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Zhang, Shuhai; de Roo, Gert; van Dijk, Theodorus

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ARTICLE

Urban Land Changes as the Interaction Between Self-Organization and Institutions

SHUHAI ZHANG, GERT DE ROO & TERRY VAN DIJK

Abstract

There is interest among planners in autonomous behaviour and non-linear processes supporting urban development. Self-organization has attracted attention as a potential driver for urban transformations. This paper aims to explore the mechanisms behind urban land use patterns resulting from the interdependence of self-organization and institutions. Our argument is based on an empirical study of two land development cases in urban Beijing. The paper argues that urban land transformations include characteristics of symmetry breaks, self-organizing processes, unintended collective behaviour and spontaneous patterns while simultaneously being institutionally framed. The interdependence between self-organization and institutional rules builds upon a circular causality framework at various spatial levels.

Keywords: urban land use; self-organization; institution; Beijing

1. Introduction

‘Institutions are the rules of the game to a society to collectively live together. Or, more formally, institutional rules are the humanly devised constraints that shape human interaction’ (North, 1990, p. 3). It is impossible to imagine urban space without any institutional design. Although the urban locale is never a fully controlled system, there are plenty of institutional rules that aim to restrict or steer activities. Despite this, urban areas are subject to self-organization processes and unplanned, spontaneously emerging spatial patterns. Self-organization is an adjustment process responding to symmetry breaks and resulting in pattern formation. Such adjustment processes can be found everywhere, in piles of sand (Bak, 1996), in flows of traffic and in urban transformations (Portugali, 1999). Understanding self-organization processes in urban areas supports adapting to unexpected and autonomous processes of land use change. Knowledge of the interdependence between self-organization and institutional rules is an as yet underexplored issue in current research.

Shuhai Zhang, Gert de Roo and Terry van Dijk, Department of Planning, University of Groningen, Landleven 1, 9742 AD, Groningen, The Netherlands. Email: shuhai.zhang@rug.nl; g.de.roo@rug.nl; t.v.dijk@rug.nl

This paper explores this gap in knowledge further, incorporating existing knowledge of self-organization as a process and as a result of other processes, which displays characteristics of pattern formation. Self-organization as a process is neither organized nor controlled by any external power (Heylighen, 2003). Self-organized pattern formation is often the result of behaviours of a number of individual agents responding to conditional change, structural breaks and mismatches between the function and structure of an urban system. Beyond a given threshold, an existing structure breaks, resulting in a reshuffle or adjustment behaviour out of which a spontaneous pattern can emerge at a higher scale level. There is no linear relationship between reaching a threshold (the break's criticality and the energy that went into it) and the pattern that will emerge from it. In other words: the consequence of adjustment behaviour to symmetry breaks within the urban is unpredictable. Self-organization, therefore, contributes to urban areas developing non-linearly.

Self-organization is not a new phenomenon. However, it has hardly ever been applied to urban development and planning (Portugali, 1999). Various scholars have addressed the need for a more detailed understanding of self-organization (political geographers such as Dreier Mollenkopf & Swanstrom, 1995; Lewis & Neiman, 2009; modellers such as Batty, 2005; Torrens & Benenson, 2005). The planning debate has taken various alternative routes, in the early days supporting a command-and-control approach, developing towards communicative approaches in the last 20 years. The 'communicative turn' to planning in Europe in the early 1990s was an acknowledgement of uncertainty. The planning community turned to agreed realities in response to failing, incomplete and unclear factual realities. Consensus on how to view the situation became the new paradigm to work from. However, just like the technical paradigm, the communicative approach to planning did not always yield the desired results, as the conditions under which both technical and communicative planning work are specific and cannot always be met. At the same time, Rittel's (1972) argument about fundamental uncertainty and his 'wicked' problems were rediscovered. These and other arguments stress that coping with uncertainty is as important as investing in and seeking certainty. It means a shift in planning away from a generic frame of reasoning towards a situation-specific approach, which allows alternative views to flourish.

Throughout planning's history, governance and institutional design were considered to be essential to urban development. Only recently has the idea that urban areas could, to some extent, develop autonomously and non-linearly gained support (Kombe, 2005; Kironde, 2006; Verburg & Overmars, 2009). There is also growing interest in debate among various disciplines aligned to planning—such as organizational theory, decision theory and systems theory—within which increasing attention is paid to non-linear, multi-level and plural contexts (Jarzabkowski & Wilson, 2006; Avelino & Rotmans, 2009; Flanagan *et al.*, 2010). This is just one step away from chaos theory and the complexity sciences. Planners used to consider these theories slightly exotic and avoided them. Only the modellers within the planning community (Batty, Torrens, White, etc.) felt differently and had been exploring the potential of non-linear reasoning in their simulations (White, 1998; Batty, 2005). Increasingly many planners are now willing to recognize autonomous behaviour and non-linear processes as supporting

urban development. Self-organization is also attracting attention as a driver for urban land use change (Allen & Sanglier, 1979; Portugali, 1999; Liu *et al.*, 2010). Within the urban, neither institutional development rules nor self-organizing processes are isolated activities. Two questions therefore arise: how does self-organization contribute to emergent urban land patterns while being interdependently related to institutional rules, and how will the answer to this question enhance our understanding of planning interventions in urban areas?

In response, we will critically explore this interdependence between institutional rules and self-organization and their effects on urban transformation, exploring how stakeholders individually interpret, understand and respond to certain regulation policy and spatial plans, how stakeholders interact individually and collectively during the development process, and how this leads to spontaneous change in urban land use patterns.

This paper is structured as follows. Section 2 will briefly elaborate on the conditions under which self-organization can occur in an urban environment, the impact it can have on planning, and the actions, interventions and strategies associated with it. Section 3 explains the case study methodology. Two detailed cases illustrating various self-organizing processes resulting from newly introduced conditions set by local planning authorities in Beijing are discussed in Section 4. Finally, we will argue the importance of understanding, appreciating and adapting to urban self-organization processes, allowing self-organization to play a symbiotic role in interaction with institutional design and planning rules.

2. Applying Complexity Thinking to Planning

Increasing appreciation for non-linear perspectives on development transformation and change also affects the disciplines of spatial planning and urban studies, providing them with alternative views and theoretical bases to address uncertainty in urban development (spatial design) and in decision-making processes (institutional design). Self-organization has been touched upon implicitly in writings on cybernetics by McCulloch and Pitts (Portugali, 2011). More explicit are Ashby's (1962) studies of the relationships between psychology and the nervous system. Yovits and Cameron (1960), and Forrester (1961) studied self-organization in the domain of system theory. Self-organization attracted great attention following Prigogine's introduction of dissipative structures (Nicolis & Prigogine 1977; Prigogine 1980; Prigogine & Stengers, 1984) and Haken's theory of synergetics (Haken, 1983, 1991, 2000).

Although the recent interest in self-organization builds on knowledge which has its origin in physics, it has now gradually come to be studied extensively in various domains (Allen & Sanglier, 1981; Weidlich, 1994). Self-organization and other ideas of non-linearity—such as emergence, adaptivity, co-evolution and transition—are now the subjects of a rich body of research. Research groups focus, for example, on fractal cities (Batty & Longley, 1994), self-organization and the city (Portugali, 1999), cities and complexity (Batty, 2005), cellular automata and agent-based urban models (Chen *et al.*, 2002; Benenson & Torrens, 2004; Liu & Zhou, 2005; He *et al.*, 2006) and self-organized criticality (Bak & Chen, 1991). Aspects of non-linearity are also being explored in the fields of planning and

institutional design (Byrne, 2003; De Roo, 2010; Boonstra & Boelens, 2011; Rauws & De Roo, 2011).

Spatial dimensions help knit institutional rules, symmetry breaks and the spontaneous pattern together. Macro-level institutional rules controlling specific spatial changes in many contexts can only exert limited direct control over actor behaviour. Instead, these changes create symmetry breaks and mismatches, but also the possibility space to allow actors to respond to symmetry breaks and mismatches creatively. Stakeholders at the micro level interpret, understand and respond to institutional rules in their own ways and interact with other stakeholders, which creates spontaneous urban land use patterns at the meso level. These ‘institutionally’ unanticipated urban land use changes at the meso level ultimately result from local interactions and responses between and from various stakeholders, though induced by institutional factors. Macro institutional rules, local responses and their contribution to the aggregated urban land use pattern are all interdependent. They form a framework with feedback and feed-forward loops (see Figure 1).

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’ (Portugali, 2011, p. 278). We consider this complex and spontaneous urban game to be a mix of intentional and unintended actions and motions. In other words, urban development is the result of a set of institutional rules and autonomous behaviours. Both are very real and influential. Therefore, both matter. Consequently, self-organization and intentional planning efforts are the two parts of the same game. Sometimes, the game is dominated by the former, while at others, it is conditioned by the latter. In abstraction, we could consider a spectrum of contingencies with two extremes: self-organization and intentional interference through planning.

FIGURE 1. Framework of the self-organization process in this paper. *Source:* Author’s own.

3. Research Methods and Case Background

Self-organization needs to be explored in action in a fast-growing city such as Beijing, which is known for its strict planning regime. This will demonstrate that self-organization is far more common than previously thought, which underlines that self-organization should somehow be made part of planning concern. It also bridges spatial policy and institutional design with self-organization processes occurring in an urban environment. To reveal the urban land use patterns resulting from interactions between institutional regulations and self-organization, we have to acquire information from related stakeholders. In the current context in China, public sector actors remain very powerful stakeholders (Zhang, 2002), though developers are becoming increasingly influential (Güneralpa & Setoa, 2008; Zhao, 2010). As the third force, planners also have their contribution to make to some extent, although their diverse roles could either benefit government, developers or the public. To explore this, we prepared illustrative case studies from Beijing, supported by interviews. We gathered information by interviewing actors on the reasons behind the development of recently developed sites. Semi-structured face-to-face interviews were conducted with various stakeholders on the micro-level determinants of urban growth in Beijing.

In total, seventeen interviewees¹ participated, eight of which were private developers, six government officials and three planning specialists. Developer interviewees were from eight different companies, with significant differences in ownership, organization, scale, development experience, relations with local officials from Beijing, etc. (see Table 1). They represent various types of development agencies in Beijing. Government official interviewees were from key departments related to growth management. Three were from the land resource bureau and three more interviewees from the planning, agricultural and industrial bureaus. The interviews were conducted as follows.

A preliminary list of items was used to structure the interviews. Each interviewee was informed that the information he or she provided would be stored and used in such a way that disclosing its origin would be impossible. Similar questions on the same item were asked to confirm the answers given. The interviews lasted from one to three hours. An assistant took notes while the author spoke with

TABLE 1. Basic information about land developers

Company names	Characteristics
Wanke	Biggest real estate company in China
Huarun	Top 10
Beijing Chengjian	Top 50, Beijing local state-owned enterprise
Zhongliang	One of the best commercial real estate developer, state-owned
Tianhong	State-owned
Wukuang	State-owned
Jinxiuzhiye	Small private enterprise
Qiyeshu	Small private enterprise

Note: The ranking of real estate enterprises is in line with the Chinese real estate association.

Source: Author's own.

each interviewee. An interview report for each interviewee was prepared by the author immediately after each interview, to minimize information loss.

Being an explorative case study to identify the reasons underpinning urban development, the interviews were meant to be representative, to enable the reconstruction of illustrative examples of actor behaviour and their spatial outcomes. The interviews provided the material to analyze the three cases presented in Section 5.

4. Case Analysis

4.1. Physical and Institutional Contexts

We focused our analysis on urbanization processes in Beijing, China. This enables us to identify self-organization processes in societies that are considered to be heavily regulated. The last few decades have witnessed unprecedented urban growth in eastern China (Wu *et al.*, 2007; Deng *et al.*, 2010). Beijing is one of the most prominent and consequently one of the most dynamic metropolitan areas in the world. Its dynamics are manifold: the rapid expansion of the Beijing urban region, the increasing investment and employment, the increase in education and healthcare services, the strong and highly accessible information networks, the increasingly wealthy population, the exponential increase in goods and traffic flows etc., are all having a severe impact on urban land consumption and transformation.

All these aspects are somehow regulated. These regulations order a world that ‘is’, a world full of sectors, with each sector having its own set of rules and tailor-made institutional designs: traffic rules, housing development rules, rules for work, school and healthcare regulation, and so on. While the rules order the world that ‘is’, change is quite a dominant factor within the Beijing urban space. We imagine the continuous creation of symmetry breaks emanating from rules trying to preserve conditions as they ‘are’, and conditions that are in processes of change. The various actors are adapting to these changing situations, taking advantage of newly created chances and opportunities and bypassing emerging constraints and obstacles. We identified some of these symmetry breaks and we explored adaptive behaviour by the various actors which have led to uncontrolled pattern formation within Beijing.

The demand and supply of construction land in the Beijing urban region are being positively and mutually promoted, supporting high-speed growth over an extended period. This situation is, by-and-large, the result of in-migration from rural areas and other cities across the nation. This has resulted in quite complex, intensive and persistent dynamics, which are becoming a great challenge for both planners and policymakers, not least because many natural resources are at risk. Urbanization causes a decrease in the quality of arable land (Tan *et al.*, 2005), groundwater is being overexploited (Varis & Vakkilainen, 2001; Bao & Fang, 2012), the air is polluted (Chan *et al.*, 2005; Wang & Xie, 2009) and traffic is congested (Gwilliam, 2003; Kombe, 2005; Wei & Zhao, 2009; Zhao, 2010).

In terms of the institutional setting, Beijing is characterized by strong top-down regulation and a homogeneous urban governance structure (Maskin *et al.*, 2000;

Zhang, 2006), which is mainly a consequence of and guaranteed by the centre-dominated federal system in China. Higher-level government sets a yardstick to evaluate the performance of local officials, which acts as a political incentive and career objective. Meanwhile, local governments are in principle obliged to accept the tax rates and revenue-sharing rules that higher-level government set (Chen, 2004).

Beijing also functions within a unique land property system (Liu *et al.*, 1998), which stamps its mark on its urbanization. For example, Cartier (2001) argued that inconsistencies in China's land use regime lead to 'zone fever' (the booming of industrial zones in 1990s), arable land loss and real estate speculation. Frederic Deng and Huang's (2004) work exposes institutional motives which reveal two seemingly contradictory phenomena in Beijing's urban development: development zones and semi-urbanized villages.

In China, there are two categories of land ownership: state ownership of urban land and collective ownership by villagers of rural land. These two types of ownership, however, are not equivalent, with collective ownership being subordinate to state ownership. This is firstly because villagers' collective ownership is not complete ownership in that it is strictly forbidden to use, lease or sell such land for non-agricultural purposes. Urban use can only be achieved after transfer of land ownership from collective to state ownership through a process called requisition. For the loss of rural land, villagers receive one-off monetary compensation or compensation in kind, which according to current national and local standards, however, remains relatively low and unfair (Ding, 2007; Lichtenberg & Ding, 2009). A land developer can only lease land for a fixed period (e.g. 70 years in the case of residential land) from local government before it can start any development activities. This institutional setting gives local government a dominant position in urban land supply.

The chair of a village representative committee tends to have dual loyalty. The chair makes decisions for villagers as a collective, but in practice also acts as the bottom level in the Chinese top-down government system. The chair's decisions are largely dependent on the higher government levels. This causes urban growth to be firmly controlled by the top-down government system. The institutional link between this top-down structure and land use changes is land use planning, through which the distribution and regulation of urban land use is realized.

Land use plans are embedded in the Chinese top-down governance system and characterized by a technical rationale. They contain regulations on land use, intended to programme the spatial distribution of various land uses—usually for a fifteen to twenty-year period—such as industry, residential, commercial, etc., and they assign various land use quotas for each lower-level urban region, all of which are mainly predetermined by a strictly technical planning system.

This state-owned land property system and the technical spatial planning system together provide Beijing with a unique context for urban growth and urban control, in contrast to many Western countries, which have private land ownership and which appreciate and apply communicative planning methods to some extent. Nevertheless, as in Western cities, buildings are constructed only if and where developers are prepared to invest.

We will continue by critically evaluating two cases. One is Dingxiu, a case which shows how a change in planning rules compelled various independent actors to change their behaviour, which led to a collective result: a pattern formation. The other case, Maofangchang, is slightly more controversial in the sense that we argue that any plan or idea bridging the status quo with a desired future is a symmetry break or a mismatch, to which actors independently respond by adjusting their behaviour, and pattern formation results as a consequence.

4.2. Dingxiu Community Development Case: How Small Developers Cause Spatial Decentralization

This case shows how local policymaking triggers self-organizing behaviour in the real estate market by small land developers, which has ultimately resulted in a more decentralized urban land use pattern.

The real estate market in Beijing has been growing prosperously for two decades and consequently the average housing price has doubled four times since the mid-1990s. The land developer interviewees expressed repeatedly that the key to profiting from the Beijing real estate market was to obtain land use rights from the municipal government, which exposed an uneven market from which the selling party takes advantage. To calm the overheating real estate market, to restrict speculation on real estate products and to stabilize the rapid increase in house prices, since 2005 the Beijing municipal government has adopted specific policy measures. These policy measures have been revised and enhanced several times since then. According to the latest official policy, *Municipal regulation and control on real estate market* (Beijing Municipal Government, 2011), only two groups of people possess the right to buy housing in the Beijing urban region. The first group comprises Beijing local residents with *Hukou* (household registration, see Chan & Zhang, 1999) and owning no more than one residential property. The other group are people without Beijing *Hukou*, who do not already own a home, and who have been living and working in Beijing for more than five consecutive years. This land use policy has reduced the number of potential house buyers by one third, and reduced the number of houses they can buy to one. The indirect consequences of this land use policy are even more significant than its direct effect, mainly evidenced in two structural changes which can be regarded as symmetry breaks.

First, the municipal land use policy has a spatially heterogeneous effect. The Beijing municipal government is confronted with choosing between housing price control and local economic development. On the one hand, a controlling institution for the real estate market is required by higher-level government to address the public's complaints about housing prices. On the other hand, land use policy would no doubt harm the local economy by reducing the number of potential buyers, which will reduce local job opportunities and revenue income. A solution to this dilemma comes in the form of a partially regulated spatial policy, with an emphasis on regulating the central city, and paying less attention to the urban periphery. Secondly, due to this regulation, most of the people only have one opportunity to buy a house in Beijing, which causes them to be very cautious in the selection of real estate products. This has created a shift in real estate

product preferences away from functionality to quality (a conclusion from interview results). The market has seen a shift favouring relatively spacious and high quality neighbourhoods over proximity to business or commercial centres.

No doubt this spatial policy has obstructed many land developers, small land developers in particular. The policy has forced them either to lower their prices or leave the Beijing market. Some have responded to this land use policy in a third way, which has led to unexpected land use changes.

Dingxiu Company was founded in the late 1990s and is a representative of small real estate companies in the Beijing market. Confronted by this institutional intervention on the real estate market, Dingxiu diagnosed the intentions and psychology of the Beijing municipal government. They became aware of the dilemma mentioned above, and the public's changing preferences in real estate products. We argue that they were confronted with a symmetry break: a change in conditions due to the latest local policy fundamentally altered the business potential of their area of operation, reducing its expected profit yield as a real estate market for house sellers. It caused Dingxiu to develop an alternative option: leaving the central city, transferring their development activities to suburban districts and developing high quality communities.

In October 2007, after two years of preparation with cautious investigation and successful attempts to build cooperative relationships with peripheral local governments, they bid for and acquired a 310,000 m² plot. This site was situated 50 km north of the Beijing city centre and 5 km south of Huairou District centre, and was not subject to geographic proximity rules (see [Figure 2](#)). A nearby industrial research park for the Chinese Academy of Science was already under construction. Further, the new national digital centre for Chinese film and television is to be located here, and the comprehensive development of the nearby Yanxi Lake area provided a promising prospect for real estate development.

Dingxiu's peripheral developments focused on relaxing dwellings and European-style houses, integrated within and supported by the region's natural environment (see [Figure 3](#)). The planned real estate products matched the changed preferences of potential buyers and the company achieved more than twenty percent annual growth (Data source: interview) in a very unstable period.

Dingxiu's response to the local change in land use planning reflects comparable moves made by other land developers. Quite a number of companies like Dingxiu also survived the regulatory restrictions by moving out. The Shijia Guangzhigu real estate project in Huairou district undertaken by the Junjianyulong company, the Shanghewan real estate project in Miyun district developed by the Beijingchengjian company, the Huijingwan real estate project in Pinggu district of the Beijing Shouchengzhiye company, are just a few of a long list of developments and companies that have adopted this strategy. All have opted for similar adjustments regarding their activities in urban land development, moving from the inner city to peripheral districts of the Beijing urban region in response to changes in land use policy. In comparison to residential communities, which have emerged so far on the basis of functionality, these projects relate strongly to specific preferences of the customer. Therefore, they are spatially more extensive: larger area per household, lower density of buildings, higher ratio of green space, a parking space for every single household and advanced security systems.

Location of Dingxiu community and Maofangchang site

FIGURE 2. Location of Dingxiu community and Maofangchang site. *Source:* Author’s own.

FIGURE 3. Appearance of Dingxiu community. *Source:* Author’s own.

Collectively, these land developers have created a prosperous real estate market away from the city centre. Aside from their business success, there is a collective result visible in the rise of alternative and spontaneously emerging land use patterns within the urban region of Beijing: a diffuse, polycentric urban morphology of Beijing (Feng *et al.*, 2009; Zhao, 2010; Cartier, 2011).

4.3. The Case of the Maofangchang Site: Transcending Traditional Patterns of Decision-Making Resulting in Unprecedented Behaviour

Unlike the Dingxiu case, which to some extent is ‘self-explaining’ with regard to self-organization, the Maofangchang case is meant to break barriers of thought. The Maofangchang case is brought forward here to invite us to reconsider ‘symmetry breaks’ as a fundamental step of self-organization. Our argument is to consider the construct of a ‘desired future’ as a ‘symmetry break’ with the reality of today. If this argument is considered valid, even the most basic activity of planners—composing a plan with a desired future and a route towards it—should be regarded as a condition for self-organizing mechanisms. In other words: if so, any planning action regarding desired futures will include (to various degrees) processes of self-organization and non-linear behaviour.

A spatial plan is commonly seen as a means of either giving expression to a future world to be, or to enable agreement on the actions to be taken to realize a plausible world under discussion. The intention behind the plan is to guide (and to some extent to control) actions and interventions. If we shift perspective from factual and agreed realities to a perspective of non-linearity and to an adaptive and self-organizing world, a plan would have to be seen as a mismatch generator: a mismatch between what ‘is’ in reality and what is considered desirable to become. In terms of ‘self-organization’ a mismatch will be followed by adjustment behaviour after criticality has been reached. The impact of this adjustment behaviour is supposed to be non-linear and includes fundamental uncertainty.

Beijing’s land use plan is a statutory institutional rule made by the municipal government. In 2005 a new Beijing land use plan was released to the public, as the formal strategy for Beijing’s spatial future in 2020. The ambition of the plan is immense: Beijing will incrementally develop 587 square kilometres of new construction land over the 15 years to come in order to support its multiple functions as national capital, global city and liveable municipality (Beijing Municipal Government, 2009). Consequently, Beijing’s strategic plan creates a mismatch between ongoing land use developments and newly stated targets. This ‘mismatch’ has caused land developers to adjust their actions and strategies. Huarun Company is representative of these land developers.

Although the strategic plan is no blueprint, it is still concrete enough in its allocation of future land development to be taken seriously by Huarun and many other land developers reconsidering their position in the real estate market and thinking of newly emerging opportunities and threats. Huarun is one of the top ten real estate enterprises in China. Unlike small companies such as Dingxiu, Huarun closely focuses on long-term targets and strategies, while evaluating its structural actions annually. The common project-level factors such as profitability, overall

investments, risks to return on investments and local authority relations, are secondary to its long-term strategy. Huarun is an ambitious company. As such it sought to progress towards high-level targets planned for achievement within the Beijing urban region in the five years from the plan becoming operational in 2005. With respect to its performance in 2004 and 2005, the company maintained a low profile. Therefore, its high level targets were somewhat surprising and seemingly impossible to achieve. A comment from its competitors offers an explanation: ‘they were anxious about annual performance, pressures were coming from headquarters’.

In this situation the issuance of the Beijing urban land use plan and the mismatch it created could be perceived as an opportunity for Huarun to improve its performance in the Beijing market. What we know is that Huarun was—as others were and as was to be expected—triggered into action by the plan, and was eager enough to adapt its policy. What it did, however, was not to change its existing activities to achieve compliance, but to follow a new route to achieve its own desires and needs. Both its initiative to develop a real estate project and its actions to fulfil its obligations were unexpected and out of line with common practice. Nevertheless, the result was copied by many others: a landslide of similar initiatives followed. The first step Huarun made was to bid for the Maofangchang site, at any cost.

This is what happened: Maofangchang is the largest development site in the Beijing urban region since the open-market land leasing policy was implemented in 1988 (For more information, see Ho & Lin, 2003). It is a suburban area outside the fifth ring road, northwest of Beijing’s city centre (see [Figure 3](#)). Seven major real estate companies in Beijing participated in the auction, one of them having had a long-established interest, including long-standing investment in preparatory work. Compared to its competitors, that company was willing to accept a lower profit margin to win the auction. After 81 rounds of bidding, however, the Huarun company bought the site. The price paid, CNY 2565 million, was almost three times higher than the floor price at auction. It was an absolute record for a single sale. Compared to the surrounding properties and the investments made there, hardly any profit could be expected for Huarun.

Only in retrospect does it become clear that Huarun wanted to win the bid at any cost, which was at that time considered by most if not all parties as a move totally out of touch with reality. Huarun compensated for its ‘irrational’ bid for the Maofangchang site mainly through publicity and land banking. First, Huarun undertook a publicity programme, including television commercials, a forum and a series of items in the regional news—even a book was published—all of which described a magnificent future for the region, trying to create an image for potential customers that was too good to deny. The image created was intended to express the region’s outstanding real estate potential. Second, due to its confidence in expected land use in the area, Huarun adopted a land banking strategy. In the first stage less than twenty percent of the Maofangchang site was developed. For Huarun, this meant supporting two goals. On the one hand, the remaining eighty percent of the site could be held back in the expectation that land prices would go up due to Beijing’s rapid urban development. On the other hand, this limited development led to a temporary shortage in real estate products for this

‘promising’ region. Consequently, housing prices rose. In 2006, the price per square metre was around CNY 8000. This figure rose to CNY 9000 in 2009 and all the way up to CNY 35,000 in 2012.² The rise in terms of land and real estate value at the Maofangchang development site was an immediate result of Huarun’s strategy (mismatch between land use plan expectation and land use reality resulted in manipulation and speculation).

Huarun is not the only land developer who recognized the real estate potential of the new land use plan. The Dongba southern site (1105-655), the Shahezhen site (C-X06), Guangqulu 36 and the Qingheying site, to name but a few, are profitable due to the rapid land value increase. The success of companies like Huarun resulted in similar actions and decisions by other land developers. It contributed to land speculation practices and market manipulation in Beijing’s urban region. Since 2006, the sale price record for a single plot of land in Beijing has been broken many times.

Before the depression affected the real estate market in the latter half of 2011, both land developers and house buyers were by and large blind, overly confident and full of expectations. The depression made them aware of the illusions that had been created. In 2012, many previously record-breaking plots, such as Number 14 Baiziwang Road and the Number 22 Tianzhu development zone, were withdrawn due to the developers’ financial difficulties. This development was an immediate consequence of a policy to regulate credit more strictly. The overheated land market began to cool down. No doubt this will again create a mismatch and a new round of adjustment behaviour by quickly adapting land developers.

In retrospect the housing manipulation and land speculation can be regarded as the collective action of land developers. It had massive impact on Beijing’s urban development. The urban development occurred at a larger scale and with greater speed than ever before, creating massively built up areas (see the analyses by Hui & Shen, 2006; Yan *et al.*, 2010). Aside from the housing manipulation and land speculation, this real estate expansion came with some spontaneous features: (1) the unexpected speed of the transfer of land use rights from the municipal government to land developers (urban land use rights expected to be leased for 15 years was transferred in 5 years); (2) the unexpected form (large land parcels far from built-up area, lack of urban infrastructure); and (3) the unexpected process (land speculation with a very slow building process).

This case shows how the urban land use plan proposed by the Beijing municipal government was interpreted by developers as an attractive business opportunity, instead of regarding the plan as a blueprint. The plan created a break between the current land use conditions and the land developers’ expectations. These expectations were cumulatively amplified in the real estate market through peer interactions among developers and real estate customers. This gave rise to unexpectedly high investments, but also to manipulation of the housing market and to land speculation. This change was due to the individual motives and long-term strategies of Huarun and other real estate companies, which had previously been unheard of, and had been overlooked as possibilities. The independent activities of land developers like Huarun, who substantially took the same speculative path, resulted in the formation of a spontaneous pattern of land use expansion in the Beijing urban region, on a surprising scale.

5. Discussion

Assumptions about linearity and the direct causal responses to the intentions of policymakers in spatial plans overlooked the local behaviour of actors who are no longer under the immediate control of the authorities. In Beijing, this resulted in manipulation of the housing market and speculation by real estate developers. Not surprisingly, the relationship between the conditions set by spatial planners and local authorities, and the autonomous actions taken by real estate companies, are being reconsidered. Various proposals for top-down and regulated policies have been launched to try to get a grip on a vastly changing urban environment and on a dynamic real estate market with its various actors and their strategic behaviours. This reconsideration was not meant to bring back the good old days, which are remembered in China as the pre-reform period, with economic factors such as labour, finance agencies, taxation and foreign direct investment all under strict control at state level (Zhang *et al.*, 2012). The urban environment and the markets are far too dynamic to allow a technical and control-driven policy approach. The dynamics, being the result of liberalizing reforms, have resulted in increasing interactions and strong, open and emerging networks which have passed the point of no return (Bardhan, 2002).

We cannot deny that the unexpected outcomes of the independent, strategic and non-linear behaviour of the real estate market have confused policymakers. Originally they had the power to define and control reality. A first response could have been to regain this power by proposing more regulations to reduce uncertainties and autonomous actions. Our point is to consider the opposite, and to take into consideration characteristics of self-organization. These will emerge in any situation which is not fully controlled: a symmetry break reaches a critical point beyond which adjustment behaviour is expected, without also conforming to a guaranteed and well-defined set of expected outcomes.

A spatial plan which proposes a particular future, and which is meant to trigger action instead of controlling parties to participate in the process towards this future, has to be flexible in how it envisions a future will unfold. Only then can creativity in support of the plan and related local developments become an advantage. Actors adjust their strategies, activities and interactions creatively, competing with and imitating each other, under the existing conditions. Therefore, local stakeholders desire conditions under which their activities can take place, resulting in both a fair market and a liveable environment. In a non-linear world in which self-organizing processes are expected along with institutional trajectories, conditions are becoming as important as content and process. Conditions under which content and process co-evolve enable plans to be implemented, the various actors to relate their responsibilities, and processes of self-organization to unfold in support of societal development. Local entrepreneurs, real estate developers, housing constructors and house buyers need the confidence that under these conditions their actions will pay off. Therefore, there are various reasons for planners to consider not only content and process, but also the conditions under which the various actors will be willing to invest in a development area.

In other words, policymakers, planners, real estate companies and local entrepreneurs have to accept that they have to find a synergy between the plan, its

conditions, the spatial products being proposed and their qualities. The various actors have to understand and to appreciate the interdependence between institutional conditions and self-organizing behaviours, and all should have a keen eye for the non-linear processes that might emerge, stressing the positive effects such as producing products people desire, and reducing the impact of negative effects, such as housing market manipulation and land speculation.

This will be a learning process which should allow adjustments to occur, for the better good of all parties involved. This can only be if all parties—policymakers as well as market actors—appreciate the interdependence of institutional design and self-organizing processes, and of actors who trust in each other's capabilities to work mutually together and the conditions under which each can fulfil their responsibilities.

If our argument is followed through, self-organization should not just to be regarded as a physical or material process causing a symmetry break and criticality out of which non-linear adjustment behaviour and pattern formation emerges. Even a spatial plan, still being a conceptual idea, can create a symmetry break which results in a process of self-organization. When are processes of self-organization to be expected? They are the moment when a plan deviates from command-and-control and from being a blueprint to being a set of conditions which constrain and enable the planning playing field. This is what we have seen in Beijing's cases. Within an institutional setting, which has undergone a shift from strong control to a set of guidelines about visualizing the urban future, it allowed self-organization processes to occur. It is relevant to consider the consequences: after creating a criticality, the responses of developers in complying with the conditions of the local land use plan resulted in their following a non-linear route with unexpected results. Our call is for awareness of such unexpected effects due to self-organizing behaviours, as their impact can be substantial, uncontrollable, and both negative and positive.

We have used the two cases in Beijing's urban region to identify mechanisms of spontaneous, unplanned and unexpected urban land use patterns within a policy environment which was traditionally considered to be highly controlled and strictly planned. This unexpected behaviour is a consequence of interdependence between self-organization and institutional rules which allow flexibility and creativity by market parties. Our cases show self-organizing mechanisms which include the following phases of development: institutional change resulting in symmetry breaks between what was and what is being proposed; self-organized behaviour due to the independent actions of real estate actors; and which unintentionally resulted in spontaneous pattern formation as a collective outcome. The increase of economic and spatial dynamics in China after reform shows the relevance of a better understanding of self-organization, not just because of the identified negative effects, but also to appreciate and enhance the positive effects.

We presented these two cases in support of our argument, and we considered carefully the mechanisms of self-organization in situations where outcomes differed substantially from the expected, usual ones. Specifically, a new spatial policy plan created spontaneous, unplanned and unexpected land use patterns in Beijing's urban region. The argument in this paper is that the interdependence between self-organization and institutional rules was not well understood, if at all,

despite this interdependence being very much in evidence. Lacking direct control and the expected linear result, the institutional rules played a role in creating symmetry breaks which triggered adjustment behaviours and non-linear, unpredictable outcomes.

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Notes

1. One was interviewed by email and telephone due to a sudden schedule change.
2. These price figures were acquired from interviews.

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