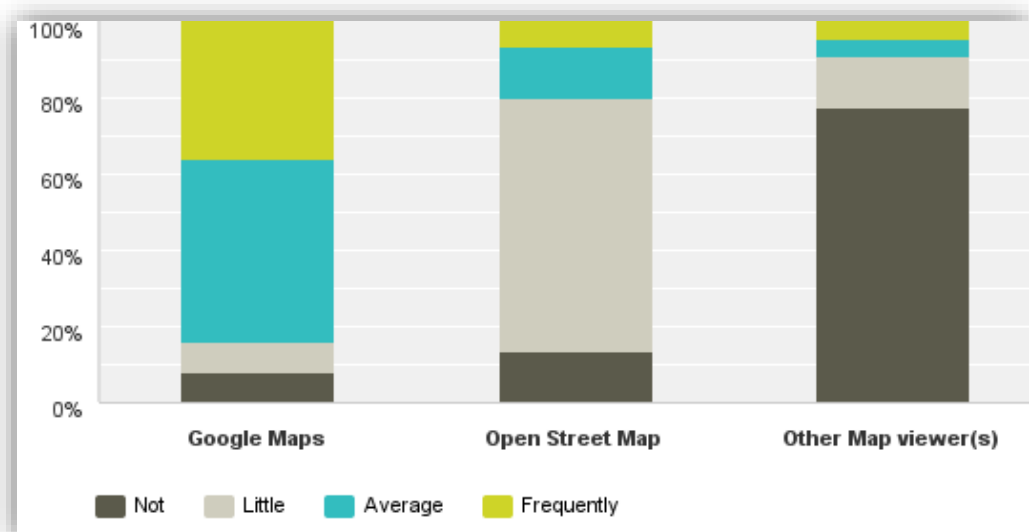


Figure 47: frequent use of alternatives

Frequent use	Not	Few	Average	Frequent
Google Maps	8% 2	8% 2	48% 12	36% 9
Open Street Map	13% 2	67% 10	13% 2	7% 1
Other Map viewer(s)	77% 17	13% 3	5% 1	5% 1

Table 25: frequent use of alternatives

- *If you use other Map viewer(s), what do you use? (Question 21)*

The following are the responses on this question:

- Microstation with recent aerial photos,
- PDOK Viewer (<http://pdokviewer.pdok.nl>),
- BAG Viewer (<https://bagviewer.kadaster.nl/lvbag/bag-viewer/index.html>), and
- Bing Maps (<https://www.bing.com/maps>).

9.1.14. Other questions - Occupation

- *What is your occupation? (Question 22)*

Most users and respondents to this questionnaire are staff members (88%), figure 48, table 26. This question asked for general information to check. A majority of the users should be (as usual) staff members.

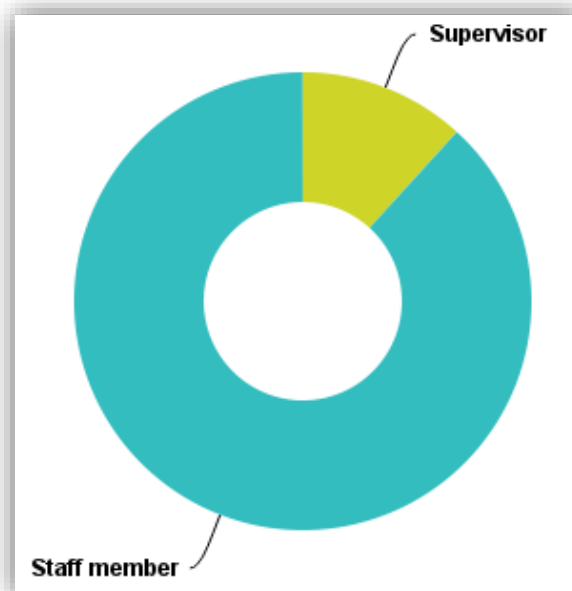


Figure 48: User occupations

User occupations	Percentage	No. of reactions
Supervisor	12%	4
Staff member	88%	30

Table 26: User occupations

9.1.15. Other questions - Suggestions

- *Do you have any comments or suggestions? or What other data or function you want to see in the (new) GIS? (Question 24)*

Table 27 shows the responses' detail of this question, the suggestions and remarks of the users help to develop the system or replace it in consideration with users' demands.

No.	Dutch (Original)	English (adapted translation)
1	openbare objecten als lantaarnpalen, adviezen, een kaartviewer	Adding public objects like lampposts
2	Er is een groot aantal archeologische rapporten; deze zijn van toegevoegde waarde; op termijn zal stroomlijn ook voor de burger toegankelijk zijn; het raadplegen van archeologische info is dan mogelijk; de 'papierenen' rapportages kunnen dan plaats maken voor de digitale versie via stroomlijn en zijn eenvoudig terug te vinden. Dit vereist een goede samenwerking tussen de afdeling, de medewerkers van Stroomlijn en ook van de extern deskundige archeologie tw Vestigia Archeologie en Cultuurhistorie.	Archaeological reports have their added values also for residents. Providing digital archaeological reports through an internet Geo-portal for the residents. Digital versions are easy to find if they will be published through an internet Geo-portal.
3	Werk aan de snelheid, die is echt dramatisch. Daarnaast is de uitstraling van Stroomlijn is ouderwets.	Work on Stroomlijn speed, which is really dramatic. In addition, the appearance of Stroomlijn is old-fashion.
4	bestemmingsplankaarten (aanvullend op de plangrenzen)	Adding land use maps with boundaries' plans
5	1. Op straatnaam zoeken gaat het niet altijd best. 2. af en toe kan je stroomlijn niet opstarten.	1. Searching for street names does not always work at best. 2. Occasionally, one cannot start Stroomlijn.
6	Integreren van beschikbare data omtrent parkeerdruk, intensiteiten en straatmeubilair	Integrate available data on parking intensity and street furniture
7	Een GIS-applicatie wordt pas echt gebruikt als het betrouwbare informatie bevat die actueel gehouden wordt. Voor mijn werkzaamheden heb ik regelmatig informatie nodig over eigendomssituaties, afspraken over beheer en onderhoud van objecten en gebieden, rioleringsgegevens, verzameling van verrichten onderzoeken die geraadpleegd kunnen worden door gewoon simpelweg op een kaart te klikken op een icoontje.	A GIS application will only be used if it contains reliable and up to date information. For my work activities, I am regularly in need of information on ownership situations, agreements on management and maintenance of objects and regions, sewer data, collection of performed investigations which can be consulted simply by simply clicking on a map on an icon.
8	toevoegen van hoogtematen	Adding height measurements
9	-wijkdeals -informatie over de vitaliteit (keuring van de bomen), jaar van aanplant, etc. -kaarten Visie openbare ruimte (glas en lood)	Neighbourhood agreements, Information on vitality (tree inspection), year of planting, etc. Maps on public space vision (glass and lead)

10	Vraag 7 snelheid is wisselvallig dus ook wel eens ontevreden	Question 7 speed is unstable, so sometimes unhappy
11	Ondanks veel klachten ben ik niet ontevreden over Stroomlijn an sich. Helaas is de functionaliteit de laatste tijd slecht. Een nieuwe viewer moet evenveel functionaliteit bieden zonder de frustraties in de bediening. Daarnaast moet het mogelijk blijven dat we zelf uiteenlopende informatie middels het Gis systeem kunnen koppelen en ontsluiten. De informatie (kadastraal/BAG) moet actueel zijn.	Despite many complaints, I am not dissatisfied about Stroomlijn. Unfortunately, lately the functionality is poor. A new viewer must provide as much functionality without the frustrations in the operation. In addition, we have to be able to add and join various information through the GIS. The Information (Cadastral / BAG) must be up to date.
12	1. zelf meer mogelijkheden om simpel meerdere datasets over elkaar heen te leggen. 2. simpeler werkwijze om een thema of subthema te kiezen.	1. More possibilities to lay datasets on each other. 2. Simpler method to choose a theme or a sub-theme.

Table 27: Comments or suggestions

9.2. Westland questionnaire

Only five users of internal GIS (IBORgis) in Westland municipality filled the questionnaire (Appendix 5), four of them on 16 May 2017 and another one on 22 May 2017, figure 49.

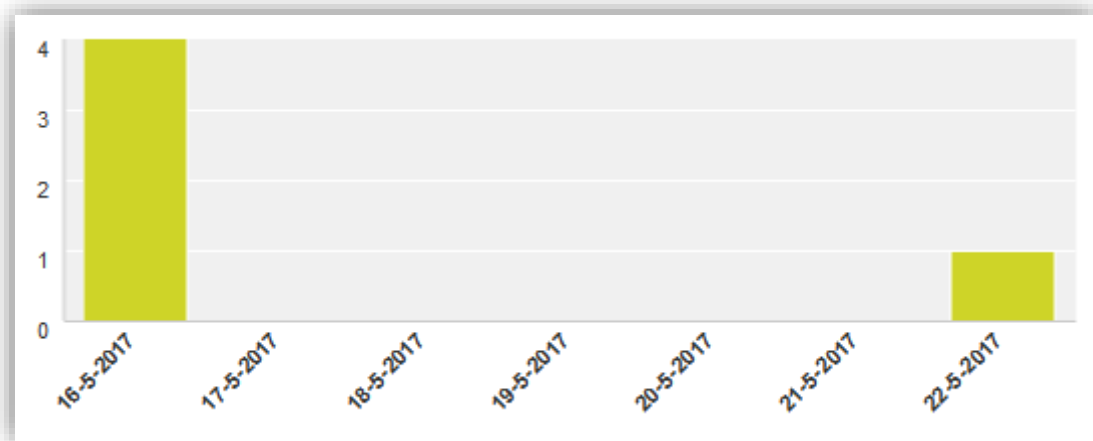


Figure 49: Westland questionnaire responses

The questions of the questionnaire arranged logically to be filled by the users but to analyse them, they were categorised on the indicators in tables 6 and 7 as follows:

9.2.1. Effectiveness – Quality

- *How satisfied are you with the quality of offered data? (Question no. 11 in the Questionnaire)*

Data quality scored very high, 60% of the responses were satisfied and very satisfied, figure 50, table 28; there was no responses with dissatisfied or very dissatisfied. This is an expected result because government (including municipalities) has lots of concerns about the data quality.

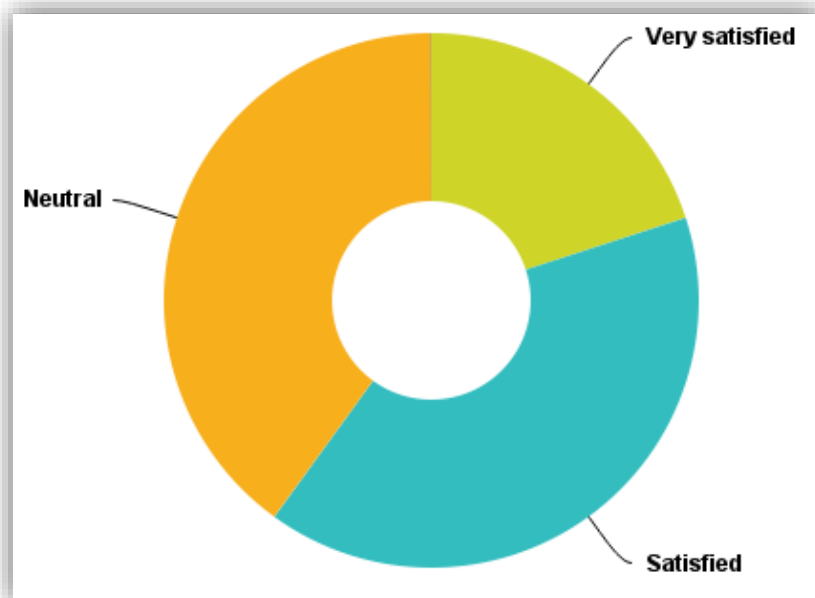


Figure 50: Data quality

Data quality	Percentage	No. of reactions
Very satisfied	20%	1
Satisfied	40%	2
Neutral	40%	2
Dissatisfied	0%	0
Very dissatisfied	0%	0

Table 28: Data quality

9.2.2. Effectiveness – Quantity

- *How satisfied are you with the amount of offered data? or Is there enough data (information) to support your work? (Question 10)*

Most of the respondents (80%) were satisfied with the amount of offered data, figure 51 and table 29. The rest of the respondents (20%) are neutral. IBORgis created for a specific department and needed datasets made available through IBORgis for that specific department. This was not the responses of the majority or the opinion of other staff members in other clusters or teams.

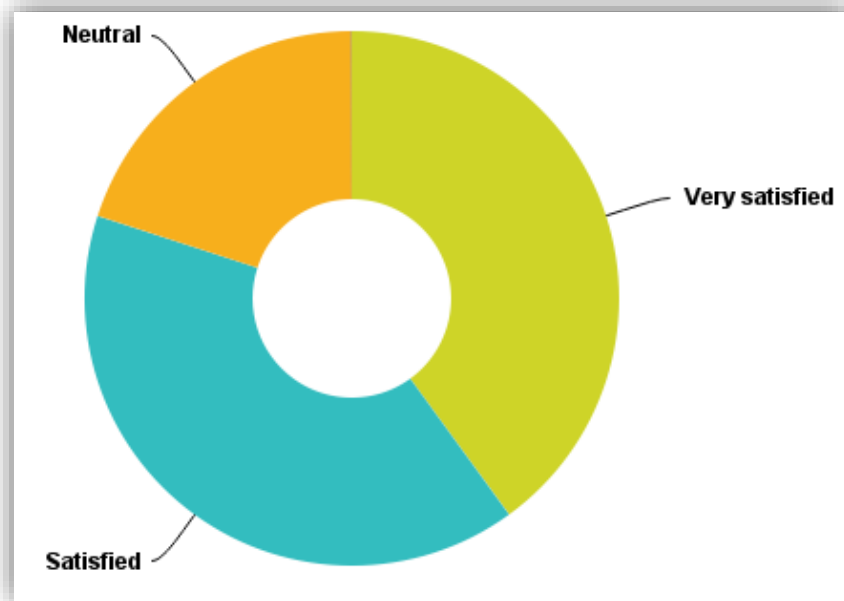


Figure 51: Data quantity

Data quantity	Percentage	No. of reactions
Very satisfied	40%	2
Satisfied	40%	2
Neutral	20%	1
Dissatisfied	0%	0
Very dissatisfied	0%	0

Table 29: Data quantity

9.2.3. Efficiency – Temporal efficiency

- *How much time you spend with IBORgis per session? (Question 2)*

Most of the users (60 %) spend more than an hour per session. It means the users obtained information needed within long time, figure 52 and table 30.

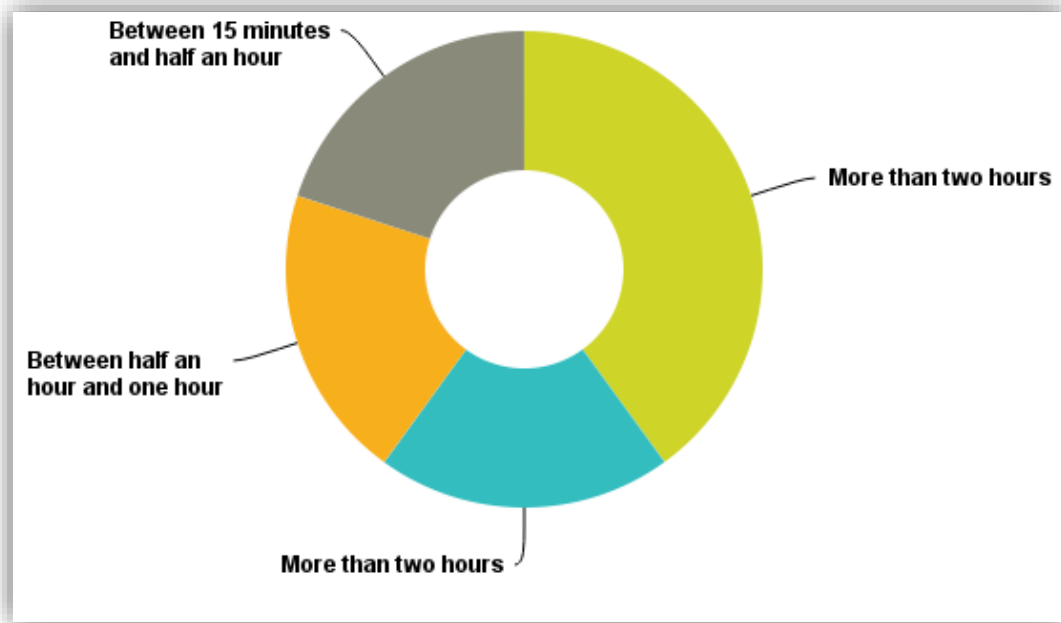


Figure 52: Time per session

Time per session	Percentage	No. of reactions
More than two hours	40%	2
Between one hour and two hours	20%	1
Between half an hour and one hour	20%	1
Between 15 minutes and half an hour	20%	1
Less than 15 minutes	0%	0

Table 30: Time per session

- *How satisfied are you with the working speed of IBORGis? (Question 7)*

The users were (very) satisfied with the speed of IBORGis, figure 53 and table 31.

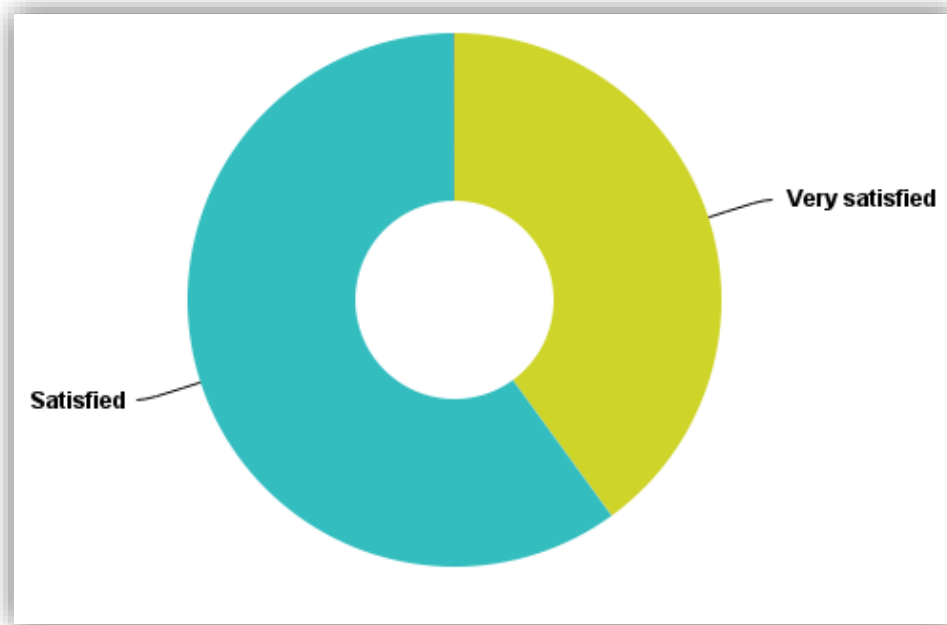


Figure 53: IBORgis speed

Speed	Percentage	No. of reactions
Very satisfied	40%	2
Satisfied	60%	3
Neutral	0%	0
Dissatisfied	0%	0
Very dissatisfied	0%	0

Table 31: IBORgis speed

9.2.4. Efficiency – User efficiency

- *How satisfied are you with IBORgis ease of use? (Question 6)*

All the users agreed that IBORgis is easy to use, figure 54 and table 32.

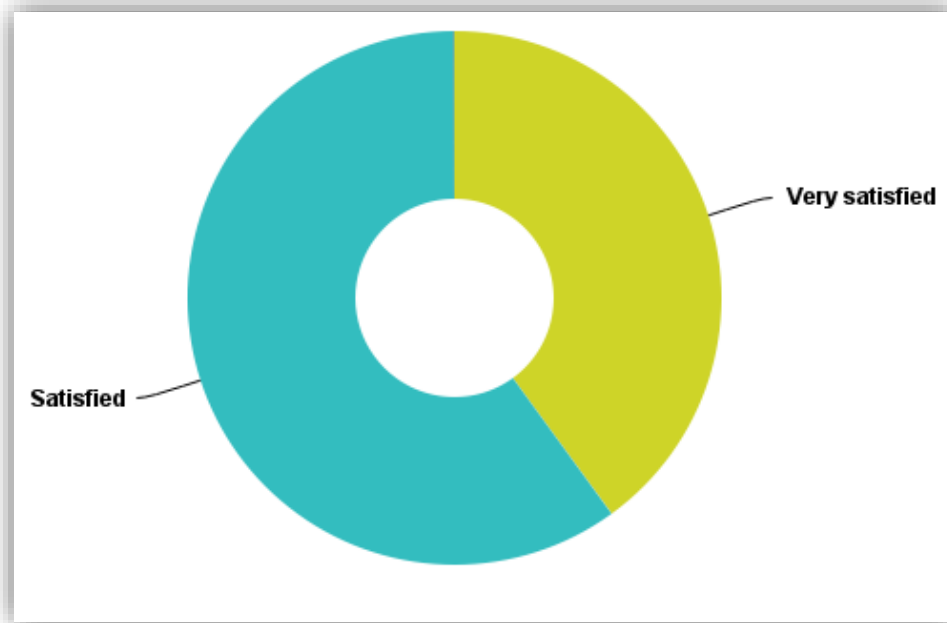


Figure 54: Ease of use

Ease of use	Percentage	No. of reactions
Very satisfied	40%	2
Satisfied	60%	3
Neutral	0%	0
Dissatisfied	0%	0
Very dissatisfied	0%	0

Table 32: Ease of use

▪ *How satisfied are you with printing and PDF-extracting? (Question 9)*

The number of neutral and dissatisfied users is more than satisfied users. There is no very satisfied user, figure 55 and table 33. IBORgis have a problem with printing. Furthermore, the administrators admitted that IBORgis has no pdf extracting facility.

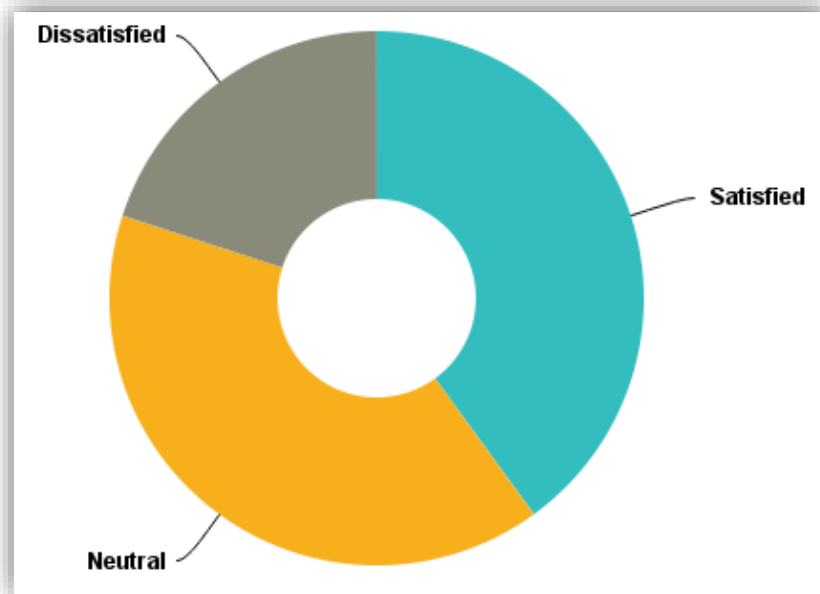


Figure 55: Printing

Printing	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	40%	2
Neutral	40%	2
Dissatisfied	20%	1
Very dissatisfied	0%	0

Table 33: Printing

9.2.5. Efficiency – Support efficiency

- *Our support policy is making a digital request via TopDesk, how satisfied are you with that policy? (Question 12)*

Figure 56 and table 34 show that most of the responses to this question are neutral. The percentage of satisfied and dissatisfied users is the same. On the one hand, users know the importance of TopDesk (<http://www.topdesk.com>); on the other hand, they were not comfortable with a digital request (via TopDesk) per problem. In general, there is not a big resistance on this policy.

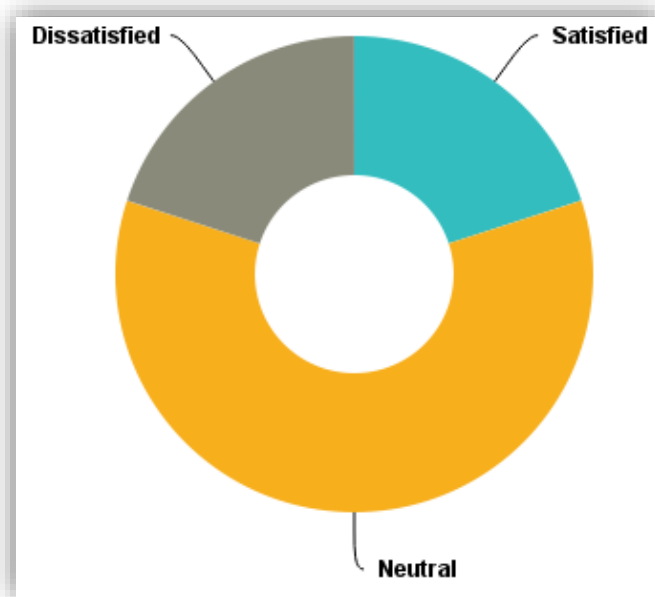


Figure 56: Support policy

Support policy	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	20%	1
Neutral	60%	3
Dissatisfied	20%	1
Very dissatisfied	0%	0

Table 34: Support policy

- *What kind of contact you prefer with the helpdesk of IBORgis? (Question 13)*

Most of the users prefer to call administrators to seek support than to call ICT help desk. The users' last prefer choice is to make the digital request (via TopDesk), figure 57 and table 35.

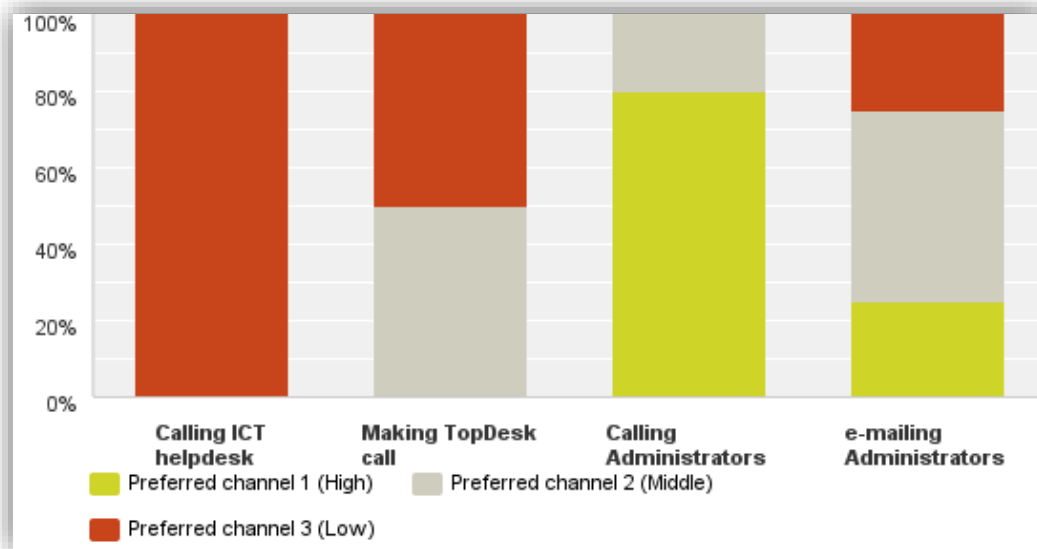


Figure 57: Preferable method of support

Support policy	Preferred channel 1 (High)	Preferred channel 2 (Middle)	Preferred channel 3 (Low)
Calling ICT Helpdesk	0% 0	0% 0	100% 1
Making TopDesk call	0% 0	50% 2	50% 2
Calling Administrators	80% 4	20% 1	0% 2
e-mailing Administrators	25% 1	50% 2	25% 1

Table 35: Preferable method of support

- *How satisfied are you with searching information in IBORGis? (Question 8)*

All of the users were satisfied (100%) with the search facilities of the system figure 58 and table 36.

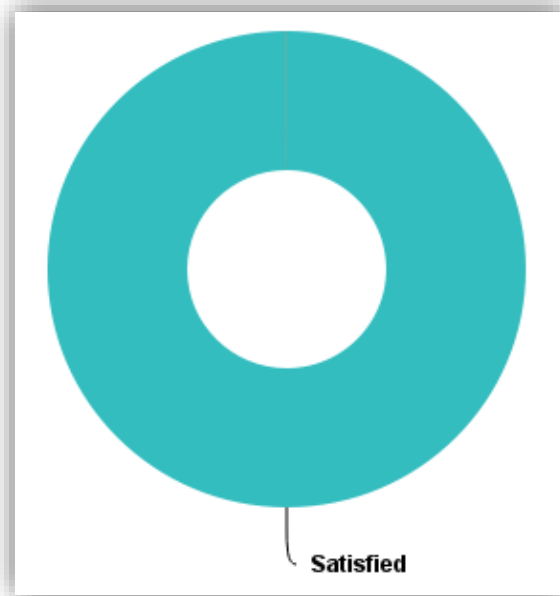


Figure 58: Search facility

Search facility	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	100%	5
Neutral	0%	0
Dissatisfied	0%	0
Very dissatisfied	0%	0

Table 36: Search facility

9.2.6. Satisfaction – Comfort

- *How satisfied are you with the Demonstration, Explanation, and Support of the IBORgis administrators (Sjoerd & Dao)? (Question 14)*

All the responses are (100%) neutral. There were no dissatisfied or satisfied responses to this question, figure 59 and table 37. Further investigation needed to make administrators' support better.

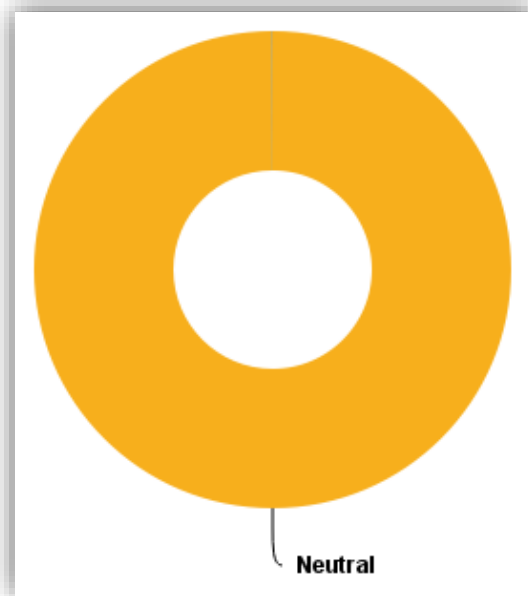


Figure 59: Administrators

Administrators	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	0%	0
Neutral	100%	5
Dissatisfied	0%	0
Very dissatisfied	0%	0

Table 37: Administrators

▪ *How satisfied are you with the IBORgis manual that you can consult? (Question 15)*
 Most of the users have neutral responses. There were also (40%) satisfied and very satisfied responses. There are no dissatisfied responses, figure 60 and table 38. This means that the help documentation is good. Westland developed video explanations for the users as well.

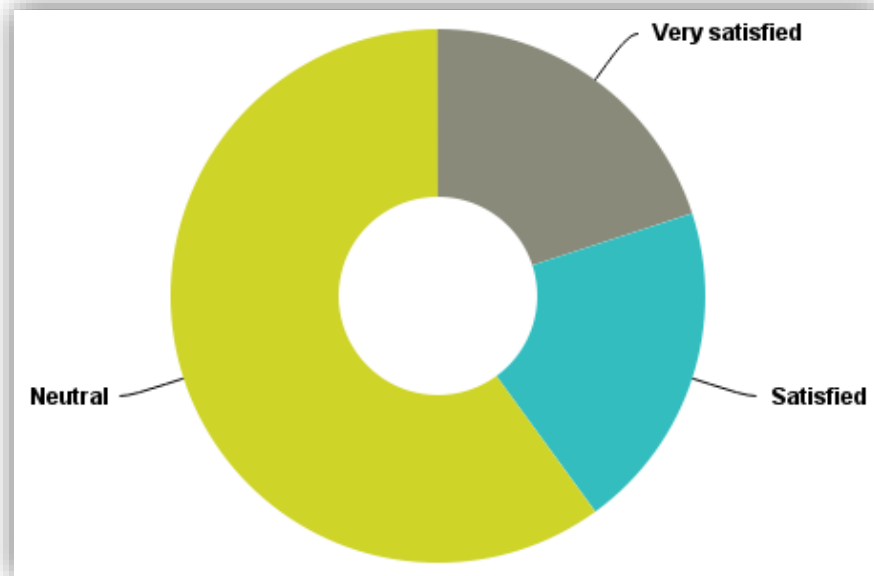


Figure 60: Help documentation

Help documentation	Percentage	No. of reactions
Very satisfied	20%	1
Satisfied	20%	1
Neutral	60%	3
Dissatisfied	0%	0
Very dissatisfied	0%	0

Table 38: Help documentation

- *How satisfied are you with the Intranet message-news on IBORgis? (Question 16)*

Neutral responses scored the highest (40%), thus by looking at (very) dissatisfied responses (40%), one can conclude that intranet messages are not acceptable, figure 61 and table 39.

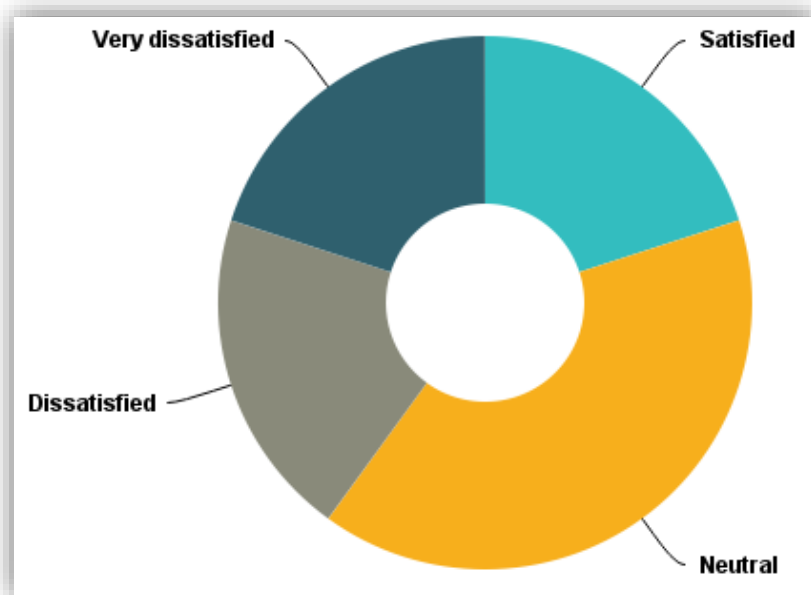


Figure 61: Intranet messages

Intranet messages	Percentage	No. of reactions
Very satisfied	0%	0
Satisfied	20%	1
Neutral	40%	2
Dissatisfied	20%	1
Very dissatisfied	20%	1

Table 39: Intranet messages

9.2.7. Satisfaction – Acceptability

- *To what extent does IBORgis help your productivity? (Question 3)*

All of the users say that IBORgis helps them to be more productive, figure 62 and table 40. Supporting users to be more productive is one of the important targets of SDI.

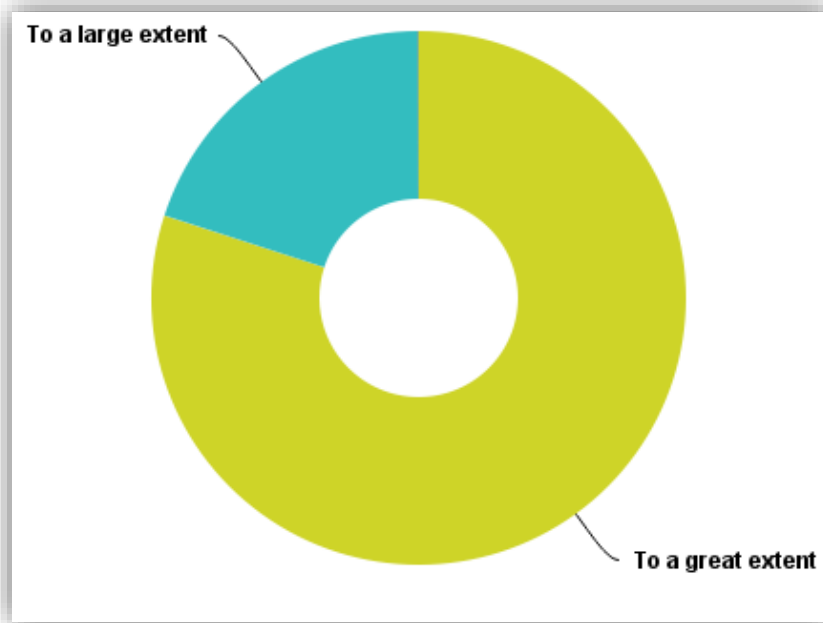


Figure 62: Productivity

Productivity	Percentage	No. of reactions
To a great extent	80%	4
To a large extent	20%	1
To a reasonable extent	0%	0
To a limited extent	0%	0
Not at all	0%	0

Table 40: Productivity

- *Would you recommend IBORgis to your closest colleague? (Question 18)*

The response of all the users on this question is yes. This means that IBORgis has good added value to the organisations and it is important to the users, figure 63 and table 41.

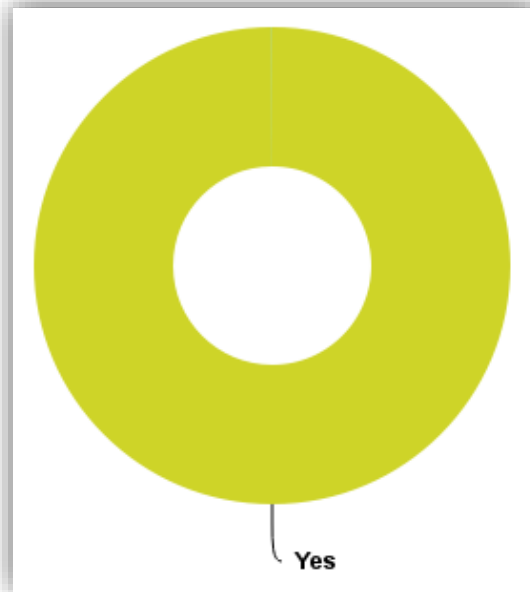


Figure 63: Recommendation

Recommendation	Percentage	No. of reactions
Yes	100%	5
No	0%	0

Table 41: Recommendation

9.2.8. Satisfaction – Preference

- *Where do you usually work? (Question 23)*

All of the users who filled the questionnaire work full or part time at the office (100%), figure 64 and table 42. This thus underlines the importance of desktop interface to use the system.

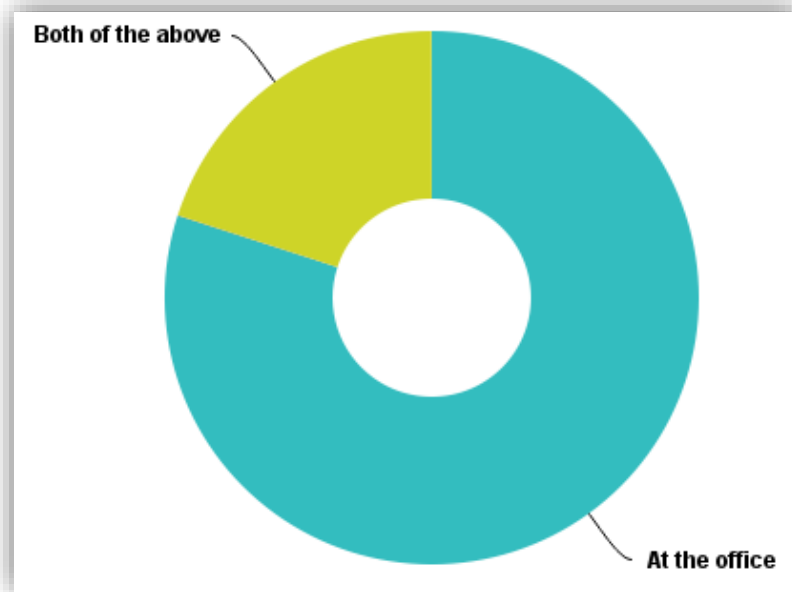


Figure 64: Work place

Work place	Percentage	No. of reactions
At the office	80%	4
Outside	0%	0
Both	20%	1

Table 42: Work place

9.2.9. Satisfaction – Overall

- What rating do you give to IBORGis? (Question 17)

The users gave the system an overall satisfactory rating of 7.6, figure 65.

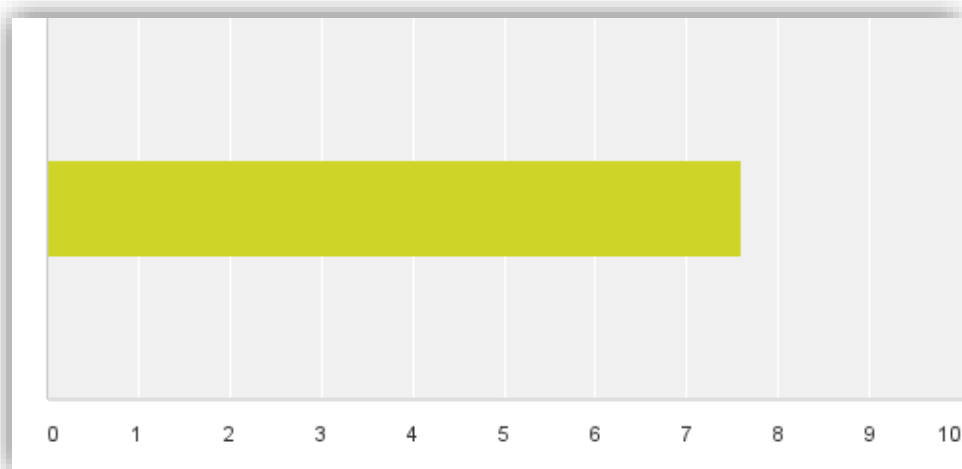


Figure 65: Overall Rating

9.2.10. Other questions - Target group

- *Are you using IBORgis? (Question 1)*

All respondents were users of IBORgis, figure 66. This is necessary for the purpose of the questionnaire to assess, depending on users' perspectives.

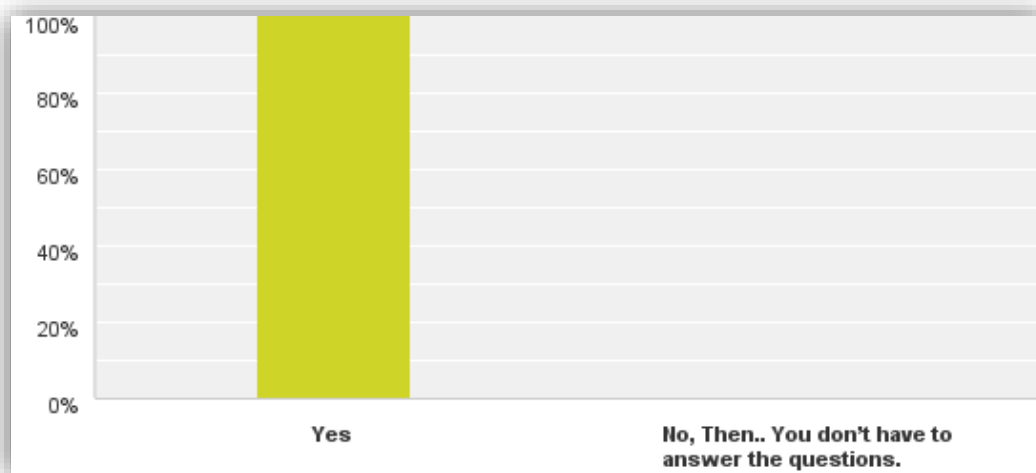


Figure 66: Westland questionnaire responses

9.2.11. Other questions - Municipal demands from SDI

- *Can you briefly describe a (important) task that you can carry out by using IBORgis? (Question 4)*

The main purpose of this question was to support answering research question 2 (Business process supported with SDI). The responses should explain the system's importance for the organisation's processes, table 43.

No.	Dutch (Original)	English (adapted translation)
1	Programmeren, prioriteren en communicatie	Programming, prioritizing and communication
2	Opzoeken kadastrale gegevens	Look up cadastral data
3	Omdat er beheerobjecten in staan kan je heel snel in combinatie met bijv een luchtfoto een overzicht maken	Because there are management objects, you can quickly compile with an aerial view, e.g. create an aerial view
4	offerte trajecten voor werkzaamheden, bron gegevens, arealen	Trajects' offer for work activities, data sources, Areal activities

Table 43: Municipal demands from SDI - Westland

9.2.12. Other questions - Sustainability

- *To what extent does IBORgis provide an integral view of social, ecological and economic data? (Question 5)*

According to the users, IBORgis have a neutral view of social, ecological and economic data, figure 67 and table 44.

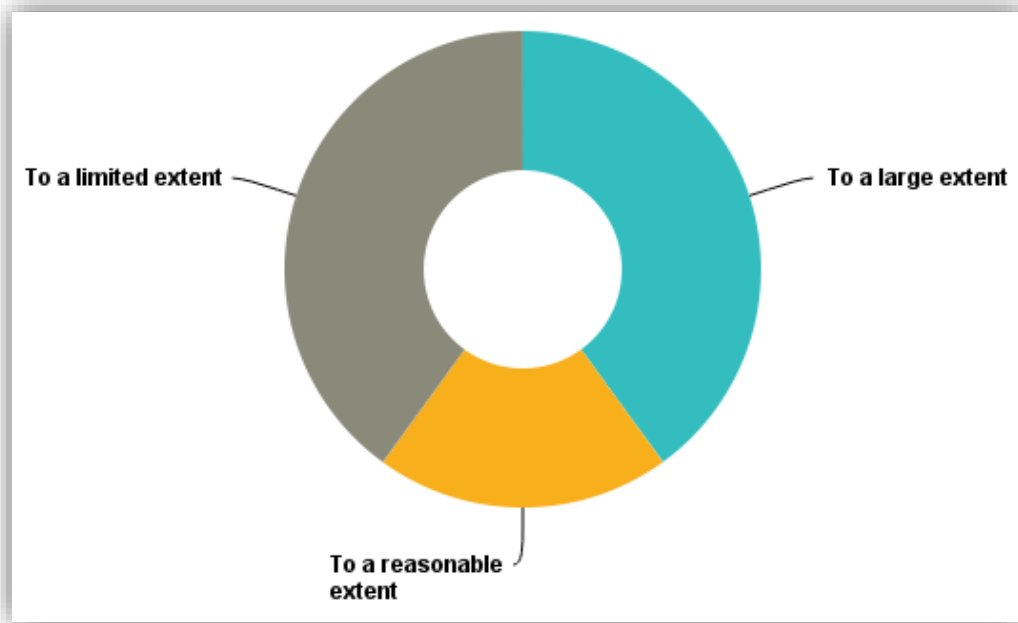


Figure 67: Sustainability

Sustainability	Percentage	No. of reactions
To a great extent	0%	0
To a large extent	40%	2
To a reasonable extent	20%	1
To a limited extent	40%	2
Not at all	0%	0

Table 44: Sustainability

9.2.13. Other questions - Alternatives

- Do you use alternative Map viewer instead of IBORgis? Map viewer Such as Google Maps, Open Street Map, etc. (Question 19)

Most of the users (60%) do not use alternative map viewers, figure 58 and table 45.

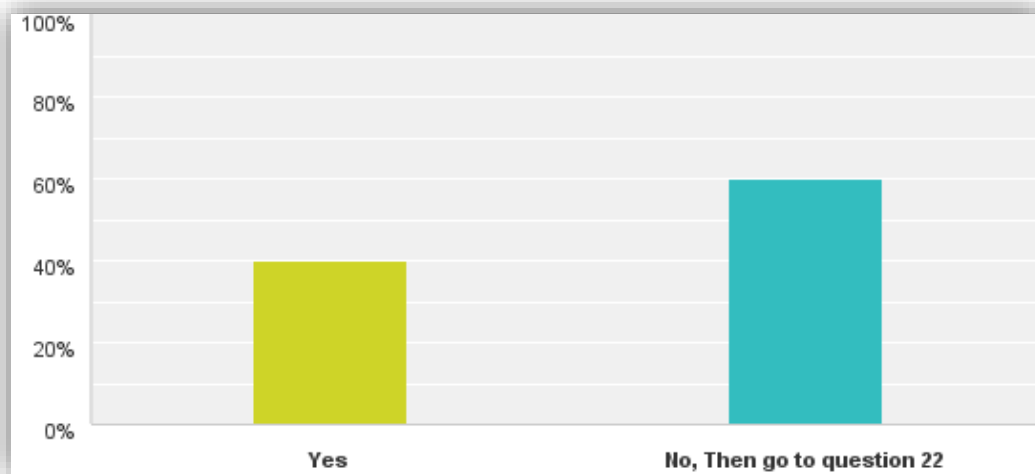


Figure 68: Using alternatives

Using alternatives	Percentage	No. of reactions
Yes	40%	2
No	60%	3

Table 45: Using alternatives

- *Which Map viewer do you use with IBORgis? In addition to IBORgis, you may also use other (often-commercial) Map viewers. Which Map viewers are they? (Question 20)*

The response on this question is not complete. According to the responses Google maps is used frequently as an alternative map viewer by 20% of the users. Open Street Map used also by the users in an average level. According to the responses, the users do not use any other Map viewers! figure 69 and table 46.

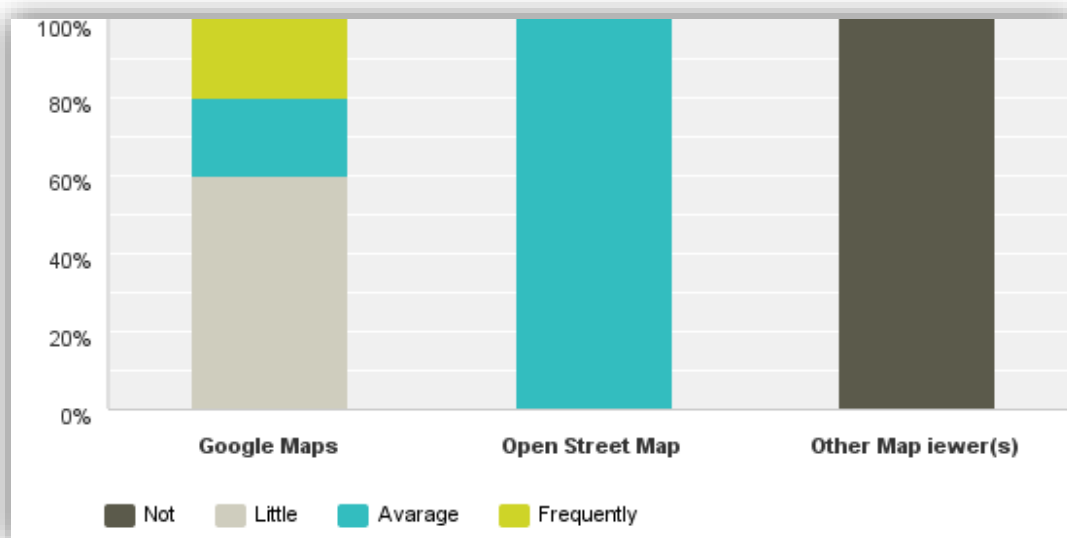


Figure 69: frequent use of alternatives

Frequent use	Not	Few	Average	Frequent
Google Maps	0% 0	60% 3	20% 1	20% 1
Open Street Map	0% 0	0% 0	100% 1	0% 0
Other Map viewer(s)	100% 3	0% 0	0% 0	0% 0

Table 46: frequent use of alternatives

- *If you use other Map viewer(s), what do you use? (Question 21)*

No responses!

9.2.14. Other questions - Occupation

- *What is your occupation? (Question 22)*

All the respondents to this questionnaire are staff members (100%), figure 70, table 47. This question asked for general information to check. A majority of the users should be (as usual) staff members.

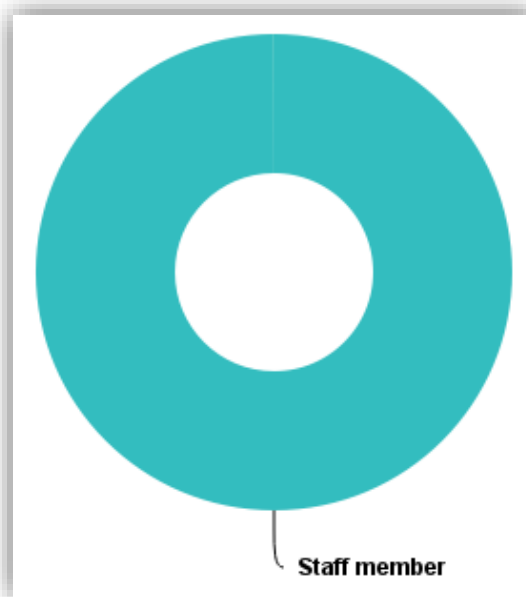


Figure 70: User occupations

User occupations	Percentage	No. of reactions
Supervisor	0%	0
Staff member	100%	5

Table 47: User occupations

9.2.15. Other questions - Suggestions

- *Do you have any comments or suggestions? or What other data or function you want to see in the (new) GIS? (Question 24)*

Table 48 shows the responses' detail of this question, the suggestions and remarks of the users help to develop the system or replace it in consideration with users' demands.

No.	Dutch (Original)	English (adapted translation)
1	De kaartindelingen kunnen effectiever en gericht. Veel kaarten.	The map layout can be more effective and targeted. Lots of maps.
2	Opmerking: ik heb nog nooit ondersteuning van Sjoerd of Dao gehad. Wel van Harry van Dalen.	Note: I have never had support from Sjoerd or Dao. I had support from Harry van Dalen.
3	in de vragen lijst bovengenoemd kun je niet aanvinken nvt als voorbeeld wordt genoemd dat sjoerd en dao presentaties geven, hier heb ik nog nooit van gehoord, door areaalbeheer zijn zelf presentaties gegeven	In the question list mentioned above you cannot check out (NA) as an example that Sjoerd and Dao presentations, I have never heard of that, areal management has given presentations

Table 48: Comments or suggestions

10. DISCUSSION

10.1. Research process discussions

SDIs were initially developed as a mechanism to facilitate access and the sharing of spatial data to use within a GIS environment (Rajabifard, 2008). GIS is considered as the underpinning technology for SDI and it has significant role in facilitating data collection and storage as well as facilitating decision-making based on spatial data processing and analysis (adapted from Mansourian et al., 2004). That is why, this important underpinning technology of municipal SDI (internal GIS or inter-organisational GIS) assessed depending on users' perspective in this research. The internal GIS or inter-organisational GIS in the municipality is the windows which the users looking though at SDI and we can call it Internal SDI.

Municipalities have many necessary systems depending on Geo-information for the purpose of meeting legal obligations, supporting business processes and providing services for the residents, such as: BAG, BGT, BRK, HR, WRO, WION, WKpB, WOZ, WABO, Public space management (GBI), Environmental data, Notifications on Public Space, etc. The mentioned systems have their own infrastructures and because they are depending on Geo-information or spatial data we can call them municipal SDIs. Those systems or SDIs provide spatial datasets to Internal GIS/SDI. The users can use provided spatial datasets through the internal GIS. This research is on usability based on user's perspective, that is why, the concentration of this research was on Internal GIS/ SDI.

Concisely, Municipal SDIs is not just Internal GIS/SDI but Internal GIS/SDI is the most suitable municipal SDI that can be used for this research on usability based on user's perspective.

Every four years municipalities have their new policy programs (in Dutch: Collegeprogramma) which is a program of intentions and agreements on the policy that the municipality will conduct after the municipal elections in the next four years. Mayor and Aldermen (in Dutch: Burgemeester en Wethouders, B&W) create the policy program as soon as possible, after elections. I noticed that achieving sustainability is a recalling theme in the policy programs and visions of the municipalities. Thus if municipal SDI support's sustainability goals, it will also support a big part of municipal goals as well.

Furthermore, staff members' activities should support municipal visions and goals. At the end of each year, every staff member of Maassluis municipality must have a planning agreement for his/her activities for the forte going year. The planning agreement describes result-oriented tasks/activities, which support: department objectives, organization-wide objectives, generic competencies, specific competencies and personal development plan. Hence, if SDI supports staff members' tasks, it will support municipal visions and goals as well.

One of the crucial phases of this research was assembling a framework to specify the important indicators for the assessment, figure 26. I assembled the framework depending on:

1. *The usability aspects (effectiveness, efficiency and satisfaction) mentioned in the International standard ISO 9241*
The definition of ISO is comprehensive and it was very useful to depend on it to find out assessment indicators.
2. *Indicators from Hornbaek (2004) and Suarez (2010)*
The indicators mentioned by Hornbaek (2004) and Suarez (2010) on 180 studies published studies was too much and very wide. They were helpful to choose the suitable, feasible and applicable indicators from them.
3. *Reeve and Petch (1999) which describes usability like ISO 9241-11 with a deference in using competitive advantage benefits (Cost) instead of satisfaction*
The mentioned competitive advantage benefits by Reeve and Petch (1999) assisted to concentrate on cost, especially the time which the users spent to use offered spatial datasets through the system.
4. *An idea from diagram by Sans (2014)*
The diagram idea of figure 26 is taken from Sans (2014).
5. *Appropriateness for the study area (municipalities).*
Study area has also lots of effects on changing some questions to be suitable for provided facilities and adding other questions on sustainability, demands form SDI and information on alternative maps.

Another important phase was choosing appropriate questions for the questionnaire. This was done depending on many resources, especially Post-Study System Usability Questionnaire explained by Sauro and Lewis (2016), Den Bosch municipality questionnaire (GeoWeb Tevredenheidsonderzoek, 2015) and demands of the study area. It was difficult to select questions and they were updated several times because they should be: in an understandable language, goal-oriented, compact and accepted by the municipalities of Maassluis and Westland.

It was difficult to make subjective topics objective measurable. Supervisors' guidance, literatures on others' experiences helped me to make the indicators as SMART (Specific, Measurable, Achievable/Accepted, Realistic, and Time-bound) as possible.

Interviews and questionnaires were feasible in Maassluis. In Maassluis many opportunities were provided: such as available e-mail addresses, Maassluis' supports for implementation, existing log files to find the users and using Intranet to publish the questionnaire.

Westland had more cons than pros, e.g. e-mails addresses of the users was not available, the responsible staff members did not agree to evaluate the old Inter-organisational GIS (GeoMedia), they did not complete some tasks we agreed on and did some of the tasks poorly. GeoMedia was more important and suitable than IBORgis for this research because the whole organisation using it since 2006. At this moment, IBORgis is used by a part of the organisation (Westland municipality).

An arrangement made with two responsible staff members to disseminate the questionnaire. We agreed on sending the questionnaire to some 40 users of internal GIS (IBORgis) on 12 May 2017. The response time was set to one week until 19 May 2017. They sent the questionnaire on 16 May 2017 to only 10 users and until 24 May 2017, five of the users filled the questionnaire, Appendix 5 (D&E). Although I tried time and again through many communication means seeking cooperation, there was no response.

10.2. Questionnaires' results discussion and calibration

Depending on the percentages of satisfied and very satisfied responses the result of each indicator will be decided on, as follows:

- the result considered as bad if the responses' percentage of satisfied and very satisfied is less than 55%,
- the result is acceptable if it is between 55% and 70%,
- the result is good if it is more than 70%, and
- NA for not applicable responses.

At the end, the results will be calibrated as well, table 49.

10.2.1. Maassluis questionnaire results

Reference table 49 the usability aspects' conditions according to the users in Maassluis municipality varied from an aspect to another:

The effectiveness aspects scored well because the quality and quantity of the available/offered datasets are good:

- The users were satisfied with the quality of offered data and this is an expected result because governmental organisations in the Netherlands (including municipalities) have lots of concern for data quality, and
- The users were satisfied with the quantity of offered data as well but there are 30% neutral and dissatisfied users, more datasets need to be added.

The efficiency scored between badly and acceptable because the score of the efficiency indicators are as follows:

- User efficiency indicators scored badly because there are serious problems with system software (Stroomlijn) such as time consuming, not easiness of use, and poorly working facilities such as printing and PDF files extracting. Moreover, the administrators are not happy with poorly working of printing and PDF files extracting facilities,
- On the other hand (and in general) the support efficiency scored acceptable, support policy is acceptable although the users prefer to call or e-mail administrators to seek support than calling ICT help desk, and
- The search facilities of the system are acceptable, although there are 12% dissatisfied users.

In general, satisfaction aspect scored well because:

- Users were satisfied with comfort sub indicators (internal services such as administrators, ICT helpdesk and Intranet news),
- Once more, system software scored badly because users are not happy with available help documents.
- Acceptability sub indicators also scored well because:
 - according to the users, Stroomlijn helps them to be more productive. More productivity is one of the important goals of SDI, and
 - the majority will recommend Stroomlijn to a colleague, this means that Stroomlijn has important benefits for the users and the organisation,
- Preference sub indicator, scored well because Desktop Interface is available for all the staff members and most of the users who filled the questionnaire work fully or partially at the office. Depending on the outside staff members' tasks, the municipality decides on offering better interface to access the system from outside. At this moment, staff members who work outside can access the system though Citrix Apps (<https://www.citrix.nl>), and
- Overall satisfaction scored well. The users gave the system an overall satisfactory rating of 6.8 from 10.

Furthermore, other aspects scored well because:

- The responses on municipal demands from SDI question showed that the available datasets play an important role to support business processes of the municipality, table 2, chapter 7, MUNICIPAL DEMANDS FROM SDI.
- Stroomlijn supports sustainability, a goal of the municipality. According to most of the users, Stroomlijn has an integral view of social, ecological and economic data. There is also (18 %) of the users who do not agree. Municipality should deal with this 18% as well. One of the choices is providing more (or missing) datasets that supports the sustainability goals of the municipality.
- Most of the users use alternative map viewers for other purposes such as Navigation and quick location search and consulting datasets which are not available in Stroomlijn such as datasets of The Dutch National SDI (in Dutch: Publieke Dienstverlening Op de Kaart, PDOK) (<http://pdokviewer.pdok.nl>).
- The occupation of most of the users responded to this questionnaire are staff members. This question asked for general information on users.
- As a response to the suggestion question, the users explained why they answered some of the questions with dissatisfied. Paying attention to suggestions and comments helps in the improvement of the SDI situation for the better.

Usability aspects	Indicators	Sub indicator	(very) satisfied%	Result	Explanation/ Calibration	Result after calibration
EFFECTIVENESS	Quality		77%	Good	The users were satisfied with the quality of offered data. This is an expected result because governmental organisations in the Netherlands (including municipalities) have lots of concern with the data quality, figure 28, table 8.	Good
	Quantity		71%	Good	The users were satisfied with the quantity of offered data as well but there are 30% neutral and dissatisfied users. This should be investigated, figure 29 and table 9.	Good
EFFICIENCY	Temporal efficiency	Time per session	NA	NA	Most of the users (82 %) spent less than an hour per session. That means the user obtain information needed within relatively reasonable time and the administrators can set up time out session on 45 minutes. This depends generally on the performance of the system. Accordingly, better performance will decrease session time, figure 30 and table 10.	NA
		Stroomlijn speed	21%	Bad	Most of the users were not satisfied with the speed of Stroomlijn. This point supports replacement of the system because in the past many attempts were conducted to increase the speed of the system, figure 31 and table 11.	Bad
	User efficiency	Ease of use	53%	Bad	Although 53% agreed that Stroomlijn easy to use but there is also 15 % who dissatisfied and very dissatisfied with easiness of use. These responses need attention and investigation to make the system easier to use. The responses of this question support the intention of the organisation to replace the system as well, figure 32 and table 12.	Bad
		Printing and PDF_Extracting	41%	Bad	The amount of neutral and dissatisfied users is more than satisfied users. This point support replacement of the system as well, figure 33 and table 13.	Bad
	Support efficiency	Support policy	32%	Bad	Most of the responses on this question were neutral, while satisfied users of this policy treble dissatisfied users. On the one hand, users know the importance of TopDesk (http://www.topdesk.com); on the other hand, they were not comfortable with a digital request (via TopDesk) per problem. In general, there is not a big resistance on this policy., figure 34, table 14	Acceptable
		Support method	NA	NA	Most of the users prefer to call or e-mail administrators to seek support than calling ICT help desk. The users last prefer choice is to make a digital request (via TopDesk), figure 35 and table 15.	Acceptable
		Searching	62%	Acceptable	Most of the users were satisfied (62%) with the search facilities of the system figure 36 and table 16. There were also dissatisfied users. Further investigation needed to find out why (12%) of the users were dissatisfied.	Acceptable
SATISFACTION	Comfort	Administrators	76%	Good	Most of the users (76%) were satisfied with the Demonstration, Explanation, and Support of the Stroomlijn administrators. There is no response with dissatisfied on this question, figure 37 and table 17.	Good
		Help documentation	33%	Bad	Most of the users had neutral responses (55%). There were also (33%) satisfied responses. Dissatisfied responses record just 12%. Adding new methods of explanation (e.g. videos) may increase number of satisfied users, figure 38 and table 18.	Acceptable

Others		Intranet messages	41%	Bad	Neutral responses scored the highest (53%) and by looking at satisfied responses (41%), one can conclude that intranet messages are acceptable, figure 39 and table 19. It is not clear why there is a minority dissatisfied responses (6%).	Acceptable
	Acceptability	Productivity	71%	Good	Most of the users (71 %) agreed that Stroomlijn helps them to be more productive, figure 40 and table 20. Supporting users to be more productive is one of the important goals of SDI.	Good
		Recommend to a colleague	94%	Good	The majority of responses on this question is yes (94%). This means that Stroomlijn has good added value to the organisations and it is important to the users, figure 41 and table 21	Good
	Preference	Preference	NA	NA	Most of the users who filled the questionnaire are working full or part time at the office (97%), figure 42 and table 22. An indication of the importance of desktop interface access to the system. Depending on the tasks' importance of the outside staff members' municipality decides on arranging access to the system from outside. At this moment, staff member who work outside can access the system though Citrix Apps (https://www.citrix.nl).	Good
	Overall		68%	Good	The users gave the system an overall satisfactory rating of 6.8, figure 43.	Good
	Municipal demands from SDI	Business processes	NA	NA	The main purpose of this question is to support answering research question 2 (Business process supported with SDI), the responses on this question shown in table 2, chapter 7, MUNICIPAL DEMANDS FROM SDI. Moreover, the responses explain the system importance for the organisation processes.	NA
	Sustainability	Municipal goals	82%	Good	According to most of users (82 %), the Internal GIS has an integral view of social, ecological and economic data. This means that Stroomlijn support sustainability which is the goal of the municipality, figure 45 and table 23. There were also (18 %) of the users who do not agree. Municipality should deal with this 18% as well. One of the choices is providing more (or missing) datasets which support sustainability goals of the municipality.	Good
	Alternatives		NA	NA	Most of the users use alternative map viewers, figure 46 and table 24. According to the responses, users use Google maps mainly as an alternative map viewer. Other alternatives (including Open Street Map) scored low. Users use Google maps mainly for the purposes of Navigation and quick location search. Open Street Map exists already as a web service in Stroomlijn, figure 47 and table 25. The following alternatives mentioned in the responses: <ul style="list-style-type: none"> ▪ Microstation with recent aerial photos, ▪ PDOK Viewer (http://pdokviewer.pdok.nl), ▪ BAG Viewer (https://bagviewer.kadaster.nl), and ▪ Bing Maps (https://www.bing.com/maps). 	Good
	Occupations		NA	NA	Most of the users responded to this questionnaire are staff members (88%), figure 48, table 26. This question asked for general information on users. The majority of the users should be (as usual) staff members.	Good
	Suggestions		NA	NA	This question explains (in general) why the users responded with dissatisfied to some of the questions. Paying attention to suggestions and comment make the SDI situation better, table 27.	NA

Table 49: Maassluis questionnaire results

10.2.2. Westland questionnaire result

Reference table 50 the usability aspects' conditions according to the users in Westland municipality varied from an aspect to another:

The effectiveness aspects scored well because the quality and quantity of the available/offered datasets are good:

- The users were satisfied with the quality of offered data and this is an expected result because governmental organisations in the Netherlands (including municipalities) have lots of concern for the data quality, and
- The users were satisfied with the quantity of offered data as well. Users can consult round 200 layers via IBORgis. One of the responses on the suggestion question was "Lots of Maps".

The efficiency situation according to the indicators is as follows:

- Most of the users spent more than an hour per session. That means the user obtain needed information within a long time. The reason could be the quantity of available datasets or type of users (users who deal with projects spend more time per session).
- System speed and ease of use scored well.
- Printing scored badly. The number of neutral and dissatisfied users is more than satisfied users. There is no very satisfied user. This means IBORgis has a problem with printing. Furthermore, the administrators admitted that IBORgis has no pdf extracting facility.
- Support policy scored acceptable; most of the responses to this question were neutral. The percentage of satisfied and dissatisfied users was the same. On the one hand, users know the importance of TopDesk (<http://www.topdesk.com>); on the other hand, they were not comfortable with a digital request (via TopDesk) per problem. In general, there is not a big resistance on this policy.
- Most of the users prefer to call administrators to seek support than to use other support methods. The users last preferred choice is to call ICT helpdesk.
- Searching scored well. All of the users were satisfied with the search facilities of the system.

The satisfaction situation according to the indicators is as follows:

- Users are not satisfied with comfort sub indicators (administrators and Intranet news),
- Acceptability sub indicators scored well because:
 - According to the users, IBORgis helps to be more productive. More productivity is one of the important goals of SDI,
 - The majority will recommend IBORgis to a colleague, this means that IBORgis has important benefits for the users and the organisation,
 - Preference sub indicator scored well because Desktop Interface is available for all the staff members and most of the users who filled the questionnaire are working fully or partially at the office, and
 - Overall satisfaction scored well. The users gave the system an overall satisfactory rating of 7.6 from 10.

Furthermore, other aspects scored well because:

- The responses on municipal demands from SDI question showed that the available datasets have a role to support business processes of the municipality, table 43.
- IBORgis support sustainability, which is the goal of the municipality. According to most of the users, IBORgis has an integral view of social, ecological and economic data.
- Most of the users (60%) did not use alternative map viewers, figure 58 and table 45.
- The responses on question (Which Map viewer do you use with IBORgis?) is not complete. May be something technically went wrong in the questionnaire preparation with SurveyMonkey software.
Some users (20%) use Google maps frequently as an alternative map viewer. Open Street Map used also by the users in an average level. According to the responses, the users do not use any other Map viewers and this is strange!
- The occupation of most of the users responded to this questionnaire are staff members. This question asked for general information on users. A majority of the users should be (as usual) staff members.
- As a response to suggestion question, the users also explained why they answered some of the questions with dissatisfied. Paying attention to suggestions and comments make the SDI situation better.

Usability aspects	Indicators	Sub indicator	(very) satisfied%	Result	Explanation/ Calibration	Result after calibration
EFFECTIVENESS	Quality		60%	Good	The users were satisfied with the quality of offered data. This is an expected result because governmental organisations in the Netherlands (including municipalities) have lots of concern with the data quality, figure 50, table 28.	Good
	Quantity		80%	Good	Most of the users (80%) were satisfied with the quantity of offered data. There were no dissatisfied users. Users can consult round 200 layers via IBORgis, figure 51 and table 29. One of the responses on the suggestion question was “Lots of Maps”.	Good
EFFICIENCY	Temporal efficiency	Time per session	NA	NA	Most of the users spend more than an hour per session. That means the user obtain needed information within a long time. The reason could be the quantity of available datasets or type of users (users who deal with projects spend more time per session), figure 52 and table 30.	NA
		IBORgis speed	100%	Good	All the users were (very) satisfied with the speed of IBORgis, figure 53 and table 31.	Good
	User efficiency	Ease of use	100%	Good	All the users were agreed that IBORgis is easy to use, figure 54 and table 32.	Good
		Printing	40%	Bad	The number of neutral and dissatisfied users were more than satisfied users. There is no very satisfied user. This means IBORgis have a problem with printing. Furthermore, the administrators admitted that IBORgis has no pdf extracting facility.	Bad
	Support efficiency	Support policy	20%	Bad	Figure 56 and table 34 show that most of the responses to this question were neutral. The percentage of satisfied and dissatisfied users was the same. On the one hand, users know the importance of TopDesk (http://www.topdesk.com); on the other hand, they were not comfortable with a digital request (via TopDesk) per problem. In general, there is not a big resistance on this policy.	Acceptable
		Support method	NA	NA	Most of the users prefer to call administrators to seek support than to use other support methods. The users last prefer choice is to call ICT helpdesk, figure 57 and table 35.	NA
		Searching	100%	Good	All of the users were satisfied with the search facilities of the system figure 58 and table 36.	Good
SATISFACTION	Comfort	Administrators	0%	Bad	All the responses were neutral (100%). There were no dissatisfied or satisfied responses to this question, figure 59 and table 37. Further investigation needed to make administrators’ support better.	NA
		Help documentation	40%	Bad	Most of the users had neutral responses (60%). There were also (40%) satisfied and very satisfied responses. There is no dissatisfied responses, figure 60 and table 38. This means that the help documentation is good. Westland developed already video explanations for the users as well.	Good
		Intranet messages	20%	Bad	Neutral responses scored the highest (40%) thus by looking at (very) dissatisfied responses (40%) one can conclude that intranet messages are not acceptable, figure 61 and table 39.	Bad
	Acceptability	Productivity	100%	Good	All of the users say that IBORgis helps them to be more productive, figure 62 and table 40. Supporting user to be more productive is one of the important targets of SDI.	Good
		Recommend to a colleague	100%	Good	The responses of all the users on this question were yes. This means that IBORgis has good added value to the organisations and it is important to the users, figure 63 and table 41.	Good

	Preference	Preference	NA	NA	All of the users who filled the questionnaire work full or part time at the office (100%), figure 64 and table 42. This indicates the importance of desktop interface to use the system.	Good
	Overall		76%	Good	The users gave the system an overall satisfactory rating of 7.6, figure 65.	Good
Others	Municipal demands from SDI	Business processes	NA	NA	The main purpose of this question was to support answering research question 2 (Business process supported with SDI). The responses should explain the system importance for the organisation's processes, table 43.	NA
	Sustainability	Municipal goals	80%	Good	According to the users, IBORgis have a neutral view of social, ecological and economic data, figure 67 and table 44.	Acceptable
	Alternatives		NA	NA	Most of the users (60%) do not use alternative map viewers, figure 58 and table 45. The responses on question (<i>Which Map viewer do you use with IBORgis?</i>) is not complete. According to the responses Google maps is used frequently as an alternative map viewer by 20% of the users. Open Street Map used also by the users in an average level. According to the responses, the users do not use any other Map viewers, this is strange! figure 69 and table 46. May be something technically went wrong in the questionnaire preparation with SurveyMonkey software.	Good
	Occupations		NA	NA	All the respondents to this questionnaire are staff members (100%), figure 70, table 47. This question asked for general information to check. A majority of the users should be (as usual) staff members.	Good
	Suggestions		NA	NA	This question explains (in general) why the users responded with dissatisfied to some of the questions. Paying attention to suggestions and comment make the SDI situation better, table 48.	NA

Table 50: Westland questionnaire results

11. CONCLUSIONS AND RECOMMENDATIONS

11.1. Conclusions

The overall objective of this research is to assess the usability of municipal SDI from the user's perspective in support of the municipal goals. In order to address the overall research objective, the research questions and sub-questions were answered as follows:

1. *What are the characteristics of municipal SDI?*

The characteristics of municipal SDI are explained in chapter 3, 4 and 5. The following is the description of the outcome:

a. *SDI (hierarchy)*

According to Rajabifard and Williamson (2000) Municipal SDI is considered as a Local SDI.

b. *Municipal SDI relationships and influences*

Different SDI levels have impact on each other. Municipal (Local) SDI has a huge impact on State SDI (e.g. provincial SDI) and in terms of fundamental datasets on National SDI. On the other hand, State SDI also has direct impact on Local SDI. The National SDI also has some impact to the Municipal SDI, table 1.

c. *SDI model of the municipality*

The municipal SDI works at the operational level according to the Product Based Model (Rajabifard, 2001).

d. *Geographic Information System (GIS) and its Architecture*

Geographic Information System (GIS), explained in appendix 1, is considered as the underpinning technology for SDI and it has a significant role in facilitating data collection and storage as well as facilitating decision-making based on spatial data processing and analysis (adapted from Mansourian et al., 2004). The internal GIS or inter-organisational GIS in the municipality is the windows which the users looking through at SDI and we can call it Internal SDI.

e. *The present SDI situation of the study area (municipality of Maassluis and Westland)*

The present SDI situation of the study area (municipality of Maassluis and Westland) described according to the five Geowares concept (Humanware, Dataware, Orgware, Software and Hardware). Interviews dedicated for explaining the five Geowares situation of the study area. The concept of the five Geowares is very important and interesting to visualise the SDI aspects' situations. The five Geowares' descriptions and visualisations are also important to develop SDI for any organisation and especially for the municipalities.

2. *What are the legal obligations, business processes and services for the municipality and residents which are supported by using SDI?*

Depending on interviews and actual use of spatial data in Maassluis and Westland municipalities the three categories are described:

- Legal obligations and laws are listed, which SDI plays essential role for the municipalities to meet them. The following are the imported ones: BAG, BRK, BRT, BGT, BRO, WION, WOZ, Wkpb, WABO, WRO, OW, HR and BRP, figure 22, figure 23, Appendix 3.
- Municipalities have huge numbers of business processes, which depend on SDI or supported with SDI. Interviews and one of the questions of the questionnaire were dedicated to describe the business processes, which depends on using spatial datasets. These spatial datasets are categorised to basic and thematic datasets.

Basic datasets such as basic registers (BAG, BGT, BRK, BRT, BRP, HR, etc.), Official boundaries, Photos (Aerial, Geo-oblique and Cyclorama), Land use plans, AHN, etc. Thematic datasets such as crisis and safety management (e.g. emergency drinking water points, wind, siren locations, reception locations, vulnerable objects, hectometre, waterway marking, monitoring, safety contours, etc.), Public space management (e.g. sewage, green, roads, lighting, playground, multi-year planning, etc.), Environmental data, Archaeological datasets, Statistics, etc.

The business processes which depends on the mentioned datasets are numerous, e.g. checking ownerships, making maps for discussions, View outside situation quickly without having to go outside, making neighbourhood agreements with the residents, maintaining public space facilities, etc.

Each of the spatial datasets can be used in many processes, e.g. BAG. All the government services and organisation must use the address's data of BAG. Furthermore, all other basic registers, laws, governmental instructions must depend on the addresses from BAG if they are in need of using addresses. A resident cannot register him/ herself in the BRP at the municipality if the address, he/she wants to register on, is not registered in BAG. An owner of a parcel is in need to register his/her ownership in BRK and BRK must depend on BAG for the address of the owner. A resident cannot register his/ her business by the Chamber of Commerce (in basic register HR) without a registered address in BAG, etc.

- Municipalities providing better services to their residents depending on SDI. Some of the datasets, which provided or can be provided to the residents, are inventoried, such as waste calendar and containers places, Sports, recreation and green places, Dogs outlets areas, Firework prohibited areas, Salt spray plans (in Dutch: Strooiplan) for safe roads in the winter, etc.

The detail of datasets and business processes explained in chapter 6.

3. How to assess the usability (measure usability aspects from the user perspective) of municipal SDI?

To answer this question, usability framework and assessment approach was designed depending on the literature in the field of local SDI assessment and usability assessment.

According to Grus et al. (2008), the assessment of this kind of researches has two purposes (accountability and knowledge). Nevertheless, my research has also the development purpose because of the study area demands. In this research, the users will evaluate the performance and accordingly, the user's opinions will help development and improvement.

The usability framework depended mainly on ISO 9241-11 definition for usability. The mentioned usability aspects (Effectiveness, Efficiency and Satisfaction) of that definition were foundation stones for the usability framework.

Managing access to GIS software through Microsoft Active Directory and Log files of GIS software in Maassluis municipality helped in finding the users who needed to be contacted for this research.

Sustainability or sustainable development (balance between people, planet and prosperity) selected to represent general municipal goal in this research because sustainability is a long lasting goal of almost every municipality. One of the questions in the questionnaires dedicated specifically for this reason.

Although difficulties in making this subjective topics objective measurable, SMART indicators, sub-indicators and questions for the questionnaire found/ assembled/ adapted (as far as possible) depending on the usability aspects, other's experiences and appropriateness for the study area.

4. What is the usability of SDI in Maassluis and Westland municipalities?

Two Questionnaires based on chosen SMART (sub-) indicators found for research question 3 prepared and conducted to answer this research question in both of the municipalities of Maassluis and Westland.

As a result, the SDI usability aspect situations are as follows:

In Maassluis municipality

- The effectiveness aspects scored well because the quality and quantity of the available/ offered datasets are good;
- The efficiency scored between badly and acceptable mainly because of problems in the system software (Stroomlijn);
- In general, satisfaction aspect scored well because internal support is good, SDI helps users to be more productive, Provided interface acceptable and the system overall satisfaction rating is 6.8 from 10.
- Other aspects scored also well such as SDI supports sustainability and users using other map viewer for other reasons.

This research is useful to Maassluis in finding out the strengths and weakness of its SDI for more development.

In Westland municipality

- The effectiveness aspects scored well because the quality and quantity of the available/ offered datasets are good;
- The following efficiency aspects scored well and acceptable: System speed and Easiness of use, Support policy and Support methods.
- The following efficiency aspects scored badly: Printing, Westland does not have PDF extracting facility either, and Time per session. Although, it depend on users' activities but working more than an hour to accomplish a task via IBORgis is a long time.
- The situation of satisfaction sub-aspect (Comfort - Administrators' support) is not clear. Furthermore, Intranet messages scored badly. Westland municipality does not have specific Geo-information group or team, which has a negative effect on developing of its SDI.
- The following satisfaction aspects scored well: Help documentation because Westland has video explanations as well, Productivity, Recommendation to a colleague, Provided interface, and Overall satisfaction
- Other aspects (sustainability) scored well, thus SDI supports sustainable development.

Westland is in need of developing (and implementing) a new SDI strategy.

11.2. Recommendations for further researches

It is possible to research more on this topic and many parts of my research deserve individual research, e.g.:

1. Dutch government initiatives and municipal SDI;
2. Municipal SDI role to meet legal obligations;
3. Municipal SDI role in Business processes;
4. Municipal SDI role in providing better services for the residents;
5. Municipal SDI role in supporting municipal visions and goals;
6. Municipal SDI effects on sustainability goals;
7. Using the five Geowares concept to develop (Local/ Municipal) SDI;
8. Managing access to Municipal Spatial Data;
9. Improving this research more and applying it on other municipalities (in other countries); and
10. Role of Metadata in Municipal SDI;

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<http://geoserver.org>
<http://heron-mc.org>
<http://mapserver.org>
<http://opentopo.nl>
<http://pdokviewer.pdok.nl>
<http://webofknowledge.com>
<http://westindies-aerialsurveys.com> (Slaagboom & Peeters)
<http://www.ahn.nl>
<http://www.anteagroup.nl> (GBI)
<http://www.binnenlandsbestuur.nl>
<http://www.buitenbeter.nl>
<http://www.centric.eu>
<http://www.crotec.nl>
<http://www.dcmr.nl>
<http://www.encyclo.nl/begrip/Collegeprogramma>
<http://www.esri.com> (ArcGIS)
<http://www.esri.nl>
<http://www.geonovum.nl>
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<https://www.thorbecke.nl>
<https://www.vicrea.nl> (Stroomlijn)
<https://www.youtube.com/watch?v=0UmTdJNW9EI>
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<https://www.zuid-holland.nl>

APPENDICIES

Appendix 1 – Basic definitions

The following are definitions of essential terms and subjects which will be dealt with during this research:

Geospatial data (Spatial data)

Geospatial data is data that refer to the location or the attributes of objects or phenomena located on Earth (Kraak et al., 2010). ESRI defined spatial data as spatial data structure and spatial data model, data structures is information about the locations and shapes of geographic features and the relationships between them, usually stored as coordinates and topology and data models is any data that can be mapped (GIS Dictionary, 2017). Spatial data sets are primarily defined as those which are directly or indirectly referenced to a location on the surface of the earth. When a dataset cannot be related to a location on the surface of the earth is referred as non-spatial data (Sharma, 2016).

Geo-information

Geo-information, or geographical information, is the term applied to any information which can be linked to a specific point on the Earth's surface. This can be related to altitude, the position of a road or bridge, the type or state of vegetation at a given point, or statistical information such as an average temperature in a particular region. This information is created from terrain assessments (physical measurements, surveys, etc.) as well as, very often, from the analysis of space-based or aerial imagery. It is made available in the form of digital databases which are used to produce maps or which are processed by specific software according to the kind of application for which the geographic information is required, e.g. see figure 71. (Airbus Defence and Space, 2017)



Figure 71: Before and after the 2004 tsunami (Airbus Defence and Space, 2017)

Geographic Information System

A geographic information system (GIS), as defined in the Environmental Systems Research Institute (ESRI) is a collection of computer hardware, software, and geographic data for capturing, storing, updating, manipulating, analysing, and displaying all forms of geographically referenced information(geoawesomeness.com, 2017).

GIS lets us visualize, question, analyse, and interpret data to understand relationships, patterns, and trends (ESRI.com, 2017). GIS helps to save costs through greater efficiency, making better decisions, improve Communication, keep better records and manage geographically (adapted from ESRI.com, 2017).

In essence GIS is a central repository and analytical tool for spatial data collected from various sources which can be overlaid and analyse together (geoawesomeness.com, 2017), figure 72.

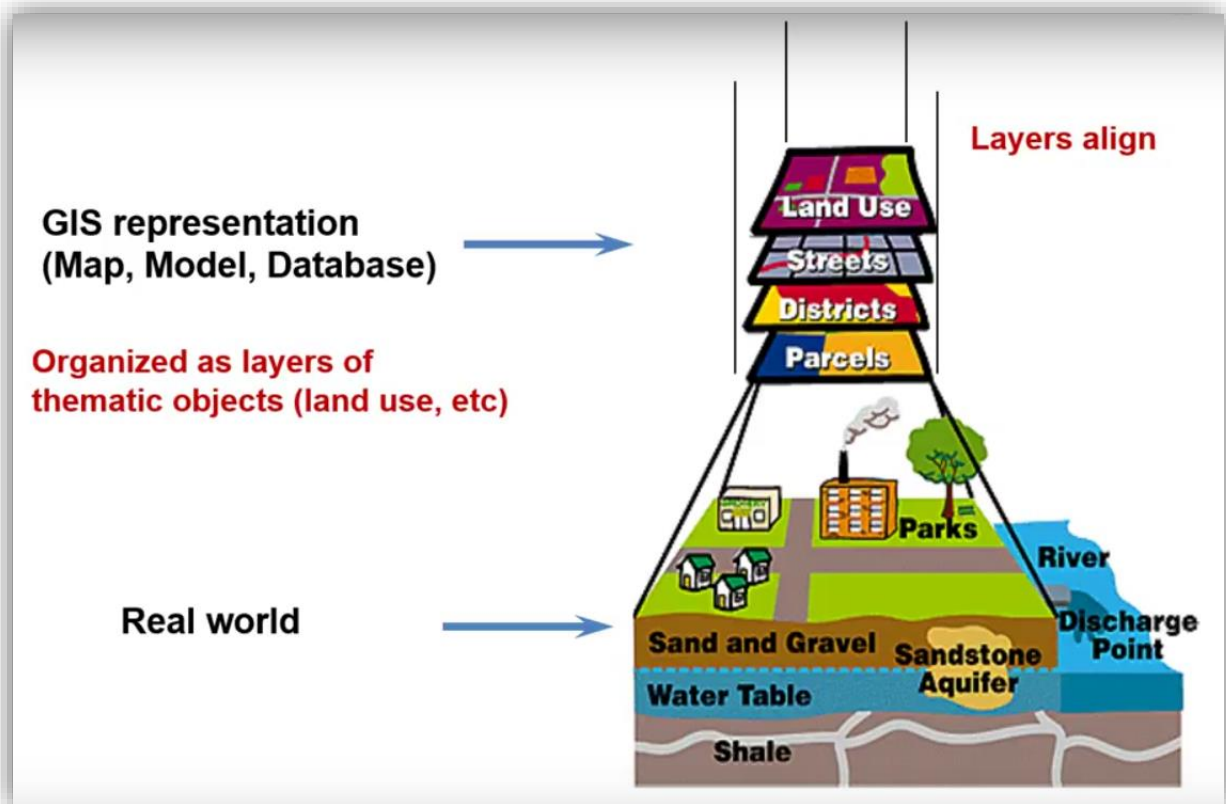


Figure 72: GIS various layers of data (GIS VideosTV YouTube channel, 2017)

This YouTube video: <https://www.youtube.com/watch?v=-ZFmAAHBfOU&t=19s> explains the GIS quickly and in detail.

Geographic Information System Architecture

Almost all municipalities have a Geographic Information System (GIS), during my more than twelve years career I saw many (ICT) architectures for GIS. I think Koedam (2010) describes the basic GIS architecture in a most logical and practical approach. The architecture (figure 73) consists of:

- a. Geo-warehouse:
A central data layer.
- b. Extract, Transform and Load (ETL):
A tool (application) and scripts for converting , importing data from the data management systems to the Geo-warehouse.
- c. Internet mapping server:
A tool (application) and processes that create, edit and update themes of the Geo-portals.
- d. Desktop GIS:
A tool (application) to access, connect, save, edit, analyse and visualize spatial and non-spatial data (of the Geo-warehouse).

- e. Intranet Geo-portal:
A consult application for the thematic maps and data of the Geo-warehouse for the internal use of the organization.
- f. Internet Geo-portal:
A consult application for the thematic maps and data of the Geo-warehouse for the external use (public).
- g. Metadata management system:
Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource. Metadata is often called data about data or information about information. Thus data over system data should be available to the users according to the standards.
- h. Management features and capabilities:
An operational management organization and working procedures to ensure the quality and availability of the system.
- i. Geo-support for the official municipal website.
- j. Cloud data:
From the cloud automatic download of data sets and connection to web services are possible.
- k. Internet and Intranet GIS applications (Viewer) is also possible via mobile and tablets (iPad).

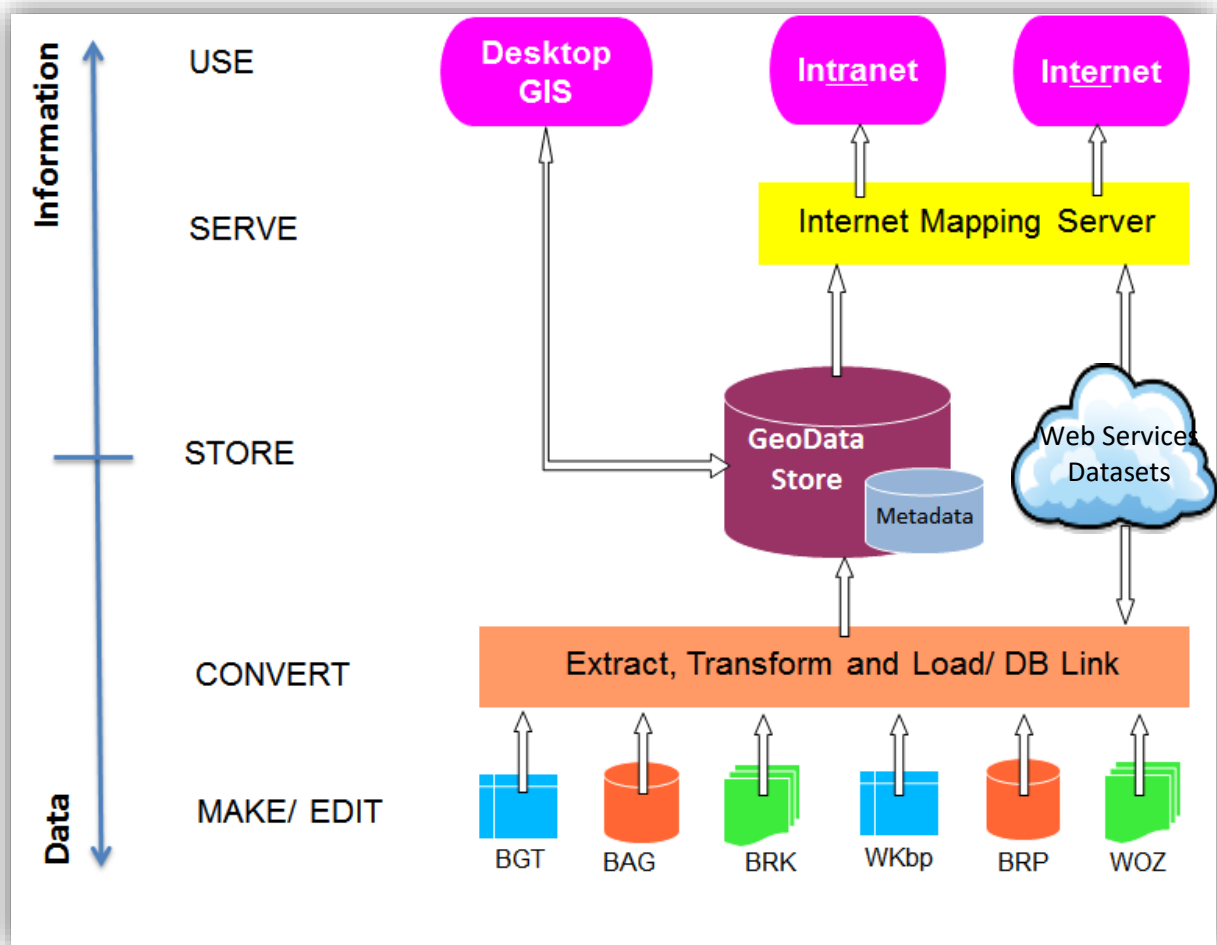


Figure 73: GIS Architecture (adapted from Koedam, 2010)

Knowing the architecture of Municipal GIS is very important not just before designing the system but more so to insure that the system will continue running with good performance. Database connections, database optimisation, system hardware (such as RAM) to name a few have an effect on the performance of the system. The performance of the system has high effects on usefulness of GIS. It is known that system architecture is important to find out the components detail properties of municipal SDI and GIS. This YouTube video on performance of Stroomlijn (in Dutch: <https://www.youtube.com/watch?v=AvBh4pBkeng>) explains how some component of above-mentioned GIS architecture can be dealt with for better performance.

Appendix 2 - Search Strategy

To find needed literature to answer the research questions a literature search need to be done. Some of the available databases will be searched according to the following search strategy:

Steps	Search Strategy							
Topic statement	Assessing the usability of municipal SDI							
Selecting the keywords from the topic	Keyword A	Usability						
	Keyword B	Municipal SDI	OR	Local Government SDI				
	Keyword C	Assessment						
Based on the keywords identified above, selecting synonyms, related terms, and alternate forms for each of these keywords.	Keyword A Synonyms	Effectiveness	OR/ AND	Efficiency	OR/ AND	Satisfaction		
	Keyword B Synonyms	SDI	OR	Spatial Data Infrastructure				
	Keyword C Synonyms	Evaluation						
Formulating a search strategy using Boolean operators ('OR', 'AND') to connect the keywords.	Keyword A Synonyms	Usability	OR	Effectiveness	OR/ AND	Efficiency	OR/ AND	Satisfaction
	AND							
	Keyword B Synonyms	SDI	OR/ AND	Local SDI	OR/ AND	Spatial Data Infrastructure		
	AND							
	Keyword C Synonyms	Assessment	OR	Evaluation				
Selecting appropriate search tools (i.e. library catalogue, an article database, etc.).								
Search	Taking the search strategies from above and inserting it (e.g.) to the following databases: ScienceDirect / Elsevier (http://www.sciencedirect.com) Scopus (https://www.scopus.com) Web od Science (http://webofknowledge.com) NB: There are many databases available (https://www.itc.nl/Pub/Home/library/Search-for-information/all_databases_alphabetically.html)							
By not enough result	Revising search terms and/or removing one of keywords to broaden the results.							
Too many results	Using limits (scholarly journals, or by publishing year, etc...) and/or add another keyword to narrow the results.							

Appendix 3 - Abbreviations

Abbreviations	English	Dutch
AHN	Actual Height Dataset	Actueel Hoogtebestand Nederland
BLAU	Basic registration Wages, Labour and (unemployment) Benefits	Basisregistratie Lonen, Arbeidsverhoudingen en Uitkeringen
BOR	Management of public space	Beher Openbare Ruimte
BRI	Basic Registration Income	Basisregistratie Inkomen
BRK	Basic Register of Cadastre	Basisregistratie Kadaster
BRO	Basic Register of Underground	Basisregistratie Ondergrond
BRP	Municipal Personal Records Database	Basisregistratie personen
BRT	Basic Register of Topography	Basisregistratie Topografie
BRV	Basic Vehicle Registration	Basisregistratie Voertuigen
CAD	Computer-Aided Design	The same
CBS	National Statistics Service	Centraal bureau voor de Statistiek
DB	Database	The same
GBI	Integrated Management Information System	Geïntegreerd Beheer Informatiesysteem
GBKN	Large Scale Map of the Netherlands	Grootschalige Basiskaart van Nederland
GIS	Geographic Information System	Geografisch Informatie Systeem
HR	Basic Register of Chamber of Commerce	Handelsregister
ISO	International Organization for Standardization	Internationale Organisatie voor Standaardisatie
LV	National Service	Landelijke Voorziening
MBA	Master of Business Administration	The same
MBO	Intermediate vocational education	Middelbaar BeroepsOnderwijs
NA	Not Applicable	N.V.T. (Niet van Toepassing)
OW	Environmental Act	Omgevingswet
PDOK	Dutch National SDI	Publieke Dienstverlening Op de Kaart
RNI	Registration Non-Resident	Registratie Niet-Ingezetenen
SDI	Spatial Data Infrastructure	The same or Ruimtelijke Data Infrastructuur
VVR	Security Region Rotterdam	Veiligheidsregio Rotterdam-Rijnmond
WABO	Law of General Provisions environmental	Wet algemene bepalingen omgevingsrecht
WION	Law of underground information exchange networks	Wet informatie-uitwisseling ondergrondse netten
Wkpb	Law of limits public accountability	Wet kenbaarheid publiekrechtelijke beperkingen
WOZ	Basic Register of Real Estate Assessment	Basisregistratie Waarde Onroerende Zaken
WRO	Planning Act	Wet ruimtelijke ordening

Appendix 4 – Personal interviews

Name	Organisation	Occupation	Place	Date
Mr. H. De Groot	Thorbecke	Project manager	Maassluis	11 February 2011
Mr. S. Eftemeijer	Maassluis municipality	Information Manager	Maassluis	27 March 2017
Mr E. Schwencke	Maassluis municipality	Project manager and ICT Specialist	Maassluis	28 March 2017
Mrs. A. Peyrer	Westland municipality	Advisor Green, Water & Ecology	Maassluis (Telephone)	21 April 2017
Mr. H. Over de Vest	Maassluis municipality	Project manager	Maassluis	26 April 2017
Mr. F. van der List	Maassluis municipality	Functional administrator for financial applications	Maassluis	26 April 2017
Mr. S. Wiersma	Westland municipality	Geo-information Specialist	Wateringen	1 May 2017
Mr. Ngoc Dao	Westland municipality	Geo-information Specialist	Wateringen	1 May 2017
Ms. A. Pronk	Maassluis municipality	Policy Officer - Sustainability	Maassluis	2 May 2017
Mr. K. Luijten	Maassluis municipality	Policy Officer - Environmental	Maassluis	2 May 2017
Mr. H. van Dalen	Westland municipality	Areal administrator	Wateringen (Telephone)	3 May 2017
Mr. A. van Kampen	Maassluis municipality	ICT Team leader	Maassluis	5 May 2017
Mr. L.D. Kerkhof	Maassluis municipality	Geo-informatie specialist	Maassluis	8 May 2017
Mrs. S. Brons	Maassluis municipality	Tax team leader	Maassluis	9 May 2017
Mr. M List	Maassluis municipality	External Staff	Maassluis	9 May 2017
Mr. Martijn Snel	Westland municipality	Information Advisor	Wateringen	10 May 2017
Mr. P. Mostert	Maassluis municipality	Green Administrator (BOR)	Maassluis	11 May 2017
Mr. M Okay	Maassluis municipality	Trainee	Maassluis	12 May 2017

Appendix 5 – Questionnaires

A. Maassluis Questionnaire (In Dutch)

<https://nl.surveymonkey.com/r/stroomlijn>



Stroomlijn Tevredenheidsonderzoek

Beste Collega,

Team I&A is benieuwd naar de tevredenheid over Stroomlijn. Daarom houden we dit tevredenheidsonderzoek. Deze vragenlijst geeft je de mogelijkheid om jouw mening anoniem te geven over Stroomlijn.

Deze mening helpt ons om te begrijpen welke aspecten van Stroomlijn jij positief of negatief beoordeelt. Deze informatie gebruiken wij bij de vervanging van Stroomlijn en is dus erg belangrijk! Het onderzoek is ook een onderdeel van de Masterstudie van collega Bestoon A. Mahmoud.

Wil je a.u.b. deze enquête binnen één week (uiterlijk 16 mei 2017) invullen? Het onderzoek bestaat uit 24 (meerkeuze) vragen en duurt ongeveer 5 tot 10 minuten. Denk zo veel mogelijk aan alle taken die jij met Stroomlijn hebt gedaan terwijl je deze vragen beantwoordt.

Alvast bedankt voor het voor deelname aan onze enquête en vriendelijke groeten,

Team I&A - Geo-informatie
10 mei 2017

1. Gebruik je Stroomlijn?

- ☐ Ja
- ☐ Nee, dan hoeft je deze vragenlijst niet in te vullen.

2. Hoeveel tijd gebruik je gemiddeld per keer Stroomlijn?

- ☐ Meer dan twee uur
- ☐ Tussen één uur en twee uur
- ☐ Tussen een half uur en één uur
- ☐ Tussen een kwartier en een half uur

- Minder dan een kwartier

3. In hoeverre helpt Stroomlijn jouw productiviteit?

- In zeer sterke mate
- In sterke mate
- In redelijke mate
- In beperkte mate
- Helemaal niet

4. Kan jij in het kort een (belangrijke) taak beschrijven die jij m.b.v. Stroomlijn kunt uitvoeren?

5. In hoeverre geeft Stroomlijn een integraal beeld van zowel sociale, ecologische en economische data?

- In zeer sterke mate
- In sterke mate
- In redelijke mate
- In beperkte mate
- Helemaal niet

6. Hoe tevreden ben je over het gebruiksgemak van Stroomlijn?

- Zeer tevreden
- Tevreden
- Neutraal
- Ontevreden
- Zeer ontevreden

7. Hoe tevreden ben je over de snelheid van Stroomlijn?

- Zeer tevreden
- Tevreden
- Neutraal
- Ontevreden
- Zeer ontevreden

8. Hoe tevreden ben je over het zoeken naar informatie?

- Zeer tevreden
- Tevreden
- Neutraal
- Ontevreden
- Zeer ontevreden

9. Hoe tevreden ben je over het printen of extracten van een pdf bestand?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

10. Hoe tevreden ben je over de hoeveelheid aangeboden data?

of

Is er voldoende data (informatie) om je werk te ondersteunen?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

11. Hoe tevreden ben je over de kwaliteit van de data?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

12. Het beleid van de ondersteuning is: eerst via TopDesk en bij acute problemen contact opnemen met de beheerders, hoe tevreden ben je over dat beleid?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

13. Welke manier van contact met de helpdesk Stroomlijn heb je voorkeur?

	Voorkeurskanaal 1 (Hoog)	Voorkeurskanaal 2 (Middel)	Voorkeurskanaal 3 (Laag)
ICT helpdesk bellen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Incident maken via TopDesk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beheerders bellen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beheerders e- mailen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. Hoe tevreden ben je over de demonstraties, het uitleggen en de ondersteuning van de Stroomlijn beheerders (Bestoon & Bart)?

- ☐ Zeer tevreden

- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

15. Hoe tevreden ben je over de handleiding die je in Stroomlijn kunt raadplegen?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

16. Hoe tevreden ben je over de berichtgeving op intranet over Stroomlijn?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

17. Welke cijfer geef je voor Stroomlijn?

0 (Zeer Onvoldoende)
Neutraal
10 (Zeer Voldoende)

18. Zou je Stroomlijn bij je naaste collega aanbevelen?

- ☐ Ja
- ☐ Nee

19. Gebruik je een alternatieve kaartviewer in plaats van Stroomlijn?

Gebruik je in plaats van Stroomlijn een andere kaartviewer zoals Google Maps, Open Street Map, enz.?

- ☐ Ja
- ☐ Nee, Dan ga naar vraag 22

20. Welke kaartviewer gebruik je naast Stroomlijn?

Naast Stroomlijn gebruik je misschien ook andere (vaak commerciële) kaartviewers. Welke kaartviewers zijn dat?

	Niet	Weinig	Gemiddeld	Vaak
Google Maps	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Street Map	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overige kaartviewer(s)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. Als je een overige kaartviewer gebruikt. Welke gebruik je dan?

22. Wat is je functie?

- ☐ Leidinggevende
- ☐ Medewerker

23. Waar werk je meestal?

- ☐ Op het kantoor
- ☐ Buiten
- ☐ Allebei

24. Heb je nog opmerkingen of suggesties?

of Welke data of functie wil je nog zien in het (nieuwe) GIS?

Klik a.u.b. op Gereed knoop om jouw antwoorden te sturen.
Hartelijk dank voor je medewerking.

Vorige

Gereed

B. Maassluis Questionnaire (Translated to English)

Stroomlijn - User satisfaction survey

Dear colleague,

Team ICT is curious about the satisfaction on Internal GIS (Stroomlijn). For this reason, we are keeping this satisfaction survey. This questionnaire give you the opportunity to anonymously give your opinion about Stroomlijn.

This opinion helps us to understand which aspects of Stroomlijn is positive or negative. This questionnaire is very important because we will use it in the process of replacing Stroomlijn. The research is also part of the master's degree of our colleague Bestoon A. Mahmoud.

Could you please complete this survey within one week (by May 16, 2017)? The survey consists of 24 (multiple-choice) questions and takes about 5 to 10 minutes. Think as much as possible of all the tasks you did with Stroomlijn while answering the questions.

Thank you in advance for participating in this survey and kind regards,

Team ICT - Geo-information

10 May 2017

1. Are you using Stroomlijn?

- ☐ Yes
- ☐ No, Then.. You don't have to answer the questions.

2. How much time you spend with Stroomlijn per session?

- ☐ More than two hours
- ☐ Between one hour and two hours
- ☐ Between half an hour and one hour
- ☐ Between 15 minutes and half an hour
- ☐ Less than 15 minutes

3. To what extent does Stroomlijn help your productivity?

- ☐ To a great extent
- ☐ To a large extent
- ☐ To a reasonable extent
- ☐ To a limited extent
- ☐ Not at all

4. Can you briefly describe a (important) task that you can carry out by using Stroomlijn?

5. To what extent does Stroomlijn provide an integral view of social, ecological and economic data?

- ☐ To a great extent
- ☐ To a large extent
- ☐ To a reasonable extent
- ☐ To a limited extent
- ☐ Not at all

6. How satisfied are you with Stroomlijn ease of use?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

7. How satisfied are you with the working speed of Stroomlijn?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

8. How satisfied are you with searching information in Stroomlijn?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

9. How satisfied are you with printing and PDF-extracting?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

10. How satisfied are you with the amount of offered data?

or

Is there enough data (information) to support your work?

- ☐ Very satisfied
- ☐ Satisfied

- Neutral
- Dissatisfied
- Very dissatisfied

11. How satisfied are you with the quality of offered data?

- Very satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very dissatisfied

12. Our support policy is: First, contact TopDesk and in case of acute problems contact the system administrators, how satisfied are you with that policy?

- Very satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very dissatisfied

13. What kind of contact you prefer with the helpdesk of Stroomlijn?

	Preferred channel 1 (High)	Preferred channel 2 (Middle)	Preferred channel 3 (Low)
Calling ICT helpdesk	○	○	○
Making TopDesk call	○	○	○
Calling Administrators	○	○	○
e-mailing Administrators	○	○	○

14. How satisfied are you with the Demonstration, Explanation, and Support of the Stroomlijn administrators (Bestoon & Bart)?

- Very satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very dissatisfied

15. How satisfied are you with the Stroomlijn manual that you can consult?

- Very satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very dissatisfied

16. How satisfied are you with the Intranet message-news on Stroomlijn?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

17. What rating do you give to Stroomlijn?

0 (Zeer Onvoldoende)
Neutraal
10 (Zeer Voldoende)

☐

18. Would you recommend Stroomlijn to your closest colleague?

- ☐ Yes
- ☐ No

19. Do you use alternative Map viewer instead of Stroomlijn?

Map viewer Such as Google Maps, Open Street Map, etc.

- ☐ Yes
- ☐ No, Then go to question 22

20. Which Map viewer do you use with Stroomlijn?

N In addition to Stroomlijn, you may also use other (often-commercial) Map viewers.

Which Map viewers are they?

	Not	Little	Average	Frequently
Google Maps	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Street Map	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other Map viewer(s)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. If you use other Map viewer(s), what do you use?

22. What is your occupation?

- ☐ Supervisor
- ☐ Staff member

23. Where do you usually work?

- ☐ At the office

- ☐ Outside
- ☐ Both of the above

24. Do you have any comments or suggestions?

or What other data or function you want to see in the (new) GIS?

Please click on DONE button to send your answers.

Thank you for your cooperation.

Previous

DONE

C. Maassluis Questionnaire (Published via Intranet website)

Bestoon Mahmoud

nog 1 minuut

Stroomlijn Tevredenheidsonderzoek

Team I&A is benieuwd naar de tevredenheid over Stroomlijn. Daarom houden we dit tevredenheidsonderzoek. Deze vragenlijst geeft je de mogelijkheid om jouw mening anoniem te geven over Stroomlijn.

Deze mening helpt ons om te begrijpen welke aspecten van Stroomlijn jij positief of negatief beoordeelt. Deze informatie gebruiken wij bij de vervanging van Stroomlijn en is dus erg belangrijk! Het onderzoek is ook een onderdeel van mijn Master scriptie.

Wil je a.u.b. deze enquête uiterlijk 16 mei 2017 invullen? Het onderzoek bestaat uit 24 (meerkeuze) vragen en duurt ongeveer 5 tot 10 minuten. Denk zo veel mogelijk aan alle taken die jij met Stroomlijn hebt gedaan terwijl je deze vragen beantwoordt.

De link van de enquête: <https://nl.surveymonkey.com/r/stroomlijn>

Alvast bedankt voor het voor deelname aan onze enquête en vriendelijke groeten,

Team I&A [minder weergeven](#)



Stroomlijn Tevredenheidsonderzoek Survey

Web survey powered by SurveyMonkey.com. Create your own online survey now with SurveyMonkey's expert certified FREE templates.

[Leuk](#) · [Reageren](#)

D. Westland Questionnaire (In Dutch)

<https://nl.surveymonkey.com/r/IBORgis>



IBORgis Tevredenheidsonderzoek

Beste Collega,

Team Belastingen en Basisregistraties is benieuwd naar de tevredenheid over IBORgis. Daarom houden we dit tevredenheidsonderzoek. Deze vragenlijst geeft je de mogelijkheid om jouw mening anoniem te geven over IBORgis.

Deze mening helpt ons om te begrijpen welke aspecten van IBORgis jij positief of negatief beoordeelt. Deze informatie gebruiken wij bij de doorontwikkeling van IBORgis en is dus erg belangrijk!

Het onderzoek is ook onderdeel van de Masterstudie van oud-collega Bestoon Mahmoud, nu werkzaam bij de Gemeente Maassluis.

Wil je a.u.b. deze enquête binnen één week (uiterlijk 18 mei 2017) invullen? Het onderzoek bestaat uit 24 (meerkeuze) vragen en duurt ongeveer 5 tot 10 minuten. Denk zo veel mogelijk aan alle taken die jij met IBORgis hebt gedaan terwijl je deze vragen beantwoordt.

Alvast bedankt voor het voor deelname aan onze enquête en vriendelijke groeten,

Team Belastingen en Basisregistraties

1. Gebruik je IBORgis?

- ☐ Ja
- ☐ Nee, dan da naar vraag 19

2. Hoeveel tijd gebruik je gemiddeld per keer IBORgis?

- ☐ Meer dan twee uur
- ☐ Tussen één uur en twee uur
- ☐ Tussen een half uur en één uur
- ☐ Tussen een kwartier en een half uur
- ☐ Minder dan een kwartier

3. In hoeverre helpt IBORgis jouw productiviteit?

- ☐ In zeer sterke mate
- ☐ In sterke mate
- ☐ In redelijke mate
- ☐ In beperkte mate
- ☐ Helemaal niet

4. Kan jij in het kort een (belangrijke) taak beschrijven die jij m.b.v. IBORgis kunt uitvoeren?

5. In hoeverre geeft IBORgis een integraal beeld van zowel sociale, ecologische en economische data?

- ☐ In zeer sterke mate
- ☐ In sterke mate
- ☐ In redelijke mate
- ☐ In beperkte mate
- ☐ Helemaal niet

6. Hoe tevreden ben je over het gebruiksgemak van IBORgis?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

7. Hoe tevreden ben je over de snelheid van IBORgis?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

8. Hoe tevreden ben je over het zoeken naar informatie?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

9. Hoe tevreden ben je over het printen?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal

- Ontevreden
- Zeer ontevreden

10. Hoe tevreden ben je over de hoeveelheid aangeboden data?

of

Is er voldoende data (informatie) om je werk te ondersteunen?

- Zeer tevreden
- Tevreden
- Neutraal
- Ontevreden
- Zeer ontevreden

11. Hoe tevreden ben je over de kwaliteit van de data?

- Zeer tevreden
- Tevreden
- Neutraal
- Ontevreden
- Zeer ontevreden

12. Het beleid van de ondersteuning is een call maken via TopDesk, hoe tevreden ben je over dat beleid?

- Zeer tevreden
- Tevreden
- Neutraal
- Ontevreden
- Zeer ontevreden

13. Welke manier van contact met de helpdesk IBORGis heb je voorkeur?

	Voorkeurskanaal 1 (Hoog)	Voorkeurskanaal 2 (Middel)	Voorkeurskanaal 3 (Laag)
ICT helpdesk bellen	○	○	○
Incident maken via TopDesk	○	○	○
Beheerders bellen	○	○	○
Beheerders e- mailen	○	○	○

14. Hoe tevreden ben je over de demonstraties, het uitleggen en de ondersteuning van de IBORGis beheerders (Sjoerd en Dao)?

- Zeer tevreden
- Tevreden
- Neutraal
- Ontevreden

- ☐ Zeer ontevreden

15. Hoe tevreden ben je over de handleiding die je in IBORgis kunt raadplegen?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

16. Hoe tevreden ben je over de berichtgeving op intranet over IBORgis?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Neutraal
- ☐ Ontevreden
- ☐ Zeer ontevreden

17. Welke cijfer geef je voor IBORgis?

0 (Zeer Onvoldoende)

Neutraal

10 (Zeer Voldoende)

18. Zou je IBORgis bij je naaste collega aanbevelen?

- ☐ Ja
- ☐ Nee

19. Gebruik je een alternatieve kaartviewer in plaats van IBORgis?

Gebruik je in plaats van IBORgis een andere kaartviewer zoals Google Maps, Open Street Map, enz.?

- ☐ Ja
- ☐ Nee, Dan ga naar vraag 22

20. Welke kaartviewer gebruik je naast IBORgis?

Naast IBORgis gebruik je misschien ook andere (vaak commerciële) kaartviewers. Welke kaartviewers zijn dat?

	Niet	Weinig	Gemiddeld	Vaak
Google Maps	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Street Map	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overige kaartviewer(s)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. Als je een overige kaartviewer gebruikt. Welke gebruik je dan?

22. Wat is je functie?

- ☐ Leidinggevende
- ☐ Medewerker

23. Waar werk je meestal?

- ☐ Op het kantoor
- ☐ Buiten
- ☐ Allebei

24. Heb je nog opmerkingen of suggesties?
of Welke data of functie mis je nog in IBORGis?

Klik a.u.b. op Gereed knoop om jouw antwoorden te sturen.
Hartelijk dank voor je medewerking.

Vorige

Gereed

E. Wetland Questionnaire (Translated to English)

IBORgis - User satisfaction survey

Dear colleague,

Team Taxes and Basic Registrations is curious about the satisfaction on Internal GIS (IBORgis). For that reason, we are keeping this satisfaction survey. This questionnaire gives you the opportunity to anonymously give your opinion about IBORgis.

This opinion helps us to understand which aspects of IBORgis you judge positive or negative. This questionnaire is very important because we will use it in the process of developing IBORgis.

The research is also part of the master's degree of our former colleague Bestoon A. Mahmoud, he is now working at municipality of Maassluis.

Could you please complete this survey within one week (by 18 May 2017)? The survey consists of 24 (multiple-choice) questions and takes about 5 to 10 minutes. Think as much as possible of all the tasks you did with IBORgis while answering the questions.

Thank you in advance for participating in this survey and kind regards,

Team Taxes and Basic Registrations

1. Are you using IBORgis?

- ☐ Yes
- ☐ No, please go to question 19

2. How much time you spend with IBORgis per session?

- ☐ More than two hours
- ☐ Between one hour and two hours
- ☐ Between half an hour and one hour
- ☐ Between 15 minutes and half an hour
- ☐ Less than 15 minutes

3. To what extent does IBORgis help your productivity?

- ☐ To a great extent
- ☐ To a large extent
- ☐ To a reasonable extent
- ☐ To a limited extent
- ☐ Not at all

4. Can you briefly describe a (important) task that you can carry out by using IBORgis?

5. To what extent does IBORgis provide an integral view of social, ecological and economic data?

- ☐ To a great extent
- ☐ To a large extent
- ☐ To a reasonable extent
- ☐ To a limited extent
- ☐ Not at all

6. How satisfied are you with IBORgis ease of use?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

7. How satisfied are you with the working speed of IBORgis?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

8. How satisfied are you with searching information in IBORgis?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

9. How satisfied are you with printing facilities?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

10. How satisfied are you with the amount of offered data?

or

Is there enough data (information) to support your work?

- ☐ Very satisfied
- ☐ Satisfied

- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

11. How satisfied are you with the quality of offered data?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

12. Our support policy is making a call via TopDesk, how satisfied are you with that policy?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

13. What kind of contact you prefer with the helpdesk of IBORgis?

	Preferred channel 1 (High)	Preferred channel 2 (Middle)	Preferred channel 3 (Low)
Calling ICT helpdesk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Making TopDesk call	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calling Administrators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e-mailing Administrators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. How satisfied are you with the Demonstration, Explanation, and Support of the IBORgis administrators (Sjoerd and Dao)?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

15. How satisfied are you with the IBORgis manual that you can consult?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

16. How satisfied are you with the Intranet message-news on IBORgis?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied

17. What rating do you give to IBORgis?

0 (Zeer Onvoldoende)
Neutraal
10 (Zeer Voldoende)

18. Would you recommend IBORgis to your closest colleague?

- ☐ Yes
- ☐ No

19. Do you use alternative Map viewer instead of IBORgis?

Map viewer Such as Google Maps, Open Street Map, etc.

- ☐ Yes
- ☐ No, Then go to question 22

20. Which Map viewer do you use with IBORgis?

In addition to IBORgis, you may also use other (often-commercial) Map viewers. Which Map viewers are they?

	Not	Little	Average	Frequently
Google Maps	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Street Map	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other Map viewer(s)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. If you use other Map viewer(s), what do you use?

22. What is your occupation?

- ☐ Supervisor
- ☐ Staff member

23. Where do you usually work?

- ☐ At the office
- ☐ Outside

- Both of the above

24. Do you have any comments or suggestions?
of What data or function you still miss in IBORgis?

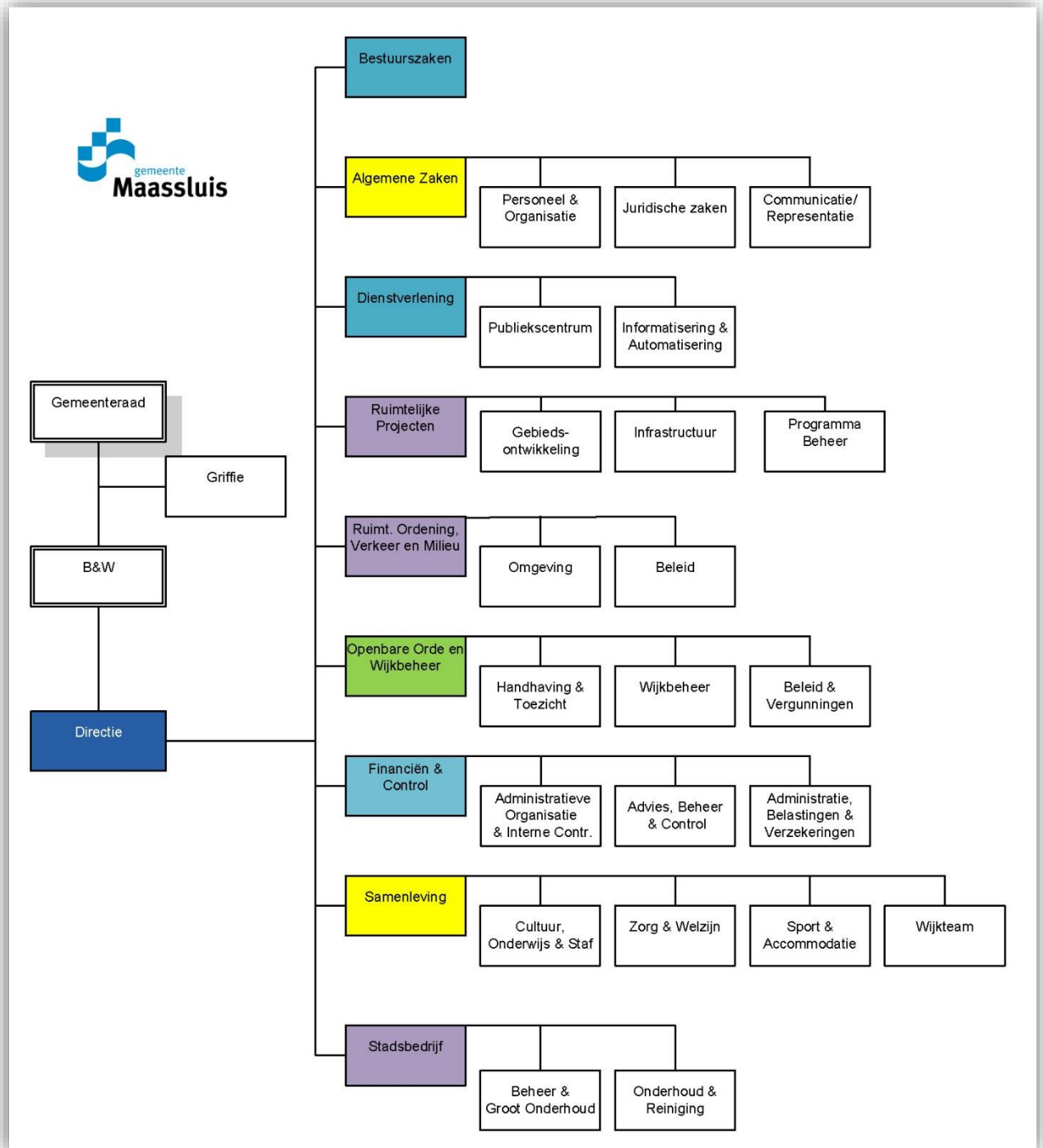
Please click on DONE button to send your answers.
Thank you for your cooperation.

Previous

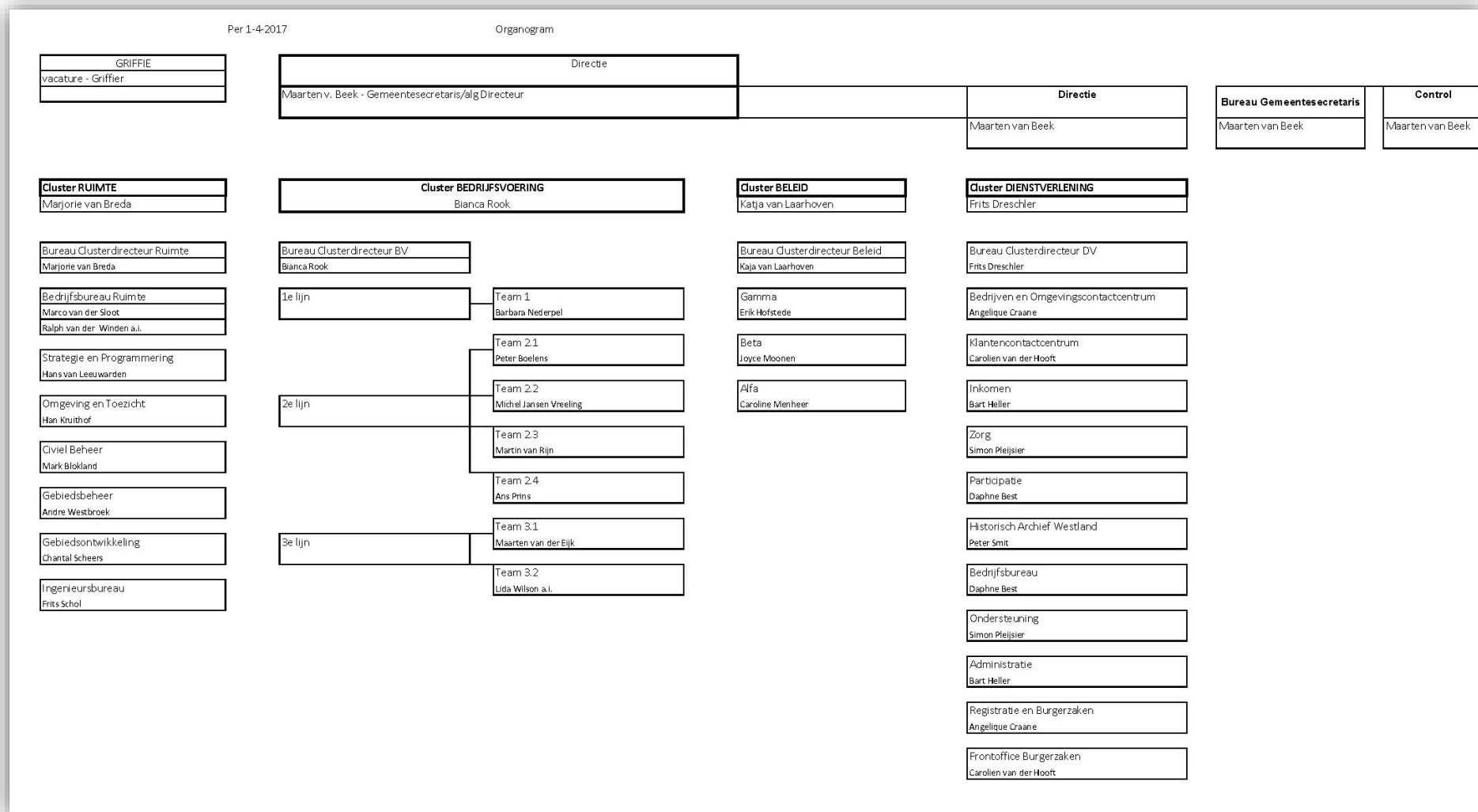
DONE

Appendix 6 - Organograms

A. Organogram of Maassluis municipality



B. Organogram of Westland municipality



Appendix 7 - Data and applications architecture – Westland municipality

