# A Framework of Quality Indicators System for Evaluating Hyderabad Urban Sustainability

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**Abstract:** Remote sensing technology using satellite access has been increasingly helpful in performing natural resources mapping and management. This includes processes that cannot be done manually or might take many years to complete when you are covering vast areas of land such as satellite imaging, accuracy assessment, image processing, classification, and geometric or radiometric corrections. It is evident that any nation's economic development is largely supported by the richness of its water and land resources. The management capability and mapping tools use to monitor these resources are crucial to raise the economic development of specific regions. Accuracy is a general requirement in managing delicate land and water resources for sustainable development. The remote sensing using satellite based approach in generating data ensures updated cost effective natural resources monitoring and management in Iran. This research will demonstrate the need to maintain remote sensing for mapping and managing natural resources in Iran as well as enhancing and supporting the decision making capabilities of the government regarding the use of its natural resources.
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## 1. Introduction

Sustainable urban planning should aim at achieving economical, social and environmental equity while improving the lives of the people. For that to happen we need to have a sustainable city form and also provision and suitable management of the services. Sustainable urban development means achieving a balance between the development of the urban areas and protection of the environment with intent to Justice in employment, shelter, basic services, hygiene, social infrastructure and transportation in the urban areas (Bertolini, 2005).

A city is a relatively large, dense, and permanent settlement comprising of socially heterogeneous individuals (Ziari, 2009, Wirth 1938, Pijanowski et al., 2009). In accord with Aristotle, cities are places which include gladness and security for its residents. Plato also explains a city as suitable location for citizens to live in and also the birthplace for civilizations. As a matter of fact, at the time when human beings obtained a relative amount of peace, safety and security in thought and action, urban areas were generated. Eventually, with the passage of time and creation of cities, the human race gradually started thinking about comprehending ideals such as justice, social relations, lawfulness, and prettiness (Broadbent, 1990).

At the same time, in recent years metropolises are confronted with unpleasant situation such as immoderate population and the conditions arising out of it, including pollution, dirt, congested traffic, destruction and plundering of natural resources. In the same manner, Hyderabad is also faced with managerial, environmental, infrastructural, physical, social and economic problems which collectively decline the city's environment quality (Divan, 2001, GOI, 1992, Prasad et al., 2007). As a most evident many of Hyderabad's regions has been considered "critical" for their high polluted air conditions, water pollution, sold waste management, uncontrolled industrial effluents, indigent sanitation and inadequate water supply (Rama Rao, 2004, Ramachandraiah, 2003, Venkateswara Rao et al., 1998).

The urban environment quality is declining day by day with the greatest cities reaching saturation points and unable to handle the increasing pressure on their infrastructure. Rapid urbanization brings with it many difficulties as it places enormous demands on land, water, housing, transport, health, education etc (Gyananath et al., 2001). The city witnessed an increase in population from 0.448 million in 1901 - 1.429 million in 1961, between 1981 and 1991 the population went up to 4.34 million and the growth rate so far is 67.04% (Census of India,

1991). As per the population estimates, Hyderabad is likely to become a metropolis with about 7.5 million populations by 2011(Census of India, 2011). This rising population density will continue to have an impact on the quality and quantity of environment and natural resources.

In this regard, similar studies have been done by scholars and national and international organizations based on determining and evaluating a collection of city environmental quality indicators. Urban sustainability indicators (Mitlin,1992), Indicators of sustainable development (Meadows, 1998), Encyclopedia of Earth (EOE) (Bartelmus, 2008), Quality of Living global city rankings Mercer survey (MHRC, 2007), Sustainability Plan for the City of San Francisco (SCS, 1997) and Urban indicators and the integrative ideals of cities (Holden, 2006) are a number of these studies. In order to select the desired indicators in this study, the whole of indicators used in the aforementioned studies and other similar sources have been compared and their proficiency for evaluating Hyderabad's environmental quality have been analyzed. These studies showed that some of the indicators introduced in them were a lot more general or much more insignificant than the measures of city indicators, lacked measurement criteria and importance coefficients and in some cases even had lack of clarity in concept. Also, in some cases the indicators introduced are not compatible with India's cultural and social conditions or do not have documented statistics in India's official organizations. In the next stages, the attempt was made to alternative indicators that had more clarity, contained measurement standard and to the extent that was possible, had accessible documented information and statistics. On the other side, for the feasibility of the evaluation from the outlook of time and executive expenses, the most extensive and proficient indicators have been chosen from the comparable indicators. At last the model and collection of chosen indicators with the adjusted classification and important coefficients have been used in order to evaluate the quality of Hyderabad's environment. Afterwards, subsequent identifying the problems of Hyderabad's environmental quality, planning solutions for decreasing the inadequacies and enhancing the quality has been presented. It have to be mentioned that evaluating Hyderabad's environmental quality according to the mentioned model demonstrates part of the reality which has been stated in mathematical language and based on the country's official statistics; thus, there is the possibility of differences between the model with its chosen indicators and existing realities.

## 2. Case study of the research

The study area of Hyderabad city and its environs extend from 17.010 -17.050 N and 78.010 - 78.050 E. Hyderabad is a capital of Andhra Pradesh state and the total area of Municipal Corporation of Hyderabad (MCH) is 650 square kilometers and divided into 11 planning zones (GHMC, 2011). The city has 6,809,970 residents and the metropolitan area comprise of 7,749,334 residents making it the fourth most populous city and the sixth-most populous urban agglomeration in India (Urban Agglomerations/Cities having population one lakh (100,000) and above, (Census of India, 2011). The city is located at 550 meters above sea level in the center of the Deccan plateau in the southern part of India. Hyderabad is located in a rocky, sparsely-wooded area surrounded by hills that contain a large number of lakes, ponds, streams, and rivers (HMWSSB. 2010). Hyderabad experiences a minimum temperature of 11.600 C and a maximum of 40.500 C with an average annual rainfall of 73.55 cm (Asadi, 2007). The daily mean maximum temperature varies from a minimum of 14.10 C during the month of December to 38.80 C in the month of May (HUDA, 2003).

**Figure 1:** Showing the location map of the study area

## 3. Material and Methods

The principal research method of this study is based on usage of indicators. An indicator is a marker that is helps us to understand where we are, where we are going and how far we are from the goal or showing a special action, path or state (Rodenburg, 1995). In fact, each indicator is a determiner which explains the cause and effect elements and the actions and outcome of policies (Westfall, 2001). In the present study, in order to obtain indicators suitable for evaluating the quality of Hyderabad's environment, in the first step a comparative analysis of the varied classifications and models of the introduced indicators in different researches has been carried out (Table 1). This has led to the select of the preliminary model and categorization for the evaluation indicators collection. The main structure for the model used in this research has been extracted from the model of estimation of urban environmental quality (Bahrainy and Tabibian, 1999). Then in the

following stages a number of substitute indicators were recognized and chosen during a comparative analysis and placed in the model. Table 1 shows an example of comparing various models of indicators based on their essence, so that in next stage the model and collection was adjusted based on the substitute indicators and obtaining documented and statistical data. The ultimate model shows the selected indicators and their importance coefficients (Fig. 2).

The model comprises of six layers; in the first layer there is the "final indicator" which shows the whole amount of urban environmental quality. The final indicator has a 1000 important coefficient which is reached from the sum of the measure's importance coefficients in the lower layers. Measure's importance coefficient has been arbitrarily considered for each measure.

**Table 1:** Comparative analysis of indicators presented by various studies for evaluating the urban environmental quality of cities

| Bahrainy, Tabibian, 1999 | | Bartelmus, 2008 | | MHRC, 2007 | | Westfall, 2001 | | SCC, 2006 | | Majumder, 2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Indicator | Nature | Indicator | Nature | Indicator | Nature | Indicator | Nature | Indicator | Nature | Indicator | Nature |
| Natural environment | Consideration of details, clarity, lucidity. Has capacity to be measured, has importance coefficient | Air quality | Extensive range of indicators; No attention to detail; lack of evaluation criteria; lack of importance coefficient | Sufficient health centers | General; lacking evaluation criteria; lacking importance coefficient ; unclear | Justice | Consideration of details; clear and lucid; has capacity to be measured; lack of importance coefficient | Natural resources | Unclear; general; Ambiguous; Lacking importance coefficient | Air quality | Extensive range of indicators; No attention to detail; lack of importance coefficient |
| Welfare & health | | Biodiversity | | Healthy water, Gas, Telephone, Electricity | | Urban productivity | | Environment quality | | Water quality | |
| Safety & security | | Ozone Destruction | | | | New technology | | | | Traffic jam | |
| Housing | | Agricultural & food | | | | Housing | | | | Noise | |
| Economy & employment | | Economy & economic development | | Suitable climate | | Urban land | | Variety in the ecosystem | | Transport availability | |
| Education | | General Knowledge & education | | | | Health & education | | | | Earthquake | |
| Social environment | | Environmental justice | | Efficient public transport | | Population | | Human needs | | Hill Cutting | |
| | | Water & wastewater | | Low traffic congestion | | City services | | | | Cyclone | |
| | | Energy change & climate | | | | City | | Economy | | Electricity | |
| | | | | | | environment | | | | | |
| Urban facilities | | Public transportation | | | | City transportation | | Globalization | | Gas supply | |
| Energy | | Parks & urban outdoor spaces | | Small amount of natural disasters | | Local government | | | | Sanitation | |
| Transportation | | Solid trash | | | | Urban management | | Natural and man-made disasters | | Educational facilities | |
| Art & cultural heritage | | Dangerous material | | | | | | | | Business facilities | |
| Artificial environment | | Human health | | | | | | | | Slum | |
| | | Risk management | | | | | | | | | |

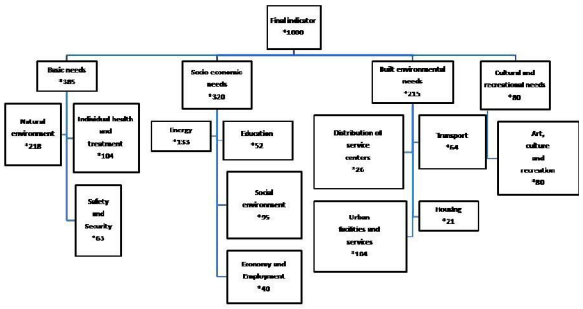


**Fig. 2.** Final model for evaluating Hyderabad's environment quality,
"*" Shows the important coefficient numbers

In the second layer, we have four groups of "main indicators": basic needs, cultural and recreational needs, built environmental needs and socioeconomic needs. In the third layer, twelve main indicators such as energy, safety and security, natural environment and others are placed. In the fourth layer each of the main indicators has been divided into "secondary indicators", such as water pollution, soil resources and so on. In the fifth layer the subdivision of the secondary indicators known as "environmental factors" has been divided into smaller parts, such as human resources, accidents, rescue operations and others. Finally, the sixth layer contains "measures" such as the number of general practitioners, the amount of Sulfur oxides and the average total of rainfall and so on. As it can be seen, measures are the smaller form of the indicators of the higher layers which can be measured. This means that, "measures" are in the lowest layers of the model and "the final indicator" is in the highest layer, in a way that with a mathematical formula in a bottom up order, first the sum of the "measures", then "environment factors" pursued by "secondary indicators", "main indicators", "group of main indicators" and at the end "the final measurement of city environment quality" are calculated. For evaluation, documented, accessible statistics and information from various studies and organizations have been collected. The most important among these resources are the following: central pollution control board (CPCB), state pollution control boards (SPCB), Andhra Pradesh Pollution Control Board (APPCB) and state environment impact assessment authorities.

So that for more clarify the idea of the model and its indicators, following is an example of the method of calculation. For example the "natural environment" indicator is one of the twelve indicators in the third layer which in the fourth layer is divided into the four secondary indicators of "water resources", "soil resources", "air pollutants" and "climate" with importance coefficients of 47, 38, 32, and 14 respectively. The total importance coefficient for the four above-mentioned secondary indicators adds to a 218 importance coefficient for the "natural environment" indicator. In the same manner, for instance 48 as the importance coefficient for the secondary indicator of "air pollutants" itself is the added total of the importance coefficient of five evaluators; SO2, NO2, Pm10, CO, O3 with the importance coefficients of 11, 9, 10, 12 and 9 respectively (Fig. 2). Computations for the amount of the indicators' quality is done in a similar manner of first hierarchically adding the amount of the measures quality in the lowest levels, continuing to the next levels until finally reaching the final quality for the city (in the first layer of the model). At last after calculating the quantitative amount of each of the measures, secondary indicators and the other levels of the model, the amount of the quality of each is determined and evaluated according to Table 2.

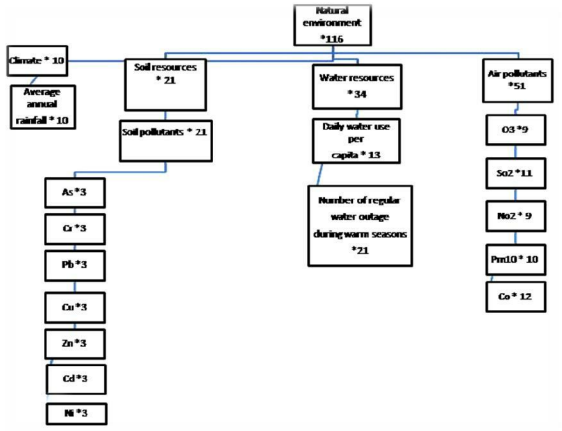


**Fig.3.** Flowchart of "natural environment" indicator,
"*"Shows the important coefficient numbers

**Table 2.** Categorizing of the quality amounts

| Condition | Amounts |
|---|---|
| Best quality (very desirable) | 80% and more |
| Desirable quality | 60-80% |
| Middle ranking quality | 40-60% |
| Low quality | 20-40% |
| No quality (undesirable) | 20% and less |

(Tabibian and Faryadi 2002)

Hyderabad's environmental quality symbolized by the twelve indicators: after carrying out the evaluation in the manner explained in the calculation and research method, Hyderabad's environmental

quality in 2010 has been calculated as demonstrated in Table 3. The resulted amounts show the quality of each main indicator compared to the highest quality considered by the model for that indicator.

**Table 3.** Twelve main indicators of Hyderabad environmental quality

| | |
|---|---|
| Culture, Art, Recreation | 14% |
| Housing | 52% |
| Transportation | 37% |
| Urban facilities | 65% |
| Service centers distribution | 45% |
| Economy and employment | 58% |
| Education | 75% |
| Social environment | 53% |
| Energy | 42% |
| Safety and security | 34.4% |
| Individual health and treatment | 48.6% |
| Natural environment | 65% |

Based on the sum of the twelve main indicators (first model's layer), the scores of the four main indicator groups (model's second layer) were calculated in the following step. The computations in all layers are based in following meanings:

$E_{ij}$: Raw weight of each measure in 4 hierarchical orders:

i=1-5

| | | | | |
|---|---|---|---|---|
| 0 | | | 60 | |
| 0 | | 30 | | 60 |
| 0 | 20 | | 40 | 60 |
| 0 | 15 | 30 | 45 | 60 |

$E_{12}$ = 60: The raw weight of each measure in its best condition which always is 60 in every layer

D: Measure's importance coefficient, which has been arbitrarily considered for each measure

$\Sigma E_{i3} = E_{i2} \times \Sigma D$: Current situation of indicator

i=1-5

$\Sigma E_{13} = E_{12} \times \Sigma D = 60\Sigma$ D: Best situation of indicator

N: Total number of measures in the each main indicator group

N: $n_1+n_2+n_3+.....n_n$

Q = the amount of Quality: $(Current\ situation\ /\ Best\ situation) \times 100$

**Table 4.** "Basic needs" main indicator group (natural environment, individual health and treatment, safety and security):

| | |
|---|---|
| N=15+10+4=35 | Total number of measures in the "basic needs" main indicator group: |
| n1= 14 | Total number of evaluators in the "natural environment" main indicator |
| n2=12 | main indicator Total number of measures in the "individual health and treatment" main indicator |
| n3= 9 | Total number of measures in the "safety and security" main indicator |

Current situation = $\Sigma E^{13}_{N}$ = (9810+1560+945) =12315

Amount of the "basic needs" main indicator group quality in Hyderabad (2010):

Best situation = E12 × Σ D = ΣE13

60 × (218 + 104 + 63) = 23100

*Q*= 7195/ 11580 × 100= 53.3%

Based on Table 2, Hyderabad had a middle quality in 2010 with a score of 53.3% in the "basic needs" main indicator group.

**Table 5.** "Socio-economic needs" main indicator group (energy, social environment, education, economy and employment):

| | |
|---|---|
| N=4+ 2+3+2=34 | Total number of measures in "socio-economic needs" |
| n1= 10 | main indicator group: Total number of measures in "energy" main indicator group |
| n2=11 | Total number of measures in " social environment" main indicator group |
| n3= 7 | Total number of measures in "education" main indicator group |
| n4=6 | Total number of measures in "economy and employment" main indicator group |

Current situation= $\Sigma E^{2}_{i2}$ = (5985+1560+2850+1200) = 11595
Best situation= $E_{12} \times \Sigma D = \Sigma E_{12}$
60 × (133+52+95+40) = 19200
Amount of the "socio-economic needs" main indicator group quality in Hyderabad (2010):
*Q* = 4440 / 6660 × 100= 60.3%
Based on Table 2, Hyderabad had a desirable quality in 2010 with a score of 60.3% in the "socio-economic needs" main indicator group.

**Table 6.** "Built environmental needs" main indicator group (service centers distribution, urban facilities, transportation, and housing):

| | |
|---|---|
| N= 1+5+4+2=11 | Total number of evaluators in "built environmental needs" main indicator group: |
| n1=3 | Total number of evaluators in "service centers distribution" main indicator |
| n2=4 | Total number of evaluator s in "urban facilities" main indicator |
| n3=2 | Total number of evaluator s in "transportation" main indicator |
| n4=2 | Total number of evaluators in "housing" main indicator |

Current situation= $\Sigma E^{13}_{i3}$ = (780+1560+1920+630) = 4890
Best situation= $E_{13} \times \Sigma D$ = 60 × (26+104+64+21) = 12900
Amount of the "man-made needs" main indicator group quality in Hyderabad (2010):
*Q* = 4890 / 12900 × 100= 37.9%
Based on Table 2, Hyderabad had a low quality in 2010 with a score of 37.9% in the "built environmental needs" main indicator group.

**Table 7.** "Cultural and recreational needs" main indicator group (art – culture – recreation):

| | |
|---|---|
| N: n1= 12 | Total number of evaluators in " cultural n1: Total number of evaluators in art – culture – recreation indicator =12 |

Current situation= $\Sigma E^{13}_{i3}$ = (675)
Best situation= $E_{13} \times \Sigma D$ = ΣE13 60 × 80=4800
Amount of the "cultural and recreational needs" main indicator group quality in Hyderabad (2010): *Q* = 675 / 4800 × 100= 14%
Based on Table 2, Hyderabad had an undesirable condition in 2010 with a score of 14% in the "cultural and recreational needs" main indicator group.
Final amount of Hyderabad's environmental quality (2010) in the end, by adding the results of the four groups of main indicators (basic needs, socio-economic needs, man-made needs, cultural and recreational needs) the total score of the final amount is calculated as follows:
n=4 Number of groups of main indicators (basic needs, socio-economic needs, man-made needs, cultural and recreational needs)
Current situation:
$\Sigma E^{4}_{i2}$= (12315+11595+4890+675) = 29475
Best situation
$\Sigma E^{4}_{i2}$= (23100+19200+12900+4800) = 60000
Final amount of quality= Current situation total / Best situation total ×100
$\Sigma E^{4}_{i2}$/ $\Sigma E^{4}_{i2}$× 100= 29475 / 60000 ×100 = 49.1%
Therefore, in 2010 Hyderabad possessed near to half of this model's expected quality with a collective score of 49.1%. This percentage demonstrates Hyderabad's average environmental quality in the studied year (2010) based on the presented model.

## 4. Results and discussion

As it was observed, the final amount of Hyderabad's environmental quality was approximately calculated to be 49.1%. This quantity has been extracted from the scores achieved by the four groups of main indicators (basic needs, socio-economic needs, built environmental needs, cultural and recreational needs). "Basic needs" with a score of 53.3%, "socio-economic needs" with a score of 60.3%, "built environmental needs" with score of 37.9%, and "cultural and recreational needs" with a score of 14% placed Hyderabad in the middle ranking of environmental quality. A general comparison between the evaluation results from the viewpoint of four main indicator groups show that although "basic needs" and "socio-economic" needs have an important role in determining Hyderabad's environmental quality based on their respective importance coefficients of 385 and 320, the "cultural and recreational" main indicator group with a mere importance coefficient of 80 which allocates only 14% of the total importance coefficients, is the most important factor in decreasing Hyderabad's environment quality in 2010. In the main indicator group of "cultural and recreational needs" which incorporates the art, culture and recreation indicator, insufficient exploitable sport areas, museums and theater hall per capita and insignificant library use per capita are the main reasons for the low final quality of this main indicator.

In the "basic needs" main indicators group, the "natural environment" indicator with a score of 65%, the "individual health and treatment" indicator with a score of 48.6%, and the "safety and security" indicator with a score of 34.4% were effective in their group's 53.3% score. In the natural environmental section, the weather desirable

conditions, average rainfall in Hyderabad and providing the residents with drinking water despite insufficient regional water resources are among the effective factors on Hyderabad's desirable situation in this group. It should be added that Hyderabad has an urgent needs of upgrading old sewerage system with laying of proper underground drainage lines and replacement of old water pipelines in the core and outskirt areas. Regarding air pollution's undesirable condition due to the Industries, thermal power plants, Use of coal and fuel wood and also motor vehicles are among the major contributors to air pollution in Hyderabad.

Regarding the "individual health and treatment indicator", the effective factors that helped this group achieve a middle quality were the high percentage of vaccination of children under the age of two, decreasing the amount of patients affected to pulmonary and non-pulmonary tuberculosis to an middle ranking amount, decreasing relative risk of malaria, HIV & AIDS and underweight children of less than 4 years. Finally, presence of specialist doctors and general practitioners, and also the existence of the necessary number of public and private hospital beds (public and private hospitals).

With regard to the "safety and security" indicator, the high stats of in-city car accidents, deception and robberies across the city were reasons for Hyderabad's quality to be 34.4% in this indicator.

Regarding the "socio-economic needs" main indicator group, it can be observed that even with a variety of economic and social problems in metropolises, Hyderabad was able to achieve 60.3% of the model's expected quality in this group. As the scores obtained by the four "main indicators" of this group demonstrate, the "energy" main indicator with a score of 42%, the "social environment" main indicator with a score of 53%, the "education" main indicator with a score of 75%, and the "economy and employment" main indicator with a score of 58% were all effective in this group achieving a 60.3% quality.

In the "energy" indicator, Hyderabad's middle quality was due to insufficient source of energy and also the city's unstable condition from the viewpoint of average electricity outage period. Regarding the "social environment" indicator, Hyderabad's undesirable quality of littering and dumping of garbage, sewage treatment and the city's middle quality for family size caused to its middle ranking place. With regard to the "education" indicator, Hyderabad's desirable quality was due to illiteracy rate (20.4%) and also 100% radio and television coverage across the city and the desirable rate of signing in elementary school. Regarding the "economy and employment" indicator, the city's middle ranking quality was due to unemployment and inflation rate.

In the "built environmental needs" main indicator group, the "public service centers distribution" indicator with a score of 45%, the "urban infrastructures" indicator with a score of 65%, the "transportation" indicator with a score of 37%, and the "housing" indicator with a score of 52% were effective in their group's 56% quality score. Regarding the "public service centers distribution" the average number of vegetable and fruit stands and markets throughout the city has lead to a desirable ranking quality in this indicator. With regard to the "urban infrastructures", Hyderabad achieves a middle quality, the city's low quality in the aspect of wastewater piping, urban drainage networks and canalization, especially in monsoon season. Hyderabad as well achieves middle percentage of amount of phone landlines; recycling house waste and also post office boxes throughout the city on the other hand, have all lead to the achievement of middle quality in this group.

In the "transportation" indicator group, the desire quality of public transportation fleet per capita (number of people per vehicle), small share of bicycles in intercity travelling, and also lack of basic facilities at subway and monorail, the middle ranking percentage of using public transportation for inter-city travelling has lead to an middle ranking quality score in the group.

Achieving a desirable quality score in the housing indicator demonstrates the city's suitable condition in this regard, while at the same time providing residents with housing has always been one of the main problems of the citizens of Hyderabad. It seems that, this inconsistency is related to the type of chosen measures based on the existing data and statistics, most of which emphasize in production of housing (measure of number of families' ratio to housing units) and also buildings conditions from the viewpoint of sustainability and strength. Regarding the slum dwellers, Hyderabad's middle quality is due to health, water sanitation, gender inequality and living condition.

With regard to the "cultural and recreational needs" main indicator group, the main indicator of "art, culture and recreation" was the reason for this group's 14% quality score. Insufficiency of exploitable sport areas per capita, library usage per capita and city parks per capita, as well as the low per capita of museums per 100000 people, are all the main reasons behind Hyderabad's low quality in this indicator.

## 6. Conclusion

The main result for this evaluation was calculating the final amount of Hyderabad's environmental quality in 2010 (the census year based in this research). Based on this evaluation, Hyderabad achieved near half of the best quality expected, that is, 49.1%. Observing this process can signify the city's movement towards a livable and sustainable city. On the other hand, observing these results can make the city's management and planning authorities aware of the city's points of strength and weakness. Finally, it can be asserted that such an insight facilitates major decision-makings regarding the execution of development programs. Accordingly, it seems that creating an integrated urban management approach can have a major role in solving many of Hyderabad's problems and speeding up the process of improving its environment quality. Although obviously Hyderabad's municipality is not capable of solely realizing this integrated management and it requires an all inclusive cooperation on the part of the people and other related sections. Another important result is providing a suitable model for evaluating the city's environment quality based on a collection of environment indicators. The present model is the result of comparing and analyzing similar models and selecting more suitable indicators based on available data and measurable indicators. Therefore, the model presented in this survey is a suited and harmonized model which can be used for evaluating the environmental quality of other areas and cities. This model's dynamism rely on information input and substituting correct data in it which, in a cumulative movement from bottom -up, can explain city environmental quality. Also, the research's results clearly indicate that although in the presented model numerous amounts of factors constituting the urban environmental quality are presented through a limited amount of measures (48) or measurable and more comprehensive indicators, a relatively thorough evaluation of cities' environmental quality is possible to a high extent using of this model. Considering the evaluation results, some planning strategies for improving Hyderabad's environmental quality are presented below. The strategies are classified on the basis of the most important identified problems.

For decreasing high amount of cars and the high traffic it is suggesting utilizing intelligent control and management systems, improving road quality, developing transportation rail lines (urban trains) and more use of public transport in inter-city travelling and increase special bicycle trails throughout the city.

To improve the littering and waste management it is suggests for prohibit littering on the street, devise ways to collect waste from unsanitary and difficult areas such as slums, hotels, restaurants, office complexes and commercial areas, build adequate storage facilities taking into account the population density so as to prevent overflowing of trash cans and color-code waste bins so as to promote segregation of waste at source-green for biodegradable, white for recyclable wastes and black for other wastes. To increase the sport places per capita is suggests for establishing new sport centers throughout the city and its neighborhoods and installing sports equipment in city parks in order to create suitable sport areas.

To decrease the repeated and lengthy period of time occurrences of power outage it is suggests for moving in the direction of privatization and decreasing cities' dependency on the national powerhouse network through establishing new powerhouses around cities.

To increase the library use per capita it is suggest that to increasing libraries' work hours and developing, also improving their services, establishing public and specialist libraries throughout the city and promoting the culture of book reading and using libraries.

To decrease of high air pollution it is suggests for eliminating timeworn vehicles, standardizing new vehicles, improving public transport, using clean technology, improving fuel quality, technical examination of vehicles and traffic management and education. To decrease the high rate of in-city car accidents it is suggesting for improving the content and performance of driving laws, prohibiting the use of mobile phones while driving, driving below the speed limit and standard number of passengers in cars.

To decrease the high rate of inflation it is suggest for using monetary policy strategy (selling partnership papers, decreasing the amount of loan payoffs), utilizing fiscal policy and transition of incumbency activities of the government toward policy making and supervision.

## References

1. Asadi, S. S and et al. Remote Sensing and GIS Techniques for Evaluation of Groundwater Quality in Municipal Corporation of Hyderabad (Zone-V), India. Int. J. Environ. Res. Public Health. 2007; Vol. 4(1). pp. 45-52.
2. Bahrainy, S. H. and M. Tabibian. A model for evaluation of urban environmental quality. Journal of Environmental studies, 1999; Vol. 24 (21&22), pp. 41-56.
3. Bartelmus, P. Indicators of sustainable development, Encyclopaedia of Earth (EOE), 2008; Retrieved November 30, 2010, from http://www.eoearth.org/article/Indicators of sustainable development.

4. Bertolini, L. The multi-modal urban region: A concept to combine environmental and economic goals. In Future Forms and Design for Sustainable Development, M. Jenks And N. Dempsey eds. Oxford, Uk, 2005; 238.
5. Broadbent, G. Emerging concepts in urban space design. London & New York, Van Nostrand Reinhold, International, 1990; 56.
6. Census of India. District Census Handbook of Hyderabad, Andhra Pradesh, Census of India, 1991; 234.
7. Census of India. Urban Agglomerations/Cities having population 1 lakh and above. The Registrar General & Census Commissioner, India. Retrieved 17 October 2011; 249.
8. Divan, S. and A. Rosencranz., Environmental Law and Policy in India: Cases, 2001; 223.
9. GHMC. Greater Hyderabad Municipal Corporation Report. Retrieved 17 August 2011, 2010; 423.
10. Evaluation of Central Pollution Control Board, (CPCB). Report of Ministry of Environment and Forest Government of India. Indian Institute of Management, Lucknow, 2010; 328.
11. GOI. Policy Statement for Abatement of Pollution. Delhi: Ministry of Environment, 1992; 158.
12. Gyananath, G. and et al. Assessment of Environmental Parameter on ground water quality. Indian Journal of Environmental Protection, 2001; Vol. 21, pp. 289-294.
13. HMWSSB. Report of Hyderabad Metropolitan Water Supply & Sewerage Board. Hyderabad, A P, 2010; 198.
14. Holden, M. Urban indicators and the integrative ideals of cities", in Cities Journal, 2006; vol. 23(3), pp. 170-183.
15. HUDA. Hyderabad area Transportation study, HUDA 2020, Report of Hyderabad Urban Development Authority. Hyderabad, AP. Materialsand Statues. New Delhi: Oxford, 2003; 285.
16. Meadows, D.H. Indicators and Information Systems for Sustainable Development, The Sustainability Institute, Hartland Four Corners, Vermont, 1998; 275.
17. MHRC. Mercer Human Resource Consulting, Quality of Living global city rankings Mercer survey. Retrieved November 30, 2010, from: http://www.mercer.com/summary.html, 2007; 153.
18. Mitlin, D. Sustainable development: a guide to the literature, in Environment and Urbanization, 1992; vol. 4(1), pp. 111-124.
19. Pijanowski, B. C and et al. Urban Expansion Simulation Using Geospatial Information System and Artificial Neural Networks. Int. J. Environ, 2009; Vol. 3 (4), pp. 493-502.
20. Prasad, S. and C. Ramachandraiah. Health Services and Disease Profile of Hyderabad City: A Pilot Study, Report submitted to the sub-group on Public Health in Hyderabad to the larger project on Megacities of Tomorrow, being conducted by the Humbolt University, Berlin, and being coordinated by Prof. H.C. Konrad Hagedorn and Dr. Ramesh Chennamaneni, 2007; 374.
21. Rama Rao, J. Protection of Hyderabad Drinking Water Sources: A Note, Hyderabad, 2004; 213.
22. Ramachandraiah, C. Urbanization and Urban Services", in Hanumantha Rao, C.H. and S. Mahendra Dev. Andhra Pradesh Development: Economic Reforms and Challenges Ahead, CESS, Hyderabad, 2003; 352.
23. Rodenburg, Eric and Dan Tunstall. Environmental Indicators for Global Cooperation. World Bank Publication, 1995; 212.
24. SCS. Sustainable city of San Francisco, Sustainability Plan for the City of San Francisco. Retrieved December 6, 2010 from: http://www.sustainable-city.org/index.htm.
25. state pollution control boards, (SPCB). Anhera Pradesh State Pollution Control Board and Forests, Government of India, 2010; 234.
26. Venkateswara Rao, B. and N. Srinivasa Rao. Influence of Urbanization over the nearby Catchments of the City – A case Study of Hyderabad (India). Hyderabad: JNT University, 1998; 284.
27. Westfall, M. and V. de Villa. Urban indicators for managing cities. Manila, Asian Development Bank, 2001;124.
28. Wirth, L. Urbanism as a way of life. American Journal of Sociology, 1983; vol.44, pp.1-24.
29. Ziari, K. and M. Gharakhlou. A Study of Iranian New Towns During Pre and Post Revolution. Int. J. Environ, 2009; Vol. 3 (1), pp. 143-154.

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