City Planning Theory: Incentive Compatible Planning System

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Abstract

Recent trend of population decrease, prevalence of dispersed city structure, global environmental issues and consolidation of municipalities triggered active discussion on the reform of current city planning system in Japan, which was originally established to control disordered expansion of urbanization. Current particular need is the introduction of strong urban management system that may stimulate city structure to a more compact form. For this sake, incentive compatible planning system should be devised so that even “selfish” players in a city are motivated to act in socially benefitting way. Another important planning tool will be dynamic planning commitment, in which some planning decision will be made conditional on certain state, such as population density, user density and/or tax revenue. A new way of social contract between public service sectors and people in an area should be introduced to ensure the quality of social service. Decentralization of planning prerogative has been promoted in Japan. Even though issues of wide-area adjustment have been pointed out, its concrete and effective procedure has not been proposed. Since this can be regarded as a way to internalize external effects, accreditation of such effects and imposing appropriate settlement money among municipalities may resolve the situation.

Keywords: city planning, incentive compatible, dynamic planning, social contract, external effect

1. Introduction

Big tide of change in city planning system has risen in Japan confronting with recent drastic transformation in the society. One notable transformation is the change from population increase to population decrease in Japan. As is shown in Figure 1, the total population reached its maximum in 2005, and now we are in the decreasing phase. This implies that most of cities are now shrinking in population.

Recent trend of population decrease, prevalence of dispersed city structure, global environmental issues and consolidation of municipalities triggered active discussion on the reform of current city planning system in Japan, which was originally established to control disordered expansion of urbanization. Current particular need is the introduction of strong urban management system that may stimulate city structure to a more compact form.

For this sake, incentive compatible planning system should be designed so that even “selfish” players in a city are motivated to act in socially benefitting way. Moreover, new planning measure for dynamic planning should be introduced. For example, dynamic planning commitment, in which some planning decision will be made conditional on certain state, such as population density, user density and/or tax revenue. Related to this, one such method can be a social contract between public service sectors and people in an area.

Decentralization of planning prerogative has been promoted in Japan. Even though the importance of wide-area adjustment has been pointed out, its concrete and effective procedure has not been proposed. Since this can be regarded as a way to internalize external effects, accreditation of such effects and imposing appropriate settlement money among municipalities may resolve the situation.

This paper discusses these issues with some theoretical consideration.

2. Incentive compatibility

Incentive compatibility is the notion that stakeholders have right incentive to participate in the newly designed social regulation of collective decision, implying that participation pays them, in designing the mechanism for social systems (Hurwicz, 1972). This notion became one of basic condition to design economic mechanisms, and vast amount of literature appeared on this issue (Green and Laffont, 1979; Laffont and Maskin, 1982; and Groves and Ledyard, 1987). The essence of this notion is that the stakeholders have incentives to "cooperate" with others, so that the society itself evolves to a better situation.

When we apply this notion to planning, which include (a) planning measures such as planning regulations and (b) setting social goals, incentive compatibility is the coherence between stakeholders' incentives and social goals. For example, suppose that planning authority may want to develop an area in a certain way, and stakeholders in the area do not have incentives to develop in that way under the

specified regulation, then the plan will not be materialized. This means that such a plan is in failure, and we need to modify either its regulation or social goal (or both).

This may sounds rather a matter of course, but when we look back on the city planning in the past, we can easily find out huge amount of plans which are not incentive compatible. City Planning Law and Building Standards Law are two major laws for city planning in Japan. However, the Building Standards Law basically limits its scope of regulation to the minimum level. Naturally, the regulation based on this law is the minimal requirement so that the city does not face fatal disorder. If the planning agency seeks a better state of the city much above the minimal order, and it aims to enforce the land use regulation, then such an effort contradicts to the spirit of the Building Standards Law. Land use zones will be allocated so that land use never exists that is incompatible to the requirement of the zones. This fact makes it difficult to improve the situation of land use allocation through zoning regulation, for basically the problem, which now exists, will last forever. One of the causes of this issue is attributed to the fact that the laws are not designed to intervene in the stakeholders' incentives.

Another example is the master plans. In Japan, municipal governments prepare master plans drawing the ideal future image of the cities. In many cases, the ideal image is drawn from expectation of planning authorities with little consideration of actual possibility of development. A better approach should be to examine if the stakeholders have incentives toward the future image development, if the incentives are weak, then regulation and/or the future image have to be changed.

Incentive compatible planning system is the set of planning measures, such as regulations, subsidy, taxation and other measures like social movement, and social goals, so that stakeholders have incentive to achieve the social goals under the given planning measures.

3. Styles of planning

The styles of planning can be expressed as an optimization problem in an abstract way.

There were a number of ideal city proposals in the past. Garden city idea by E. Howard is one of notable proposals. Usually, ideal cities are proposals that are thought to be the best for the planners. Of course, in proposing the plans, planners may consider the social situation and acceptability to the citizens. But major momentum will come from planners’ belief to reform the society to what they think the ideal state. The basic objective of problem is to maximize planners’ evaluation function of the city. This problem can be expressed as the following abstract form:

Ideal City Problem:

max [evaluation function or ideality of the city for the planner]

with respect to [spatial objects and planning measures].

Citizen participation is promoted in the city planning recently. Citizen participation to planning is regarded as a primary concern in planning, especially for those promoting citizen driven planning movement. This problem can also be expressed as a maximizing problem in the following abstract form:

Citizen Participation Problem:

max Σ_i [evaluation function or ideality of citizen *i*]

with respect to [spatial objects and planning measures].

This form can be thought to be an advanced version of the first problem, for in the first problem the city is optimized only from one person's perspective, but in the current problem all the citizens' perspectives are taken into account. It does not, however, imply that the solution to the first problem is always inferior to the second problem. Citizens, who are major stakeholders, are mostly novices in making plans, and therefore they may astray in making decisions, unless they are well informed and understand important factors and relations and they can make right decisions by not becoming egoistic.

Nowadays, plans are never constructed by only one designer or planner, but many specialists somehow get engaged in planning process. Thus still another style of planning can be expressed as:

Team Planning Problem:

max Σ_i [evaluation function or ideality of professional *i*]

with respect to [spatial objects and planning measures].

These three styles of planning can be extreme cases of how planning is executed, but even now lots of plans are made based on one or combination of the styles above.

4. Incentive compatible planning system

The formulated problems above are not guaranteed to be realized, for it is not evident if the solution satisfies incentive compatibility feature defined above. For example, in case of the ideal city problem, the planner may think the proposed picture is the best, but if the stakeholders are not motivated to develop in the planned manner, the final picture will never be realized in the future. This holds true for the case of team planning problem, if the planner is replaced with the team of planners (or professionals). In the case of citizen participation problem, the realization of the solution is not guaranteed, too. To see this, all we need to observe is that the solution to:

max Σ_i [evaluation function or ideality of citizen *i*]

does not coincide with the solution to:

max [evaluation function or ideality of citizen *i*]

for all *i*.

What will be the right formulation of the planning, then? To ensure the incentive compatibility, the problem of individuals should be embedded in the main problem. To be more precise, the planning problem has to be formulated as follows:

Incentive Compatible Planning Problem:

max [social welfare function or ideality of the society]

with respect to [spatial objects and planning measures]

subject to (individual *i* behaves such that

max [evaluation function or ideality of individual *i*])

with respect to [individual *i*'s behavior]

The objective function of the first maximization problem, social welfare, is not determined clearly here, but if it is the evaluation function or ideality of the city for the planner, then this problem becomes incentive compatible ideal city problem. Likewise, if it is the summation of utilities of citizens, then it becomes incentive compatible citizen participation problem. Finally, if it is the summation of evaluation functions or ideality of professionals, then it becomes incentive compatible team planning problem. The important point here is that the individual optimization problem is embedded in the main problem.

This notion is not new. For example, a standard textbook such as Heal (1986) clearly states the requirement of double optimization problem in dealing with planning problem. Incentive compatibility problem is the optimization problem by introducing incentive condition and thus guaranteeing the feasibility at the sacrifice of optimality without the incentive condition. This theoretical consideration, however, is seldom seriously taken into account in the actual planning process. Of course, stakeholders' behavior is considered in making city plans to some extent. But it is quite rare to simulate several planning measures strictly in examining zoning ordinance, for example, in Japan.

PDSA cycle (Deming, 1986) is said to be used for evolving planning so that the plans are kept compatible with the actual situation. PDSA is the abbreviation of Plan-Do-Study-Act cycle, implying that (1) plan: establish objectives and processes; (2) do: implement the new processes; (3) study (or check): study if the actual result is conforming with the expected results; (4) act: search for the causes that make difference between the actual results and expected results to improve plan for the new

problem; and repeat this cycle. Constant checking may look critical in this cycle, for this yields the clue to improve in this process. However, what incentive compatibility comes into play is not in this phase, but in “plan” phase. In “plan” phase, optimization of planning measure has to be analyzed based on the incentive compatible planning problem.

To explicitly express the process, “plan” phase should be partitioned into several phases. The first phase is to define the sub-problems embedded in the main problem, i.e., to find out the behavioral patterns of stakeholders. This phase can be termed as “submodel setting”. The second phase is to establish the main objective to define the entire planning problem. This phase can be termed as “formulation”. The third phase is to optimize the main objective to search for the best planning measures to implement. This phase can be termed as “optimization of plans”. Explicitly recognizing these three phases, the “plan” phase can approach to the incentive compatible planning.

5. Economic adjustment for incentive compatible system

To achieve the incentive compatibility in a local scale, one practical way is to introduce the externality adjustment system into planning. Recent development in spatial information system led equipment of urban information data base. Detailed analysis of such data can yield quantification of the externality effect of development to residential environment in micro scale.

For example, Gao and Asami (2001) conducted hedonic analysis for detached houses in Setagaya Ward of Tokyo. The derived hedonic equation implied that: (1) If no building in the neighborhood is deteriorated, then the price of house (including land price) per unit site area (termed unit price hereafter) will increase about 58 thousand yen/m^2; (2) If the sunshine duration on the winter solstice increases by one hour, then the price of house will increase about 950 thousand yen; (3) If the site is adjacent to public park, then the price will increase provided that the site area is less than 110 square meters; (4) If the amount of tall tree is abundant, then the unit price will increase about 34 thousand yen/m^2. This kind of detailed information is of particular importance, for it can be applied to the project evaluation in a micro level. For example, in a hypothetical area of detached houses, Gao and Asami (2001) simulated the effect of lot subdivision. The particular example showed that subdivision yields about 620 thousand yen benefit to the owner of the site, but it yields about 2,370 thousand yen loss in real estate value to the neighbors. Such a subdivision has to be blocked in the city planning, for it reduces total social welfare. If this negative external effect is calculated and the amount will be levied on the landowner of the subdividing site, the rational owner will give up subdivision. This is exactly the internalization of external effect due to individual development, and this kind of economic adjustment is potentially effective in controlling the land use. Economic adjustment system should be introduced in planning process, so that stakeholders will consider the effect of their activity to the neighbors.

6. Dynamic planning

Dynamic planning is another direction for the planning system reform. A very traditional way of planning was to fix the future image, and to consider planning measures that effectively guide the development of the city to the future image. This traditional planning style could have been effective, if it is possible to envision the stable future image of the city.

The population continues decreasing, and the attainment of total fertility rate to become above 2.0, to keep the population stable, seems very difficult in the future in Japan. This means that it is impossible to envision the stable future image of a city. Basically cities continue shrinking, and hence gradually the cities will be changing over time. Thus there will be no final image and future images are dynamic by nature. This is why dynamic planning measures should be devised in city planning.

Since population is decreasing in a city, urbanized areas have to shrink as well. However, a city may not shrink as if a big balloon will shrink as air in it will come out. A house may become empty, but it may occur by a variety of reasons, and their occurrence will be somehow probabilistic. Thus counter-urbanized areas will spread in a mosaic manner. The resultant situation may suffer from inefficiency in provision of urban infrastructure and urban public service, leading to a big financial burden to the municipalities. Therefore, new planning tools, that can control the transformation of urban areas to counter-urban areas, are in urgent need.

Expropriation of sites, which are still occupied by houses or other urban land use, will not be financially possible. Thus a realistic solution will be to announce limiting urban service by the municipalities. This can be done in two ways.

One approach will be to limit the duration of urban service. For example, a municipality may announce the snow removal service of community road for next 20 years. Advantage of this approach is that the time limit is very clearly defined, and hence residents can well prepare for the cessation of the urban service. Disadvantage of this approach is that this may not be optimal, for the prediction of social situation for long time, such as 20 years, is not so accurate. Thus unless it is very clear that the area is counter-urbanized within 20 years, this approach may not be the best way.

The other approach will be to set condition on the provision of public service. For example, a municipality may announce to continue the snow removal service of community road, provided that the population density of the area exceeds 40 persons per hectare. The condition can be selected from a variety of options. Another example will be that the municipality keeps operating a certain facility, provided that the number of its yearly users exceeds a certain threshold amount. Still another option is that the municipality keeps operating the facility, provided that the tax revenue plus burden charge collected from the area exceeds a certain level. Advantage of this approach is that the municipality can set rational condition to operate social service, and hence efficient operation of the facility can be expected. If the residents expect continuation of the operation, then they may have incentive to start movement to use the facility, which may contribute the efficient management of the facility. Disadvantage of this approach is that the duration of the operation is not clear from the first, and residents may have difficulty in preparing for its cessation.

These approaches can be thought as social contracts between residents and the municipality. In city planning system in Japan, there are few such social contracts agreed upon. However, to promote efficient urban management to control urban shrinking phenomena, this new type of social system should be utilized more. Citizen participation is often discussed, but this kind of commitment for citizens' side is not well emphasized. For the shrinking age, bilateral commitment for citizens and the municipality may become the key for the urban management.

7. Decentralization and wide-area adjustment

In Japanese city planning system, basically the prerogative of city planning was decentralized to the municipalities. Since the municipalities are the closest public body to the citizens which have administrative power, it is believed that municipalities understand the needs of citizens most among all public bodies. This is why municipalities are selected as the principal agent to make city plans.

If the plan is concerned with spatial structure which may influence only areas in the municipality, then it may be good that the municipality makes the plans. However, if the plan is related to spatial structure, that may influence areas outside of the city, then some form of planning adjustment should be conducted with the affected areas to maintain the conformity of the plans.

Fundamental principle of social decision is that when all the influence is internalized, the group can make the best decision. To internalize the effects, one way will be to let all, that are concerned, participate in the decision process. This may be the best approach if the negotiation cost is negligible. However, in reality negotiation cost is very high, and it can easily become a very inefficient approach. A remedy may be to stipulate the negotiation rule to reduce the negotiation cost.

Another way to internalize the effects is to introduce economic adjustment procedure, such as settlement money system, by quantifying the external effects and letting generators and those affected (positively or negatively) of the external effects will exchange the economic value of the influence. If the quantification is possible in such a matter that the people in the area can agree with the results, and if the process of the quantification is not time-consuming and work-consuming, then this approach will be a very effective way.

Either way may have potential to remedy the current planning system with some practical innovation. However, there is no social system so far that introduces internalization mechanism in Japan.

To overcome this situation, in the traditional system in Japan upper public bodies were thought to play the role to adjust the wide-area issues. For example, prefectures would adjust issues among municipalities, and national government would adjust issues among prefectures. Upper public bodies had the right of intervening in the local plans if there is a concern about wide-area inconsistency. However, Decentralization Package Law changed the system, and now municipalities can decide plans without getting approval from the prefecture. This promotes the autonomy of municipalities, but wide-area adjustment may not work well under this law. Thus two ways for adjustment proposed above should be introduced into the planning legislation urgently.

So far, the discussion was based on the assumption that a municipality can make the right decision for the plans that may affect only in the municipality. However, this proposition is questionable under the current social system in Japan. The main interest of the municipality may deviate from the total social welfare in the municipality.

The mayor of a city may be concerned most with the voting behavior of the citizens, for the election will determine the continuation of the mayor. This implies that the opinion of voters is more made much of than those without voting rights. Typically, those who are doing business but not living in the municipality may have less power than those who are living in the municipality. This may lead to a biased management of the city.

Municipalities are relying on the local tax revenue from the area and national subsidy. There were many national subsidies that have the scheme of matching fund. For example, half of the cost will be subsidized from the national government. This scheme may appear a good policy, for the municipality has to bear the cost and therefore it will not start unnecessary projects to the local community. However, with the subsidy by a half share of the cost, the municipality virtually takes the price for the project being cut by half, and price mechanism gets distorted. Municipalities now have incentive to develop excess amount of public facilities, leading to inefficient management of urban facilities.

A better scheme of the national subsidy will be to give subsidy in package without confining the relationship between the project cost and the amount of the subsidy. If the national subsidy can be designed so that the external effects to outside of the municipality can be internalized, then the subsidy amount should be the bulk subsidy plus the amount of positive externality to other areas minus the amount of negative externality to other areas. This will lead to incentive compatible management of cities as a whole nation. The reform of city planning should not be confined only to the city planning itself but wider area of urban management. The reform thus requires not only for City Planning Law and its “sister law”, Building Standards Law, but also for Local Government Law and Local Tax Law as well.

8. Conclusion

Incentive compatibility in planning is the coherence between stakeholders’ incentives and social goals. The incentive compatible planning system will become the key feature for the planning system from now on. To introduce this feature, simulation step that take into account all the major stakeholders’ behaviors with relation to the possible planning measures. The planning measure, that optimize incentive compatible planning problem, will not have conflict with market force, for the market force is already introduced in the simulation system.

To cope with the urban issues in the era of population decrease, several dynamic planning tools should be introduced to enforce the effectiveness of the incentive compatible planning system. Duration limitation of urban services in the form of social contract between service providers and residents in an area will be one notable tool. Another tool may be the transition zones from high intensity of land use to lower intensity of land use. A wide-area adjustment process should be also

devised to maintain the coherence between small area plans and wider area plans. The reform of city planning system cannot be achieved only in the area of city planning, but reforms of other social systems such as taxation scheme are neccessary.

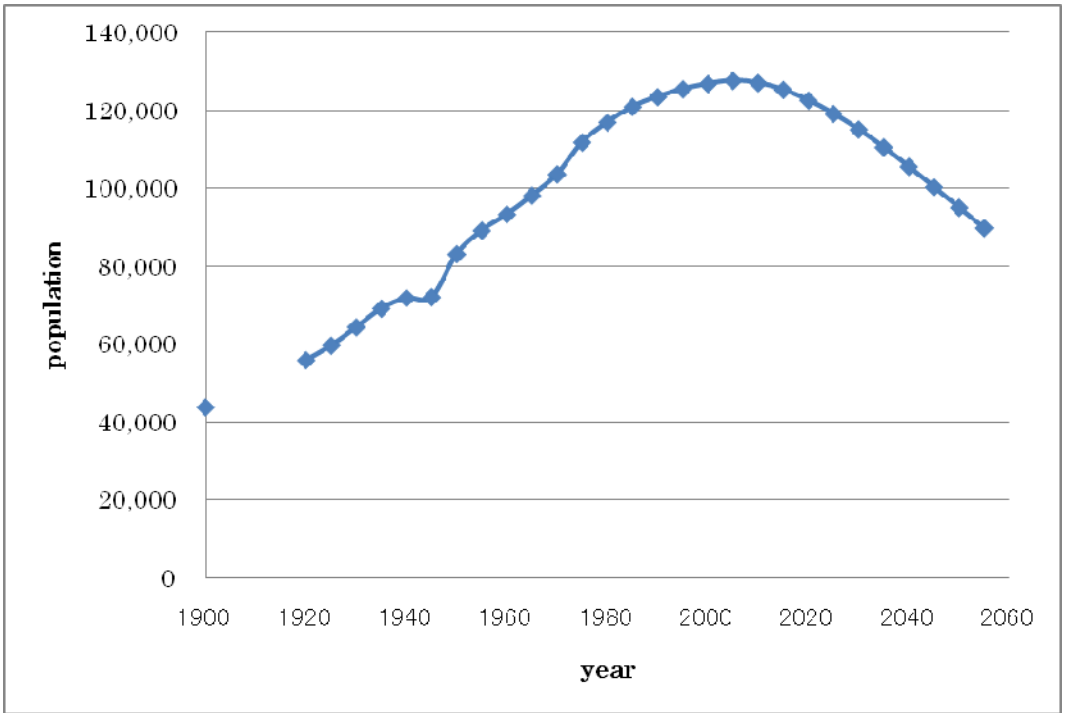

Figure 1: Total population in Japan

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