SPATIAL DATA INFRASTRUCTURES IN CONTEXT

NORTH AND SOUTH
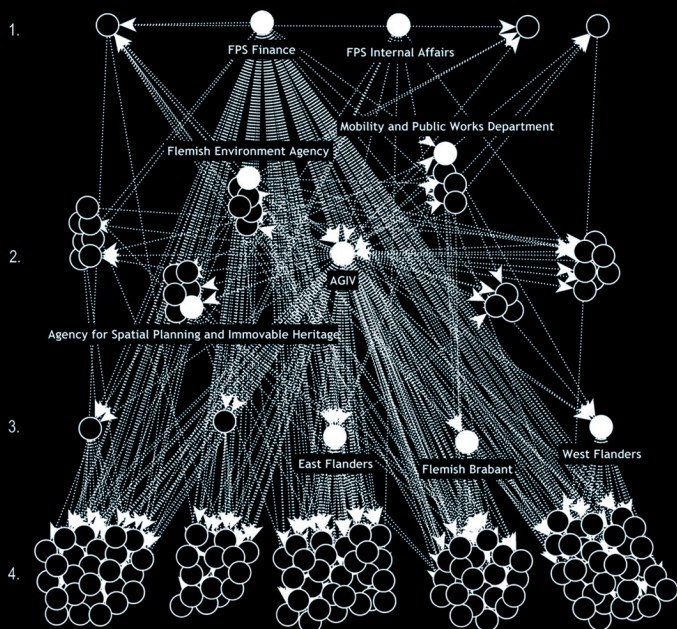
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SDI in North and South—A Full Circle Yet?

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11.1 Introduction

Since the beginning of the 1990s, the notion of spatial data infrastructure (SDI) has inspired different organizations to share geospatial data and achieve seamless integration. After nearly two decades, incidentally overlapping with the Internet age, this vision has gained global acceptance (Homburg and Georgiadou 2009; Masser 2010) and is confirmed by the growing participation in the Global SDI Association's conferences. However, the meaning of SDI in terms of implementation and use has become more fragmented. In spite of a general understanding of SDIs as ways to facilitate access to and use of geospatial data, it is difficult to find wide agreement on a more precise definition of SDI (Grus, Crompvoets, and Bregt 2010).

This becomes obvious from reading the different chapters of this book. All authors agree that SDIs refer not only to the technologies but also to institutional arrangements and practices. Also, all authors argue that the user should be at the center of the SDI and that user needs should be the driving force when designing SDIs. SDIs could underpin local planning practices (Chapters 8 and 9), business processes (Chapter 3), and even citizens as sensors of data and public service delivery (Chapter 10). But how this should be achieved is less obvious from reading the different chapters.

The way we look at SDIs becomes an important issue when a collection of research works includes cases from a global variety of settings from developed and so-called developing contexts. Some readers may question that

what we call SDI in India or Uganda is an SDI in Europe. Comparing SDI implementation across contexts assumes that SDI development is a linear process, following preset steps of social and technical change. In fact we can see that within both the Northern Hemisphere (North) and the Southern Hemisphere (South), SDIs take different forms and shapes.

For instance, countries take different approaches in Europe for an SDI initiative like INSPIRE, with its legislation, implementing rules, and guidelines aiming to streamline SDI development, even though the INSPIRE legislation directs them all to evolve toward more active sharing of geospatial data (Vandenbroucke, Janssen, and Van Orshoven 2008). In fact, INSPIRE defines what countries should have (ideally) in common, but leaves in practice a lot of room regarding how this is done and by whom (European Commission 2007).

We are not implying that there are no substantial differences between North and South, but we want to avoid the self-fulfilling prophecy of predefining phenomena in a certain way, only to find what we were looking for and confirm our expectations (Callon and Latour 1981). The relevance is both academic, in the sense of providing a different perspective on SDI as a research domain, and practical, in terms of finding different angles to tackle issues of SDI design and implementation at local, national, and global scales. To rebalance the predominantly North-oriented research, this book compares globally spread cases and draws lessons on the theoretical, methodological, and practical levels.

The open-ended view on how SDIs are used and evolve is probably the most prominent common characteristic of the research studies collected here. These aim to understand and explain SDIs in their actual context before jumping to recommendations about how to improve them. In pursuing an open-ended view, the authors bring social issues into the picture: organizational, interorganizational, economic, legal, cultural, and historical issues. They do so by conceptualizing SDI as enabling resources and distribution mechanisms that cut across organizational levels.

The studies presented here are informed by a variety of methodologies that bridge different disciplines and concepts to understand SDIs as entanglements of social and technical issues. With this enormous challenge in hand, the contributions address the sociotechnical nature of SDI mainly through the lens of social science. A true multi- and interdisciplinary approach to SDI design and implementation and integration of technological and nontechnological disciplines is still to be achieved. However, the coeditors' call for complementing design-prescriptive with theory and empirically grounded explanatory research succeeds in bringing to the foreground usually downplayed issues such as implementation, use, and institutionalization.

We elaborate on these topics by considering four dichotomies: North and South, local and national, social and technical, and explanatory and prescriptive. By discussing where SDI efforts are focused, what SDIs are actually made of, and how different researchers look at them, we discern a complex picture of SDI in real-life settings where its usage and users are not peripheral but rather central in developing successful and sustainable SDIs.

11.2 North and South

The dichotomy of North and South is mainly related to development—a normative concept whose meaning is rooted in the idea of "progress" attached to new technologies and organizational forms. The global acceptance of the northern meaning and manifestations of development has led to transfer of approaches originating in one context (see, for example, the work of Samir Amin on Eurocentrism, 1988) to settings that are incomparable on many accounts. With respect to SDI, we propose to rethink the way it is designed and acted upon in relation to contexts where usual northern assumptions cannot be taken for granted (e.g., developing an SDI based on Internet access or establishing complex coordinating mechanisms). This is well illustrated in Chapter 2 when Silva discusses the institutionalization of the land administration system in Guatemala.

To rebalance the predominantly North-oriented research, this book compares globally spread cases and draws lessons on the theoretical, methodological, and practical levels. Due to their common sensitivity to SDI organizational contexts, the authors show and discuss remarkable differences between the North and the South in terms of what they highlight and what they leave in the background. The analyses from the North assume the availability of geospatial data and focus on the sociotechnical relations along which such data are (expected to be) shared. The studies from the South are more sensitive to geospatial data and their dynamics of production and use.

From an analytical perspective, the North/South dichotomy suggests relevant differences between SDI in the North and in the South. The actual propensity (and possibility) of existing interorganizational relations to be "enacted" (Orlikowski and Scott 2008) by SDI-related efforts needs to be understood. Along this line, Chapters 5 and 8 explain persistence and function of an SDI "antidogma": duplication, redundancy, and proliferation of geo-data and their sources. It must be noted here that although avoidance of duplication efforts is still an important driver for SDI development (as can be seen from the chapters on the developments in the United States and Flanders), redundancy as a motivator is losing ground.*

Even though there are important differences, it is at the same time true that similar problems exist across those regions. In Chapter 4, Nedović-Budić, Pinto, and Warnecke suggest that sharing is still more prominent within organizations than between organizations. Chapter 7 illustrates how, in a well organized project to develop a geo-portal, the original goals were never

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* Many SDIs in the North replicate data sets and databases on purpose in order to guarantee continuous access to the data. This is done within the framework of INSPIRE, but it is also applied by such providers as Google. Also, within data sets and databases information might be repeated for practical reasons.

met because dealing with a continuous stream of technological innovations became almost a goal in itself.

Both Northern and Southern contributions concur in challenging the idea that SDIs are drivers of organizational change, and they show how interorganizational relations are a prerequisite rather than the effect of SDI implementation, as convincingly argued in Chapter 2 and as developed in Chapter 3. At this point, we do not want to overlook an important aspect of the dichotomy of North/South: The research on SDI seems to be a northern exercise. In spite of many efforts from the editors, most chapters about the South are not written by southern scholars affiliated with southern organizations. We see this as a relevant research limitation—not because we assume that the locals know more about their own environment, but rather because if their voices are not heard in the academic community, local and tacit knowledge are difficult to access.*

Another limitation resulting from the few southern scholars conducting research on SDI is underutilization of their knowledge in the process of social and political change. A weak presence of local research creates a wider gap between SDI design (taking place in the North), implementation, and use for organizational change (in the South) with often unpredictable results (Rottenburg 2000, 2006). Development projects are considered successful as far as they comply with rules designed and agreed to in the North, with the South having no say in the process. This is much in line with the claims in Chapter 9, which attributes SDI success in Belo Horizonte, Brazil, to the emancipatory character of the project explained by Habermas's typology of knowledge.

11.3 Local and National

SDIs evolve by connecting organizations and people and data and systems into larger artifacts. Rather than starting from scratch, SDIs tend to emerge a posteriori by "connecting the dots." For this reason, local and national levels are not floors upon which to implement SDIs, but rather connection hubs. Different levels contain gateways to link to each other, while each level consists of a multitude of (interconnected) nodes (Vandenbroucke et al. 2009). Connections are across the levels, forming a network that is clearly illustrated with the Flemish case in Chapter 6. Chapter 1 gives a better view, from a legal perspective, on how the local and national levels link to the supranational level—in this case, Europe. It also turns attention to the importance of defining and agreeing on the fundamental concepts that underlie

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* Similarly, tacit knowledge enriches SDI research in the North, as evidenced from the work by Harvey and Tulloch (2006) and Nedović-Budić and Pinto (2000, 2001).

multinational SDI activities—primarily, the difficult concept of public task for providing access to spatial data.

As the concept of SDI becomes fragmented because SDIs evolve organically with existing organizational patterns, the long life of SDI vision is noteworthy. The widely accepted myth of SDI (Mosco 2004; Homburg and Georgiadou 2009) mobilizes resources in a variety of contexts, which are gaining relevance in information system research, broadly speaking. Chapter 7 provides an original interpretation of Dutch technological temptation that may be found in Southern settings as well. SDIs span numerous contexts and spread out across multiple scales, even globally—often in precarious balance between global uniformity and local contextual solutions (Georgiadou, Puri, and Sahay 2006). In general, there is a tension between uniformity (and standardization) and specificity, between robustness and flexibility, and between perfect organization (e.g., division of tasks) and ad hoc cooperation.

These issues are also raised in the development of higher level SDIs like INSPIRE (European Commission 2010). Examples are the discussions on what should be the scope of data specifications (host the wishes of everyone in the data model against the choice for a core that suits many) and who should be involved in the process (only key stakeholders or all interested and relevant stakeholders as promoted by the democratic spirit of Janssen, Crompvoets, and Dumortier in Chapter 1).

Universalist views are unlikely to provide exhaustive explanations of how SDIs gain and sustain their dynamic; therefore, context has to come into the picture. The usual way to consider context is to classify it according to levels (Avgerou and Walsham 2000). From the chapters in this book, however, we see how the subnational level becomes more important, as is illustrated by the Flemish case (Chapters 3 and 6). Also across the national level, it is equally important to take local specificities into account (see the case of the United States in Chapter 4). This is supported by other SDI literature (Rajabifard et al. 2006; Masser 2010; Nedović-Budić et al. 2009).

When coordination across organizations, groups, and individuals is not facilitated by colocation, SDIs are expected to keep data-related activities aligned. This is the common rationale for SDIs cutting across levels. This becomes clear in the social network analysis in Chapter 6. While the SDI in Flanders includes mainly actors from the Flemish (subnational) level, the network is clearly interwoven with nodes from the federal (national), provincial, and municipal levels, as well as with other nodes at the European level. SDIs literally do not stop at borders.

To expand this understanding, we note also that the contexts of reference for SDI cannot be sliced according to predefined levels. The settings within which the majority of actors operate and their actions are legitimated are not necessarily hierarchical. Local and national levels are affected by international policies, or just technological trends, in nonlinear ways. For example, a new good practice from a different country can be adopted at the

local level without being fostered by the national level. Following Callon and Latour's (1981) advice against creating micro/macro distinctions a priori, we do not assume the explanatory relevance of the local/national level before looking at the actual contexts of reference and legitimization for SDI.

This nonhierarchical view is in consonance with Czarniawska-Joerges and Sevon (1996), who conceptualize the global spread of changes as a continuous transformation of ideas into objects, actions, institutions, and other ideas—ideas spread by continuous processes of embedment and disembedment. From this perspective, the global can be seen as an extended network of localities instead of transcending the local (Czarniawska-Joerges and Sevón 1996). This flat and "embedded in actions" concept of "global" highlights SDI as part of the actual contexts. This is evident in Chapter 10, where citizen-sensors are by default embedded into the variety of contexts—some local and some international—contributing volunteered geographic information long distance.

Davis and Fonseca (Chapter 9) take the local perspective in their case. Chapter 2 (Silva) may be positioned more at the national level. In both studies, the hierarchical logic of a national level deciding and a local level executing does not explain the actual situations, nor does it help deliver useful recommendations. The research in Chapter 8 discusses the logic underlying SDI from the perspective of local planning processes, highlighting a mismatch between local perceptions and activities and SDI implications. Yet another context to zoom in on is the reality on the work floor, where particular organizational structures and business processes should be taken into account in order to make the SDI work (as shown in Chapter 3). Also of interest might be to make a distinction between behavior of organizations and individuals (Wehn de Montalvo 2003; Omran 2007).

11.4 Social and Technical

Paraphrasing Bowker (2000), similarly to other information infrastructures, SDIs operate simultaneously at the concrete level of design and implementation (fields in a database, capacity building, integration of data sets and organizational practices) and at an abstract level (dealing with the relationships between information, organization, service providers, and global software development, among others). "It is vital to dissolve the current disjunction between database (as technical storage medium) and policy (as way of acting in the world). The production of the database is productive of the new world we are creating" (Bowker 2000, p. 676). To a certain extent, this idea is similar to what in the (geo-) standardization world is called the "universe of discourse," which holds a view of the real or hypothetical world including everything of interest (ISO 2002).

Star and Ruhleder (1996) criticize the idea of infrastructure as a "thing." Infrastructures are closely interwoven with people's work and activities, so they exist and evolve in relation to the organized practices that embed them. Therefore, they become invisible unless they break down. Indeed, as our cases show, SDIs emerge differently in relation to who does what, where, and when. The work of one organization is a resource to another. Hence, SDIs are not a thing, but rather a relational entity, as can be seen in Chapters 3 and 6 and is implied in Chapters 4 (the United States), 5 (Uganda), 7 (The Netherlands), and 8 (India) (see also Vandenbroucke et al. 2009).

Star and Ruhleder (1996) suggest asking *when* is infrastructure, rather than *what* is infrastructure. For example, parcel data are mandatory for cadastres and can be used by a finance ministry if technological standards and regulations allow it. The obstacles to this relational functioning of SDI are prominent in the studies about the South, which bring to the front stage the lack of coordinated bureaucratic (Chapter 5), institutional (Chapter 2), organizational, and societal (Chapter 8) relations underneath SDI deployment.

To see this in terms of SDI, making a digital map, for example, requires integration of different layers. Thus, the cartographer and the personnel have to search for the right data, to make several choices about from whom to receive data, the format, and the quality of data. Then, they must (eventually) negotiate access and terms of use with data custodians, make hardware and software platforms available, or use existing (Internet) tools. This variety of actions is dispersed and affected by a high number of actors and technological artifacts that have to be temporarily aligned.

Therefore, in their travel across levels and settings, SDIs are both transformed and transforming in terms of actual functioning, requirements, failures, and responsibilities attached. To grasp the transformational role of SDI in terms of a metaphor, we may say that it is like Kodak, which did not simply invent a new photographic technology, but also created popular photography by mobilizing a huge number of actors and interests.

Looking at SDIs as distributive processes between the technical and the social helps in understanding their dispersed nature as combinations of social, technical, local, and global resources. Relying on a conceptualization of information infrastructures that emphasizes the complexity of large-scale interconnected information systems, Contini and Lanzara (2008) call information infrastructures in complex institutional settings "assemblages." They are heterogeneous sociotechnical networks, not simply technical networks being passively shaped by managers. The physical connections and equipment, technical standards, conventions of use, technical and organizational support structures, organization of work, and cooperation are constitutive parts of the infrastructure.

The growth of assemblages is also shaped by their installed bases, which are constituted by what is already in place at all levels. Thus, the installed base provides both possibilities and constraints for infrastructural evolution. Radical and abrupt changes are rare; intervention attempts need to take

into account the inertia or flexibility of the installed base. Not limiting the installed base to its technical dimension helps to understand both the actual constraints described about Uganda (Chapter 5) and Guatemala (Chapter 2) and the actual possibilities of mobilizing millions of citizen-sensors as suggested in Chapter 10. The role of lay people is thus becoming one of great interest: empirically because of the increasing use of geo-ICT in accessing, producing, manipulating, and sharing information and theoretically because of the consequences for a constructionist view, which includes the question of shifts in power between different actors.

11.5 Explanatory and Prescriptive

Descending from the previous discussion about local and national levels and social and technological components of SDI, it is clear that context cannot be reduced to the physical surroundings in which SDIs are situated and where researchers collect data. SDIs need to be contextualized in organizations, rules, technologies, and the skills that actually create, legitimize, and constrain them, which change with time and scale.

In terms of methodology, contributions about the South tend to be based more on qualitative methods, whereas those about the North are more eclectic and rely on both quantitative and qualitative data. An explanation for such a difference can be that measuring phenomena in the South may be more difficult for contingent reasons. Measuring itself—with what it implies in terms of social legitimization and consequent actions—cannot be taken for granted. To provide reliable interpretations, researchers in the South need to be more open to reconceptualizing and changing the assumptions promoted in the Northern sources. For example, in the field of land administration, customary land tenure systems are prominent in many countries and often conflict with geometry and legal enforcement inscribed in cadastral systems (De Soto 2000). This is an important difference with most countries in the North. In general, in the North measurement maintains a paramount role (Bouckaert and Halligan 2008; Van Dooren, Bouckaert, and Halligan 2010).

This is not to say that quantitative measures could not be developed and used for studying the SDI phenomenon in the South. In fact, it is more a question of establishing appropriate measures that reflect the local context and circumstances than of deeming the processes in the South as nonmeasurable. Quantitative and qualitative approaches are both valuable, and their use depends on the nature of the research more than on the location. Chapter 7 on the North and Chapter 5 on the South are the cases in point, respectively, providing the qualitative and quantitative methods suited to the problem and context at hand. The prevalence of qualitative research in the South may be an

indicator of the complexities embedded in both problems and contexts that are poorly understood and not easily subjected to available measures. Thus, these rich and largely unexplored dynamics require the depth of analysis and investigative detail that would, over time, possibly lead to the formalized procedures generally used for well defined or more mature phenomena.

Another ambitious goal of this volume is to emphasize the explanatory dimension of research. To ensure understanding of SDI, the actual realm of use has been put in the foreground (infrastructural inversion, Star 1996). It has been pursued by looking at tangible applications in urban planning, decision making, administration, and management. It has also required that each study be theoretically framed and include empirical work that would be used to test the theoretical propositions.

In a doctoral colloquium preceding this book, some of the authors were asked to situate their research on a two-dimensional graph whose axes were explanatory–prescriptive and exogenous–endogenous change (SDI creates organizational change or vice versa). The majority of respondents placed their research in the explanatory–exogenous quadrant, which signifies that they understand SDI as affected by external forces. Thus, connecting the last two dichotomies, the studies collected here are more sensitive to the social dimension of SDI and epistemologically more oriented toward explanation (Orlikowski and Barley 2001). Methodologies have been designed accordingly to fit explanatory research. It has to be noted about "developing contexts" that the Latin American contributions are inclined toward the adoption of Habermas's theory of communicative action as a normative theory on ideal discursive conditions and categorization of knowledge to technical, practical, and emancipatory areas.

If levels of analysis are not predefined and SDI has a networked nature, what are the research empirical boundaries? How does one trace not only the actors, as actor network theory (ANT) recommends, but also the contexts? An option would be to extend the ANT with contextual information, which is chosen in the analysis of Flanders in Chapter 6. Other methodological venues have been explored in the book: infrastructural inversion (Star and Ruhleder 1994), by Richter et al. (Chapter 8); unbounded ethnography (Engeström 2006), by Koerten and Veenswijk (Chapter 7); and the use of the Internet as a tool to know the wider world (Rogers 2009), by Georgiadou, Budhathoki, and Nedović-Budić in Chapter 10. The reason to mention these approaches is that they all promise to enhance research on SDIs that cut across multiple scales and require consideration of both social and technical agency.

11.6 Conclusions

A rigorous definition of SDI would not have allowed the open approach to the field that the reader can find in this book. Nevertheless, we stress

that not relying on a strict definition of SDI does not mean that anything can be an SDI. Rather, following Rottenburg (2006), we argue that SDI provides a vocabulary that acts as a metacode (defined as a universal code that appears to be comprehensible in all frames of reference) that allows both practical developments on the ground and research on SDI. Thus, although we do not find universalist conceptualizations of SDI credible, we think that a metacode is good to have for a mixed community of researchers and practitioners.

Most SDI literature asserts that SDIs improve decision making, support good governance, foster social equity and development, support disaster prevention and management, help manage environment and environmental risks, and improve planning and sustainability of local communities as well as large cities. We might temper the expectations of what an SDI should do. We might also need more research in order to confirm such statements by assessing performance and impact (Crompvoets et al. 2008). On the other hand, does this lead to SDI convergence (the central theme of GSDI11)? We do not have a final answer, but we do not see SDI across the globe converging into a seamless, universal SDI. Only theoretically and empirically grounded cases can show how SDIs enable a diverging variety of activities in dispersed settings.

Therefore, given the resilience of the SDI myth (Homburg and Georgiadou 2009) and the considerable variations of its translations into dispersed settings, we could ask where to ground SDI. To answer this question, we cannot refer simply to the geographic locality of SDI initiatives, but should consider their contexts of reference as well. While the contemporary world is getting "infrastructured" also because of SDI, the studies presented here help in gaining understanding beyond SDIs themselves. For example, organizing public administrations and their relations with citizens can be interpreted by tracing and understanding the distributive mechanisms at which SDIs aim.

By presenting and discussing significant cases, we draw some preliminary conclusions about interactions between SDI-related agencies—with their global outreach—and the heterogeneous institutional settings "crossed" by them. Interdisciplinary theory-based analyses (ranging from neo-institutionalism to ANT, from theory of communicative action to hermeneutics) and a mix of methodologies (from statistical and social network analysis to ethnography) have been used to account for the richness of SDIs in their actual dispersed contexts.

It is difficult to give a black or white answer to the question whether we really need different theories and methods for SDIs in the South and in the North. Certainly, we can claim that while SDIs grow to larger scale within and across a variety of organizational settings around the world, SDI research tends to remain focused on North American and Western European environments (with some interesting exceptions that can be seen, for example, in the work of Delgado Fernández and Capote Fernández (2009)). We cannot

take for granted that findings originating in these contexts are necessarily relevant everywhere else. Therefore, research crossing those boundaries is a strategically important area of inquiry.

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