

SUSTAINABLE LAND USE ZONING IN AFGHANISTAN

Tokai University Student Member○ Osama HIDAYAT

Tokai University Regular Member Yoshitaka KAJITA

1. INTRODUCTION

Alternative land use zoning scenarios provide guidance for sustainable land use controls. This paper studies the urban land use zones mechanism that operates within Japan and Afghanistan. This study focused on an ecologically vulnerable catchment in the cities of Afghanistan, proposed novel land use zoning model, and generated alternative zoning solutions to satisfy the various requirements of land use stakeholders and managers. The paper introduces the term sustainability and urban design. And also this paper address fundamental issues concerning technical and social aspects of Afghanistan zoning system and finally suggest alternative land use zoning models to be analyzed and deliver the better solution for the future zoning system.

Afghanistan is a landlocked country and recently from 2002 by the participation of international communities' developments of large cities in Afghanistan, such as Kabul New City Project, have caused a lot of attention worldwide. Planning of new cities are aimed as long-term beneficial projects therefor the different technical and social aspects has to be examined and select the best suitable for future planning. The below table identifies some general differences between Japan and Afghanistan. Although these differences are interesting to ponder, the thrust of this paper is to explore the different land use models and propose the better urban land use zone strategy for the future.

Table 1. Comparison data of two countries

STAT	Afghanistan	Japan
Area (Land)	647,500 km ²	374,744 km ²
Area (Land Per capita)	19.78 sq km per 1,000 people	2.94 km ² per 1,000 people
Area (Total)	652,230 km ²	377,915 km ²
Climate	arid to semiarid; cold winters and hot summers	varies from tropical in south to cool temperate in north
Average rainfall in depth (mm per year)	327	1,668
Population (density)	39.88 people per km ²	336.72 people per km ²
Largest city (with population)	Kabul - (est. 3,000,000 to 4,000,000)	Tokyo - 12,527,115
Environment (Current issues)	limited natural freshwater resources; inadequate supplies of potable water; soil degradation; overgrazing; deforestation desertification; air and water pollution	air pollution from power plant emissions results in acid rain; acidification of lakes and reservoirs degrading water quality and threatening aquatic life
Forest area (km ²)	8,078	248,648
Road density (Km road per 100 km ² land area)	6 km ²	89.06 km ²
Agricultural land (% of land area)	59.28%	12.76%
National parks (Number of parks)	1	29

2. INTRODUCTION TO KABUL NEW CITY

The Kabul New City, approximately 1.5 times larger than the existing Kabul City, it is mainly located in Kabul province. The major problems resulting from rapid population growth includes very high unemployment rate, housing crisis, and lack of proper infrastructure and pollution of all sorts. The New City project generates hundreds of thousands of skilled and unskilled jobs on temporary and permanent basis, provides around 250,000 housing units, improves the infrastructure of greater Kabul and lessens pollution through eco-system measures. The site for the new city can take a maximum of three million people and utilizes the modern living facilities. The stage one of Master Plan shall be implemented upon cleared land and certain other conditions in 15 years.

3. SUSTAINABLE DESIGN

The word "Sustainable design" has been used everywhere ranging from environmental applications and building technology to transportation and social factors. In urban design sustainability is a holistic mix of all these various aspects, where each of these aspects are mutually interrelated and contribute on its own to the sustainability of the entire area or district.

3.1 Urban design

Urban design is defined as, first, the physical design and planning of the built environment (physical infrastructure, building complexes, spaces and urban areas) in relation to the natural environment in and around built-up areas and second, the production of concepts and models that serve the purpose of guiding the sustainable development of settlements.

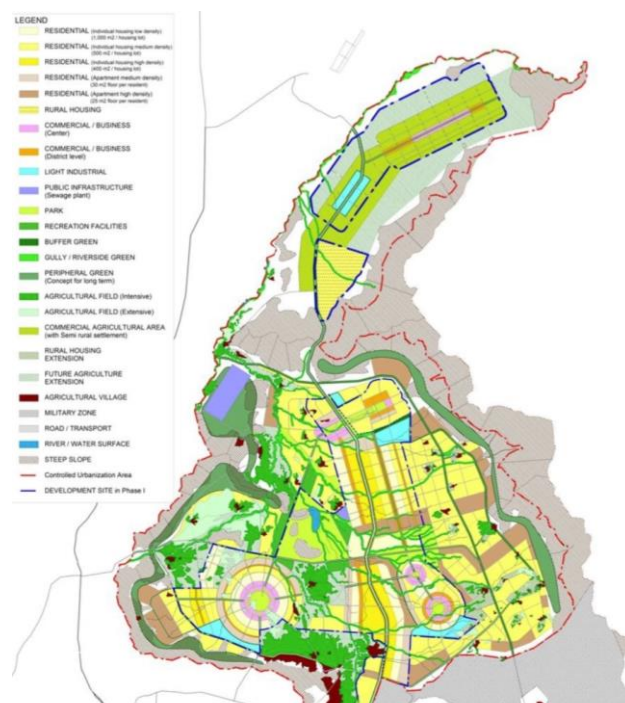


Fig.1 Kabul New City Master Plan

Keywords: Land use zoning, Sustainability, Zoning model, Zoning analysis and Building regulation.

Contact details: 4-1-1 Kitakaname, Hiratsuka-shi, Kanagawa 259-1292, Japan Tel.: 0463-58-1211, e-mail: yokaji@tokai-u.jp

3.2 Parameters of sustainable urban design

Recent research has focused sustainability concerns upon the environmental stock in terms of three main aspects.

- Global ecology
 - air quality, climate, biodiversity, water, land, mineral and energy resources
- Regional resources
 - Air, Water, land, mineral and energy resources
- The human environment
 - Buildings, infrastructure, open space, aesthetic, cultural and built heritage.

According to recent researches it is suggested that urban design for sustainable development should address the following objectives:

- The protection of the natural environment and conservation of natural resources at the local and regional scale;
- The reduction of the impact on the natural environment at the global scale and in the longer term: reducing ecological footprints and achieving balanced production and consumption systems;
- Promoting balanced and appropriate economic development while reducing social inequalities and improving social integration and cohesion
- Promoting the long term health of the citizens.

4. THE URBAN LAND USE ZONING IN AFGHANISTAN

A zoning plan is a legal document that establishes the types of land uses allowed in different parts of the city. Land use standards defined in zoning laws should always be set after analyzing the population's income and the local real estate markets. Housing typologies reflect cultural values and fulfill different demands for different socioeconomic groups; land use standards specified in zoning plans for residential areas should respect this diversity. Unrealistic zoning minimum standards and arbitrary norms imported from other countries force the population that cannot afford them to build illegally. Appropriate zoning techniques can facilitate the determination of land use zones and improve the efficiency of land use management.

4.1 Afghanistan

The land use zones are to provide an orderly arrangement of compatible buildings and land uses, and for the property location of all types of uses required for the social and economic welfare of the community. To accomplish this objective, each type and kind of use is classified as permitted in one or more of the various use districts established by Afghanistan National Standard Authority. Ten categories of Land Use Zone provide a pattern for land-use zoning in each type of urban area:

1. Neighborhood residential
2. Mixed residential/commercial
3. Central commercial
4. District commercial
5. Local commercial
6. Institution
7. Light industrial
8. Reserve
9. Reserve tourism
10. Parks/gullies

This paper explore simulation model in which sustainability factors can be utilized for different scenarios of zoning. There are different land use planning models which analysis different scenarios and evaluate the better one for urban land use planning.

4.2 Problems of zoning system in Afghanistan

4.2.1 Problems of zoning system in technical aspects

- The existing zoning regulation are not analyzed from both the regulatory perspective and the planning perspective
- Zoning system differing in urbanization promotion area and urbanization control area
- Although there are 10 kinds of zones prescribed in the urban planning act and building codes, only a few zones are actually designated and operated
- The excessive relaxation of land use regulation might be revealed through the level of the permitted FAR on buildings in general residential zones.
- The land use zones in the urban planning area are not designated in concurrence with the urban comprehensive plan.

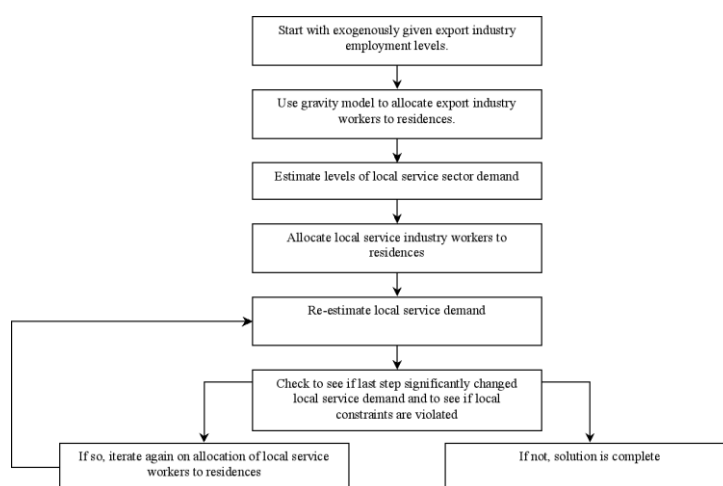


Fig.2 Lowry model planning procedure

4.2.2 Problems of zoning system in view of social equity

- The land price increase generally occurs even without any development activities which impacts on development costs and eventually the social cost increment
- The decision-making processes of zoning are required to be transparent by participating with related land owners.

5. ZONING MODELS

Zoning models deal with describing activities of land consuming actors and their competition for land in an urban setting. These actors are households, firms and retail establishments, each with particular requirements for space and access to jobs, schools and markets.

a. Lowry model: which analyzes the land use allocation based on employment attractiveness, the structure of the Lowry model is shown on the flow chart.

First, the model responds to an increase in basic employment. It then responds to the consequent impacts on service activities

b. Pen-jersey model: is formulated to forecast land use in metropolitan area, is so far the most ambitious practical effort to thus describe the residential land market as based on trade-offs between land and transportation cost.(5)

c. Cluster, opportunity, and trend model (COT): the intervening opportunity model is based only on the presumed desires of people to settle near their jobs, shopping, opportunities, and other resources which characterize population centroids. This model describes three behavioral aspects of the new household location process:

- The cluster component expresses the tendency of people to locate where others have already settled.
- The opportunity component expresses the tendency of people to settle as near as possible to one or more centers of activity.
- The trend component expresses the inertial

Hereinafter a theoretical framework can be assembled that integrates these different perspective. In approaching the question sustainable land use zoning in Afghanistan, there are essentially two ways of proceeding. The first is to generate alternative plans, testing them against whatever battery of performance indicators can be developed, ideally using the tools of cost-benefit analysis. The second, more ambitiously, is to seek procedure for developing optimal plans through defining an appropriate objective function.

5.1 Methodology for selecting land use model

Many of the models mentioned were one time applications at a single city. This paper suggest that the better model to implement should be operational, able to be used in multiple locations and be cost effective.

Table 2. Summary of comparison of three models

Model	Subsystem modeled	Model theory	Policies Modeled
Lowry	employment – population – Housing	Random utility – Location surplus	Land-use regulations – Transportation improvement
Pen-Jersey	Travel – Employment – Population – Land use	Location rule	Transportation improvements
COT	Employment – Network	Network equilibrium	Land use regulation

The proposed zoning model comprises two procedures, modeling the land use zoning problems with goal programming techniques, and searching for the optimal zoning solution by using a modified simulated annealing (SA) algorithm. Figure 3 displays a flow chart of the zoning process.

5.2 Zoning objectives

Sustainable land uses at the Kabul new city area focus on neighborhood protection, facilitating commercial facilities and environmental conservation. Thus, maximum zoning suitability and maximum planning compatibility serve as two land use zoning objectives.

i. Maximum zoning suitability: suitability analysis is a prerequisite of land use planning. The suitability assessment determine the appropriateness of a given unit for a particular zone type and guides the land use based on the evaluated potential of the unit. Assume that u_i is a zoning unit, a_i is the area of u_{ik} , x_{ik} is the suitability value of u_i for zone k , x_{ik} is a binary variable, and $u_{ik}=1$ when u_i is located within the zone k , or else $u_{ik}=0$. Let s denote a zoning solution, the suitability of the whole zoning solution is expressed as:

$$f_1(s) = \sum_{i=1}^N \sum_{k=1}^K u_{ik} x_{ik} a_i, 1 \leq x_{ik} \leq 10$$

ii. Maximum planning compatibility environmental conservation at the Kabul new city area aim at protection the environment from the disturbance of rural and urban land use. The existing planning solutions, e.g., natural preservation planning and urban planning, can provide guidance for the conservation. Thus, land use zones should keep consistent with these planning solutions. Assume A_l denotes the area of the l the existing planning solutions, O_l represents the overlapping area between the optimal zoning solution s and the existing planning solution l , the

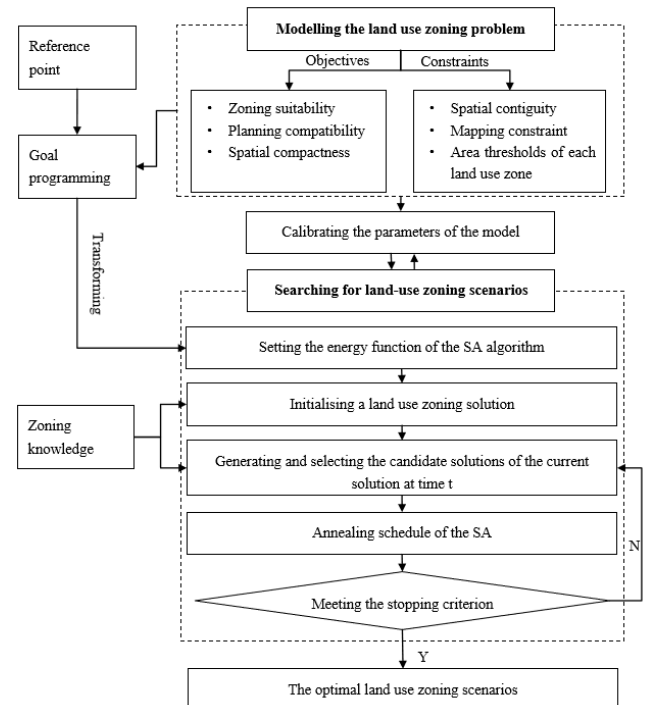


Fig.3. proposed flow chart of zoning process

planning compatibility objective minimizes the conflicting area:

$$f_2(s) = \sum_{l=1}^L o_l | a_l$$

Where is the number of the existing planning solutions. The value of $f_2(s)$ ranges from 0 to L, and the smaller the value is, the higher the planning compatibility is.

6. ZONING ANALYSIS

6.1 Use Zone

The system gives a set of rules concerning different types of land use, including residential, commercial, business and industrial use. Twelve categories of Land Use Zone provide a pattern for land-use zoning in each type of urban area. Each Land Use Zone has specifications concerning the uses of buildings which can be constructed in the zone. Land Use Zones are allocated according to a future vision of land-use pattern.

1. Category I exclusively low-rise residential
2. Category II exclusively low-rise residential
3. Category I mid/high-rise oriented residential
4. Category II mid/high-rise oriented residential
5. Category I residential
6. Category II residential
7. Quasi-residential
8. Neighborhood commercial
9. Commercial
10. Quasi commercial
11. Industrial
12. Exclusively industrial.

After selection the better model the next step is zoning analysis which designate land for a specific use and purpose, moreover restrict the layout and composition of land parcels including:

- a) Heights of buildings b) building setbacks c) green space d) Density e) Type of business

6.2 Restrictions on buildings in the land use system

To describe the standard to which a Structure is to be constructed, in terms of structural, operational and aesthetic aspects including;

Table 3. Restriction on buildings in the land use zone

Use of buildings	Allowable use of buildings is listed in building standard law
Floor area ratio	The maximum ratio of the total floor area to the site area
Building coverage ratio	The maximum ratio of a covered area of a building to the site area
Slant plane restrictions	A height restriction by a plane depending on the distance from the edge of the opposite side of the road adjacent to the site
	A height restriction by a plane depending on the distance from the edge of the adjacent lot lines
	A height restriction by a plane depending on the distance from the edge of the north lot line
Restrictions in low-rise residential exclusive zones	10 or 12 meter height restriction
	Side setback requirement from adjacent lot lines (if necessary)
	Minimum lot sizes (if necessary)

In the past forty years, Japan has experienced great economic growth and has been called one of the fast growing and developing countries in the world and currently Afghanistan is also facing the rapid growth of population in urban areas therefore it is needed to study, analyze and adopt the ideas that are found effective in Japanese land use zoning system.

7. CONCLUSION

The goal of this study is to make optimal and informed choices on the future zoning uses of the land and building regulations. It will be achieved through interactions and negotiations between planners, stakeholders and decision-makers at national, provincial and local levels. It will be on the basis of efficient, comprehensive data gathering and processing in an appropriate storage and retrieval system, through a network of municipalities and/or Cartography head office. The plan will enable all implementing bodies to co-decide on the sustainable, equitable and economic use of the land and follow it through to successful implementation

Land use control system in Afghanistan, which has been based for more than 40 years, should be thoroughly reexamined. Partial modification based on zoning system cannot solve the mentioned issues. To solve the problems, improvement of whole system is urgent. In addition, in-depth analysis of the issues and case study of foreign experiences are also required, as well as effort to draw national consensus among people about the necessity and direction for the improvement.

REFERENCES

www.dcd.gov.af

Berke, P, and Manta, M, Planning for Sustainable Development: Measuring Progress in Plans, Lincoln Institute of Land Policy Working Paper-1999,

<http://www.nationmaster.com/country-info/compare/Afghanistan/Japan/Environment>

Development guideline for Kabul New City in Reference to PDA

http://en.wikipedia.org/wiki/Land-use_forecasting

A.G. Wilson: Land-use/Transport interaction Models, pp. 6.

Kazem Oryani, URS Greiner, Inc. and Britton Harris, University of Pennsylvania (Review of Land Use Models: Theory and Application) pp 87

Alternative zoning scenarios for regional sustainable land use control in China: Yin Xia, Dianfeng liu, Yaolin liu, Jianhua He, and Ziaofeng Hong. pp., 44, 45, 2014

Urban Land Use Planning System in Japan – Ministry of Land infrastructure and transport, pp. 31, march 2007