Environmental Sustainability in Urban Planning - Special Reference to Policy Parameters

Akshey Bhargava, Swati Bhargava, Prablin Kaur, Pallavi Thool

M.tech, Ph.D., LLB, Professor, Department of Civil Engineering, Global Institute of Engineering and Technology, Hyderabad, India

Pursuing master's in Sustainable Environmental Design (SED) AA School of Architecture, London, UK

M.E Environmental Engineering, the Maharaja Sayajirao University of Baroda

Masters in Urban Planning, Assistant Professor at Sinhgad College of Architecture Pune, India

Abstract

Development usually means progressive improvement in human living which is related to and should emerged into planning by effectively putting consciously predetermined public policy in place. Planning should manage human effects upon the natural environment and support to conserve the natural heritage, to restore impaired ecosystems, to maintain material wellbeing, to preserve the cultural heritage, and to represent and moderate the needs of all interest groups. Urban planning is an important tool for the development and use of land, planning permissions, protection and use of the environment, public welfare, and the planning of the urban infrastructure in the form of transportation, communications, and distribution networks. Such an integrated planning should be able to sustain economically, technically, socially, and at all stake holders. An effort has therefore been made by the authors in the present paper discuss urban planning having regard to environmental sustainability.

Keywords

Environment; Urban Planning; Policy Planning, Strategy; Land use Planning; Economic Growth; Quality of Life, Sustainable Development; Planning Institutions; Land use Zoning, Sustainability Indicators

1.0 Introduction

Rapid growth of urban areas leads to environmental and socioeconomical challenges, residents, businesses and municipalities. With inadequate planning and limited finances accommodating the increasing urban populations often results in expansion of informal housing in cities or suburban developments requiring high use of private transport. The magnitude of the growth of urban population in developing countries is direct indicator industries, commerce, vehicles, energy consumption, water use, waste generation, and other environmental stresses [1]. Usually, the countries mainly focus on increasing economic development resulting into non sustainable

Received January 12, 2018; Accepted January 13, 2018; Published January 25, 2018

and environmental problems which may be beyond the assimilative capacity of nature. Moreover, the resulting severity of environmental conditions in urban areas is predominantly seen over a period of time and space which warrants the need infusing and optimizing environmental strategies and plans for specific and sustainable urban development [2]. An important factor in the present context is to make existing and new urban areas self-sufficient, sustainable, and enjoyable places to live with environmental parameters into the planning process [3].

Nowadays land use planning mechanism are usually considered as sustainable development along with improving quality of life by ensuring economic progress while ensuring equal access to environmental resources [4]. Sustainable development has resulted into change of the traditional planning between social equality, economic efficiency and amenity, but the institutional requirement to strengthen public participation and ensure social inclusiveness has now become one of the most important functions of planning systems [5].

Institutions of Land use planning in India have gradually focusing towards the model of ecological modernization. The model of this type has been characterized as a free-market system incorporating sustainable development parameters along with urban regeneration through public and private sector partnerships [6]. The planner’s role within this model is to ‘facilitate economic processes while making them environmentally compatible. The environmental considerations and economy must go together to ensure a sustainable future [7].

2.0 Human Settlements and Sustainability

2.1 Communities and their Environment

The significant urban environment in developing countries usually include healthy housing and other infrastructure in the form of schools, workplaces, shopping markets etc. along with access to adequate water supply, sewerage, solid waste management, storm drainage, urban transport,…etc. and availability of open spaces in terms of properly designed community parks and other green areas [8]. Moreover, proper environmental surveillance and cleaning services in public buildings and outdoor areas need to be effectively ensured. However, the most important adverse impacts on the urban environment affecting people on account of inadequate urban development are as under [10].

• Water pollution and water depletion

• Energy wastage

• Air pollution on account of vehicles and other commercial activities

• Solid waste, especially hazardous waste, when improperly discharged by households and industries.

• Groundwater contamination

• Land and ecosystem degradation

• Degradation of historic structures and cultural resources

• Man-made hazards in the form of chemical spills, explosions and other industrial accidents

2.2 Aggravating Factors

Factors responsible for the degradation of urban environment on account of poor planning and inadequate response mechanism are as under:-

• Lack of public and political awareness –

• Lack of public pressure and political will –

• Lack of effective public education and participation –

• Inadequate governance (e.g. Weak institutional capacity, Poor inter-sectoral coordination),

• Lack of effective public accountability,

• Inadequate regulatory policies,

• Inefficient economic policies,

• Insufficient knowledge and information,

• Shortage of environmental professionals and pollution control mechanism [7]

2.3 Improving the Urban Environment Efforts

The salient efforts for improving the urban environment include the following [11]:

• Focus on cost-effective development approaches

• Ensuring "win-win" situations to complement environmental and economic goals

• Cost-effective approaches to carrying out environmental reforms

• Property and business taxes along with fuel taxes.

• Mobilizing Public Support and Participation

• Raising awareness by formal/informal education on environmental options, solutions, enforcement and monitoring.

• Involving NGOs and informal sector in addressing local environmental concerns.

• Improving Governance

• Developing skills and capabilities in the form of managerial, technical, regulatory and financial.

• Capacity building in the public and private sectors as well as NGOs.

• Improving the operation of urban services, such as water supply, sewerage, drainage, solid waste management,
transport, land management, etc.
- Establishing public-private partnerships to deliver environmental services, technological innovation and sustainable approaches.

3.0 Sustainable Development
3.1 Development and Sustainability

Economic development earlier or even today in many cases has resulted in certain environmental and social weaknesses which became the very basis for sustainability [12]. Economic development could lead to sustainability if it is decentralized, carefully planned, environmentally sensitive, locally-based, and focused on creating jobs and improving quality of life [13]. An integrated and strategic approach of local government as a service provider together with its regulatory and legislative powers and its internal economic policies can have a positive effect on economic activities and development toward improving socio-economic quality and achieving sustainability. The predominant three elements of sustainable development are [14].

- Environmental considerations must be infused in economic policy-making.
- Environmental Technology in Sustainable Development • Sustainable development must incorporate commitment to social equity.

Development must not simply mean "growth". It must imply qualitative as well as quantitative improvement. In other words sustainable development must be different from economic development of the past. It must be a proactive strategy to develop sustainability. And its benefits must last well into the future generations [15].

3.2 Greening the City

Greening the city with the help of compatible strategies and techniques can protect and restore ecology within urban communities. It would mean "combining urbanism and nature to create healthy, civilize, and healthy place to live [16]." It also means a living area governed by nature along with sustainable human settlement based on ecological balance, community self-reliance, and participatory democracy [17].

Urban ecology needs to create, preserve and restore green and open spaces sustainably and scientifically. The green open spaces provide communities with several benefits such as [18].
- Reduces urban heat island effect
- Minimizes use of pesticides
- Conservation of energy
- Clean urban air
- Absorption of CO₂ from the atmosphere

Development of urban agriculture is another feature which comes under greening the city and its benefits are as under [19]:

- Protects land which produces food
- Supports local economy through local production
- Empowers communities through self-reliance; gives them increased food security
- Enhances community well-being through improved health and nutritional conditions
- Increases environmental health because of reduced transportation of food

Development of urban aquatic areas is yet another feature included in Greening the city and its benefits are as under [20-21]:

- Maintaining aquatic areas like streams, swamps and beaches
- Protection and restoration of above stated systems to revitalize neighborhoods and commercial areas
- Making seafronts, riverfronts etc. as special development zones from point of view of shopping and entertainment

4.0 Environmental Policy Parameters

The authors in the present paper have define following environmental policy Parameters required to be infused into the process of urban planning in a more scientific and compatible manner.

- Optimization between concreting and non-concreting urban surface area
- Optimization between vertical to horizontal expansion of the city
- Ventilation coefficient
- Heat island effect
- Albedo effect
- Urban Atmospheric stability
- Temperature inversion
4.1 Optimization between Concreting and Non-concreting Urban Surface Area

The urban areas are fast expanding looking to the needs of people, commercial activities and other amenities. These areas are becoming the jungle of concreting. In case of a concreting surface, the incoming solar radiation, reradiates back in to the lower urban atmosphere, making it more warmer as compare to rural or open area where absorption of incoming solar radiation are more than the reradiation.

Once the urban atmosphere becomes warmer, the air pollutants released from automobiles, household fuel burner and commercial activities gets activated due to high heat. Once these pollutants became activated, they are more reactive and if impinges on human body resulting in to skin problems. Incase these reactive pollutants are inhaled by human beings, they cause multifarious complex diseases.

The resulting warmer atmosphere leads to more energy consumption in the urban areas along with more consumption of water. Such an optimization can be achieved by employing mathematical models.

4.2 Optimization between Vertical to Horizontal Expansion of the City

With the fast growing of urban area, vertical expansion is getting momentum leads to high rise buildings and more concreting within the same area. These high rise buildings if not plan in a scientific manner, restrict the movement of air on the leeward side of the lower buildings. Moreover, it provides shadow to the lower buildings restricting the light. These restrictions lead to higher energy consumption in the lower buildings and also agglomeration of air pollutants on the leeward side to impart higher concentration and adverse health effects. In order to incorporate this environmental parameter into the process of urban planning, mathematical models may be employed to address this important issue of optimization.

4.3 Ventilation Coefficient

Air ventilation of an urban area is very important partly for the dispersion of air pollutants and partly to save energy during summer and monsoon seasons. The more is ventilated city; the least shall be air pollution levels in urban area due to higher dispersion and transportation of pollutants. Highly ventilated city consume less energy.

The ventilation coefficients are to be considered at different heights of urban area with a maximum at the tallest building. A well-defined scientific study with the use of mathematical models would be able to address this parameters in the process of planning.

4.4 Heat Island Effect

The urban area with higher concreting surface and higher degree of air pollutant emissions give rise to higher temperature which transform into island of heat. It can be easily witnessed that there is a significant difference between the temperature profile of urban and adjacent rural area. Such a difference has been reported to the magnitude of 3 to 8°C.

This heat island phenomenon would attribute to activation and there after reactive nature of pollutants leading to health effects along with higher energy consumption. This issue can also be addressed scientifically in order to minimize heat island effect dealing the process of urban planning.

4.5 Albedo Effect

Albedo is the ratio of incoming to outgoing solar radiation. This ratio is disturbed in case of urban area where concreting of urban surface is more predominant. This Albedo effect leads to heat island effect, the details of which have already been elaborated.

The use of mathematical models would be able to addressed this parameter in the process of urban planning by balancing the incoming and outgoing solar radiations. The urban planning should have sufficient open spaces in the form of non-concrete areas like green cover etc at appropriate and scientifically identified places.

4.6 Urban Atmospheric Stability

The atmospheric stability is defined as the ability of the atmosphere for the dispersion of air pollutants released from various air polluting sources.

The atmospheric stability is further classified under six categories starting from category A to category F. The atmospheric category A represents highly unstable atmosphere followed by B as unstable, C as slightly unstable, D as neutral, E as stable and F as highly stable. Highly unstable atmosphere is good for dispersion of air pollutants where as highly stable is known to have poor dispersion ability. The urban atmospheric stability should be considered while identifying the location of an urban area.
4.7 Temperature Inversion

In an ideal atmosphere, temperature decreases with height but during winter conditions in an urban area where concreting is more, the temperature increases with height. This phenomenon is known as temperature inversion. In such a situation the air above becomes heavier which restricts the air pollutants to disperse thereby Ground level concentrations of these pollutants are much higher and may lead to air pollution episodes or catastrophes.

In case where the frequency of temperature inversion in an urban area is significant, vertical expansion of city should be restricted to a desired level.

4.8 Aerodynamics Effects like Wind Rose and Stability Rose Diagrams

The aerodynamics of an urban area is to be scientifically analyzed accordingly urban planning needs to be optimized in tune with aerodynamics.

The wind roses are the important tools for overall spatial planning and environmental policy parameter. It provides the overall scenario of sectoral winds along with their speeds to facilitate the planners to identify the locations or areas for residential colonies, commercial activities, and industrial areas and so on so forth.

These roses have the following applications.

1. Urban Planning
2. Siting of industrial locations including chimney and other air polluting source
3. Industrial zoning & industrial estate planning
4. Air pollution modeling.
5. Disaster Management
6. Street layout
7. Ventilation of urban, industrial and housing
9. Oceanography
10. Wind Energy
11. Agriculture Engineering
12. Ambient Air Monitoring
13. Noise Impact Modeling

Similarly, the atmospheric stability roses represent graphically the % frequency distribution of different stability classes in different directions for a specified period and location. The application of stability roses are mainly in the air dispersion modeling which predict ground level air pollutant concentrations for a given air polluting source under different stability conditions.

Conclusions

With growing population growth particularly in urban areas coupled with mixed land use patterns has resulted in alarming environmental problems. This has necessitated the need of environmentally sustainable urban planning in an integrated manner, an absence of which might result into critical air pollution levels in urban areas, ever increasing water pollution problems, exposure to high noise pollution levels, ecological and environmental imbalances, and increased health problems of high magnitude, and so on so forth. It would therefore be of utmost importance to address all issues relating sustainable urban planning with infusion of environmental policy parameters judiciously and in an integrated manner.

References

6. The World Bank and UNDP (1994) Other References Metropolitan Environment Improvement Program, Japan’s experience in urban environmental management.


