Sustainable Urban Environment- Conceptualization and Policy Parameters

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Abstract

The world population is migrating towards urban centres in search of better amenities, employment, trade, comfort, etc. resulting into agglomeration of increasing population and matching need to expand or develop urban areas. Such an expansion or development of urban areas are usually missing integrated urban planning having regard to sustainability. It has been widely observed and witnessed that with the unplanned growth of urban areas world over, the consequential negative impacts have been seen in terms of climate change, heat island effect, albedo effect, poor ventilation of city, adverse heath, high energy consumption, transportation problems, environmental pollution in terms of air, water, noise, municipal and chemical waste and so on so forth. Such emerging negative impacts are posing serious threats on human beings, property, vegetation, economy and social structure. An effort has therefore been made by the authors in the present paper to discuss and elaborate the importance of sustainable urban planning coupled with steps and required parameters to be considered in the process of evolving strategy for sustainable urban environment and planning thereof.

Keywords

Sustainability; Urban planning; Environment; Heat Island; Albedo; Green building; Ventilation

1. Introduction

Integrated and effective urban planning may lead to sustainable urban environment which in the present circumstance is very essential to address the alarming and emerging negative impacts being caused on account of unplanned urban areas. However, there are myths and realities in terms of defining an urban planning. According to Wikipedia, urban planning is a technical and political process concerned with the development and use of land, protection, environment, public welfare, along with design of urban environment which include air, water, infrastructure in terms of transportation, communications, and distribution network. However, English Lexicon describes urban planning as a branch of architecture dealing with the design and organization of urban space and activities besides determining and drawing up plans for future physical arrangement. Moreover in IFREK, urban planning is accompanied by sustainability concept which enables to carry out the urban development process in the right way to keep sustainable environment for future generations [1].
Urban areas are becoming crowded as it has been estimated that over 50% of the world’s population now lives in urban areas and it is further predicted that this will increase to 70% by 2050. This is going to be an alarming change which will have a significant impact on the millions of people in urban areas and would pose serious challenge to planners, developers, decision makers, urban authorities and environmentalists. Under such scenario, it has become essential to develop and plan sustainable urban cities with sustainable urban environment, economy, social balance, and to evolve integrated urban strategy to address all the negative on the scale of time and space. Generally, it is aptly visualized and said that sustainable city should meet the needs of the present without sacrificing the ability of future generations to meet their own needs. Some experts think that cities will be the growth drivers of the future, stimulating both supply and demand in the economy which provides opportunities for employment and economic success. However, if sustainable urban planning is not implemented effectively, there can have a large negative impact on the environment in much as that use large amounts of energy will be observed along with degradation of the land and pollution of the atmosphere. Therefore effective technology has a large part to play in enabling positive outcomes for cities [2].

2. Sustainable Urban Planning

An integrated planning of urban areas with long term sustainability in respect of economic efficiency, social equity, as shown in Figure 1 below:

Figure 1: Maintenance of Environmental Quality in General May be Classified as Sustainable Urban Planning

Sustainable urban planning involves many disciplines, including architecture, engineering, biology, environmental science, materials science, law, transportation, technology, economic development, accounting, finance, and government, among others. Such an integrated planning conceptualizes innovative and practical approaches to land use, energy utilization and saving, water conservation, available resources and their augmentation to support existing and future demands, urban economy, social equity, maintenance and restoration of environmental quality along with other parameters and their impacts on natural resources. Innovative sustainable solutions for urban planning can include green and energy saving buildings and housing, greening of urban area, open spaces, alternative energy sources such as solar and wind, and transportation options [3].

Effective sustainable land use planning along with above environmental policy parameters would help to improve the welfare of people, communities, transform urban areas and neighborhoods into healthier and more efficient spaces. It has become essential with the present and predicted pace of urbanization over a period of time that Urban development should only be guided by a sustainable planning coupled with environmental issues and effective vision of management which among others promotes interconnected green space, a multi-modal transportation system, and mixed-use development. Moreover, diverse public and private partnerships should be used to create sustainable and livable communities that protect historic, cultural, and environmental resources. In addition, policymakers, regulators and developers should support sustainable site planning and construction techniques that reduce environmental pollution and create a balance between built and natural systems. The manner in which economic efficiency, social equity and environmental quality can be achieved is depicted in figure 2 below [4].
New sustainable urban development’s or re-developments should provide a variety of commercial, institutional, educational uses as well as housing styles, sizes and prices. The provision of sidewalks, trails, and private streets, connected to transit stops and an interconnected street network within these mixed-use developments provides mobility options and helps reduce pollution by reducing vehicle trips. Walking, bicycling, and other mobility options should be encouraged throughout the urban mixed-use core and mixed-use neighborhoods with easily accessed and well-defined centers and edges as reflected in Figure 3 below [5].

3. Ideal Parameters for Achieving Urban Sustainability

Following domains having integration between each of them may be able to achieve sustainability if properly designed and implemented.

- Economy
- Environment and ecology
- Land use
- Society/Community
- Climate change
- Carrying capacity based development planning
- Transportation
• Governance

The above broad domains are interlinked and needs to be integrated to achieve effective sustainability of urban environment. The brief description of each domain is given here under along with symbolic diagrams as shown in figure 4 below:

**Figure 4:** The Brief Description of Each Domain is Given Here Under along with Symbolic Diagrams

3.1 Economy

Economy of urban area is very important which should be able to achieve economic sustainability enabling satisfaction of present consumption level without compromising needs of future generation. Economic growth should not only confine to specific classes only but at the same time should equally be addressed to weaker sections of the urban society also. Necessary infrastructure, diversified trade and commercial activities are required to be developed for all the societies of the urban area including weaker sections. Thus the economic sustainability needs to be ensured while planning sustainable urban development [6].

3.2 Environment and Ecology

Usually the planning and development of urban areas ignore many issues relating to environment and ecology resulting into multidimensional environmental and ecological problems of serious dimensions. With the growing necessity of sustainable development, all such issues are required to be adequately addressed on a highly scientific scale. In order to address the problem one has to examine and understand the “building blocks”, brief details of which are given hereunder:

• Parks

Community parks not only provide green open space but also offer play grounds, recreational activities, walking and sitting place for all kind people. Such parks should be located in each locality of the urban because they also provide scavenging systems to absorb and reduce air and noise pollution along with balancing albedo effect and reducing heat island effect.

• Water Supply

Availability of water for urban area needs to be ensured for all sectoral activities and communities with public awareness and mandatory programmes for
conservation and optimal use of water. Water supply should match the existing usages along with future demands considering population growth, infrastructure development, economic growth and other developments. Moreover, water supply leakages should be completely plugged along with water augmentation programmes should be effectively put in place.

• Sewerage

Generation of sewage and lack of sewerage system in urban area is posing serious threat by polluting the water bodies or water courses, ground water and contamination of soil along with breeding places for insects and mosquitoes. A well defined sewerage system and network is therefore required to be designed and put in place in urban area to collect and carry sewage to collection sumps located at different locations depending upon the topography of the urban area. The sewage so collected at different locations is required to be treated in a well designed sewage treatment plant and the treated sewage should be used for development of green belt, parks, and irrigation purposes. This would reduce the use of fresh water and also fertilizers because the treated sewage would have adequate nutrients to support plant growth and vegetation. The sludge so collected and obtained from sewage treatment plan should be used to transform fuel pallets, compost or even production of energy to make the system economically viable.

• Solid Waste Management

Urbanization is resulting into generation of huge quantity of solid waste which include domestic waste, chemical, biomedical and chemical waste which if not properly managed, leads to land, surface and ground water pollution and also air pollution. It is therefore essential to have collection, segregation, transportation, storage and treatment of solid waste plans and strategies in place and implemented effectively. Concept of 4 R needs to be considered in policy making which include reduce, reuse, recycle and recover along with public awareness campaigns to be launched periodically. Reduction of waste can be achieved through system optimization at generation of source while reuse may be accomplished by industries and business through encouragement and making economically viable. Recycling is usually being carried out for paper, plastic, glass and metal but more technological options and feasibilities are to be evolved on scientific scale to cover more waste products. Recover may be achieved through waste to energy transformation.

A waste disposal site is shown in figure 5 below.

Figure 5: A Waste Disposal Site
• **Energy Efficiency**

Energy conservation programmes and strategies should be evolved to focus on renewable energy options such as solar energy, solar hot water systems in individual house, wind power, transformation of waste, biomass, and agriculture plants into energy. Moreover, energy reduction technological options should be put in place through green building concept, green or cool roof and pavements, reduction of heat island effect, planning of highly ventilated urban area, and using eco friendly appliances. All such issues need to be made mandatory under the urban laws and integrated energy conservation tools should be infused into the process of planning by the local and national government.

• **Air Quality**

Urban air quality is deteriorating on a time scale and becoming a serious threat to human health on account of automobile air emissions, house hold fuel burning, commercial activities, industries, open waste burning, indiscriminate dumping of solid waste and chemical hazards caused by accidents. Increasing air pollution not only deteriorate local urban air quality but also lead to climate change, depletion of ozone layer, and acid rain resulting into incidence of skin cancer, damage of lungs, other health problems and diseases, damage to crops, and plant life. The problem of air pollution needs to be controlled firstly at source through technology, then pathway filtering through green belt development and finally at receptor by developing green space to act as scavenging mechanism. A comprehensive program need to be developed and made mandatory in the process of urban planning.

• **Innovative parameters**

Sustainable urban planning should have following innovative parameters which should adequately be addressed on scientific scale.

- Heat island effect
- Albedo effect
- Ventilation coefficient of urban area and individual building
- Atmospheric stability
- Aerodynamic behavior of urban area like application of wind roses and atmospheric stability
- Optimization between concreting to non concreting urban surface area and vertical to horizontal expansion of urban area with the help compatible simulation models
- Resources carrying capacity based planning and their optimization through compatible simulation models

3.3 **Society/Community**

Urban area has diversified Society or community having different religion, economic status, cast, working class. Urban planning should take care of all the diversified structures of society or community with special emphasis on weaker sections of the society in order to ensure that no slums are developed in the absence of such issues. Land use planning and economic considerations coupled with supporting infrastructure needs specific attention for all the diversified societies.

3.4 **Climate Change**

With the rapid expansion of urban areas, industrialization and other human development activities, the greenhouse effect is significantly enhanced with the release of greenhouse gases from manmade activities in the form of burning of fossil fuels for producing electrical energy, heating and transportation etc. The significant release of greenhouse gases like CFCs, CO₂, Methane, and Nitrous Oxide from such human activities resulted into raising the average global temperature. Moreover, Land Use Changes occur very fast with the pace of development replacing forests with mining lands, or natural vegetation with asphalt or concrete resulted in imbalance of incoming and outgoing solar radiations substantially. All these changes also affect regional evaporation, runoff and rainfall patterns [7].

The climate change world over and India poses variety of threats on human health, agriculture, food security, bio-diversity, eco-systems, water resources, economy and so on so forth. The causal factors in the form of global warming, green house effects, ozone depletion resulting from industrialization, urbanization, and other developmental activities need to be addressed in an integrated scale. Significant research is essentially required to be taken up in respect of cause-effect of climate change. Simulation models need to be developed to predict and assess the extent of climate change over a period of time and space and mitigation measures need to be taken up on integrated front. Moreover, extensive public awareness campaign needs to be launched at regular intervals through well-defined information, education and communication models [7].
3.5 Land Use

Land use planning in urban area is an important physical parameter which needs to be designed by considering carrying capacity of urban region in terms of road network and vehicular growth, population and depending requirements, water resources, food requirement, etc. It should also focus on balance between concreting to non concreting urban surface area or in other words built-up area to open space area. Land use planning should ensure that at least 30 percent of the urban land should have green space but should preferably be increased to 50 percent if found feasible. Moreover, layout of road network and building structures should consider aero dynamics of urban region, air ventilation, wind rose diagrams, and so on so forth. Adequate land needs to be allocated for solid waste disposal and treatment, sewage disposal and treatment, equally distributed parks and green spaces, and weaker sections of the society. Environmentally compatible zoning of residential, industrial, commercial and sensitive activities should be scientifically designed and implemented in as much as that industrial activity should be on the downwind side of the residential or sensitive activity in order to ensure that the effect of industrial activity should not have any negative impact on residential or sensitive activity [8].

3.6 Transportation

Urban transportation is causing significant air pollution problem, global warming and traffic congestion. The vehicles are increasing in significant proportion on a time scale and the available road network is not sufficient to support free flow of traffic thereby causing congestion which amounts to generation of increased air pollution. It would be important for the urban planners to assess vehicular growth for next 30 years and according the road network should be designed and developed after assessing the carrying capacity of roads. Land use planning should include adequate space along the road side for development of green belt partly to act as barrier for the air pollutants to travel further to residential sites and partly to act as absorbing medium to reduce air pollution. Moreover, the vehicles permitted should be EURO compatible in order to generate less air pollution. Vehicles plying on road in a major city are shown in figure 6.

3.7 Carrying Capacity

Urban planning and design should be integrated with carrying capacity of all resources which should be scientifically assessed in terms of assimilative and supportive capacity. Urban design is to be planned while considering the carrying capacity of water resources available, atmospheric conditions of urban region, available land resources, and economic resources along with other environmental attributes. It would be desirable to develop simulation models considering all the relevant input parameters for working out carrying capacities of different resources in order to design and plan sustainable urban environment.

Figure 6: Vehicles Plying on Road in a Major City
3.8 Governance

Sustained urban planning can only be achieved with good, well defined and effective governance which should be without any vested interests and interferences. A well defined and codified system should be formulated which should be made public and if there is any deviation, the public may be able to agitate and even approach judicial system for intervention. A multidimensional task force or urban administration should be created and strengthened by the government to take care of all the components of sustainable urban structure and should be made responsible to achieve objective. Well formulated indicators of governance needs to be developed and periodical review, evaluation and assessment of such indicators need to be carried out and published so that all the stake holders should be able to know the out puts and accordingly contribute their suggestions in case of any bottlenecks.

4. Bottlenecks in Present Sustainable Urban Management

4.1 Problems of Governance and Management

There are multiple agencies in India responsible for managing urban area or city which usually is town planning department, Municipal Corporation, city development authority, transport department, traffic police and other regulatory authorities like pollution control board, public health engineering department and so on so forth. The main problem is the lack of coordination between them and no one knows the plans or activities of one agency to the other. Such a situation result in isolated planning or activities of all the agencies ignoring the input of other agencies thereby leading to problematic situations and unsustainable development. In order to overcome such an important problem there should be an effective integration of all the concerned agencies [9].

4.2 Land for Weaker Sections

Usually the land allocation is not done for laborers, migrated weaker people come for employment, and other refugees resulting into development of slums with no sanitary conditions and supporting infrastructure. Such a situation leads to unhygienic conditions of the city and also to negative environmental conditions.

4.3 Land for Disposal of Waste

In any urban town in India, the generation of solid waste is quite significant but usually an environmentally compatible land for disposal and treatment of waste is not earmarked resulting into indiscriminate disposal of waste any where causing mosquitoes, air pollution, ground and surface water contamination, health risk, nuisance and land degradation or contamination. Similarly, significant quantity of sewage is generated resulting into indiscriminate disposal in the absence of environmentally safe site for disposal and treatment, causing ground or surface water pollution, land contamination, health risks, mosquito or insect breeding places, and unhygienic conditions. Moreover, biomedical waste disposal and treatment along with chemical and hazardous waste also pose serious threat to the urban environment in the absence of environmentally safe land.

4.4 Lack of Environmental Concern

Urban authorities or city development authorities usually have lack of interest in dealing with environmental issues on a well defined scientific scale resulting into significant air pollution problems, water pollution, noise pollution, heat island and albedo effect, reduction in urban air ventilation, ignoring carrying capacity based urban development, lack of environmentally safe urban zoning and the issues refereed by the authors under head environment and ecology.

Conclusions

Urban areas with existing planning in India are posing serious problems particularly in environmental or ecological concerns. With the expansion of urban cities such problems are becoming more alarming in as much as that the level of air pollution has reached highly critical levels in major urban cities, water pollution problems increasing on a time scale, noise pollution disturbing mental state, disposal problems of sewage and solid waste along with multifarious issues. The need has therefore been felt to develop sustainable urban planning coupled with integrated approach to address all the relevant attributes reflected in the present paper. Simulation techniques should be developed and validated for all the relevant parameters for the planners and decision makers to evolve scientific models for achieving sustainable urban environment. There should be integration of all the agencies involved in urban development along with good governance models.

References


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


