Self-organized Urban Growth Shaped by Institutional Rules

Empirical Experiences from Beijing

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Abstract

Beijing, as capital city of China is undergoing a striking fast urban growth process. The increasing dynamics and uncertainties along with it already become a key issue as well as a great challenge for contemporary planning debate. Among the various perspectives, there is an emerging body of research trying to address and solve it by touching upon complexity science. This paper aims to contribute to this debate through an empirical study on case of Beijing urban region. As one of the most developed cities in China, Beijing had experienced tremendous urban expansion over the last thirty years. Meanwhile, Beijing land use plan is featured by a strong control system supported by the Chinese unique land ownership system. This plan performed well in functionality such as urban growth management, preservation of farm land and open space. On the other hand, it created illusions that reality could be well controlled and changes could be well created. In reality however, more and more dynamics outside this powerful plan can be found lately. We'll explore these informal urban land use changes in this paper, with evidence coming from Beijing land use data, two land use plans of Beijing, and interviews on urban planners and private developers. We expect this evidence can indicate potential autonomous changes under a self-organized mechanism instead of controlled reality. Moreover, we have disagreement with the complexity based discussion on this point that a self-organized urban region is totally unpredictable. Instead, we take a perspective called institutional constrained self-organization. The influence of institutional settings on self-organization urban progress could also be found in the empirical study. Through all of these, the influences of both self-organization mechanism and institutional settings on urban growth and their relationship during this urban process can be well analyzed. Then the main concern of land use planning, As one type of institutional power, could be reconsidered and clarified: telling what to achieve and what to avoid.

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1. Introduction

The past decades has witnessed an astonishing urban growth process in China, particularly for some very big cities in the eastern part of the country (Wu & Yeh, 2007; Deng et al., 2010). Beijing, as one representative for this situation, is now one of the most dynamic metropolitan area in the whole universe. The dynamics can be observed extensively: the over flourishing of Beijing urban region, increasing employments and investment, better service in education and health care, convenient information network, abundant daily flow of population, goods and information, et al., all of which leads to large amount of urban land consumption. The expansion of urban land, on the one hand can better meet the urgent demand for more residential, commercial and industrial space; on the other however, acts as trigger to stimulate additional regional development. Therefore, the demand and supply of construction land in Beijing urban region are now positively interacted and mutually promoted, well supporting high-speed growth during this period. This situation greatly benefits from demographic bonus due to regional gradient urbanization, meaning immigrants from both rural areas and other cities are coming national wide. From this perspective, we can conclude that the trend of rapid growth with loads of land consumption in Beijing urban region will also not change in the coming years. The increasing and lasting dynamics create a rather complex situation which becomes a great challenge for both planners and policy makers.

In addition, the increasing negative effects coming along with this fast urban land growth has put sustainable development under high risk. Ecologists and environmentalists remind us that negative effects of this fast growth is ignorable, of which two aspects are most alarming First, increasing tension between sharping decrease of farming land and Chinese farming land regulations. For food safety reasons, China has been long emphasizing on a policy of self-sufficiency food crop. According to this policy, every provincial level region (Beijing urban region is also one of provincial level region), no matter how developed it is, has to conserve certain amount of farming land. What's more, this policy is reinforced by a code named arable land balanced system, which means the exact same amount of arable land as growth of urban land should be supplemented during urbanization process. It in general causes decreasing quality of arable land as in these big cities like Beijing as potential arable land resources are rather limited (Tan, et al., 2005). Secondly, environmental implications of fast urban growth are becoming serious including depletion of natural resources and descending level of underground water (Bao and Fang, 2012; Varis and

Vakkilainen, 2001), air pollution (Wang and Xie, 2009; Chan et al., 2005), traffic jams (Zhao, 2010; Kombe, 2005; Gwilliam, 2003), et al.. Both of the above two negative effects of fast urban growth in practice, also attract research attentions, in order to get in-depth knowledge on urban growth process and find a solution to cope with growing demand for urban space.

If we move one step further to pay attention on the context within which Beijing urban growth is happening, more inspirations could be found. This unique system could be summarized as a strong top-down mandates and a homogeneous urban governance structure (Zhang, 2006; Maskin et al., 2000), as well as a unique land property system (Liu et al. 1998; Li et al. 2010), both of which makes research on Beijing urban growth an additional contribution to current theory and therefore a very hot topic (Wei and Zhao, 2009; Cartier, 2001; Alston et al., 1996). In China, there are two categories of land ownership: state ownership for urban land and collective ownership of villagers for rural land. These two types of ownership however, has a subordinate relation instead of being equivalent. This is firstly because the collective ownership of villagers is not a complete ownership in term of that it is strictly forbidden for utilizing, leasing or selling for non-agricultural use. Urban utilization can only be achieved after transfer of land ownership from collective owned to state owned through a process named requisition. For the loss of land ownership, villagers will get one-off compensation in money or in kind, which according to current national and local standard however, is still rather low and unfair (Ding, 2007; Lichtenberg and Ding, 2009). Besides, the chair of village representative committee who made decisions for villagers collectives act as the bottom level in the Chinese top-down government system and their decisions are largely dependent on higher level government. This makes it clear at least for two points. For the first, two types of ownership in China can be summarized as one as far as urban growth is concerned only if we don't consider growth outside legal context. . And the second, urban growth is in firmly controlled by the top-down government system. The linkage between this top-down structure and land use changes is land use planning, by which distribution and regulation of urban land use are realized. Land use plan is embedded in Chinese top-down governance system and featured by a technical rationale. It is regulations on land use usually for 15 to 20 years. It's main task is for spatial distribution of various land use like industries, dwellings, commercials, et al. and quota of various land use for each lower-level urban region, all of which are mainly pre-determined by a strictly technical planning method system. This state-owned land property system, and the technical spatial planning system together gives a unique context for Beijing urban growth, in term that many western countries on the contrary have private land ownership and dominated communicative planning method.

Right out of the above reasons, Urban growth has been a popular topic in several subjects like urban economics, natural geography, public management and so forth. Topics related with Beijing urban growth also covers a wide range including driving forces, growth mechanism, how planning contribute in urban sprawl, et al.. Much have been much discussed in past research, which is full of diversity with respect of both research focus and methodology. Research basing on the regional and urban economics theories are very much focusing modeling with market factors including demography, economy, transportation, rent, and so forth (Ewing, 1997; Brueckner, 2000, 2001; Anderson & Ge, 2004; Deng et al., 2010). Geographers and planners are quite dominant in urban growth research. Research interests encompass urban land changes (Gaubatz, 1999; Tan et al., 2005), spatial pattern and process (Liu et al., 2002; Gu & Shen, 2003; Deng & Huang, 2004), driving force (Cohen, 2004; Wu & Webber, 2004), urban growth prediction (Chen et al., 2002; Liu & He et al., 2011), and environmental and ecological implications (Chan, H et al., 2005; Güneralpa & Setoa, 2008). In particular, an increasing group of scholars, enlightened by complexity theory, start to use cellular automata model and agent based model recently, making good use of computer science, remote sense and GIS (Chen et al., 2002; Liu and Zhou, 2005; He et al., 2006).

In sum, the above research provided abundant material for this paper. To certain extent, however, they are basing on fact, causes and impacts of urban growth, attempting to explore historical-morphological and spatial characteristics and evidence on urban land use changes of Beijing metropolitan area. Cities are somehow taken as machine when making predictions for spatial-temporal regulated planning and policies, which have profound influences on decision makers. On the contrary, they take little or no account of interactions of stakeholders between different spatial levels, how these macro regulated plan and policies are influencing people on micro-level, how they understand, interpret and respond to them, and ultimately how these responses contribute to the "fact" of urban growth. Factors of economy, proximity, topography and so forth are not the whole story. Although this is largely ignored, we happily find a small part of research touched upon this realm. Zhang's (1997) research provides a number of important insights on mechanism of Beijing urban growth by clarifying the informal constructions in Beijing's older inner city neighbourhoods in urban growth process. Moreover, social equity implications are also taken into account as an inspiration to rethink of the regulatory function of city planning and management. These pieces of work are particularly appreciated because it was an very early in-depth argument on relation between marco-level regulation and local responses although it didn't make this crystal clear. Research from another group of scholars who have strong institutional concerns also shed a light on this debate.

Cartier (2001) argued that inconsistencies in China's land use regime lead to 'zone fever,' arable land loss and real estate speculation. China's decentralized fiscal system and the changing structure of local public finance are also regarded as institutional causes in urban growth (Deng, 2003c). Deng and Huang's (2004) work reveals institutional reasons by making two seemingly contradictory phenomena in Beijing's urban development: development zones and semi-urbanized villages, suggesting the role of uneven land reform in leapfrog growth in suburban area as well as inadequate growth in urban surroundings. It'll be interesting to continue this exploration of macro level institutional influence, in addition to connect self-organization on micro level.

This paper, focusing on urban growth process of Beijing urban region by taking an institutional constrained self-organization perspective, aims to explore the existence of self-organized behaviours within this top-down controlled, technical-highlighted governance style. More than that, interactions between these self-organized behaviours and related institutional settings will also be analysed. Both of the above could contribute to current theoretical debate in both urban growth and complexity theories of cities, as an growing part of planning theory research, as well as suggestions for planners and decision makers in practice.

To achieve the above objectives, the paper is structured as the following. Section two will elaborate the methodology and analytical framework of case study. Section three gives three cases to illustrate different types the self-organized mechanism in Beijing urban growth process, basing on an interview result. In the next discussion part, in depth discussion are made to explore the general characteristics of these three cases and reflect questions in Beijing urban growth process. Also, additional mechanism promulgated in case study are put in a broader arena in the light of self-organization theory, in order to orient this research and also to inform further research directions. The conclusion part will give general brief words on how plan can better work with this additional mechanism being taken into considerations: what to achieve and what to avoid.

2. Methodology

2.1 Perspective

According to an interview on related stake holders, we find additional such a type of growth which is neither in line with policy intention, nor in line with the common technical rationale. Instead of being organized, behaviours of stakeholders seem to be rather emergent and self-property based. self-organized.

This phenomenon could also be well linked to an emerging body of research, trying to address growth and planning issues by touching upon complexity science, or to be more specific, self-organization.

Progress in complexity theories shed a light on planning and urban studies, by providing an alternative perspective and theoretical basis to cope with increasing uncertainties in both urban development and decision making process. According to Portugali (2011), self-organization already Implicitly appeared in the cybernetics writings of McCulloch and Pitts, and then explicitly in studies such as Ashby's psychological discussion on the nervous system and Yovits and Cameron's and Forester and Zipf's studies in the domain of system theory. Nevertheless, dominant opinion on the origin of self-organization, particularly original application of self-organization in urban and regional science, will be referred to related theories since 1960s, mainly including Prigogine's(Nicolis and Prigogine 1977; Prigogine 1980; Prigogine & Stengers (1984) dissipative structures and Haken's (1983, 1991, 2000) theory of synergetics. Although rises in physics, mathematics and cybernetics, gradually it became general methodologies beyond the boundaries of its original domains. Haken's theory of synergetic beyond the domain of laser and fluid, Prigogine's dissipative structures beyond physical-chemical systems (Portugali, 1999/2000). Portugali(2000) himself contributed a lot in applying self-organizations concept in cities and planning. Regional science turned to be an suitable filed to apply self-organization. Application of Prigogine's theory of dissipative structures by Allen and Sanglier (Allen 1981; Allen and Sanglier 1981), who reformulated the static central place theory of Christaller and Losch in the dynamic terms of dissipative structures. The old formulations the landscape reflects an equilibrium state which is the optimized sum of the properties of the various economic forces while the new formulations holds the idea that spatial hierarchical order among the central places is obtained, maintained and then transformed by means of an interplay between interaction and fluctuations, and dissipation. Synergetic theory emphasizes on the interrelations, interactions and synergy among the many parts of the system and its overall structure and behaviour. Weidlich(1994) applied Haken's theory of synergetics to population distribution in cities to create theory of synergetic cites.

Portugalli (2011) summarized theory and research which tries to apply complexity theories into cities as complexity theories of cities (CTC). The domain of CTC already includes a rich body of research on fractal cities (Batty and Longley 1994), self-organization and the city (Portugali, 2000), cities and complexity (Batty 2005), cellular automata and agent base urban models (Benenson and Torrens, 2004), self-organized criticality (Bak and Chen, 1991),

etc. Main achievements of CTC research can be briefly summarized into two aspects. First, it reinterpreted on urban and regional issues which were considered as independent of each other earlier, by using complex networks emerging out of local interactions between urban agents that give rise to the global structure of cities (Portugali, 2010). Second, it added new insights to understanding of cities, inspired by basic properties of complex system such as fractals, self-organization criticality, phase transition, et al.

This paper treats cities as systemic wholes, and scientists and planners as some of the many parts, agents and forces that participate in a complex and spontaneous urban game (Allen, 1997; Batty, 2005; Portugali, 2000). More and more scholars now take this alternative perspectives. Cities are the example par excellence complex systems: emergent, far from equilibrium, requiring enormous energies to maintain themselves, displaying patterns of inequality spawned through agglomeration and intense competition for space (Batty, 2008). Self-organization behaviours in this paper are defined as such a type of local behaviours of stakeholders with the following characteristics: i) they are responses to environmental changes (mainly refer to plan or policy regulations); ii) they are usually not in line with expected effect of regulated policy or plan; iii) they are somehow responsible for large-scale urban structure evolution, which is called contribution to urban development from local-scale decision-making process in terms of principles of self-organization (Batty & Xie, 1994).

2.2 Interview

In order to explore self-organized behaviours on micro scale, this paper adopts an semi-structured face to face interview on various stakeholders with regard to urban growth in Beijing. Under current context in China, public sectors are still very powerful stakeholder (Zhang, 2002). Meanwhile, developers are becoming more and more influential(Güneralpa and Setoa, 2008; Zhao, 2009). Planners as the third force, also have their contribution to some extent although their diverse roles could be either on benefit of government, developers or common people. Therefore, interviewees were selected among these three groups, private developers and government officials are particularly emphasized.

In total, 17 interviewees[4] participated, of which eight are private developers, six are government officials and three are planning specialists (See table 1a). Developer interviewees are from eight different companies, which have significant variance in ownership, organization, scale, developing experiences,

[4]1 of them was interviewed by email and phone call due to an sudden schedule change of the interviewee.

relations with Beijing local officials and so forth (See Table 1b). They can well represent an overall situation of various styles of developing agencies in Beijing. Government official interviewees are from key departments related with growth management. Three of them are from land resource bureau and the other three are from planning bureau, agricultural bureau and industrial part respectively. These 17 interviewees are adequate because hardly any new information can be acquired as number of interviewee increases (See Figure 1).

Table 1a. Basic information of interviewees

	Developers	Government officials	Planning specialists
Number of interviewees	8	6	3

Table 1b. Basic information of interviewees

company names	characteristics	Government department	Number of interviewees
Wanke	biggest real estate company in China	land resource bureau	3
Huarun	Top 10	planning bureau	1
Beijing Chengjian	Top 50, Beijing local state owned enterprise	agricultural bureau	1
Zhongliang	One of the best commercial real estate developer, state owned	industrial park	1
Tianhong	state owned	planners	3
Wukuang	state owned		
Jinxiuzhiye	Small private enterprise		
Qiyeshu	Small private enterprise		

Source: Author compiled. Ranking of real estate enterprises refer Chinese association of real estate.

A preliminary list of items was included in the interview, which covers how stakeholders interpret, understand, respond to certain regulation policy; uncertainties during developing(planning implementation) process and innovative solutions to them; interactions with other stakeholders during a specific developing(planning implementation) process, and so forth. Each item was defined in unambiguous terms. Each interviewee was also informed that information he or she gave would be stored and used in a way that made it impossible to disclose its origin. Specific questions were devised for each specific interviewee according to their characteristics, in order to make them feel relaxed and tell their real feelings as much as possible. Similar questions around the same

item will be skillfully asked in order to confirm the given answers. The interviews lasted from one to three hours. Recording machine wasn't used because most interviewees felt being under surveillance and will talk less. Instead, an assistant helps to take notes while the author is talking with each interviewee. A interview report for each interviewee will organized by the author right after each interview, just to keep the information loss as low as possible.

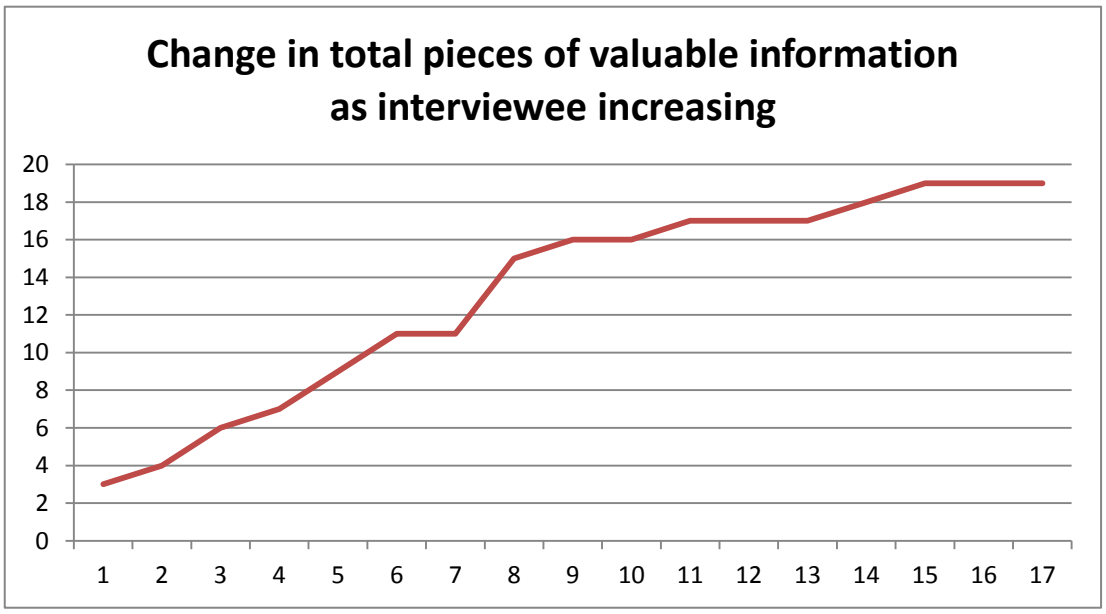

Figure 1. correlation between total pieces of valuable information and number of interviewee

3. Case study: three types of self-organized behaviours

3.1 Case of Dingxiu Community development: contribution from small developers to spatial decentralization of urban area

The past decade was the best times for real estate developers in Beijing in term of spectacular appreciation of house properties. The idea has been repeatedly confirmed by interviewees that over the past years the only secret for making a profit in Beijing real estate market is to buy a piece of land and develop it. The past decade was the worst times for real estate developers in Beijing in term of inconstant regulated policy. The number of potential customers can be reduced to one third in one day because of a new restriction code on real estate market. On February 16th, 2012, Beijing municipal government announced an official document named *restrictive conditions for real estate consumptions*, according to which only two groups people own the rights to buy a house in Beijing urban region. The first group is Beijing local residents with Hukou (household

registration, see Chan & Zhang, 1999) with no more than two house property and the other group is people without Hukou but have been living and working in Beijing more than 5 years with no more than one house property, proved by a 5 years consecutive payment of social security fund. Actually this was not the first time of governmental intervention on real estate market. Similar regulations already appeared early in 2005 and revised, enhanced, adjusted over past years, all of which are aiming to cope with the so called over heated real estate market, trying to stabilize the over fast upward tendency of housing price at least if this trend can't be stopped. However, the real effects of this intervention on one hand, was not that effective as expected and on the other, had more unexpected effects. Dingxiu company's experiences can well illustrate this observation.

Dingxiu company is a small real estate company founded in late 1990s. Although it's clear inferior position when competed with big companies which is both powerful in finance but also in good relation with Beijing municipal government, this company can still acquire steady growth benefit from good market environment. However, this situation have changed since 2005 when intervention from macro level came occasionally. Many defects of this company are magnified under this new context of inconsistent regulation policies such as complicated stock right structure with many small stockholders, weak capacity in financing, lower anti-risk ability, et al.. According to a co-owner of this company, every policy change could possibly push this small company to bankrupt.

In order to cope with this emergency, the company adopted a series of new strategies, which proved to be very effective later. They did a special and deliberate research on the intention and psychology of Beijing municipal government. They found that the local government may also be in a dilemma between housing price control and local economic development. Therefore, from a pragmatic perspective, this regulation will neither be one hundred precents restrictive nor being revocatory soon. So it could be an appropriate strategy to avoid spatial focus of regulation in the central city and look for opportunities in outer space of Beijing urban region. Moreover, they also realized that the close relations between big companies, particular state owned companies and Beijing municipal government, and information, conveniences they got from this relations just took away the slight chance of Dingxiu developing successfully in central city. On the other hand, property of potential consumers has shifted to people who want better housing instead of people for their first house. So preferable product becomes with relatively large space and decent surroundings instead of proximity to business or commercial centres. By taking the above two ideas into consideration, the company made their final response: leave the central city and transfer their developing activities to suburban districts.

In October 2007, after two years preparation with cautious investigation and successful attempts to build cooperative relations with local county government, they got this 310 thousand squares meters piece of land through bidding. This site locates 50 km north from Beijing city centre and 5 km south from Huairou District centre, which in either ways, doesn't follow the proximity rules. Development aiming is relaxing dwellings, totally European style houses coordinated with ecological orientation in land use plan for this region (See Fig. 2). On messo spatial level we can still find many technical functional considerations in selection of this site. In its surroundings, an industrial-research park for Chinese academy of science was already in construction, as well as the new national digital centre of Chinese film and television, together with comprehensive development of Yanxi Lake area all of which provided a promising prospect for real estate development. Nevertheless, this is not the same rationale of Beijing municipality for the real estate regulated policy.

Figure 2. Apperance of Dingxiu residential area

The company confirmed this was a very smart decision by the achievement of more than 20% growth of their company under such a unstable period. However, what they may not know is that many small companies like them which also got survived in the regulated period adopted similar strategies. Moreover, they didn't realize that they have greatly contributed to the diffused and polycentric urban morphology (Zhao, 2009). It's difficult to tell whether the municipal government will like this result or not, nevertheless it is not what is expected effect of intervention on real estate market.

3.2 Case: Maofangchang piece of land: accelerated growth caused by contingent developing decision

In this case the leading role is Huarun, one of the top ten real estate enterprises in China. Unlike small companies like Dingxiu, Huarun is focusing more on strategic development instead of one single profitable opportunity. Therefore, they make plans for developing activities each year, have their spatial priority, keep intensive interaction with government officials and other companies. Normally, decisions for single developing project is made basing on influential factors like profit rate, total investment, risk, relations with local government departments and so forth. However, long term strategy usually has priority when it's not coordinated with the factors mentioned above. An ideal illustration for this argument can be a very influential event in Beijing real estate company: Maofangchang piece of land. An contingent factor becomes dominant in this deal: annual performance of the company in Beijing market.

This case is unique for many reasons: Firstly, Maofangchang plot of land is the largest piece in area since land leasing has been implemented through market approaches. Second, it became prime site in term of the highest dealing price. Seven influential real estate companies in Beijing participated in the auction, one of which has been paying attention to this piece of land for a long time and did quite a lot preparation work in various aspects. Compared with its competitors, this company was willing to accept lower profit in order to win the auction. After 81 rounds bid, however, Huarun company, out of expectations of many involved companies, finally became the buyer of this auction. And dealing price, 2565 million CNY was almost as three times higher floor price of the auction, which also became the new record of single sale. Calculated by the real estate price of its surroundings, there was already hardly no profit could be made out of this piece of land.

Although Huarun refused to admit all stochastic reasons for this seemingly inappropriate decision, asserting that only economic and strategic consideration were taken into account, they didn't deny various sayings from its rivals." they are anxious about annual performance, pressures are coming from headquarters", "they are crazy because they want to avoid being crazier when available developing land in Beijing runs out, which will come very soon". On the other hand, Huarun made an ambitious goal in its strategy for the coming 5 years which seems not to be achieved according to the its performance over the last two years. Therefore, Maofangchang plot of land meant much more than the land itself. So it's not difficult to understand why Huarun would like to win this bid at all cost. It

seemed they took a big risk, but at least they grasped the opportunity to achieve their ambition.

In fact, the difficult situation Huarun faced was not adequate for them to make their final risky decision because this irrational decision could put them into financial trouble. However, it was made anyway, pushed by the urban planning made in 2004 to a large extent. Beijing urban planning basically sketched a regional divergent landscape in land development. According to this plan, the regions Maofangchang plot belongs to is right one the high-tech industry development zone. This fills developers with firm confidence of prospect for regional real estate development. This confidence can be seen according to what a principal of Huarun said:" We believe the promising prospect for this region, we believe government and customers have same beliefs with us. Superiority of this plot of land is comprehensiveness, not only for dwellings, but also for commercial, sports, and financial real estate development. We have the confidence to elevate the value of the whole region through our comprehensive developing activities." A big publicity program was implemented to achieve what he told, including commercials, forum, hype of related regional news, even published a book, all of which is to describe a magnificent future of this region, trying to create an image that this region has great potentiality of real estate appreciation through interactions with potential customers. In addition, only a small precents (less than 20%) of the whole project was developed as first stage, which for Huarun basically achieves two purposes. On one hand, the left part could wait for higher price which is companied with fast urban development process in Beijing. On the other, they not only release to the public an impression but also cause the fact that real estate products in this promising region is in shortage. Through all these interactions, Maofangchang turned to be a big success, companied with the premium of the whole region. The housing price for the first developing area was around 8000 CNY in 2006, and 9000 CNY in 2009. In 2011, this figure turned to be 35,000 CNY.

The demonstration effect of Huarun's case is significant. During last five years, the dealing record of single plot of land in Beijing was broken many times. Before the depression of real estate market in latter half of 2011, people didn't realize how blindness and over-confidence relying on the very high interactive-created expectations. In 2012, many plots of land used to have bidding record, such as Number 14 Baiziwan Road, Number 22 of Tianzhu development zone, were withdrawn due to affordability problems of developers because of more strict credit policy under regulation times. From this case, municipal plan scheme is not only accepted but also utilized by developers as tools to enhance their effort in convincing people with a very high expectation in regional

development, as well as their real estate product. Growth therefore was pulled ahead and speeded up as expectation increased.

3.3 Case: Key town development project: interactions between government departments and its contribution to multi-centred urban growth

This case shows how self-organized behaviour even exists within the top-down government system itself, how policy orientation is continuously adjusted to coordinate with changing realities. In Beijing urban region, there is a four-level urban network in spatial plan: central city, new sub-city, town and new rural community. For the municipal government, there is always a dilemma between efficiency and equity when making development strategies for these four types of urban agglomerations. Therefore for a long time they adopted a easy solution called Administrative Nonfeasance, meaning without putting special intervention for any level. Under such a governance system, as the central city and new sub-city, particularly central city has significant advantages in competing for investment, migrants, technology, et al., it's no doubt development of small town long lagged behind. On the contrary, various government departments of Beijing urban region are also competing for opportunities to extend authority of its own department. As the landscape of authority within central city and new sub-city are very clear and almost steady, mainly charged by land use bureau, housing and urban-rural construction bureau and so forth, there is little chance for any other department to get involved. On the contrary, towns in periphery area become ideal spatial extension for management authority. Beijing agricultural department, making good use of its tradition management authority in rural area, then becomes dominant power in town development. Cooperated with department of Beijing development and reform, a project of 42 key towns development was launched in 2009. This project earns enough attention from the municipal government because it can somehow help decrease the increasing gap between central city and periphery rural areas. Then in order to avoid turning these key towns into residential sleepy parts of Beijing urban region, a very functional development policy came up to instruct these developments: called production first, and then live. With this policy, key towns are encouraged and requested to build their own industry park which can take in adequate employment to turn key towns into urban units with comprehensive functions. Beijing municipal government also carried out a series of additional measures to ensure the achievements of this policy. First, a special financing platform was built for construction of transportation and industry infrastructures. 500 million CNY was financed by municipal government as initial capital; second, most key towns were provided about 100 square kilometres construction land for the construction of industrial

park. Third, several state-owned companies like SANY Group built production centre in town as supportive strategy to help local development.

It's difficult and not the main concern of this paper to evaluate this town policy. However, it's indeed crucial to explore the pros and cons this policy brings in to local development, particularly the unexpected part, all of which are originally resulted from interactions of various municipal government departments. First of all, these supported policy greatly accelerate development of these small towns. And part of them have found their distinguishing characteristics for competition. For example, Caiyu town as famous tourism destination, Xiaotangshan town provides graceful commercial conference places, industrial service base built in Beiqijia town, famous industrial park in Nankou town, et al. Depending on these comparative advantages, the growth speed of these small towns are really beyond expectation. pre-development for cities. E.g. Mapo, Songzhuang, Xihongmen which used to be small town are now part of central city or new cities.

Secondly, development of small towns just explored a bottom-up style of urbanization, significantly absorbed surplus labours in rural area to relieve employment pressure of central cities. Third, the above achievements also contribute to improving villagers' living standard and enhance social equity.

Meanwhile, cons resulted from this town development policy cannot be ignored either. Although there is a financial platform, town development still can't completely solve shortage of investment due to drawbacks of location, infrastructure and other facilities compared with central city. 38 industrial parks were actually set up and most of them were less efficiently operated, homogenization and less sustainability of industries. Besides, due to the specificity of Beijing as the political centre, experimental behaviour not in line with current institutional framework is not welcomed. This also resulted in lower efficiency of these towns when compared with Yangtze river delta area or pearl river delta area.

4. Discussion

Three cases are given to elaborate an additional mechanism in Beijing urban growth process. In the light of self-organization theory, they can be better analysed, compared and understood. If we regard Beijing urban region as an open complex system, the above case then can be seen more in-depth as various emergent local behaviours driven by certain kind environmental changes coming for upper spatial level. Macro institutional rules, local responses, and its

contribution to upper level aggregate pattern, together form a interacted feedback or feed-forward loop (See figure 3).

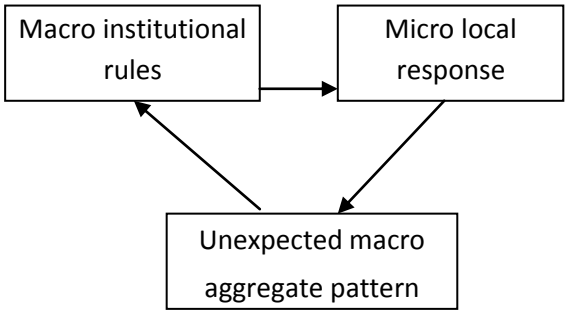

Figure 3. Feedback loops during urban growth process

In all three cases, we see interesting unanticipated aggregate patterns on macro level of urban growth which are actually caused by local interactions and responses between and of various stakeholders. Macro institutional rules or changes of them usually result in certain kind of unexpected local effect. Then local decisions are made as responses, which are rather comprehensive, complicated, even contingent occasionally, however without escaping from the institutional 'rules'. Nevertheless, these seemingly simple rules can still cause various possibilities of complex unexpected aggregate patterns. In all of three cases, elements of self-organized behaviour could be observed.

In Case one, regulation policy on real estate consumption of Beijing municipal government set a simple rule for real estate development and trade: only people with certain qualifications (mentioned in case study) are allowed to buy. This policy is aiming to control the over-speed increasing housing price. However, this policy could result in different unexpected local effects on developers with divergent properties. In our case, this regulation means high risk for developing activities in central city because as a small company, Dingxiu doesn't have either strong financial ability nor a steady relationship with local government, both of which are necessary and crucial conditions to guarantee successful development activities. Therefore, instead of developing with lower price, this small company shift its spatial focus outward to suburban area and put great efforts in product design, in order to attract potential qualified buyers. This process was easily elaborated here but actually cost the company almost 2 years to make the final decision after trying various possibilities like contacting with municipal and local authorities to check the risk of developing in central city, interacted with rivalries, making research on land use plan and people who implemented plan, et al. The decision could be totally different if any main changes during this process happened, which made this very emergent, contingent

and unpredictable. Nevertheless, for this time Dingxiu's moving outward strategy and its many other fellow developers who adopted similar tactics contributed to aggregation of constructions outside central city and act as one important driving mechanism to the fact of a decentralized urban pattern of Beijing urban region (Feng et al., 2009; Cartier, 2011). In the second case, urban planning of Beijing urban region provides public a promising future as well as a divergent growth strategy, following with a snowball effect. They were firstly interpreted by developers as positive signals from Beijing municipal government, which are precious business opportunities. This belief is continuously amplified through peer interactions among developers, real estate customers, and the physical reality of increasing housing price. Higher and higher expectation and confidence about a prosperous real estate market is gradually formed and believed without a shadow of doubt. In practice, this gives rise to irrational investment, particularly when it is combined with individual reasons of real estate company like in Huarun's case the confidence is pushed one step forward due to the pressure of annual performance. The result is, larger scale, faster speed and more in quantity of growth than needed. This could be seen from facts such as the large quantity of real estate stock, the vacancy rate, and land in developer's control without real building, waiting for opportunities of land speculation (Yan and Feng, 2010; Hui and Shen, 2006). Once again, simple rules has dominated the final macro aggregation form through local interactions. In Case three, the institutional rules are not as explicit as the first two. However it's not difficult to find it out when we move our attention to government structure and power relation. As mentioned in the above part, central city development has been long taken charge by several powerful departments, development and reform committee, land use bureau, housing and urban-rural construction bureau and so forth. Other departments like agriculture committee, which according to current administrative structure, are parallel with the above departments, however, with much less management authority. In order to change this unbalanced power landscape, it's necessary to search specific spatial area as base for development. This directly resulted in a series of supportive policy for small town development, particular the industrial parks. The other side of this coin is that the municipal government, as upper level government of these departments, also looks forward a more balanced power landscapes among its sub-sections. Although this feedback forward is rather within horizontal and vertical government departments, but it left physical manifestation in urban growth through pushing forward a multi-centred spatial pattern. Meanwhile, although efficiency of industrial parks in those towns is in general low, facilities and infrastructures built for these industrial parks made those small towns easily merged into the central city as a functional part. It can be regarded as pre-development of central city expansion, accelerating the growth process but also solving part of problems in advance (See Table 2).

Table 2. Mechanism of feedback nodes for each case

Case	Macro institutional rules	unexpected local effect	Local response	Unexpected macro aggregate pattern
Dingxiu	Regulation onreal estate consumption	High risk for developers	Developing moving outside	Decentralization in urban growth
Maofangchang	Master plan on urban growth	High expectation: Over confidence and speculated opportunities	Irrational investment under pressure of annual performance	Faster growth speed
xiaochengzhen	Governance framework and Power balance	Own spatial area for management	Supportive policy for small town development, particular industrial parks.	Multi-centre pattern, pre-development of central city expansion

Here we actually talked two seemingly contradictory elements in urban growth, unpredictable self-organized behaviours and manageable institutional settings. It's necessary to clarify the relation between the two, which can also help us to orient ourselves on a broader arena.

The key to unlock this seemingly contradiction is to pay attention on spatial dimensions. If we conceptualize spatial level into three levels with macro, messo and micro, Beijing urban region as our case belongs to the messo level. Take case 1 as illustrations to explain how behaviours on various level interacts. Beijing implemented a regulation policy on real estate market, as requested by the central government. This can be seen as institutional influence from macro level to messo level. Then this messo level policy subsequently put influences on developers of micro level. Within the framework of policy rules, developers on micro level have to make decisions. It could be made out of expected possible options, also could be created by developers themselves according to their own specific properties or the unique situation they are in. So right on the micro level, it's where the real constrain of institution happens and where the rule shaping self-organization is set. Then thousands of these decisions from individual companies and their interactions contributed to certain kind of physical aggregated pattern in urban growth, which belongs to physical dimension. This is rather result of

self-organization and is too difficult to be predicted. Then there perhaps follows with institutional changes as response to this unexpected physical outcome of the original institutional rules. From this feedback loop we can notice that how wrong or at least inadequate to only pay attention on the relation between physical urban growth and institutional settings on the same spatial level. This is also where the complementary role of the additional self-organized mechanism to current debate on urban growth. Besides the physical and institutional dimension, some scholars also add organizational level in between (Burnes, 2005; Dawson, 1994), which form a matrix together with three spatial levels (See Fig. 4). With this matrix, case study can be oriented and space for research directions are informed as well.

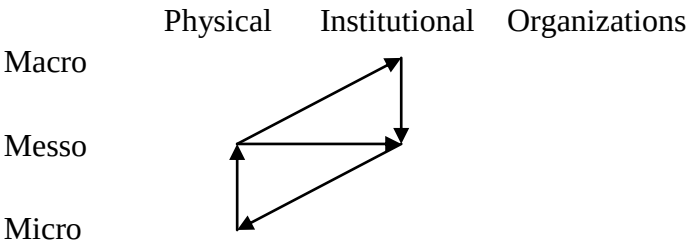

Figure 4. interactions between various spatial scales

5. Conclusion

This paper reported results of three case study, in order to illustrate various types of self-organized behaviour in moment of fast change in Beijing urban region, which is an increasingly important additional mechanism to better understand and cope with this comprehensive and complicated urban growth process. More than that, these self-organized behaviours are not totally unpredictable, but constrained by certain institutional settings and therefore manageable to some extent. The spatial scales matters when physical, organizational and institutional elements interacts among various spatial levels through feedback or feed-forward loops. This complementary mechanism, as we called self-organized urban growth shaped by institutional rules also reminds us to reflect back on current planning: what to achieve and what to avoid.

The pursuit for single causal-relationship in management and planning made decentralized approaches long been ignored or overlooked in China. Inadequate attention on self-organization mechanism leads to various top-down style of regulated policy, trying to create a reality as desired by organizing both changes of reality and behaviours of related stakeholders. This methodology used to be very effective in China during pre-reform times decades ago when economic factors such as labours, finance agencies, fiscal levy, foreign direct investment

were all in strictly control and highly decentralized (Zhang et al. 2012). However, as the Chinese urban system has been turning to become rather dynamic after reform, increasing interactions and networks have been gradually built (Bardhan, 2002). Therefore it's not difficult to understand unexpected results coming out after the regulation policy, which was originally designated to control reality but was inevitably forced to adjust itself to cope with new emergent situations. In order to get out of this trap, the self-organized mechanism in urban growth process should be serious dealt with.

Although the unexpected results of regulated policy could be seen as positive or negative, it's necessary and beneficial for both planners and policy makers to better understand them, in the light of which appropriate urban planning and policy can be improved by enhancing pros and reducing cons, or we can say to be clear of what to achieve and what to avoid.

First of all, the conventional governance idea of single focus in causal relationship, trying to build direct relation between physical growth and institutional settings and trying to use regulation policy to control changes of reality should be adjusted. More attention should be paid on exploring self-organized behaviours on micro level and find out how they were influenced by current planning policy. On the basis of the above, the following can be achieved. Gradually and smartly add incremental intervention on micro behaviour while decremented control on macro level should be reduced meanwhile. Cooperated with this policy orientation, a dynamic in time update system of planning should be built as complementary to current long term land use plan. Last but not least, policy makers and planners should take concerns of interactions between organizational and institutional dimensions, organizational and physical dimensions, and so forth on various spatial levels, Where further research is still needed.

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