

## **Towards Developing Indicators of Environmental Sustainability for Kathmandu, Nepal**

**Ambika Prasad Adhikari, Dr. Des., AICP**

Faculty Associate  
Arizona State University  
Tempe, AZ, USA

### **Abstract**

*Sustainability is now considered one of the key objectives in urban planning. However, due to inappropriate planning, weak institutions, limitation of resources, and poor implementation of policies, many big cities in the developing countries have become even less environmentally, economically and socially sustainable than they were in the past. Historically, the Kathmandu valley enjoyed a unique tradition, rich heritage and a moderate state of sustainability in all areas, particularly in the environmental arena. However, the rapidly expanding and modernizing cities in the valley are facing serious problems of sustainability in all fronts: economic, social, environmental and ecological. Whereas environmental and economic sustainability were tacitly imbedded in the traditional planning practices in Nepal, the rapid growth and modernization of the major cities in the valley is making them increasingly unsustainable. This paper proposes major indicators of sustainability, and discusses an approach to implement sustainable practices in urban planning and development in Kathmandu.*

**Key words:** Sustainability, Indicators, Planning, Environment, Kathmandu

### **What is sustainability?**

The term “Sustainable Development” was first used by the World Commission on Environment and Development (WCED) in its report “Our Common Future” published in 1987. The report’s definition of sustainable development as “which meets the needs of the present without compromising the ability of future generations to meet their own needs”<sup>1</sup> is still the most often quoted and referred definition of sustainable development. Since then, numerous writers and organizations have created more encompassing, customized and specialized definitions of sustainable development relevant to urban development. These definitions attempt to cover a more comprehensive spectrum of sectors to ensure sustainability of an entire urban system. One definition particularly related to urban development was developed by the URBAN 21 Conference held in Berlin in July 2000, which states:

“(Sustainable urban development) is improving the quality of life in a city, including ecological, cultural, political, institutional, social and economic components without leaving a burden on the future generations”<sup>2</sup>.

In most definitions, the concept of sustainability includes three major dimensions (often compared to a three legged stool): economic, social and environmental. Lately, the cultural, ethical, and philosophical elements have also been considered as integral parts of sustainability. In the urban arena, due to the urgency created by several global, regional and local environmental problems, such as global warming, loss of bio-diversity, air and water pollution, and problems of waste management, the environmental aspect of sustainability is more often emphasized. The environment and the ecological system is considered by some as the container within which the socio-economic activities take place.

Particularly, in urban areas, sustainability must involve addressing the long term well-being of the people, conserving resources, making long range financial plans, empowering community, creating a culturally appropriate sense of place, ensuring a just and equitable governance, and ensuring the integrity of the urban environment. This paper seeks to address sustainability issues particularly related to the urban development of the Kathmandu valley, the capital region of Nepal.

This paper is limited to devising an approach to develop indicators of environmental sustainability for the Kathmandu valley cities, which can provide reference to the policy makers, planners and urban development professionals the Kathmandu valley and similar other urban metropolitan areas in developing countries. Given that Kathmandu valley's environmental quality is deteriorating at an unprecedented rate, preserving the environmental quality is of paramount importance.

### **Sustainability in Kathmandu**

The entire Kathmandu valley is a single ecological unit, because of the way the water-shed, drainage, agriculture, atmospheric commons, forests and ground water systems are naturally configured and inter-related. Accordingly, it is best to plan and manage the valley's environment as a single unit.

The valley includes five cities, Kathmandu, Lalitpur, Bhaktapur, Kirtipur and Madhyapur Thimi. The valley covers an area of about 665 square kilometers<sup>3</sup> and total population of the valley is 2.51 million according to the preliminary data from census 2011 (2001 population was 1.65 million)<sup>4</sup>. The three districts of Kathmandu, Lalitpur and Bhaktapur cover a total area of approximately 900 square kilometers, as parts of the Kathmandu and Lalitpur districts extend outside the valley's boundaries.<sup>5</sup> The valley is experiencing an unprecedented rate of population growth. An indication of this accelerated growth can be seen by the growth rate of population in Kathmandu district, which increased at the rate of 4.71 percent per year between 1971 and 2001.<sup>6</sup> This makes Kathmandu one of the fastest growing cities among the major cities of the world.

Historically, the valley of Kathmandu was a sustainable place from the environmental and ecological point of view. It is seen from the fact that in its long history of human settlement, no environmental disasters have been recorded. It was agriculturally self-sufficient and socially harmonious, bound in a social hierarchy that remained intact for a long period of time throughout history. The segregated social structure and its desirability are normative issues that beg a critical review by the standards of today's democratic and pluralistic norms in Nepal. That sociological part however, is not within the scope of this paper. The environmental quality of the valley is on a speedy decline as can be seen from the high levels of air pollution, water pollution and land pollution in the urban areas. The accelerated levels of pollution in all media have been widely studied by experts, international agencies and Nepal government agencies.<sup>7</sup>

Urban management practices will impact the level of sustainability the valley may enjoy in future. For example, the current population growth is clearly unsustainable if appropriate infrastructure, housing, water supply and other urban amenities cannot keep up with the rate of population growth. Furthermore, planners and policy makers have to ascertain whether adequate potential exists for supplying Kathmandu with water, building materials, waste management resources (such as, landfills), pollution control and other urban amenities to ensure an acceptable level of urban quality of life. With the runaway growth pattern, planners and policy makers must ask: for how long can Kathmandu maintain an adequate quality of life given the large amount of resources that need to be imported into the Kathmandu metropolitan region?

Additionally, the availability of energy and use of locally produced power will also determine how vulnerable Kathmandu is for its energy needs. The regular black-outs and the ever-present load-shedding requirements in Kathmandu have already given Kathmandu a reputation of a dark city. However, of late, the increasing use of solar energy and photo-voltaic panels and bio-gas in the valley are encouraging indicators of sustainable energy use. The use of individual electricity generators, even if they can be perceived as bestowing self-sufficiency to individual home owners and business, are bad from sustainability perspective. The generators consume petroleum, need a regular supply of spare parts, emit disproportionately high quantity of pollutants, and do not enjoy an economy of scale in energy production.

### **Traits of Effective Sustainability Indicators for the Urban Environment**

Sustainability indicators are the instruments for measuring the changes in the quality and state of sustainability of any system. The indicators comprise of information, data and parameters that measure the state of the environment and other sustainability factors. Without indicators, one cannot measure the status, trends and long terms changes in the factors that in aggregate demonstrate the suitability of a system. If changes or impacts of a program cannot be measured well, it is difficult to assess the effectiveness of any policy or program that seeks to enhance urban sustainability.

The following are the main characteristics of the indicators that can explain and assess the sustainability of an urban area. If the indicators entail these qualities, they will help to examine, monitor, and predict how sustainable the urban system is. Although these traits can apply to the study of sustainability of many systems, they are particularly valuable to predict the sustainability in urban development in Kathmandu. Regular measurement of the indicators and comparing them for different time periods can help assess the progress of various programs which aim at enhancing sustainability.

### **Relevance to the Local Conditions**

Any sustainability indicator must be relevant and well-suited to the local circumstances. Kathmandu has a unique history, is facing a rapid urban growth, and is burdened by overstrained infrastructure. Furthermore, the environmental quality of the valley is rapidly declining. In this situation, the indicators that can define Kathmandu's sustainability have to reflect this difficult ground reality of Kathmandu. The indicators must express the current and changing scenario in Kathmandu, and must be able to capture the unique conditions on the site. For example, the physiographic features of the valley, its mid altitude, the bowl-like shape and the economic level of the urban metropolis impact the environmental quality of the area. The indicators must address these traits, and must facilitate how any planned improvements in the environmental quality can be effectively measured by the indicators.

### **Imbedded in Social Vision**

Indicators become more useful if they help capture the community aspirations and visions of the local community. Kathmandu residents are struggling to modernize in a hurry a largely traditional society and an old built-environment. Furthermore, people from all over Nepal aspire to come and live in Kathmandu hoping for better mobility, employment, education and other opportunities, causing the rapid growth discussed earlier. Sustainability indicators for Kathmandu must be realistically based on the community vision of its residents, who wish to live in a clean environment, utilize an acceptable quality of infrastructure, and enjoy a high urban quality of life. What the residents want in their city is often derived from consultation and participatory programs involving the stakeholders. The shared vision of a city is what the planners and policy makers should strive to create. As gathered by the author from the informal conversation with many residents, the problems of solid waste management, water shortage and pollution, and air pollution are often identified by the local residents as their priority problems in Kathmandu. The indicators must be able to reflect the visions and aspirations of the society, and should also help in identifying the desirable future.

### **Easy to Measure and Compare**

Nepal lacks critical long term data in urban sector that may be considered absolutely basic in developed countries. Especially, in the environmental arena, the existing data is of relatively recent origin. Long term time series data have not been kept in Kathmandu. For example, environmental record keeping in a comprehensive manner began only in the mid eighties. Thus indicators have to appreciate this reality. International comparative studies and the status of other South Asian cities can perhaps help visualize the utility of certain indicators on how they can measure the changes happening in Kathmandu region, and how planners and policy makers can utilize them to measure any progress or loss in environmental quality and sustainability parameters.

### **Helpful to Devise Policy**

Kathmandu desperately needs realistic and a forward looking planning process that can achieve goals and objectives efficiently. If indicators are available for key areas, and if the people and media become excited about the state of the environmental and development as reflected by the indicators, the policy makers can benefit from this linkage. Indicators should arouse a wide interest, and politically help policy and decisions makers devise swift programs to achieve the stated goals of sustainability. Many plans and policies for the improvement of the urban areas have been devised for the Kathmandu valley since the 70's. However, in the absence well defined benchmarks and lack of easily measureable indicators, it has not been easy to assess the impacts of those plans and programs. One generally sees the deteriorating environmental and infrastructure situation in Kathmandu, but they are all the result of anecdotal evidences, intuition or personal or collective observation. Very few scientifically measured changes have been recorded to examine the changes in the urban quality and sustainability.

## **Supporting the Community to Become Pro-active**

Kathmandu's population is relatively young, and is highly motivated as many come from extreme hardship in the countryside. If attractive indicators are devised and publicized, it will motivate the community to become pro-active in their day to day behavior and their efforts to improve the quality of life in Kathmandu and also upgrade their own lives. As the programs developed by the government by themselves have not been very successful, an inspired citizenry is more likely to help improve the sustainability situation in the Kathmandu region. Having indicators that are easily understood and simple can help arouse public interest in improving the quality of life in their neighborhood and city. They will know when certain policy objectives are met.

## **Reliability of the Information**

Indicators should provide a reliable basis for comparing the potential of sustainability of various infrastructure, utility, energy and urban design elements for Kathmandu. A vague and undefined indicator does not provide a reliable basis to create a rapid improvement of urban quality in Kathmandu. Data can be reliable if they have been derived from on the ground-level survey or measurement, or are being devised by seasoned professionals who have observed the phenomenon for a long time and with a keen eye. A peer review or survey by local professionals can provide a more reliable and professional assessment of the situation rather than a single observation or analysis based only on anecdotal story.

## **Based on Available Information and Data**

As the quality of data and information on the environment, transportation, housing, water supply and energy use is largely inadequate in Kathmandu, the indicators should be built on what is available as true measurements of the situation in Kathmandu. Because of the limited hard data that is available related to the quality of urban life in Kathmandu, some qualitative measures and observations must also be sympathetically considered in developing appropriate indicators for sustainability. The indicators should be efficient which can work with the limited area of data and surveys that are currently available for Kathmandu. As more high quality data becomes available, the indicators of sustainability can also be revised and refined to include some complexity.

## **Some Possible Indicators of Environmental Sustainability for Kathmandu**

This paper recommends some indicators that will be valuable in assign the sustainability of the Kathmandu Valley. These indicators are derived and crafted on the basis of the qualities described above and can be valuable in examining the potential sustainability of Kathmandu Valley, particularly from an environmental and ecological standpoint and urban management. Examples of the status of some indicators are tabulated in Table 1. Sustainability indicators provide concrete measure for the quality of environmental, water supply, transportation and other sectors to illustrate the status of the changes in their quality over time. Box A provides an example of some sustainability indicators.

## **Conclusions**

Sustainability criteria are critical for planning and management in Kathmandu. Many of the urban practices and the ground reality of the situation in Kathmandu indicate that the present business-as-usual scenario is unsustainable. Particularly, the quality of life and urban environment has suffered a drastic level of damage vastly reducing the quality of life in the valley. The valley's environment is likely to deteriorate even more over time, if sustainable urban practices are not urgently implemented. Sustainability indicators should be developed to reflect the uniqueness of the location and its socio-economic circumstances. Kathmandu's exceptional urbanism requires selecting and modifying indicators that suit the local conditions.

Planners and policy makers should be able to review the indicators of sustainability on a regular basis to ensure that plans and programs are working as planned. Planners must ensure that the Kathmandu residents will enjoy a high quality of life for a long time, and the urban system will not collapse because of poor practices in urban planning and management. Appropriate sustainability indicators will be required for a regular assessment of the urban health of Kathmandu.

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This paper attempts to specify the characteristics of indicators of sustainability for Kathmandu, and provides some examples of indicators.

Sector	Possible Indicator Areas	Remarks <sup>8</sup>
Environmental	Air pollution levels: concentration of major pollutants	Indicators in use
	Water pollution levels: presence of major pollutants in drinking water	Regular monitoring is lacking
	Waste management: solid waste generation per capita, and per 1,000 sft of commercial and other buildings, diversion and disposal rate (percentage of total)	Data is scant
	Waste management: capacity and number of landfills and transfer stations compared to the quantity of waste generation	Weak area at present
	Environmental and Carbon Footprints of Residents	Needs to be developed
Water Supply and Distribution	Capacity of the existing and potential water supply sources to serve the valley	Needs to be developed
	Proportion of population served by potable water supply	Reasonable data exists
	Change in per-capita daily water consumption levels	Reasonable data exists
	Number of hours per day when piped water supply is available	General data exists
Transportation and Accessibility	Rate of use of public transportation by the public; percentage of people walking to their destinations	Weak quantified information
	Percentage of population with car ownership	Data presently exists
	Percentage of residents with access to public transportation within ½ kilometer distance	Weak information
Energy Use	Proportion of energy generated from renewable sources (solar, wind etc)	Partial information exists
	Energy use per capita per day	Data exists
	Effectiveness of energy conservation programs	Needs to be developed (complex indicators needed)
	Proportion of energy from local sources (Fire wood, coal, solar, natural gas)	Needs to be developed
Housing and Urban Design and Management	Percentage of housing that is affordable (Assumptions needed for affordability and income)	Needs to be developed
	Public green open space per capita	Data exists
	Percentage of population living in squatter homes and slums	Data is scattered
	Percentage of land area with urban agriculture	Needs work
	Percentage of land with urban forestry	Needs to be developed
	Population density by neighborhoods, and crowding data	Some data exists
	Percentage of residences meeting disaster mitigation standards	Needs to be developed

**Table 1: Examples and Status of Selected (partial) Sustainability Indicators for Kathmandu, Nepal.**

<p>Box A: Example of some Sustainability Indicators</p> <p><u>Air Quality Indicator</u></p> <ul style="list-style-type: none"> <li>The number of days per year when levels for any specified pollutant (e.g., Ozone, TSP, SO<sub>2</sub>, NO<sub>2</sub>) exceeds the defined safe levels of pollutant concentration.</li> </ul> <p><u>Carbon footprint - GHG emission Indicator</u></p> <ul style="list-style-type: none"> <li>The annual total and percentage change in the per-capita total emission of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and O<sub>3</sub> in the valley.</li> </ul> <p><u>Water Supply: Level Indicator</u></p> <ul style="list-style-type: none"> <li>The annual volume of ground water extracted for water consumption as a percentage of the total volume of fresh water supply delivered annually.</li> </ul>
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## End Notes

<sup>1</sup> UNCED (1987), Our Common Future, Oxford University Press, pp 4

<sup>2</sup> Regional Environmental Center for Central and Eastern Europe (REC), web site, <http://www.rec.org/REC/Programs/SustainableCities/What.html>, accessed on 06-15-2012

<sup>3</sup> ICIMOD, UNEP and Government of Nepal (2007), Kathmandu Environment Outlook, Hillside Press, Kathmandu, Nepal.

<sup>4</sup> Central Bureau of Statistics, Nepal (2001) census data, and preliminary data from the 2011 census.

<sup>5</sup> Panta, P. R. and D. Dongol (2009), Unpublished paper – workshop on Governance and Infrastructure Development Challenges in the Kathmandu Valley

<sup>6</sup> ICIMOD, UNEP and Government of Nepal (2007), Ibid

<sup>7</sup> See for example several publications by URBAIR, World Bank, Nepal Meteorological Department, IUCN, UNEP, ICIMOD and other agencies on this topic.

<sup>8</sup> Author's assessment