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DIGITIZING THE DRAGON HEAD, GEO-CODING THE URBAN LANDSCAPE: INVESTIGATING ROLES OF GIS IN CHINA’S CHANGING URBAN GOVERNANCE

Abstract:

While local governments have been one of the major user groups of GIS, there is still little research on how GIS development in local government might be intertwined with urban governance, especially in the non-Western contexts. Drawing upon insights from GIS implementation, critical GIS, and governmentality studies, this article seeks to bridge this gap by examining the implications of Chinese urban government GIS practices in the context of China’s changing urban governance. Through an in-depth case study of Shenzhen, this article argues that the urban GIS developments in Shenzhen have been transformed from mainly internal organizational workflow automation to increasingly participating in governing urban spaces, reflected in the efforts of ‘geo-coding’ the urban landscape. ‘Geo-coding’ here refers to a broadly defined spatial practice of carving and reconstructing a rational urban space. In this way, these GIS practices have constituted a particular form of geographic rationality that seeks to govern in a distance and regulate the urban environment simultaneously, intersecting with the broader transformations of China’s urban governance. These GIS developments have been largely government-centric rather than citizen-centric. Nonetheless, these GIS practices can provide possibilities of new forms of spatial knowledge production for citizen participation in urban governance.

Keywords: Critical GIS, governmentality, geo-coding, urban governance, China, Shenzhen

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1. Introduction

GIS technologies have been increasingly developed and used in Chinese city governments (e.g., Kong, 2001; Lai, 2006), especially in the urban planning sector (Chen, 2004). In the meantime, urban planning has been designated as the “dragon head” (longtou) in China’s urban development (Qiu, 2005). The term “dragon head” is frequently used as a metaphor in China’s public political discourse, referring to these entities or industries that have a guiding and steering role in their respective sectors (Wu, 2003). The dragon-head role of urban planning, in contrast to its subordinate role in urban development in China’s pre-reform era, indicates an interesting and complex transformation of political rationalities that calls for governing through autonomy (Tang, 2000). However, there is little work on documenting and analyzing in what ways local government GIS development and urban governance might pervade one another. This study aims to address this issue through an in-depth case study of GIS development in Shenzhen’s city government in China.

I employ a synthesized theoretical framework. First, I draw upon insights from research in GIS implementation, which has noted that GIS can serve multiple roles, including improving quality of mapping, data analysis, information processing, and decision-making support (Worrall, 1994). However, Nedovic-Budic (1998) suggests that more process-based and context-sensitive studies are needed. In addition, it is also necessary to examine the impacts of GIS over time. Second, critical GIS research also suggests that it is necessary to view GIS as more than merely hardware and software, as GIS embodies, and is embedded in, complex social relations, which

also has social implications (Pickles, 1995; Elwood, 2006). The impacts and implications of GIS development, in turn, need to be situated in the social conditions in which the technology is employed. Furthermore, drawing upon insights from governmentality study, I argue that GIS practices have been enrolled and implicated in the transition of political rationalities in China's urban governance. Specifically, the "geo-coded landscape" notion (Rose-Redwood, 2006; 2012) is useful in explicating how GIS constructions have moved beyond the mere function of mapping or spatial data generation and helped to constitute the geographic rationality of governing and managing heterogeneous urban environments.

My analysis is based on data collected from semi-structured interviews, archival documents, and participant observations through fieldwork conducted in China in 2005 and 2006. In the remainder of the paper, I first provide a review of relevant literature. I then situate Shenzhen's government GIS constructions within the broader urban governance transition in reform-era China. I subsequently document the major roles of GIS in Shenzhen's urban governance and illustrate the ways in which these GIS practices have (re)configured the relations between the governing and the governed, power and knowledge. I argue that while various GIS technologies have been implemented in Shenzhen's urban governance, there is an important shift of governing rationality intertwined with such urban GIS usage. This shift places more emphasis on governing the urban space and population through geospatial technologies but differs from the previously encompassing and totalizing work unit system in China's urban governance. In this way, I show that urban GIS have become an integral part of the devolution of state powers in China in the past decades. Such urban governance transitions share certain traits of the neoliberal governance discourses situated in North America and Europe including the discourses of restructuring state power and increasing inter-urban competition, but with significant Chinese

characteristics shaped by the authoritarian regime and path dependency (Peck and Zhang, 2013). As such, with a more nuanced analysis on how political and technological rationalities are intertwined and mutually shape one another, this study will contribute to critical GIS and urban geography research through explicating “the [particular] techniques and processes of governance” (Kipnis, 2007, p.385) that constitute the complex state-society relations in China including “the coexistence of these evolving state (and party) forms with endemic, uneven and conflictive processes of deepening marketization” (Peck and Zhang, 2013, p.380) as well as revealing possible spaces for contestation and resistance in these processes.

2. Theoretical Background

2.1. Constructing and implementing GIS in urban governance

Two strands of GIS research inform my study regarding the intersection of GIS development and urban governance. First, studies on GIS implementation in organizations and government agencies in particular provide insights into various dimensions of evaluating GIS, both with respect to its instrumental roles and social impacts. Second, critical GIS research further provides rich accounts of in what ways GIS is socially constructed. Specifically, in GIS implementation research, some studies focus on the financial aspects of acquiring and implementing GIS (cf. Worrall, 1994; Karikari and Stillwell, 2005). Some other studies provide multi-dimensional frameworks (Nedovic-Budic, 1998), which can be grouped into the following categories: system quality, information quality and use, user satisfaction, individual impact, organizational impact (e.g., Pinto and Onsrud, 1997) and societal impact (e.g., Tulloch et al., 1996). Given the dynamic scopes of GIS and complex environments of implementation, the impacts of GIS seem to vary (Worrall, 1994; Nedovic-Budic, 1998). Thus, instead of developing

a universal set of evaluation criteria of GIS implementation, Nedovic-Budic (1998), among others, suggests that it is necessary to consider specific organizational settings (such as organizational size and political framework) and user-technical interfaces. Several studies also acknowledge the symbolic meaning of modernity through digital technologies in public administration (e.g., Campbell, 1996). Nonetheless, these studies have focused primarily on the organizational levels, and interactions between the organization and broader social processes have been largely neglected.

At the same time, critical GIS research argues that GIS construction is a multifaceted, multi-scalar, complex and ambivalent process, and its implications and impacts should be investigated within the broader social conditions in addition to the organizational settings in which GIS is employed (Pickles, 1995; Sheppard, 2005; Chrisman, 2005; Schuurman, 2002). In this field, there are fruitful discussions of the role of GIS in local government agencies with a focus on social relations embedded in GIS constructions. For example, Obermeyer and Pinto (1994) acknowledge that the introduction of GIS might increase, rather than reduce, conflicts in the planning agency. Harvey (2006) reveals how the GIS and spatial data usage has constituted new meanings of administrative boundaries in relation to neo-liberal governance. These studies, while underpinned by various theoretical approaches, have been concerned with examining how GIS might change organizational operations and performance and alter power relations (both intra-organizational and inter-organizational).

Another related body of work in critical GIS is the discussion on spatial data infrastructure (SDI) development, which subsumes an array of geospatial technologies and data, networks, standards, policies, stakeholders, organizational aspects, and end users (Georgiadou et al., 2005; Harvey and Tulloch, 2006). These initiatives, mainly carried out by state agencies at

various levels, have been initially driven by economic purposes. Later efforts and discourses have sought to address the issue of access and tackle broader social and political issues such as environmental regulations and food security, underpinning the notions of information society and social progress (Georgiadou et al., 2005). Studies show that the roles and impacts of SDI vary highly and are dependent on institutional arrangements and organizational factors as well as technological factors. Notable efforts have been carried out to examine the sociopolitical dimensions of SDIs (e.g., Craig, 2005; Georgiadou et al., 2005, Harvey and Tulloch, 2006; Elwood, 2008). For example, in their study of the national spatial data infrastructure development in the US, Harvey and Tulloch (2006) show that data sharing in local government tends to be informal and that it is carried out to support existing governmental activities rather than corresponding to national policies and programmes. Some studies also point out the influence of the devolution of governance on SDI and data access (Elwood 2008; Ghose, 2007; Martin, 2003). In these contexts, local governments and other non-state agencies may take up new roles and responsibilities in addressing a range of socioeconomic issues, in which spatial data are often seen to play an important role in planning and decision making as well as collaborative governance.

Together, these studies demonstrate the importance of investigating the roles and impacts of GIS and spatial data constructions developed and employed by state agencies through both technological factors as well as social and political factors. Yet, research on in what ways GIS development in government and urban governance might pervade one another is still largely absent. Specifically, there is very little research that traces how the usage of GIS and associated discourses have been intertwined with political and governmental rationalities in relation to urban governance. This study seeks to interrogate this aspect further. In particular, I argue that

insights from governmentality study are useful to understand these complex relationships (Crampton, 2004; Pickles, 2004), which are discussed further below.

2.2. Governmentality and the geo-coded landscape

Following Foucault (1991), the notion of governmentality refers to “the array of knowledge and techniques that are concerned with the systematic and pragmatic guidance and regulation of everyday conduct” (Ong, 2006, p.4)¹. The governmentality concept has been employed to examine mapping and GIS practices (Hannah, 2000; Crampton, 2004; Pickles, 2004; Harvey, 2006; Brown and Knopp, 2006). For example, Crampton (2004) views mapping as an aspect of geographic governance that reflects and constitutes political reasoning. He investigates the shifts of governmental reasoning between choropleth mapping and dasymetric mapping from the early 19th century to 20th century, which helped shape the knowledge on population distributions and space. Pickles (2004) provides an account of how the urban space has been rationalized with new ways of mapping in the 19th century such as the emergence of paronomasia technology. He shows how the technologies and practices of mapping have emerged as part of “a broad social project of urban and social rationalization”, “paralleled by the use of cartographic rationality and its presentational logics as new forms of commodification” (ibid, p. 133).

These studies reveal the important role of mapping technologies in constituting spaces and territories that may in turn structure our way of understanding the world and acting upon it. Pickles (2004, p. 5) notes that “cartographic institutions and practices have coded, decoded and recoded planetary, national and social spaces”. Rose-Redwood (2006) further argues that geographic governance is a pre-condition of biopolitical power (see also Crampton, 2004). Increasingly, spaces have been geo-coded, through which more efficient and rational

management can be undertaken. Here, ‘geo-coding’ is a broadly defined spatial construction practice, rather than a geo-computational technique in GIS. This practice provides the geographic foundation that links governmental knowledge with the governed population (Rose-Redwood, 2006). For example, historical urban house numbering in the US can be viewed as a type of geo-coding practice that should not be taken for granted (ibid). This type of geo-coded urban landscape has been in parallel with the commodification of urban space in the capitalist societies (Pickles, 2004; Rose-Redwood, 2006). The notion of a ‘geo-coded landscape’ (Rose-Redwood, 2006; see also Pickles, 2004 and Crampton, 2003) is particularly useful in my study. While these geo-coding practices are mainly situated in Western industrialized contexts, such a conceptualization draws important attention to examining *how* geographic technology usage has emerged within particular socioeconomic contingencies and consequently *what* are the implications.

A number of researchers have attempted to extend Foucault’s ideas into non-Western contexts (Legg, 2005; Sigley, 2006; Ong, 2006). In particular, several studies have investigated how governmentality is played out in China (Sigley, 2006; Hoffman, 2006; Tang, 2000; Anagnost, 1997). Sigley (2006, p. 494) argues that China’s “socialist governmentality”, especially during the Maoist period (1949-76), is characterized by a belief in “the ability to know the object to be governed in detail”. The state occupied a position of moral authority and was able to intervene into the social life in every aspect, which can be characterized using Foucault’s notion of disciplinary power (see also Tang, 2000). The objectification of the governed was facilitated by a range of techniques such as mass mobilization through powerful propaganda and institutions such as the work unit system² (see for example, Anganost, 1997).

However, as the society becomes more diverse with China's transition from a centrally planned economy to a market-oriented one since the 1980s, new strategies have emerged, calling for governing through autonomy, either through "market mechanisms or the autonomous conduct of individuals" (Sigley, 2006, p. 495). As such, the reform process has produced a hybrid form of political rationality, which is authoritarian while also seeking to govern certain subjects through their own autonomy (ibid). Meanwhile, scholars have pointed out that the state power has transformed from previously all-encompassing administration to more indirect and micro-level social control (e.g., Chung, 2007). This shift of governmental reasoning intertwined with the scalar strategy of economic decentralization in China forms the backdrop against which GIS is developed and employed in China's urban planning and related agencies.

With respect to planning knowledge production, Sandercock's work (1998; 2003) illustrates how different forms of rationalities underpin planning theory and practices. In particular, she identifies five major pillars of the so-called "Chicago model", which are characterized by instrumental rationalities, comprehensiveness of planning, quantitative modeling, state-directed and hierarchical features, and a public image of neutrality. However, such a paradigm has been challenged in recent years. New theoretical developments on planning have emerged, of which some major characteristics include: means-ends rationalities (such as for building bridges and dams), planning as negotiated, political, and focused actions, appreciation of different forms of knowledge including more "experiential, grounded, contextual, intuitive knowledges" by local communities, community-based planning geared to community empowerment, and multiple publics (Sandercock, 1998, p.30). These insights are also helpful here to illustrate the interrelations between geospatial technology usage and planning practices.

As I will analyze later, GIS constructions in Shenzhen's planning agencies appear to experience a transition from an earlier focus on automating internal administrative workflows to more explicitly using geo-spatial technologies to help govern and discipline the urban environments on a larger scale. In these processes, one can argue that a means-ends rationality, using Sandercock's term, is playing a role such as reducing operational errors through employing GIS and information technologies. There is also a discourse of enhancing public participation in the discourse of 'E-governance' development. However, I argue that these developments largely underpin the instrumental rationalities (Sandercock, 1998; see also Pickles, 2004). Furthermore, these practices are also enrolled in, I contend, the state's attempts to 'geo-code' the increasingly diverse urban environments in the face of rapid urbanization and globalization. This can be shown through the example of the "urban grid information system" development. Such transformations of geographic knowledge production in urban governance constitute a hybrid governing rationality in China (Sigley, 2006) as noted earlier, which is intersected with the increasing role of the city as a major economic entity in China (Wu, 2003). It is through these perspectives that I will situate and investigate the case of Shenzhen.

3. Governing Shenzhen with GIS development

Shenzhen, located on the northern border of Hong Kong within the rapidly urbanized Pearl River Delta region in southern China, has been one of the leading cities in developing information technologies and GIS in its governmental sector. Specifically, the Shenzhen Urban Planning and Land Information Center (SUPLIC hereafter) has been a key entity in developing local government GIS. The SUPLIC, founded in 1993, has more than 100 staff members and is the largest government agency of its kind in Shenzhen. The technology development in the

SPULIC has no doubt been influenced by its organizational context and by the local sociopolitical conditions, such as the monopoly control of spatial resources by the planning bureau in local government, the strong financial support of the organization and the strong leadership (Lin, 2008).

Furthermore, I argue that two major transformations of China's urban governance have played a key role in shaping the constructions and discourses of GIS in urban governments including that of Shenzhen. One is the restructuring of the state, through which the city has emerged as a key player in socioeconomic developments as well as technological developments. The other is the transformation of political rationalities, which is highly related to and intersected with the restructuring of the state. These shaping forces in the case of China are in contrast to the important role of the private sector in local governments' GIS development in Western capitalist societies (see Lin and Ghose, 2010).

The Chinese city has been promoted by the central government as an important economic growth center for the national economy in the reform era, as compared to the city mainly serving an administrative role prior to reform, entailing an important rescaling strategy of state power (Cartier, 2001; Wu, 2002; Ma, 2004; Chung, 2007). As such, cities are left to themselves to attract investment for local development. Hence, cities are competing with each other and are increasingly playing an entrepreneurial role to promote local growth (Wu, 2003). Second, there are challenges for city governments in maintaining more governable urban spaces that become more mobile and diverse resulted from market reforms and rapid urbanization (Ma and Wu, 2005). Third, the central government's policies and plans remain an important force in shaping local politics in China because of the legacy of the centrally-planned system (Ng and Tang, 2004). There are still strong vertical connections between the central ministries and their

corresponding municipal departments. In many respects, while such restructuring of the state in China may share many characteristics with those identified in the devolution of government and governance situated in North American and European contexts (e.g., Ward, 2000; Brenner, 2004; Swyngedouw, 2005), the Chinese case has some significant differences such as these vertical connections noted earlier (e.g., Zhang, 2012).

In particular, Shenzhen has acted as a showcase of China's economic reform and Chinese modernization because of its role as the first Special Economic Zone (SEZ). The SEZ developments were aimed to serve as an experimental field for economic reforms, including the transfer of new technologies and management practices from abroad, which would subsequently be applied elsewhere in China. Shenzhen first served as an export-oriented manufacturing zone and has experienced unprecedented urban growth, growing into a business service center. More recently, the city elites and planners have attempted to build Shenzhen into a "world city," encouraging high-tech industry development as opposed to the earlier emphasis on manufacturing.

Such political economic structural transformations are simultaneously accompanied by emerging new forms of governing rationality. The process of implementing new regulations and building institutions suggests that the way of governance has changed from "a dominant, all-encompassing surveillance to one that is more indirect" (Chung, 2007, p. 792; Saich, 2004; Bray, 2006). In this process, the state power, rather than being hollowed out, re-scales and reconsolidates into lower levels of governance, particularly at the urban scale (Wu, 2002; Cartier, 2005; Chung, 2007). Wu (2002) notes that rapid urban growth creates a vacuum in governance, as the former institutions of direct control (e.g., the work unit system) are dissolving, while adequate alternative systems are not completely ready. In response, territorial organizations

(such as the municipality, ‘urban districts’, and ‘street offices’) are reinvented and consolidated to restore a governable society rather than self-organized local governance (Wu, 2002).

In particular, urban planning, which played a rather subordinate role in the pre-reform era, has revived and been proposed to play a bigger role in city management and socioeconomic development (Ng and Tang, 2004; Wu, 2007). Tang (2000) illustrates how urban planning knowledge has been produced in such transitions addressed above, viewing urban planning as part of the tactics and strategies of the Chinese state to govern the economy and the society (see also Lu, 2006). In the case of Shenzhen, the urban planning and land management sector, which was initially under the same bureau until 2004, has played a fundamental role in Shenzhen’s development (Ng, 2005; Ng and Tang, 2004). Cities and towns, which offer advantages to discipline the collective whole and environment of individuals and enterprises, have gained prominence in the reform era. Simultaneously, urban planners in China are very keen to exploit the emergent role of cities and towns in the national economy and society to raise the societal role of urban planners (Tang, 2000). Associated with this new urban governing rationality, information technology usage has played an increasingly bigger role in the planning agencies.

As such, since the mid-1990s, there has been a burgeoning interest in fostering GIS development in the urban context in which the city government has become the major user (Kong, 2001; Chen, 2004). One important driving force has been the national agenda of “informationization” (*xinxihua*), in which the central state has strived to foster GIS and other IT developments in China (Lin and Ghose, 2010). The policy discourse has started to associate IT development in government agencies with the technology’s transformative role of improving governmental operations and services. It is important to note that this emphasis of improving governmental services facilitated by technological developments is closely related to the

governmental rationality transition to more indirect ways of governing in China (Sigley, 2006). More recently, much attention has been given to government GIS applications in China, in which the urban scale has emerged as an important arena for enacting the national informationization agenda. This is in parallel with the urban restructuring process taking place since the 1980s, which has important implications for authority and power in city governments and thus for GIS use in these state agencies.

In response to the increasing inter-urban competition noted earlier, Shenzhen city leaders have called for more efficiency in its administration, and more detailed socio-spatial information at lower levels for its urban management. Meanwhile, local planners also strive to undertake and represent local planning in a way that fits to the national policy agendas, in order to gain both material and discursive resources for the local development, which implies a scaling up process (see also Lin and Ghose, 2010). GIS and other information technologies are considered a useful means in meeting the above ends, especially to ensure planning implementation and development control. Moreover, GIS also plays a symbolic and political role in urban governance which has implications for the power relations between the central government and local government. I further illustrate these roles of GIS in Shenzhen's urban government and tease out the ways in which they are intertwined with the changing political rationalities in the following section.

4. Roles of Shenzhen's GIS Constructions

The SUPLIC has developed and implemented a range of GIS technologies in Shenzhen's planning agency since its inception. In particular, four major functions of these GIS constructions can be identified, which are automated mapping, data processing, online service

provision, and urban management monitoring. While the major roles of such GIS practices have not been significantly different from those identified in the GIS implementation literature, I contend that it is important to interpret these GIS practices through the lens of the restructuring urban governance and transitioning political rationalities in China. Such an analysis provides a more nuanced illustration of how technological and political rationalities might intersect and mutually constitute one another. I further argue that together these practices constitute a particular form of geographic governance, manifested in attempts to ‘geo-code’ the urban landscape (Rose-Redwood, 2012). This form of governing is perhaps most apparent in the example of the “urban grid information system” development listed in the fourth category outlined above. However, the other three functions help to *pave the way* for enacting such a form of governance.

In particular, on the one hand, there has been a major emphasis on increasing the efficiency of governmental operations with these digital technologies to ‘economize the time for administration,’ which corresponds to the technocratic approach undertaken in China’s urban governance (see Saich, 2004; Tang, 2000) and shares traits of the instrumental rationalities in the “Chicago model” of planning (Sandercock, 1998). In many ways, GIS uses and functions in the planning department reflect an ‘ideology of automation’ (McHaffie, 2002), in order to help accelerate the rate of capital accumulation in the city. On the other hand, GIS development in relation to the recent “Digital City” and “E-governance” discourse in China also points to the goal of improving governmental operations and services facilitated by digital information technologies. These efforts and discourses help to facilitate, directly and indirectly, the large-scale operations of urban management monitoring, through which the geo-coded urban landscape is produced and operated upon. These roles are discussed in greater detail below.

4.1. Mapping automation

One of the major functions of GIS in the SUPLIC has been mapping automation, especially reflected in the development of the Fundamental Geographic Information System. This system was one of the five GIS databases initiated in the early workstation GIS development (Lin, 2008). Upon its final stage of completion, the database consisted of 6870 charts of topographic maps with a total size of 5.78 gigabytes of data. This database includes maps of topography, land use, construction, road networks, and underground utilities (Peng et al., 1998). The data have been frequently updated through regular terrain surveys contracted to survey and mapping companies, while the SUPLIC is in charge of monitoring the accuracy and standardization of the survey results and transferring them into the database.

This system has played an important role in enhancing the work efficiency of the bureau (Peng et al., 1998). Previously in any business operation related to using topographic maps, the staff needed to work with different paper maps of various scales. These manual operations were considered inefficient and susceptible to errors. For example, land record boundaries may mistakenly overlap in the department's land lease procedure (ibid; Interviewee 1, GIS manager in SUPLIC, May 24, 2006). Digitizing these topographic maps and automating this mapping process through this information system would allow the staff to display and overlay multiple digital topographic maps for land-record processing. Such a change has improved the land management, planning management, and property management business procedures in the bureau. This database has also improved the topographic mapping management and updates, such as shortening the update circle and maintaining the timeliness of the database.

Second, this database has fostered inter-organizational data exchange. It has been one of the most frequently requested data sources by other entities (Interviewee 2, GIS staff in SUPLIC, May 15, 2006; Peng et al., 1998). In particular, the urban design and municipal public works entities associated with the planning bureau have been regular users of this database to assist with their master planning, district planning and zoning practices. Recently, various thematic data have also been provided to other municipal bureaus and companies such as the police department, the fire department, the environment protection department, a municipal running water company, and a local telephone company.

4.2. Data processing and speeding up the workflow

One of the frequently stated goals of developing information systems including GIS in the planning bureau has been to increase administrative efficiency. One significant case is the development of the Document Processing Information System (DPIS) (SUPLIC, 2003). The DPIS was launched to facilitate the bureau's "one-stop" administration reform. In this system, the staff can view the progress of related document processing, including who has processed the document. Moreover, a new set of time limits would be designated regarding each business procedure. In order to determine the specific time necessary for particular business procedures, each step of the procedure has to be identified in a definite manner. According to the SUPLIC staff, this explicit time allocation coded into the information system has contributed to speeding up the document processing and standardizing many of the regular business procedures.

As such, the DPIS development has been considered a significant success through automating the major document processing procedures, as it not only saves time for administrative operations, but also increases the transparency of the workflow within the bureau

(Interviewee 3, official in the Shenzhen Land and Housing Bureau, 2006). In particular, the aspect of accelerating the speed of organizational business operations has been emphasized by the planners, which can facilitate and attract more foreign investment (Ng, 2005). Consequently, it is believed that the transaction costs for the overall capital circulation in the city would be reduced. It was reported that three to four months after the implementation of the one-stop service equipped with the DPIS, over 500 foreign enterprises had set up their factories in Shenzhen (ibid, p. 131).

4.3. Online service delivery and E-governance

In addition to internal data transfer and processing, GIS has also been used for direct service delivery to the public, which is increasingly combined with Web-based technologies. Compared to the stand alone information system development, the use of Internet in Shenzhen's planning department is relatively newer. So is the notion of "E-governance" in Shenzhen, which is inseparable from the national promotion of "government-online" project and "E-governance" development. Associated with the "E-governance" discourse is the goal to enhance administrative efficiency and transparency as well as public participation. The SUPRIC has been developing the bureau's official website since the early 2000s. For example, the outcomes of the housing permits approval have been posted online. Another example is the E-petition system that collects citizens' opinions and complaints concerning with urban planning issues. This E-petition and other similar applications such as the "Emailing the mayor" function characterize most of the "E-governance" construction efforts in Chinese cities (Hartford, 2005). In addition, live online question-and-answer discussions between the planners and the citizens on master planning issues have also been undertaken on the official website³.

An E-mapping application has been developed on the planning department's official website with four layers of streets and transit routes, statutory planning information, building names, and the basic ecological control line. It is difficult to assess how often and in what ways this online mapping application has been used by the general public with available evidence. Nonetheless, a local newspaper's report at the time of fieldwork observation provides information about possible interactions between the general public and this application (*Shenzhen SEZ Daily*, April 16, 2006). This report critiqued the lack of updates on public facilities information such as hospitals, police stations and so forth on the E-mapping site. It pointed out that the most up-to-date location information on the E-mapping site is that of the posted enterprises rather than that of public facilities. This article citing citizens' opinions argued that this website maintained by SUPLIC has become "too commercialized." In response, the SUPLIC urged the correspondent unit to update the location information of public facilities. Meanwhile, SUPLC explained to the newspaper that this delay in data updates on public agencies was largely caused by the slower speed of the data provision from these public entities being mapped. In other words, the enterprises would provide more updated information promptly, while the public agencies involved tend to be "slower" in doing so. Overall, in the local official reports, the above technological applications involving the Internet have been considered to facilitate greater public participation.

4.4. Urban change monitoring and decision-making support

As addressed earlier, Shenzhen has undergone tremendous urban growth, which can be reflected in its massive built environment transformation. GIS-related technologies are seen as a critical means to manage urban space and to facilitate urban growth (Ng, 2004). One example is

the “basic ecological control line” (BECL) project initiated in 2005, spearheaded by the planning bureau, working in collaboration with the city’s environment protection bureau. A certain part of Shenzhen, such as the hilly area, forests and wetlands, had been carved out by this BECL (Figure 1), forbidding any new constructions within this zone in the future. In order to further ensure the implementation of the BECL policy, remotely-sensed images were used to monitor land use changes in order to inspect any new constructions in the BECL area. If any “suspicious spots” were identified from these remotely-sensed images, fieldwork would be subsequently conducted to investigate the existence of these constructions. Following the fieldwork, whether or not to take further actions against these constructions would be determined by checking associated historical documents of such constructions in the planning department (for example, if the owner had applied for a permit before the delineation of the BECL). This type of technological development at the municipal level has not been practiced in other Chinese cities before. However, the use of remote sensing data for land use management has been carried out at the national level, such as by the Ministry of Land and Resources. This use of remote sensing and GIS analysis has allowed the government to “govern in a distance” (Rose-Redwood, 2006; Sigley, 1996). The development and implementation of these techniques at the city level initiated by Shenzhen is thus a good example of how these efforts of governing in a distance have constituted urban governance.

Figure 1: Map of Shenzhen Development Plan (2003-2005) (Source: Shenzhen City Government). The green shaded area denotes the protected area carved by the BECL.

Another notable example is the more recently developed “urban grid information system” in Shenzhen. The urban grid information system is derived from a project originated in Beijing, in which part of the city is divided into a set of grids to better manage the urban environments (Chen, 2006). The Ministry of Construction has established an industrial standard based on Beijing’s experience. Various built environment features (such as municipal utilities including sewage wells, street trees, bus stops, etc.) have been coded and recorded as “elements” and “events”. Both within “elements” and “events,” these features are further grouped into the large and small categories. Specifically, the types of the “large category” include: public facilities, roads, urban environment, urban green, housing, other facilities, and the like. Each of these large

categories is further subdivided into small categories. For example, in the large category of public facilities, the small category components include various well covers for sewage, water pipes, power lines, and heating facilities (Ministry of Construction, 2005).

In Shenzhen's grid system, the city is divided into 8,764 grids (*Shenzhen SEZ Daily*, April 17, 2007). Each unit is smaller than the lowest "Community" level and is assigned with a 14-digit code, including the information of the District number, Street Office number, and Community number. A 'two-core' management system comprising a city management monitor center and a city management committee is adopted based on Beijing's experience (Figure 2). In particular, the city management monitor center is responsible for data collection and processing regarding the urban environment management, with data provided by a patrol team on the ground. A centralized database plays a key role in identifying respective city departments to deal with problems discovered by the patrol team. The city management committee is responsible for allocating the tasks delivered from the monitor center to correspondent administrative departments and units. This committee is also responsible for negotiating the relationships among different departments if needed and assessing the outcomes of the operations carried out responding to the issues reported. For example, if a sewage well cover is missing, the patroller in charge of that grid can promptly report this via a specifically designed GPS-enabled cell phone to the city monitor center. With the grid-based coding, the location can be quickly identified, and the Street Office of that district can be called upon to deal with this issue by the city management committee, using the information provided from the monitor center (Figure 2). After the Street Office completes any operations regarding the reported issue, they are expected to report the result back to the monitor center. The monitor center then assesses the outcome and decides whether this could be identified as a 'closed case' or not. All these outcomes are recorded and

summarized through a so-called “Automated Assessment Mechanism” integrated in the computer system. The general public may provide feedback or comment upon these outcomes (*Shenzhen SEZ Daily*, January 8, 2006).

Figure 2: The General Workflow of the “New Urban Management Model” (based on Chen, 2006)

This model of urban management has been highly praised in China as it can provide prompter responses to urban built environment management issues. In particular, the establishment of the independent monitor center and the ‘two-core’ model are believed to break up the traditional compartmentalization of urban management (*Shenzhen Economic Daily*, September 21, 2007). Previously, the urban management issues were undertaken by different city departments. For example, the transportation bureau would be responsible for issues related to road networks and the urban management bureau for “unregulated” street vendors. Lack of coordination or overlapping responsibilities among these city departments were considered as obstacles to providing prompt response to the problems (Chen, 2006; *Shenzhen SEZ Daily*, January 8, 2006). Within this newly established model, the monitor center, equipped with GIS and provided with authority by the municipal government, can exercise significant power in

managing urban environments crossing different departmental boundaries. Numbers suggesting greater efficiency of monitoring these urban built environments have been frequently cited in the media (ibid). As such, this new urban management model has been applauded by the city leaders, and it has been implemented in more than fifty Chinese cities including Shenzhen (*Beijing Daily*, June 6, 2008).

Clearly, GIS technologies have played an important role in monitoring and managing urban environments. This urban management model indicates an interesting shift in the way of governing in Chinese cities. The urban grid information system reflects the efforts of the state power in recreating and governing urban spaces, by which the local government claims to provide “better governance” and ease the tensions between the public and the government due to the “improved efficiency” (Chen, 2006). Moreover, government officials have shown interests in possible overlaying other socioeconomic data (for example, real-estate data, micro-economic data, environmental protection data, and so on) on this urban-grid base (*Nanfang Daily*, July 28, 2006). In this way, “we would have a better understanding of the market, say, the housing market, on a particular location.” (ibid) Creating such urban spaces can thus help to facilitate capital accumulation in the city. This urban grid system model has been applied in many Chinese cities and has caught attention from other cities outside China such as from France, the US, Canada and India (*Beijing Daily*, June 6, 2008). This shift has been accompanied with institutional and organizational changes in urban governance, such as the monitor center in the urban grid management system and the collaboration with other city departments in the biological ecology control line project.

I view such practices of urban monitoring systems as a form of ‘geo-coding the urban landscape’ that aims to administer the urban space for the proper functioning of the government

(Rose-Redwood, 2006; Crampton, 2004). Urban space, in particular, the public built environment, is carved into “more manageable” grids with specific boundaries and coding. Moreover, the efforts of automating the mapping operations and data processing as well as the “E-governance” discourse are not separated from the practice of geo-coding the urban landscape. In many ways, the former has contributed to and constituted the latter. For example, the data collection and management process enabled by the central GIS system housed in the monitor center is necessarily built upon the long-standing efforts of developing GIS and related information technologies in urban government. The discourse of “E-governance” and “Digital Shenzhen” also underpin the discourse of improving urban governance through the geo-coding urban landscape practice. I illustrate the implications of these GIS constructions at multiple levels further in the next section.

5. Implications of GIS constructions: From automating workflows to geo-coding urban landscapes

The preceding analysis has examined the multiple roles of GIS in Shenzhen’s planning agency. These uses of GIS illustrated above have important effects on urban planning knowledge production and power relations at different levels. First, within the planning department, GIS has provided information in a more structured way. According to the staff as well as the senior leaders from SUPPLIC and the planning department, work efficiency has increased under a digital environment. There is also more transparency of workflows, which has modified the traditional work structure of the local authority (Interviewee 3, Official in Shenzhen Land and Housing Bureau, March 3, 2006). The increasing transparency of workflows has been noted as important for the anti-corruption efforts by the local authority (Interviewee 1, GIS manager in SUPPLIC,

May 24, 2006). Such technological developments also have an impact on the composition of the local administration. The GIS staff members have played a bigger role in the urban government for data collection and analysis, training other staff, and maintaining the systems. Nonetheless, some still feel that the so-called “information staff” who would deal with IT and GIS have not obtained a stronger role in participating in decision-making (Interviewee 4, official in Shenzhen Science and Information Bureau, June 15, 2006).

At the municipal level, the planning department’s public image has improved in Shenzhen (Interviewee 5, GIS scholar, August 2, 2006; Peng et al. 1998), particularly with respect to faster service delivery for the business. These technological developments also facilitate greater data accessibility such as the online postings noted earlier. It is claimed that these technological developments have facilitated more citizen participation, for example, informing citizens of planning projects and collecting their feedback. These developments in turn reinforce the position of the urban planning sector in Shenzhen as the “dragon head.”

At the national level, such GIS developments have been packaged to gain national recognition including winning several national awards. The national recognition and the “pioneering role” of Shenzhen are seen as strategically important for local policy makers and planners in a keen inter-urban competition environment. Such national recognition in turn enables Shenzhen to obtain high-profile status from national senior leaders, contributing to Shenzhen’s local development strategy. For instance, after the second China Digital City Expo was held in Suzhou, the local planners and GIS practitioners from Shenzhen felt that with the increasing GIS developments in other Chinese cities, Shenzhen needed to reclaim and maintain its pioneering role in this realm. Consequently, Shenzhen requested to host the third China Digital City Expo, which was subsequently held in 2007 in Shenzhen.

However, several critical issues can be raised with regard to these urban GIS constructions. First, while cost reduction has been frequently associated with the use of information technology, tremendous capital and human resources have been invested in this process, due to the rhetoric ‘inevitable’ technology development. For example, the workstation project cost around 30 million RMB (approximately US\$3.75 million at that time). However, due to the miscommunications among the project teams as well as the lack of skilled staff on GIS, this application performed poorly in the planning bureau. In terms of cost-benefit evaluation, the returns did not always sufficiently justify the expenses. As this interviewee noted, “*Sometimes, it could be a bit waste of money [in developing some information systems] because they are not substantially used*” (Interviewee 6, senior GIS manager in SUPLIC, July 27, 2006). One can argue here that GIS has also played a symbolic role of modernity and efficiency for the public administration (see also Lin and Ghose, 2010).

Second, the notion that GIS and spatial data usage will guarantee better decision making process reflects a technocratic planning culture in SUPLIC. This can be seen in the following internal report which notes that “*We should consider some ways of expanding the functions of the information system [...] so the load of face-to-face interactions can be reduced*” (Internal work report by one Land Resource Office 2001). While this document does not reflect the opinions of all of the local officials, it does convey the strong technocratic traits in Shenzhen’s governing practices. Some of my research informants have recognized the potential problems that arise out of such a technocratic focus in planning. One planner noted, for instance, that some citizens found it difficult to comprehend the topographic mapping, which served as a base map in a planning application. For an average citizen who may not have the requisite technical

knowledge, the use of spatial data can lead to confusion instead of clarity, and adversely affect citizen participation in urban planning.

Third, in the process of GIS development much of the attention has been given to the internal needs of the government agency, while the digital divide among citizens within Shenzhen is seldom addressed. Throughout the years, SUPLIC's GIS practices have prioritized serving the needs of the planning department. As one interviewee acknowledged, "*We are bound up with the internal demands and could not reach out much to the external ones*" (Interviewee 7, GIS manager in SUPLIC, June 21, 2006). For example, the focus of the mapping automation applications has been on facilitating internal administration and assisting related official organizations for planning and urban design. Digital Shenzhen construction is an important strategy to build Shenzhen into a world city. Thus, GIS developments serve more at a level of informing citizens rather than actively engaging citizens in decision-making process, and public participation in urban planning is still very limited. Moreover, while Shenzhen has one of the highest GDP figures in Chinese major cities, its income inequality is very high (*Xinhua News*, May 31, 2006). Therefore, the use of GIT is more likely to empower those who can afford to have access to these technologies or have the necessary knowledge to understand the way spatial data is provided by the local government.

With respect to the larger-scale geo-coding urban landscape practices, the media have highlighted the improved quality of urban built environment management because of this urban grid system implementation and increased satisfactions by the citizens. However, there could be increasing surveillance conducted through this form of urban governance, as addressed by Crampton (2004) in his analysis of GIS usage and mapping practices. Furthermore, situated in China's rapid urbanization and its decentralization of the central government, these practices

facilitate the restructuring of the state power. The emphasis of these urban government technological developments is to control the increasingly diverse urban environments in the face of dissolving work-unit institutions of direct control in reform-era China. The policy makers propose that in the future, an array of social, economic, and demographic data (such as census, housing, and the like) can be overlaid on the urban grid, providing strong potentials for resource management and decision-making (*Nanfang Daily*, July 28, 2006). The population information and the city environment thus can be calculated upon a shared geographic scale in the city, distinct from the previously encompassing population governance by each work unit within the city (Lu, 2006). Such planning knowledge production, in many ways, is underpinned by the instrumental rationality identified in Sandercock's discussion (1998; 2003), while there are discourses of encouraging input from the citizens.

Furthermore, this form of knowledge production and associated processes also underline an increasing role played by urban planning in Shenzhen's urban governance. The more prominent position of urban planning is in contrast to its status in the pre-reform era in China, during which urban planning was subordinated to national economic planning and was mainly to carry out physical designs of capital constructions decided by higher-level government (Leaf, 2005). As Tang (2000, p. 361) points out, in this shift of political rationality in China's urban planning, "it is not the individual enterprise that is subject to surveillance; it is the environment it operates that is to be disciplined." Thus, regulating the urban environment through GIS is the city leaders' strategies of facilitating more fluid capital accumulation. These strategies include the efforts of automation within the administration, such as the "one-stop" service development. Thus the urban environment is also seen as a valuable resource that needs to be properly controlled and exploited. In this way, such GIS deployment helps to constitute more governable,

and perhaps more profitable, urban spaces that are inscribed and coded in the seemingly controllable and efficient layers of objects.

6. Conclusion

Despite the rapid development of GIS in a wide range of social fields including urban governance, there has been little research to trace how these GIS constructions in local government and associated discourses intersect with and constitute governmental rationalities in relation to urban governance. This paper seeks to bridge this gap. Deciphering these dynamics and socio-technological intersections and constructions in the Chinese context is important, as this will not only add to the scarce literature in critical GIS research on GIS constructions in non-Western contexts (Lin, 2008; Lin and Ghose, 2010), but also contribute to discussions in urban geography aiming to unpack and conceptualize various forms and modalities of urban restructuring and governance including those in China (e.g., Sigley, 2006; Wu, 2007; Peck and Zhang, 2013). There have been significant efforts to discuss the extent to which urban restructuring in China can be considered as neoliberal governance derived from the Western contexts (e.g., Zhang, 2012; Wu, 2008; Kipnis, 2007). What is commonly recognized in these debates is that the Chinese case is characterized by its strong state intervention in these political economic transformations, in which the state remains strong political control of the society despite economic decentralization. At the same time, a number of scholars have called for a broader conceptualization of neoliberalization (Brenner et al., 2009) and viewing these possible ‘exceptions’ as a “political rationality” (Ong, 2006, p.3). As such, I suggest that a synthesized analysis approach from the GIS implementation literature, critical GIS, and governmentality is useful in unraveling the complex GIS development process and its effects and implications. I

further illustrate these relationships through the case of Shenzhen situated in China's transitioning urban governance.

China's economic reforms and participation in the global economy have resulted in increasing 'entrepreneurial city' activities (Wu, 2003). Cities have become central sites and entities for capital accumulation and social control, which also have seen increasing development of GIS and other IT in city governments. In the meantime, the persisting central-local political connections remain an important force in China's urban governance. Such a dynamic restructuring of the state power from the national to the municipal reflects a 'Foucauldian regulatory role' (Harvey, 2006, p. 64) of the national informationization and other related national agendas, which supplements mandates and direct commands from the central government. The emergence of GIS development in China's urban governance has been influenced by the intersections of the national ambition of modernizing the state and boosting the economy through IT usage and the challenges of governing an increasingly diverse urban society. Shenzhen is a useful case in revealing such a process, which has experienced dramatic economic growth and rapid urbanization since the 1980s. In particular, Shenzhen's planning department has strived to manage urban growth more efficiently and to facilitate local economic development at the same time, developing and employing a range of GIS and information technologies ranging from data processing to decision-making support.

In particular, I argue that a shift of governing rationality has taken place through the notion of 'geo-coding the urban landscape,' intertwined with these GIS constructions in Shenzhen's urban governance. This form of governing rationality views the urban environment as a whole and leaves more room for urban governance at lower levels, in stark contrast to the earlier governance mode in a strict top-down manner. In this sense, GIS development is both

practical and strategic. With the increasing drive of scaling-down urban governance and associated information requests, GIS and other mapping practices by the urban elites serve as an important instrument to monitor, regulate, reconfigure, and transform the urban spaces for capital accumulation and social control. These practices also contribute to the status of Shenzhen in the Chinese city system, a scaling-up strategy employed by local agencies in a keen inter-urban competition environment.

Conversely, these technical constructions help define and constitute the seemingly more ‘rational, disciplined’ urban spaces. However, in these attempts of modernizing the state, the focus has been largely government-centric rather than citizen-centric. The emerging discourse of ‘public participation’ in China’s urban planning has remained far from being fully realized. Yet, this critical and nuanced analysis has shown that there have been constant requests and active engagement from the general public, putting pressure on the local authority. As such, while GIS tends to empower those that have the expertise in the technology, it is worth noting that GIS also provides possibilities for other forms of knowledge production and contestations from the general public. These findings resonate with other research suggesting that rather than a hollowing-out effect of state power usually found in the Western contexts regarding urban governance, the central-local state relations have been re-worked in China’s urban transformation (e.g., Ma and Wu, 2005; Zhang, 2012). At the same time, this analysis also shows that these GIS constructions, which constitute the efforts of rationalizing urban spaces, are not a monolithic process without contestations.

As such, this study helps to enhance our understanding of how policy discourses and spatial technology developments at various scales might be mobilized, employed and reconfigured in particular sites as well as how they might pervade one another. I therefore call

for more critical analysis of ‘the technological’ and how it might intersect with the political regarding urban transformation and governance in China. Moreover, continuous efforts are needed to investigate how the increasing deployment of geospatial technologies by multiple actors and institutions has played a role in urban governance situated in different contexts. This is particularly imperative considering the most recent emergence of Web 2.0 technologies that allow citizens to record and geo-code the environment as well as their experiences.

Footnotes:

1. The notion of governmentality has several meanings (Dean, 1999). First, it can mark a particular form of modern governmental reasoning that takes as its object ‘the population’ and is coincident with the emergence of political economy. Second, it implies a certain relationship of government to other forms of power, in particular sovereignty and discipline. Third, governmentality seeks to enframe the population within what might be called apparatuses of security. And fourth, it stresses the long process by which the juridical and administrative apparatuses of the state come to incorporate the disparate arenas of rule concerned with this government of the population. This is the process Foucault calls the ‘governmentalization of the state’ (Dean, 1999, p. 18-20).

2. The work unit system (danwei) serves as the basic unit of urban social, economic, and political life in socialist China’s cities, providing its members with housing, free medical care and other welfare services (Bray, 2005, p. 3).

3. For example, the planning bureau has undertaken a live online discussion with the citizen on the Draft of Shenzhen Planning (2006-2010) in March 2006

(<http://www.szplan.gov.cn/main/gzcy/wszbsl/200603240206346.shtml>).

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