Strategic Position Model Geo-ICT Function: Facing the Challenge of Organizational Alignment

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Key words: SDI, organization, alignment, Strategic Position Model Geo-ICT Function

ABSTRACT

This paper focuses on organizational aspects and aims to explain the dynamic alignment between the development of the internal Geo-ICT function, including the corporate SDI, of an organization and the interest of this organization in an SDI. It is proposed that a better understanding of the topic of alignment provides an insight into the qualitative and quantitative benefits of an SDI and can give direction to a further development of the SDI.

The cooperation among the different public and private organizations involved in an SDI is complex and the success of the SDI is mainly based on the organizational aspects of the cooperation. The complexity of the cooperation among organizations in an SDI has also a dynamic aspect. Not only the organizations involved in the ongoing process of developing the SDI, also the SDI's itself developed due to new initiatives.

As a result of an ongoing study at the Delft University of Technology the Strategic Position Model Geo-ICT Function is developed. In this paper the Strategic Position Model Geo-ICT Function describes a theoretical approach on with it becomes possible to compare, analyze and explain the dynamic alignment between the internal Geo-ICT function, including the corporate SDI, of the organization and the different levels of SDI's. At present several cases are selected to assess the utilization of this model in practice.

When organizations are 'in alignment with the SDI' and they can rely on an SDI, the SDI becomes an important cornerstone for the internal Geo-ICT function of each organization.
In return, the investments, development and business decisions of organizations for their Geo-ICT function give an impulse to the interest and the use of an SDI. This interest can lead to further development of the SDI, so the community of all users drives a successful development of the SDI.

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1. INTRODUCTION

Spatial data infrastructures (SDI's) are an emerging phenomena world-wide (Masser, 2005). From a niche activity, it has developed into the backbone of today's geo-data provision (Bregt et al., 2008). An SDI is nowadays seen as a basic infrastructure, like roads, railways and electricity distribution, which support sustainable development, and in particular economic development, environmental management and social stability (Rajabifard et al., 2001).

With the growth of SDI's also the number of stakeholders and organizations involved increased, and in many countries it started to attract the attention of policy makers at different levels of government. For example, the executive order 12906 of President Clinton (USA, 1994) phrases the benefits as follows: "Geographic information is critical to promote economic development, improve our stewardship of natural resources, and protect the environment. Modern technology now permits improved acquisition, distribution, and utilization of geographic (or geospatial) data and mapping. The National Performance Review has recommended that the executive branch develop, in cooperation with State, local, and tribal governments, and the private sector, a coordinated National Spatial Data Infrastructure to support public and private sector applications of geospatial data in such areas as transportation, community development, agriculture, emergency response, environmental management, and information technology."

The development and the success of SDI's depends on the use by organizations of these SDI's (Rajabifard et al., 2002). By reducing duplication and facilitating integration and development of new and innovative business applications, SDI's may produce significant human and resource savings not to mention the returns and benefits for the whole user-community.

If organizations can rely on an SDI, the SDI becomes an important cornerstone for the internal Geo-ICT function of each organization. In return, the investments, development and business decisions of organizations for their Geo-ICT function give an impulse to the interest and the use of an SDI. This interest can lead to further development of the SDI, so the community of all users drives a successful development of the SDI.

This paper focuses on organizational aspects and aims to explain the alignment between the development of the internal Geo-ICT function of an organization and the interest of this organization in an SDI. It is proposed that a better understanding of this alignment provides an important insight into the qualitative and quantitative benefits of an SDI. This should help to direct the further development of the SDI.

Through redefining the model of SDI hierarchy (Rajabifard and Williamson, 2001) and connecting the components of an SDI (Van Loenen, 2006) to the different roles, ambitions and interests of organizations, it becomes possible with the Strategic Position Model Geo-ICT Function to explain the dynamic alignment between the internal Geo-ICT function of an organization and the interest of this organization in an SDI.

The Strategic Position Model Geo-ICT Function is the result of an ongoing study at the Delft University of Technology. In this study several cases in The Netherlands are selected to assess the utilization of the Strategic Position Model Geo-ICT Function in practice. The coming results of this investigation are expected to provide insight in the validity of the model and explain the dynamic alignment among organizations in their relationship with SDI's.

In section 2 of this paper the SDI Hierarchy Model is redefined and in section 3 the Strategic Position Model Geo-ICT Function is presented. At the end, in section 4 the conclusions will be given. Throughout the paper the organizational aspects are clarified with some examples from The Netherlands.

2. ORGANIZATIONAL ASPECTS IN THE SDI-HIERARCHY

Within information infrastructures, the SDI is the infrastructure that includes information with a geographic component. An SDI can be defined as a framework continuously facilitating the efficient and effective generation, dissemination, and use of needed geographic information within a community or between communities (Van Loenen, 2006).

2.1 SDI Hierarchy Model

As a result of developing SDI's at different political-administrative levels, a model of SDI Hierarchy that includes SDI's developed at different political-administrative levels is developed (Rajabifard et al., 2000). In this model an SDI Hierarchy (see figure 1) is made up of interconnected SDI's at different levels of jurisdictions.

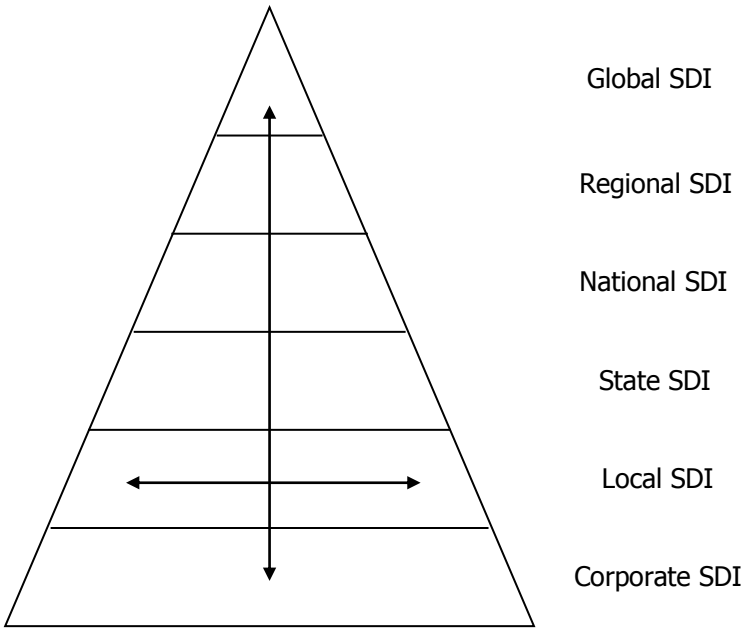

Figure 1: SDI Hierarchy Model (Rajabifard et al., 2000)

The SDI Hierarchy Model defines different levels from a corporate SDI-level to a Global SDI level. In the model, a corporate GIS is deemed to be an SDI at the corporate level, the basis level of the hierarchy. Each level has its own characteristics in the core components of the infrastructure. "Each SDI at the local level or above is primarily formed by the integration of spatial data sets originally developed for use in organizations operating at that level and below" (Rajabifard and Williamson, 2002).

Understanding the SDI hierarchy is important because it can help to explain the importance of the relationships within different levels of SDI. In additional to the vertical relationships between the SDI levels, shown in the SDI Hierarchy Model, there are also relationships between SDI's at a horizontal level. Any component (Van Loenen, 2006) at a hierarchy level, such as a National SDI in the SDI hierarchy has two different faces, one looking toward wholes in a higher level of SDI, and the other looking towards parts in lower levels of SDI. This is in figure 1 illustrated by a double-ended vertical arrow (Rajabifard et al., 2000). The double-ended horizontal arrow gives expression to the fact that all the components, such as the organizations involved, of a SDI at a hierarchy level must cooperate in partnership.

The vertical and horizontal relationships within an SDI hierarchy are very complex, and this complexity is due to the dynamic, inter- and intra-jurisdictional nature of SDI's (Rajabifard et al., 2002). These relationships can be related to the policies, the spatial data sets, the technologies and also to the cooperation among organizations in every level of the SDI-hierarchy.

An example of a horizontal organizational relationship in the level of the 'national SDI' in The Netherlands is the cooperation of the municipalities in DataLand (Jellema, 2009). DataLand was founded in 2001 and in a period of nine years DataLand has managed to become the largest shared service centre for Dutch municipalities and makes spatial data of more than 7,400,000 buildings accessible for public and private organizations. Furthermore, DataLand operates a web based information-system to improve the quality of the data in cooperation with the producers of the data, the municipalities, and the users of the data. (Jellema, 2002). In figure 2 the cooperation among these organizations is presented with the quality circle of information.

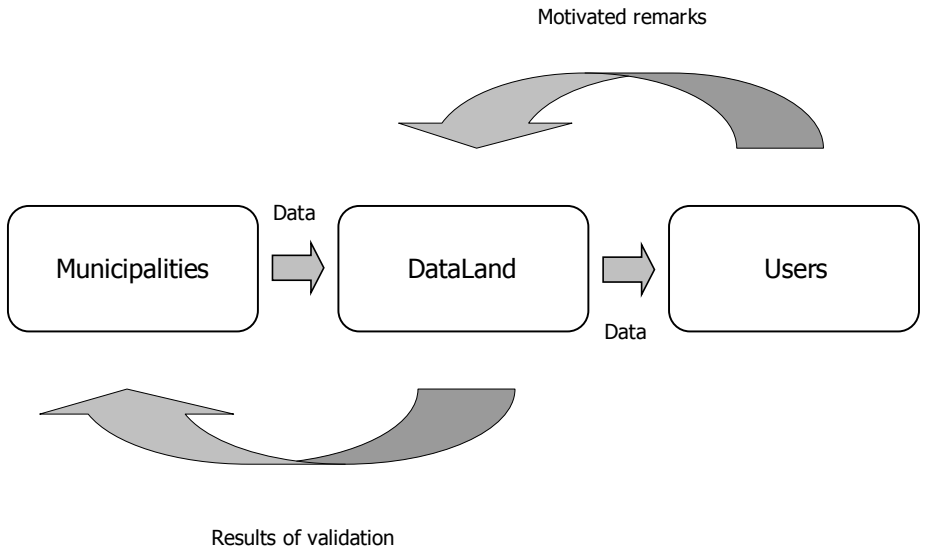

Figure 2: The quality circle of information

In a period of nine years almost all 441 municipalities decided autonomously to participate in DataLand. When a municipality decides to participate in DataLand, the mission and activities of DataLand gives at that time a positive contribution to the strategic orientation and goal of that specific municipality (Jellema, 2008).

Another example of a horizontal organizational relationship stems from the 1990's. In that period, public and private organizations worked on a horizontal organizational relationship together on the level of a 'local SDI' in the city of Amsterdam. For the local SDI stakeholders, this local SDI provided access to many spatial data sets including data about buildings, parcels, cables and pipes and topography (Jellema, 1994).

The experiences and evaluation of both examples make clear that the cooperation among the different public and private organizations involved is complex and the success of the SDI was mainly based on the organizational aspects of the cooperation.

The complexity of the cooperation among organizations in an SDI has also a dynamic aspect. Not only the organizations involved in the ongoing process of developing the SDI, also the SDI's itself developed due to new initiatives. Partnership building among the stakeholders is an important element in this process of development of SDI's (Kok, 2005).

Although most literature focuses primarily on SDI's as a public good, an SDI may also exist in the private sector (Van Loenen, 2006). The consequence of this vision can be that the base level of the SDI-hierarchy, the corporate SDI, will be formed by public and private organizations. It is also possible that the corporate SDI of an organization will perform in an SDI-level that is not always the level of the local SDI, such as suggested in the SDI Hierarchy model.

For example, the information about the zip-code of an address belongs in The Netherlands to a privatized public organization. In 2006, the Dutch government and this private company agreed that this zip-code information becomes part of the national SDI. This example makes clear that information of the 'corporate SDI' of a private company is directly integrated into the level of the national SDI.
And Shell, a worldwide operating company in the oil-industry, has global databases with geographic information (Davies, 2006). When this geographic information becomes accessible for other private and public organizations, the geographic information of this corporate SDI is directly connected into the level of the global SDI.

These examples makes clear, that geographic information of a corporate SDI of a private organization can have a direct connection or can directly be integrated into each level of the SDI hierarchy.

2.2 SDI Hierarchy Model and the corporate SDI

Reflection of all these examples to the original SDI Hierarchy Model suggests that redefining the SDI Hierarchy Model is needed. This redefinition does not change the hierarchy between the local, state, national, regional and global SDI's, but emphases that the level of the corporate SDI may not only be the base of the local SDI, but potentially also the base of each level of an SDI.

This means that, for example, a national SDI is primarily formed by the integration of spatial data sets originally developed for use in public and private organizations operating their own corporate SDI at that national SDI level and with SDI levels below the level of the national SDI. It is also possible that an organization with different spatial data sets is connected to more than one SDI level. Figure 3 presents the redefined model 'SDI Hierarchy Model and the corporate SDI'.

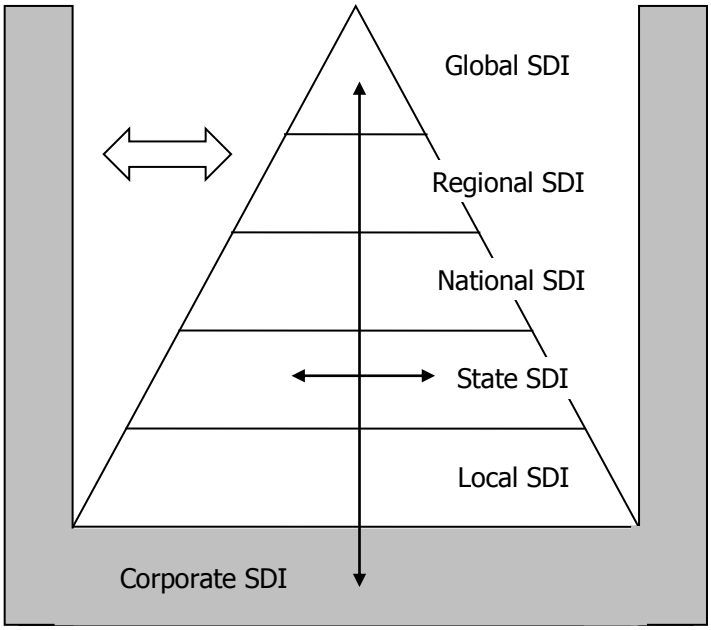

Figure 3: SDI Hierarchy Model and corporate SDI

The redefined 'SDI Hierarchy Model and corporate SDI' shows that organizations can have different roles in and different ambitions to be involved in an SDI.

2.3 Organizational participation in an SDI

An SDI consists of seven major components: data sets, institutional framework, policies, technology, standards, financial resources and human resources (Van Loenen, 2006). All these components have an impact on what spatial data is collected, how it is distributed and how it is used. This paper further develops the components institutional framework and human resources. This should clarify how and why an organization participates in an SDI.

The organizations that are strongly involved in the policymaking, development, maintenance, dissemination and use of an SDI belong to the institutional framework. The way this is organized is important for, if not the most important aspect of, an SDI (Van Loenen, 2006).

Examples of this kind of organizations for the National SDI in The Netherlands are the Ministry of Housing, Spatial Planning and Environment that is responsible for the national SDI coordination, many public organizations who are obliged to produce and to use spatial data sets of the National SDI, private organizations who deliver by agreement spatial datasets to the National SDI and the Cadastre, Land Registry and Mapping Agency who is responsible for the distribution of these spatial data sets.

Supporting organizations, like Geonovum, the Association of Dutch Municipalities (VNG) and GeoBusinessNederland, and the whole consultative body with all kind of organizations involved and other stakeholders, belong also to the institutional framework.

Human resources, which is similar to the component people (Rajabifard et al., 2002), are a natural component of an SDI. The available human resources determine to what extent the full potential of an SDI will be utilized and to what extent the needs of the society are sufficiently addressed.

All the potential user groups belong to this component. Although, this does not imply that all potential user groups need to be identified. It does mean that the user community has to be considered as part of the total SDI. Van Loenen (2006) distinguishes four user groups: primary, secondary, tertiary and end-users.

The primary users are the organizations producing the spatial data sets for an SDI and are the major users of these spatial data sets of an SDI. The secondary users use the spatial data sets for similar purposes but less frequently and the tertiary users are those that add value to the spatial data sets belonging to an SDI.
Finally, the end-users are the fourth group of users consisting of citizens, decision-makers, and others that use the end-products.

The organizations that can be defined as primary or secondary users belong to the institutional framework of an SDI, and the tertiary users and end-users belong of course to the user community of the SDI, but are not directly involved in the institutional framework of an SDI.
The consequence is that the organizational alignment of primary or secondary users will be much stronger and have a higher importance than organizations that are tertiary user or an end-user.

3. DYNAMIC ALIGNMENT AMONG ORGANIZATIONS AND SDI's

This paper is about organizational aspects and aims to explain the alignment between the development of the internal Geo-ICT function of an organization and the interest of this organization in an SDI. It is proposed that a better understanding of this alignment provides insight into the qualitative and quantitative benefits of an SDI and can give direction to a further development of the SDI.

The 'SDI Hierarchy model and corporate SDI' redefined the position and the influence of a corporate SDI to the other SDI's in the SDI Hierarchy Model. The corporate SDI is the internal spatial data infrastructure of the Geo-ICT function of an organization. Related to which user group the organization belongs to, the importance of the organizational alignment among these organizations and the SDI is defined.

When organizations can rely on an SDI, the SDI becomes an important cornerstone for the internal Geo-ICT function of each organization. In return, the investments and business-decisions of organizations for their Geo-ICT function stimulate the interest and use of an SDI.

This interest can lead to further development of the SDI, so the community of all users drives a successful development of the SDI (Rajabifard et al., 2002).

The Geo-ICT function can defined as the ICT-function of an organization which plan, organize, realize and manage the effort of ICT-components for all the geo-related processes.

The Geo-ICT function belongs to one of the four competencies of an organization. Based on the concept that organizations are striving to increase all the competencies in a continuous process by exchanging one competence for another, the Geo-ICT function is in a continuous process of development.

3.1 Strategic Position Model Geo-ICT Function

Knowing that there are many potential models for analyzing and explaining the dynamic alignment between organizations, the Geo-ICT function and SDI's, the Strategic Position Model Geo-ICT Function is based on the vision of the Four-Phase Model (Hardjono, 2001), the Spatial Model of Effectiveness (Quinn and Rohrbaugh, 1983) and the Strategic Alignment Model (Henderson and Venkatraman, 1999).

The Four-Phase Model analyzes the present organization and determines the organizational control points and interventions in relation to their strategy. It also clarifies the most likely strategy for an organization from the point of view of the present organization. It gives, for example, insight in the possible discrepancy between the most likely strategy from an external market view and from an internal organizational view.

The Four-Phase Model assumes that organizations are striving for an increase in all competencies in a continuous process by exchanging one competence for another. Organizations can reach their goals by becoming externally oriented, internally oriented, oriented on control or oriented on change. According to the vision of the Four-Phase Model, an organization should focus on all the four orientations. In practice however, it has become clear that is not possible for the management of an organization to focus on both external and internal orientation at the same time. The same accounts for the dichotomy control and change. It is possible, however, to focus on a combination of two parts of the two dichotomies, thus creating four different quadrants. So, for example, there can be an emphasis on the combination of external orientation and orientation on control.

The Four-Phase Model consists of four layers:
- the four (material, commercial, socialization and intellectual) basic competencies of an organization. The Geo-ICT function belongs to the socialization competence;
- the organizational orientations (external versus internal, control versus change), which is based on the model of Quinn and Rohrbaugh;
- the strategic premises and performance criteria;
- change over time.

Figure 4 shows the two first layers of the Four-Phase Model.

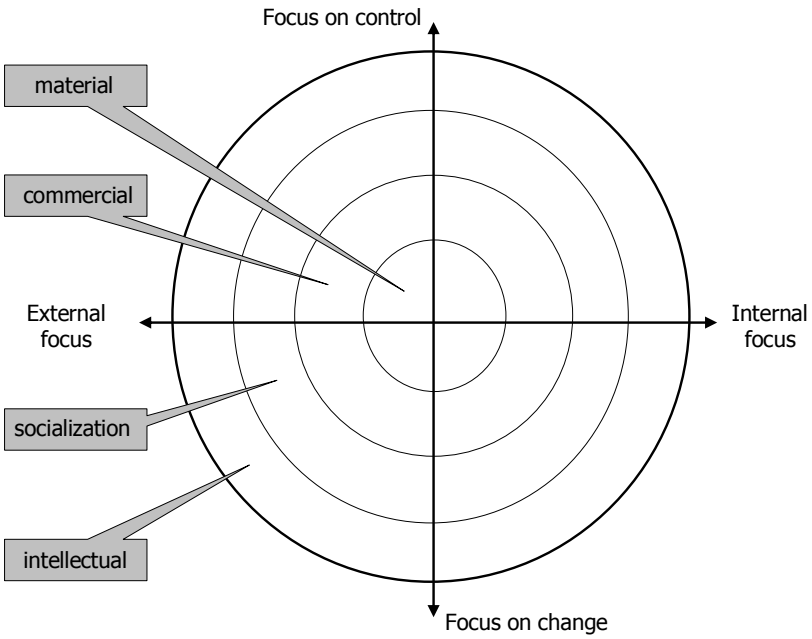

Figure 4: The competencies and organizational orientations of the Four-Phase Model

In the Four-Phase Model each quadrant is formed by a combination of two orientations and four interventions are related to a competence. Each quadrant also makes it possible to distinguish a strategic orientation with its own specific goal (see figure 5).

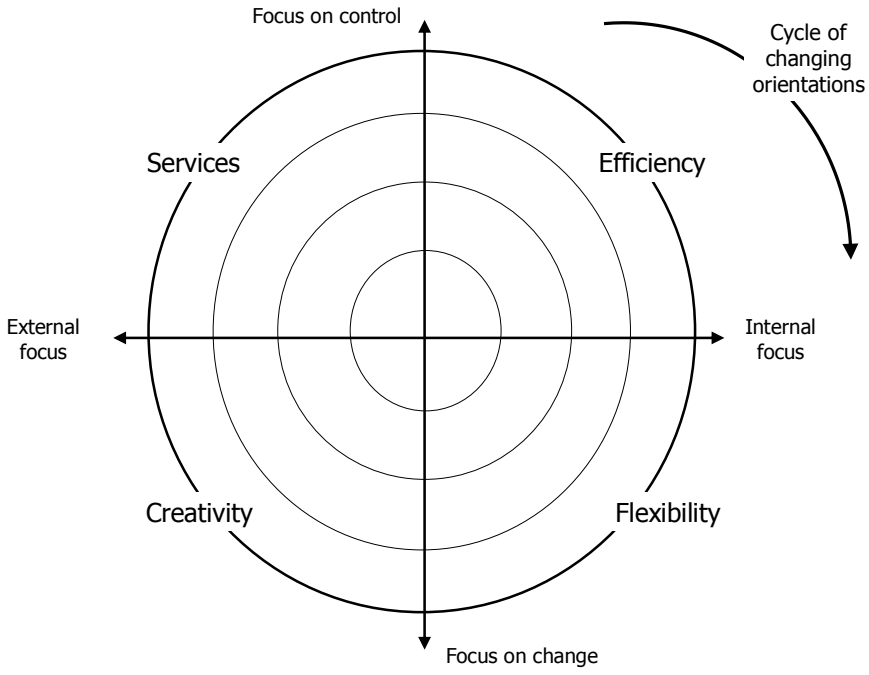

Figure 5: The strategic orientations of the Four-Phase Model

In this way, the quadrant with a service orientation is directed towards increasing the effectiveness of an organization, an efficiency orientation is directed towards increasing the efficiency, an orientation towards making the organization lean is directed at increasing the flexibility and finally an orientation towards innovativeness is aimed towards the creativity of an organization.

Ideally, an organization should keep all four goals in balance at the same time. In practice, however, it has become clear that this balance cannot be reached by giving attention to all four goals at the same time. It can only be reached by shifting the attention in time from one goal to another with a certain rhythm. This stresses the necessity to choose one of the strategic orientations for a certain period. In the model, such a period is called a phase, hence the name Four-Phase Model.

According to the strategic orientation in each phase the management of an organization has to make decisions about the investments and development of the competencies, including the Geo-ICT function.

The Strategic Alignment Model (Henderson and Venkatraman, 1999) is a good framework for comparing, analyzing and explaining the goals, objectives and activities of the ICT-department to the goals, objectives and activities of the organization. In the Strategic Alignment Model (see figure 6) the alignment between the business structure and the ICT strategy, and also the business strategy and ICT structure is described as a cross-dimensional alignment.

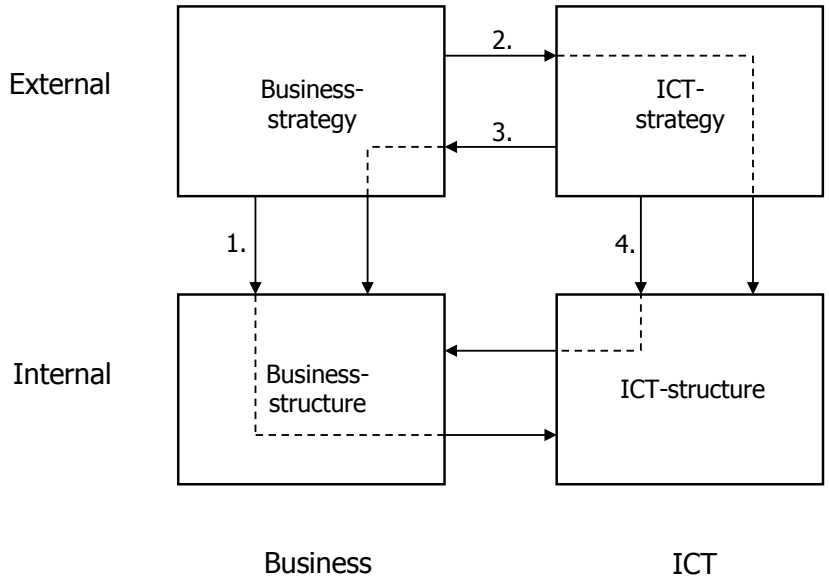

Figure 6: Strategic Alignment Model (Henderson and Venkatraman 1999)

Henderson and Venkatraman (1999) based their concept of strategic alignment on two building blocks: strategic fit and functional integration. The first building block recognizes the need for any strategy to address both external and internal domains. In the external domain,

the Strategic Alignment Model addresses the business arena in which the organization is active and is concerned with decisions such as product-market offering and distinctive strategy attributes that differentiate the organization from its competitors.

In contrast, the internal domain is concerned with choices pertaining to the logic of the administrative structure and the specific rationale for the design and redesign of critical business processes, as well as the acquisition and development of the human resource skills necessary for achieving the required competencies for the organization.

Ideally, the management of an organization should keep all four domains in balance at the same time. In practice it has become clear that the management take notice of two or three out of the four domains. In figure 6 the four dominant alignment perspectives are presented with four arrows. Each arrow represents a different alignment perspective.
None of the perspectives is the best and no single perspective is exclusive for the management. There is also no correlation between the perspectives and the strategic orientation of the management at that moment. Depending on the kind of issues at hand the management chooses the best alignment perspective.

When the vision of the Strategic Alignment Model is integrated into the Four-Phase Model and the organizational orientations of the Four Phase Model are redefined to similar ICT-orientations, it becomes possible to compare, analyze and explain the development of the Geo-ICT function, including the corporate SDI, in relation with the strategic orientation of the organization at a certain period. In figure 7 the resulting Strategic Position Model Geo-ICT Function is presented.

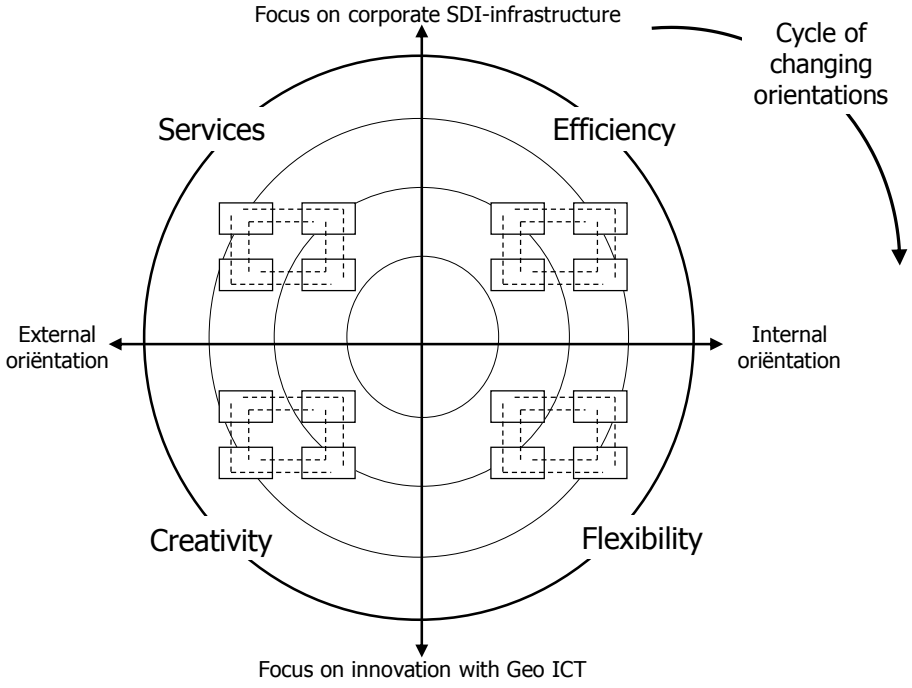

Figure 7: Strategic Position Model Geo-ICT Function

3.2 Dynamic alignment between Geo-ICT function and the SDI's

When it is possible with the Strategic Position Model Geo-IT Function to compare, analyze and explain the development of the internal Geo-ICT function in relation with the strategic orientation of the organization at a certain period, it becomes also possible to explain the dynamic alignment between the internal Geo-ICT function and the SDI's from the SDI Hierarchy Model.

The suggestion is that when in a certain period the strategic orientation of the Geo-ICT function is in the same phase of strategic orientation as an SDI, there is an optimal alignment between both. The consequence can be that the SDI can produce significant human and resource savings and significant returns and benefits for the organization 'that aligns with the SDI'.

When the strategic orientation of the Geo-ICT function is in a different phase of strategic orientation as an SDI, there is a sub-optimal or even a negative alignment between both. In this situation the organization may make no or less use of the SDI and the benefits of the SDI for the user-community will diminish.

Both of these possibilities in alignment are presented in figure 8.

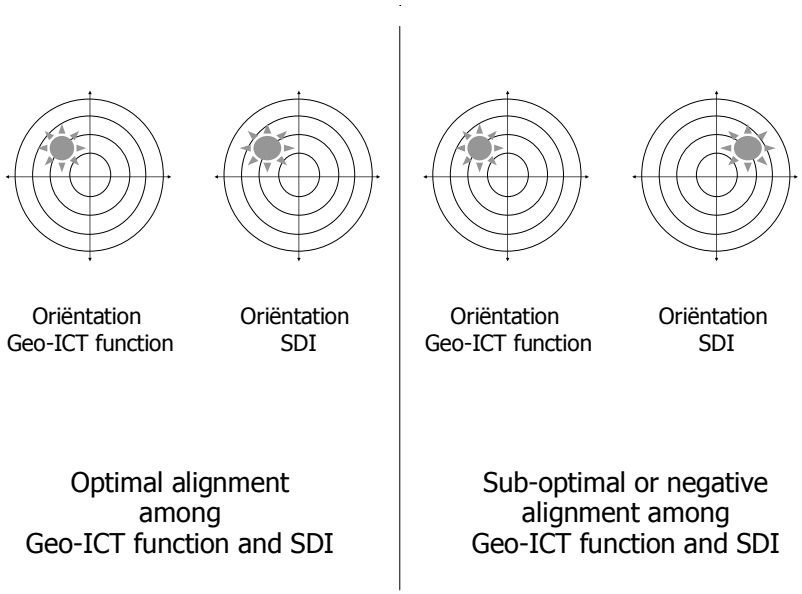

Figure 8: Alignment among Geo-ICT function and SDI

At present, in the ongoing study several cases in The Netherlands are selected to assess the utilization of the Strategic Position Model Geo-ICT Function in practice. The coming results of this investigation are expected to provide insight in the validity of the model and explain the dynamic alignment among organizations in their relationship with SDI's.

4. CONCLUSION

The development and the success of SDI's depend on the use and involvement of organizations of these SDI's. By reducing duplication and facilitating integration and development of new and innovative business applications, SDI's can produce significant human and resource savings and returns and benefits for not only the organizations involved but for the whole user-community.

This paper focuses on organizational aspects and aims to explain the dynamic alignment between the development of the internal Geo-ICT function, including the corporate SDI, of an organization and the interest of this organization in an SDI. It is proposed that a better understanding of the topic of alignment provides an insight into the qualitative and quantitative benefits of an SDI and can give direction to a further development of the SDI.

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The Strategic Position Model Geo-ICT Function describes a theoretical approach on with it becomes possible to compare, analyze and explain the dynamic alignment between the internal Geo-ICT function, including the corporate SDI, of the organization and the SDI's from the SDI Hierarchy Model. At present several cases in The Netherlands are selected to assess the utilization of the Strategic Position Model Geo-ICT Function in practice.

When organizations are 'in alignment with the SDI' and they can rely on an SDI, the SDI becomes an important cornerstone for the internal Geo-ICT function of each organization.
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BIOGRAPHICAL NOTES

Michiel Jellema is a PhD-candidate at OTB Research Institute for Housing, Urban and Mobility studies of Delft University of Technology. Michiel Jellema has been working in the geo-information sector since 1984. He did this in different positions and roles (Cadastre, Utility company, Municipality of Amsterdam, large ICT-company, independent advisor, DataLand, Infofolio), but always bridging organizational and other aspects of making geo-information widely accessible.

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