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Why plans matter for cities

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ABSTRACT

That plans work in urban development is a claim that lacks theoretical and empirical backing. In the present paper, we consider the urban development process as a set of five partially independent streams of problems, solutions, decision makers, locations, and decision situations. When the elements of the five streams collide under some structural constraints and fulfill an energy surplus decision rule, decisions are made. Given this model of urban development in which plans and the planner are embedded, we prove axiomatically that some characteristics of urban development decisions, namely interdependence, indivisibility, irreversibility, and imperfect foresight, or the four I's, are the sufficient condition for the complexity of the city, and that the four I's in turn are the necessary condition for why plans work. The two lemmas together give rise to the theorem that plans work in the face of complexity as manifested by the urban development process. The theorem reached from the axiomatic system provides a theoretical basis on which planning is practiced in the face of complexity and the results might prompt us to return to and focus on plans as the object in planning research.

1. Introduction

We plan for our daily life: when and where to work, shop, play, eat, drink, meet, rest, and etc. In the context of urban planning, we plan for urban development through agenda, vision, design, policy, and strategy (Hopkins, 2001).Though planning is a ubiquitous phenomenon, little has been said about why plans emerge and when plans matter partly because traditionally we view cities as simple and linear systems which tend toward equilibrium (c. f., Byrne, 2003). Planning in such a world is straightforward in effects which are embedded in a set of linear causal links. We now know that cities are complex and nonlinear of which the urban development process is non-equilibrium (e. g., Alfasi & Portugali, 2007; Batty, 2014; Byrne, 2003; Moroni, 2015; Portugali, 2008; Rauws & De Roo, 2016; Yamu, De Roo, & Frankhauser, 2016). More specifically, Byrne (2003) argued for complexity approach to planning as synthesis across knowledge and action, rather than positivist's or postmodernist's approach as extremes. Alfasi and Portugali (2007) proposed a planning system that intends to bridge the separation between planning theory and built environment. Using paradoxes in science, Portugali (2008) listed major planning paradoxes and explained how they came about through the conception of self-organization. Moroni (2015) argued forcefully how we should design planning regulations that adopt the conception of self-organization to cope with urban uncertainties. Yamu et al. (2016) and Rauws and De Roo (2016) identified, both descriptively and normatively as well as theoretically and empirically, the conditions for urban development that view cities as complex adaptive systems and proposed the conception of adaptive planning. The relevant literature is large, but it would be safe to argue that all urban complexity theorists conceive cities as complex adaptive systems that defy traditional linear approaches to dealing with uncertainties and that most such discussions are confined to conceptual debates without concrete operational meanings. Regardless, planning effects in such a world is still ambiguous at best and the nonlinear causal links are hard to pin down.

Imagine a simple world where decisions are independent of each other. There is no need for plans in such a situation because each decision can be considered separately without being referred to other decisions. This is our presumption of the traditional way of problem solving for cities. Thus, housing problems can be tackled ignoring land use and transportation issues. However, most, if not all, urban development decisions are interdependent (Hopkins, 2001) in that solving one problem would cause consequences on others (Rittel & Webber, 1973). It is not surprising that planners view these unexpected consequences as planning disasters (Hall, 1980). What planners do not know is that these disasters come about mainly because of the complexity of the urban development process. As a result, we need to look at cities afresh by considering them as organisms rather than machines (Batty, 2014). This shift in perspective about cities has a significant impact on how we should think about plans. For example, plans and the city are not separate entities; rather, they co-evolve. Plans emerge endogenously from the complex urban system under consideration, rather than being imposed exogenously from outside; therefore, there exists a

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web of plans, rather than a single plan for urban development (Hopkins, 2014). Put differently, the planner as the observer of the city must be embedded in the system, rather than as an external experimenter who attempts to control the city (c.f., Prigogine & Stengers, 1984). All these new insights derived from the new perspective about the city require us to reconsider why plans matter in a complex urban development.

The present paper provides an axiomatic approach to this question of why plans matter in the face of complexity. The central conception concentrates on interdependence, irreversibility, indivisibility, and imperfect foresight, or the four I's that characterize the urban development process (Hopkins, 2001). Cities are no doubt complex systems which are mainly characterized by irreversibility (Nicolis & Prigogine, 1989), but cities are also characterized by agents, mostly humans, who are capable of strategic, adaptive behaviors. In particular, we will prove analytically that the four I's are the sufficient condition of why the urban development process is complex. We then prove deductively that the four I's are the necessary condition under which plans work. Drawing on the two lemmas, we can conclude that plans work in a complex setting; that is, plans matter in a complex system, such as the city. To simplify, throughout the proving process, we consider the city as a set of partially interacting decisions forming a network and a plan is defined here as a set of interdependent decisions. In Section 2, we depict a conceptual model of the city based on which the ensuing proofs are carried out. In Section 3, we set out by introducing some preliminary ideas. In Section 4, we proceed to prove the lemmas and theorem. In Section 5, we discuss some related issues. We conclude in Section 6.

2. The model of urban development

The model of urban development based on which the ensuing proofs are developed is called the spatial garbage can model, or SGCM (Lai, 2006), which has been partially validated empirically (Lai, Kuo, and Yu, forthcoming). The SGCM is an extension of the garbage can model, or GCM, originally proposed by Cohen, March, and Olsen (1972) by adding a spatial element of locations. The GCM is an attempt to capture the essential interacting elements of a complex organizational system by expositing four streams of partially independent streams: problems, decision makers, solutions, and decision situations (or choice opportunities). These four streams of elements meet in a random fashion subject to some structural constraints and if the elements of the three streams of problems, decision makers, and solutions collide in a particular decision situation at a particular time, then decisions may or may not be made, depending on whether the "energy" supplied by the colliding elements exceeds that demanded. In the SGCM, a fifth stream of locations is incorporated into the model in that if problems, decision makers, solutions, and locations each collide in a particular decision situation at a particular time, subject to some structural constraints and the decision rule of positive energy surplus, then decisions may or may not be made. The SGCM view of the city is distinct from that of the traditional urban modeling approach. In a sense, the SGCM view is to look at the city from inside, rather than from outside as perceived by the traditional urban modeling approach and most, if not all, complexity theory-based modeling approaches (e. g., Batty, 2005).

Based on the SGCM, the building blocks of the city are interacting decision situations, or decisions for short. There are numerous such decision situations forming a giant network. The physical environment of the city, such as roads, housing units, infrastructure, and public facilities, is embedded in these decision situations as locations. The structural constraints which confine where activities take place and who are involved, specify the relationships between problems and decisions situations (access structure), solutions and decision situations (solution structure), decision makers and decision situations (decision structure), as well as decision situations and locations (spatial structure). These structural constraints can roughly be considered as institutions. The city perceived this way is a giant, dynamic network of decisions interacting with each other, so that order as manifested by spatial or institutional structures emerges from chaos of seemingly random interaction. The reader is encouraged to consult Lai (2006) for the detailed workings of the SGCM.

3. Preliminaries

Based on the model of urban development as a set of interacting decisions, the following definitions of the relations between the decisions are given.

Definition 1. Dependence relation D

Let x and y belong to a non-empty set of decisions X. x and y are dependently connected, denoted as xDy or $(x, y)\in D$, if and only if the choice in x depends on the consequences resulting from the choice in y, but not vice versa.

Spatially, that the development along a river on a site upstream affects that on another downstream, but not vice versa, shows a dependent relation between the two development decisions. Temporally, that the development on a site early in the development of a human settlement affects the ensuing development, but not vice versa, demonstrates a path dependent relation between the two decisions of development in time. Mathematically, we can define the following relations based on the fundamental relation of dependence.

Dependent relation D:

$(x, y)\in D\bigwedge(y, x)\notin D$.

Converse of dependent relation $\overline{D}$.

$(y, x)\in D\bigwedge(x, y)\notin D$.

Interdependent relation I:

$(x, y)\in D\bigwedge(y, x)\in D$.

Independent relation N:

$(x, y)\notin D\bigwedge(y, x)\notin D$.

In addition, any two decisions are strongly connected if and only if their relation belongs to D, $\overline{D}$, or I. That is,

Definition 2. Strong connectedness

Let x and y belong to a non-empty set of decisions X. x is strongly connected with y, denoted as (x, y) or $(y, x)\in R$, if and only if (x, y) or $(y, x) \in D$, $\overline{D}$, or I.

It is arguably true that the relation between any two decisions in the urban development process falls into one of the four categories which can also be described in game theory (Hopkins, 2001).

In the context of the SGCM as depicted earlier, we assume that if two decisions are strongly connected, then they may have common problems, decision makers, solutions, or locations that could be attached to them. In other words, if two decisions are strongly connected, then they may be competing for problems, decision makers, solutions, or locations. The results of such competition of one decision will cause different consequences that in turn would affect the choices in the other decision. Consider the locational choices of a highway corridor and a shopping mall, both competing for locations with good accessibility. The locational choice of either decision would result in consequences that would affect the choice of the other. Therefore, they are interdependent and thus strongly connected. The same logic applies to the competition for problems, decision makers, and solutions.

In a complex network of decisions such as the city, decisions may be clustered, forming substructures of the system. In the societal context, for example, these clustered sets of decisions can be families, firms, governments, voluntary groups, or any other type of organizations.

Definition 3. Clustered set

Let C_i be a clustered set, $i = 1, 2, \ldots, n$. For any decision $x \in C_i$, there exists a decision $y\in C_i$ so that x is strongly connected to y.

The strong connectedness relation is defined on pairs of decisions. Clustered sets can also be weakly connected as defined below.