Studying the use of geo-information in government – A conceptual framework

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ABSTRACT

The aim of this paper is to develop a conceptual framework for studying the use of geo-information and associated technology in government. We first review how *geo-information*, *geo-information technology* and *people*—notions central to geo-information use—are conceptualized in the literature and show that authors view these notions through two contrasting lenses, a *market* and a *polis* lens. We then present a people-centered conceptual framework for the study of geo-information use in government. The framework encompasses people's *values*, people's *practices* and the *rules* that people are expected to follow to optimize the use of geo-information. We show how the market and polis lenses illuminate the study of values, practices and rules in different ways resulting in radically different insights. Finally, we illustrate the usefulness of the conceptual framework with preliminary findings from a longitudinal empirical study in the Netherlands.

1. Introduction

The use of geo-information in government is a study area of increasing relevance and urgency. A case in point is the use of earth observation in environmental policy making. A significant amount of grey literature testifies to the link between earth observation and policy. Yet a review of refereed literature in the ISI Web of Science by de Leeuw et al. (2009) showed that the percentage of scientific articles referring to earth observation and policy rose from around 1% in the early 1990's to only just above 2% in 2007. From the 300 articles (obtained by searching with "remote sensing *or* earth observation *and* policy") not a single one describes and analyses how earth observation is used in actual policy making in the real world of government practice. Instead, they only demonstrate the *potential* of earth observation for policy. Similarly, research on spatial data infrastructure (SDI) is less concerned with the actual use of geo-information and more with access to the infrastructure. Nedovic-Budic, Pinto, and Budhathoki (2008) point to the lack of clear evidence about who the users are, what they use the information for, and how well they are served by the geoportals. They suggest a shift in SDI studies toward people-oriented questions (p. 274). Bregt, Grusz, Crompvoets, Castelein, and Meerkerk (2008)

challenge academics to develop policy relevant *and* scientifically sound approaches to evaluate the use of geo-information and SDI in government.

An example of the focus on geo-information use is the strategy of Dutch government. In April 2008, the Dutch cabinet and parliament approved a vision and implementation strategy to further develop the spatial data infrastructure (SDI) in the Netherlands and embed the pan-European INSPIRE directive into the nation's legislation (Ministry of Housing, Spatial Planning and the Environment; VROM in Dutch, 2008). The strategy document, known as GIDEON, is remarkable for its pragmatic emphasis on the practical consequences of SDI implementation—the increased use of geo-information in government. The focus of GIDEON is on the degree to which geo-information use is socially embedded in electronic government services (e-services), the extent of use of key geo-registers and the use of geo-information in public management and public policy. The epistemic shift from SDI implementation to geo-information use calls for more attention on how to study the use of geo-information theoretically and empirically.

In this paper, the research objective is to develop a conceptual framework for the study of use of geo-information in government and to illustrate its usefulness with preliminary findings from a longitudinal empirical research project. We do not attempt to develop a framework for the *evaluation* of geo-information use in government. Rather, as a first step towards this larger goal, we describe and analyze in this paper how two contrasting lenses, the

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market and *polis*, influence the way we study how people use geo-information in the real world.

The remainder of this paper is organized as follows. In Section 2, we review how notions central to geo-information use are conceptualized in the literature. In Section 3, we develop a conceptual framework for the study of geo-information use. In Section 4, we describe and discuss preliminary empirical results from an ongoing case study. Conclusions are presented in Section 5.

2. Literature review

The study of geo-information use compels us to make explicit our assumptions about the nature of *geo-information*, *geo-information technology* and *people*. In the first three sections, we review how these notions have been described in theoretical analyses in GIScience as well as in related social science literature. We also briefly review how they are related to each other by drawing on empirical studies of geo-information use in spatial policy making, in the coordination of geo-information sharing across government organizations, and in participatory GIS planning. In the fourth section we introduce the contrasting lenses on geo-information use as focus of our paper.

2.1. Nature of geo-information

Geo-information is often portrayed in GIScience as a standardizable, formal, quantitative, mediator of spatial knowledge. In their seminal article, Poore and Chrisman (2006) explain that the pervasiveness of this view can be traced back to powerful metaphors, which GIScience inherited from telecommunications engineering in the 1950s and from utopian movements in the 19th century. Critical GIScience (e.g. Harley, 1989, 1990) has furnished evidence of the contingent, informal, qualitative nature of geo-information and of the social and political power it mediates. The power of geo-information is most pronounced in spatial policy making.

In spatial policy making, geo-information is often assumed to be an objective and scientifically accurate resource with the role of providing spatially relevant information to rational decision making (Faludi & Waterhout, 2002). Either research leads policy and hence policy is evidence-driven, or research follows policy and hence research is policy-driven. Of course, we recognise practical problems. For example, spatial policy problems require a particular kind of evidence to the resolution of the issues of the day that typically is not immediately to hand, because policy making process and the information generation process have different dynamics.

Critics argue that geo-information and spatial policy do not have an unproblematic, linear and direct relationship. In choosing between policy options, political arguments are more salient than scientific arguments. "The question is not whether planning will reflect politics, but whose politics it will reflect. What values and whose values will planners seek to implement? (Dühr, 2007, p. 21)."

Carton's (2007) research illustrates how policy actors clash over interpretations of geo-information and how they deal with these controversies. In an empirical study of the role of geo-information in deliberative spatial policy making practices in the Netherlands, she found that the use of geo-information—map sketches, geo-databases, GIS analyses, spatial designs or local knowledge—often deepens the conflict between policy actors. Policy makers' strategies for dealing with controversies vary from placing the problem in a wider context by extending the region represented on the planning maps, to manipulating the map picture by, for instance, hiding controversial boundaries or adding lightning-rods to the maps to shift the attention of stakeholders towards other issues.

2.2. Nature of geo-information technology

Geo-information technology is often assumed to be value-neutral, a force of nature driving organizational and social change. Critical GIScience scholars have questioned this assumption. For Obermeyer (1998) "the key to understand the relationship between GIS and society is to acknowledge that GIS is not a tool designed to solve one aspect of a particular problem. Rather, the development of GIS or any other technology is a social process" (p. 65). It is now well understood that geo-information technology is value laden and historically contingent; it shapes and is shaped by social and political processes (Chrisman, 2005).

De Vries's (2008) analysis of government organizations in the Netherlands shows that the degree of institutionalization of geo-information technology across government departments can be explained by means of the strategic behavior of organizations with regards to the image that the use of geo-information technology creates for the environment on which they depend. He finds that the role of geo-information technology is political in nature and aims at reinforcing existing power balances between government departments.

The use of virtual city GIS technology to involve citizens in participatory urban planning in Dutch cities does not seem to empower citizens, according to Moody (2007). While it apparently diminishes the gap between citizens and policy makers, democracy does not increase. On one hand, city governments are reluctant to use virtual city GIS technology to its full potential, because consequences are unpredictable and governments are notoriously risk-averse. On the other hand, while city governments maintain the largest part of the power, the relative power of designers of virtual city GIS technology increases, to the point where they may influence government. "The elite in power decides what can be decided on by citizens and the way in which citizens are allowed to do so, and in this way the elite only strengthens their power." (p. 12)

More broadly, empirical research on the role of information and communication technology in public management and policy in Europe suggests that geo-information technology is a social intervention in a policy and organizational network influencing the position, interests, values and domains of the actors involved (Bekkers & Homburg, 2007). Political, legal, economic and professional developments "in and around public administration, and the changes in ideas and ideals for that matter, are as important for the effects of [information and communication technology] on public administration as the technological developments themselves" (van deDonk & Snellen, 1998, p.11).

2.3. Nature of people

People feature prominently in SDI and participatory GIS (PGIS) research. Authors setting out to develop SDI assessment frameworks typically start by reflecting on the nature of SDI, since the assessment of an artifact is only possible after the nature of the artifact has been properly described. They often refrain from describing people—broadly considered a key SDI component—explicitly. However, it is possible to infer their view of people's nature from the measures they derive to assess the people component. In Crompvoets, Rajabifard, van Loenen, and Delgado (2008), most contributing authors (but see Nedovic-Budic et al., 2008) assess people (sometimes referred to as human resources, influencing factors, participants, providers, users, etc.) as discrete actors with characteristics that are measurable, either quantitatively (e.g. through their education, professionalization) or qualitatively (e.g. through their degree of leadership, or SDI awareness).

People are central in PGIS research. PGIS is a genuinely political response to concerns for equity in the distribution of a valuable *item* (geo-information and related technology) to *recipients*

(people) in a fair *process* (participation) (Stone, 2002). PGIS redefines *recipients* of the item by including resource-poor organisations and non-traditional users, non-governmental organisations (NGOs), grassroots groups, and community-based organisations (McCall, 2003). PGIS expands the *item* to also include multimedia strategies (digital photographs, sound files, sketch maps, etc.) and representations of diverse and vernacular forms of spatial knowledge in a GIS (Elwood, 2006). It 'rewires' the *item*, as in GIS/2 (Sieber, 2004), to represent different visions of place, to support cultural and multilingual distinctions, to integrate local knowledge, and identifies participation as a fair distribution *process*. Common in the conceptualization of people in PGIS are people's diverse values, interests and spatial representations.

2.4. Reflection

Two contrasting perspectives of viewing geo-information, geo-information technology and people emerge from the literature review: a rationalist-analytic and a political-discursive perspective (Table 1).

In the rest of this paper, we follow political scientist Deborah Stone (2002) and use the terms *market* and *polis* for the rationalist-analytic and political-discursive lenses. Our grounds for preferring the terms *market* and *polis* are not only the convenience of using short-hand instead of the rather more cumbersome alternatives. More importantly, the *market* and *polis* lenses incorporate dimensions of people's nature (e.g. people's motivation and sources of societal change) that are well established in Political Science and still not adequately explored in GIScience. For instance, people's motivation in the market is maximising self-interest, while in the polis it is public as well as self-interest. The source of change in the market is material exchange and the quest to maximize own welfare. In the polis, the sources of change are ideas, persuasion, the pursuit of power, of own welfare as well as of the public interest (Stone, 2002). People's motivation and sources of (societal) change are useful in examining how people use geo-information in the real world, as will be explained in the sections below.

3. The use of geo-information: a conceptual framework

We propose a people-centred conceptual framework for the study of geo-information use that encompasses three aspects: the *values* to which people aspire, people's actual use *practices*, and the *rules* that either legally prescribe or just encourage people to use geo-information optimally. Values, practices and rules are aligned to broader concepts in political decision making—policy goals, policy problems and policy solutions, respectively (Stone, 2002). They may also be thought as a contribution to Dodge, Kitchin, and Perkins (2009) call for studying "modes" of mapping. The three aspects are neither exhaustive nor mutually exclusive. Nevertheless, they represent a useful and novel heuristic to describe and analyze geo-information use as a social phenomenon,

by placing people (and their values, practices and rules) at the centre of the stage.

1. *Values:* Optimal geo-information use is poised to advance certain values, things that people hold dear: e.g. efficiency, equity, legitimacy, privacy, security and sustainability, among others.
2. *Practices:* People use geo-information in routine, everyday practices: politicians use geo-information in decision and policy making; citizens use it in routine locational questions and civil society groups in participatory planning processes. Bureaucrats use geo-information within a single administrative agency, while various governance actors coordinate the sharing of geo information—formally and informally—across administrative, political, cultural, sectoral contexts, spread out in time and space.
3. *Rules:* Optimal geo-information use is prescribed in influential texts—policies, principles and declarations of global associations, that attempt to change people's behaviour. Examples are national policies (e.g. free or for-a-fee access policies), national and supranational principles (e.g. promoted by GIDEON and INSPIRE) and declarations promoted by global, professional and academic associations in the field of GIScience (e.g. GSDI, FIG, GEOSS, etc.).

Of interest in this paper, is how the market and polis lenses illuminate values, practices and rules in distinct ways, as we show in the following sub-sections.

3.1. Values

The first example of geo-information use concerns the aspect of 'values'. Values are standards we aspire to, through optimal geo-information use. From a market lens, values offer simple, easily measurable standards that determine goodness. In the polis, values contain ambiguities and problems of interpretation that make them the object of political struggles (Stone, 2002). Values are continuously socially constructed and are often in competition with each other (value trade-offs).

No other value has been as pervasive in GIScience, as efficiency. Efficiency can be simply defined as "getting the most output for a given input", or "attaining an output for the lowest input". It is the ratio between input and output, efforts and results, expenditure and income, cost and benefit. A market perspective on efficiency of geospatial operations and investments focuses on scoring what can be easily measured, or even measured at all.

Geospatial managers in the public sector usually take this simple market perspective on efficiency (Lance, Georgiadou, & Bregt, 2006). They emphasize operations and investment decisions as inputs and typically measure outputs as ratios, percentages, and indices of readily and automatically measurable entities. Table 2 shows a typical example: the objectives and efficiency measures of a geospatial clearinghouse serving a city in the USA.

Efficiency from a polis perspective poses questions such as: "1. Who determines what is the correct output [...]? 2. How should

Table 1
Perspectives for fundamental notions in geo-information use.

Fundamental notions	Market or rationalist-analytic model	Polis or political-discursive model
People	Autonomous, rational, individual actors maximizing self-interest	Individuals, groups and communities do not follow a mould of consistent rationality; they display diverse values and interests and are motivated by public as well as self-interest
Geo-information	Standardizable, formal, quantitative; mediates spatial knowledge	Can be contingent, informal, qualitative; mediates spatial knowledge and social and political power and is strategically manipulated in policy processes
Geo-information technology	Value-neutral; drives organisational and social change	Value-laden, historically contingent; shapes and is shaped by social processes

Table 2
A market perspective of efficiency for a geospatial clearinghouse (Lance et al., 2006).

Objective of clearinghouse	Efficiency measures (outputs)
Facilitate widespread sharing of geospatial data, by means of: improved participant operations, reduced costs and by supporting cross-jurisdictional decision-making	Number of visits/sessions to DataFinder Web site Number of entities visiting DataFinder Number of whole or partial datasets and regional datasets downloaded through DataFinder Number of entities listing metadata on DataFinder Hours of data-producer staff time saved

we value and compare multiple [outputs]? 3. How do different [...] outputs benefit different constituencies or groups? 4. How should we count inputs (e.g. labor costs) that are simultaneously outputs to somebody else (e.g. jobs for local community)? 5. How should we decide which of the many benefits of any input to count in the equation? 6. How should we count the virtually unlimited opportunity costs of resources used as inputs?" (Stone, 2002, p. 67)

Efficiency is not a value-neutral technical term but a contestable political claim. Everybody supports the abstract idea of efficiency, but to go "beyond the value slogans and apply the concept to a concrete policy choice requires making assumptions about who and what counts as important. There are no correct answers to these questions to be found outside the political process." (p. 65).

Let us consider the 'efficiency ratio' of Chicago's geospatial clearinghouse (Elwood, 2008). In the city of Chicago, grassroots NGOs provide homeownership counseling or disaster response services to residents in poor neighborhoods. They identify and represent the needs of neighborhood residents. They use their own priorities, semantics, and attribute schemes in the geo-information they produce. City officials admit that NGOs are valuable because they are "always in and out of streets and alleys, and so they're able to tell you the most current information" (p. 83). How to include these NGOs—who want to use data and maps from the city's clearinghouse—in the 'efficiency ratio' of the clearinghouse cooperative?

To benefit the NGOs, the clearinghouse cooperative would have to modify, supplement or transform data for the GIS applications relevant to the NGOs, thereby increasing the inputs in the 'efficiency ratio'. It would have to include different browsing, query and selection interfaces. It would have to include the possibility for grassroots NGOs to add 'non-expert', vernacular descriptions of spatial data, thus increasing both the inputs and outputs of the 'efficiency ratio'. However, the trade-off for the decreased efficiency of the Chicago clearinghouse could be an increase in legitimacy of the city administration. Is not legitimacy the ultimate test of successful innovation in public governance? (Bekkers, 2007).

3.2. Practices

The second example of geo-information use concerns the aspect of 'practices'. Sharing of geo-information across government organizations is a vital practice because the more geo-information (and data) is shared, the more it is used (Tulloch & Harvey, 2007). The Shared Land Information Platform (SLIP), the Public Sector

Mapping Agencies consortium (PSMA), and the Large Scale Base Map (LSBM) are three examples of technical-organizational reforms that have resulted in increased data sharing (Masser, Rajabifard, & Williamson, 2007, p. 13). From a market lens, we can argue that rational government actors in the three cases engaged in technical redesign (second column of Table 3), which was a driver to successful organizational redesign (third column of Table 3), with increased data sharing as a result.

From a polis lens, the success (or failure) of a technical-organizational reform can be explained by foregrounding social factors, for example, dominant public management ideas at the time of the reform. In the polis, dominant public management ideas frame opportunities for reform and shape 'what' and 'how' things should be done and 'who' should do them. We draw upon public administration literature, in particular Hood and Jackson (1991) and Hood (1998), to sketch out how a polis lens could explain the three reforms.

In a particular country at any time, a certain public management paradigm—individualism, egalitarianism, hierarchism—dominates public sector, until the paradigm is deemed inadequate and replaced by another. Each paradigm is a constellation of *doctrines* specifying who, should do what, and how in government. Reformers argue for paradigm change using three generic types of *justifications*. Individualist justifications commonly include the limitation of waste, the pursuit of efficiency, the avoidance of muddle and confusion. Egalitarian justifications include fairness, mutuality, pursuit of accountability, the avoidance of abuse of office. Hierarchist justifications include reliability, robustness and resilience, especially in adverse conditions.

The three cases of technical-organizational reforms (SLIP, PSMA, and LSBM) correspond to three 'sourcing' doctrines for government that are well established in the literature (Hood & Jackson, 1991, pp. 80-87). Reformers defend the change in sourcing doctrine with a battery of also well known justifications (Hood & Jackson, 1991, pp. 80-87).

1. SLIP corresponds to a sourcing doctrine, known as 'single source supply'. The doctrine holds that good public administration should avoid rivalry and overlap of producer units for a particular government service. Reformers usually defend it with individualist justifications: effectiveness, avoidance of confusion and deadlocks.
2. PSMA corresponds to a sourcing doctrine known as 'multi source supply by the public sector'. The doctrine holds that competition and rivalry should be preferred in public administration, and—and as often happens with doctrines—is exactly

Table 3
Technical and organizational redesign for coordination of data sharing (after Masser et al., 2007).

Three cases of successful reforms	Technical redesign	Organizational redesign
1. SLIP: Shared Land Information Platform, Western Australia	Creation and maintenance of an integrated land-information database	Restructuring within government structures
2. PSMA: Public Sector Mapping Agencies consortium, Australia	Integration of datasets held by state and commonwealth agencies	Joint venture – consortium of data producers
3. LSBM: Large Scale Base Map, The Netherlands	Maintenance and dissemination of core datasets	Joint venture by key data users

the opposite of the previous one. Reformers usually defend it with mixed egalitarian (reduction of the arrogance of office) and individualist (setting up pressures to minimize cost) justifications.

3. LSBM corresponds to a sourcing doctrine known as 'multi source supply by metaphytic competition'. The doctrine reflects an attempt to engineer competition between public and private sector. Reformers usually defend it with mixed egalitarian (keep the private sector honest) and individualist (make the public sector competitive) justifications.

A polis analysis of the three successful instances of data sharing could test the hypothesis that the justifications given by the reformers in Australia (at the provincial and federal level) and the Netherlands resonated with the dominant public management paradigm, in each case and at the time of the reform, with a successful reform as a result.

3.3. Rules

The third example of geo-information use concerns the aspect of 'rules'—'policies' more specifically. From a market lens, rational geo-information policies, based on hard factual evidence of benefits are enacted in consultation with fully informed governance actors (Longhorn & Blakemore, 2008). Alternatively, policies are seen as blueprints transportable by virtue of factual evidence of benefits and of rational analysis (Burkert & Weiss, 2004).

In the polis, policy ideas win over competing ideas by persuasion. Competing groups frequently frame their self interest as public interest (Litman, 1994): "Thus, we have seen an avalanche of proposals to privatize, nationalize, commercialize, or liberate information in general and computerized data in particular. So far, the debate has seemed to be fueled by some combination of almost religious faith [...] with self interest: those who have invested in data collection argue that the public interest is best served by the enforcement of strong property rights in collected data, while those with an interest in mounting competing products incorporating the data assert that the public interest lies in unfettered movement of information" (Litman, 1994).

For Litman, the way forward is to identify, first, our prejudices about information law and second, our notions of what the government is, what government does and what it is for. Harlan Onsrud (1992a), Onsrud (1992b) also underlines the politics of policies. However, in contrast to Litman, Onsrud foregrounds the citizen as "citoyen" and vigilant member of the polis, who should "continually question and investigate whether specific approaches provide greater or lesser economic and social equity benefits than others. In democracies, irrational governmental policies are inevitably exposed over time with the result that the system corrects itself. Whether the policies actually implemented by elected officials and government bureaucrats are successful or unsuccessful is a determination which again is ultimately made at the ballot box" (Onsrud, 1992a,b).

Policies, unlike theories, are not testable, and debunking them is of little value. Policies are doctrines integrating behavior in a sensible way, being a source of inspiration that experts, politicians and other participants in SDI development can use to enact social reality (Hood & Jackson, 1991). Doctrines serve as a link between argument and acceptance, and have a number of recurrent features: they often are ubiquitous, usually rest on soft data (selectively drawn examples) and soft logic (use of persuasive example), they 'win' over competing ideas by persuasion in communicative processes rather than by hard factual evidence, and often are contradictory and unstable (susceptible to new styles, fashions and fads). What is of interest is what they represent, and how they may or may not contribute to established bases of meaning and experience with technology (Georgiadou & Homburg, 2008).

3.4. Reflection

The examples show that the *polis* and *market* lenses illuminate geo-information use (values, practices, rules) in radically different ways and thus contribute to different insights and knowledge in studies of geo-information use. We summarize these insights in Table 4.

In the next section, we present preliminary results of a longitudinal case study that explores how digital plans supplied by a brand new central government portal are used by citizens and other tiers of government. We focus on the aspect of people's values and elucidate them from a polis lens. In other words, our ontological stance regarding 'people' is that they do not follow a mould of consistent rationality. Instead, we assume that people display diverse values and interests and are motivated by public as well as self-interest (third column of Table 1). Regarding 'values', we take the stance that values contain ambiguities and problems of interpretation. We assume that they are continuously socially constructed and are often in competition with each other (third column of Table 4). Our purpose in the long term is to understand whose values matter and how value trade-offs among the portal's beneficiaries can be taken into account.

4. Value matters in RO-online: preliminary results

The RO-online portal (RO stands for *Ruimtelijke Ordening,* i.e. Spatial Planning) makes digital spatial plans publicly available via Web services. It has been in the air since the 1st of June 2008 (see Fig. 1). The portal covers the entire country at all tiers of government—State, Province and Municipality. According to the Ministry VROM, responsible for the portal "with RO-online, the government aims at providing spatial plans to citizens, private organisations and governments in a transparent way. The site presents the complete and most recent situation at any location in the Netherlands, in a reliable and clear way. Consequently, citizens and professionals will be able to integrally query spatial plans" (VROM (Volkshuisvesting Ruimtelijke Ordening en Milieu) & Spatial

Table 4
Conceptual framework for studying of geo-information use.

| Studying geo-information use	Market	Polis
Values (e.g. efficiency)	Values offer simple, measurable rules that determine goodness	Values contain ambiguities and problems of interpretation. They are continuously socially constructed and are often in competition with each other (value trade-offs)
Practices (e.g. data sharing)	Rational actors engage in technical redesign which drives organizational change with improved data sharing as a result	Technical-organizational reforms, required for coordinating geo-information sharing, shape and are shaped by social factors (including dominant public management ideas)
Rules (e.g. policies)	Rational policies are enacted in consultation with fully-informed governance actors	Policy ideas win over competing ideas by persuasion rather than by hard factual evidence
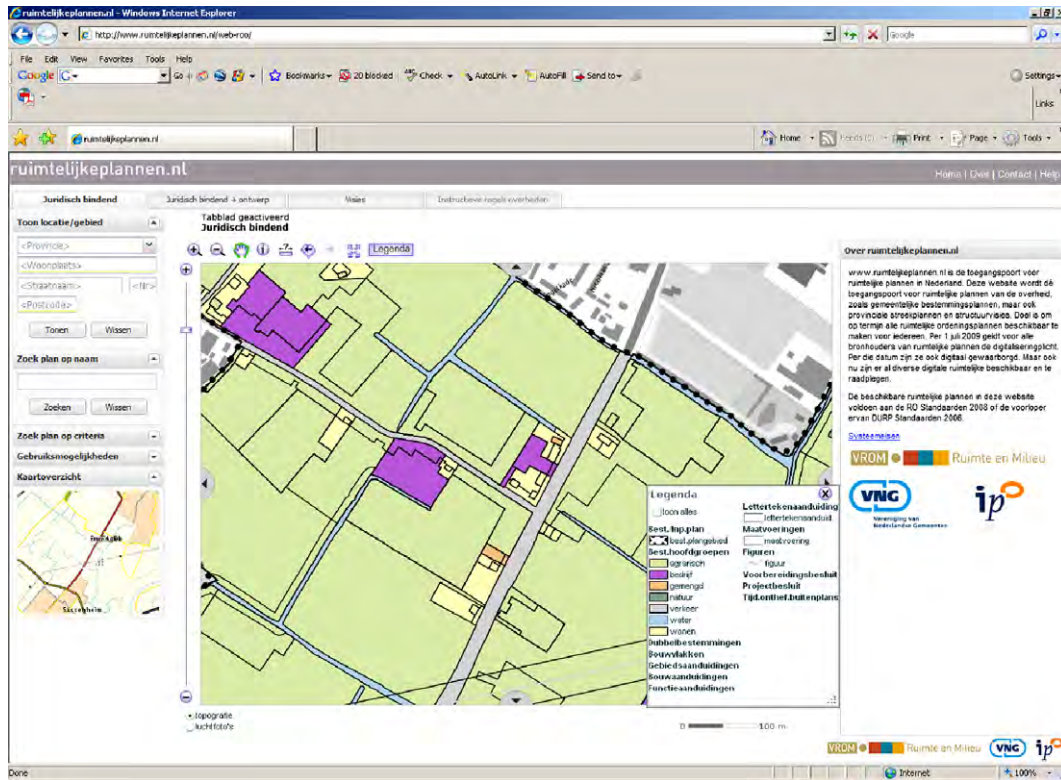
Fig. 1. Screenshot of RO-online.

Planning, 2007a, p. 1). The portal partially implements a new Law on Spatial Planning that came to force on the 1st of July 2008 (VROM (Volkshuisvesting Ruimtelijke Ordening en Milieu) & Spatial Planning, 2007b). The new Law stipulates that all municipalities must make their plans digitally available at the source by the 1st of January 2010.

In this section, we describe and discuss how some of the presumed beneficiaries value the portal's outputs. Our research method is exploratory (not confirmatory) and qualitative, befitting the study of a brand new artifact (the portal) with unpredictable effects (Silverman, 1997). We conducted open-ended, unstructured interviews with three public managers responsible for the plan making process—two at the provincial and one at the municipal level, shortly before and right after the portal became available in July 2008.

The timing of the interviews was selected to coincide with the first sudden rupture of routine practices, brought about by the new portal, a significant "moment" of change that is worthy of study, according to Dodge's et al. (2009, p. 234). The interviews lasted from 1.5 to 2 h. Extensive notes were taken by one of the authors, and written up shortly after each interview. Other data sources included official documents and the RO-online website. Through careful reading and reflection on the field notes by both authors, two provisional themes emerged: the value of the portal's outputs to four groups of presumed beneficiaries (central government, citizens, municipal plan makers, provincial plan makers) as well as value convergence and contests. These themes are described below.

4.1. Value matters for RO-online constituencies

4.1.1. Ministry VROM

The efficiency improvements claimed by VROM include: "Fewer rules, less central control where possible, and an implementation-oriented approach. These are the guiding principles behind the

new Spatial Planning Act [...], which is expected to go into effect on 1 July 2008. These are no empty slogans; they represent an actual simplification of the decision-making process in spatial planning, with due consideration of such important concepts as legal certainty and democracy. The new Act ensures a clear division of labour. The responsibilities and powers are distributed among municipalities, provinces and the national government in such a way that each tier of government can represent the interests entrusted to it to the best of its ability. [...] The new Law aims to achieve the following objectives, among others: more efficient decision-making, improved enforcement and simplified legal protection in spatial planning. In short, it will represent an effective, decisive and goal-oriented spatial planning system in the Netherlands." (2007a. p. 1)

4.1.2. Citizens

In line with the Ministry's claims, citizens also value the ease of querying standardized, comparable spatial plans at all levels of government via Internet without having to visit the various government offices.

Conflicts may arise over a number of issues. First, the Ministry's pledge to allow "citizens [...] to integrally query spatial plans" (2007a. p.1) is not materializing. Although it is technically feasible to assure that citizens can view all plans at a specific location simultaneously, a citizen can now only query plans one at a time to determine what s/he is allowed to do at a specific location. Second, the Ministry's aim to provide "spatial plans to citizens, private organisations and governments in a transparent way" mismatches citizens' needs. Citizens query physical plans with locally situated, detailed questions, e.g: Am I allowed to build a shed in my garden? To answer such questions citizens still need to find their way through a maze of difficult to digest documents. As in Moody's study (2007) the government decides what information is presented to citizens and in what way, instead of using the portal to

its full potential. A third issue concerns citizens' legal security. Under the new Law, the Municipality, and not the Province, resolves conflicts over plans with citizens. A citizen may now appeal an 'unfair' municipal decision only to the Council of State. This new practice has disadvantages: 1. Citizens may not trust the Municipality to decide 'objectively' because municipal employees, who are local people themselves, might have personal interest in certain locations within the city. 2. An appeal to the Council of State is not free of cost, in contrast to a citizen's appeal to the Province, which used to be free of cost in the past. As a result, citizens may be discouraged to exercise their right of appeal. 3. In the past, an appeal to the Province had to be processed within 6 months. Under the new Law, the Council of State does not have this obligation and can take more than a year to process an appeal. In sum, cost and time issues may discourage citizens to appeal municipal decisions they perceive as unfair.

4.1.3. Municipal plan makers

The Municipality perceives the increased power accorded to it by the new Law as an improvement. In the past, a Municipality made the local plan and the Province approved it. Under the new Law, the Municipality makes and approves the plan. In case of conflict, the Province may appeal to the Council of State. Municipalities are also content with the reduced decision power of the Province in case of conflicts with citizens, a perception that contrasts with how citizens perceive the transfer of more power to the Municipality.

The Municipality recognizes shortcomings. In the era of analogue spatial plans, the municipal plan maker had the freedom to assign any land use to a certain area and to apply any symbolization to the plan. RO-online curtails these freedoms. Only 23 predefined land use types are allowed now with the new digital plans, while the accompanying symbolization is centrally standardized and prescribed by the Ministry VROM. Municipal plan makers perceive this as limitation of their discretionary power to make subtle judgments regarding land use, based on local knowledge.

4.1.4. Provincial plan makers

The Province is comfortable with the power shift to Municipalities under the new Law, and hence attuned to the Ministry VROM's claim "that each tier of government can represent the interests entrusted to it to the best of its ability" (VROM, 2007, p. 1). Municipalities decide based on local interests; the Province safeguards provincial interests and cannot interfere when it disagrees with a local plan. Both the Province and Municipality value the efficiency of the appeal process, where the plan needs to be defended in court. In the past, the Province had to defend in court plans made by others (Municipality) with processes unfamiliar to the Province. Under the new Law, the Municipality defends its own planning choices. The power shift towards the municipalities also alleviates the Province's work load and allows it to re-deploy provincial employees (previously tasked with approval of municipal plans) to other work, more relevant to the Province (e.g. making local physical plans with provincial interest, such as an infrastructural project covering more than one municipality).

On the downside, the Province anticipates efficiency losses, in case it rejects the plan of the Municipality and has to appeal to the Council of State, a process that may take at least a year. Moreover, the Council of State still works in an analogue manner, and therefore the Province may need to convert plans to paper in support of Council of State decision making.

4.1.5. Value convergence and contests between Municipality and Province

Both the Municipality and the Province foresee a more efficient relationship, under the new Law for a number of reasons. 1. The establishment of a plan is reduced from 1 year to 22–24 weeks. 2. The digital plans enable integration with other spatial data (e.g. plans at the Province level). 3. The Province has now an interest to communicate future provincial plans to municipalities in a timely manner because of its reduced power. In the past, the Province could reject a local plan that was not correctly motivated, an action the Municipality felt was 'useless', since it did not affect the content of plan. However, from a Province's perspective rejecting a plan for procedural mistakes protected the Municipality when the plan had to be defended before the Council of State.

Ambiguities still remain that may be difficult to resolve. For example, under the old regime the Province had both the interest and expertise to remove errors, before the plans achieved a legally binding status. Under the new Law, the Province has no interest to check for errors. Quality assurance of the plans rests entirely on municipal employees, who often lack the requisite expertise for quality assurance, especially in small municipalities. Another uncertainty concerns the digital aspects of the new Law requiring legal commitments by the information technology (IT) departments in a Municipality. For example, a Province has six weeks to respond to a municipal concept plan. Therefore, it is of utmost importance that municipal digital plans are accessible to provincial plan controllers within several days after they are issued by the municipality. IT departments at the provincial level should disseminate the received concept plans in an accessible format to the controllers and become with this obligation part of the legal process.

4.2. Reflection

These initial findings illustrate that the efficiency claims of the Ministry VROM cannot be easily translated into simple, measurable standards that determine goodness for all presumed beneficiaries. The outputs of RO-online contain ambiguities and questions of interpretation. The claim that RO-online "represent[s] an effective, decisive and goal-oriented spatial planning system" (VROM, 2007, p. 1) entails making assumptions about which beneficiary's values count as important.

Values of presumed beneficiaries of large-scale geo-information portals, such as RO-online, may harmonize or clash. Outputs that citizens value, such as the ability to query local plans integrally, the locally-situated ease of use and legal security seem to be pitted against the claim of VROM for transparency. While the power shift brought about by RO-online and the new Law is welcomed by both the Province and Municipality it may reduce the legal security for citizens.

Digitization and standardized symbolization allows the Ministry transparent provision of geo-information but curtails the freedom of the Municipality to develop pragmatic plans of land use, based on local knowledge. At first sight it seems that citizens stand to lose the most. But, how should we compare and value a negative output to citizens against a positive output to the Municipality? For instance, Municipalities are content with the reduced decision power of the Province in case of conflicts with citizens. At the same time, citizens may not deem the Municipality an objective judge in case of conflicts on plans.

This reflection would be incomplete without pointing out to and discussing possible limitations of the provisional results. The first relates to the sample size. The number of interviews is rather small considering the portal's target population. (The Netherlands contains 12 Provinces and the province in which the Municipality in question is situated contains 25 Municipalities.) Nevertheless, qualitative data and themes emerging from a small sample can help identify hypotheses that can be tested in future research with larger samples. In the next round of exploratory field work, we plan to test the validity of the themes and also interview citizens and business users of RO-online.

The second limitation concerns the qualitative methods used at this initial stage. Conducting participant observation—in addition to interviews and document analysis—of the interviewees would have allowed us to triangulate what the respondents say with what they actually do in everyday professional practices, in their attempt to follow the letter of the new Law. A more opportune moment for participant observation, seems to be the period around January 2010, when all municipalities will have to make their plans digitally available at the source. In this sense, January 2010 represents a second rupture of routine practices, and another significant "moment" of change, worthy of study (Dodge et al., 2009, p. 234).

The third limitation is endemic to longitudinal research. In this longitudinal project, our research will evolve from the currently used exploratory-inductive methods (yielding tentative results) to hypothetical-deductive methods, and finally to a pragmatic approach where social and/or technical models will be developed to tackle persisting value trade-offs.

5. Conclusions

Our point of departure was the challenge to better understand and stimulate the use of geo-information in government. The study of geo-information use shifts the centre of gravity to people, and their relation to geo-information and geo-information technology. We produced three interlocked lines of reflection.

First, we described how authors perceive the nature of people, geo-information and geo-information technology in GIScience, Public Administration and Political Science. We distinguished two contrasting perspectives (or lenses) that shape researchers' engagement with these fundamental notions. By borrowing the terms *market* and *polis* from Political Science to refer to these lenses, we underline the centrality of this literature in the study of geo-information use, as a social phenomenon. We then developed a people-centered conceptual framework that disaggregates the phenomenon of geo-information use into manageable aspects—values, practices and rules. Finally, we illuminated these from a market and polis lens, and showed how radically different insights can be obtained in each case. The examples in Section 3 suggest that values are not easily measurable standards of goodness; that dominant ideas can be the source of technical-organizational reforms while policies can be fruitfully examined as persuasive arguments to target audiences. The empirical findings of the case study highlight the significance of a polis lens in eliciting in-depth knowledge on people's values, and on possible value contests among presumed beneficiaries of government portals.

With a polis lens we stand a chance to understand and explain in different ways how authentic human actors, groups and communities with different values, interests and motivations use geo-information and how societal benefits materialize or not as a result.

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References

Bekkers, V. (2007). Modernization, public innovation and information and communication technologies. *Information Polity, 12*(3), 103–107.

Bekkers, V., & Homburg, V. (2007). The myths of e-government: Looking beyond the assumptions of a new and better government. *The Information Society, 23*(5), 373–382.

Bregt, A. K., Grusz, L., Crompvoets, J., Castelein, W. T., & Meerkerk, J. (2008). Changing demands for spatial data infrastructure assessment: Experience from The Netherlands. In J. Crompvoets, A. Rajabifard, B. van Loenen & Delgado, T. (Eds.), A multi-view framework to assess spatial data infrastructures. Space for geo-information. Wageningen University. ISBN: 978-0-7325-1623-9.

Burkert, H., & Weiss, P. N. (2004). Towards a blueprint for a policy on public sector information. In G. Aichholzer & H. Burkert (Eds.), *Public sector information in the digital age*. Cheltenham: Edward Elgar.

Carton, L. J. (2007). Map making and map use in a multi-actor context: Spatial Visualizations and frame conflict in regional policy making in the Netherlands. PhD dissertation, Technical University of Delft. ISBN: 978-90-5638-169-1. <http://www.library.tudelft.nl/ws/search/publications/search/metadata/index.htm?docname=378981>. Accessed 20.04.09.

Chrisman, N. (2005). Full circle: More than just social implications of GIS. *Cartographica: The International Journal for Geographic Information and Geovisualization, 40*(4), 23–35 [Winter 2005].

Crompvoets, J., Rajabifard, A., van Loenen, B., & Delgado, T. (2008). A multi-view framework to assess spatial data infrastructures, space for geo-information. Wageningen University. ISBN: 978-0-7325-1623-9.

de Leeuw, J., Georgiadou, Y., Kerle, N., de Gier, A., Inoue, Y., Ferwerda, J., et al. (2009). The function of remote sensing in support of environmental policy. *Remote Sensing of Environment*, submitted for publication.

de Vries, W. T. (2008). A review of the political nature of ICT in G2G integration – based on 3 cases from the geoICT domain. In *ACM International Conference Proceeding Series*: Vol. 289. *Proceedings of the 2008 international conference on digital government research*, 18–21 May 2008 (pp. 124–131), Montreal, Canada: Digital Government Society of North America. ISBN: 978-1-60558-099-9.

Dodge, M., Kitchin, R., & Perkins, C. (2009). *Rethinking maps: New frontiers in cartographic theory*. London and New York: Routledge, Taylor and Francis.

Dühr, S. (2007). *The visual language of spatial planning: Exploring cartographic representations for spatial planning in Europe*. Routledge, New York: RTPI Library Series.

Elwood, S. (2006). Critical issues in participatory GIS: Deconstructions, reconstructions, and new research directions. *Transactions in GIS, 10*(5), 693–708.

Elwood, S. (2008). Grassroots groups as stakeholders in spatial data infrastructures: Challenges and opportunities for local data development and sharing. *International Journal of Geographical Information Science, 22*(1), 71–90.

Faloudi, A., & Waterhout, B. (2002). *The making of the European spatial development perspective: No masterplan*. Routledge, New York: RTPI Library Series.

Georgiadou, Y., & Homburg, V. (2008). The argumentative structure of spatial data infrastructure initiatives in America and Africa. In C. Avgerou, M. L. Smith, & P. van den Besselaar (Eds.), *Social dimensions of information and communication technology* (pp. 31–44). Boston: Springer (International Federation for Information Processing, 282).

Harley, B. J. (1989). Deconstructing the map. *Cartographica, 26*(2), 1–20.

Harley, B. J. (1990). Cartography, ethics and social theory. *Cartographica, 27*(2), 1–23.

Hood, C. (1998). The art of the state: Culture, rhetoric and public management. Oxford University Press.

Hood, C., & Jackson, M. (1991). *Administrative argument*. Aldershot: Dartmouth.

Lance, K. T., Georgiadou, Y., & Bregt, A. (2006). Understanding how and why practitioners evaluate SDI performance. *International Journal of Spatial Data Infrastructures Research, 1*, 65–104.

Litman, J. (1994). Rights in government-generated data. In *Proceedings of the conference on law and information policy for spatial databases*. NCGIA and the Center for the Study of Law, Science and Technology, Arizona State University College of Law, held October 28–29, 1994, Tempe, Arizona. <http://www.spatial.maine.edu/~onsrud/tempe/tempe94.html>.

Longhorn, R., & Blakemore, M. (2008). *Geographic information: Value, pricing, production and consumption* (p. 230). CRC Press/Taylor & Francis Group.

Masser, I., Rajabifard, A., & Williamson, I. (2007). Spatially enabling governments through SDI implementation. *International Journal of Geographical Information Science, 22*(1), 5–20.

McCall, M. (2003). Seeking good governance in participatory GIS: A review of processes and governance dimensions in applying GIS to participatory spatial planning. *Habitat International, 27*, 549–573.

Moody, R. (2007). Assessing the role of GIS in e-government: A tale of e-participation in two cities. In Eleventh international research symposium on public management, 2–4th April 2007. Germany: University of Potsdam.

Nedovic-Budic, Z., Pinto, J. K., & Budhathoki, N. R. (2008). SDI effectiveness from the user perspective. In J. Crompvoets, A. Rajabifard, B. van Loenen & T. Delgado (Eds.), A multi-view framework to assess spatial data infrastructures, Space for geo-information (pp. 273–303). Wageningen University. ISBN: 978-0-7325-1623-9.

Obermeyer, N. (1998). The evolution of public participation GIS. *Cartography and Geographic Information Systems, 25*(2), 65–66 (Special issue on Public Participation GIS).

Onsrud, H. J. (1992a). In support of open access for publicly held geographic information. *GIS Law, 1*(1), 3–6.

Onsrud, H. J. (1992b). In support of cost recovery for publicly held geographic information. *GIS Law, 1*(2), 1–7.

Poore, B., & Chrisman, N. (2006). Order from noise: Toward a social theory of geographic information. *Annals of the Association of American Geographers, 96*(3), 508–523.

Sieber, R. (2004). Rewiring for a GIS/2. *Cartographica, 39*(1), 25–39.

Silverman (1997). Qualitative research, theory, methods and practice. SAGE Publications, ISBN: 0-8039-7665-8.

Stone, D. (2002). *Policy paradox: The art of political decision making. Revised edition.* New York/London: Norton and Company.

Tulloch, D. L., & Harvey, F. (2007). When data sharing becomes institutionalized: Best practices in local government geographic information relationships. *URISA Journal, 19*(2), 33–41.

van deDonk, W., & Snellen, I. (1998). *Towards a theory of public administration in an information age? Public administration in an information age.* Amsterdam: Elsevier.

VROM (Volkshuisvesting Ruimtelijke Ordening en Milieu), Ministry of Housing, Spatial Planning and the Environment (2007a). RO-online: Dé toegangspoort voor ruimtelijke plannen (in Dutch).

VROM (Volkshuisvesting Ruimtelijke Ordening en Milieu), Ministry of Housing, Spatial Planning and the Environment (2007b). The new Spatial Planning Act gives space, November 2007.

VROM (Volkshuisvesting Ruimtelijke Ordening en Milieu), Ministry of Housing, Spatial Planning and the Environment (2008). GIDEON – Key geo-information facility for the Netherlands. Approach and implementation strategy (2008–2011). (April 2008). <http://www.geonovum.nl/geo-informatie-infrastructuur.html>. Accessed 20.04.09.