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HOW DOES THE ORGANIZATIONAL STRUCTURE INFLUENCE THE GEO-INFORMATION END USERS' SATISFACTION?

A CASE STUDY OF DUTCH PROVINCES

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Preface

This is my thesis report for the Master's programme in Geographical Information Management and Applications. With this, I conclude my master's programme. In this programme I learned how geographic information can be applied and managed. A broad spectrum of geographical information activities and functions have been highlighted in the programme; from the collection of spatial data to its visualization.

In my thesis research I studied the organizational structure of Dutch provincial government services with regard to geographical information. This allowed me to use the theoretical knowledge acquired in the first year of my GIMA study and the practical experience gained during my internship at the province of Gelderland. When conducting this research and writing my thesis, I gained many new insights into how geographic information is applied and managed in practice. The visits to the various Dutch provinces have broadened my knowledge and have given me a valuable insight in 'the kitchen' of potential employers.

Aside from providing me personal new insights, I hope the results obtained will also be of benefit to others. In this respect, I particularly think of advisors in the field of geographic information. Although they already have a lot of knowledge and the results of the research are partly based on their input, I think that the factual description of the organizations investigated in this research can be of additional value.

I would first of all like to thank sincerely my supervisors at Wageningen University Łukasz Grus and Jaap-Willem Sjoukema for their support and cooperation. Next to providing input and feedback during the course of my research and the writing of my report, they gave me confidence and were always ready to give me advice. Many thanks also to all the GI experts working at the provinces I interviewed and to all those at the provinces who have participated in the questionnaire and have answered my many questions carefully. Thanks to their willingness and cooperation, I have been able to collect the necessary research data. I would finally thank Joop Begemann for his mental and linguistic support in writing this thesis.

Enjoy reading! If you have any questions, please do not hesitate. I am always willing to provide further explanations.

Christiaan Begemann

Wageningen, 8 November 2018

Summary

In recent decades, the geographical information demands within provincial organizations have changed due to various developments in the field of technology data and policy. The change in demand for and supply of geo-information products within an organization affects the position and role of the GI specialist, the GI department and the GI end users.

This research seeks to get insight in the way Dutch provinces[1] have set up their intra-organizational structure with regard to geographical information services and which of these structures satisfy the demands of provincial GI end users the most. The term *GI organizational structure* refers in this study to the position of geographical information and its users in the organization and the way it is managed. The term *demands of provincial GI end users* refers to GI requests made by provincial civil servants as part of their primary work processes.

The first part of the study looked at *What types of GI intra-organizational structures can be distinguished?* in order to establish a theoretical framework. The literature study resulted in a classification system with three organizational models based on the degree of centralisation: Central, Hybrid and Decentral. This three-way division was further elaborated in a theoretical framework using two dimensions, allocation and coordination, and related quantifiable characteristics. *Allocation* involves all characteristics regarding the position of geographical information functions and activities in an organization. *Coordination* refers to the level of centralized coordination or control of the geographical information related activities in an organization. The resulting theoretical framework served as a basis for the empirical (second) part of the research.

The empirical part of the research first focused on the question *Which types of GI organizational structures can be identified within Dutch provinces?* For this purpose, it was decided to use the comparative case study as method of research. Based on the theoretical framework developed, interviews were conducted with geo experts working at seven provinces and for each province a GI organizational chart was elaborated. After an extensive analysis of these interviews, it was concluded that the organizational structure of the provinces studied all have the characteristics of the Central Model, combined with some hybrid organizational features. The degree of centralization is more or less the same.

However, an interesting difference was found in the positioning of the central GI unit. Based on the interviews, three positioning models were distinguished to be used for further research:

- IT-model – GI unit positioned within the IT Department;
- Policy-model – GI unit positioned in a policy department, next to the main end users;
- Public Services-model – GI unit positioned in a department concerned with providing all kind of services to both internal and external end users.

The geo-advisers explained the motives behind the choices made for the positioning of the central GI unit and mentioned a number of aspects which are important for the functioning of the GI organization and are influenced by the positioning of the team. These aspects were clustered into four themes used in the second part of the empirical research: Accessibility of the GI unit, Design process of information products, Quality of services provided by the GI unit and Supporting service.

[1] Dutch provinces => in the context of this report, 'province' means the provincial governmental organization within each of the 12 Dutch provinces and which is responsible for the implementation of the provincial policy.

The classification system based on the positioning of the central GI unit was used in the second part of the empirical research which focused at the research question *To what extent do the identified provincial GI organization structures satisfy the demands of the GI end users?* As method of research, the questionnaire was chosen. The questionnaire was based on the four themes mentioned above and was conducted among GI end users working at six provinces belonging to either the IT-model or the Policy-model. The one province with a Public Services-model refrained from further participation in the study.

Based on the results of the questionnaire, it was concluded that the demands of the GI end users within the current provincial organizational structures are overall adequately met and that the positioning of the central GI unit does not seem to have an influence on the degree of satisfaction. The survey did however show that the level of satisfaction of GI end users was significantly higher in small-size organizations than in large-size organizations. This study will give geo advisers at the provinces a better understanding of how provincial organizations are organised, which will be useful to them when making new decisions.

It is recommended to do further research on the relationship between the positioning of the central GI unit and their role in the organization. In this respect, it would be interesting to conduct further research on the changes in the organizational structures and positions of the central GI unit and the role of governance in time, over the past decades. Also, there seem to be many research opportunities in the area of self-service organizations and the way in which they can meet GI end user demands. The observation that the degree of satisfaction is higher in small sized organizations than in large sized organization is something to consider in further studies.

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1. Introduction

1.1 Project context

Over the last decades the use of Geographical Information (GI) has become increasingly important to society to inform about location-related phenomena. Geographical Information is information about places on the Earth's surface (Heywood, Cornelius, & Carver, 2011, p. 19). Geographical Information has evolved into a standard component of and essential source of information for governmental and private organizations. Driven by technological developments, Geographical Information Systems (GIS) have been implemented in many organizations (Petch & Reeve, 1999b, p. 2) to manage the geographical information. A GIS is a tool to collect, store, retrieve, transform, analyse and display geographical information (Burrough, McDonnell, & Lloyd, 2015, p. 3).

In the early phase of GI development, GI was often implemented spontaneously in an organization to support the business (Chan & Williamson, 2000, p. 287). As a result, each department with location-related services introduced its own GIS and had its own GI expert(s) (Chan, 1998, pp. 158–159). Examples of these departments are policy departments who develop governmental plans and executive departments who execute these plans. In later stages, organizations developed more corporate GI approaches with central coordination of the departments or subsections into which an organization is divided (Campbell, 1996, p. 626). This development resulted in the establishment of separate GI departments.

GI specialists used to be the only civil servants within an organization who had access to geographical data and the associated GI tooling (Sugarbaker, 2005, p. 615). When a policy maker needed a cartographical product, such as a map or geographical analysis, he went to a GI specialist, who had the capacities to create these products.

This last decade however, a number of developments in the field of geo-information have progressed rapidly. As a result, the focus of GI has shifted from supply driven to demand driven (Zeeuw & Lemmen, 2012, p. 2) and a review is required of the role and position of GI specialists and departments in the organization (Gaens, Lentacker, & Crompvoets, 2013, p. 41; Sugarbaker, 2005, p. 615).

The first development to be mentioned is Web GIS, where the complete GIS runs in the cloud (Hojati, 2014). This goes a step further than internet GIS, where work is done partly through the web and partly on local servers (Peng & Tsou, 2004). Web GIS makes it possible to exchange data through services and to provide tools to edit, analyse and visualize geographical information which runs in the cloud (Harder & Brown, 2017). This development, from stand-alone computers to cloud-based GI, influences the position of GI in the organization as it encourages the exchange of data and information products (Kraak, 2004, p. 84). This has resulted in an increased use of geographical information in the business processes of organizations and by end users who are more self-service oriented, as they can produce their own geographical information in the cloud. It also changes the relation between GI producers and end users such as policy makers, as the latter can create, access and analyse geographical information themselves without having to send in a request for information to a GI specialist in the organization (Gilfoyle & Thorpe, 2016).

An increase in the use of interactive maps by directors, policy makers and civilians is noticeable (Jong, 2017a, 2017b). Instead of a simple paper map, interactive (web)maps are becoming the new

standard. In an era in which everything seems to run at a quicker pace, policy makers want to have analysis immediately. An interactive visualization of geographical data seems to be the future (Daalhof, 2017). These interactive GI applications can be very helpful to make decisions, as on-demand analyses can be conducted. The development of new hardware such as map tables, makes it even possible to use geographical information during meetings to support instantly spatial policy (Geodan, 2012). This development fits to the idea of Jellema (2013, p. 43), who expect that the current role of geographical information services provided at governments will shift from data-processing to a decision supportive function.

A second major development in GI is the enormous growth of the quantity and availability of open geographical data for everyone through data portals. A few years ago, Henk Scholten (2008, p. 197), professor in Spatial Informatics at the VU, predicted major changes in the field of GI that other expectations would entail. Scholten (2008, p. 197) describes the progress of geographical information using three perspectives: data, visualization and spatial analyses.

The trend of more data is reflected in the development of data portals such as open data portals and metadata registers. For example, the number of geographical datasets at the Dutch national geo-register has grown from 3582 in October 2016 to 5092 in October 2017 (Ministerie van Binnenlandse zaken en Koninkrijksrelaties, 2017). Data portals can be seen as a datawarehouse of governmental datasets provided in various ways, such as GI files and web services. Portals ask for adequate metadata and reliable data services (Postma & Arragon, 2014, p. 5).

This development has made it possible to answer more complex questions, based on geographical information. As a result, the data management strategies of the data provider have to be changed. On the other hand, data providers will receive less data requests, as most data is accessible through data portals (Postma & Arragon, 2014, p. 5).

The establishment of data portals, the increase in open data and the growing number of Dutch key registrations[2] have raised the awareness of geographical information among the policy makers. As a consequence, policy makers within governmental organizations have higher demands and expectations regarding up-to-date geographical data and visualizations, which they can use as input for their policy making (Dessers, Van Hootegem, Crompvoets, & Hendriks, 2010, p. 7). The new Dutch Environment & Planning Act (Omgevingswet) for example will integrate the geographical information even more in the policy domains, as it combines different spatial regulations on the basis of location (Dolle & Koperdraat, 2017; Government of the Netherlands, 2017). It is plausible that this will ask for new geographical data sources.

The above described developments were made possible also because of technological developments in the field of data, software and hardware. These developments have enabled GI employees and departments to offer more complex information products to end users, such as policy officers (Somers, 1998, pp. 160–161). An example of one important technological development in hardware is the improvement of the computer specifications (Batty, 2005). Almost every present-day computer or laptop is able to run GI software (Burrough et al., 2015, p. 4). This makes it possible for a broad range of people to collect, store, retrieve, transform and display geographical information.

[2] Dutch key registrations = Nederlandse Basisregistraties

It can be concluded that because of technological developments and the availability of data, policy officers are nowadays asking increasingly complex questions and demands of end users have shifted to more complex "self-service" GI tools which they can use to analyse data and create their own geographical information products, like an interactive webmap or app. The shift from supply driven to demand driven challenges traditionally allocated GI roles and organizational structures and changes the relation between GI producers and end users.

1.2 Research problem

The developments outlined in the previous paragraph has, as mentioned before, led to a shift in focus of GI from supply driven to demand driven and have been accompanied by a debate on the position and role of geographical information within organizations (Bevelander, 2007, p. 375). The change in demand for and supply of geo-information products within an organization makes it necessary to change the position and role of the GI specialist, the GI department and the GI end users (Zeeuw & Lemmen, 2012, p. 2) and to review the GI organizational structure.

According to different studies, the organizational structure has a considerable influence on the degree of success of geographical information services in organizations (Dessers, 2012, p. 21; Kurvers & Van Arragon, 2006, p. 370; Lemire & Schlosser, 2003; Traub, 1998) and organizations should update their GI organizational structure, in line with the demands of the users (Somers, 1998, p. 158). According to Somers (1998), a GI organizational structure should give a proper representation of the role of GI and a GI department in an organization. By studying the GI organizational structure, insight can be gained in the role of GI in an organization.

The problem that will be addressed in this research is whether the GI organizational structures of provincial governments in the Netherlands are sufficiently adapted to the aforementioned changes in the GIS world. It will look at the way(s) the different GI organizational structures meet the change in the demands for geographical information products and overcome the perceived gap between the GI demands of civil servants working at executive and policy departments and the GI products delivered by the geographical information specialists.

The problem described is applicable for different governmental organizations. In order to ensure a science-based and in-depth study, this research is limited to the GI organizational structures of Dutch provinces[3] (Figure 1.1), as they are one of the most dominant governmental bodies in the field of geographical information in the Netherlands (Kurvers & Van Arragon, 2006). For example, the provinces provide more than two thousand open geographical datasets within the National Geo-register. The responsibilities of the provinces are also very diverse and they need geographical data for their policy areas such as spatial planning, environment, housing, traffic, nature and waterways (Kurvers & Van Arragon, 2006, p. 370). Within these organizations, there is a lot of interaction between GI specialists and internal GI end users, such as policy makers. In order to carry out the provincial duties, geographical information is needed (Arragon, 2005). A solid organizational structure should guarantee this.

[3] Dutch provinces => in the context of this report, 'province' means the provincial governmental organization within each of the 12 Dutch provinces and which is responsible for the implementation of the provincial policy.

Figure 1.1 Administrative boundaries of the 12 Dutch provinces

Some governmental organizations, such as the Province of Zuid-Holland, have started changing the scope and role of their GI department (Van Niel, 2017). In their vision, the GI department will function as a facilitator, providing self-serving GI tools and ready-to-use-data to the policy departments of the organization, their main client. By focusing on self-service, the GI department of the Province of Zuid-Holland offers its customers the opportunity to perform their own GI analyses and to produce maps themselves. This development is in line with the developments outlined by Sugarbaker (2005, p. 615), who stated that the role of GI departments is changing from providing ready-made products to coordination and facilitating of geographical information within organizations. An important mechanism to ensure this is the presence of a well-functioning geographical information infrastructure (Dessers et al., 2010, p. 1). Although the literature on geographic information infrastructure (GII) does emphasize the importance of organizational structures, there seems to be a lack of studies that focus on the intra-organizational structure. The latter refers to the organizational structure within the organization. Most GII studies focus on inter-organizational structures (Dessers et al., 2010).

1.3 Research objectives

As stated in the previous paragraph, this research aims to contribute to a better understanding of the current role and place of geographical information in Dutch provincial organizations. Based on these results, GI organizational structures can be enhanced in order to facilitate the demands of policy makers at Dutch provinces. This has resulted in the following research objective:

> ***Identify the current GI organizational structures within Dutch provinces and evaluate which of those structures satisfy the demands of provincial GI end users the most.***

The first part of the objective is about getting a better understanding of the GI organizational structures used at the Dutch provinces. The second part is about the evaluation of the identified organizational structures in order to obtain insight in the advantages and disadvantages of these structures with regard to the demands of the provincial GI end user. Provincial GI end user refers to all users of geographical information services provided by GI specialists within the province, such as policy makers and road authorities. In order to reach this objective, three research questions have been developed.

Question 1:
The first question is theoretical in nature and provides insight in existing literature on GI intra-organizational structures.
What types of GI intra-organizational structures can be distinguished?

Question 2:
The answer on the second question will provide insight in the types of GI organizational structures that are currently used at the provincial governmental bodies.
Which types of GI organizational structures can be identified within Dutch provinces?

Question 3:
In order to be able to evaluate the identified GI organizational structures with regard to the demands of the provincial GI end user, insight is needed in whether the user demands are properly met or not and in the advantages and disadvantages of the different structures as perceived by the GI end users.
To what extent do the identified provincial GI organization structures satisfy the demands of the GI end users?

The analysis of the results collected under questions 2 and 3 will lead to insight in the different GI organizational structures used within the Dutch provinces, in what characteristics of an organizational structure are of importance for meeting the GI demands and, possibly, which structure will best meet the GI needs of the GI end users.

1.4 Scope of research

To avoid false expectations and misunderstandings, this study focusses primarily on the 'orgware' of Dutch provincial organizations and on the demands of provincial GI end users. ***Orgware*** is about the organizational structure of organizations and the way organizations exchange their geographical information (Traub, 1998).

The emphasis of this study is on the dimension of orgware, as this is strongly related to the main research object of this study: 'GI organizational structures'. The term ***GI organizational structure*** refers in this study to the position of geographical information and its users in the organization and the way it is managed. In general, this includes geographical information or mapping departments and GI end users spread across the organization. The focus of this research is also limited to the GI intra-organizational structure of the Dutch provincial organizations and not on the inter-organizational structures that may exist.

In terms of Geographical Information Infrastructure (GII) the intra-organizational level is the lowest level and is synonym to the Corporate GII, according to Jellema (2010, pp. 6, 14). Within GII, different levels can be distinguished, as can be seen in Figure 1.2 (Williamson, Rajabifard, & Feeney, 2003). Speaking in terms of GII, the scope of this research is on the orgware of a corporate GII.

Figure 1.2 GII hierarchy model (Williamson et al., 2003)

The second part of the research objective refers to '***demands of provincial GI end users'***. This refers to all geographical information products which are requested by provincial civil servants, such as data services, cartographical maps, (web) applications and analyses. The research is focussed on the demands of internal users within the provincial organizations. The demands of external users will indirectly be taken into account, as internal demands are related to provincial tasks that ultimately serve the interests of the citizens of the province.

The research method as conducted to achieve the research objectives can best be described as diagnostic. According to Verschuren & Doorewaard (2010, p. 76), a diagnostic research should provide insight in background and causes of the problem. It may help decision makers develop workable proposals for organizational change and improvement (Harrison, 2004, p. 1). In this research, this has been done by analysing the GI organizational structures of Dutch provinces and the way they facilitate the exchange of geographical information within the organization.

The purpose of this research is not to identify or develop the ultimate organizational structure which fits all Dutch provinces. Neither is this study to be considered as a study in organizational sciences; it is a study in the field of geographical information management.

1.5 Reading guide

After the introduction, Chapter 2 describes the literature research done on existing theories about types of organizational structures and classification systems of organizational models, in order to answer research question 1. This results in the presentation of the theoretical framework which serves as the theoretical basis for the empirical research conducted for research questions 2 and 3.

Chapter 3 is about the research design of the empirical part of the study. The research strategy chosen is explained and the methods used are described, including the way the data was collected and analysed.

The results of the conducted comparative case study to answer research questions 2 and 3 are presented in Chapters 4 and 5. Chapter 4 is about the types of GI organizational structures identified at the Dutch provinces and Chapter 5 describes to what extent a provincial GI organization meets the demands of their GI end users, including identified advantages and disadvantages.

In Chapter 6, the conclusions, limitations and recommendations of the conducted research are given. A summary of the report structure is given in Figure 1.3.

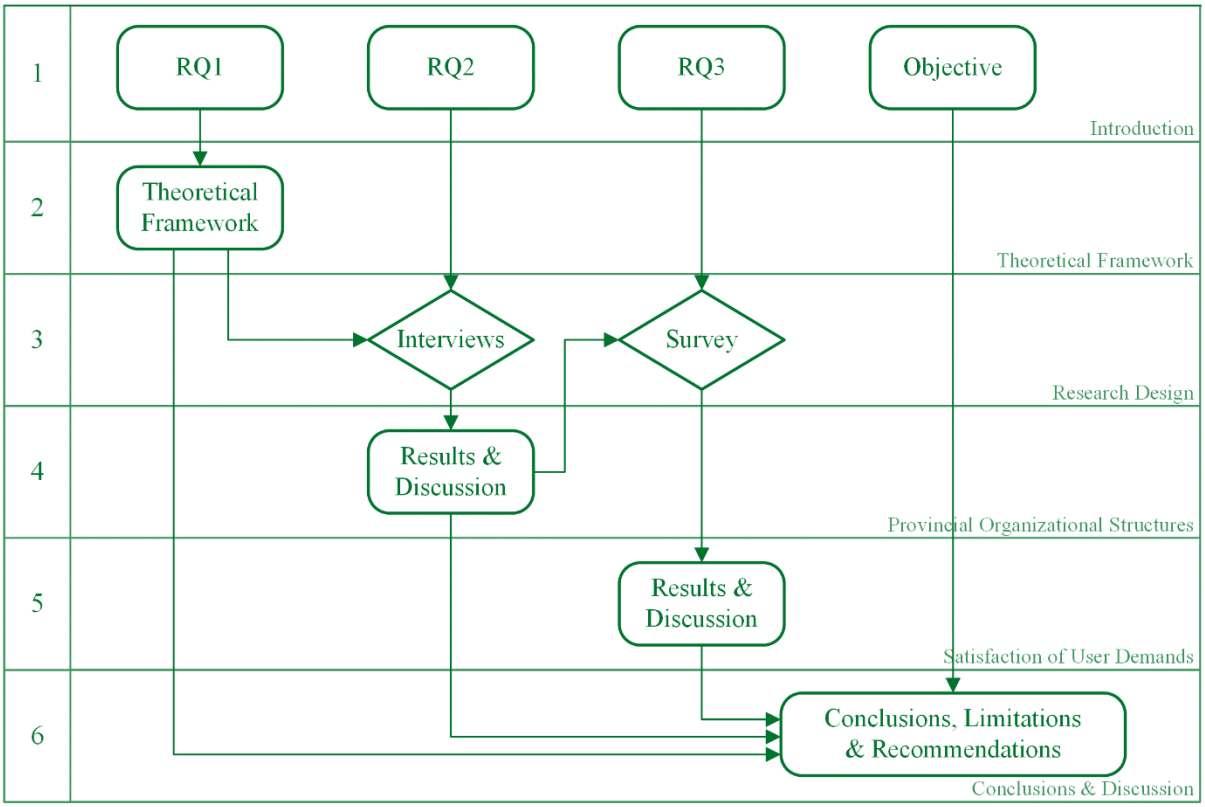


Figure 1.3 Overview of report structure

2. Theoretical Framework

This chapter is about the literature study carried out to find an answer to the first research question:

RQ1 - What types of GI intra-organizational structures can be distinguished?

In this literature study, different types of organizational structures and models with regard to geographical information used within (governmental) organizations are examined. The study will lead to a theoretical framework of the types of GI intra-organizational structures on which the empirical part of this research will be based. The empirical part is described in the Chapters 3, 4 and 5.

A theoretical framework is a framework that serves as a starting point for looking at the research object (Verschuren & Doorewaard, 2007, p. 17) It draws the concepts, terms, definitions, models and theories from literature within a given field of study which can be used to interpret empirical results (Anfara & Mertz, 2015, p. 11). It serves, so to speak, as a kind of searchlight from which the research object can be approached. The theoretical framework indicates the point of view from which the research object is examined and provides a general overview of which facets are being studied and which are not (Verschuren & Doorewaard, 2007, p. 75). In other words, it serves as a kind of guide to frame the empirical results (of interviews and questionnaires) and the discussions and conclusions of the study (Anfara & Mertz, 2015, p. 217). The objective of the first research question described at the beginning of this chapter is in total compliance with the principles of a theoretical framework.

In Paragraph 2.1, the definitions and characteristics of a GI organizational structure are discussed, based on the outcome of the literature study. In Paragraph 2.2, three types of classification systems of organizational models are described and the choice for the classification system to be further used in this research is presented. The most important characteristics of the models within the classification system chosen will be listed and summarized in a framework in Paragraph 2.3. The chapter is concluded with a short résumé in Paragraph 2.4.

2.1 GI organizational structures – Definitions & characteristics

The main research object of this study is the GI organizational structure, see Paragraph 1.4. This concept is defined within existing literature in different ways. This paragraph provides an overview of these definitions and discusses the characteristics of an organizational structure.

Definitions of organizational structure

Within a geographical information infrastructure, three types of components can be distinguished according to Hendriks, Dessers & Van Hootegem (2012, p. 1486): "

1. *organizational structures, or the pattern of tasks and the coordination needed to achieve the objectives;*
2. *skills and competencies of individuals and groups required;*
3. *all other resources, identified as technological components, employed by these individuals and groups*."

In this research the focus is on the first component: the GI organizational structures.

The organizational structure refers to the division of work in an organization (Achterbergh & Vriens, 2009, p. 27). Gottschalk (2008, p. 184) uses the following definition: *Organizational structure is the formal decision-making framework by which job tasks are divided and coordinated*. In this study the focus will be on the job tasks related to geographical information. The way these tasks are allocated and coordinated in an organization has influence on the other GII components (Hendriks et al., 2012, p. 1490) and on the ability to meet the demands for information products.

In addition to the division of tasks, good coordination is also an important factor. The coordinating capacity of an organization should therefore be in proportion to its coordinating needs in order to deliver the right products (Dessers, Vancauwenberghe, Vandenbroucke, Crompvoets, & Van Hootegem, 2015, p. 405). Products are the result of a sequence of activity steps, which we call a process (Dessers et al., 2012, p. 127). The way business processes are coordinated and executed are described in the process structure.

Characteristics of intra-organizational structures

Within organizational structures, two levels can be distinguished. First the inter-organizational level, in which activities in different steps of the business process can be allocated to different organizations. The focus is on task division between organizations. The second level is the intra-organizational structure. Intra-organizational structures can be characterised as the division, allocation and coordination of tasks across organizational divisions within the same organization (Dessers, 2012, p. 28).

As discussed before, this research focusses on the way Dutch provinces have set up their intra-organizational structure with regard to geographical information services. An interesting and for this research useful framework to analyse the intra-organizational structures has been developed by Dessers (2012). He has conducted a case study on Belgian governmental bodies including their intra-organizational structures with regard to geographical information. In his analysis he distinguishes four organizational structure variables:

a. coordination
b. task division
c. spatial data function - allocation
d. spatial data function - coordination

Dessers (2012, p. 71) operationalizes coordination as the places in the organization where processes are coordinated and controlled. This can be done centrally at a high level, meaning that the coordination and control of the process is executed at the management level, or decentrally at a ‘low’ level, meaning that coordination is largely integrated in the various processes of the organization.

The task division refers to the task allocation between the organization’s departments and services. With regard to task division, Dessers, Van Hootegem, Crompvoets & Hendriks (2010, p. 3) distinguishes two types: function-based and process-based. A function-based task division is characterized by the fact that similar and related tasks are concentrated within an organization. In other words, related tasks are grouped together in one organizational unit. As a result, business processes in an organizational structure with a function-based task division goes criss-cross through the organization. In contrast to the function-based task division, in a process-based task division, departments are set up in line with the business processes. All activities related to a specific information product are concentrated in one department. This may result in a situation where more or less same types of activities are performed parallel, heterogeneous and relatively autonomous in different departments (Vanhaverbeke & Torremans, 1999).

Besides coordination and task division, Dessers (2012, p. 219) discusses the way spatial data is organized within organizations. He uses the term spatial data function, which refers to the set of activities to collect, use and distribute spatial data. The variable 'spatial data function – allocation' refers to the level of functional task division with regard to the spatial data function in an organization (Dessers, 2012, p. 224). The GI activities and data management can be centralized at a central GI department or be maintained in a decentralized way at different departments. The fourth variable 'spatial data function – coordination' describes the level of central coordination of the spatial data function in the organization. *'A high level of centralisation indicates that the coordination and control of the spatial data function is largely situated at a central level in the organization, while a low level signifies that coordination and control is mainly integrated in the various processes of the production and policy units of the organization'* (Dessers, 2012, p. 219).

Conclusion

The organizational structure variables distinguished by Dessers (2012) are a good starting point for analysing the organizational structures of the provinces. The focus of this research is primarily on the organizational structure with regard to geographical information services. Therefore, the last two variables of Dessers:

a. the allocation of GI functions and activities
b. the coordination of GI functions and activities

have been selected as variables to be used in this study. These two variables, or dimensions, focus specifically on geographical information and provide a good starting point to identify the way geographical information is positioned and managed in an organization. The other two variables of Dessers are more related to the entire organization and for this reason it has been decided not to take these variables into account in this study.

2.2 GI intra-organizational models - Classification

As explained in previous paragraph, the organizational structure with regard to geographical information in organizations may differ. In order to be able to distinguish and compare the different existing provincial GI organizational structures, three different classification systems of organizational models as described in literature will be presented in this paragraph and compared with each other.

The term organizational model can be used in various ways and at various levels, like the concepts of geographical information infrastructure and organizational structure. Some articles may use the term 'organizational model' to refer to inter geographical information infrastructures on national level (Jellema, 2013), some to the overall organizational structure within an organization (Mintzberg, 1980), where others use it to refer to the way a specific domain, such as geographical information, is structured in an organization (Holdstock, 2016; Sugarbaker, 2005). The last cited definition by Holdstock and Sugarbaker will be used in this report.

With respect to organizational models that focus on the role and place of geographical information within the organization, different types of models have been described in literature. In general, these models are all based on *"differing arrangements concerning the scope of GI, the degree of integration of GI into business operations, the degree of centralization of GI operation and use and the degree of centralization of management control"*(Somers, 1996). In most articles, a classification system with three types of GI organizational models are presented. Three of these systems will be described below.

Sugarbaker (2005, pp. 611–621) distinguishes three models: (1) Corporate GI, (2) Departmental GI and (3) Project GI.

1. Corporate GI model: an organization type in which the geographical information is managed in, coordinated by and distributed from a central GI unit, often placed in the central information technology-support department of an organization.
   The GI unit supports the departments, by delivering geographical information products. The main advantage of the centralization of GI management in one unit is that it improves the overall productivity and profitability (Sugarbaker, 2005). Other terms which are used to refer to a Corporate GI are Enterprise GI (Somers, 1998; Sugarbaker, 2005) and Corporate SDI (Chan & Williamson, 1999).

2. Departmental GI model: an organization type, in which a department using geographical information has its own GI unit which exclusively supports the department to which it belongs. These units often receive technological support from a central IT department. The departmental GI is typical for organizations in which geographical information is used only in a few departments (Sugarbaker, 2005).

3. Project GI model: an organization type characterized by the fact that it is aimed at delivering an information product only once and within the context of a project. In other words, a Project GI is temporally and may not be considered as an operational system, like Corporate and Departmental models.

Somers (1996) also distinguishes three models: (1) Enterprise GI, (2) GI Service Centre and (3) GI Business tools.

1. Enterprise GI model: an organization type in which geographical information is integrated throughout the organization in different business processes and managed at a central department. The central GI unit operates as a supportive department that centrally coordinates and controls the organization's geographical information and provides software and data to the GI end users. These GI end users, operating decentrally, have direct access to GI and may perform their own analyses. This type has characteristics of both Sugarbaker's Corporate GI and Departmental GI model. Sugarbaker (2005) emphasises that in his Corporate GI model the coordination and in some cases the data is placed in one central GI unit, but production of geographical information products may also be done at a decentralized level. According to Somers (1996), the Enterprise GI model is often used at organizations like local governments.

2. GI Service Centre model: an organization type which has completely centralized their geographical information. In this type of model, end users who are positioned at the programme level may occasionally have at their disposition some simple GI tooling and data. However, most requests for geographical information, ranging from a data server to a simple cartographic map, are executed at the central GI unit. This kind of organization can be found in some companies and large public sector organizations. The strength of GI Service Centre organizations is efficiency, as activities are conducted on a large scale. The main weakness is that users themselves may be inclined to make their own geographic information products, which will affect the autonomy of GI Service Centres (Somers, 1996, p. 51). The GI Service Centre model has more or less the same characteristics as Sugarbaker's Corporate GI.

3. GI Business tools model: an organization type in which geographical information is decentralized. The geographical information used is part of the business processes of and executed at individual GI-participating departments. There is no central control and a central GI unit is missing (Somers, 1996, p. 51).

Within the models of Somers and Sugarbaker, the degree of centralization is a key factor and is of major influence on the organizational structure. Holdstock (2016) puts even more emphasis on the degree of centralization, as his classification of organization models is almost completely based on the degree of centralization of GI activities. To describe organizations, he uses the term GI Governance Models: "*GI governance is the management of an integrated solution that serves an entire organization by offering levels of geospatial functionality, uniform standards, good management, reliable digital data and databases, workflow procedures, training education and knowledge transfer, and a backbone for architecture and infrastructure"*(Holdstock, 2016, p. 123).

Holdstock identifies in his article three organizational models: (1) Centralized, (2) Decentralized and (3) Hybrid. These models are based on an organization in which geographical information is used in an enterprise-wide way. According to Holdstock, these organizational structures are characteristic for local government organizations in the United States. This classification is also often used to describe the organization of IT (Hanschke, 2010, p. 267). In Figure 2.1 a graphical representation is given of the three organizational models.

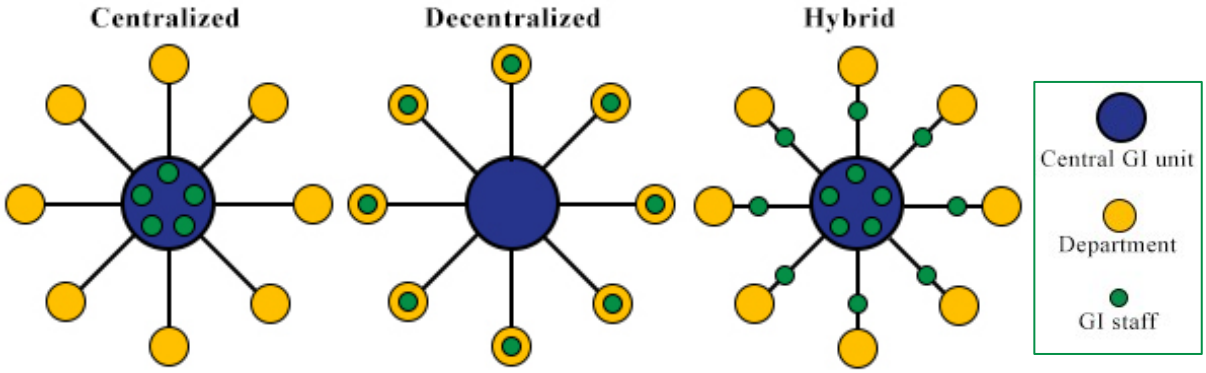


Figure 2.1 Three organizational models identified by Holdstock (2016)

1. Centralized model: includes a central GI unit which is responsible for all geographical information services and products within the organization. It is often placed within an IT department and all GI tasks are handled by this GI unit, with the exception of data viewing and analysis. The end users working at other departments do not have to worry about the processes behind the geographical information products, as they can easily put in their requests at the central GI department.

   The Centralized model can be compared with the Corporate GI model defined by Sugarbaker (2005) and shows some similarity with the Enterprise GI model of Somers as far as the organizational scale is concerned. The Centralized model is also very similar to Somers' GI Service Centre model, as the geographical information is provided by a central GI unit. Like the Corporate GI model of Sugarbaker, the efficient and uniform provision of geographical information services to the whole organization is the strong point of the Centralized model. The high degree of centralization may also be a drawback, because of limited participation of end users in the GI unit's business process, which may result in inappropriate geographical information products.

2. Decentralized model: all GI responsibilities in the organization are divided among the different departments, resulting in different small groups of GI professionals. The end users and their departments are responsible to produce and maintain the geographical information products and share them with each other. A main advantage of such an organization is that the user departments have more freedom to use geographical information in a way which is well in line with their demands and objectives. Bottlenecks of a Decentralized model are the lack of technological competences at the departmental level and the generally weak coordination between departments regarding the use of uniform standards, software and data. This model can best be compared with the Departmental GI model of Sugarbaker (2005).

3. Hybrid model: organizations try to combine the best characteristics of the Centralized and Decentralized organization. In accordance with the Centralized model, a central GI unit is present within a Hybrid model. The unit is responsible for the overall coordination and control of geographical information within the organization, including the management of applications and its licenses, the division of tasks, the overall GI architecture and the GI strategies. Practical GI issues, such as data collection, data analysis and mapping, are carried out by GI professionals with knowledge of the related policy domains. Per policy department or cluster of policy departments, a group of GI professionals will be operating between the central GI unit and the policy departments.

   Possible flaws of the Hybrid model include confusion regarding the division of roles and tasks, missing directions and unnecessary bureaucracy. The strengths of the model are active participation of users and sharing of geographical information. Over the years, the role of a central GI unit should develop from a primarily operational geo-related department to an advisory and coordinating body within the organization. The GI tasks at operational level should be included in the business processes of the operational departments. This will eventually result in a GI unit which encourage and facilitate this adaptation of geographical information throughout the organization (Spotsylvania County Government, 2006).

To show the differences between the three classification systems presented, it is described in Table 2.1 for each different type of model how the GI functions and assets are organised in terms of allocation and coordination. In the table, it is indicated whether the function described within a model is organized at a 'central GI unit'-level or at a 'departmental' level, by using a colour:

- spatial data function - allocation:
  = central GI unit; = departmental
- spatial data function - coordination:
  = central GI unit; = integrated in departmental processes

The choice for the organization structure variables ‘allocation’ and ‘coordination’ of Dessers (2012) is described in Paragraph 2.1. With regard to Table 2.1, it should be noted that the valuation of the organizational variables has been done primarily on the basis of articles of Sugarbaker (2005), Somers (1996, 1998) and Holdstock (2016), in which the general guidelines of the various models and their characteristics are described.

Table 2.1 Description of organizational models of Somers, Sugarbaker and Holdstock per organizational structure variable by Dessers

Variables / Models	Spatial data function - allocation	Spatial data function - coordination	
Corporate GI	- The GI unit supports the departments, by delivering geographical information products.	- Management responsibility normally lies with a central information technology- support organization	(Sugarbaker, 2005)
Departmental GI	- The departmental GI supports one critical business area of an organization.	- It is managed within the department that it supports.	
Project GI	- A GI project has a well-defined deliverable and is produced by or at the request of a department.	- The GI project is often managed without oversight or guidance from a central information technology organization.	
Enterprise GI	- GI use is decentralized. Most users have direct GI access through their own systems and run their own applications.	- Coordination and control are centralized. - GI design, implementation, expansion, and standards are centrally managed, as are the core system software and databases.	(Somers, 1996, 1998)
GI Service Centre	- The GI service group run a GIS, build and provide access to datasets, provide operational and applications services (do jobs). - Users generally do not have GI integrated into their basic operations, although each user may have some of his or her own GI tools and data.	- The GI service centre provide guidance and standards. GI management is placed outside any line department.	
GI Business tools	- Use of GI is relatively isolated	- There is no central control and a central GI unit is missing	
Centralized	- All GI tasks, except data viewing and analysis, are handled by a central GI department or division. All GI staff are located within the central GI department or division.	- Bureaucracy and duplication of effort are minimized since there is a central command and control and a single budget source	(Holdstock, 2016)
Decentralized	- All GI activity occurs within each separate department.	- GI data updating and maintenance responsibilities are assigned to individual GI-participating departments	
Hybrid	- GI end users, editors and custodians are at the Departmental level	- GI management, coordination and control are handled centrally from the GI Division within the IT Department.	

Table 2.1 shows that models in the different classification systems may correspond to each other. For example, the Corporate, GI Service Centre and Centralized model can be considered quite similar. These models have all the characteristics of a centralized organization, including a clear central GI unit which serves as a support service within the organization.

On the other side of the spectrum are the Departmental GI, Project GI, GI Business tools and Decentralized models with values of the two variables which are similar and represent a decentralized organization. These models also have in common that the GI activities are executed in accordance with the business processes.

In between, there are the Enterprise GI and the Hybrid model who correspond to each other and have similar characteristics. In terms of allocation of the GI services, they can be compared to the decentralized and departmental models. In both cases, the operational GI activities are carried out decentrally at departmental level. In terms of coordination, the Enterprise and Hybrid models show much more similarities with the Corporate and Centralized models. After all, the management and control of the GI is assigned to a central GI unit.

Conclusion
In the context of this research, the following classification system will be used for the study on the organization of geographical information in the provinces: Central, Decentral and Hybrid Model. This classification is broadly in line with the models described by Holdstock (2016). The main reason to choose for this classification system is that a clear three-way division in organizational structures can be made based on the variables allocation and coordination of geographical information services as distinguished by Dessers (2012). In addition, Holdstock's classification system is highly suitable for the evaluation of organizational structures of local and regional authorities.

2.3 Characteristics of organizational models

In this research, the classification system of Holdstock will be used which distinguishes three organizational models: Central, Decentral and Hybrid. The organizational structures of the provinces will be studied on the basis of the two variables (or dimensions) distinguished by Dessers (2012): 'allocation' and 'coordination' of geographical information.

For each dimension, based on articles by Holdstock and Dessers, thirteen measurable characteristics have been identified (see Table 2.2) that play an important role in the structure of an organization. Per organizational model (Central, Decentral, Hybrid), these characteristics can be described and can be given an indication of where they are positioned in the organization or how they are organized.

The 13 identified characteristics are described per dimension in the following subparagraphs and are briefly defined for the three models. An overview is subsequently presented in Table 2.2.

Allocation
The allocation of geographical information in an organization focusses on the place of geographical information functions and activities in an organization. The allocation provides insight in where GI roles and GI related roles are placed in the organization and which departments are involved in the execution of activities.

Within the dimension ‘Allocation', the first two characteristics to be taken into account are:

- the presence of a central GI unit
- the position of the operational (supporting) GI activities in the organization

In a Centralized model, a central GI unit or department will be present which is located at the central level in the organization. The unit is responsible for the execution of GI activities and supports end-users at the departments and fulfils their requests for new information products. In a Decentral model, most GI specialists work at various departments, often as part of a business process, and have a much closer relation with the end users than in a Central model. Some form of GI support can therefore be provided within the departments. A central GI unit may also exist, but its main role is to support the use and maintenance of geo-information activities throughout the organization. A Hybrid model will have both a central GI unit and highly specialized GI staff at the departmental level, positioned nearby the business process.

Regarding geographical information in provincial organizations, different types of activities can be identified. According to Holdstock (2016), the location in the organization where these activities are executed is one of the factors that determines and characterises the type of organizational model. Based on various articles the main fields of activity within a provincial organization are:

- Data management
- Database maintenance
- Data creation and editing
- Data analysis
- Data visualization / map production
- Management of applications (incl. soft- and hardware)

(Begemann, 2017; Holdstock, 2016; Roebert & Scheele, 2006; Arragon, 2005).

An organization with GI activities placed in one central unit can be classified as Central organization model, whereas an organization in which the GI activities are distributed throughout the organization will be classified as Decentral (Beck, 2010; Holdstock, 2016). A Hybrid model is characterized as an organization in which certain activities such as data management and software support are placed centrally but other activities, such as for example the editing, creation, analysation and visualization, are done at the departments.

Coordination
The second dimension that is used to characterize the GI organizational structure is coordination. This refers to the level of centralized coordination or control of the geographical information related activities (Dessers, 2012, p. 219) and addresses the question who or what is in charge for the GI in the organization. Is a central GI manager in charge of the coordination or is the coordination done by a steering committee placed between the central GI unit and the departments? Or is the coordination of the geographical information products done in the business processes itself? The way geographical information is coordinated may have an influence on the accessibility of geographical information for end users (Nedović-budić & Pinto, 1999).

Five characteristics of Coordination have been identified which can be considered to be indicative for the structure of an organization and will be used in this research:

- Coordination of strategic or main GI activities and procedures
- Planning and design of GI products and services
- Ownership and responsibility of Data and GI products
- Decision making structure
- Funding of GI activities

The coordination of the strategic GI activities and procedures in a Central organizational model is done centrally by a GI manager at the central GI unit. In a Decentralized organization, the GI activities are managed decentrally at the departments at the business level. In a Hybrid model the coordination of the activities is primarily performed centrally, with the exception of some.

The planning and design of new GI products is also related to the coordination of GI activities. In a Central model this is done by the central GI unit. In a Decentral model this is done at the departments and in a Hybrid model new geographical information products are initialized by the departments and further elaborated in collaboration with the central GI unit.

The ownership of GI products and data is also an important characteristic of organizational structures (Nedović-budić & Pinto, 1999, p. 58). In a Central model, the ownership of most products and data is held by the central GI unit, whereas in a Decentral model the ownership lies with the different departments. A Hybrid model will be characterized by the division of ownership between different units, which may include the central GI unit and the departments. The division of ownership, as well of responsibility may be laid down in a responsibility matrix (Holdstock, 2016, p. 135).

Another characteristic of coordination is the structure of decision making of an organization. In a centralized model a top-down hierarchy of power and control of resources is often the case (Smith, 2016, p. 20). In contrast, a Decentral model supports a bottom-up decision making (Holdstock, 2016). A Hybrid model will also mainly work with a bottom-up approach, as GI specialists are placed within the departments.

The last characteristic identified in this research is the way the GI activities are funded. Funding may also provide insight in the organizational structure of an organization (Holdstock, 2016; Nedović-budić & Pinto, 1999). A central budget for GI activities is characteristic for a Central model. In a Decentral model, activities will be financed from the departmental budget. Organizations where costs of GI activities are shared between different departments is an indication for a Hybrid model.

Framework of Organizational Models

An overview of the characteristics per dimension for the three organizational models, Central-Decentral-Hybrid, as described in this paragraph, is summarized in Table 2.2. The framework is primarily based on the articles by Holdstock (2016) and Dessers (2012).

Table 2.2 Theoretical Framework of Organizational Model
Overview of different dimensions and characteristics per organizational model

Dimensions	Characteristics	Central Model	Decentral Model	Hybrid Model
Allocation	Presence of central GI unit	Yes	Optional	Yes
	Position of operational GI activities in the organization	Central GI unit	Throughout the organization	Throughout the organization
	Data management	Central GI unit	Departments	Divided between central GI unit and departments
	Database maintenance	Central GI unit	Divided between central GI unit and some departments	Central GI unit
	Data creation and editing	GI specialists in central unit	Entirely performed by departments	Mainly done at departmental level
	Data analysis	On request done by central unit; simple analyses done by end users	Entirely performed by departments within business processes	Mainly done at departmental level
	Data visualization / map production	Central GI or Mapping unit	Departments	Mainly done at departmental level
	Management of Applications (incl. soft- and hardware)	Central GI unit or IT department	Divided between departments and central GI unit	Central GI unit or IT department
Coordination	Strategic GI activities and procedures	Central GI unit	Departments	Central GI unit
	Planning and design of general GI products and services	Central GI unit	Departments	Central GI unit
	Data / GI product ownership / responsibility	Central GI unit	Departments	Divided among central unit and some departments
	Decision making	Top-down hierarchy, power and control of resources by central steering committee	Bottom-up; departments have direct influence on decisions	Bottom-up; departments have direct influence on decisions
	Funding	Central GI or IT budget	Departments	Different departments share costs

2.4 Résumé

Research question 1, 'What types of GI intra-organizational structures can be distinguished?' was investigated by creating a theoretical framework based on literature study.

Based on the results of the theoretical framework, the following conclusions can be drawn:

- The organizational structure refers to the division of work in an organization and the way these tasks are allocated and coordinated throughout the organization.
- Within organizational structures, two levels can be distinguished: inter-organizational and intra-organizational structure. This study focusses on intra-organizational structures. This type of structure can be characterised as the division, allocation and coordination of tasks across organizational divisions within the same organization (Dessers, 2012, p. 28).
- A framework to analyse the characteristics of organizational structures is made by Dessers (2012). He distinguishes four variables or dimensions:
    - coordination
    - task division
    - spatial data function - allocation
    - spatial data function - coordination
- With respect to GI intra-organizational structures, the last two dimensions distinguished by Dessers (2012) will be used for the analysis of the organizational structures of provinces.
- Based on the analysis of articles by, among others, Somers (1996), Sugarbaker (2005) and Holdstock (2016), it was decided to use the following classification system for the study on the organization of geographical information in the provinces:
    - Central model, all GI activities are centralized at one unit in the organization
    - Decentral model, individual departments manage their own GI activities
    - Hybrid model, all strategic and coordination GI activities and the data management are centralized, but operational activities are performed decentral

  This classification is based on the degree of centralisation of the GI activities in intra-organizational models.
- In order to make the three models quantifiable for further (empirical) research, they have been operationalised on the basis of the two dimensions of Dessers, allocation and coordination. This resulted in a theoretical framework consisting of an overview of the different dimensions and its characteristics per organizational model (Table 2.2).

3. Research Design

This chapter describes how the empirical part of the research has been conducted and which research strategy and methods have been used to find an answer to the two research questions involved:

- *Which types of GI organizational structures can be identified within Dutch provinces? (research question 2)*
- *To what extent do the identified provincial GI organization structures satisfy the demands of the GI end users? (research question 3)*

Chapter 3 builds on the results of the literature study on the types of GI intra-organizational structures to be distinguished in scientific research as described and concluded in Chapter 2, the theoretical framework. In Paragraph 3.1, the research strategy used and the selected study cases are presented. In the Paragraphs 3.2 and 3.3, the methods used for the data collection, analysis and validation are described; a separate paragraph for each research question. The chapter is concluded with a schematic overview of all the research steps involved (Paragraph 3.4).

3.1 Research strategy

An important decision within this study was the choice for the research strategy for the empirical part. This paragraph discusses the adopted strategy. First of all, the choice for the case study approach as research strategy is explained, followed by the presentation of the selected cases.

3.1.1 Comparative case study approach

The comparative case study approach was chosen as research strategy for answering the second and third research questions, for a number of reasons.

The case study approach is a qualitative research strategy characterised by the fact that it focuses on selected case(s), for instance an organization (Yin, 2013, p. 15), and that it also takes into account the context in which the research object(s) is situated (Baarda, De Goede, & Teunissen, 2009, p. 114). The cases serve as a representation of a certain phenomenon or problem. By means of studying cases, it is possible to better understand the problem (Dessers, 2012, p. 41). In this research, the organizational structures of the Dutch provinces serve as 'the cases'.

Evaluation of a GI organizational structure in terms of the degree of end-user satisfaction is very complex. By using a case study approach, an in-depth understanding of organizational structure of Dutch provinces can be provided (Creswell, 2013, p. 104). A case-study can also provide a much more holistic view of the research objects (Verschuren & Doorewaard, 2007, p. 185). With a more quantitative research strategy, such as a survey approach, such holistic view would not be possible (Verschuren & Doorewaard, 2007).

The research objective of this study asks for an overview of the types of GI organizational structures within Dutch provinces. Taking this into consideration, a single case study approach, focussing on one provincial organization only, would be too limited. Therefore, it has been decided to use a comparative case study approach. In a comparative case study, several cases are studied and analysed (Dul & Hak, 2008, p. 4). According to De Vries & Slob (2008, pp. 240–241) such comparative case study of some organizations may help in identifying the organizations needs and improve the business performance. This is in line with the objective of this study, which aims to study the alignment of provincial geographic information services with end-users' demands.

With the comparative case study approach as main research strategy, an in-depth, qualitative and empirical research strategy has been chosen.

3.1.2 Case selection

In order to get insight in the types of organizational structures of the Dutch provinces, in total seven provinces were contacted and studied. Due to the limited time available for this research, it was not possible to contact all 12 provinces.

The selection was done after a short preliminary study, based on provincial documents and consultation of experts on provincial organizations. This resulted in a good mix of large, medium-sized and small sized provincial organizations, based on the number of employees, namely Zuid-Holland, Gelderland, Groningen, Utrecht, Overijsel, Drenthe and Flevoland (see A&O-fonds Provincies, 2017). It is assumed that this selection of Dutch provinces is a good reflection of the organizational structures. An overview of the selected cases is given in Figure 3.1. The seven selected provinces participated in the study of research question 2. In the study of research question 3, the Province of Overijssel did not participate. This will be further explained in Paragraph 3.3.

Table 3.1 Number of employees per selected case (A&O-fonds Provincies, 2017)

Provinces	Number of employees expressed in terms of FTE (2017)
Zuid-Holland	1350,2
Gelderland	1108,0
Groningen	742,5
Utrecht	737,7
Overijssel	701,2
Drenthe	452,8
Flevoland	357,2

Figure 3.1 Selected provinces for comparative case study

3.2 Interviews

The second research question aims at getting an overview of the current types of organizational structures of the Dutch provinces and classifying them according to the theoretical framework resulting from research question 1.

RQ2 - Which types of GI organizational structures can be identified within Dutch provinces?

This paragraph explains how this research question was answered using the interview method. First of all, the choice to use interviews as means of data collection as part of the case study approach is explained. Subsequently, it is described how and when the interviews were conducted and the data were collected. This is followed by a review of the methodology used to analyse the interviews. Finally, the validity and reliability of this data collection method is discussed.

3.2.1 Method of data collection

Type of sources

The primary research object within the second research question is the GI organizational structure used within Dutch provinces. This research object has been studied, in line with the case study approach, on the basis of various sources of information (Creswell, 2013, p. 105; P. Verschuren & Doorewaard, 2010, p. 2017). For this study, it has been decided to use 'persons' and 'documents' as data sources. In this context, 'persons' are defined as experts working within the provincial organization, who have knowledge of the GI organizational structure of the provincial organizations and can oversee the processes in the organization. After all, their activities give them an overview and insight into the GI organizational structure.

Besides these human resources, strategy documents of the provincial organizations have been studied, such as annual reports and strategy and vision documents in which the role, place and organizational structure of geographical information in the organization is outlined.

Disclosure of sources

The semi-structured interview technique was chosen as the main method of accessing the above-mentioned data sources. A characteristic feature of a semi-structured interview is that the questions are asked on the basis of a topic list (Brinkman, 2014, p. 14). A semi-structured interview provides enough structure to compare the results of the different interviews, as they cover the same topics. Semi-structured interviews also give the opportunity to ask additional questions during the interview and to get a more in-depth understanding of the organization if needed (Baarda, 2009, p. 80).

A disadvantage of this method is that conducting interviews is very time-consuming, especially when several cases need to be studied. In this study, seven cases were selected. For this reason, is was decided to limit the number of interviews to one per province; in spite of the fact that interviewing several different persons within an organization would give more reliable results (Verschuren & Doorewaard, 2007, p. 233). In order to guarantee the quality of the research, a number of experts, working as geo adviser or team leader, were selected for the interviews.

An expert is defined as someone within the province with knowledge and overview of the GI organizational structure of the province and its processes (Verschuren & Doorewaard, 2010, p. 209).

Selection of respondents was primarily based on a document provided by the interprovincial expert group on Geographical Information PP-Geo[4]. All respondents are or used to be members of this expert group and operate as (strategic) advisor in their organization (Table 3.2). This resulted in seven interviews with eight experts in total. In the case of one organization, a double interview was held. All interviews were conducted at the provincial offices. The way the interviews were conducted is described in Paragraph 3.2.2.

Interview design
In the semi-structured interviews, the organizational structure in terms of allocation and coordination of geographical information services was addressed. For the interviews, a topic list was designed based on the theoretical framework which is presented in Chapter 2. In this framework, distinctive characteristics of different types of organization structures are given. These characteristics have been taken into account when setting up the interview's list of topics. The topic list can be found in Appendix I.

A key element of the interviews was the design of the provincial organizational structure on paper. Each interviewee had been asked to draw the organizational structure of their organization in accordance with the features stated in the theoretical framework. These drawings have been uniformised after all provinces had been visited. Based on the sketches and the information provided by the advisors, a schematic outline of the main GI organizational structure for each province is given in Chapter 4.

The oral interview has the disadvantage that people are more inclined to give desired answers, thus not revealing the full reality (Baarda, 2009, p. 80). For this reason, the interviewees were asked to provide strategy documents of their organization regarding the GI organizational structures. These annual reports and strategy and vision documents provided by the experts are used as support for the analysis of the interviews.

3.2.2 Process of data collection
The expertise and relationships of the supervisors of this study were used to approach potential respondents. Both supervisors have a large network within provincial organizations and were able to provide the contact details of the potential respondents. As mentioned before, the selection of people to contact was made mainly on the basis of the results of a PP-Geo survey. On this basis, an e-mail was sent to seven experts on 14 January 2018. In this e-mail, the respondents were asked to participate in the research by doing an interview. After contact by telephone, it appeared that all experts were willing to be interviewed. The expert of the Province of Zuid-Holland indicated that his knowledge of the most recent developments in the field of the GI organizational structure was possibly too limited. This resulted in a double interview with a second advisor present during the interview.

The interviews were conducted in the period from 30 January to 9 February 2018. All the interviews were held at the House of Province of the province concerned. The meetings lasted one and a half to two hours. An overview of the interviews conducted is given in Table 3.2.

[4] PP-Geo = Provinciaal Platform GEO-informatie = Inter-provincial platform on geographical information

Table 3.2 Overview of semi-structured interviews conducted with experts of the provinces

Date	Location	Province	Position of respondent
30th of January 2018	The Hague	Zuid-Holland	Senior Advisor IT (Geo) Advisor GIS
1st of February 2018	Assen	Drenthe	Coordinator GIS
5th of February 2018	Lelystad	Flevoland	Advisor GIS
	Groningen	Groningen	Advisor and specialist GIS
7th of February 2018	Arnhem	Gelderland	Advisor Geo-information
	Zwolle	Overijssel	Advisor and specialist GIS
9th of February 2018	Utrecht	Utrecht	Strategic advisor Geo-information

The interviews were all recorded with a voice recorder with the approval of the respondents. These recordings were fully transcribed to make further analysis of the interviews possible. However, because of the company-sensitive content of the interviews, it was agreed not to publish or share them with other parties. The public information relevant for this study is summarized in Paragraph 4.1.

3.2.3 Data analysis

Based on the conducted interviews and the analysis of the strategy documents, the organizational structure of the provinces was characterized and classified. This was done by making use of ATLAS.ti, a qualitative data analysis & research software tool.

All characteristics mentioned during the interviews were labelled. Initially, this was done using open coding. Open coding is a way of labelling in which the codes remain as close as possible to the actual wording without interpretation (Baarda, 2009, p. 130). Based on a first round of open coding, a more selective way of coding was developed in which arguments were grouped and coded in a more generic way. The focus of the analysis was to identify a number of central characteristics.

The outcome was compared with the types of organizational structure presented in the theoretical framework resulting from research question 1 and conclusions were drawn whether they fitted in the theoretical framework or not and which aspects of the present GI organizational structures could be considered decisive and important for their ‘success’ or ‘failure’. The outcome gave direction to how the next step of the study should be implemented.

3.2.4 Reliability and validity

This subparagraph looks at the validity and reliability of the method described above to get insight into the quality of the data obtained during the interviews.

Reliability

The disadvantage of semi-structured interviews is their relatively low reliability (Vennix, 2012, pp. 206–207). The many open questions asked during the interviews may result in a huge amount of information. It is the researcher's responsibility to extract the correct data from these results by means of coding. It is not likely that two different coders will encrypt the open answers in the same way. In other words, the reliability, the degree to which a reading is independent of coincidence (Baarda, 2009, p. 77), is small.

To increase the degree of reliability of the interviews, respondents were given insight into the purpose of the survey before and during the interview. For example, a topic list of the interview was sent to all respondents in advance, to give them an unequivocal knowledge of the survey. During the interviews, it was clear that the respondents had understanding of the objective and therefore also answered in an unambiguous way. The careful selection of the respondents certainly contributed to this. The interviewees all had the required knowledge and skills to provide a good insight into the organizational structure. This certainly contributed to the reliability of the research.

In addition, the pre-established topic list was closely followed during the interviews (see Appendix I). It was ensured that all topics were discussed. To make sure that the respondents' answers were well understood by the interviewer, the answers given were summarised during the interviews and verified by the interviewee. This made it possible to rectify given answers straight away after further explanations from the interviewees. The reliability of the interviews has therefore been relatively well guaranteed.

The influence of the researcher in the interview process should however never be underestimated (Baarda et al., 2009, p. 194). The following reservation needs to be made regarding the reliability of the analysis of results. The interviews have been transcribed and then coded by the researcher. Open coding and selective coding were used to encrypt the content of the interviews as objectively as possible, applying the characteristics regarding the degree of centralisation as described in Paragraph 2.3. However, there is always the possibility that the way the coding is done differs per researcher. This will certainly have an impact on the outcome of analysis of the results and therefore the reliability of the research. One must be aware of this influence.

Validity

Validity is about the question whether the instrument is measuring what the researcher wants to measure (Vennix, 2012, p. 184). It is an indicator of the validity of the chosen research design (Baarda et al., 2009, p. 198).

In handbooks it is often stated that interviews with open-ended questions provide more valid information than closed questions because it gives the respondent maximum freedom to express him/herself in his/her own words (Vennix, 2012, p. 206). This assertion is certainly also applicable to the interviews conducted in this study. During the interviews, respondents were given maximum freedom to express themselves and to give as complete a picture as possible of the GI organizational structure. In some cases this did lead to responses with partial non-relevant information, but this superfluous information was filtered out of the results when the interviews were coded.

The unrestricted liberty to sketch an image of the organization was also stimulated because the interviews were conducted at the provincial offices. This made the respondents feel comfortable and talk about the organization with ease. This was demonstrated, for instance, by the respondent's gestures pointing to locations in the building. As stated by Baarda (2009, p. 76), this increases the so-called 'ecological validity'. Furthermore, conducting the interview on location was also very pleasant and helpful for the researcher himself. By being physically present in the building, a better understanding of the organization could be obtained through observations. This made it easier to interpret the answers during the interviews and to ask the correct follow-up questions on the spot. In combination with the documents on the organization, the physical observations made a valuable contribution to the analysis of the results of the interviews. In this way, the results were processed on

the basis of various sources (triangulation), which increases the internal validity of the research (Baarda, 2009, p. 76).

3.3 Questionnaire

The third research question is about to what extent do the different organizational provincial structures identified after research question 2 facilitate and support the demands of GI end users in the organization. It also looks at the advantages and disadvantages of the different types of organizational structures as experienced by the GI end users.

RQ3 - To what extent do the identified provincial GI organization structures satisfy the demands of the GI end users?

This paragraph discusses the methodology used to answer research question 3: the questionnaire. First of all, the choice for using the data collection questionnaire is explained. This is followed by a description of the different steps taken in the actual collection of data in Paragraph 3.2.2. The method used to analyse the questionnaire is then described in 3.2.3. Finally, the validity and reliability of this method will be discussed.

3.3.1 Method of data collection

Type of sources

The research question's focus is on the extent to which the GI organizational structure of a province satisfy the demands of GI end users. GI end users being individual people in the organization who make use of geographical information services for their work.

To answer research question 3, the experiences of GI end users with the GI organizational structure will be studied. The main source for the collection of data to answer research question 3 will therefore be the provincial GI end users. Who belongs to the main GI end users within the province will be investigated and determined during the interviews conducted in the context of research question 2.

Disclosure of sources

The written questionnaire technique was chosen as the main method for disclosing the above-mentioned data source. A characteristic of the written questionnaire is that all questions are fixed in advance and that there is little interaction between the researcher and the respondent (Verschuren & Doorewaard, 2007, p. 231). Reason to choose for questionnaires instead of interviews is that it is less time consuming and more people can be reached (Baarda, De Goede, & Kalmijn, 2007, p. 22). The questionnaire only has to be sent to the respondent, who can answer the questions in his own time.

An important disadvantage of a questionnaire is its non-response (Baarda, 2009, p. 82). Another disadvantage of questionnaires is there is little control over how seriously the respondent fills in the answers (Baarda, 2009, p. 81). Even though it takes relatively little time to complete a questionnaire, it is time-consuming to develop and prepare it. The correct wording and order of the questions is very important because there is no possibility to clarify things when the respondent is answering the questions, as can be done during an oral interview. For this reason, the questionnaire was first discussed with various people in order to prevent unclearly formulated questions from being included in the survey.

There are various survey software tools which can be used to design questionnaires and submit them to the respondent via the web. In this survey, the online survey programme Qualtrics was used. A major reason for choosing this programme was that the license of the program was available, which made it possible to develop a questionnaire without restrictions in number or types of questions.

Questionnaire design

The questionnaires are based on the results of the oral interviews and built around four themes which were found to be relevant for the GI organizational structure and the provision of geographical information services. These results will be described in the paragraphs 4.2, 4.3 and 4.4. In order to assess these four themes, they have been operationalised and for each of the themes described, a number of questions have been elaborated. The questionnaire is included in Appendix II.

In 27 questions, the selected GI end users were asked to validate and assess these characteristics, how they perceive the current GI organizational structure and what problems they could identify related to the internal organizational structure. The results of the questionnaire have been used to get a better understanding to what extent do the organizational structure satisfies the wishes of the GI end users.

It was decided to use closed questions as much as possible. Advantages of closed questions are the use of standardized responses and respondents are familiar with the format. Most of the questions, 18 out of 27, consisted of so-called rating scale questions in which the possible answers to the questions were ranked in category of satisfaction or agreement. Rating scale questions are often used to measure attitudes, opinions and feelings (Brinkman, 2014, p. 78). The aim of this study was to measure the opinions of GI end uses (policymakers) regarding the geographical information organizational structure of their province. The rating scale questions in the questionnaire consisted of statements on the provision of geographical information to which the respondents were asked to react. The statements were related to the four organizational themes which emerged from the previous expert interviews.

The downside of closed questions is that respondents have only limited possibilities to respond (Baarda et al., 2007, p. 52). To overcome this, an open annotation field was included in the questionnaire after each question, allowing respondents to add comments.

Besides rating scales questions, a few other question types were used. For instance, a multiple response question was added to identify which types of geographical information services were used by the respondents. In a multiple response question, several answers are possible to the question. This difference in response options was also reflected in the questionnaire layout by using square boxes instead of rounds (Brinkman, 2014, p. 72).

In order to get a better understanding of the respondents, some personal data were asked using a different type of questioning. Respondents were asked about their role & position in the organization, the period of employment and the amount of time spent on GI-related activities. These characteristics were asked as they may be of influence on the answers given by the respondents.

In order to get a high response, the questions in the questionnaire were adapted to the organization. For instance, the name of the central GI unit differed per organization. This specific name was used in the questionnaire send to the people working at that province.

3.3.2 Process of data collection

Initially, the same seven cases as used for research question 2 were selected to study question 3. The experts interviewed at the seven provinces were asked to cooperate in the launching of the questionnaire among the GI end users working at their province, by providing access to their internal customers, mainly policy makers. All but one of the provinces were prepared to provide this access. The Province of Overijssel indicated that it did not want to be further involved in the study. The main reason for this was that a number of surveys had been taken place at the province over the last months and that it did not feel appropriate to bother their staff again with another request for feedback from an external researcher. So, the number of cases used for research question 3 was limited to 6 provinces.

The experts interviewed were asked to select at least 15 GI end-users in their province who were qualified to take part in the survey; the selection being based on the services provided by the central GI unit in the past. They were also asked to send an email to the selected respondents with a request for cooperation and to fill in the questionnaire. Sending the questionnaire via the interviewee would also help in getting a larger response rate.

The email to the interviewed experts with the request to forward the questionnaire to the selected respondents within their province was sent on Friday, May 4, 2018. This email was accompanied by an email addressed to the end-users explaining the reasons for the survey and including the link to the on-line questionnaire. By clicking on this link, the respondent was directed to the previously mentioned online survey program Qualtrics. A separate web link was generated for each province with the help of Qualtrics, so the respondent was sent to the correct questionnaire (the questionnaire was custom made for each province). As soon as a respondent entered the questionnaire, this was visible in Qualtrics' design interface. In addition to the answers, the program also provides insight into the date and time the respondent submits the questionnaire (or parts of it).

Table 3.3 below gives an overview of the six provinces, the number of respondents contacted and the outcome of the response. It was immediately clear that a number of experts were on holiday because of the automatic out-of-office replies received. This explains why most of the questionnaires were distributed to end-users with some delay. More information about the outcome of the response to the questionnaire is given in Paragraph 5.1

Table 3.3 Number of distributed and returned questionnaires per province

Province (Case)	Addressed number of people	Date of sending of questionnaire	Number of responses after 1ste email	Date of reminder email	Extra responses received after 2nd email	Date of first response received	Date of last response received	Total number of responses received
Drenthe	15	May 15	7	May 22	+5	May 15	May 22	12
Flevoland	30	May 7	27	-		May 7	May 22	27
Gelderland	30	May 28	16	-		May 28	May 31	16
Groningen	18	May 15	13	May 28	+1	May 15	May 28	14
Utrecht	24	May 16	17	-		May 16	May 25	17
Zuid-Holland	40	May 22	18	June 1	+9	May 22	June 8	27

Table 3.3 shows that the number of respondents contacted varies significantly between the various provinces; ranging from 15 in Drenthe to 40 in Zuid-Holland. The number of contacted respondents was determined by the action of the experts involved. The initial response rate varied from province to

province. In the case of three provinces, it was decided to send a reminder email because the number of responses was low. The reason for not sending a reminder email to the Provinces of Gelderland and Utrecht was a lack of time.

3.3.3 Data analysis

The data from the returned questionnaires were analysed by making use of SPSS, a statistical data analysis software tool. The choice for SPSS was aided by the fact that the survey program Qualtrics used for the questionnaire offers the option to export the answers to the questionnaire to SPSS file format. This allowed all raw data to be uploaded into SPSS in one step without any difficult transformation or reclassification.

In view of the small number of respondents, it was decided to use descriptive statistics as the main method. With descriptive statistics, one makes statements about the sample and not about the entire population (Baarda, 2009, p. 111). This is in line with the chosen qualitative research strategy. The answers are presented per province by means of bar graphs. A table with absolute numbers has been added to the bar graphs presented in Paragraph 5.2, to make the reader aware that the number of valid responses may vary quite considerably per case. The comments given with the answers have been taken into account in the interpretation of the bar graphs.

After having examined the outcomes of each province, the results were analysed using the classification based on the positioning of the GI unit as presented in Chapter 4. All the responses to the survey statements based on a value judgement (I am satisfied ...?) were then added together for each theme. The outcomes of the four themes were presented and compared for each positioning model (see Paragraph 5.3).

The results obtained gave reason to conduct a statistical analysis. On the basis of this descriptive statistics, significant variations in responses between different types of organizations were identified (see Paragraph 5.4). To test the significance of this difference, a One-way Analysis of Variance (ANOVA) test was performed. An ANOVA examines the differences between group means, like a t-test (Foster, Barkus, & Yavorsky, 2013, p. 7). The difference with a t-test is that an ANOVA test is more flexible. For instance, it allows to compare the average value between more than two groups. This study looked at three different groups. This is useful because this study looks at three different groups. Paragraph 5.4 and Appendix III describe in more detail how this test was conducted and which results were obtained.

3.3.4 Reliability and validity

This subparagraph looks at the validity and reliability of the method described above to get insight into the quality of the data obtained from the questionnaires.

Reliability

The advantage of questionnaires is their relatively high external reliability (Vennix, 2012, pp. 206–207). When asked closed questions, a respondent can only choose from the available answer options. The chance that these answers will be interpreted differently by different researchers is minimal compared to a qualitative survey. After all, the answer 'I fully agree' will be interpreted in the same way by everyone. This replication requirement of a questionnaire makes it a reliable measuring instrument (Baarda et al., 2009, p. 193).

When analysing the data, the answers given were analysed by theme at a certain moment. For this purpose, various items (questions) were cumulated, see Paragraph 3.3.3. The decision to express a theme on the basis of the sum of a number of questions can have an impact on the internal reliability of the research. The internal reliability, also referred to as internal consistency, reflects the relationship between items belonging to the same 'scale' (Brinkman, 2014, p. 162). To test a questionnaire with respect to its internal consistency, the Cronbachs alpha can be used. With the help of SPSS, the Cronbachs alpha has been calculated for the four themes. The results of this analysis are summarised in Table 3.4.

Table 3.4 The internal consistency (Cronbach's alpha) of cumulated items per theme

Themes relevant for GI organizational structure	Cronbach's Alpha	N of items
1 accessibility of the GI unit	.337	2
2 design process of information products	.878	7
3 quality of services provided by the GI unit	.693	5
4 GI unit as supporting service	.604	3

Cronbachs alpha always has a value varying between 0.00 (not homogeneous) and 1.00 (perfectly homogeneous) (Baarda, 2009, p. 77). A high value of Cronbach's alpha is an indication of a high homogeneity of the questions and therefore a high reliability. The minimum value used for a reliable investigation varies from 0.50 to 0.80 (Brinkman, 2014, p. 161). The lower limit also depends on the number of entries. In general, the Cronbachs alpha increases with a larger number of items (Brinkman, 2014, p. 162). Based on the statements with regard to the interpretation of the Cronbachs alpha in the manual of Brinkman, the results of the second, third and fourth theme can be considered as reliable. Especially the second theme, with a Cronbachs alpha of 0.878, shows a very strong consistency. Only the first theme has a low Cronbachs alpha value of 0.337, which indicates a lack of coherence between the questions on which the theme is based (Brinkman, 2014, p. 161). This lack is to be attributed to the limited number of just two questions included. Therefore, the two items within the accessibility theme will be treated separately as theme 1a and theme 1b in the remainder of this report.

Validity

Whereas the validity of measurement methods consisting of many open questions, such as semi-structured interviews, is often high, the validity of closed-ended questions in a questionnaire is low (Vennix, 2012, p. 207). In order to increase the validity of the answers to the closed questions, the opportunity was offered with all questions to provide an explanation of the given answer in a comment field. This possibility increases the chance that a final answer given is good reflection of the reality. The explanations also help the researcher to interpret the answers (Vennix, 2012, p. 206).

The validity of the results is also influenced by the method of questioning. Despite the fact that several people had gone through the questions beforehand, the analysis of the results afterwards revealed that respondents had not properly understood some of the questions. For example, some respondents answered with 'neither agree nor disagree' to questions on which they had no knowledge or opinion. The choice for the answer option 'not applicable', which had been included specifically with certain questions, would have been much more logical in these cases. For example, in the explanation to question 19, people often indicated that they did not use or had knowledge of geographical datasets. Instead of ticking 'not applicable', many of them chose to indicate their degree of consent. This example shows how important it is for the validity of the results to include in the questionnaire the possibility to give a comment to an answer.

3.4 Overview of research steps

As outlined in the theoretical framework (Chapter 2) and in this chapter, a number of steps have been taken in this study to answer the three research questions formulated. A summary of these steps, including the steps taken in Chapter 2, are given in Figure 3.2. The identified steps in the figure are based on the three research questions (RQ1-RQ3). Every step resulted in an answer or conclusion with regard to a research question and served as a starting point for the next research question. In the final fourth step, the research objective (RO) is met by drawing conclusions and providing recommendations based on the outcomes of RQ1 to RQ3.

Figure 3.2 Overview of research steps in this study

4. Provincial Organizational Structures

This chapter describes the different types of organizational structures of Dutch provincial organizations. The goal of the chapter is to gain insight in how, in practice, the geographical information services within Dutch provinces is organized and to which theoretical model as described in chapter 3 the Dutch provincial organizations belong. For this purpose, eight different geo advisers working in seven different provinces were approached and interviewed. The empirical results of these interviews are presented in this chapter. Based on these results, an answer is given to the second research question.

RQ2 - Which types of GI organizational structures can be identified within Dutch provinces?

In Paragraph 4.1, the results of the interviews are presented per province. Based on the sketches drawn by the advisors and the information provided by the advisors during the interviews, the GI organizational structure of each province is described.

In Paragraph 4.2, the degree of centralisation of the geographical information provision within the provinces studied with regard to allocation and coordination is further analysed and compared with the models from the theoretical framework described in Chapter 2.3. In this paragraph, conclusions are also drawn with regard to which type of organizational model the GI organizational structure of a province belongs to.

Paragraph 4.3 looks at the positioning of the central GI unit within the provinces, which results in the presentation of three 'sub-models' within the Central model, under which the provincial GI organizational structures found can be classified.

The last paragraph describes the differences between these three 'sub-models' found, based on four themes that emerged from the interviews as being of importance for the functioning of the geographical information provision.

4.1 Results per case

In this paragraph, the GI organizational structures of the seven cases are presented. Per province, a sketched GI organizational chart is given as well as an outline of the allocation and coordination of geographical information within the province. The results presented are mainly based on the interviews with the geo-advisors. In addition to the interviews, organization charts and GI strategy papers have been used.

As the interviews with the geo advisors contain confidential business information, interview transcripts are not included in this report, as is also explained in Paragraph 3.2.2.

The figures of the organizational structures are based on the sketches made in consultation with the interviewees. These figures have been digitised in a uniform manner, in which a number of icons are used to indicate the position of certain GI activities within the organization. Figure 4.1 gives an overview of the different icons used and the meanings of each one of them.

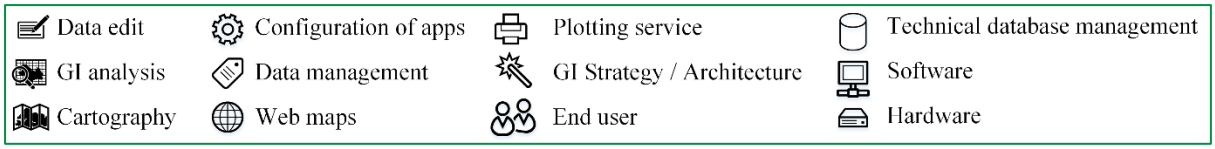


Figure 4.1 Legend of Icons used in the concluding illustrations of the provincial organizational structures

4.1.1 Zuid-Holland

In Figure 4.2, the GI organizational structure of the province is presented, showing the main organizational units who are involved in the provision of geographical information and their tasks and connections. The figure is based on the information given in the following subsections.

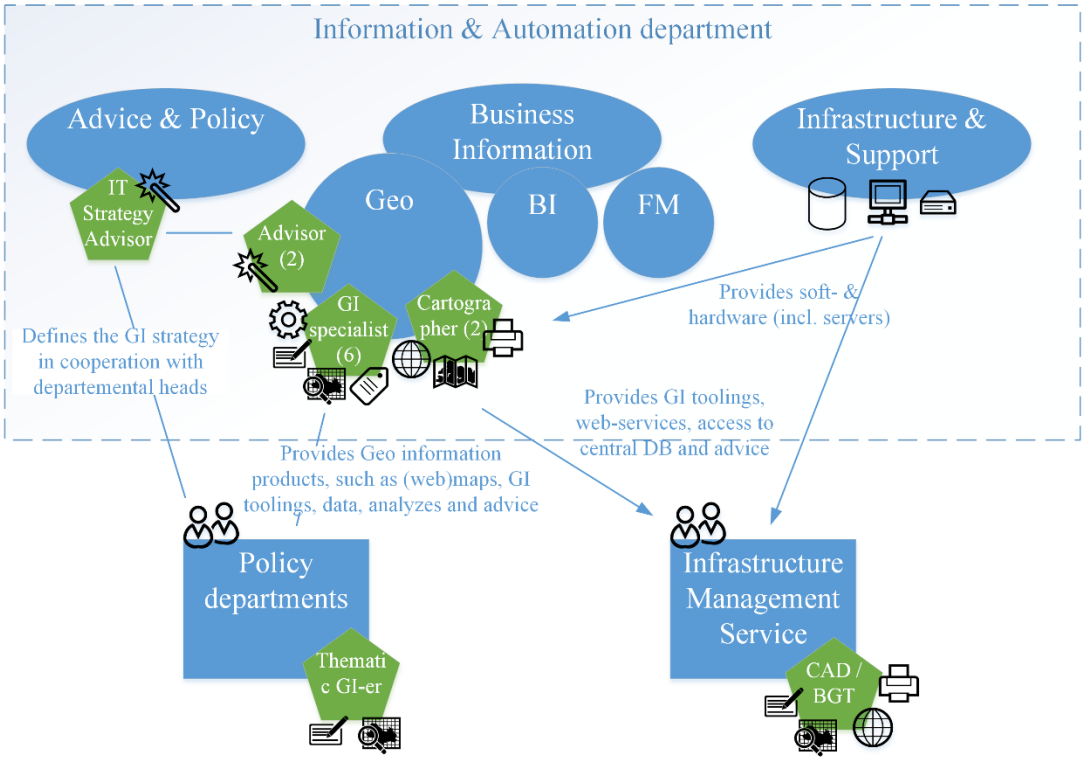


Figure 4.2 GI Organizational structure of the Province of Zuid-Holland (see page 36 for explanation of symbols)

Size of organization

The Province of Zuid-Holland is the largest province in the Netherlands in terms of numbers of employees: 1350.2 FTE (A&O-fonds Provincies, 2017) and is therefore defined as a large sized province.

Allocation of GI

Zuid-Holland has a central GI unit, placed at the Department of Information and Automation (I&A)[5]. This Department, together with the departments responsible for finance and human resources, is part of the Corporate Division[6] of the province.

[5] Department of Information & Automation = Afdeling Informatisering en Automatisering
[6] Corporate Division = Directie Concernzaken

The I&A Department consists of four sections Infrastructure & Support, Business Information, Advice & Policy and Documentary Information. Being an information oriented service, the GI unit is placed within Business Information section. Besides geographical information, Business Information also deals with all other related business information services such as business intelligence and functional management.

The central GI unit or 'Geo team' is in charge of the general provincial geographical information services. This includes the functional management of the central databases and GI tools (e.g. desktop GIS), the configuration of webmaps, the provision of data (e.g. web services), the production of cartographical maps and the analysis of geodata. These GI activities are performed by six GI specialists and two cartographers. The Geo team also consists of two advisors, who develop and provide advice at the operational level. This advice is based upon the information strategies at the strategical level, developed by the IT advisor of the section Advice & Policy in consultation with the managers of the policy departments. Both the IT advisor of the Advice & Policy section and the advisors of team Geo have a role with regard to the identification of new customer demands from the policy departments.

Besides the GI specialists placed in the central Geo unit, a few GI specialists are placed within the policy departments. They usually work in the classical spatial policy domains such as land-use, water and nature and they are mainly engaged in annually recurring spatial tasks, such as the 'Environmental and Planning Vision'[7] and the 'Nature and Landscape Subsidy System'[8]. These tasks require a relatively high level of substantive knowledge, but are relatively simple in terms of geographical information. The more technical activities, such as data dissemination and (web)map production, are performed by the central Geo unit.

Besides the Geo team at the Department of Information & Automation, a second group of GI-specialists is located at the Infrastructure Management Service (DBI)[9]. This operational entity of the province is in charge of the maintenance and management of the provincial waterways and roads. In contrast to the policy departments, the Infrastructure Management Service has a strong demand for large-scale topographical products. As they use geographical information for their asset management, most of the GI-related work is done by the Service itself. For example, they are in charge of the production of the BGT (Key Register Large Scale Topography) [10]. One could say that the GI specialists at the Infrastructure Management Service form a separate GI unit within the province with a focus on large-scale topographical activities. The tasks of this 'unit' includes editing and analysing data. They also have control over a web service, which is related to the BGT, and have access to a plotter. Only for the more technical activities, the functional management of GI tools and GI analyses, they consult the central GI unit within I&A.

Coordination of GI

The coordination at the Province of Zuid-Holland has been centralized, like the allocation of the geographical information provision. Prior to this centralization, the province was organized in a federal structured way – every policy domain managed its own geographical information. As a result, geographical datasets were rather fragmented throughout the organization. When it was decided to

[7] Environmental and Planning Vision = Omgevingsvisie
[8] Nature and Landscape Subsidy System = Subsidiestelsel Natuur- en Landschapsbeheer
[9] Infrastructure Management Service = Dienst Beheer Infrastructuur (DBI)
[10] BGT = Key Register Large Scale Topography = Basis Registratie Grootschalige Topografie

centralize all geographical information, all employees who spent more than fifty percent of their time on information processing were transferred to the department of Information and Automation. According to the interviewees, this decision has improved the quality of data a lot. However, policy makers at decentral units complained about the coordination with the GI specialists at I&A, as they were used to contact a colleague who worked at their division. To overcome this problem, some of the information specialists have been re-assigned to the policy departments. This mainly concerns the policy departments Water & Green[11] and Space, Living & Soil[12] which deal with large important geographical information issues and require the full-time involvement of a few information specialists. But also in these cases, the databases used are all coordinated centrally.

The capacity and budgets for the provision of geographical information are centrally determined annually by the account managers of the section Advisory & Policy[13]. Together with the heads of the departments, GI projects are prioritised each year, which forms the basis for the choices to be made regarding the allocation of work and budget. I&A has its own budget from which, in principle, all management and regular geographical information activities can be paid. The budget is generally sufficient for the implementation of the services provided to the policy officers. For the larger GI projects in the province, such as the development of web viewers, extra budget is generally needed. In principle, the departments involved have additional budgets to pay for these information products in order to be able to execute their tasks properly. The budget of for example the Infrastructure Management Service (DBI) is large enough to have a viewer built by an external organization and thus pass the Geo team.

Conclusion

In conclusion, the provision of geographical information within the large Province of Zuid-Holland is highly centralised at the Geo team. The Geo team also prepares the vision in the field of geographical information provision within the province in consultation with the architects and strategic advisors of the section Advisory & Policy. Apart from the central Geo team, policy departments with a strong spatial link may have their own decentralized geographical information specialists. The Infrastructure Management Service (DBI), which is responsible for the management of public space and infrastructure, also has its own geographical information specialists and tools, which are mainly focused on large-scale topography. See Figure 4.2 for an overview.

[11] Department of Water & Green = Afdeling Water & Groen
[12] Department of Space, Living & Soil = Afdeling Ruimte, Wonen & Bodem
[13] Section Advisory & Policy = Bureau Advies & Beleid

4.1.2 Drenthe

In Figure 4.3, the GI organizational structure of the province is presented, showing the main organizational units who are involved in the provision of geographical information and their tasks and connections. The figure is based on the information given in the following subparagraphs.

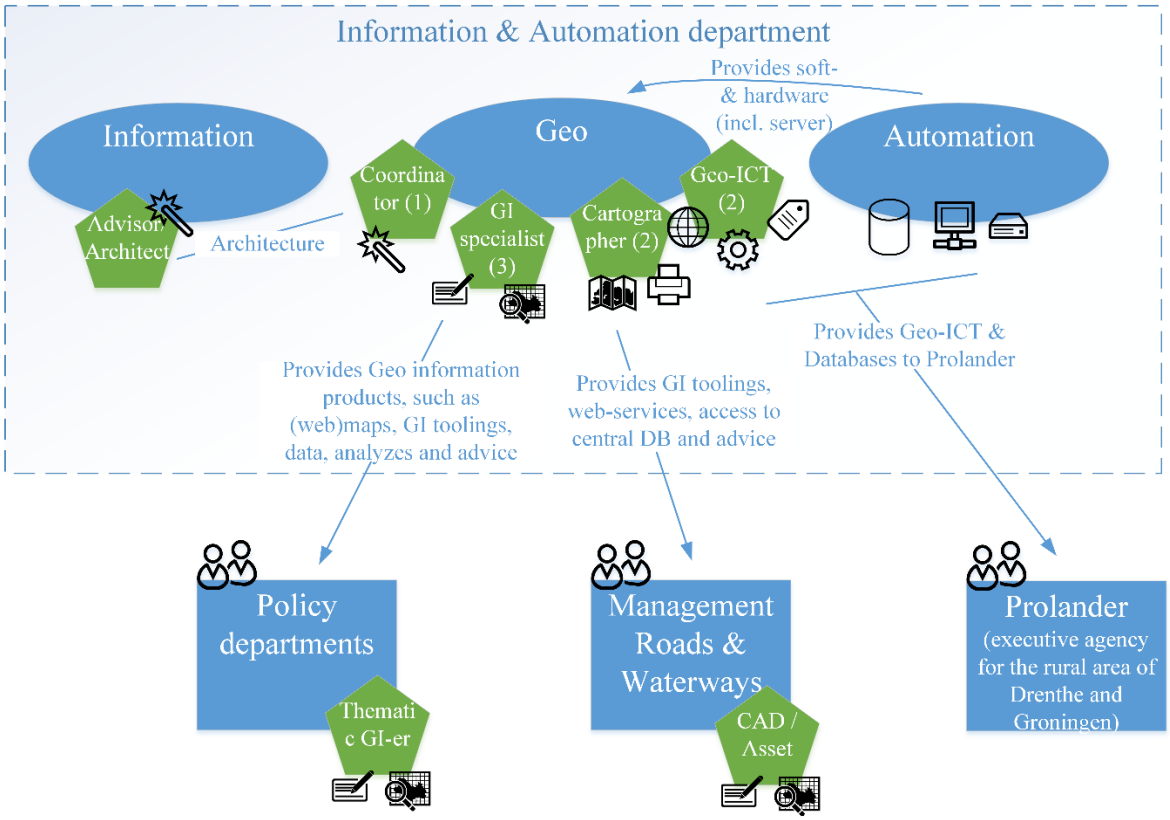


Figure 4.3 GI Organizational structure of the Province of Drenthe (see page 36 for explanation of symbols)

Size of organization

With only 452,8 FTE staff (A&O-fonds Provincies, 2017), the Province of Drenthe can be defined as a small sized province.

Allocation of GI

The main geographical information services are placed within the Department of Information & Automation. Besides the Geo team, this department consists of the teams 'Information' and 'Automation'. Although these units do form a department together, each unit has its own anchor point in the provincial government building and the teams work more or less independently from each other. In principle, the Geo team takes care of all geo-information services within the province. The required technological facilities, such as servers, are provided by Automation. It should be noted that the Geo team itself is in control of the updates of geo-related software packages such as web servers. Consultation of the Information team is mainly related to information architecture.

The two main tasks of the Geo team are: 'to unburden' and 'to take care of'[14]. 'To unburden' involves supporting customers by taking care of all the management and maintenance of data, GI tools and

[14] To unburden and to take care of = ontzorgen en verzorgen

associated applications, like the dissemination of aerial photographs and the management of the central geodatabase, on their behalf. The Geo team takes also care of certain obligations to archive data and documents and to transfer data to INSPIRE. Policy departments do not need to spend time on this, although it is their responsibility that the content of the data is correct.

The 'taking care of' activities are about the provision of geographical information products, such as customized (web)maps, data analyses and digitalization of work requested by policy makers. The purpose of these kind of activities is to support proposals and decisions made by the policy makers. The focus of the Geo team is on maintenance and visualization of geographical data and information; not on development of new applications.

The Geo team itself consists of eight people: three GI specialists, two cartographers, two Geo-ICT specialists and one coordinator. The Geo-ICT specialists are in charge of the data management and the associated database administration. Furthermore, they are responsible for the configuration of the data layers and online maps in Web GIS applications. The cartographers take care of the visualization of the data. Both for the 'old-fashioned' paper maps used in policy reports as well as for the online maps and the corresponding layer files and SLDs. This also includes providing print-ready maps which can be plotted. The plot service itself is part of the team Documents, which has some plotter machines in the basement of the provincial hall. The GI specialists mainly do the analyses and the editing of geographical information using GIS.

Besides the GI specialists placed at the Geo team, a number of people working at the policy departments have knowledge of geographical information and do GI analyses at the departmental level. For instance at the policy teams of Nature & Water, two FTE of staff is working on geographical information related issues. Also at other teams, such as 'Environment & Soil' and 'Rural development', staff members can perform GI analyses. These employees have access to a GIS desktop tool through concurrent use licenses. In total 35 to 40 people, including the members of the central Geo team have access to a GIS desktop tool.

Another department which makes extensive use of geographical information is the Management of Roads & Waterways Service[15]. This Service has its own asset management systems in which large scale topographical information is used. The central Geo unit mainly supports the Management of Roads & Waterways Service by providing GI tools, access to the central geodatabases and advice. However, the GI analyses and edits are entirely performed by the Management Roads & Waterways Service itself. The central Geo team at the I&A department has only a limited insight in how and for what reason the Service makes use of the geographical information.

A special customer of the Geo team is Prolander. Prolander is the executive agency for the rural areas of Drenthe and Groningen. They are an independent operating organization. Three GI specialists work at Prolander who perform the GI analyses and maintain the datasets. However, as they do not have their own Geo-ICT, the database management and IT are provided by the Province of Drenthe on the basis of a service contract. Another partner of the Geo team is the regional executive service RUD[16]. Geo information is provided to this service in a more informal way.

[15] Management of Roads & Waterways = Beheer Wegen en Vaarwegen
[16] RUD = Regionale Uitvoeringsdienst Drenthe

Coordination of GI

The majority of the geographical information services of the province are centrally coordinated by the Geo team. According to the interviewee of the Province of Drenthe, the Geo team's main focus is to support the policy teams. The Geo team used to be part of the former policy team Space & Water[17], which dealt with spatial development issues and was the main GI end user at the province for a long time. After the reorganization of the province, the Geo team became part of the Facility Department. The obvious motivation of this decision was that the Geo team is supposed to operate in the service of other departments. However, the Geo team's focus at the moment is still mainly on the policy departments and to a much lesser extent on the operational services.

The outlook of the Geo team is updated annually, based on the annual plan. Indirectly, the architects and strategic advisors of the Information team have an influence on this vision. They do not interfere with the way the team operates. The teams concerned with the management of roads and waterways have their own GI strategies.

In line with the strategies, the management of geographical data is centrally performed by the Geo team for the entire organization. This strategy is supported by the policy departments who acknowledge that the Geo team is very well capable of executing this task efficiently. The exception to the rule could be the Management of Roads and Waterways Service, who manage some own datasets.

The Geo team has their own budget with respect to the financing of services they provide. At the Province of Drenthe, services provided are not invoiced internally. E.g., if a GI specialist of the Geo team fully works for a policy department, the personnel costs are not charged. In principle, everything goes with closed budgets. Only if there are large projects, such as the development of a new geographical information project, the policy department is requested for a contribution from project funding. Two-thirds of the Geo team's time is spent on projects for other departments. The remaining one third is spent on own projects involving management and maintenance of geographical information.

The Province of Drenthe is a relatively small organization. Therefore, the organization's culture is one of direct contact. Most of the GI requests are done by mail, phone or people dropping by. Only in case of technological malfunctions of information products, a service management software program is used. This service management tool is however not suited for use during the interactive processes which occur during the development of new products.

Conclusion

All in all, it can be concluded that the Province of Drenthe is a small-sized province with a central Geo team positioned within the Department of I&A. The provision of geographical information is highly centralised at this Geo team. The primary focus of the Geo team is to unburden and to take care of the policy departments. In addition to the Geo team, a number of GI specialists work in some policy departments and some executive services. An overview of the GI organizational structure of the province is given in Figure 4.3.

[17] Space & Water = Ruimte & Water

4.1.3 Flevoland

In Figure 4.4, the GI organizational structure of the province is presented, showing the main organizational units who are involved in the provision of geographical information and their tasks and connections. The figure is based on the information given in the following subparagraphs.

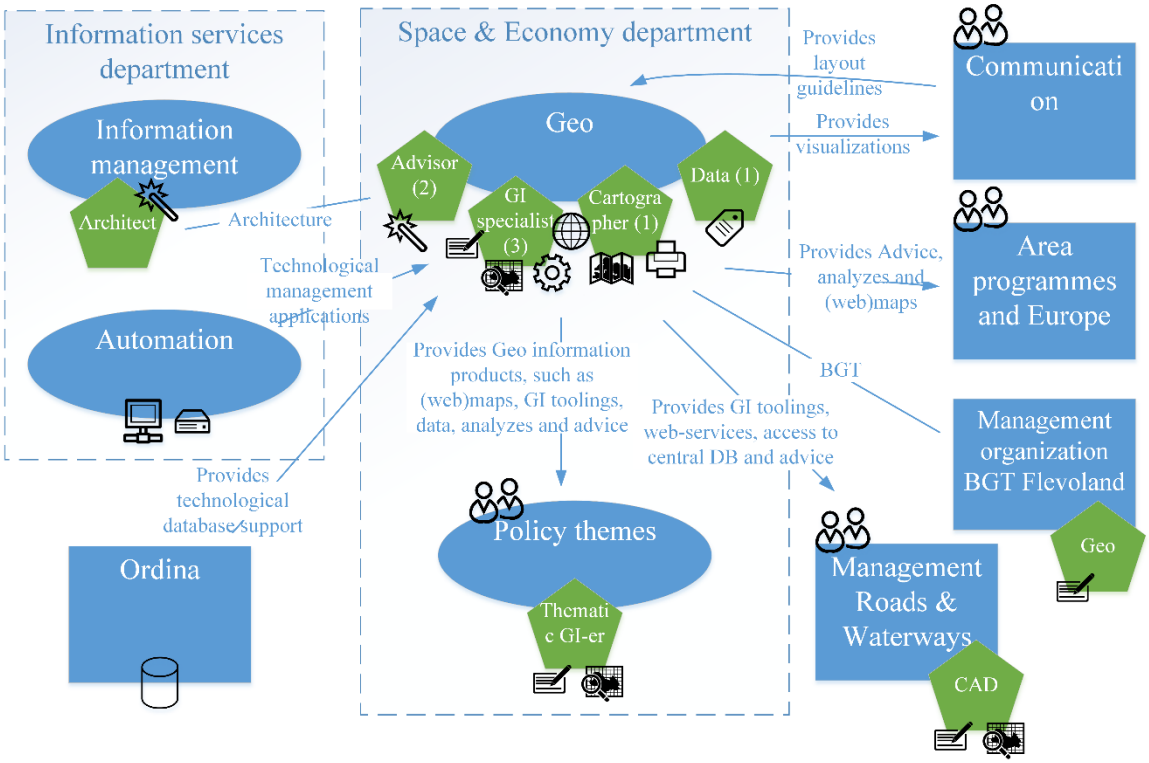


Figure 4.4 GI Organizational structure of the Province of Flevoland (see page 36 for explanation of symbols)

Size of organization

The Province of Flevoland is the smallest province in the Netherlands in terms of numbers of employees: 357,2 FTE (A&O-fonds Provincies, 2017).

Allocation of GI

The central GI unit is placed at the Department of Space & Economy[18]. At this department, all spatial policy domains are also located. Within this department, the main role of the Geo team is to coordinate and manage the geographical information.

Ever since the foundation of the Province of Flevoland in 1986, geographical information has played an important role. The role and position of the Geo team has however evolved in the course of time. Initially, geo information activities were carried out at the Department of Roads and Traffic[19]. At this department, the predecessors of the current GI specialists were operating; they mainly consisted of surveyors and cartographers. This resulted in the Bureau Cartography & Graphical Design[20], where all cartographical, graphical and geodesic activities were clustered. As the range of their field of operations was much wider than just Infrastructure, this team was placed at a facility department.

[18] Department of Space & Economy = Afdeling Ruimte & Economie
[19] Department of Roads and Traffic = Afdeling Wegen & Verkeer (Nowadays called Infrastructure)
[20] Bureau Cartography & Graphical Design = Bureau cartografie-grafisch ontwerp

However, after a number of years it became clear that there was little connection with the primary process and it was decided to place the Team Geo at the Department of Spatial planning and Public housing[21], nowadays called Space & Economy.

The Team Geo currently consists of two advisors, three GI specialists, one Cartographer and one Data specialist. One of the advisors also acts as coordinator and manager of the team. The second advisor is more focussed on the key registrations[22]. The GI specialists all have knowledge of GI analyses, but each has a specific expertise. For instance, one is specialized in 3D analyses, one in Big Data and one in graphical visualizations. The cartographer supervises the creation of visualizations. The Data specialist knows everything about the datasets and the associated metadata. The databases and schemes themselves are outsourced and managed by an external IT service provider. Besides this external service provider, who is in charge of the technology and management of the databases, Team Geo makes use of the services offered by the Department of Information Services[23]. Within this department, the provincial architecture is designed by information architects operating in the cluster Information Management. Team Geo has to comply with this architectural framework. A second cluster in this department manages the software and hardware for the organization. It provides Team Geo with Web GIS applications and servers; the functional management of these GI applications is done by Team Geo. The technology related functions have clearly been separated in order to avoid that team Geo is being seen as part of Automation. Team Geo sees itself as part of the policy domain and Automation as a support to their tasks.

The main user of the services provided by Team Geo is the policy Department Space & Economy. As some policymakers in this department have some knowledge of GI and access to GIS, they perform simple GI actions themselves. Another important customer of Team Geo, is the Department of Infrastructure. This department is in charge of the management and maintenance of the public roads and waterways. The key registrations are an important information product for them. There is direct contact between the members of Team Geo and some CAD[24] drawers of the Department of Infrastructure. The CAD drawers make lots of mutations which have to be updated in the key registrations. Characteristic for the collection of the BGT data is the independent BGT authority, established in cooperation with the municipalities of Flevoland. This authority has their own land surveyors and executes the BGT tasks on behalf of the province.

Finally, Communication (part of the Department of Management Support) and the Department of Area Programmes & Europe[25] should be mentioned as customers of Team Geo. In cooperation with Communication, the layout of (web)maps is discussed and designed. On one hand, Communication provides advice on how to design the maps. On the other hand, Team Geo provides graphic illustrations to Communication. The Department of Area Programmes & Europe is in charge of European subsidized projects and they regularly use geographical information to monitor their projects or to make decisions.

[21] Department of Spatial planning and Public housing = Afdeling Ruimtelijke Ordening & Volkshuisvesting
[22] Key registrations = Basisregistraties
[23] Department of Information Services = Afdeling Informatie Voorziening
[24] CAD = computer-aided design = computerondersteund ontwerpen
[25] Department of Area Programmes & Europe = Afdeling Gebiedsontwikkeling & Europa

Coordination of GI

Information requests are received rather informally by Team Geo as the team does not have a service desk. Automation does have a service desk, but this does not fit the customer approach as envisaged by Team Geo. Information questions are send in by e-mail and are answered within one day. In case of urgency, people are asked to come to the office personally. In addition, all seven members of Team Geo function as sort of account managers who monitor the customer questions constantly. The Team has an excel-sheet in which they keep track of all projects including project numbers. For every project, a registration form is being filled in which makes it possible for team members to replace tasks from each other.

The central geographic information budget is split into two parts. One part of the budget is for current subscriptions, mainly for the purchase and collection of project data. The other part is for the development of new information products. Although Team Geo has its own budget for developing new information products, the team always asks customers from the other departments for co-funding. The costs of software licenses are borne by the Automation cluster, part of the Department of Information Services.

Although the Team Geo provides geographical information products to the entire province, the responsibility for the content of the produced products always lies with the customer. If policy makers make new datasets or mutations to an existing dataset and want to disclose it through the central databases, they can send in a request at Team Geo to do so. Team Geo, as functional manager of the database, then checks whether the data meets the specified requirements. A quality test is used to check the meta-data. Only if the data meets these requirements, it will be included in the database.

According to the interviewee, current policy makers more and more rely on facts and numbers. This so-called evidence-based policy making asks for more geographical information of high quality. In the future, Team Geo has to further improve their knowledge in order to meet these requirements and to develop more into an advisory panel. This is in line with the idea of being a centre of expertise. The policy makers at the Department of Space & Economy consider Team Geo as an information box in the middle of the department, where all GI related questions can be dropped. Efforts are being made to further develop this idea, so that team geo is seen throughout the organization as the knowledge centre.

Conclusion

At the small-size Province of Flevoland, the geographical information services are highly centralized and placed within a policy department, situating them more closely to the end users. The Team Geo more and more acts like a centre of knowledge and provides information products throughout the organization. In Figure 4.4 an overview of the GI organizational structure is given.

4.1.4 Groningen

In Figure 4.5, the GI organizational structure of the Province of Groningen is presented, showing the main organizational units who are involved in the provision of geographical information and their tasks and connections. The figure is based on the information given in the following subparagraphs.

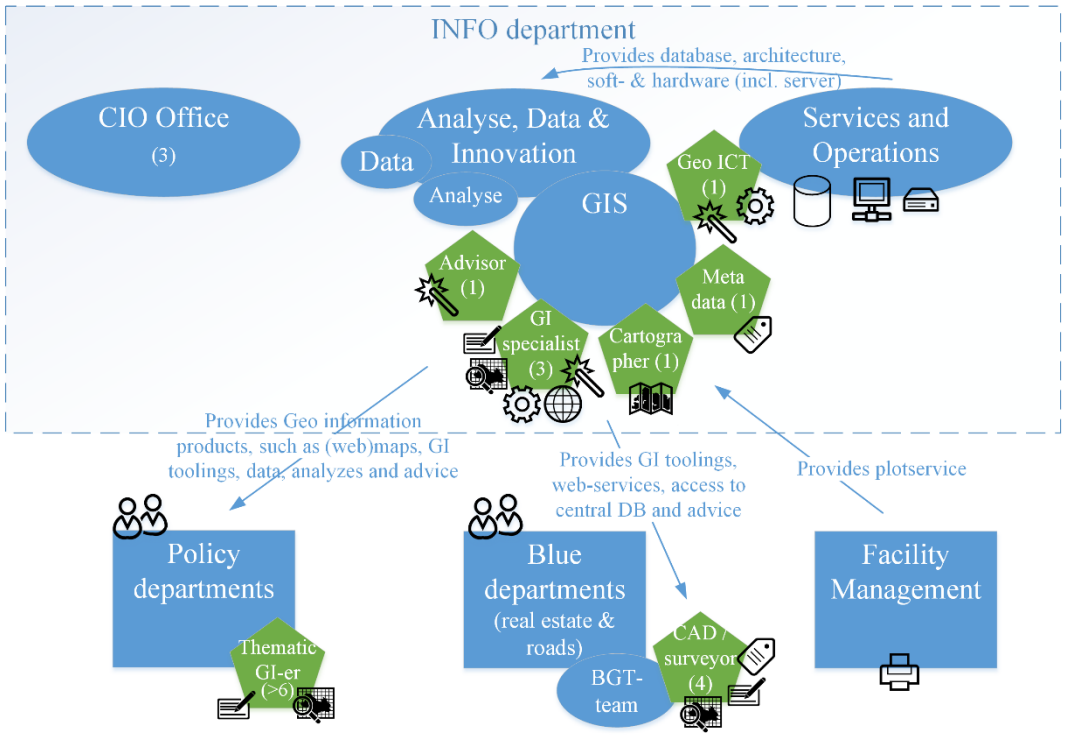


Figure 4.5 GI Organizational structure of the Province of Groningen (see page 36 for explanation of symbols)

Size of organization

The Province of Groningen, with a staff of 742,5 FTE (A&O-fonds Provincies, 2017), can be considered a medium-size provincial organization.

Allocation of GI

As of April 2017, the central GI unit of the Province of Groningen is located at the Department of INFO. The INFO department is a classic example of an Information & Automation or ICT department. It consists of three clusters: CIO Office, Analyse, Data & Innovation (ADI) and Services & Operations. The GIS team is part of the ADI cluster. The ADI cluster is coordinated by a central coordinator and consists of the GIS team plus four information analysts, two ICT project leaders and one data scientist.

The GIS team itself is coordinated by the ADI coordinator and is composed of a Geo advisor, three GI specialists, one meta-data manager and one cartographer. A part-time Geo-IT specialist, who works for both the GIS team and the Services & Operations cluster, completes the team. The Geo advisor provides advices on geographical information challenges and maintains contacts with Geo advisors of other provinces, being a member of the inter-provincial consultation group. The GI specialists configure viewers, set up web services, perform geo-analyses, create geodata and provide advice during the design and implementation of projects. For instance, they contribute to the Environmental & Planning Vision and Nature Management Plan. The GI specialists use software programmes like

desktop GIS, web GIS and ETL[26] tooling. The meta-data manager is responsible for the data quality and the up-to-dateness of the geographical information, although it should be noted that the owner of the data is ultimately in charge of this data. The cartographer does not interfere at all with the data. His main job is to visualize the data and provide maps to the customer. The Geo IT specialist is contracted from outside the organization. He is the link between the GIS team and the technological application managers of the cluster Services and Operations. Finally, one staff member of the Department of Road Construction[27] is employed at the GIS team for one and a half day per week (0.3 fte). This person has expertise on cadastral information and property rights.

The Department of Road Construction is one of the so-called 'blue departments'. The blue departments are in charge of the management, maintenance and construction of the provincial roads and waterways. As opposed to the policy departments that mainly use small-scale topography, the blue departments work with large-scale geographical information. They have their own GI unit for this purpose. This unit, called BGT team, is in charge of all large-scale topographical information products and has its own GI specialists. This situation originates from the time of the land surveyors. The data they collected was at some point processed with CAD software tools. In the course of time, the role of GI in their work became increasingly important. As a result, GIS is now being used for the unit's activities in addition to the CAD software programs. Recently, four employees of the BGT team have followed GI courses.

In contrast, the policy departments do rely on the services of INFO's GIS team to a large extent. At some of these departments, some staff members work extensively with GIS. E.g., at Area & Environment[28] two staff members and at Area & Water[29] three. These specialists perform specific analyses and adaptations using the data and tooling provided by the GIS team. According to the interviewee at the province, the department of Traffic & Transport also makes use of a lot of geographical information. However, it is not entirely clear how and what is done with this information. Improvement of the feedback from this department to the GIS team is something that needs to be looked at.

Finally, the Facility Department should be mentioned briefly, when it comes to the allocation of the geo-information services. This department is equipped with a plotter and provides a plotting service to plot maps on paper up to the A0 format.

Coordination of GI

The coordination of the geographical information is positioned at the Department of INFO since April 2017. Before that date, the GIS team was part of the Department of Human Resources, Organization and Information[30]. The re-organization of April 2017 has brought the GIS team back to the situation of 2004, when the team was part of a similar department called IVT (Information provision and Technology)[31]. The relocation of the GIS team to the I&A department does make sense, as the link between Human Resources & Organization and Geographical Information is not evident. Being now positioned at I&A, the lines with the technical support cluster are much shorter. Although according

[26] ETL = Extract Transform Load
[27] Department of Road Construction = Afdeling Wegenbouw
[28] Department of Area & Environment = Afdeling Omgeving & Milieu
[29] Department of Area & Water = Afdeling Gebied & Water
[30] Department of Human Resources, Organization and Information = Afdeling Personeel, Organisatie en Informatie
[31] IVT = Information provision and Technology = Informatievoorziening en Technologie

to the interviewee, the GIS team needs to be aware that they will get caught up in the rigid straightjacket of ICT. The GIS team should be seen as an extension of the policy departments and the helpdesk system used by IT professionals to register/log calls is not appropriate for the handling of geographical information requests from the policy officers. However, the GIS team is open to look for a better way to register its activities, for example with the help of the helpdesk system used by the INFO department.

The GIS team's aim is to meet the expectations of its end users. Six months ago, a process was started to update the Geo Architecture, based on user requirements. Because of the limited human resources and knowledge available within the GIS team, there is however little room for major modifications. Another aspect related to the decision making process, is the degree of autonomy of the various departments. In theory, there is no obligation for policy makers to make use of the services of the central GIS team. If they prefer to do analyses themselves, this is possible. The only restriction they have to take into account is that the GIS team controls the offered GI tools and the available geographical information. Therefore, personality and cultural differences within policy departments largely determine the way departments make use of geographical information and the degree of contact with the GIS team.

Customers can contact the GIS team in different ways. The GIS team has a central mailbox where people can send their questions and requests to. The mailbox is checked daily by the members of the GIS team; every week someone else is responsible for this. Besides the mailbox, requests are made by phone, via the provincial helpdesk or people drop in. There is not someone specifically appointed to conduct the intake interviews with the customers, like it is done at the Province of Drenthe. Currently, clear overviews of requests or lists with information products made are not available. Also, a well-defined feedback procedure to measure whether the product supplied meets the customer expectations is missing and feedback given during informal moments of contact are not registered in a structured way.

The GIS team has put a metadata catalogue at the intranet which can be searched and consulted. Its purpose is to give free access to geographical information. With the help of the internal map viewer E-Atlas, it is possible for provincial officers to browse and view the available information.

The GIS team does not have a budget of their own to finance the services they provide. The Department INFO has one budget to pay for the licenses, data and other resources of the entire department. The GIS team has to negotiate about the budget needed for the geographical information services. Because end users make more and more use of GIS, additional licences must be purchased which costs money. Often, end users are asked to co-fund these additional costs. In addition, costs of datasets are often paid partly by the policy departments.

Conclusion

To summarize, at the middle-size Province of Groningen, geographical information has been centralized at two places in the organization. The corporate department of INFO and its GIS team deals with small scale topographical information questions and focusses on the provision of information to policy makers. At the executive Department of Concrete and Hydraulic Engineering[32] the emphasis of the BGT team is on large scale topographical information questions. Both departments have their own strategies and geographical information products, but the coordination of

[32] Department of Concrete & Hydraulic Engineering = Afdeling Beton & Waterbouw

the main databases and available GI software is done by the GIS team placed at INFO. In the future, the GIS team hopes to further develop their services and to be able to focus more on providing knowledge and advice, instead of making maps and doing analyses.

4.1.5 Gelderland

In Figure 4.6, the GI organizational structure of the province is presented, showing the main organizational units who are involved in the provision of geographical information and their tasks and connections. The figure is based on the information given in the following subparagraphs.

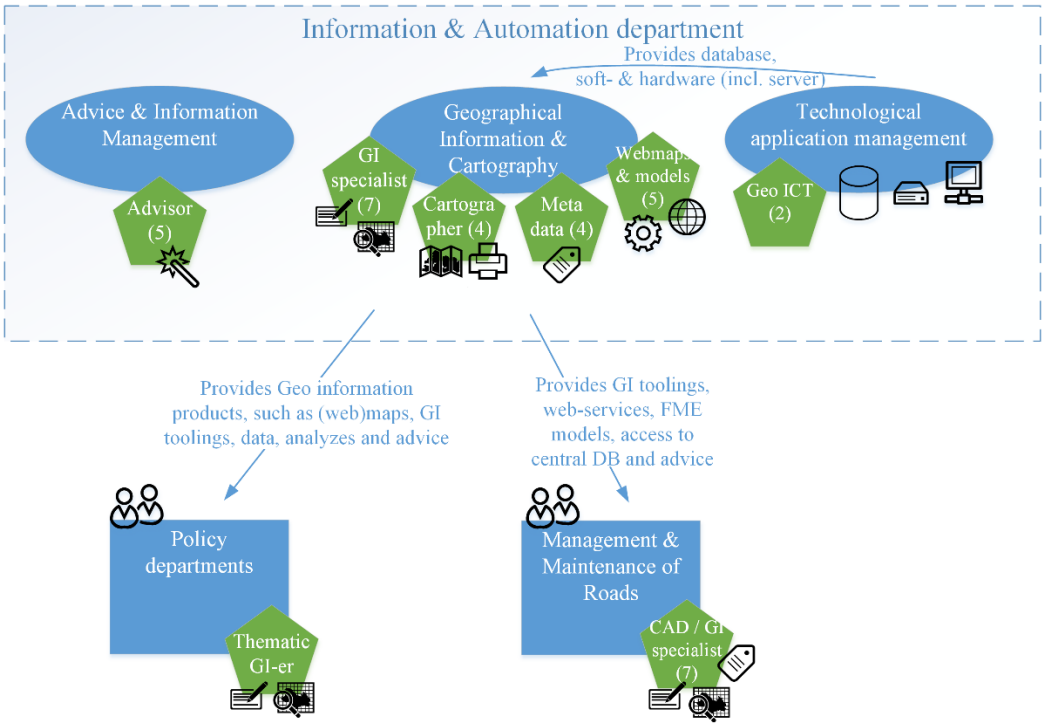


Figure 4.6 GI Organizational structure of the Province of Gelderland (see page 36 for explanation of symbols)

Size of organization

The Province of Gelderland, with 1108 FTE, is the second largest province in terms of employees (A&O-fonds Provincies, 2017) and is a large-size provincial organization.

Allocation of GI

With regard to geographical information, the province has a central GI unit consisting of twenty-two people. This team, called Geographical Information & Cartography, is part of the Department of Information & Automation (I&A) and provides the main geographical information services to the organization including cartographical products. The team is coordinated by a change manager, a hr-manager and two working coordinators. The Province of Gelderland was regarded as one of the leading provincial organizations in the field of geographical information (Ven, Bijtelaar, & Köbben, 2001).

The team Geographical Information & Cartography is structured in four clusters: Cartography, Data & GIS, Data Management and Webmaps & Models. Each cluster has its own role and specialization.

The cartographers of the cluster cartography have traditionally been involved in the design of maps, using graphic design programmes in addition to GI programmes. Information products delivered by them include illustrations, pdf documents and plotted maps. Besides geographical information, they have the expertise to design icons and symbols that are used at maps. They used to manage their own plotting service, but in 2017 the plotter has physically been moved to the central repro unit at the facility department. Although moved to another department, the cartographers are still in charge of the plot service for maps.

The cluster Data Management ensures that data is correctly retrieved, stored in the database and ultimately distributed to customers. They also check whether the metadata attached to the data are complete and correct. Furthermore, the quality of the data is checked with regard to geographical as well as attribute data.

The team members of Data & GIS are mainly involved in GI analyses and the creation of data sets. For instance, when the boundaries of a nature reserve change, the GI specialists will update the dataset concerned. Data & GIS also contributes to products such as the Environmental & Planning Vision and the Nature Management Plan.

For more complex analyses, in which for example ETL models are used, the members of the cluster Webmaps & Models are consulted. They have knowledge of the configuration of web maps and the implementation of ETL[33] processes. The members of Webmaps & Models also take care of the functional management of GI applications. The technological management of these applications is done by two IT members of team Technological Application Management, another team within the department of I&A.

The geo advisors who are assigned to the team Advice & Information management[34] also play an important role in the geographical information provision in the organization. This team is also part of the Department of I&A. One of these geo advisors operates at a more strategic level, being responsible for the company-wide geographic information strategy. This advisor also coordinates the other three to four geo advisors who provide advises at the operational level. These so-called operational geo advisors manage certain larger projects and are frequently involved in customer contacts. As a result, they act as the link between the policy maker and the GI specialist.

The end users of the geographical information products at the Province of Gelderland are located at the Department of Management & Maintenance of Roads[35] and at the so-called policy programmes. A policy programme deals with a particular policy domain, for instance Nature & Landscape or Water and Economy. In one policy programme, several policy officers are involved. The content of these programmes is based on the political decisions as laid down in the coalition agreement at the national level. The geographical information available is used as a basis and input for policies developed and programmes executed. In some of these programmes, certain policy officers spend a substantial part of their time on geographical information. These staff members can be called GI specialists with a special focus on the policy theme concerned. They can request team GIC to provide GIS licenses, in order to perform their analyses.

[33] ETL = Extract Transform Load
[34] Advice & Information management = Advies en Informatiemanagement
[35] Department of Management & Maintenance of Roads = Afdeling Beheer en Onderhoud Wegen (BOW)

The second group of end users can be found at the Department of Management & Maintenance of Roads. Within this department, a team of CAD/GI specialists work on issues involving large scale topographical information. With regard to their geographical information activities, this team of CAD/GI specialists rather operates quite independently. The six to eight people who work there have knowledge of GI tools and are able to make edits to data sets related to provincial roads. Their edit suggestions are daily transferred by team GIC to the central geodatabase. This group also has the knowledge and tools to perform analyses and visualizations without requesting support from the central GI unit from I&A. The main contact between the departments of I&A and M&M of Roads is about functional management, as team GIC manages most of the servers, services and software used by the members of Management & Maintenance of Roads. In addition, the GIC team plays an important role in the development of new products to be used by road managers.

Coordination of GI

Regarding the management of geographical information in the Province of Gelderland, team GIC is the central point. The strategic managers of the organization see team GIC as an internal provider of all geographical information services and products, including the databases and functional management of GI software. The team is supportive to the policy programmes and the executive Department of Management & Maintenance of Roads. The main reasons for the GI centralization at team GIC is that the team operates organization-wide and the size of the team is a guarantee for the continuity of processes.

With regard to the customer contact, all team members of team GIC have contact with the end users, in one way or another. The members of the clusters Data&GIS and Cartography perhaps in a more extensive way than the members of the clusters Data Management and Webmaps & Modells, but all of them work on behalf of other departments. This is in line with the position of team GIC, which is in the corporate domain. The ways of communication between GI specialists and end users vary. In principle, the initial contact is made through a service request from the end user through the service desk. The service desk forwards the request to the GI specialists using a service management software. Depending the nature of the request, the information products are delivered directly digitally or an intake interview is planned. Although the official procedure requires requests to be submitted via the provincial service desk, people still call or mail the GI specialist directly. If that happens, GI specialists are supposed to add the request themselves manually to the service management software. This facilitates the processing of an ongoing dossier by different people and to keep an overview of the information requests.

The strategy and architecture of the team and the geographical information services are defined by the geo advisors of team Advice & Information Management in cooperation with the managers and coordinators of team GIC. Furthermore, architects from Advice & Information Management are involved in the business architecture and keep an eye on whether it is consistent with the provincial reference architecture PETRA.

The activities performed by team GIC are financed out of a common I&A budget which is established annually. The budget consists of three components: main budget, programme budget, investment budget. The main budget is more or less fixed and is used to pay the costs of staff. The programme budget covers costs of hiring external specialists or developing special information products for specific projects. The investment budget is provided once every three years and is intended to cover large one-time investments in a specific programme or datasets. Each year, the consultants make an estimate of the human and financial resources required to carry out the work.

According to the interviewee, a clear distinction should be made between information products and automation. Information products are the products which are being created in consultation with the end user. In this respect, team GIC is ahead of the rest of the department. The employees of the team GIC have insight in the activities of the customers and are able and in the position to participate in the primary policy process of the customer. The team can be described as a company in a company. They have to do some acquisition within the organization and ensure that services they can provide themselves are not outsourced to external companies.

Conclusion

All in all, it can be concluded that the Province of Gelderland has a centralized GI organization with hybrid features. The Geo-team is centrally organized and positioned within the Department of I&A, which provides organization-wide services. A second group of GI specialists is positioned at the Department of Management & Maintenance of Roads. They perform GI edits and analyses for their own business processes aimed at the management and maintenance of provincial roads, giving the GI organizational structure of Gelderland a more hybrid character. Also, a number of GI specialists work within some policy programmes. An overview of the GI organizational structure of the province is given in Figure 4.6.

4.1.6 Overijssel

In Figure 4.7, the GI organizational structure of the Province of Overijssel is presented, showing the main organizational units who are involved in the provision of geographical information and their tasks and connections. The figure is based on the information given in the following subparagraphs.

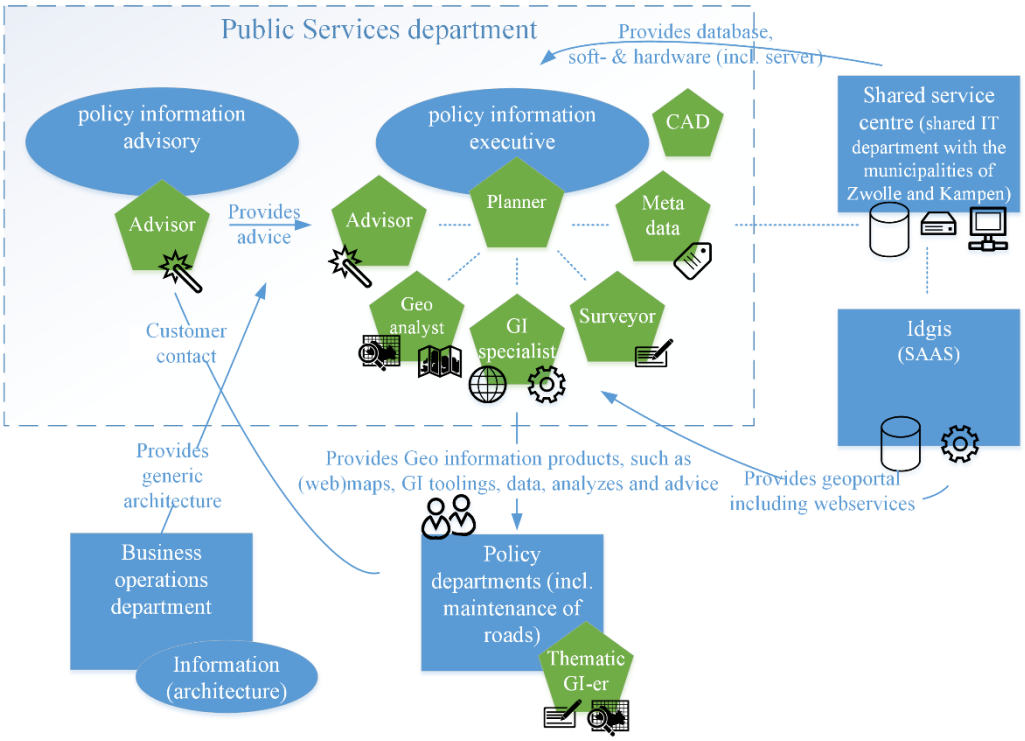


Figure 4.7 GI Organizational structure of the Province of Overijssel (see page 36 for explanation of symbols)

Size of organization

The Province of Overijssel is with 701,2 FTE an organization of relatively medium size, in terms of numbers of employees (A&O-fonds Provincies, 2017).

Allocation of GI

The main geographical information activities are centralized in the Department of Public Services[36]. This Department is responsible for granting licences, subsidies, policy information and geographical information and also for the implementation of provincial land policies. The Department consists of multiple teams. The teams Policy Information Advisory[37] and Policy Information Executive[38] are the ones responsible for the geographical information services and they work closely together. The Policy Information Executive team focusses on the operational side of the GI services, whereas the Policy Information Advisory team sets out the strategies at a more tactical level.

The Policy Information Executive team consists of around thirty people. The majority of these employees have a role which is geographical information related. But people often also have different roles between which they can switch frequently. For instance, one moment someone is surveying in the field, the next moment he/she is processing the data in the database or making a card. How often someone switches, depends on the type of project being carried out and the amount of work to be done. The following types of GI-related roles can be defined in the team: advisor, analyst, GI specialist, surveyor, functional manager and meta data manager. Some of them are specialists in CAD. It is remarkable that no real, authentic cartographers are employed within the team. The last one of them has been retired recently.

Besides the two policy information teams, a number of other units within the Department of Public Services are involved in the provision of geographical information. First of all, the technological support of software and hardware, including servers, is provided by a Shared Service Centre (SSC). This Shared Service Centre is a joint venture between the Province of Overijssel and the municipalities of Kampen and Zwolle. In this venture, the municipality of Zwolle acts as the host organization and the SSC falls under the responsibility of the municipality secretary[39] of Zwolle. However, the centre itself is located at the provincial government building of Overijssel (Rekenkamercommissie Zwolle & Rekenkamercommissie Kampen, 2015). The Policy Information teams can be considered as customers of the Shared Service Centre. The coordinator of functional management within the Policy Information Executive team is responsible for the contact with the SSC.

A second provider of technological support to the policy information teams, next to the SSC, is software developer IDgis. This company is in charge of the geoportal, web map services and geodatabases of the Province of Overijssel and offers a Software as a Service (SaaS) solution. The complete publication database is managed by IDgis. Both internal and external users make use of the data disseminated by IDgis. Within the province, it is also possible to access raw data on the internal database with a desktop GIS.

The GI capabilities of the policy officers working at Departments such as Nature & Environment[40] and Space & Accessibility[41] should not be underestimated. They are very well capable of doing simple analyses and producing maps themselves, having access to the data and the tools. In the internal geoportal more than 1000 datasets are available. It's the team policy information's task to

[36] Department of Public Services = Eenheid Publieke Dienstverlening
[37] Team Policy Information Advisory = Team Beleidsinformatie Adviserend
[38] Team Policy Information Executive = Team Beleidsinformatie Uitvoerend
[39] Municipal clerk = gemeentesecretaris
[40] Department of Nature & Environment = Eenheid Natuur & Milieu
[41] Department of Space & Accessibility = Eenheid Ruimte & Bereikbaarheid

make all available data accessible in a harmonised way through the geoportal and to guarantee the quality of the data. This makes it possible for policy offers at the Departments to consult data directly without having to consult the employees of the Department of Public Services first, and thus saving them a lot of time. If a policy officer has more complex questions, he or she can always contact the planner of the policy information teams.

Coordination of GI

The team Policy Information Executive is in charge of all geographical information products within the Province of Overijssel. This includes information request of policy makers and managers of the Department of Roads and Waterways[42].

The Executive team is supported in their task by the advisors of team Policy Information Advisory, who act as ambassadors for the geographical information products of the executive team. The advisors maintain contacts with the customers, such as the employees of the policy departments, and advise them on their information issues. If, during this contact, the need for spatial information products becomes apparent, this information will be passed on to the advisors of the executive team. The advisors of both the advisory and the executive team are also involved in setting out the strategy for the provision of information within the organization. They do this together with the team manager.

An important role within the Policy Information teams is reserved for the so-called planner. All policy information requests, including the geographical information ones, are passed on to the planner. The planner evaluates the request and forwards it to a team member assigned to do an intake interview. Goal of the interview is to get the customer's question clear and define it in more detail. For this, a form is used, consisting of several fields, some of them with closed options. For instance, a choice has to be made regarding the type of product; will it be map production, analysis, management or edit. Once the question is clear, the amount of work involved is calculated and the work to be carried out is assigned by the planner to one or more team members. In this process, the planner takes into account the capabilities and availability of the team members and possible suggestions for specific persons made during the intake interview.

The new information request is given a unique project number. This project number serves as reference number, used in the communication between GI specialists of team Policy Information and the end users. The numbers are registered in an excel-file with all pending projects and can be retrieved through the search function of the geoportal. This number makes it possible to trace an information product at all times. However, if information products are developed by policy officers themselves, without consultation of the policy information team and numbering, the retrieval and the quality of the product cannot be guaranteed.

The end user of GI products is asked in various ways about his demands. First of all, throughout the contacts between the customer and the advisors of the Policy Information Advisory team and the Policy Information Executive team. Secondly, each year, a satisfaction survey is carried out among the end-users. Furthermore, upon delivery of an information product, thirty percent of the customers receive a feedback form. According to the interviewee, all this together guarantees that the delivered information meets the user requirements.

[42] Department of Roads and Waterways = Eenheid Wegen en Kanalen

Finally, the Department of Business Operations[43] should be mentioned. Within this Department the team Information[44] is in charge of the enterprise architecture. They set out the generic structure and architecture of the geographical information services. The activities performed by team Policy Information must be in line with this architecture.

The Department of Public Services has a fixed annual budget to carry out their regular services. The budget is however not large enough to cover all information requests. Therefore, the customer is asked during the intake interviews to co-fund the requested project. Reduction of costs is achieved by purchasing data files together with other Dutch provinces. For example, datasets such as aerial photographs are bought together with members of the content group of the interprovincial expert group on Geographical Information PP-Geo[45].

Conclusion

In conclusion, the main geographical information services within the middle-size Province of Overijssel are centrally organized and are provided by the two policy information teams (advisory and executive) of the Department of Public Services. The teams are in charge of all kinds of policy information, including small scale and large scale topographical information products. The main reason for not placing these services at the individual policy teams is that a central information centre is considered to be more efficient and that better geographical information services can be provided. According to the interviewee: 1+1=3. New developments such as Big Data, for example, cannot be processed by individual GI specialists who are spread over the organization. A central group of specialists ensures a higher level of knowledge and expertise and the ability to keep up with new developments. However, policy makers do have the opportunity to analyse and view themselves the geographical information provided by the central GI unit. This adds hybrid organizational features to the GI organizational structure of Overijssel. An overview of the geographical information organizational structure of the province is given Figure 4.7.

4.1.7 Utrecht

In Figure 4.8, the GI organizational structure of the Province of Utrecht is presented, showing the main organizational units who are involved in the provision of geographical information and their tasks and connections. The figure is based on the information given in the following subparagraphs.

[43] Department of Business Operations = Eenheid Bedrijfsvoering
[44] Team Information = Team Informatievoorziening
[45] PP-Geo = interprovincial platform on geographical information = Provinciaal Platform GEO-informatie

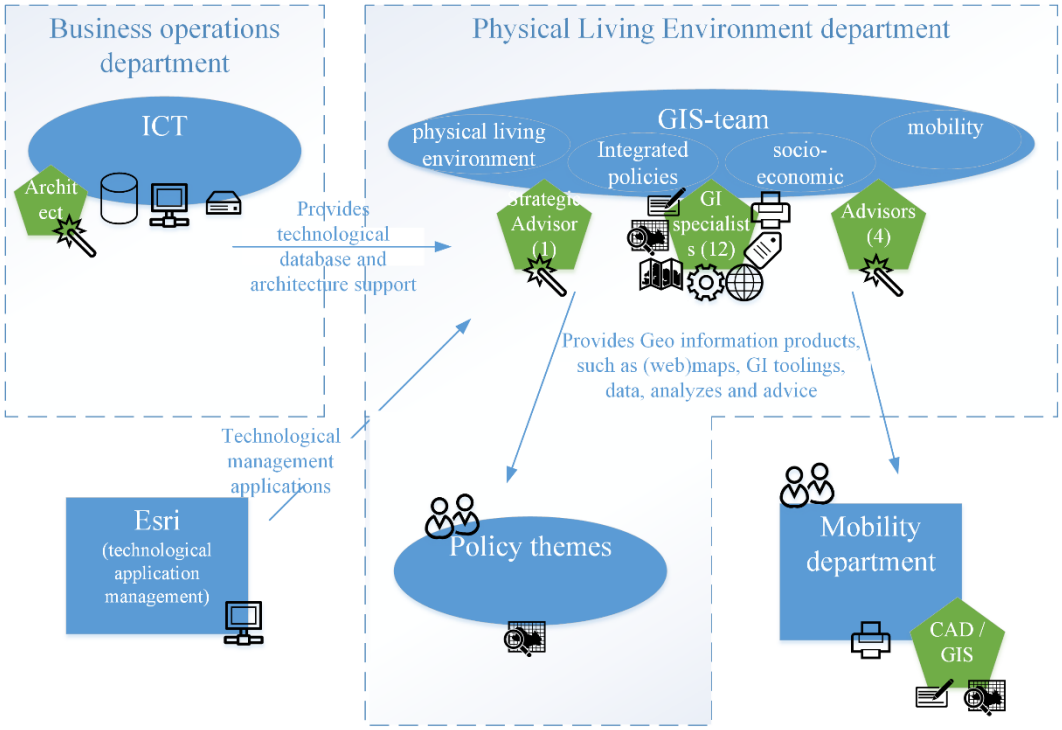


Figure 4.8 GI Organizational structure of the Province of Utrecht (see page 36 for explanation of symbols)

Size of organization

The Province of Utrecht is with 737,7 FTE a relatively medium-sized organization in terms of numbers of employees (A&O-fonds Provincies, 2017).

Allocation of GI

The central GI unit of the Province of Utrecht (the GIS team) is placed at the Corporate Department of Physical Living Environment[46]. The GIS team functions as an information centre for spatial data for the entire province. In doing so, their goal is to strengthen, connect and innovate the provision of geographical information. The team explicitly does not want to be seen as a simple service provider with the policy officer as its customer. The team considers itself as part of the policy process and tries to fit into that process. It aims to create a self-service situation in which policy officers can view and visualize their own data. The team itself focuses on providing advice, integrated tools and high quality data.

The Department of Physical Living Environment is in charge of the policy areas of Nature, Water, Planning, Environment and Soil. Next to this Department there are two other corporate departments: the Department Mobility[47], which deals with the policies, management, maintenance and assets of the provincial roads and public traffic, and the Department of Business Operations[48]. This last Department includes the regular supporting teams such as human resources, organizational affairs and ICT. Until 2013, the central geographic information provision was part of this ICT team.
When the provincial government moved to the new provincial government building at the Archimedeslaan in Utrecht, the GIS team was repositioned from the Department of Business

[46] Department of Physical Living Environment = Afdeling Fysieke Leefomgeving
[47] Department of Mobility = Afdeling Mobiliteit
[48] Department of Business Operations = Afdeling Bedrijfsvoering

Operations to the Department of Physical Living Environment. The reason for re-organization was that geographical information can be seen as part of the primary process and that a position within the policy department itself would make far more sense. According to the interviewee, 'GIS' is not about technical applications but is about information and business processes. The main reason for opting for the Physical Living Environment Department instead of the Mobility Department was that the majority (over 70 percent) of the information products of the GIS team is used by this Department.

The GIS team nowadays consists of a team manager, a strategic advisor, some operational advisors and so-called theme managers. In total the team consists of 15 FTE. Each operational advisor is linked to and in charge of a specific policy domain. The domains concerned are Physical Living Environment, Integrated policies, Socio-Economic (incl. the key registers[49]) and Mobility. Within a domain, there are several themes. For instance, Physical Living Environment includes policy themes such as Environment, Soil & Water, Rural Areas, Nature and Management of Applications. Each theme manager of the GIS team is in charge of one or more of these themes. As a result, the policy makers of the policy teams have a central point of contact for geographical information related questions and services. For example, a policy maker working on the nature conservation plan can contact the theme manager Nature for geographical information products.

Each member of the GIS team is specialised in a certain GI activity, such as data management, functional management or map production. The team provides a wide range of information products to the policy teams of the Department of Physical Living Environment and the Department of Mobility. In principle, all GI activities have been assigned to this team with the exception of the operational work for the BGT (Key Register Large Scale Topography), which is outsourced to an agency that also takes care of the collection of the data. Team GIS is responsible only for the management and outsourcing of the BGT. Strongly related to working with the BGT is the asset management and the maintenance of roads. This is carried out by the Department of Mobility, for which CAD and GI tools are being used by some skilled employees within this Department. One might therefore argue, that GI specialists are also placed at this Department. However, the jobs they perform are limited to simple edits and analyses. All other GI activities regarding the maintenance of roads including the functional management of the CAD tooling is done by the GIS team.

The technological aspects of the geographical information environment of the province are managed by the Department of Business Operations. They provide technological support, including databases, software and hardware. With regard to the management of the applications, team GIS takes the advice of the main software supplier Esri into account. When a software update is released, the reconfiguration is done by Esri.

Coordination

As far as contact with the end user is concerned, communication lines are very short. The theme managers are in close contact with the different end users. This also greatly helps to get a direct insight into the needs and wishes of these users. This insight could further be improved if satisfaction surveys were to be conducted structurally. The GIS team is not to be considered as a service organization, but rather as part of the primary process. Nevertheless, the team has to justify its actions to justify for the budget and resources allocated. For instance, the number of published datasets, the number of users and views and the type of users, all need to be registered.

[49] Key registers = Basisregistraties

The architecture of the organization is designed at the Department of Business Operations. From a theoretical point of view, they may seem to have an influence on the way the geographical information services are provided but in practice little is done with architecture. The team leader and advisors of the GIS team primarily determine the geo strategy themselves, without taking the architecture into account. The document on vision and strategy regarding the use of Spatial Information within the province is produced by them.

In terms of funding, the GIS team has its own centralized budget for GI services. The budget consists of a regular budget and an innovation budget. The regular budget is used to buy software licenses, aerial photographs and datasets and for the GBO Provinces[50]. The innovation budget is used to develop new applications such as a 3D environment or a pilot in Web GIS. In some cases, additional budget needs to be made available for large projects, like the implementation of the Environment and Planning Act[51]. In other cases, budget from the policy teams is used to finance activities. For instance, the surveying of roads is financed from the budget of the Department of Mobility.

Most geographical information requests are received by team GIS via the theme managers. In addition, there is a central GI e-mailbox. A relatively simple question will be handled by one of the theme managers directly. In case the question is more complex, they are joined by one of the advisors to do the intake interview. The theme managers then monitor themselves whether the projects are being implemented and concluded.

Conclusion

At the medium-size Province of Utrecht, the GIS team is centrally positioned within the Department of Physical Living Environment. The team functions as an information centre for spatial data for the entire province and focuses on providing advice, integrated tools and high quality data. It aims to create a self-service situation in which policy officers can view and visualize their own data. The GIS team is technically supported by the Department of Business Operations. An overview of the GI organizational structure of the province is given in Figure 4.8.

4.2 Provincial organizational structure based on the degree of centralization

In the previous Paragraph 4.1, the GI organizational structure of the seven provinces studied have been described on the basis of the results of the interviews held at the provinces. In this paragraph, the results found are summarised in Table 4.1. In the table, the observed situation is given per characteristic for each province. After the summary in tabular form, the results of the interviews are explained in more detail for each dimension (allocation and coordination). Finally, conclusions are drawn with regard to what type of organizational model the GI organizational structure of a province belongs to. This will give an answer to research question 2: "Which type of GI organizational structures are used within Dutch provinces?"

Way of organization per characteristic per province

Table 4.1 summarizes how the different characteristics are organized in a province and to which organizational model (central-decentral-hybrid) the characteristic can be classified. The dimensions and characteristics listed in the table correspond to those of the theoretical framework presented in Paragraph 2.3.

[50] GBO Provinces = Gemeenschappelijke BeheerOrganisatie provincies
[51] Environment and Planning Act = Omgevingswet

The colours in the table, given to a specified characteristic, indicate the degree of centralisation. For example, a blue cell indicates a Central Model organization and a purple cell indicates a Hybrid Model organization. In some cases, a cell is coloured blue-purple, which indicates that the characteristic concerned has characteristics of both the Central and Hybrid Model or is located in between them.

Table 4.1 Features of different characteristics per province

= *compliant with Central Model*
= *compliant with Central Model with Hybrid features or in between Central and Hybrid Model*
= *compliant with Hybrid Model*

Dimensions	Characteristics	**Zuid-Holland**	**Drenthe**	**Flevoland**	**Groningen**	**Gelderland**	**Overijssel**	**Utrecht**
Allocation	Presence of central GI unit	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Central GI Support	Geo Team	Geo team	Team GEO	GIS team	Team GIC	Team policy information	Team GIS
	Position of operational GI activities in the organization	Geo Team	Geo team	Team GEO	GIS team	Team GIC	Team policy information	Team GIS
	Data management	Geo Team	Geo team	Team GEO	GIS team	Team GIC	Team policy information	Team GIS
	Database maintenance	Infrastructure & Support (IT)	Automation (IT)	Information services (IT)	Services and operations (IT)	Technological application management (IT)	Outsourced to shared service centre and idgis by team policy information	Business operations department (IT)
	Data creation and editing	Geo Team (IT) + Road authority + policy departments	Geo Team (IT) + Road authority + policy departments	Team Geo + policy themes (both policy department) + Road authority + BGT Flevoland	GIS team (IT) + Road authority + Policy departments	Team GIC (IT) + Road authority + policy departments	Team policy information (Public services) + Policy departments	Team GIS + policy themes (both policy department) + Road authority
	Data analysis	Geo Team (IT) + Road authority + policy departments	Geo Team (IT) + Road authority + policy departments	Team Geo + policy themes (both policy department) + Road authority	GIS team (IT) + Blue departments + Policy departments	Team GIC (IT) + Road authority + policy departments	Team policy information (Public services) + Policy departments	Team GIS + policy themes (both policy department) + Road authority

	Data visualization / map production	Geo Team (IT)	Geo Team (IT)	Team Geo (Policy)	GIS team (IT)	Team GIC (IT)	Team policy information (Public services)	Team GIS (policy department)
	Management of Applications (incl. soft- and hardware)	Geo Team in cooperation with Infrastructure & Support (both IT)	Geo Team in cooperation with Automation (both IT)	Team Geo (Policy) in cooperation with Automation (IT)	GIS team in cooperation with services and operations (both IT)	Team GIC in cooperation with technological application management (both IT)	Team policy information (Public services) + shared service centre	Team GIS (policy) in cooperation with ICT (IT)
Coordination	Strategic GI activities and procedures	Geo in cooperation with Advice & Policy (both IT)	Geo in cooperation with Information (both IT)	Geo (policy) in cooperation with Information management (IT)	GIS in cooperation with Services and operations (both IT)	GIC in cooperation with Advice & Information management (both IT)	Policy information advisory in cooperation with Policy information executive (both public services)	GIS (policy) in cooperation with ICT (IT)
	Planning and design of general GI products and services	Geo in cooperation with Advice & Policy (both IT)	Geo in cooperation with Information (both IT)	Geo (policy)	GIS in cooperation with Services and operations (both IT)	GIC in cooperation with Advice & Information management (both IT)	Policy information advisory in cooperation with executive (both public services)	GIS (policy)
	Data / GI product ownership / responsibility	Users at departments in cooperation with Geo (IT)	Users at departments in cooperation with Geo (IT)	Users at departments in cooperation with Geo (policy)	Users at departments in cooperation with GIS (IT)	Users at departments in cooperation with GIC (IT)	Users at departments in cooperation with Policy information executive	Users at departments in cooperation with GIS (policy)
	Decision making	Information advisors	Information advisors	Information advisors	Information advisors	Information advisors	Information advisors	Information advisors
	Funding	Central budget for Geo + co-funding by end-user	Central budget for Geo + co-funding by end-user	Central budget for Geo + co-funding by end-user	Central budget for INFO + co-funding by end-user	Central budget for GIC + co-funding by end-user	Central budget for Public services + co-funding by end-user	Central budget for GIS + co-funding by end-user

Allocation

The interviews conducted show that in all provinces most of the geographic information products within the organization are provided by the central GI unit. These units with names such as team GIS, Geo team, GIC and Policy Information are considered within the organization as the central team for the provision of GI services.

These teams have emerged in the past decades as a result of the centralisation of geographical information services. The idea was to create a strong and broad GI unit within the organization by clustering all GI employees within the organization together in one team. In organizations where GI specialists were concentrated within the IT departments after the re-organization, such as in Gelderland and Zuid-Holland, this resulted in a weakening of previous existing short lines and direct contacts between GI employees and end users. To overcome this, GI employees have also been positioned at a number of core policy domains, next to the central GI unit.

With regard to the distribution of GI tasks within the organization, the study shows that services such as GI support, data management and functional application management have strictly been assigned to the central GI unit in all provinces studied. In almost all the cases, the data processing (creation and editing) and analysis are centrally assigned to the GI specialists, but end users are allowed to do these type of GI activities to a certain extent themselves. For this purpose, most central GI units provide access to the central database and tools to edit and analyse the data. Examples of this are the geoportal of Overijssel and EGIS[52], a Geoweb application of the Province of Gelderland. Particularly employees of policy and executive departments who are involved in roads, planning and other spatial domains make use of these possibilities and may be able to carry out GI activities independently without the intervention or assistance of GI specialists from the central GI unit.

In all provinces, with the exception of Overijssel, there is also a second team that deals with the creation, editing and analysis of spatial data, in addition to the central GI unit. In these provinces, a group of GI specialists operate in the Department of road management and maintenance. As road managers, it is their task to maintain the large-scale topography. These specialists perform their operations and analyses to a large extent themselves because spatial data is an important part of the business processes of road management. The central GI unit operates as a service provider to them by providing the right tooling to perform these analyses. Within the provinces studied, there are a number of policy officers outside the central GI unit and the Road Management department who also have access to GI tools. This mainly concerns employees who use these tools in support of their own activities and the contribution to the total geographical information services of the organization is relatively small.

In table 4.1, the characteristics data creation and editing and data analysis are both considered as a combination of the central and hybrid model. The allocation of these characteristics in the various provinces is situated in between the characteristics of the central and hybrid models as outlined in table 2.2. The characteristics 'database maintenance' and 'management of applications' have also been coloured in a gradient colour. This was done not so much because the allocation of these characteristics is in between the central and the hybrid model, but because the characteristics correspond to both models. Table 2.2 (Theoretical Framework) shows that the values for the characteristics 'database maintenance' and 'management of applications' are the same for both models.

Coordination

In all organizations, the coordination of geographical information is largely centralized. In all provinces, the geo advisors working within the GI unit or in a closely linked advisory unit, are in charge of the coordination of GI activities and procedures, the range of information products offered and the decision making. As far as the GI strategies within the various provinces are concerned, these are usually set out by geo advisers. These advisors work at the GI unit or at an advisory team within the same department.

[52] EGIS = End users GIS = Eindgebruikers GIS

As for the responsibility for the content of the information products and datasets, this is mostly assigned to end users working within the policy departments. This characteristic is coloured purple in table 4.1, in accordance with the Hybrid model.

All provinces have a central budget for the activities of the central GI unit. In case of large-scale projects, end users are asked to act as a co-financier. The characteristic 'funding' can therefore be regarded as a combination of the central and hybrid model.

Conclusions
The first conclusion to be drawn from Table 4.1 is that the different provinces do not differ in terms of centralisation characteristics. The 'colouring' is the same in all cases. The interviews also did not indicate any major differences with regard to the degree of centralization. Therefore it can be concluded that all provinces have a more or less similar degree of centralization.

The second conclusion that can be drawn from the table is that the characteristics within both the allocation and coordination dimension are to a large extent centrally allocated to a central GI unit. In general, the provinces have a centralised geographical information service provider. However, a number of GI activities can be conducted by end users working at another department or service, outside the central unit. A more hybrid situation therefore applies for these characteristics.

Based on the theoretical framework and Table 4.1, it can be concluded that the answer to research question 2 is: the organizational structure of all studied provinces mainly have the characteristics of the Central Model, combined with some hybrid features.

When conducting the interviews and performing the analysis of the interviews, the following interesting observation was made: the position of the central GI unit within the organization differs between the provinces and seems to influence the functioning of the organization and the extent to which the demands of GI end users are met. On the basis of the conclusions and this observation, it was decided to develop an adapted classification system in view of the next step of the study: the questionnaire in which the extent is investigated to which the organizational structure in the province meets the demands of the GI end users. The observation and the adapted classification system are elaborated in paragraphs 4.3 and 4.4.

4.3 Organizational Models based on the position of GI unit

As mentioned at the end of Paragraph 4.2, the position of the central GI unit within the organization differs between the provinces and seemingly has an impact on the functioning of the organization and on the extent to which the demands of GI end users are met. For example, the central GI unit at Drenthe has been positioned within the IT department but at Utrecht within a policy department, whereas the geographical information services within Overijssel are provided by the Department of Public Services.

Based on the interviews with the geo-advisers of the seven provinces, the results presented in Paragraph 4.1 and a survey conducted by PP-geo, three types of models can be distinguished within the central organizational model with hybrid characteristics. These three (sub)models are based on the positioning of the central GI unit within the provinces. These models will be named: IT-model, Policy-model and Public Services-model and are further elaborated in the next subparagraphs.

4.3.1 IT-model

The IT-model refers to the provincial GI organizational structures in which the central GI unit is part of an IT department (see Figure 4.9). This is the case with the provinces of Zuid-Holland, Gelderland, Groningen and Drenthe. In these provinces, the central GI unit is part of the so-called Department of I&A or the Department of INFO. In all cases, these IT departments fall under the domain of business operations. They are responsible for providing the infrastructure of Automation. The main objective of the IT departments is to assist the operational units by providing them the functionality they need. In the case of the IT-model, this includes, among other things, the geographical information provision.

Within the IT-model, the GI unit acts as a dedicated service provider. For this purpose, some teams use service management tools. For example, the Province of Gelderland uses a service management tool to register geographical information requests.

As the central GI unit is located in the same department as the IT specialists, technical support with regard to management and maintenance of GI applications and software is close at hand. This positioning offers efficiency on the one hand, as information specialists, architects, project leaders and technical application managers are all close by. However, on the other hand and according to the interviewees, it runs the risk of being too technologically oriented and of neglecting the end user.

Figure 4.9 IT-model (see page 36 for explanation of symbols)

4.3.2 Policy-model

The positioning of the central GI unit within a policy department can be considered as the second (sub-)model. Both the Province of Utrecht and Flevoland have chosen to place their central GI unit at a policy department instead of the IT department. Within the Province of Utrecht, the GI unit is part of the Department of Physical Living Environment and at Flevoland of the Department of Space & Economics. In both cases, the ratio behind this decision is that most of the GI unit's work is carried out on behalf of these departments. As the interviewees indicated, the geographical information products provided are closely linked to the policy processes. Placement of the team at the IT department would, in their opinion, lead to too much distance from the end user.

In this Policy-model (see Figure 4.10), the GI unit operates as a kind of information centre within the policy department and provide the geographical information services throughout the entire organization. In this model, the GI unit is a customer of the IT department, instead of a part of, and the IT department is the provider of servers and software support. During the interviews, it was emphasized that the GI units are considered to be part of the policy teams and policy officers are not labelled as customers by the GI unit.

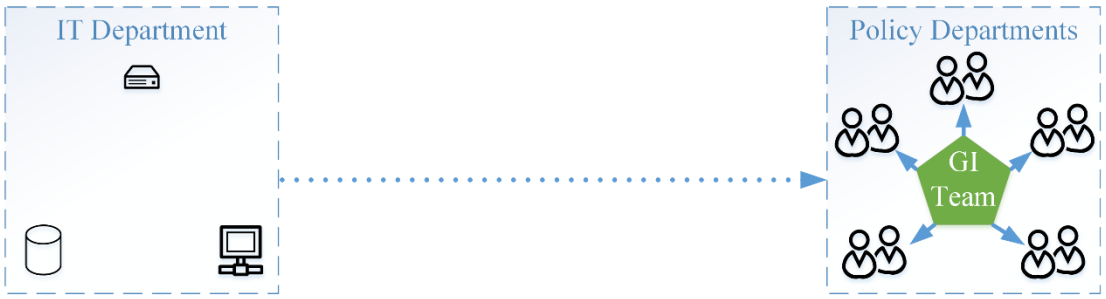


Figure 4.10 Policy-model (see page 36 for explanation of symbols)

4.3.3 Public Services-model

In the third model, the position of the central GI unit is within a department of public services. In this model, the GI unit is placed between the IT department and the policy departments. One of the tasks of Public Services is to provide policy information, such as geographical information, throughout the organization. This organizational structure is referred to in this study as the Public Services-model (see Figure 4.11). The Province of Overijssel has chosen for this model.

As a service provider, the team supplies information products to road administrators and policy officers. The GI unit in return receives technical support from the Department of Business Operations. Like the average IT department, it uses a central customer contact point to provide service, coordinated by the planner of the team.

Figure 4.11 Public Services-model (see page 36 for explanation of symbols)

4.4 Characteristics related to the position of GI unit

In the previous Paragraph, three models have been presented and described, based on differences in the position of the central GI unit within the provincial organizations. According to this system, the seven provinces studied were also classified.

During the interviews, various arguments were mentioned to justify the choice of a certain positioning of the central GI unit, as well as the advantages and disadvantages resulting from the positioning. In these interviews organizational characteristics were mentioned, related to the positioning of the GI service, which were found to be of importance for the functioning of the geographical information provision and thought to have an influence on the extent to which end-users' requirements are met.

Based on the method of selective coding of the interviews, described in Paragraph 3.2.3, the organizational characteristics mentioned in the interviews were filtered and grouped into four themes. The four themes (accessibility of GI unit, design process of products, quality of services, supporting service) are presented in this Paragraph and will serve as a basis to answer the third research question.

This question focuses on to what extent an organizational model complies with the demands of the end user. The latter is dealt with in Chapter 5.

Accessibility of GI unit
An organizational characteristic which was a key feature in all the interviews was the contact between GI specialist and end user. This customer contact is being implemented and experienced in different ways. An important argument that is used for placing the GI unit within a policy department is the 'short lines with the end user'. In the Province of Utrecht, for example, the so-called theme managers of the GI unit are often working at a desk next to the end user. According to the interviewee, this improves the accessibility of the GI unit. The other five provinces indicated that the GI units are always accessible to the end user but via a central mailbox, an advisor or a planner. Many provinces have set up a rotating system in which a different member of the team deals with incoming requests for information. The provinces of Drenthe and Groningen, which belong to the IT-model in which the GI specialists are part of the IT department, indicate that in many cases the end user personally drops by to ask a question. The positioning of the central GI unit at an IT department does not necessarily lead to less accessibility.

Design process of information products
A second theme that was discussed during the interviews is the design process of information products. The development and delivery of geographical information services differ from those of IT services because GI services are often created in iterative way. An end user often expresses additional wishes during the design process, which require adjustments to the final information product.

The positioning of the GI unit in the organization is seen as a factor that influences the design process. For example, a GI unit that is part of an IT department must be careful not to work too much on the basis of the best practice framework of ITIL[53], according to the interviewee. Furthermore, it is essential to keep the primary policy process in mind during the design process. The latter is supposed to be more guaranteed in the Policy-model. Also, the mentality and culture of a policy department seem to better match the mentality and culture of the GI specialists. Some degree of empathy of the specialists is required in order to be able to supply the right information products. On the other hand, the GI unit can also be experienced as a real service provider and from that perspective a positioning at an IT department in the field of business management can be considered advantageous. As a service provider, they will then have access to service management tools.

Quality of Services
A third feature which is used as an argument to motivate the position of the GI unit is the quality of the information services provided. The provinces are working in various ways to guarantee the quality of their information products. A clear example of this, is the centralisation of GI specialists. The provinces that are working in this way expect to be able to provide better and more efficient information products as a result of the concentrated manpower.

The positioning of the central unit within the Department of Public Services, as in the case of the Province of Overijssel, has the advantage that it can lead to an integrated information provision, including demographic, social-economical and cadastral information products as well as geographic information products. The department acts as a central information service centre in the organization for both internal and external end users.

[53] ITIL = Information Technology Infrastructure Library

To a certain extent, this also applies to the provinces with the GI unit within the IT Department. Although, there seems to be a somewhat lower level of involvement with non-geographic information services. In most of these studied cases, the focus seems to be on geographical information only and the provision of information of for example on permits, cadastral registrations[54] and economic data has been assigned to other teams. However, these provinces are looking for relationships in order to broaden the use of data. Within the Province of Zuid-Holland, for example, a Data analytics team is being set up to integrate various types of information.

The provinces of Utrecht and Flevoland argue that a high quality of their information products is guaranteed due to the fact that the GI unit is placed in the policy department and that GI specialists and end users are working closely together.

Supporting service
A fourth theme that was brought up was the GI unit as support service. What are the advantages and disadvantages of the different ways of positioning of the team with respect to this aspect?

A major advantage of positioning the GI unit in the IT department is having technological support nearby. Because most geographical information products require a technological infrastructure, a position within the IT department can be regarded as evident. Moreover, like IT, GI can be considered to be a supporting service. For instance, the GI unit manages and delivers all GI tools and data.

The GI units positioned at the policy and public services departments do not dispose of IT specialists within their own department. This may have an impact on the technical reliability of the service. The main reason given for not placing the GI activities within IT or Public Services is because GI is regarded as part of the policy process. For most of its time, the GI unit concentrates on content-related work. It is argued that the small amount of technology needed can be outsourced and involvement of the GI unit is not required. This is evident in the case of the Province of Overijssel, where both database management and technological management have been outsourced to external partners.

4.5 Résumé

Research question 2, ' Which types of GI organizational structures can be identified within Dutch provinces?' was investigated by interviewing eight GI advisors working at seven different Dutch provinces.

Based on the results of the interviews and its analysis, the following conclusions can be drawn:

- The organizational structure of the seven provinces studied all have the characteristics of the Central Model, combined with some hybrid organizational features. The degree of centralization is more or less the same.

- The seven provincial organizations studied have a central GI unit responsible for the provision of geographical information services. Most major GI activities are centrally allocated to this unit and are centrally coordinated in all organizations. However, a number of GI activities can be conducted by end users working at another department or service, outside the central unit. A more hybrid situation therefore applies for these characteristics.

[54] Cadastral registrations = Kadastrale leggers

- Differences have been identified between the provincial organizations with regard to the positioning of the central GI unit within the organization. The position of the GI unit in the organization was found to be of importance for the functioning of the organization and the extent to which the demands of GI end users are met. Based on the interviews, three organizational models are therefore distinguished based on the position of the central GI unit:
    - IT-model (Drenthe, Groningen, Gelderland, Zuid-Holland) – GI unit positioned within the IT Department
    - Policy-model (Flevoland, Utrecht) – GI unit positioned in a policy department, next to the main end users
    - Public Services-model (Overijssel) – GI unit positioned in a department concerned with providing all kind of services to both internal and external end users.

- On the basis of the interviewees' explanations and motivation, a number of characteristics have been identified which are determined by the position of the GI unit within the organization and which can be considered to be important for the quality of the GI product provision and the extent to which the demands of GI end users are met.
  These characteristics can be clustered in four themes:
    - Accessibility of the GI unit – How does the end user perceive the contact with the GI unit
    - Design process of information products – How does the end user perceive the cooperation with the GI unit and the way information products are designed
    - Quality of services provided by the GI unit – How does the end user perceive the quality of the GI services
    - Supporting service – How does the end user perceive the supporting and self-service GI services.

  The themes are relevant for the answering of the third research question, in which the themes can be used as measurable variables to assess the experiences of end users.

5. Satisfaction of User Demands

This chapter builds further on the three organizational models identified in Chapter 4, based on the positioning of the central GI unit within the province. The chapter is about getting insight into how these different organizational structures are experienced by the GI end users within the different provinces, in order to get an answer to the third research question.

RQ3 - To what extent do the identified provincial GI organization structures satisfy the demands of the GI end users?

In order to get this insight a questionnaire was send to GI end users, working in six out of the seven provinces interviewed. As mentioned in Paragraph 3.3.2, the Province of Overijssel did not take part in this part of the study.

The results of this survey are described in the next paragraphs. First, the rate and quality of the returned responses to the questionnaire are described. The results of the replies are presented and described in Paragraph 5.2, on the basis of the four themes identified in Paragraph 4.4. Based on these results, the influence of the position of the GI unit on the satisfaction of user demands is presented in Paragraph 5.3 and the influence of the size of a provincial organization in Paragraph 5.4.

5.1 Description of respondents

This paragraph looks at the number of questionnaires that have been distributed and returned, the quality of the returned questionnaires and their suitability for the study. This includes looking at whether the respondent is actually involved in the geographical information provision within the province and whether he actually is a GI end user or not.

Response rate

Out of the 157 questionnaires sent, 113 were returned. Of these 113, 79 were found to be suitable for this study because 23 of the returned questionnaires were marked to be not valid and 11 were filled in by GI producers and not end users. Of the 79 questionnaires, 35 were filled in by end users working at a province with the central GI unit positioned within a policy department. The other 44 respondents are working at a province with the central GI unit located at the IT department.

In Figure 5.1, an overview of the returned questionnaires is given per province.

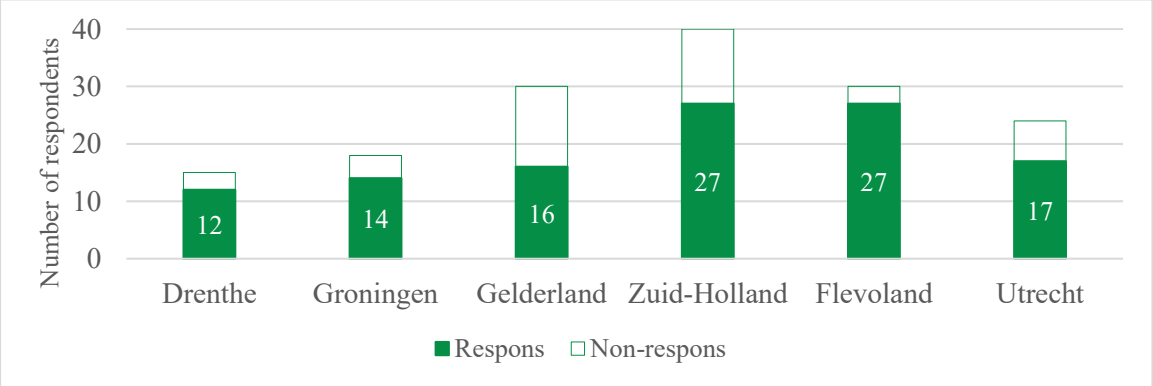


Figure 5.1 Questionnaire response numbers, per province

Looking at the numbers in Figure 5.1, it is remarkable that the response rate at small provinces such as Flevoland and Drenthe is considerably higher than at the large provincial organizations Zuid-Holland and Gelderland (90 and 80% versus 67.5 and 53%).

Quality of received responses
In total 23 out of 113 returned questionnaires were found not to be suitable for use in this research because of three reasons.

In the first place, the questionnaire was sent to a small number of people who in fact were not a GI (end) user or specialist. Nine respondents indicated that they were not involved in GI and should not be considered a user of GI; they were only indirectly related to GI (Figure 5.2, green). For example, because their colleague was a GI user or because they worked at strategic level and had to advise GI users, but not necessarily on GI related matters. Only in the Province of Drenthe, no questionnaires were 'rejected' for this reason.

The second reason was that four questionnaires were not fully completed (purple). The reason for this can only be guessed at. Perhaps, people were disturbed while completing the questionnaire, perhaps it took them too much time. However, it cannot be excluded that these respondents did fill in a full questionnaire at a later stage.

Finally, in 10 returned questionnaires only question 1 was answered (yellow), although all the people involved indicated that they were GI users. No further data were completed, as none of them subsequently went beyond the first screen of the questionnaire in their answering. The reason for this cannot be determined. It is remarkable that this was particularly the case with employees of the Province of Groningen where more than 35% of the questionnaires was returned uncompleted in this way. A possible explanation for this could be that technical restrictions within the organizations' network have restricted access to the questionnaire.

In Figure 5.2, the number of valid (90) and non-valid (23) questionnaires returned are shown. The valid questionnaires returned by GI end-users are coloured in blue.

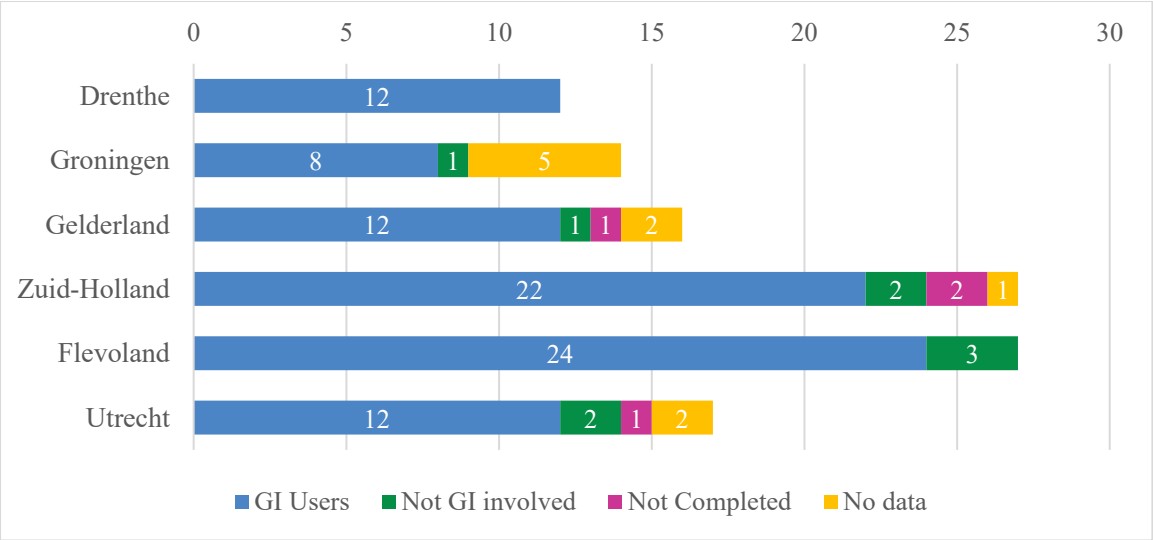


Figure 5.2 Quality of Response

GI end user vs. GI producer

A number of the 'GI users' who returned the questionnaire appeared to be GI producers after further analysis of the completed questionnaires. From their personal characteristics it could be deduced that they had to be categorized as producers of GI products and services instead of end users. In all cases, these respondents spend more than 50 percent of their time on GI activities. By looking at the GI activities they performed and their job titles, such as Cartographer or Data analyst, it was clear that that they had to be categorised as producers of GI products and services aimed at supporting other colleagues. The questionnaires of these GI producers were not further included in this study. An overview per province of the 11 GI producers is given in Figure 5.3.

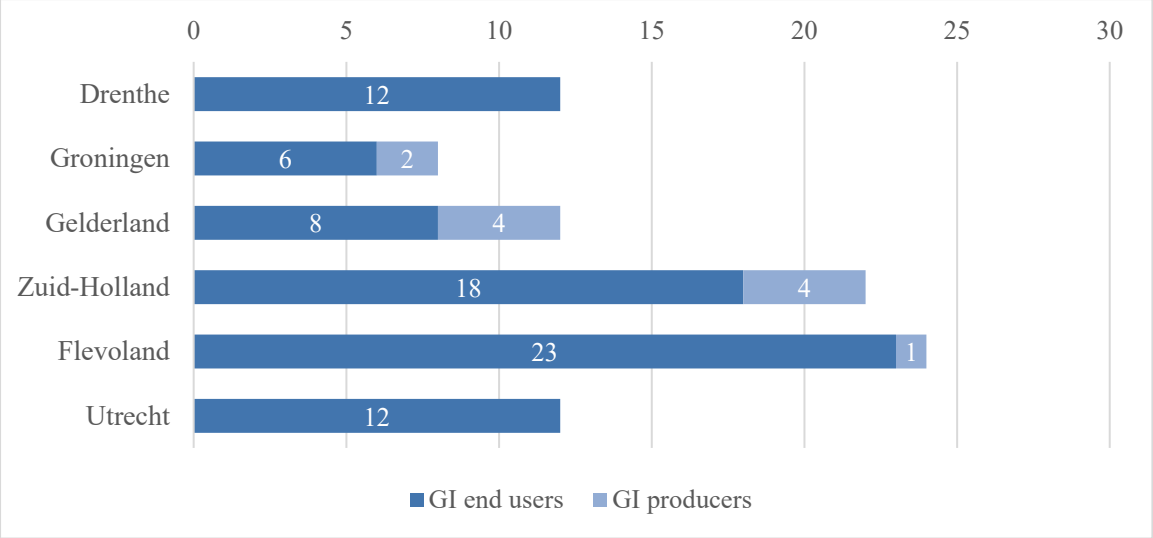


Figure 5.3 GI end user vs GI producer (response numbers per category, per province)

Position of GI end user

When we look at the position of the end users who participated in the questionnaire, Table 5.1 clearly shows that the majority of them are positioned within a policy department. This supports the view expressed in the interviews with the GI advisors that the majority of GI end-users are working in policy departments. A minority of the end-users who responded are located in the executive or corporate departments, particularly in Zuid-Holland. Four respondents did not reply to the question regarding their position within the organization.

Table 5.1 Position of GI end users within the organization (response numbers per category, per Provence)

	Drenthe	Groningen	Gelderland	Zuid-Holland	Flevoland	Utrecht	Total
Policy domain	12	4	6	11	22	11	66
Executive / Corporate domain	0	1	1	6	0	1	9
Not specified	0	1	1	1	1	0	4
Total	12	6	8	18	23	12	79

Geographical information tools

In order to gain more insight in the types of GI end users at the provinces, the respondents were asked what type of geographical information tools they use. Figure 5.4 gives an overview of seven different forms of geographical information tools used and the percentage of respondents using it.

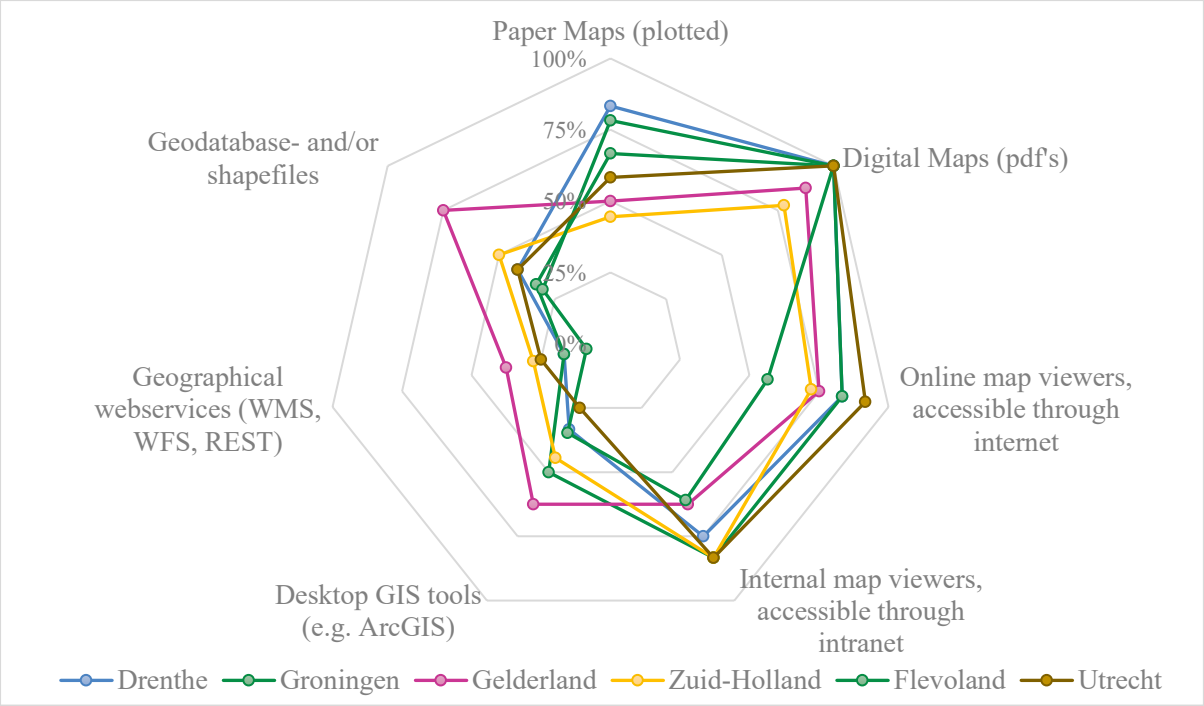


Figure 5.4 Geographical Information tools used by respondents (in %, per tool, per province)

Figure 5.4 shows that in all provinces, digital maps in pdf are used by the vast majority of respondents. In the provinces of Drenthe and Flevoland also paper maps are extensively used.

Furthermore, there is a significant difference in use of digital map viewers between the two Policy-model provinces Flevoland and Utrecht. In Utrecht, both the internal and external map viewers are used extensively. In Drenthe, on the other hand, the use of the product is considerably less. An explanation for this cannot be given.

In general, less use is being made by end users of the more advanced GI Desktop tools, geographical webservices and geo-databases. Especially use of webservices by end users is very limited in all provinces. In the provinces of Gelderland and Zuid-Holland the utilization is above average, certainly in comparison to Flevoland and Utrecht. This is an indication for a higher level of technical skills of the respondents in the first two provinces than in the last two.

Another thing that stands out in the figure is the remarkable difference in the use of tools within the Province of Utrecht. Almost all respondents use online and internal map viewers and digital maps whereas relatively little use is being made of the 'old-fashioned' desktop GIS tools (only 3). This is in line with the policy within the Province of Utrecht to focus on online map viewers for end users.

In all provinces, some respondents mentioned that they used other tools, than the ones presented in the questionnaire, such as google maps, google earth, QGIS and the information available at ruimtelijkeplannen.nl.

5.2 Results per theme

This paragraph presents the results of the conducted questionnaire. The presentation is done per theme, as identified in Paragraph 4.4:

- the accessibility of the GI unit
- the design process of information products
- the quality of services provided by the GI unit
- the GI unit as supporting service

For each theme, a number of questions have been included in the questionnaire. The answers to each of these questions are presented on the basis of descriptive statistics. In most cases, bar graphs were used for this purpose. The bar graphs are all accompanied by a table showing the answers in absolute numbers. To interpret the answers, additional comments in the questionnaire provided by the respondents were analysed.

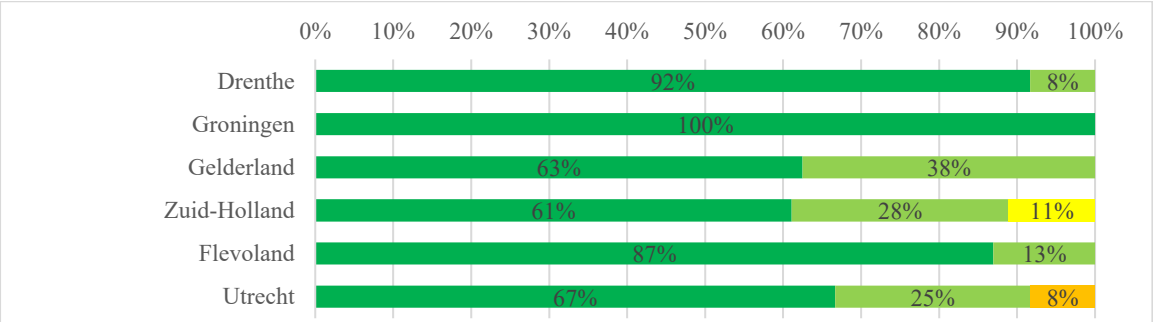
5.2.1 Accessibility of GI unit

The accessibility of the central GI unit is one of the four themes identified during the interviews which are of importance for GI end users and is indicative of the functioning of the GI organization. In order to gain insight in the end user demands, the respondents were asked to respond to the following four statements/questions related to the accessibility of the GI unit and the methods of contact:

1. I am satisfied with the accessibility of the employees of the central GI unit
2. The methods of contact with the GI unit
3. The most preferred way of contact
4. I am aware of the geographical information products that can be provided by the central GI unit

Satisfaction of accessibility

Figure 5.5 shows the extent to which the respondents within the different provinces are satisfied with the accessibility of the GI unit. From the percentages found, it can be concluded that the vast majority of respondents is satisfied about the contact with the employees of the GI unit. The questionnaires included additional comments like: 'They are easy to reach, willing to help and think along well'.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	8	20	11	5	6	11
Somewhat agree	3	3	5	3	0	1
Neither agree nor disagree	0	0	2	0	0	0
Somewhat disagree	1	0	0	0	0	0

Figure 5.5 Statement: 'I am satisfied with the accessibility of the employees of the central GI unit'. (Response numbers per category, per province(in total and in %)

In Groningen, Drenthe and Flevoland, the ratings were the highest; personnel is (very) satisfied with the accessibility. In the other three provinces the overall rating was somewhat less. In Zuid-Holland, two respondents did neither agree nor disagree with the statement. The accompanying motivation was 'unclarity with regard to who is managing which subject and who is responsible for what information question?' It was also noted that probably due to staff shortage outdated information in the geo-database was not updated or removed regularly. The same problems were recognised by a number respondents of Utrecht. They agreed that a clear service desk for information requests within the Province of Utrecht could be of added value. Limited staff capacity of the GI unit was also mentioned as an obstacle to good accessibility.

Methods of contact

Related to accessibility is the way in which someone contacts the central GI unit. Figure 5.7 gives an overview of which methods of contact with the GI unit are being used within a province and to what extent.

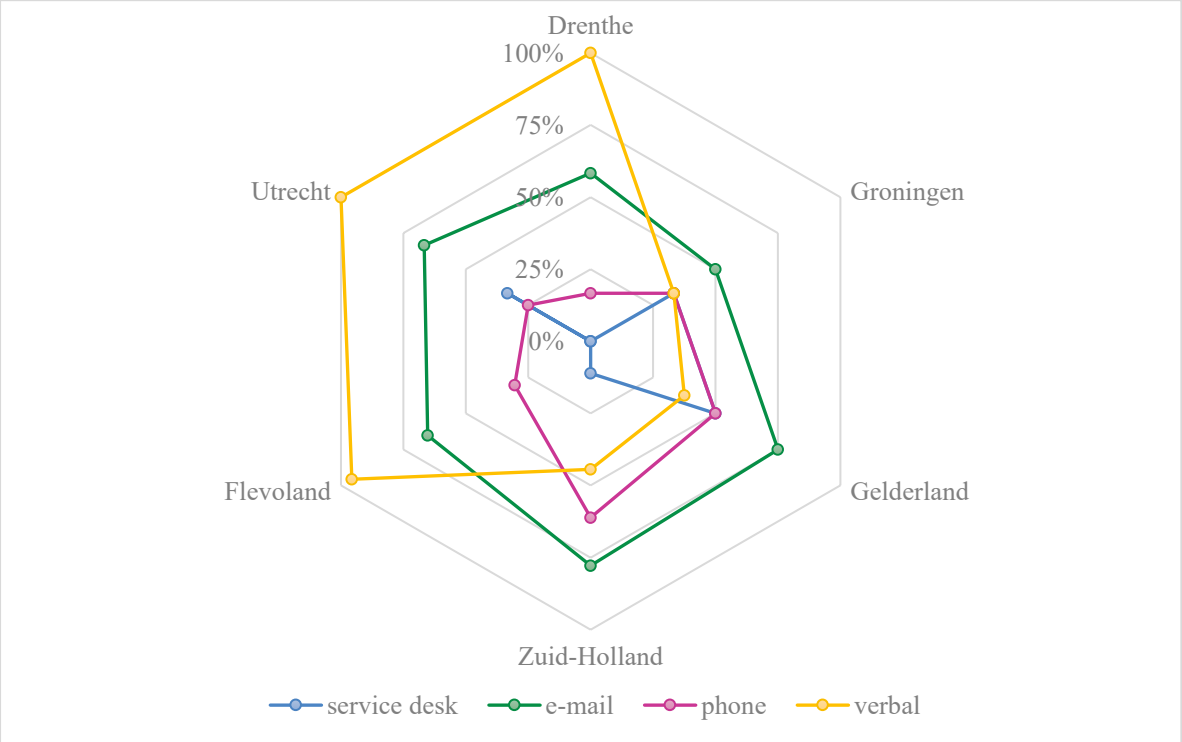


Figure 5.6 The methods of contact with the GI unit used (in %, per method, per province)

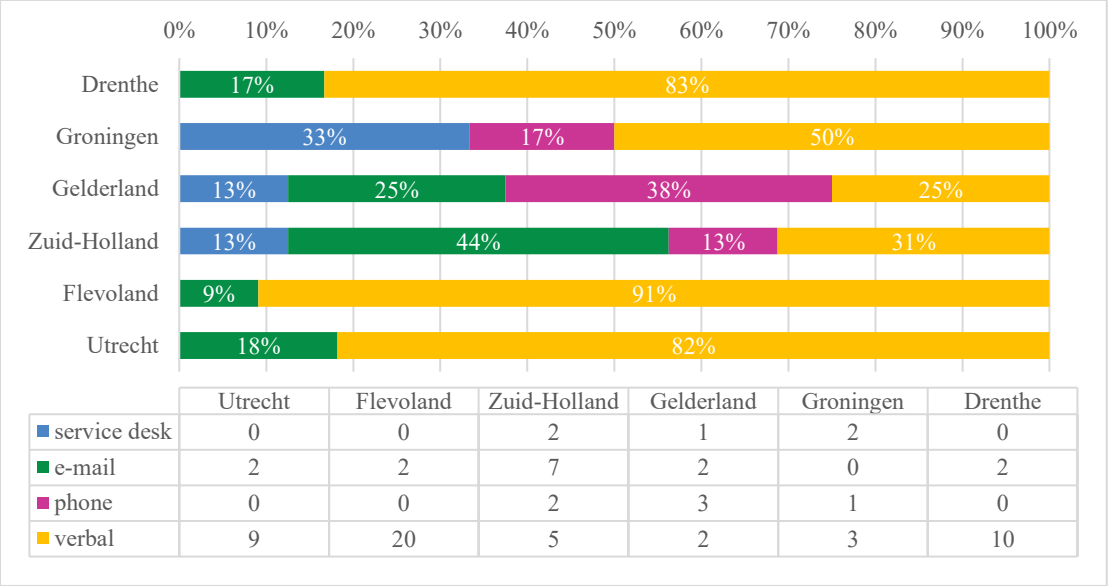
It shows that almost all end users of Drenthe, Utrecht and Flevoland drop by the GI unit's office and verbally discuss the geographical information services (yellow line), while among the end-users of the provinces of Groningen, Gelderland and Zuid-Holland this is done by less than 50% of the respondents. At these provinces, staff tends to be more inclined to use the telephone and e-mail instead. Next to verbal contacts, a majority of the respondents from Drenthe, Utrecht and Flevoland make also use of e-mail.

With regard to the use of the service desk (blue line), only at Gelderland, Groningen and Utrecht employees make use of this method to contact the GI unit. At the two smallest provinces Drenthe and Flevoland, no use is made of the service desk by the respondents.

Preferred method of contact

Respondents were also asked to indicate their preferred method of contact. The results of **the most** preferred way of contact is presented in Figure 5.7. The figure shows a very strong preference for verbal contact (82-91%) in what can be called the smaller provincial organizations of Flevoland, Utrecht and Drenthe. This is in line with what was identified as the most common method of within these provinces (see Figure 5.6). According to the respondents, the reason for this is that they find it easier to explain a question or request orally. For instance, an end user from Drenthe indicated that the employees of the GI unit are often nearby (around the corner), so dropping in is the obvious choice. End users of Gelderland and Zuid-Holland prefer to have contact by telephone and by e-mail as the distance between the sections is greater.

Making use of the service desk is the least preferred way of contact in 5 out of 6 provinces. Both respondents working at Gelderland and Zuid-Holland indicated that the process of submitting an application via the service desk can be complicated and may take some time. A direct email or phone call is usually more effective and will lead to an immediate response.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
service desk	0	0	2	1	2	0
e-mail	2	2	7	2	0	2
phone	0	0	2	3	1	0
verbal	9	20	5	2	3	10

Figure 5.7 The most preferred method of contact
(Response numbers per category, per province (in total and in %))

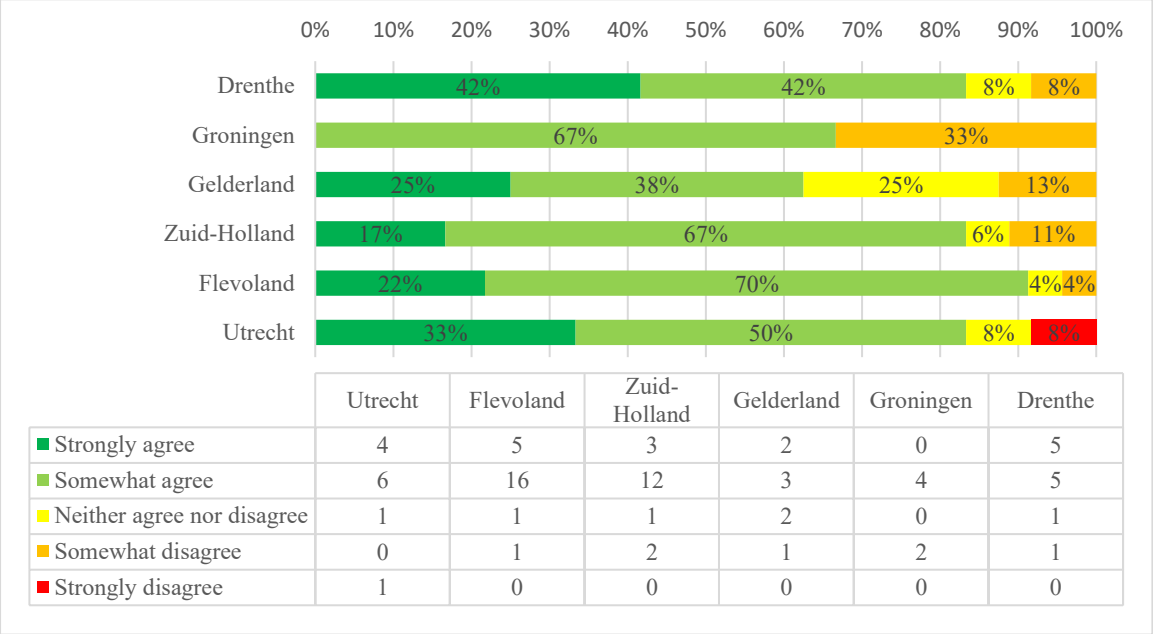
Awareness of available information products

Another element connected to the accessibility of the central GI unit is the awareness of end users of the range of provided information products and services available at the team. A good knowledge of products available will facilitate the contact between end user and team.

The majority of the respondents indicated that they were ‘aware’ or ‘somewhat aware’ of the product range available (Figure 5.8). In 25 additional comments to this question, 24 respondents however expressed that still they were often surprised by the products and services offered by the GI unit.

A respondent from Flevoland answered that it was always possible to pass the GI unit’s office to get extra information talk about the possibilities. One of the respondents working at Drenthe stated that the GI possibilities with regard to their own discipline are clear. However, the GI possibilities for other disciplines are not always clear and be of added value to the own discipline.

Despite the fact that a few people thought the access to the complete services of the central GI unit to be limited, this was not considered as an inconvenience to the majority of end-users. After consultation with the GI units, they would get the product they were looking for.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	4	5	3	2	0	5
Somewhat agree	6	16	12	3	4	5
Neither agree nor disagree	1	1	1	2	0	1
Somewhat disagree	0	1	2	1	2	1
Strongly disagree	1	0	0	0	0	0

Figure 5.8 Statement: ' I am aware of the geographical information products that can be provided by the central GI unit' (Response numbers per category, per province (in total and in %)

Summary

This subparagraph describes how respondents contact the central GI unit and the accessibility of the GI unit. In general, respondents are very enthusiastic about the contact possibilities with the GI specialists of the central GI unit in their organization. How respondents contact these specialists varies from province to province. From the answers of the end users, it emerges that within the smaller provinces of Drenthe, Flevoland and Utrecht people primarily have direct verbal contact with each other by passing each other's office. This is also in line with their preferences. In the larger provinces, the contact method is much more focused on e-mail and telephone. In addition, more use is made of service desks.

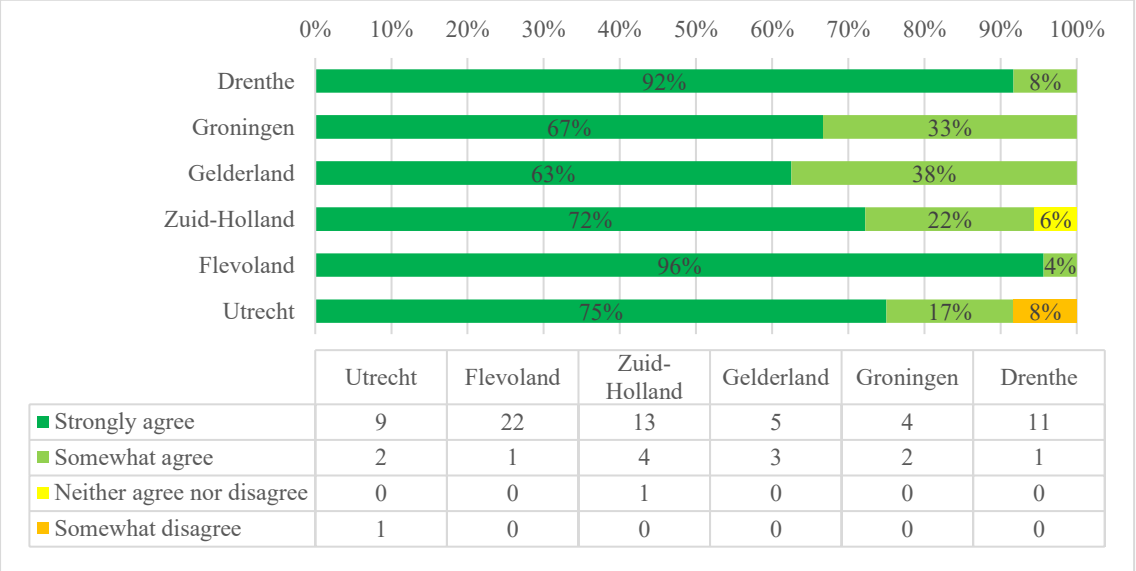
5.2.2 Design process of information products

The design process of information products is the second theme which is an important aspect in the functioning of the GI organization. The respondents were asked to respond to the following seven design-process related statements:

1. I am satisfied with the contact with the central GI unit and its employees with regard to my work
2. I am satisfied with the alignment of geographical information (GI) related activities between the GI employee of the GI unit and myself
3. The GI unit and its employees proactively contribute to the projects and solve problems
4. I am satisfied with the development of desired geographical information products
5. I am satisfied with the flexibility of the employees of the GI unit during the development process of a requested information product
6. I am satisfied with the knowledge of the employees of the GI unit with regard to the content of my work and field of expertise
7. I am satisfied with the empathy of the employees of the GI unit regarding my information needs

Contact with GI unit

When asked about their appreciation regarding the contact with members of the GI unit in the course of their work, the majority of the respondents is very positive. This is clearly evident from Figure 5.9. According to the comments of two employees of Zuid-Holland and one of Groningen, the employees of the GI unit are very customer friendly and service-oriented.



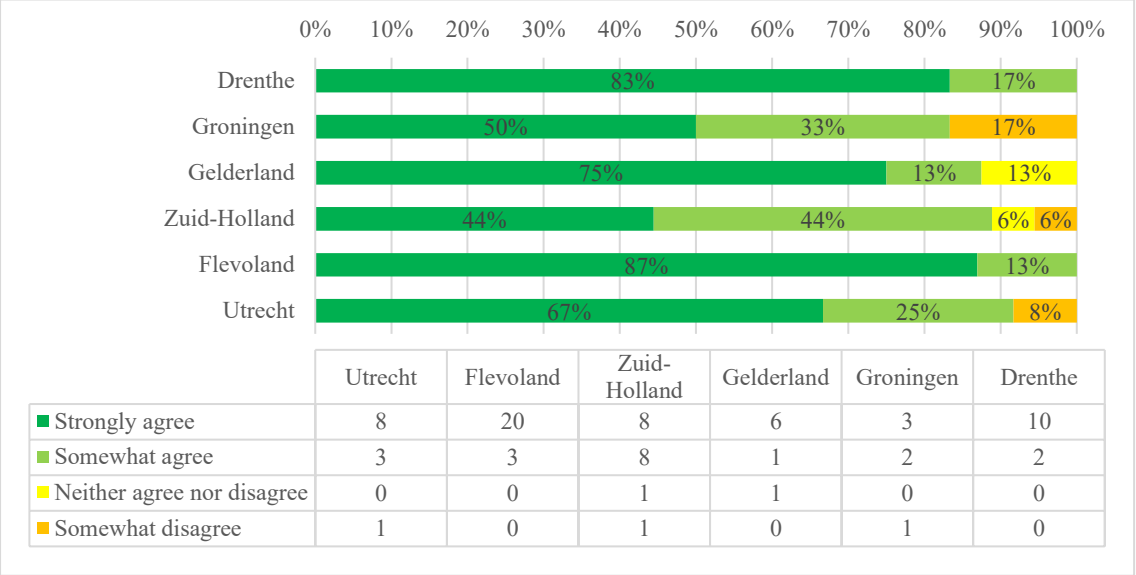
	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	9	22	13	5	4	11
Somewhat agree	2	1	4	3	2	1
Neither agree nor disagree	0	0	1	0	0	0
Somewhat disagree	1	0	0	0	0	0

Figure 5.9 Statement: 'I am satisfied with the contact with the central GI unit and its employees with regard to my work.' (Response numbers per category, per province (in total and in %)

Only two respondents are not so positive in their opinion. One respondent at Utrecht gives as an explanation that due to a recent re-organization of the I&A team and the central GI unit, contacts are still in the process of being set up and more time is needed for growth. The respondent at Zuid-Holland could not give an opinion as he/she has very little direct contact with the GI unit. A direct colleague of his/her takes care of the contacts.

Alignment of GI activities

Figure 5.10 shows the degree of satisfaction of respondents regarding the alignment of GI related activities between the members of the GI unit and the respondents themselves. It is obvious that the majority of respondents are satisfied with the alignment. In the two smallest provinces, Flevoland and Drenthe, all respondents are satisfied, of which more than 80 percent even very satisfied. But also in the larger provincial organizations, ratings are overall positive. Only a few individuals indicated that they are somewhat dissatisfied.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	8	20	8	6	3	10
Somewhat agree	3	3	8	1	2	2
Neither agree nor disagree	0	0	1	1	0	0
Somewhat disagree	1	0	1	0	1	0

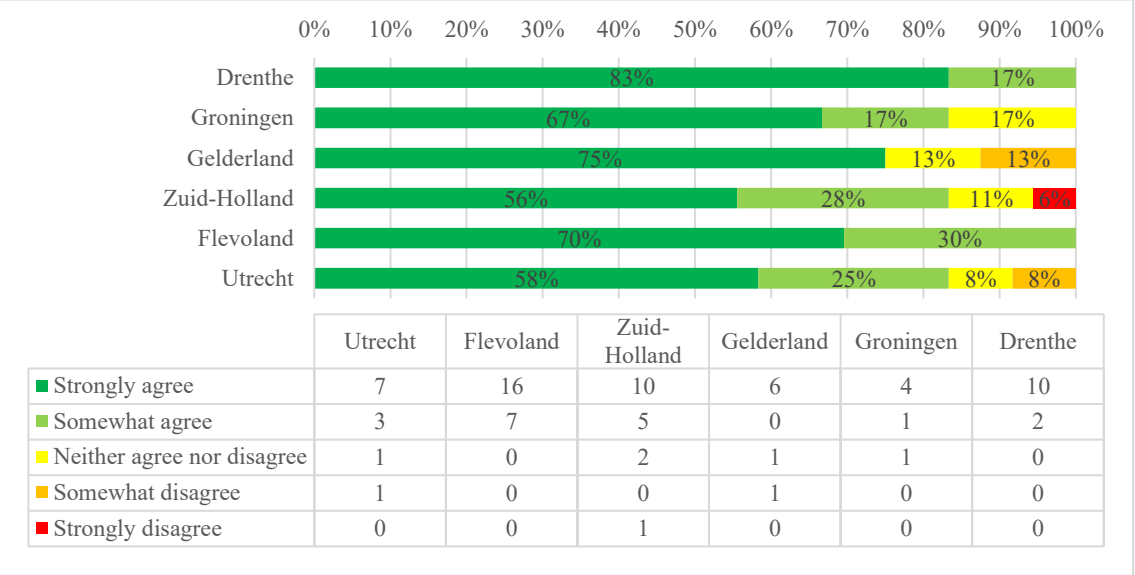
Figure 5.10 Statement: 'I am satisfied with the alignment of geographical information (GI) related activities between the GI employee of the GI unit and myself.'
(Response numbers per category, per province (in total and in %)

The respondent of Utrecht who somewhat disagrees with this statement is the same person who answered to be somewhat dissatisfied about the alignment with central GI unit. The reason for the dissatisfaction is the same: because of the recent reorganization, teams are giving priority to structuring their own activities and do not look (yet) at aligning them with other parts of the organization. The other two respondents who expressed to somewhat disagree with the statement, did not motivate their answer. Looking at the GI tools they use and the time they spend on GI (between 25-50%), it is however likely that they are employees with a certain amount of GI knowledge.

Finally, the motivation of two respondents, who strongly agree with the statement, is worthy to be mentioned. These respondents added that the collaboration with the GI unit is excellent and that the team is always ready to think along. All in all, it seems that the coordination of GI related activities between end users and GI unit is in general good.

Proactive attitude of GI unit

The third statement submitted to the respondents is about the proactive attitude of the GI unit members when it comes to contributing to projects and problem-solving.
The respondents are generally very positive about this, see Figure 5.11. Again, all respondents of the two smallest provinces (Drenthe and Flevoland) agree (strongly or somewhat) with the statement.
Two respondents of Flevoland motivate their 'somewhat agree' answer by saying that little attention is paid to innovation and that they try to solve a lot of their problems in an independent way.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	7	16	10	6	4	10
Somewhat agree	3	7	5	0	1	2
Neither agree nor disagree	1	0	2	1	1	0
Somewhat disagree	1	0	0	1	0	0
Strongly disagree	0	0	1	0	0	0

Figure 5.11 Statement: 'The GI unit and its employees proactively contribute to the projects and solve problems.' (Response numbers per category, per province (in total and in %)

Two respondents of the Province of Utrecht, who state to ‘neither agree nor disagree’ or ‘somewhat disagree’, both added that the GI unit does not really take part in the process proactively; one has to ask the team before they will contribute. This criticism is noteworthy, as the GI unit of the Province of Utrecht has been positioned within the policy department.

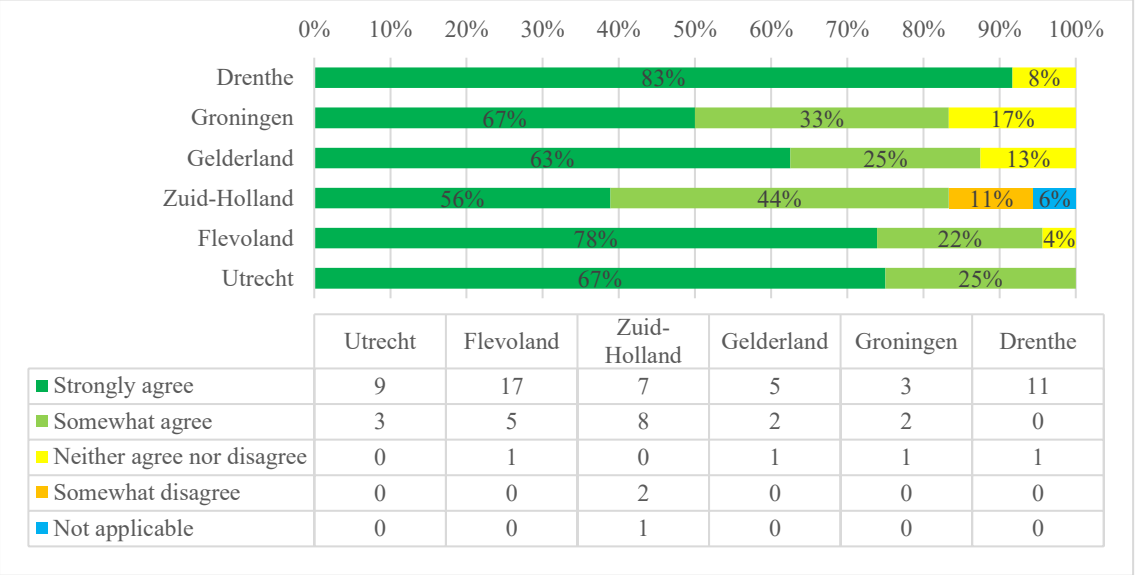
The comment made by a respondent of the Province of Gelderland who ‘neither agreed nor disagreed’, is an interesting one. In his/her opinion, GI knowledge alone is not sufficient to solve problems. The combination with content-related expertise is essential. It is not clear from the answer if this means that a GI employee needs both substantive and technical knowledge or that cooperation between the GI specialist and policy maker is always essential. But apparently, the combination of knowledge is not yet sufficiently guaranteed in the current situation.

The two respondents who 'somewhat disagree' with the statement did not further explain their choice.

The respondent from Zuid-Holland who 'strongly disagrees' with the statement explained that during the start of projects, a range of issues is often discussed, such as time, money, risk, but not geo-information. It would be therefore a good idea to take geo-information into account at the start of a project.

Development of information product

In the fourth statement concerning the design process, the respondents were asked about their satisfaction with the development of required geographical information products. Figure 5.12 gives an overview of the answers of the various respondents. Again, the respondents from the smaller provinces of Drenthe and Flevoland seem to be the most satisfied. The end users of the medium-sized organization Utrecht also all agree with the statement. According to an information advisor from Utrecht, the end product delivered by the GI unit always meets the requirements.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	9	17	7	5	3	11
Somewhat agree	3	5	8	2	2	0
Neither agree nor disagree	0	1	0	1	1	1
Somewhat disagree	0	0	2	0	0	0
Not applicable	0	0	1	0	0	0

Figure 5.12 Statement: 'I am satisfied with the development of desired geographical information products.' (Response numbers per category, per province (in total and in %)

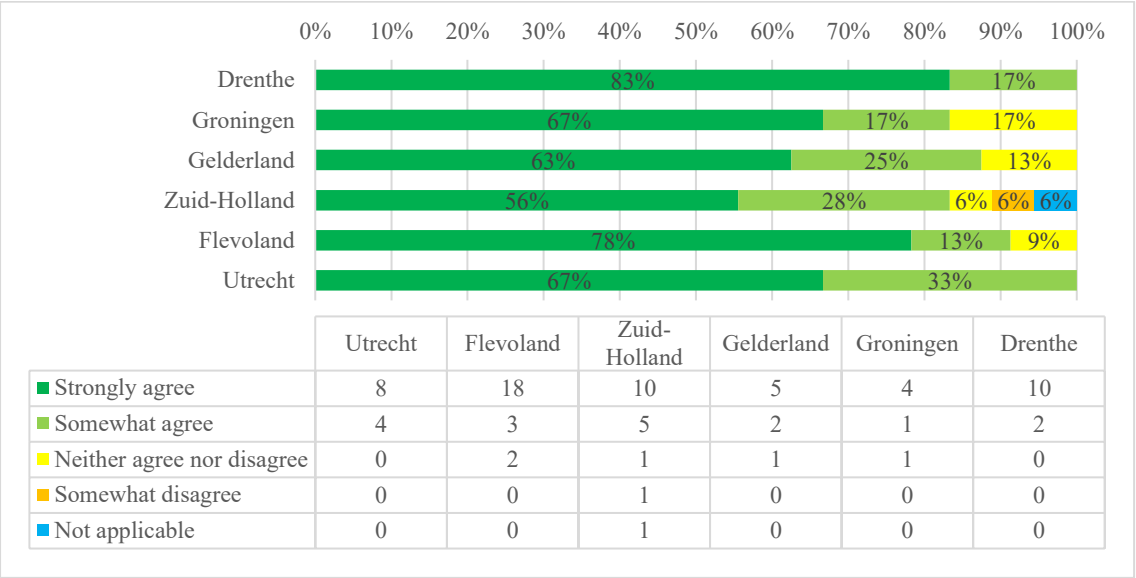
Looking further at the additional comments to the replies given, two respondents of Flevoland, one said to 'neither agree nor disagree' and the other to ‘somewhat agree’, indicated that there are hardly any tailor-made products developed in their behalf. An employee of Flevoland who strongly agrees with the statement notes that a number of information products are the result of a chain cooperation between the GI unit and policy teams. In many cases, this cooperation is however based on a few individual employees which make it according to the respondent, vulnerable and in need of attention.

Two employees of the Province of Drenthe emphasize the positive collaboration with the central GI unit during the development of information products. According to them, the GI unit generally makes a product in concept and submits it to the end user for comments.

All in all, the respondents seem to be reasonably satisfied with the development of requested information products. The remark of the employee of Flevoland regarding the vulnerability of the process because it is now depending on only a few individuals can be considered as relevant and of value from an organizational point of view.

Flexibility

In the fifth statement, the end user was asked about the flexibility of the members of the central GI unit during the development process of an information product. Once again, most end users seem to be satisfied. It is remarkable that both the end users of the smallest provincial organization with a GI unit within the IT department, the Province of Drenthe, and the largest provincial organization with a GI unit within the policy department, the Province of Utrecht, all agree with the statement.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	8	18	10	5	4	10
Somewhat agree	4	3	5	2	1	2
Neither agree nor disagree	0	2	1	1	1	0
Somewhat disagree	0	0	1	0	0	0
Not applicable	0	0	1	0	0	0

Figure 5.13 Statement: 'I am satisfied with the flexibility of the employees of the GI unit during the development process of a requested information product.' (Response numbers per category, per province (in total and in %)

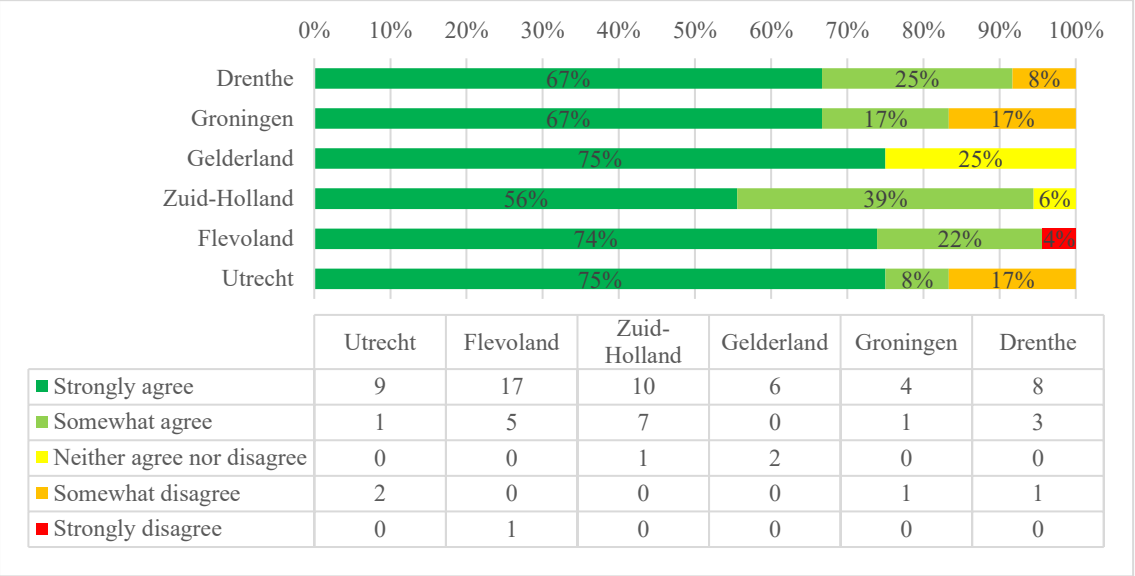
Despite the positive response, a number of end users at the Province of Utrecht provide some interesting points of criticism. According to them, interaction and the exchange of knowledge during the process between the members of the GI unit and the end user could be improved. For example, an end user indicated that it is difficult for him to formulate a well-defined and complete request for an information product as his knowledge of GI possibilities available is limited. On the other hand, the GI unit employees should have more knowledge of the business processes and be asking more what an end user actually requires. A respondent working at the Province of Groningen agrees that it is difficult to understand what is needed for an information product, because of a lack of GI knowledge.

A remark was made about, the vulnerability of the provision of information during holidays. When a GI employee is on holiday, this provision is not guaranteed and an information request may be put on hold. This probably refers to the situation in which the GI unit is managed per theme. When a theme manager is on holiday, there is a lack of knowledge on the related theme.

All in all, in all organizations most respondents are satisfied with the flexibility of the central GI unit. The main issues raised with regard to the design process concern a lack of interaction between end users and GI specialists during the process, limited knowledge of each other's fields of work, and the vulnerability of the information provision during the holidays of GI unit members.

Content knowledge

The sixth statement is about the knowledge of employees of the central GI unit with regard to the content of the end users work and field of expertise. In all provinces, a majority of the respondents stated that they strongly agree with the statement, see Figure 5.14. However, contrary to the previous statements, there is not one province in which all respondents agree. The overall reaction is nevertheless certainly not negative. There is only one respondent, who strongly disagrees with the statement.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	9	17	10	6	4	8
Somewhat agree	1	5	7	0	1	3
Neither agree nor disagree	0	0	1	2	0	0
Somewhat disagree	2	0	0	0	1	1
Strongly disagree	0	1	0	0	0	0

Figure 5.14 Statement: 'I am satisfied with the knowledge of the employees of the GI unit with regard to the content of my work and field of expertise'.
(Response numbers per category, per province (in total and in %)

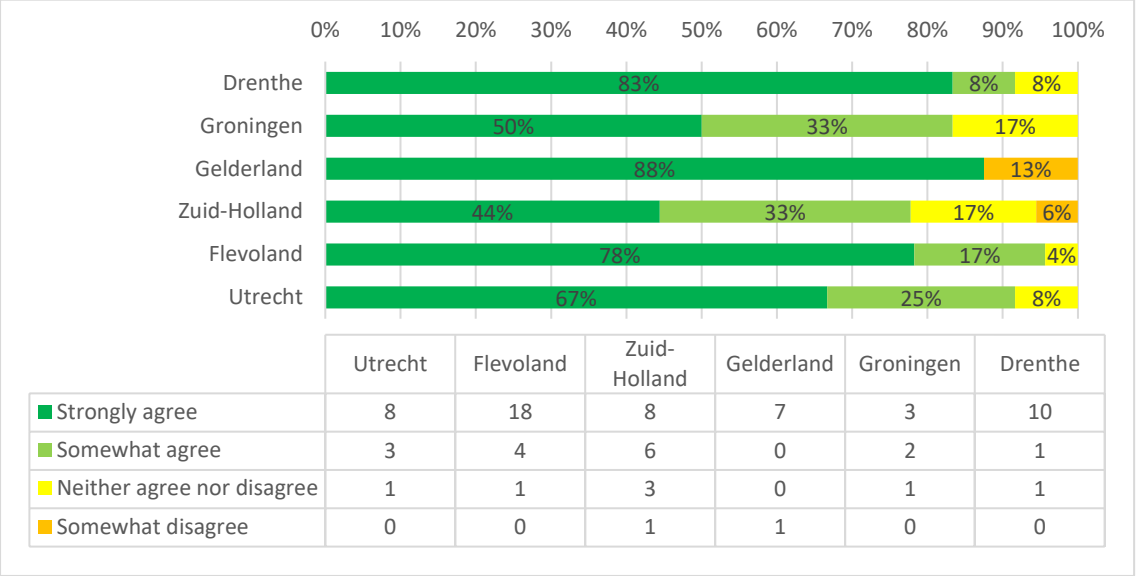
In their explanations, three employees of Zuid-Holland and Flevoland show also understanding for the situation of the GI unit employees and their sometimes limited knowledge of the business process of the end users. They argue that it is impossible for GI unit employees to know all business processes of all end users. The GI units are therefore not to be criticized in this respect, certainly not because they are usually very generous in their efforts to help.

Although the statement was about satisfaction with the knowledge of the GI unit with regard to what end users are doing at the province and what is their field of expertise, some respondents seem however to have interpreted the question as satisfaction with the knowledge of the GI unit with regard to the latest GI innovations. A few respondents answered that they were not entirely satisfied with the GI knowledge of some of the employees of the GI unit. Knowledge was not always up to date and there was a lack of innovation. This criticism is expressed by employees of Drenthe, Gelderland and Flevoland.

One respondent of Flevoland emphasized once again that knowledge of a particular GI task was in the hands of only one GI employee which makes the organization vulnerable. This may affect small organizations in particular.

Empathic ability

The seventh and final statement related to the design process of information products is about the empathy of the employees of the GI unit regarding the information needs of the end users. As with the previous statements, all but a few respondents are very satisfied with the empathic abilities of the GI unit. Once again, the employees of the two smallest provincial organizations, Drenthe and Flevoland, seem relatively the most satisfied.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	8	18	8	7	3	10
Somewhat agree	3	4	6	0	2	1
Neither agree nor disagree	1	1	3	0	1	1
Somewhat disagree	0	0	1	1	0	0

Figure 5.15 Statement: 'I am satisfied with the empathy of the employees of the GI unit regarding my information needs.'
(Response numbers per category, per province (in total and in %)

Two respondents, working at Gelderland and Zuid-Holland, indicated to 'somewhat disagree' with the statement.

Only two respondents, of Utrecht and Drenthe, commented on their assessment. They both strongly agrees with the statement. The Utrecht employee remarks that the GI employees are often clustered. According to the respondent, a little more intermingling by them among the different end-users would be desirable. From a theoretical point of view, this should indeed be easy to achieve within an organizational structure made up of different theme managers. The respondent from Drenthe indicates that the GI employees in general think along with the end users very well.

Summary

The above results show that the various end-users are generally very satisfied with the design process of their requested information products. Many indicate that the employees of the GI unit think along well during the design process.

The employees of the relatively smallest provincial organizations, Drenthe and Flevoland, in particular, seem to be very satisfied. In five of the seven statements, the end users of these provinces were the most satisfied, in terms of percentage.

There is an understanding amongst end users for the sometimes limited knowledge of GI employees about business processes. After all, they cannot know everything. End users find it more important that GI employees do their best to provide the right information product.

Remarks were made in the questionnaires about the GI knowledge of the GI unit. Among end users there is some concern about the up-to-date GI knowledge of certain GI units. For instance, latest innovations do not always seem to be available within the GI units. Also, in many cases certain GI tasks are assigned to one person only which makes processes vulnerable to delay, for instance during holidays or periods of illness.

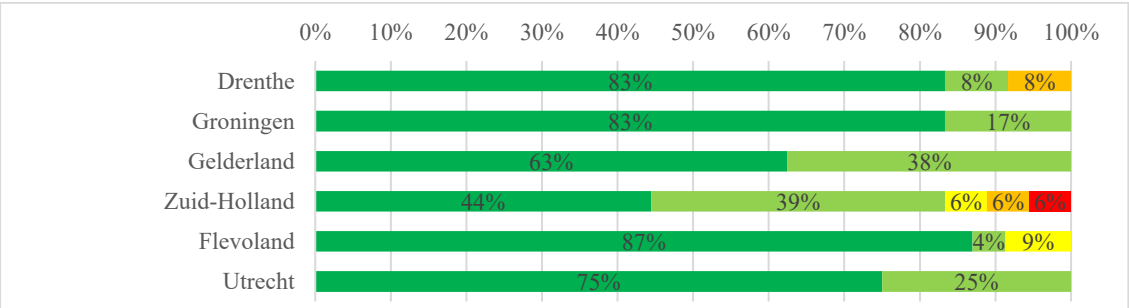
5.2.3 Quality of services

The third theme, presented in Paragraph 4.4, concerns the quality of the information products supplied by the GI unit. In the questionnaire, respondents were asked about their experiences of this quality by means of five statements:

1. I am satisfied with the quality of the service provided by the GI employee of the GI unit.
2. I am satisfied with the fastness of supply of the requested geographical information products.
3. I am satisfied with the quality of the geographical information products (e.g. web maps, viewers, applications) developed by the GI unit in the context of my work or that of my department/team.
4. The way in which geographical information and other types of information (such as statistical, economic and demographic information) are provided is harmonised within the organization.
5. My geographical information demands are satisfied within the organization

Quality of service

In the first statement, end users are asked about their satisfaction with regard to the quality of service provided by the GI colleagues of the GI unit. Overall, respondents are satisfied with the quality of the service, see Figure 5.16.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	9	20	8	5	5	10
Somewhat agree	3	1	7	3	1	1
Neither agree nor disagree	0	2	1	0	0	0
Somewhat disagree	0	0	1	0	0	1
Strongly disagree	0	0	1	0	0	0

Figure 5.16 Statement: 'I am satisfied with the quality of service provided by the GI employee of the GI unit.' (Response numbers per category, per province (in total and in %)

If we take a closer look at the answers to the statement, it seems that end users of the largest province, Zuid-Holland, are relatively the least satisfied. Unfortunately, none of the respondents bothered to explain their answer. Both respondents indicated that they use different geographical information services, such as desktop GIS, geo-databases and digital map viewers. This suggests that both have an above-average level of GI knowledge.

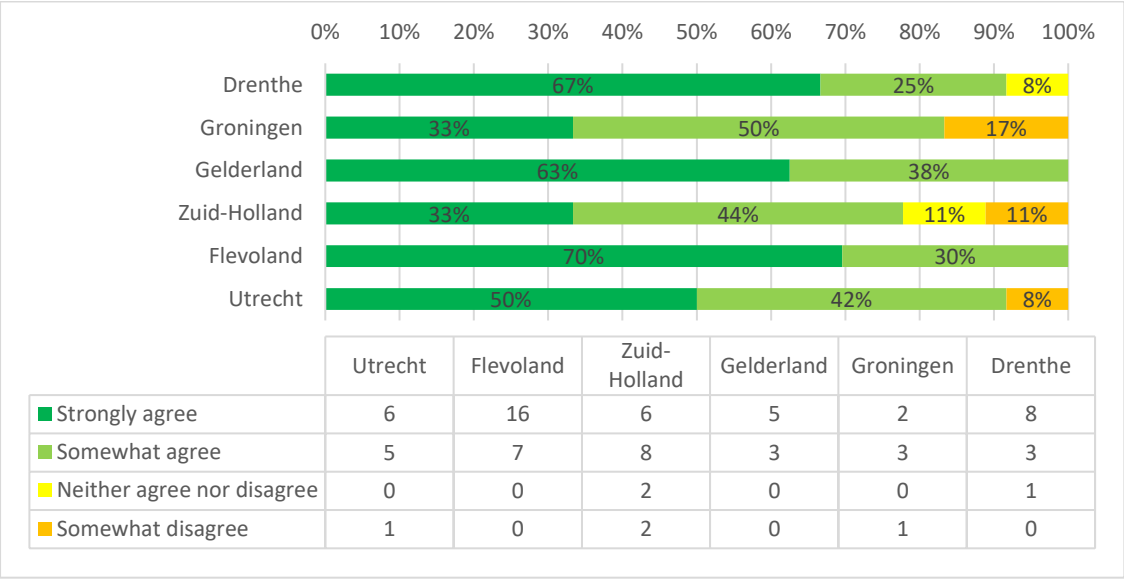
The respondent working at the Province of Drenthe, who somewhat disagreed with the statement, was dissatisfied with the quality of the products delivered, in particular at the technical level. In some cases, the finishing of the products supplied was not done carefully.

An employee of the Province of Flevoland could neither agree nor disagree because he did not know the difference between GI and GEO which were mentioned in the statement. GI referred to the term Geographical Information in general and GEO to the specific name of the Geographical Information team within the Province of Flevoland. The respondent was apparently not familiar with the first abbreviation. This can be considered as a shortcoming in the questionnaire, as the meaning was not included in this particular statement. In two other statements in the questionnaire in which these terms were used, the meaning was explained.

Two other comments from respondents interesting enough to mention are the lack of metadata within the web maps (respondent from Zuid-Holland) and hopefully a further improvement of the quality of services following the recent recruitment of new staff (Utrecht).

Fastness of delivery of supply

The second statement concerning the quality of the services is about the fastness of delivery of services. Looking at the answers in Figure 5.17, respondents seem to be somewhat less satisfied about the fastness of delivery than about the quality of service. Especially in the IT-model Provinces of Groningen and Zuid-Holland, a majority of the respondents answered that they 'only' slightly agreed with the statement.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	6	16	6	5	2	8
Somewhat agree	5	7	8	3	3	3
Neither agree nor disagree	0	0	2	0	0	1
Somewhat disagree	1	0	2	0	1	0

Figure 5.17 Statement: 'I am satisfied with the fastness of supply of the requested geographical information products.' (Response numbers per category, per province (in total and in %)

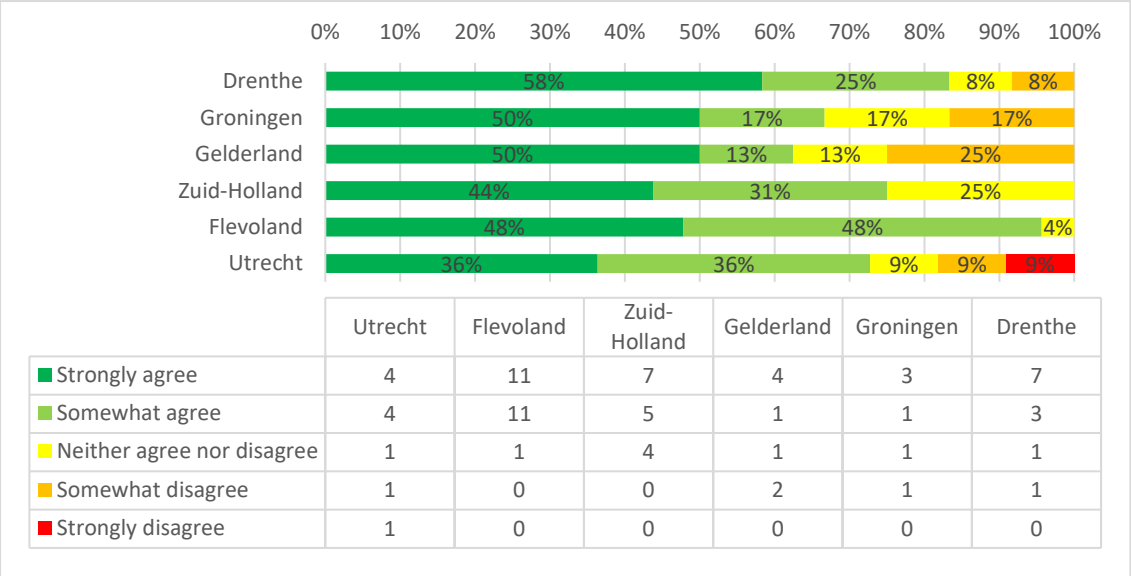
In the provinces of Zuid-Holland, Groningen and Utrecht, a few respondents somewhat disagreed with the statement, which indicates that they are not really satisfied with the fastness of supply. An employee from Zuid-Holland clarifies that it would be nice to be helped more quickly, but that it was not clear whether the cause was the employees of the GI unit or a GI colleague working at the same policy department. Another end user working at the Province of Utrecht explains that the provision of services always go slower than hoped for.

Useful additional comments from respondents who are satisfied with the fastness of supply read that sometimes the peak capacity of the GI unit is insufficient. For instance, an end user from Flevoland states that political amendments requiring immediate updates may lead to overloading of the available staff capacity. On the other hand, one satisfied respondent of Drenthe stated that during holidays duties are well transferred to colleagues and products continue to be delivered on time. Another respondent indicates that planning activities well in advance is a requirement for a timely delivery.

In general, everyone seems to be satisfied with the fastness of delivery of GI services. The main problem experienced is the delivery of urgently needed products. The peak capacity is not always sufficient to satisfy the demand.

Quality of geographical information products

In the third statement, the respondent was asked about his satisfaction with the information products provided by the GI unit. The underlying idea behind this question was that the quality of the products provided by GI units positioned within the IT department may be of a higher quality from a technical point of view than of the products delivered by a GI unit within a policy department. However, the results presented in Figure 5.18 do not support this assumption,



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	4	11	7	4	3	7
Somewhat agree	4	11	5	1	1	3
Neither agree nor disagree	1	1	4	1	1	1
Somewhat disagree	1	0	0	2	1	1
Strongly disagree	1	0	0	0	0	0

Figure 5.18 Statement: 'I am satisfied with the quality of the geographical information products (e.g. web maps, viewers, applications) developed by the GI unit in the context of my work or that of my department/team.' (Response numbers per category, per province (in total and in %)

Once again, the majority of the respondents is positive about the statement. Only six respondents disagree with the statement, of which one strongly. One respondent from Gelderland adds that the GIS software programme is relatively unstable, but that this is not so much the fault of the central GI unit. He seems to suggest that the problem is caused by shortcomings in the technical application management of the province. It should be noted that the central GI unit within Gelderland has been

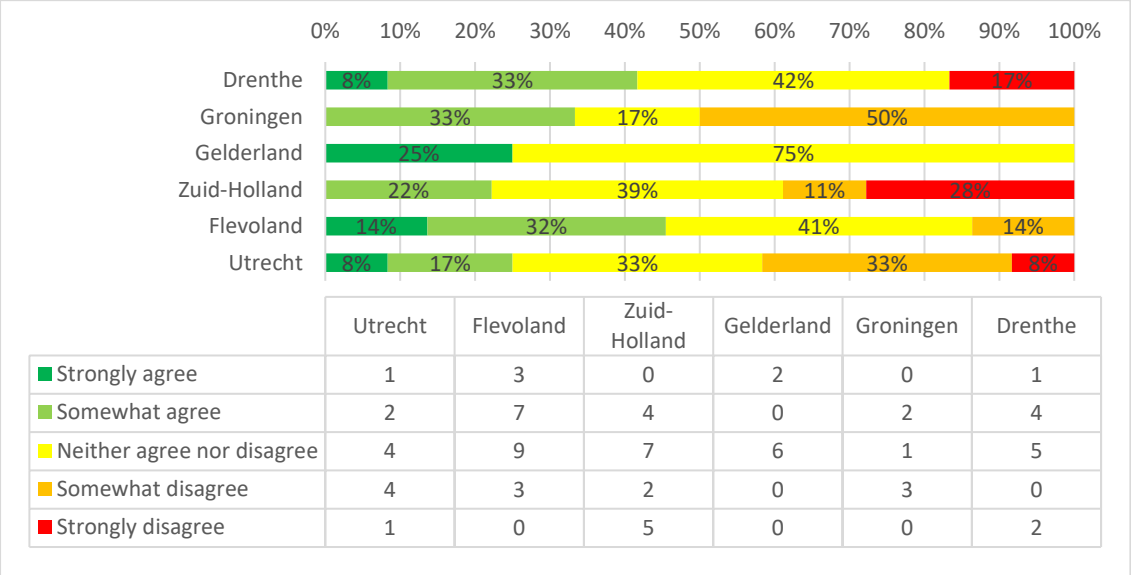
placed in the same department as the IT specialists and that most of the IT work has been outsourced. The stability of software is also criticised by an end user of the Province of Groningen. In this case, the respondent calls the internal viewer E-atlas unstable.

The respondents who assessed the quality of the products in a more satisfactory way also had several comments. At the Province of Drenthe, one end user states that webmaps are good, while another one indicates that the webmaps are sometimes faltering and a third one notes that the webmaps appear to be a little outdated. A respondent of Zuid-Holland indicates that he doesn't like the development that one has to do more and more oneself. But according to this respondent, this can't be blamed on the GI unit. The project leader is not satisfied with the development of self-service in general within the organization.

A respondent of Flevoland complains that the products are not being offered organization-wide. On top of that, the GI unit's services are not easy to find in the organization. A respondent at the Province of Utrecht has a similar comment: available GI products are not clearly visible for end users. It is remarkable that two respondents who both work in the same department as the GI unit indicate that the information products and services are not always easy to find. This may be possibly due to the fact that the IT-model provinces, as a true service desk provider, have a more visible counter.

Harmonization of information management

The fourth statement submitted to the respondents related to the quality of the services and products is about how they experience the harmonisation of geographical information and other types of information within the organization. This statement was included in the questionnaire to see whether in a Public Services-model, as in the Province of Overijssel, harmonization is better organized than in the two other models or not. Unfortunately, after the establishment and distribution of the questionnaire, Overijssel turned out to be not prepared to further participate.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	1	3	0	2	0	1
Somewhat agree	2	7	4	0	2	4
Neither agree nor disagree	4	9	7	6	1	5
Somewhat disagree	4	3	2	0	3	0
Strongly disagree	1	0	5	0	0	2

Figure 5.19 Statement: 'The way in which geographical information and other types of information (such as statistical, economic and demographic information) are provided is harmonised within the organization.' (Response numbers per category, per province (in total and in %)

Looking at Figure 5.19, the results of this statement are very different from previous statements. Instead of a large majority of the respondents agreeing with the statement, the majority in three provinces answers to 'neither agree nor disagree' and in two provinces to 'somewhat or strongly

disagree'. Only in Flevoland the majority (46%) agrees. The comments to the responses explain why: for most employees management of information in a harmonised way is this is not an important issue. No less than fifteen respondents indicated that they were not interested in this at all.

Many of the explanatory statements also state that harmonisation is something that certainly needs to be improved. A respondent of Drenthe, who somewhat agrees with the statement, indicated that there was still a lot to be done, particularly in the area of policy information.

Several respondents of Flevoland indicate that some good steps have already been taken, but that there are still many possibilities for further improvement. For instance, a respondent stated that a great deal had already been standardised with regard to the Nature Information Model, but that the storage of this information has not yet been uniformized.

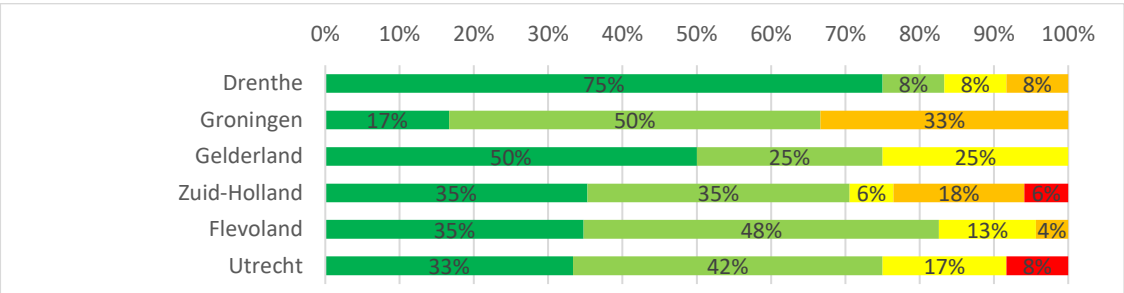
A respondent from Groningen also has the impression that many information systems within the organization are operating independently of each other. E-Gis is a perfect example of how to make information more accessible.

A respondent indicates that more portals with off-the-shelf functionalities should be created. This remark seems to be in line with the strategy of the GI unit to provide each policy team with its own off the shelve web map viewer.

In conclusion, it seems that the end users of geographical information are not really interested in the harmonisation of information and are not yet aware of the benefits of an integrated information system. One assumes that there is still much room for improvement, but no practical problems are encountered. A few respondents seem to appreciate the web map viewers as a way to harmonize and visualize different types of information.

Satisfaction of demands

In the latest statement on the quality of services theme, the respondents were asked about whether their GI demands were met by the organization or not. Once again, the end users within the smallest two provincial organizations (Drenthe and Flevoland) seem relatively the most satisfied, see Figure 5.20.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	4	8	6	4	1	9
Somewhat agree	5	11	6	2	3	1
Neither agree nor disagree	2	3	1	2	0	1
Somewhat disagree	0	1	3	0	2	1
Strongly disagree	1	0	1	0	0	0

Figure 5.20 Statement: 'My geographical information demands are satisfied within the organization'. (Response numbers per category, per province (in total and in %)

Of the nine respondents who indicated that they were not satisfied, four are employed in Zuid-Holland. Unfortunately, none of them gives an explanation to their answer. Of the non-satisfied respondents, only one from the Province of Utrecht provides an explanation. According to this respondent, it is not because of the GI unit's shortcomings, but because the policy officers do not formulate the right information questions due to capacity problems. This view was more or less confirmed by another respondent from Utrecht, who answered 'neither agree nor disagree'. The respondent indicates that he/she should specify better what is needed.

An interesting point of criticism mentioned in many of the other comments is the limitations of the geographic information products offered. For instance, it is difficult to combine external information with internal information. This issue is specifically mentioned by respondents from Flevoland, Groningen, Gelderland and Utrecht.

Two ‘satisfied’ respondents of Zuid-Holland indicate that end users are lacking knowledge. As a result, some of the possibilities offered by information products are not fully exploited. Geoweb is cited as an example, which is quite complicated to use. This lack of GI knowledge was also cited by a respondent within Gelderland. He suggests setting up a kind of consultation hour where end users can get support for carrying out their own analyses.

So, on one hand, end users are limited in their possibilities to combine external data with internal data because of barriers in the network. On the other hand, end users do not know the full possibilities of the geographical information products and would like to receive support in this respect.

Summary
The previous five statements have revealed a number of interesting opinions, wishes and concerns of end users with regard to the desired quality of the GI services and products.

In general, respondents seem satisfied with the quality of the service provided and are generous in the rating of the skills of the GI unit. For example, in the event of shortcomings in information products, people other than the GI employees are often held accountable, such as IT specialists, intermediaries or the end users themselves. A clear wish of end users is to increase the peak capacity of the GI unit to ensure timely delivery of emergency jobs.

A remarkable difference between the types of provinces concerns the 'findability' of information products for end users. Respondents working within the two Policy-model organizations indicated that the products and services are not always easy to find; they are not clearly visible within the organization. This problem was not mentioned by respondents at the IT-model provinces. One explanation may be that in this type of model, where the GI unit is positioned within the IT department, products and services are offered more clearly visible in one central service location.

As far as the harmonisation of geographical information and other types of information is concerned, this does not yet seem to be of importance to end users and is still of little interest to them. In several provincial organizations, however, this issue is on the agenda and plans are being made, such as the province of Zuid-Holland with the introduction of a data analytic team.

Two important shortcomings in satisfying the GI wishes of end users that have been mentioned are the limitations in the possibilities to combine internal and external information as a result of technical barriers in the network and insufficient GI knowledge with end users to properly make use of the offered information products.

5.2.4 Supporting service

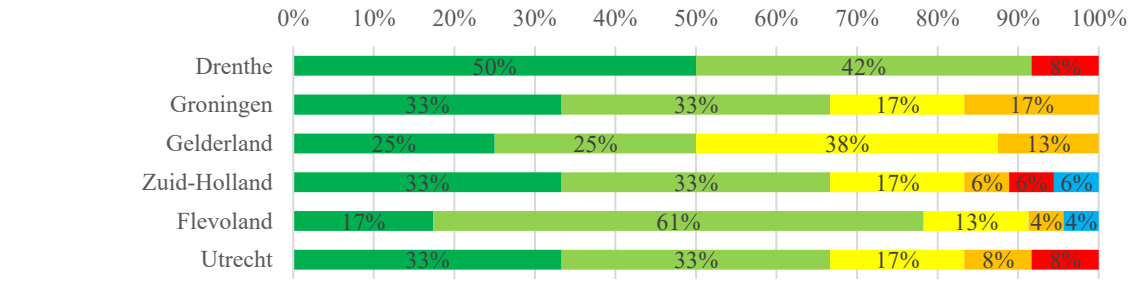
The fourth group of questions focuses on the supporting role of the GI unit as experienced by end users. In the questionnaire, four statements were submitted to the respondents:

1. I am satisfied with the centrally available geographical datasets.
2. I am satisfied with the availability of GI analysis tools within the organization
3. I am satisfied with the quality of the web map viewers.
4. I consider the GI unit as being an active part of the primary policy process and not as a reactive support service.

The first three statements address the satisfaction of end users with regard to three core GI support service. The last question is about whether the GI unit is seen as a supporting service or as part of the process.

Datasets

In all provinces, the majority of the respondents declare that they are very satisfied or somewhat satisfied with the centrally provided geographical datasets, with the exception of Gelderland where the rate is just 50% (see Figure 5.21). The employees of the IT-model province of Drenthe in particular agree with the statement.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	4	4	6	2	2	6
Somewhat agree	4	14	6	2	2	5
Neither agree nor disagree	2	3	3	3	1	0
Somewhat disagree	1	1	1	1	1	0
Strongly disagree	1	0	1	0	0	1
Not applicable	0	1	1	0	0	0

Figure 5.21 Statement: 'I am satisfied with the centrally available geographical datasets.' (Response numbers per category, per province (in total and in %)

A number of the respondents indicate that they have no experience with the use of geographical datasets. Two chose for ‘not applicable’ and six of the twelve end users who answered 'neither agree nor disagree' motivate their answer by stating that they do not use geographical datasets..

Many of the 23 respondents working at the Province of Flevoland provided also suggestions for improvement. For instance, one of them argue that a cartographic library with all the information products will be a good additional service. Another points out, again, that external data sets should also be provided centrally. Someone also indicates that raw data generally do not provide an answer on a policy issue and that a further GI analysis is therefore necessary.

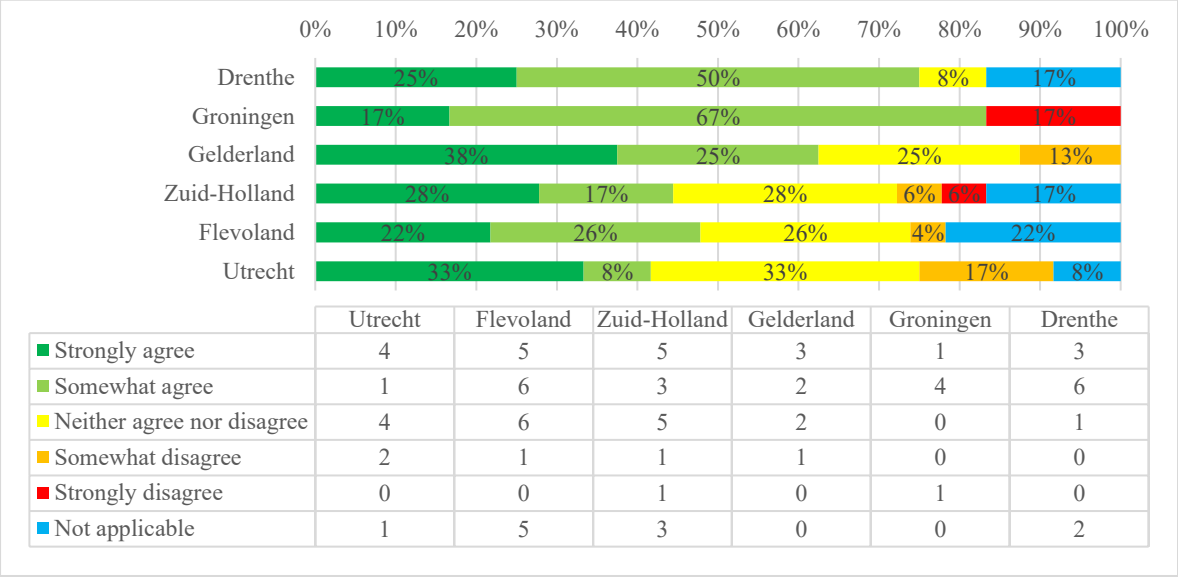
One respondent at the Province of Drenthe, who 'strongly disagree' with the statement, argues that the datasets are offered in a rather unstructured way. According to the respondent, this is not due to the GI unit but to the large scale of the organization and the lack of a data warehouse system.

An interesting comment came from a respondent within Gelderland who indicates that the responsibility for the quality, the up-to-dateness and the reliability of the datasets currently lies with the substantive departments. Unfortunately, turnover of staff within these departments is high, resulting in poor management of information. As a result, many of the centrally accessed datasets are outdated.

It seems that a large part of the respondents do not make use of the available datasets for their own purposes. Those who use it would like to have a clearer overview of what is available and external data sources included in the data warehouse. One aspect that requires attention is the allocation of the responsibilities for the datasets to the end users.

GI analysis tools

When asked about their experiences with the available GI analysis tools, a large majority of respondents of Drenthe, Groningen and Gelderland is satisfied. In the other three provinces 40-50% are satisfied. A relatively large number of respondents again states that they do not make use of this support provided by the GI unit. They answered the question with ‘not applicable’, and to a large extent with 'neither agree nor disagree' (see Figure 5.22).



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	4	5	5	3	1	3
Somewhat agree	1	6	3	2	4	6
Neither agree nor disagree	4	6	5	2	0	1
Somewhat disagree	2	1	1	1	0	0
Strongly disagree	0	0	1	0	1	0
Not applicable	1	5	3	0	0	2

Figure 5.22 Statement: 'I am satisfied with the availability of GI analysis tools within the organization' (Response numbers per category, per province (in total and in %)

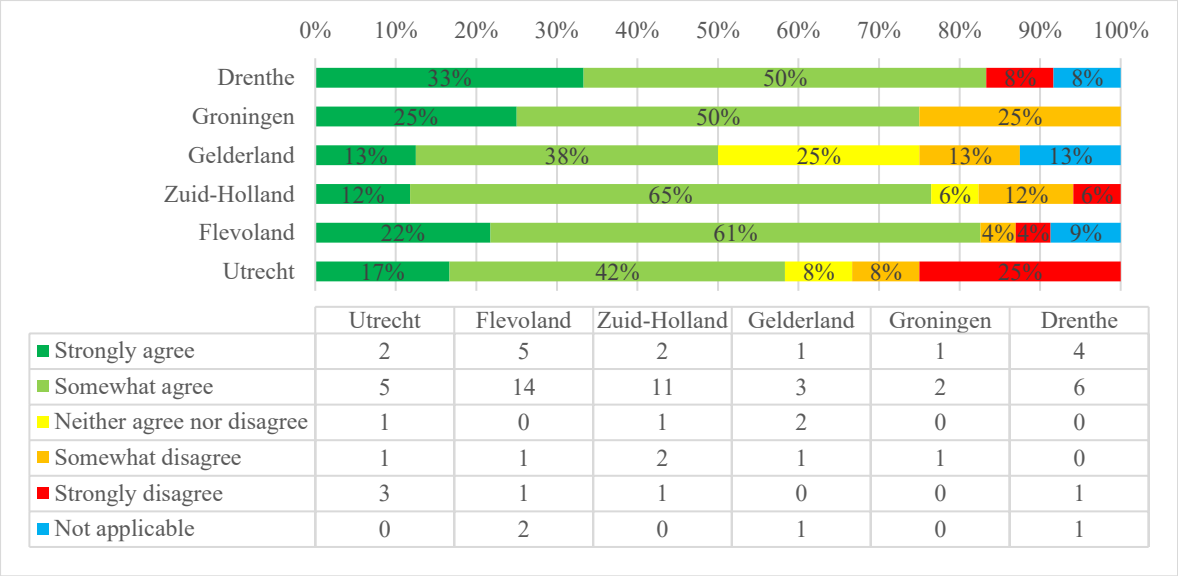
Furthermore, two respondents indicate that they strongly disagree with the statement. One of them, an employee of Zuid-Holland, provides an explanation. In his opinion, Geoweb offers too little functionalities to be able to perform GI analyses. The other respondent from Groningen who strongly disagrees did not give any further explanation, as he/she did for none of the questions by the way. However, looking at the kinds of GI tools he/she uses and time spent on GI (25-50%), this respondent must have a lot of knowledge of GI and is very active with GI. Due to this, the respondent may have a more critical and well-founded view.

Another respondent from Groningen who somewhat agrees, writes that it would be useful if end users had more GI analysis tools at their disposal, without having to ask the GI unit every time. This remark is also given in other provinces. A respondent from Utrecht notes that for real GI analyses one has to rely on the GI unit. This respondent would like more people to be given the opportunity to carry out analyses themselves.

However, it is not so easy to give all end users access to GI tools. From the reactions of the Flevoland end users, it emerges that licences for advanced GIS are granted only to a very limited number of policy officers and that one really has to make an effort to get one. This may have to do with costs of licenses and not being advisable to give access to all, as a certain level of user knowledge is necessary. Someone suggests that it would be a good idea to distribute free GI software such as QGIS within the province.

Web map viewers

A third basic GI tool is a web map viewer. Figure 5.23 shows that the majority of the respondents 'somewhat agree' with the statement that they are satisfied with the quality of the web map viewers. The outcome in general is quite similar to the one of the question on available geographical datasets. Also in this case, in every province there are end users who somewhat or strongly disagrees with the statement.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	2	5	2	1	1	4
Somewhat agree	5	14	11	3	2	6
Neither agree nor disagree	1	0	1	2	0	0
Somewhat disagree	1	1	2	1	1	0
Strongly disagree	3	1	1	0	0	1
Not applicable	0	2	0	1	0	1

Figure 5.23 Statement: 'I am satisfied with the quality of the web map viewers.' (Response numbers per category, per province (in total and in %)

The end users of the Province of Utrecht stand out with a percentage of 25 percent who strongly disagree. All three respondents took the effort to explain this answer. It appears that the web map viewer has not been functioning properly in several provincial systems for the past six months. According to one respondent, the fact that this is not being solved is shameful. Another respondent indicates with respect to the viewer that he/she is restricted in the configurations during the execution of his/her tasks. The third respondent argues that there used to be alternative web maps which met the requirements much better. In addition, three respondents working in Utrecht indicate that the web maps work very slowly.

The respondents from Drenthe Flevoland who 'strongly disagree' indicate that they do not find the geoportals user-friendly and that it is difficult to find the right geographical information. Two other

Flevoland end users add that the stability of the web maps is not always good either. Moreover, the web maps do not operate smoothly in all browsers and on tablets.

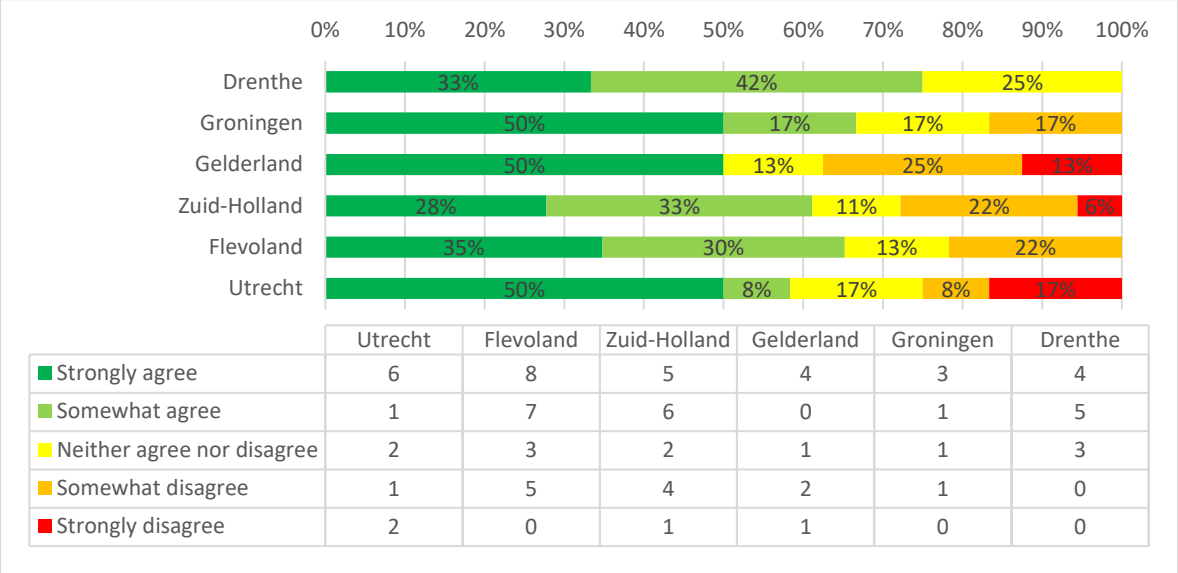
The technical instability of the web map viewers in both the Flevoland and Utrecht Policy-model organizations suggest that there are some shortcomings in the coordination with IT. In the case of the IT-model organization Zuid-Holland, the criticism in the comments remarkably focuses more on content-related issues, such as the zoom level that does not match the wishes, complicated data viewers and difficulties in combining different datasets.

The above comments are in line with the hypothesis that in the IT-model, the technical coordination between GI unit and IT specialists responsible for the technical management of GI products is better.

Policy process

The last statement in the questionnaire related to GI unit as a supporting service is about the role and position of the GI unit in the policy process. The end user is asked whether they see the GI unit as an active part of the primary policy process or as a reactive support service.

In all provinces, a modest majority of the respondents agree with the statement. With this question, one might expect that the end users within the Policy-model organizations (Flevoland and Utrecht) would experience the GI unit more as part of the primary process than within the other IT-model organizations. However, this cannot be concluded from the answers to the statement, as shown in Figure 5.24. The results show that the end-users of the smallest Province of Drenthe (IT-model) most see the GI unit as an active part of the policy process. Followed closely by Groningen (IT-model) and Flevoland.



	Utrecht	Flevoland	Zuid-Holland	Gelderland	Groningen	Drenthe
Strongly agree	6	8	5	4	3	4
Somewhat agree	1	7	6	0	1	5
Neither agree nor disagree	2	3	2	1	1	3
Somewhat disagree	1	5	4	2	1	0
Strongly disagree	2	0	1	1	0	0

Figure 5.24 Statement: 'I consider the GI unit as being an active part of the primary policy process and not as a reactive support service.' (Response numbers per category, per province (in total and in %)

Within the Province of Drenthe, end users seem to be aware of the possibilities that GI can offer in the policy process. However, this still has to further evolve and requires an improvement in quality. Respondents from other provinces also indicate that the central GI unit often functions in a responsive manner and that further interaction is desirable. A respondent from Utrecht who strongly agrees with

the statement indicates that the GI unit should be given an even more central role within the organization in the future.

Summary
The assumption that the appreciation for the provision of supporting services by the GI unit among end users who work for an IT-model province is higher than that of end users who work for a Policy-model province is not confirmed from this survey. Although there is some criticism of the stability of the web map viewers within the Policy-model organizations, the evidence is statistically too weak to draw any firm conclusions from these findings.

In all provinces, a modest majority of respondents consider the GI unit to be an active part of the primary policy process and not a reactive support service. In this respect, no significant differences were found in the responses of end users within the different organizational models.

5.3 Influence of position of GI unit on the satisfaction of user demands

In Paragraph 5.2, an overview has been given per theme of the respondents' answers to the survey. This paragraph discusses the extent to which the different positioning models as described in Paragraph 4.3 affect the satisfaction of end users.

In Paragraph 4.3 a distinction is made between three positioning models: IT, Public Services and Policy. The Public Services-model, in which the GI unit is placed within a Public Service Division, was only found within the Province of Overijssel. Since the questionnaire was not sent to this province, only the IT and the Policy-model organizations will be discussed with regard to the satisfaction of user demands.

In the previous paragraph, it became clear several times during the description of the results that significant differences in the answers between the Policy-model organizations on the one hand and the IT-model organizations on the other hand are limited. To illustrate this, the results of the survey have been grouped together for each of the four themes described in Paragraph 5.2, per organization model. The differences in the answers found are presented in the graphs in Figure 5.25. As discussed in Paragraph 3.3.4, the internal consistency of the two questions regarding the theme on the accessibility of the GI team was too low in order to combine them and treat them in one theme. The two topics addressed within this theme, satisfaction about accessibility and awareness of available GI products, are therefore presented separately.

The bar graphs in Figure 5.25 show some degree of more satisfaction among end users within a Policy Organization model than within an IT-model, in three of the four themes. The accessibility (both satisfaction as awareness), the design process and the quality of services are rated relatively better by the respondents of Flevoland and Utrecht, while the variables within the theme ‘Supporting Service’ are slightly better appreciated by the end users within an IT-model province.

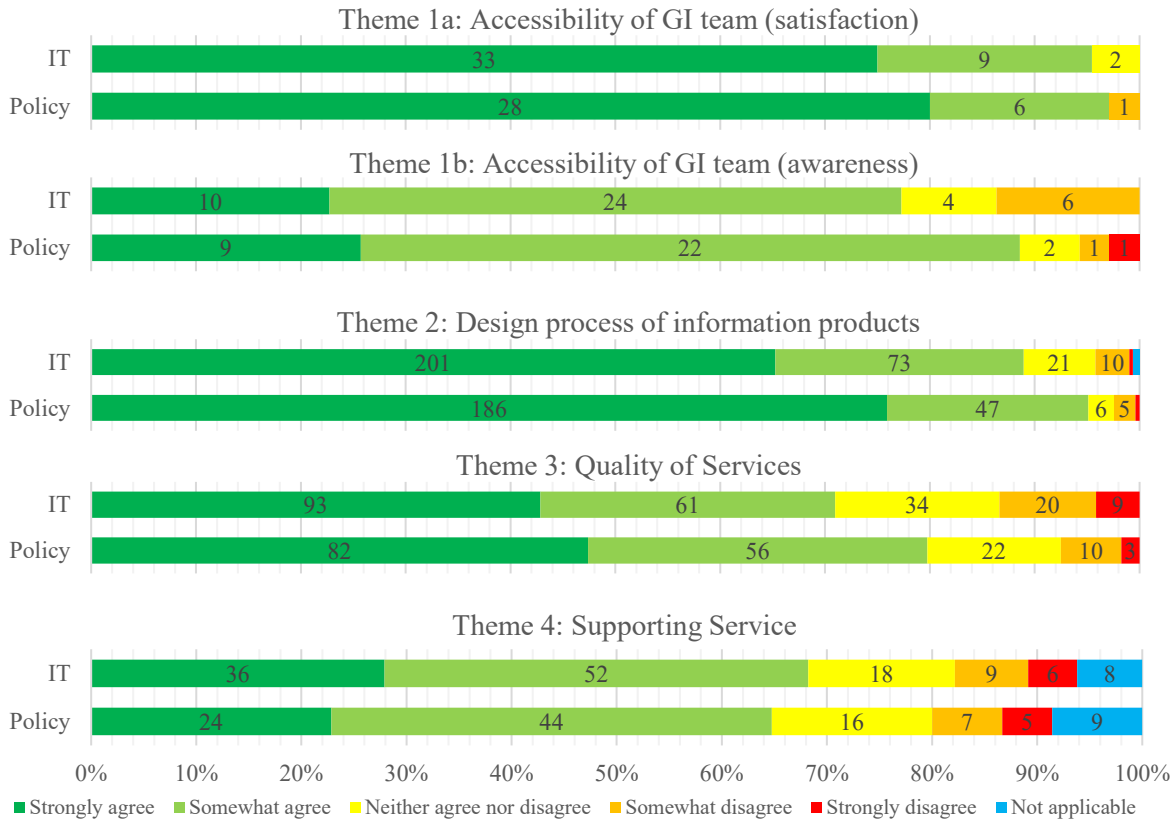


Figure 5.25 Influence of the position of the GI unit in the provincial organization on the satisfaction of user demands (Response numbers per theme, per organizational model (in total numbers and in %)

The slightly more positively assessed *accessibility of the GI unit (both satisfaction and awareness)* and t*he design process of the information products* within the Policy-model can possibly be explained by the fact that most GI end users and GI unit members work in the same department. As a result, the desks of the GI specialists and GI end users are generally close together which could play a role in a better cooperation and a higher level of appreciation and satisfaction. However, there is no real hard evidence for this assumption.

The *quality of services* is also rated slightly higher by end users within the Policy-model. Apparently, a direct colleague has a better understanding of the end user requirements than someone within an IT department. Only the range of services offered is more clear to end users if the GI unit is positioned within the IT department and not within the Policy department. This has to do with the service desk which is more prominent present in the IT-model.

Only with regard to the theme *supporting service*, the appreciation of end users within the IT-model is somewhat higher than that of those within the Policy-model. Supporting GI services such as centrally accessed data, GI tools and web map viewers, are better appreciated by the end users of the IT-model. This reflects the service-oriented characteristics of the IT-model. From the comments accompanying this theme, it appears that end users within the Policy-model mainly describe technical shortcomings in web map viewers. This suggests that the coordination of the GI unit with the technical managers is not functioning properly. The end users within the IT-model are much more critical of limitations in the possibilities of the technical applications. This criticism focuses much more on the shortcomings of the support services offered in relation to the primary policy processes.

From the figures presented in Figure 5.25, it can be concluded that there is no significant difference in satisfaction of GI end users between the two different organizational models (IT-model and Policy-model).

5.4 Influence of organization size on the satisfaction of user demands

The positioning of the central GI unit within the organization does not seem to affect how end-users assess the facilitation of services (conclusion Paragraph 5.3). However, the description of the results in Paragraph 5.2 did suggest a tendency that end users in the smaller provincial organizations respond more positively than those in the larger provincial organizations. The opinions of the end users working at both Flevoland and Drenthe were the most positive for the majority of the statements. The response rate at these two provinces was also remarkably high. Based on these observations, it was decided to further analyse the results on the basis of the size of the organization.

Like in the previous paragraph, a summarising bar graph has been drawn up for all four themes (see Figure 5.26). The questions on the theme Accessibility of the GI team are presented separately, as in Paragraph 5.3. On the y-axis of these diagrams, a three-tier classification is used based on the size of the organization. The small-size organizations include the Province of Flevoland (357,2 FTEs) and Drenthe (452,8 FTEs). The medium-size organizations include Utrecht (737.7 FTEs) and Groningen (742.5 FTEs). Large provincial organizations include the Province of Gelderland (1108 FTEs) and Zuid-Holland (1350.2 FTEs).

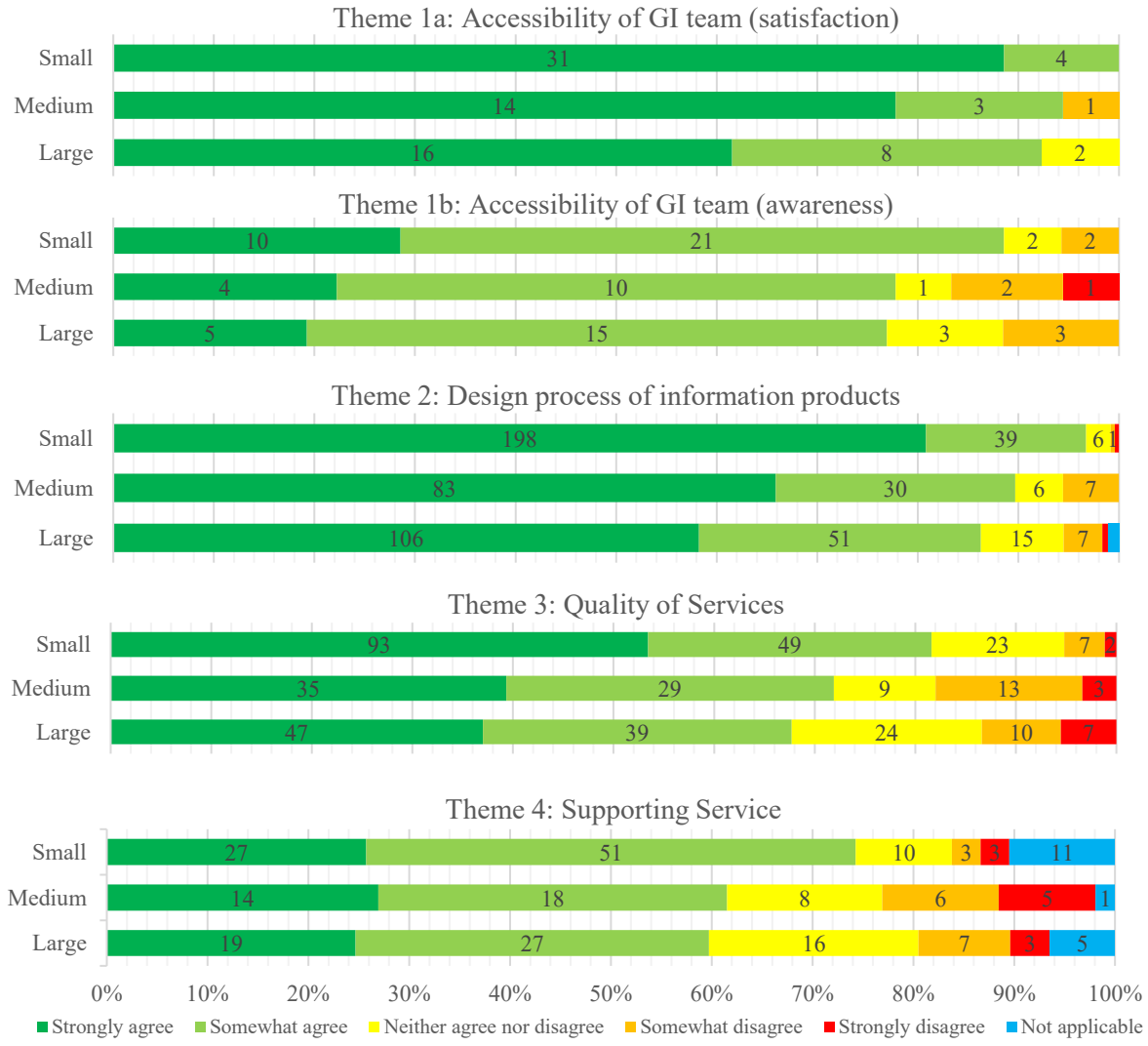


Figure 5.26 Influence of organization size on the satisfaction of user demands (Response numbers per theme and per size of organization (in total numbers and in %)

Figure 5.26 clearly shows a pattern. The end users of small provincial organizations react much more positively than their colleagues working at medium-sized or large organizations.

These clear differences in the descriptive statistics were the reason for conducting a statistical analysis. Using an ANOVA test, it was examined whether the differences in the responses of end users within small, medium and large organizations actually differ from each other. The results of this test, which are included in Appendix III, show that there is indeed a significant difference in the average rating of an end user within a small organization compared to that of a user within a large organization (p=0,019). The difference in average rating between a small organization and a medium-sized organization turns out to be insignificant within a 95% certainty margin, albeit a few percent (p=0,068). The null hypothesis that the satisfaction of employees within a medium-sized and large-sized employee does not differ from each other can also not be rejected (p=0.976). Statistically speaking, therefore, it cannot be argued that the answers of the respondents within a medium-sized organization and a large-scale organization differ from each other. However, it can be concluded that the satisfaction of respondents within a small organizational structure with regard to this questionnaire is significantly higher than that of their colleagues working within a large organizational structure.

It is difficult to give a conclusive explanation for this higher satisfaction in smaller organizations. Results from the survey that may explain this higher satisfaction:

- Respondents from the smaller organizations consider the GI unit relatively more as an active part of the primary policy process and not as a reactive support service.
- The end users of smaller organizations indicate that they have more verbal contact with their GI colleagues in comparison to the employees of larger organizations. This may be justified because of the fact that, at larger organizations, the distances between the different departments and employees are greater as the provincial government building is larger.
- Face-fo-face contact is considered to be a preferred way of contact and possibly leads to a higher satisfaction.
- The small-size organizations appear not to have a service desk, according to the respondents' answers. It is possible that the absence of a service desk has a positive influence on the level of satisfaction, because without a service desk, the processing time of an information request is usually shorter.

Finally, a point of concern that did come forward in the comments of the end users within small-size provincial organizations was the fact that the GI units may be more vulnerable during illness or holidays because of limited staffing. However, it could not be deducted from these comments that this had an impact on the level of satisfaction.

All in all, it can be concluded on the basis of the survey that end users working in a relatively small-size organization are more satisfied with the GI services provided within their provincial organization than end-users working in a large-size organization. In this context, one-to-one contact within an organization seems to play an important role in the valuations.

5.5 Résumé

Research question 3, 'To what extent do the identified provincial GI organization structures satisfy the demands of the GI end users?', was investigated with the help of a questionnaire held among end users in 6 provinces.

Based on the results of the questionnaire and its analysis, the following conclusions can be drawn:

- In both the IT-model and the Policy-model provinces studied, the demands of GI end users are adequately met.
  With respect to all four themes examined, the satisfaction amongst end users was more than satisfactory (at least 65%); in particular, the themes 'Design process of information products' and 'Accessibility of the GI unit (satisfaction)' received a very high score (more than 85% satisfied).

- Between the IT-model and the Policy-model no significant difference was found in the degree of satisfaction among end users, per investigated theme.
  In three of the four themes studied, 'Accessibility of GI unit, 'Design process of information products' and 'Quality of services provided by the GI unit', the satisfaction among end users within a Policy Organization model was slightly higher than within an IT-model. The difference was however not significant.
  Therefore, from this study it cannot be concluded that the positioning of the GI unit in the organization has an overall impact on the degree of satisfaction among end users with regard to the satisfaction of their demands.

- However, a difference was found between the average degree of satisfaction among end users of the small-size provincial organization (Drenthe and Flevoland) and that of end users of large provincial organizations (Gelderland and Zuid-Holland).
  The degree of satisfaction is statistically significantly higher in the small-size provinces than in the large-size provinces.
  The reason for this is probably that the GI unit is seen relatively more as an active part of the policy process in small-size organizations and the lines of communication between GI specialists and end users are relatively short.

6. Conclusions and Discussion

In this final chapter, first, the conclusions from the conducted research on the GI organizational structure of Dutch provinces is presented. In Paragraph 6.2, reflections on the limitations of this research are presented. The research results are placed in a broader context and related to previous findings in the field of study in Paragraph 6.3. Finally, in Paragraph 6.4 recommendations for further research or projects are given.

6.1 Conclusions

The research aimed "***to identify the current GI organizational structures within Dutch provinces and evaluate which of those structures satisfy the demands of provincial GI end users the most".*** In this paragraph, conclusions are drawn regarding the realization of the research objective on the basis of the answers to the research questions obtained.

The first research question ***What types of GI intra-organizational structures can be distinguished?*** is answered by means of a literature study which produced the following results:

- In literature, various classification systems of GI intra organizational structures exist. The classifications are often based on the degree of centralization of geographical information within an organization.
- Based on the analysis of articles the classification system of Holdstock (2016) is considered to be suitable for the study of provincial GI intra-organizational structures:
    - Central model, all GI activities are centralized at one unit in the organization
    - Decentral model, individual departments manage their own GI activities
    - Hybrid model, all strategic and coordination GI activities and the data management are centralized, but operational activities are performed decentral

  In order to be able to describe and compare the organizational models in the empirical part of the research, the models have been characterized using two dimensions identified by Dessers (2012):
    - Allocation — the place of geographical information functions and activities in an organization
    - Coordination — the level of centralized coordination or control of the geographical information related activities
- The literature study has resulted in a theoretical framework consisting of an overview of the different dimensions and its characteristics per organizational model (Table 2.2).

The second research question ***"Which types of GI organizational structures can be identified within Dutch provinces?"*** is answered using a case study approach. For this purpose, seven interviews were held with experts working in the provinces of Zuid-Holland, Drenthe, Flevoland, Groningen, Gelderland, Overijssel and Utrecht. During these interviews, the organizational structure was sketched and analysed on the basis of the various characteristics from the theoretical framework which resulted from research question 1. Based on the results of the case study, the following conclusions are drawn:

- The current GI organizational structure of the seven provinces studied all have the characteristics of the Central Model, combined with some hybrid organizational features. The degree of centralization at the provincial organizations is more or less the same (see Table 4.1 for summary).

- All seven provincial organizations studied have a central GI unit responsible for the provision of geographical information services. Most major GI activities are centrally allocated to this unit and are centrally coordinated in all organizations. However, a number of GI activities including the editing and analysis of GI can be conducted by end users working at another department or service, outside the central unit. A more hybrid situation therefore applies for these characteristics.
- Within the organizational model found (Central with hybrid features), a difference in the positioning of the central GI unit within the organization has been identified between the provinces. The central GI unit is positioned either at an IT department (Drenthe, Groningen, Gelderland, Zuid-Holland) a Policy department (Flevoland, Utrecht) or a Public Services department (Overijssel). The difference in positioning was thought to be of importance for the functioning of the organization and the extent to which the demands of GI end users are met.
- Based on this hypothesis, an adapted classification system was developed which served as basis for the second part of this research:
    - IT-model– GI unit positioned within the IT Department
    - Policy-model– GI unit positioned in a policy department, next to the main end users
    - Public Services-model– GI unit positioned in a department concerned with providing all kind of services to both internal and external end users
- Within provincial organizations, quantifiable characteristics have been identified which are important for the quality of the GI product provision and the extent to which the demands of GI end users are met.
  These characteristics are relevant for answering research question 3 and are partly determined by the position of the GI unit within the organization. They have been clustered in four themes:
    - Accessibility of the GI unit – How does the end user perceive the contact with the GI unit
    - Design process of information products – How does the end user perceive the cooperation with the GI unit and the way information products are designed
    - Quality of services provided by the GI unit – How does the end user perceive the quality of the GI services
    - Supporting service – How does the end user perceive the supporting and self-service GI services.

The second part of the research objective has been investigated through research question 3: ***"To what extent do the identified provincial GI organization structures satisfy the demands of the GI end users?"*** An online questionnaire was used for this purpose, based on the four themes mentioned above. GI end-users at four provinces with an IT-model and two provinces with a Policy-model participated in the questionnaire. The Public Services-model was not included in this part of the research, as the Province of Overijssel did not want to participate in the questionnaire. The following conclusions were drawn:

- The current GI organization model of the provinces studied meet to a large extent the demands of GI end users adequately.
  With respect to the themes examined, the percentage of satisfaction amongst GI end users who participated in the research is:
    - Accessibility of the GI unit: 80-95%
    - Design process of information products: 85-90%
    - Quality of services provided by the GI unit: 70-80%
    - Supporting service: 65-70%

- The positioning of the GI unit in the organization has no influence on the degree of satisfaction among GI end users with regard to the satisfaction of their demands. Both the IT-model and the Policy-model as used in the provinces meet the demands of GI end users adequately and differences found between the two models are minimal. For example, in three of the four themes studied, 'Accessibility of GI unit (both satisfaction and awareness)', 'Design process of information products' and 'Quality of services provided by the GI unit', the satisfaction among end users within a Policy Organization model is somewhat higher than within an IT-model, but not significant.
- The size of the provincial organization seem to have an influence on the satisfaction of user demands. The average degree of satisfaction amongst GI end users was found to be statistically significantly higher in the small-size provinces (Drenthe and Flevoland) than in the large-size provinces (Gelderland and Zuid-Holland). Reasons for this may be short lines of communication (face-to-face) between GI specialists and end users in small-sized organizations and the central GI unit being a more active part of the policy process.

Based on the aforementioned conclusions, it can be stated that the research objective has been achieved:

1. The provincial organizational structure has been identified and consists of a central model with some hybrid organizational features in all provinces studied. A difference was found within this model in the positioning of the central GI unit within the organization.
2. The extent to which the current provincial organizational model meets the demands of provincial GI end users has been evaluated. It was found that the demands are to a large extent adequately met by the identified central model with hybrid organizational features. The positioning of the central GI unit within the organization has no influence on the degree of satisfaction. However, the level of satisfaction of GI end users was significantly higher in small-size organizations than in large-size organizations.

In addition to the conclusions drawn from the research results, a personal view on a demand-driven provincial GI organizational structure is given in an essay in Appendix IV. In this essay, a number of thoughts and ideas are presented about the requirements a central GI team should meet in order to function well within a provincial organization.

6.2 Research limitations and reflection

This paragraph reflects on the steps taken in this research, the methods used, the analysis and interpretation of results and the conclusions on the basis of the various research questions.

Theoretical framework

The first research question led to a theoretical framework developed on the basis of a literature study on organizational structures and classification systems. The literature study was necessary not only to establish the theoretical basis of the research but also to get more knowledge in general with regard to 'business organization'. The latter was necessary because the subject of study was not just about geographical information but also about business organization and the curriculum of the master Geographical Information Management & Applications does not include much 'business organization'. The theoretical framework and the required study filled this gap and subsequently became a solid basis for the rest of the research.

The theoretical framework is based on the classification of the American Holdstock (central-decentral-hybrid) combined with variables (allocation and coordination) of the Belgian researcher Dessers. In retrospect, it can be concluded that the theoretical framework is probably more suitable for investigating differences in the degree of centralisation between organizational structures at different governmental levels, for example municipality vs province vs regional water authority. The Dutch provincial organizations studied turned out to be very similar in terms of centralisation and organizational structure, possibly because of their shared objectives and previous experiences. The fact that provincial organizations score similarly on the basis of the allocation and coordination characteristics is also shown in a study of Dessers, in which the Belgian provinces of Limburg and West Flanders score similar in many respects.

A limitation with regard to the theoretical framework that should be mentioned is the lack of sources based on the study of Dutch organizations. Many of the organizational structure models found in the literature were developed by American scientists on the basis of the organizational structures of American government agencies. The theoretical framework has therefore been largely based on the structure of American and Belgian government agencies. The lack in literature on 'Dutch' organizational structures was found to be a disadvantage in the further course of the study. It was only after the interviews conducted that it became clear that the organization of geographical information within all the provinces studied was comparable in terms of centralisation. If more Dutch literature study had been available, this conclusion might have been drawn in an earlier stage and might have led to an adjustment of the theoretical framework.

However, the theoretical framework within this research has certainly proved its worth in answering the research questions. The fact that the expected differences in the degree of centralization between the studied organizational structures were not present is inherent to conducting research and does not in any way invalidate the theoretical framework and the final conclusions.

Interviews

The comparative case study approach was chosen as the main research strategy for this study. This strategy, with a selection of seven cases, has led to a broad insight in the organizational structures of the different provinces. Within this comparative study, interviews were used to answer the second research question. Based on the data from the interviews, it was possible to determine which type of organizational structure is used within a province. Looking back at the interviews and their outcome, it can be concluded that they went very well overall. The in-depth interviews provided the answers to the questions of the previously established topic list. The sketches of the organizational structures based on these interviews gave a clear summary of the results of the interviews. Next to a substantive answer to the second research question, the interviews also gave the first insights in the answering of research question 3.

In Paragraph 3.2.4, about the reliability and validity of conducting open interviews, it was noted that the reliability of open interviews is limited because interviews yield a huge amount of information while it depends on the researcher to extract the correct data. In order to increase the reliability, other sources, such as documents, were used in addition to the interviews. However, most of these relevant sources are found internally inside the organization. As an external researcher you do not have direct access to these documents and you depend on what organizations make available. During the interviews, only a few internal strategy documents were shared and conditionally. A real data triangulation in which an analysis is carried out on the basis of multiple sources was therefore only possible in a very limited way. This will always be a difficult issue for a researcher with limited

resources. One has to work with company-sensitive information that limits one's research. However, the fact that all the provinces contacted were willing to cooperate, compensated a lot and was greatly appreciated.

As mentioned above, the interpretation of research data such as coding interviews and classifying different organizations is researcher-dependent and is influenced by the researcher. Therefore, there is always a chance the researcher will subjectively judge the results. For instance, in this study the characteristics of the provincial organizational structures studied did, in some cases, not fully correspond to the models formulated in the theoretical framework. The researcher therefore made an assessment as to how to classify these characteristics.

The outcome of research question 2 was that the seven provinces all have a similar organizational structure, but with a difference in the positioning of the central GI unit within the organization: at the IT, the Policy or the Public Services department. It can be interesting to further investigate the positioning models, especially the development of the position of the central GI unit in the organization over time. It was mentioned several times in the interviews with the experts that there is a kind of a fluctuation in the positioning of the GI unit. In many organizations the positioning seems to change over time from IT department to Policy and vice versa. Through further research into these changes in positioning and the reasons/causes underlying them, lessons can be learned about the arguments behind the various models and their advantages and disadvantages.

Questionnaire

A questionnaire was used to investigate the third research question about the degree of satisfaction of GI end users with regard to a certain type of organizational structure. The selection of GI end users to be contacted was done with the assistance of the experts interviewed. The number of end users contacted differed from one province to another, also in terms of comprehensive coverage, depending the time an expert was able to spend identifying and approaching the end users in his/her organization. The interpretation of who was to be considered GI end user and who was not, was also expert dependent. This has resulted in a limitation in the research. As a researcher, however, one does not have direct access to a provincial employee's contact details and it is difficult to contact them directly. Perhaps, employees could have been contacted via sites such as LinkedIn based on a job description. But that would have resulted in a selective selection of the respondents. After all, not everyone is active on these kinds of social networks. It is also difficult to decide who to contact on the basis of a job description and who not. In view of the dedication of the experts approached and the amount of time available for the survey, the above-mentioned limitation is therefore to be considered as acceptable.

A second point of discussion regarding the questionnaires is the resulting response and its usability. Of the 113 returned questionnaires, 79 were found to be filled in by ‘real’ GI end users and were used for the survey. Questionnaires filled in by GI producers were not included because the research focused on the users of geographical information; persons within the organization who use GI services and products for the execution of business processes. Within the provinces, this often concerns policy officers but also employees who implement these policies, such as supervisors or road administrators. The questionnaire ended up with GI producers possibly due to differences in interpretation of the term GI end user by the experts who forwarded the questionnaires. The overly broad interpretation can probably largely be attributed to the communication with the experts. This did lead to a limitation in this study, because the number of valid respondents per province varied between 6 and 23 GI end users.

In the case of the province with only six valid respondents (Groningen), a comment needs to be made. Five submitted questionnaires from GI end users turned out to be answerless and therefore invalid. A possible cause for this could be that the survey program Qualtrics used was not fully compatible with the computer systems of this province, which made it impossible to complete the questionnaire. The final results per province, presented in chapter 5, are therefore based on different numbers of respondents. To clarify this limitation, a table with the absolute numbers of returned questionnaires was added to the summarizing bar charts in that chapter.

In the qualitative analysis of the results, the comments placed by respondents in the open fields were often used to explain their answers. Without the open fields, few conclusions would have been drawn from the answers to the closed statements because of the limited response. The comments made it possible to interpret the answers. No statistical tests for the individual cases were used, in line with the limited response rate and the qualitative method of analysis. However, when it became clear during the elaboration of the descriptive statistics that the average degree of satisfaction in the smaller provincial organizations was higher than in the large-sized organizations, a statistical test was performed to verify this statistically. In this specific case, the sum of several indicators and provinces combined made the sample large enough to be able to carry out a statistical test.

Besides the difference in satisfaction based on organizational size, the general picture was that all GI end users are very satisfied with the geographic information services provided within the organization. The respondents were generally very positive when answering the questions. Being a critical researcher, one may ask oneself whether the formulation of the questions and propositions was sufficiently correct or whether the choice for rating scales questions was a correct one. Asking open questions, however, was not an option in view of the number of questionnaires to be conducted and the time available.

One final limitation to be mentioned relates to the indicators used in the questionnaire to determine the satisfaction of the GI end user. The indicators and subsequently the questions in the questionnaire related to them are based on the variables and themes mentioned by the GI experts during the interviews. It cannot be excluded that other variables not mentioned may also have an influence on the degree of satisfaction. As a result, the answers to the questions may result in conclusions with regard to the degree of satisfaction of GI end users which may be based on a possibly limited number of indicators.

6.3 Research results in a broader context

The presentation and analysis of the various types of organizational structures of provincial organizations provides new insights into how the geographical information services within provinces are organized, despite a number of limitations of the research as described in Paragraph 6.2. This paragraph reflects on how the results of this research relate to previous findings in the field of study.

The fact that the various provinces have a high degree of similarity in their GI organizational structure is in line with the aim to operate in the same way in the provinces, as expressed by PP-Geo members in Geo-INFO (Roebert & Scheele, 2006, p. 352). Vonk, Geertman & Schot (2007, p. 748) also agree that geographical information is organised to a large extent in a similar way within provincial organizations. The role of PP-Geo and the collective purchase of data and GI tools by the Dutch provinces will certainly have an influence on the extent of similarity in the organizational structures of the provinces studied.

The outcome that GI end users highly value a centrally organized geographic information service is in line with several articles in the trade magazine Geo-Info (Broeder, 2007, p. 102; Hootsmans & Witteveen, 2006, p. 358). The finding that the positioning of central Geo-teams within the organization differs between provinces is in line with the results of the Van Hunen survey (2006, p. 344). With regard to the Van Hunen survey, it should be noted that in those days some provinces had special cartography and surveying units in addition to the GI units, and a considerable proportion of the total number of geo employees within the provinces were cartographers or land surveyors. The Van Hunen survey (2006) consequently indicated that the size of the central GI unit varied per province. The results of this research show that separate teams for cartography and surveying no longer exist because they were either placed in one GI unit together with other GI employees, or replaced by outsourced parties, which are employed on a project basis.

In existing literature, such as the one of Petch & Reeve (1999a, p. 14), a distinction is regularly made between the domains Business and Technology and their relationship with the satisfaction of the user demands. In the interviews, the provincial experts used similar arguments based on the degree of technology or business to motivate the positioning of the GI unit in the organization. However, the results of the questionnaire conducted for this research did not result in differences in satisfaction with regard to GI units positioned within a technological IT department and GI units positioned within policy departments close to the business processes. The position of the GI unit does not seem to matter to the GI end user. Possibly, this results from the fact that the boundaries between IT and policy within organizations are fading and different areas of expertise are blending (Bevelander, 2007, p. 375).

The results of this research contribute to both the practical situation and to science. As far as known, there are no other (public) studies on the way Dutch provinces organize their geographical information. It thus provides a valuable addition to existing American and Belgian literature from Holdstock and Dessers, for example. It will also give geo advisers a better understanding of how provincial organizations are organised, which will be useful to them when making new decisions. Professionals within the domain will consider the study results to be primarily a confirmation of thoughts. The justification of the final conclusion stating that respondents working within a smaller-sized organization have a higher degree of satisfaction with regard to geographical information services may be somewhat limited, but it certainly provides food for thought and is something to consider in further studies.

6.4 Recommendations for future research

In this study, a lot of data was collected and answers to questions were found. However, it also raised a lot of new questions. In this paragraph, suggestions for future research are made.

Looking back, it can be concluded that between Dutch provinces there is little difference in the degree of centralization of the GI organizational structure. One observation that emerged during the interviews was that the positioning of the central GI unit in the organization does differ between provinces. It would be interesting to do further research on the relation between the positioning of the central GI unit and their role. This may contribute to how provinces should organize and secure their geographical information services.

The component ‘time’ would have been a good addition to this research. The provincial organizational structure, including the position of the central GI unit, changes over time. This study was limited to one moment in time, i.e. the organizational structure at the time of measurement. During the interviews, it emerged that for various reasons the organizational structures and positions of the central GI unit have been changed. For a better understanding of the current organizational structures, it would be interesting to conduct further research on these changes and the role of governance over the past decades. From the motives for change, lessons could be learned regarding the advantages and disadvantages of a particular model.

The aim of the research was to understand the degree of compliance of the organizational structures with the user demands. This research did not investigate what the exact demands of GI end users are. It was limited to the question whether the GI end users are satisfied with the organizational model. Little attention was also paid to the question whether the provincial organizations are supply or demand-driven and how organizations are giving shape to this. This also defines the role of the central GI unit. As the role of the GI unit is translated into the structure of the organization (Somers, 1998), a good understanding of this role is important for the design of the organizational structure.

Another point of interest that emerged from the interviews with provincial experts and which requires further research is 'the self-service organization'. Because GI is becoming more and more accessible to a wider audience thanks to technological developments, some provinces are increasingly aiming at having the simpler GI activities such as edits, analyses and visualizations performed by the end users themselves. For this purpose, the central GI units develop and configure various tools and applications with which end users can independently make use of geographical information services. Best practices for how to set up such a self-service organization have not yet been developed. Also in this context, further research into the GI end user demands needs to be conducted.

A final recommendation for follow-up research relates to the influence of the size of provincial organizations. As indicated before, the idea that respondents working within a smaller-sized organization have a higher degree of satisfaction with regard to geographical information services, gives certainly food for thought. A social network analysis within provincial organizations could be an interesting follow-up to understand if smaller organizations will result in more interaction with end-users and thus better GI services or other reasons are at play.

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Appendixes

Appendix I - Interview guide

Aim of interview: identify organizational structure per province by conducting interviews
Research Question: Which GI organizational structures are used within Dutch provinces?

0. Introductie

- Voorstellen + toelichten doel van onderzoek
    - Identificeer de huidige GI-organisatiestructuren binnen Nederlandse provincies en evalueer welke van die structuren het meest voldoen aan de huidige eisen van provinciale GI-gebruikers.
- Geluidsopname
- Structuur van interview

1. Positie en taken van respondent

Wat is uw huidige rol binnen de provincie en hebt u in het verleden nog andere rollen op het gebied van geografische-informatie binnen de provincie gehad?

- IPO / PPGeo

2. Positie en verdeling van GI binnen de organisatie

Kunt u een overzicht schetsen van de geo-informatievoorziening binnen uw organisatie?

- Waar binnen de organisatie bevinden zich de GI specialisten en waar de eindgebruikers?
- Is er een centrale GI-afdeling?
- In hoeverre worden er GI specialisten ingehuurd of worden er GI activiteiten geoutsourcet?
    - Aanwezigheid van een centrale GI unit
    - Centrale GI Support
    - Positie van voornaamste GI activiteiten in de organisatie
        - Data management en database beheer
        - Data aanmaken en bijwerken
        - Data analyses
        - Data visualisatie / kaartproductie
        - Onderhoud van applicaties (incl. soft- en hardware)
    - Mate van concentratie
    - Outsource / inhuur

3. Coördinatie

Op welke wijze wordt de geografische informatievoorziening gecoördineerd?

3.1 GI strategie

- Wat is de rol van de geo adviseurs en coördinators?
- Wie bepaald binnen de organisatie welke GI toolings en viewers er worden gebruikt binnen de organisatie? Is er een GI strategieplan?
    - GI activiteiten en procedures
    - Rol van geo-adviseurs en coordinatoren
    - Besluit maken

3.2 Geografische Informatieproducten

- Hoe verloopt de procedure wanneer iemand een informatieproduct aanvraagt?
- Via welk kanaal kunnen geografische informatieproducten worden aangevraagd?
- Wie is er verantwoordelijk voor de informatieproducten?
- Is er per informatieproduct een producteigenaar aangewezen?
- Uit welke budgetten worden de geografische informatieproducten gefinancierd? Is er een centraal budget of worden producten en projecten vanuit de afdelingen gefinancierd?
    - Planning en ontwerp van GI producten
    - GI product eigenaarschap
    - Data eigenaarschap / verantwoordelijkheid
    - Financiering

- Data/Kennis/Advies

4. Eindgebruiker

Op welke wijze worden de klantvragen gewaarborgd?

- Welke eindgebruikers kunnen worden geïdentificeerd?
- Wat zijn de wensen qua informatieproducten van deze eindgebruikers?
- Via welke kanalen / Op welke wijze worden de informatieproducten ontsloten?
    - Technische toegang tot database / via een atlas
- Hoe is de afstemming en terugkoppeling met de eindgebruikers?
    - Gebruikerswensen
        - Interactieve kaarten / Arcgis online
        - Kaarten voor beleidsrapporten
        - Leveren van Geo-data aan externen in kader van INSPIRE of Provinciale afspraken
    - Ontsluiting van informatie producten
        - Geo portalen
        - Geo desk

5. Afsluiting

- Vervolg onderzoek
- Geo-visies
- Uitzetten van survey onder eindgebruikers

Appendix II - Questionnaire

Geografischie Informatievoorziening binnen Provincie X

Start of Block: 1 - Introductievraag

Q0 Fijn dat u een bijdrage wilt leveren aan deze studie naar de geografische informatievoorziening binnen de Provincie X. De vragenlijst bestaat uit 27 vragen, waarvan 24 meerkeuze. Bij de meeste meerkeuze-vragen is ruimte voor een eventuele toelichting.

Q1 Vraag 1. Ik maak tijdens mijn werkzaamheden gebruik van Geografische Informatie (GI), zoals kaartmateriaal, digitale kaart viewers, ArcGIS of andere vormen

- ○ Ja (1)
- ○ Nee (2)

End of Block: 1 - Introductievraag

Start of Block: 7 - Gebruik van geografische informatie

Q35 U geeft aan tijdens uw werkzaamheden geen gebruik te maken van geografische informatie. Dit onderzoek focust zich echter op gebruikers van geografische informatieproducten. U hoeft derhalve niet de volledige enquête in te vullen. Wij verzoeken u nog wel de volgende drie vragen te beantwoorden.

Q36 Bent u bekend met geografische informatie?

- ○ Ja (1)
- ○ Nee (0)

Q37 Bent u bekend met de dienstverlening van team X (Afdeling X)

- ○ Ja (1)
- ○ Nee (0)

Q38 Kunt u toelichten waarom u geen gebruik maakt van geografische informatie

_____

End of Block: 7 - Gebruik van geografische informatie

Start of Block: 2 - Bereikbaarheid GI unit

Q1 Vraag 2. Ik maak tijdens mijn werkzaamheden gebruik van de volgende Geografische Informatie tools:
(meerdere antwoorden mogelijk)

- ☐ Papieren Kaartmateriaal (1)
- ☐ Digitaal Kaartmateriaal (2)
- ☐ Digitale kaart viewers, bereikbaar via X (3)
- ☐ Digitale kaart viewer voor intern gebruik (4)
- ☐ ArcGIS ten behoeve van GI analyses (5)
- ☐ Geografische webservices (WMS, WFS, REST) (6)
- ☐ Geodatabase- en/of shapefiles (7)
- ☐ Andere vormen van Geografische Informatie, te weten (8)

_____

Q3 Vraag 3. Ik ben tevreden over de bereikbaarheid van de medewerkers van team X (afdeling X)

- ○ Helemaal mee eens (1)
- ○ Enigszins mee eens (2)
- ○ Noch eens noch oneens (3)
- ○ Enigszins mee oneens (4)
- ○ Helemaal niet mee eens (5)

Q3a Ruimte voor eventuele toelichting op antwoord vraag 3

_____
_____
_____
_____
_____

Q4 Vraag 4. Ik ben op de hoogte van de geografische informatieproducten die door team X geleverd kunnen worden

- ○ Helemaal mee eens (1)
- ○ Enigszins mee eens (2)
- ○ Noch eens noch oneens (3)
- ○ Enigszins mee oneens (4)
- ○ Helemaal niet mee eens (5)

Q4a Ruimte voor eventuele toelichting op antwoord vraag 4

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_____
_____
_____
_____

Q5 Vraag 5. Als ik een geografisch informatieproduct wil aanvragen dan neem ik contact op met team X op de volgende wijze(n):
(meerdere antwoorden mogelijk)

- ☐ via service/helpdesk (ticket) (1)
- ☐ via de mail (2)
- ☐ Telefonisch (3)
- ☐ Mondeling (4)
- ☐ Anders, namelijk (5) _____

Q6 Vraag 6. Mijn voorkeur gaat uit naar de volgende manier van contact maken met de GI medewerker:
(Zet manier met meeste voorkeur bovenaan door erop te klikken en naar boven te slepen, enzovoort. 1=meeste voorkeur, 4=minste voorkeur)

_____ via service/helpdesk (ticket) (1)
_____ via de mail (2)
_____ Telefonisch (3)
_____ Mondeling (4)

Q6a Ruimte voor eventuele toelichting op antwoord vraag 6

_____
_____
_____
_____
_____

End of Block: 2 - Bereikbaarheid GI unit

Start of Block: 3 - Proces rond ontwikkeling geografisch informatieproduct

Q7 Vraag 7. Ik ben tevreden over het contact met team X en haar medewerkers binnen mijn werkzaamheden

- ○ Helemaal mee eens (1)
- ○ Enigszins mee eens (2)
- ○ Noch eens noch oneens (3)
- ○ Enigszins mee oneens (4)
- ○ Helemaal niet mee eens (5)

Q7a Ruimte voor eventuele toelichting op antwoord vraag 7

_____
_____
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_____
_____

Q8 Vraag 8. Ik ben tevreden over de afstemming van geografische informatie (GI) gerelateerde werkzaamheden tussen de GI medewerker van team X en mijzelf

- ○ Helemaal mee eens (1)
- ○ Enigszins mee eens (2)
- ○ Noch eens noch oneens (3)
- ○ Enigszins mee oneens (4)
- ○ Helemaal niet mee eens (5)

Q8a Ruimte voor eventuele toelichting op antwoord vraag 8

_____
_____
_____
_____
_____

Q9 Vraag 9. Team X en haar medewerkers denken proactief mee bij het ondersteunen van projecten en het oplossen van problemen

- ○ Helemaal mee eens (1)
- ○ Enigszins mee eens (2)
- ○ Noch eens noch oneens (3)
- ○ Enigszins mee oneens (4)
- ○ Helemaal niet mee eens (5)

Q9a Ruimte voor eventuele toelichting op antwoord vraag 9

_____
_____
_____
_____
_____

Q10 Vraag 10. Ik ben tevreden met het proces van totstandkoming van door mij gewenste geografische informatieproducten

- ○ Helemaal mee eens (1)
- ○ Enigszins mee eens (2)
- ○ Noch eens noch oneens (3)
- ○ Enigszins mee oneens (4)
- ○ Helemaal niet mee eens (5)
- ○ Niet van toepassing (6)

Q10a Ruimte voor eventuele toelichting op antwoord vraag 10

_____
_____
_____
_____
_____

Q11 Vraag 11. Ik ben tevreden met de flexibiliteit van de medewerkers van team X tijdens het proces van ontwikkeling van een door mij gevraagd informatieproduct

- Helemaal mee eens (1)
- Enigszins mee eens (2)
- Noch eens noch oneens (3)
- Enigszins mee oneens (4)
- Helemaal niet mee eens (5)
- Niet van toepassing (6)

Q11a Ruimte voor eventuele toelichting op antwoord vraag 11

_____
_____
_____
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Q12 Vraag 12. Ik ben tevreden over de inhoudelijke kennis van de medewerkers van team X ten aanzien van mijn werkzaamheden en werkterrein

- Helemaal mee eens (1)
- Enigszins mee eens (2)
- Noch eens noch oneens (3)
- Enigszins mee oneens (4)
- Helemaal niet mee eens (5)

Q12a Ruimte voor eventuele toelichting op antwoord vraag 12

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Q13 Vraag 13. Ik ben tevreden over het inlevingsvermogen van de medewerkers van team X in mijn informatiebehoeften

- Helemaal mee eens (1)
- Enigszins mee eens (2)
- Noch eens noch oneens (3)
- Enigszins mee oneens (4)
- Helemaal niet mee eens (5)

Q13a Ruimte voor eventuele toelichting op antwoord vraag 13

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End of Block: 3 - Proces rond ontwikkeling geografisch informatieproduct

Start of Block: 4 - Dienstverlening en Kwaliteit

Q14 Vraag 14. Ik ben tevreden over de kwaliteit van de dienstverlening door de GI-medewerker van team X

- Helemaal mee eens (1)
- Enigszins mee eens (2)
- Noch eens noch oneens (3)
- Enigszins mee oneens (4)
- Helemaal niet mee eens (5)

Q14a Ruimte voor eventuele toelichting op antwoord vraag 14

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Q15 Vraag 15. Ik ben tevreden over de snelheid van levering van de door mij aangevraagde geografische informatieproducten

- Helemaal mee eens (1)
- Enigszins mee eens (2)
- Noch eens noch oneens (3)
- Enigszins mee oneens (4)
- Helemaal niet mee eens (5)

Q15a Ruimte voor eventuele toelichting op antwoord vraag 15

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Q16 Vraag 16. Ik ben tevreden over de kwaliteit van de geografische informatieproducten (bv. web maps, viewers, applicaties) die door team X worden ontwikkeld in het kader van mijn werkzaamheden of die van mijn afdeling/team

- Helemaal mee eens (1)
- Enigszins mee eens (2)
- Noch eens noch oneens (3)
- Enigszins mee oneens (4)
- Helemaal niet mee eens (5)

Q16a Ruimte voor eventuele toelichting op antwoord vraag 16

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Q17 Vraag 17. De wijze van beschikbaarheid van geografische informatie en andersoortige informatie (zoals statistische, economische en demografische informatie) is binnen de organisatie op elkaar afgestemd

- Helemaal mee eens (1)
- Enigszins mee eens (2)
- Noch eens noch oneens (3)
- Enigszins mee oneens (4)
- Helemaal niet mee eens (5)

Q17a Ruimte voor eventuele toelichting op antwoord vraag 17

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Q18 Vraag 18. Aan mijn geografische informatie behoefte wordt voldaan binnen de organisatie

- Helemaal mee eens (1)
- Enigszins mee eens (2)
- Noch eens noch oneens (3)
- Enigszins mee oneens (4)
- Helemaal niet mee eens (5)

Q18a Ruimte voor eventuele toelichting op antwoord vraag 18

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End of Block: 4 - Dienstverlening en Kwaliteit

Start of Block: 5 - Technische ondersteuning

Q19 Vraag 19. Ik ben tevreden over de centraal beschikbaar gestelde geografische datasets

- ○ Helemaal mee eens (1)
- ○ Enigszins mee eens (2)
- ○ Noch eens noch oneens (3)
- ○ Enigszins mee oneens (4)
- ○ Helemaal niet mee eens (5)
- ○ Niet van toepassing (6)

Q19a Ruimte voor eventuele toelichting op antwoord vraag 19

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Q20 Vraag 20. Ik ben tevreden over de beschikbaarheid van GI analyse tools binnen de organisatie

- ○ Helemaal mee eens (1)
- ○ Enigszins mee eens (2)
- ○ Noch eens noch oneens (3)
- ○ Enigszins mee oneens (4)
- ○ Helemaal niet mee eens (5)
- ○ Niet van toepassing (6)

Q20a Ruimte voor eventuele toelichting op antwoord vraag 20

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Q21 Vraag 21. Ik ben tevreden over de kwaliteit van de webviewers/maps (bijvoorbeeld Atlas Flevoland)

- ○ Helemaal mee eens (1)
- ○ Enigszins mee eens (2)
- ○ Noch eens noch oneens (3)
- ○ Enigszins mee oneens (4)
- ○ Helemaal niet mee eens (5)
- ○ Niet van toepassing (6)

Q21a Ruimte voor eventuele toelichting op antwoord vraag 21

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Q22 Vraag 22. Ik beschouw het team X als een actief onderdeel van het primaire beleidsproces en niet als een reactief ondersteunende dienst

- Helemaal mee eens (1)
- Enigszins mee eens (2)
- Noch eens noch oneens (3)
- Enigszins mee oneens (4)
- Helemaal niet mee eens (5)

Q22a Ruimte voor eventuele toelichting op antwoord vraag 22

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End of Block: 5 - Technische ondersteuning

Start of Block: 6 - Persoonskenmerken

Q23 Vraag 23. Ik ben werkzaam bij de Provincie X:

- Minder dan 1 jaar (1)
- 1-5 jaar (2)
- 5-10 jaar (3)
- 10-20 jaar (4)
- Meer dan 20 jaar (5)

Q23a Ruimte voor eventuele toelichting op antwoord vraag 23

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Q24 Vraag 24. De tijd dat ik tijdens mijn werk met GIS-gerelateerde werkzaamheden (analyses, databewerkingen, kaarten maken) bezig ben is:

- Minder dan 5 procent (1)
- 5-25 procent (2)
- 25-50 procent (3)
- 50-75 procent (4)
- Meer dan 75 procent (5)

Q24a Ruimte voor eventuele toelichting op antwoord vraag 24

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Q25 Vraag 25. Mijn functie binnen de provincie is:

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Q26 Vraag 26. Ik ben werkzaam bij de afdeling/team:

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Q27 Vraag 27. Heeft u verder nog opmerkingen?

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End of Block: 6 - Persoonskenmerken

Appendix III - One-way ANOVA

This appendix presents the results of a One-way ANOVA test. In this test, differences in average rating based on the size of the organization have been compared. The aim of the test is to see whether there are significant differences in these averages.

Descriptives

The descriptive table below shows that respondents working within the small-sized provincial organizations Drenthe and Flevoland have an average satisfaction score of 1.5294 on a scale of 5.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Small[1]	35	1,5294	,41377	,06994	1,3873	1,6716	1,00	2,71
Medium[2]	18	1,8644	,62382	,14704	1,5542	2,1746	1,00	3,12
Large[3]	26	1,8975	,54666	,10721	1,6767	2,1183	1,06	3,47
Total	79	1,7269	,53552	,06025	1,6069	1,8468	1,00	3,47

[1]Drenthe, Flevoland; [2]Utrecht, Groningen; [3]Gelderland, Zuid-Holland

Test of Homogeneity of Variances

There must be homogeneity of variances, otherwise the ANOVA test may not be performed. This precondition has been tested in SPSS Statistics using Levene's test for homogeneity of variances. The null hypothesis that there is homogeneity of variances is not rejected, because the p-value is greater than 0.05. It can therefore be assumed that there is homogeneity of variances. On the basis of this outcome, the ANOVA analysis can be performed.

		Levene Statistic	df1	df2	Sig.
Mean12	Based on Mean	2,502	2	76	,089
	Based on Median	2,174	2	76	,121
	Based on Median and with adjusted df	2,174	2	71,713	,121
	Based on trimmed mean	2,487	2	76	,090

ANOVA

In this table the output of the ANOVA analysis is shown. The computed significance value is 0.012 (i.e., $p = .012$). Because this is below 0.05, it can be concluded that there is a statistically significant difference in the mean satisfaction of the end users between the three different organizational sizes.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2,461	2	1,231	4,698	,012
Within Groups	19,908	76	,262		
Total	22,369	78			

Multiple Comparisons

In the multiple comparison table, a post-hoc analysis is used to determine between which organizational models a significant difference is present. Both the Tukey HSD and the Bonferroni show that the small- and large-scale organizations differ significantly from each other.

	(I) Size	(J) Size	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Tukey HSD	Small	Medium	-,33493	,14845	,068	-,6898	,0199
		Large	-,36801*	,13251	,019	-,6848	-,0513
	Medium	Small	,33493	,14845	,068	-,0199	,6898
		Large	-,03308	,15693	,976	-,4082	,3421
	Large	Small	,36801*	,13251	,019	,0513	,6848
		Medium	,03308	,15693	,976	-,3421	,4082
Bonferroni	Small	Medium	-,33493	,14845	,081	-,6983	,0285
		Large	-,36801*	,13251	,021	-,6924	-,0436
	Medium	Small	,33493	,14845	,081	-,0285	,6983
		Large	-,03308	,15693	1,000	-,4173	,3511
	Large	Small	,36801*	,13251	,021	,0436	,6924
		Medium	,03308	,15693	1,000	-,3511	,4173

*. The mean difference is significant at the 0.05 level.

Appendix IV - Essay on 'The Central GI unit: a personal view on its role and performance'

The research questions have been answered after a literature review and the analysis of the data obtained through interviews and questionnaires. Conclusions have been drawn and recommendations have been made. In the following essay, I would like to elaborate on a number of findings and aspects of the research, in particular those concerning the central GI unit. In this essay I will present a number of thoughts and ideas about the requirements the central GI unit should meet in order to function well within a provincial organization. These thoughts and ideas are based on comments and remarks of experts and GI end users during this study, on my personal experiences from my internship with the GIC team of the Province of Gelderland in 2016/2017 and on conversations with my thesis supervisors.

Position of the GI unit

The study shows that the provincial organizational structures studied mainly have the characteristics of the Central Model, with some hybrid features. In all provinces, the geographic information provision is centrally assigned to a GI unit. The main reason for the centralization of GI services is that GI is not limited to a few disciplines only but is used throughout the organization. In addition, by offering these services centrally, more organizational 'body' is created which makes it easier to manage temporary loss of employees (e.g. in case of illness).

The central GI unit can be positioned at different locations within the organization. Provinces may consider their GI unit to be part of the facility domain and place it at an IT department or to be part of the primary process and place it at a policy department. Different reasons have been given for different positioning. However, it seems that the position of the GI unit does not directly affect how the GI end user values the GI services. These conclusions have been drawn from the thesis research.

Role of the GI unit

For a well-functioning central GI unit, it is important that the GI unit is aware of its position and understands who it is working for. The GI unit should make itself known as the knowledge centre within the organization for all geographical information.

An important task of the central GI unit is the management of geographical information. This task within the organization should be honoured as it forms the core business of the GI unit. Also if a large part of the work consists of working for policy teams and the team is regarded as an integral part of the primary policy processes, this task should not be underestimated and overlooked. Proper management of geographic information can be achieved by consulting GI end users and gaining insight into user demands.

A second important task to be attributed to the central GI unit is the provision and facilitation of geographical information services. By adequately fulfilling the role of provider and facilitator, the GI unit will also be able to present itself within the organization as the knowledge centre for geographical information. At the provinces, more and more emphasis is put on unlocking data and offering tools to view and analyse this data. The cartographic work which the GI units have grown up is increasingly becoming a thing of the past. The technological developments of the last few years have also made it possible for GI end users to make maps themselves without having to ask a GI specialist for help. To guarantee the quality of the maps made by these GI end users, it is essential that they have access to high-quality spatial data and equipment to analyse and visualize the data. It is the GI units' business to deliver these data and tools.

Communication with GI end users
To become a successful facilitator, communication with the GI end user is very important. The expectations of end user and GI producer need to be matched. One has to know what to expect from each other.

The results of this research showed that most GI end users have some insight into what the GI unit can deliver, but certainly not a complete picture. The insight is often limited to the GI products offered in one's own field of expertise and not in that of other fields of expertise. However, in this times of further integration of disciplines and the elaboration of the Environmental Planning Act, more collaboration between different disciplines is expected and needed. The geographical information products will have to be increasingly harmonized in order to keep up with these developments. Wherever possible, GI products should be developed for multiple disciplines, instead of creating a separate information product for each discipline as such.

End users have also indicated that the GI unit leaves opportunities unused in giving insight into the possibilities of GI products, for example by giving short presentations to the GI end users. To give presentations about available GI services and training in their possibilities is in line with the ideas of various geo-advisers who recognize that the GI unit needs to sell their services to the other parts of the organization. A GI unit should therefore function as if it were a company in a company, in which internal acquisition plays an important role. The GI unit must prevent that other teams within the organization give GI assignments to third parties and that they will become redundant themselves.

In line with the raising of awareness of the GI possibilities, it is important that GI unit members have knowledge of the work and expectations of the GI end user. One way for GI units to achieve this is by appointing theme managers within their team. These are persons who specialize in certain themes of GI end users and act as a kind of liaison between the team and the end users. The results of the survey show that end users have a preference for direct verbal contact with the central GI unit. The allocation of contact persons per theme is in line with the idea of user-friendly contact. It should also be made clear to external parties who is responsible for what within the GI unit and who are the contact persons and theme managers.

Management of tasks
It was mentioned a number of times during this study that within the central GI unit tasks are often assigned to one person only because of understaffing. This makes the organization vulnerable if one of its employees drops out. The team must therefore make arrangements for replacements to be available in case of illness or holidays. A quick transfer of tasks is however often hampered because in many organizations the administration of incoming requests from GI end users is limited to the mailbox or memory of the GI specialist of the team who handles the request. Therefore, in the case of small teams, only limited arrangements can be made between GI specialists on the transfer of tasks in the event of replacement due to illness or holidays.

Some organizations have found their own solution for the latter problem. For example, one province uses a planner that handles all requests and distributes them among the GI specialists. The planner monitors who is doing what and in the event of illness a job can be transferred to someone else more easily. Other provinces use a service management system such as Topdesk to register incoming requests and delegate tasks. This method of registration originates from the IT world and has, according to various participants in the thesis research, a number of disadvantages. As a result,

employees do not always have a positive attitude towards working with it. Respondents warn that a service management system like this does not suit the iterative way of working within the GI services. This implies that the assignments, customers and suppliers of geographical information products will not always be immediately clear beforehand, as is the case with many IT products. Defining all steps in advance in a service management system consequently does not always correspond well with the GI situation. Although many GI units are concerned to fall into a IT straightjacket, it is important to have an open mind about each other's strategies and to strive for collaborations.

Another risk GI units have to be prepared for is the consequence of transferring simple GI activities to the GI end users. For example, when the analyses of data and the making of maps is more and more done by the end-user, the risk of losing control of the central management of maps increases. Just like with digital photos, which are stored on external hard drives somewhere within the organization without any further specification, it is very likely that dozens of web maps will be produced on a daily basis in just a few clicks of the button, out of sight of the central GI unit. To prevent the uncontrolled multiplication of web maps, clear management guidelines for the use of tools such as ArcGIS Online will have to be established and implemented.

According to the respondents' reactions, the role of geographical information and of the central GI unit within provinces is far from being over. Next to a sound organizational structure and a strong management of tasks, good communication, including the ability to listen to each other and to think along with each other, is decisive in ensuring a high quality provision of geographical information.

The central GI unit of Dutch provinces has great potential according to Mathijs van Niel, Head Business Information of Province of Zuid-Holland.
(Photo: Petra Hoogerbrug (petronellanitta) - (c) Esri Nederland - Esri GIS Conferentie 2017).