ANALYTICAL HIERARCHY PROCESS (AHP) METHODS FOR
SLUM DEVELOPMENT ANALYSIS

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ABSTRACT

Poverty is pronounced deprivation in well-being, and comprises many dimensions. The Slum development strategies depend on different parameter based on variability & characteristics of slum. The field survey data of different parameter with variable criteria give the snap short of the characteristics of slum. Slum Development Score (SDS) can be evolved by the city development parameter and slum development parameter. The present study is developed to analyse slum parameter like land status, housing status, infrastructures, social amenity and social security using Analytical Hierarchy Process (AHP) method. Beside on result the slum improvement alternatives can be suggested. This gives the idea of the requirement of different resources. This gives the suggestions for resource management for the eradication of slum.

KEYWORDS: Slum Development Analysis, Poverty, AHP. SDS.

INTRODUCTION

Poverty is pronounced deprivation in well-being, and comprises many dimensions. It includes low incomes and the inability to acquire the basic goods and services necessary for survival with dignity. Poverty also encompasses low levels of health and education, poor access to clean water and sanitation, inadequate physical security, lack of voice, and insufficient capacity and opportunity to better one’s life.

Slum survey collected data in many formats where many data collection in language data and that have to convert in statically data for analysis. In order to measure an overall picture of SLUM to achieved the Goal “Policy & Strategies for Eradication of Slum and Integrated & inclusive Analysis”. Slum development strategies has to analyses in two main Phase

- City level influence parameter
- Slum level influence parameters

Phase I of this research involved in data collection at actual grass rout level as per government of India “various knowledge acquisition Techniques to generate a body of information that could be useful in isolating the risk factors associated with the development. To accomplish the objectives of Phase II, the results of Phase I were utilized. This phase became a continuation of
the activities in Phase I. The Analytic Hierarchy Process (AHP) as one of multi-attribute decision making (MADM) is a structured technique for dealing with complex decisions. Rather than prescribing a "correct" decision, the AHP helps the decision makers find the one that best suits their needs and their understanding of the problem. The AHP provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions.

The AHP applies three level of each category of slums and finally at city level. So calculating SLUM DEVELOPMENT SCORE (SDS)in five layers and final six layers give the score limits for Slum development strategies as under:

1. Indicators of slums
2. Sub Criteria of Indicator
3. Criteria of Sub criteria
4. Categories of Criteria
5. City level parameter to categories
6. Slum development strategies

First three layers analyses with AHP Methods and final layer analyses with weighted index method (WIP). The advantage of AHP method is easy to determine the importance of degree while comparing two criterions. The hierarchic analysis of nine –degree is widely used to determine the weights of multi criteria (9 and above). By using the AHP pair wise comparison process, weights or priorities are deprived from set of judgments. After developing weights for each criterion, the aggregated Slum Development score of each household can be calculated.

**OBJECTIVE**

Housing for Slum/Urban Poor is stressed on the specific issue urban center and also in urban agglomeration. It has been tried to completely cover all the aspects related to characteristics of slums. The characteristics of slums may quantified on different categories and their criteria and indicator.

- To develop analysis model for slum development through AHP
- This study is providing analytical approach for slum analysis, which gives the ultimate solution for Central and State Government for finance allocation for poverty alleviation program.
- This study also initiative method for public privet partnership in poverty alleviation program particularly in housing and city infrastructure.
To build partnerships that make accessible to the urban poor land, infrastructure and housing finance at affordable rates. In the process, roles and relationships amongst the many actors must change to allow community participation and control. Efforts will be made to develop and promote use of cost-effective standardized housing designs for each geo-climatic region.

**IDENTIFY CATEGORIES, CRITERIA AND INDICATOR FOR URBAN POOR MEASUREMENT**

Though urbanization is generally associated with lower levels of poverty, certain aspects of economic development and changes associated strongly with the process of urbanization in India have created a backwash effect for poor urban communities. This includes re-structuring and dismantling of larger industries in big cities like Mills due to higher land prices in cities leaving a large number of workforce jobless forcing them into informal sector activities. Similarly, slum demolition drive in some cities has made urban poor more deprived and stressed. The relationship between economic development and urban poverty is complex. Though large cities have lower levels of poverty the backwash effect of new development may become even harsher on the urban poor. Cities do need blue collar workers and in the interest of an orderly and inclusive development, cities need to integrate the poor and informal sector workers into the main city system Poverty research and slum development are interrelated but when it’s come to Physiographic development of the slum area the indicator play major role.

For the purposes of this paper, urban slum analysis is defined as the process of gathering, analyzing, and presenting information on the extent, location, and conditions of poverty in a given city. This can then be used to generate a city poverty profile that policy makers, community members and academics can use in answering questions about urban poverty and to identify appropriate responses. It also provides a baseline from which changes in policies, investments and activities may be measured. As the conditions and quality of poverty are not static, a good city poverty profile should serve as a dynamic starting point for better understanding poverty problems and appropriate responses.

The National Buildings Organization (NBO) has been functioning as an apex organization in the country for collection, tabulation and dissemination of statistical information on housing and building construction activities. Having regard to the changing requirements under various socio-economic and statistical functions connected with housing, construction, slum development, urban poverty alleviation and related activities, and also to ensure that the schemes of the Ministry of Housing & Urban Poverty Alleviation (MoHUPA) are supported database.

It is essential that for statistical, administrative and other reasons, the data relating to urban poverty, slums, livelihoods, delivery of civic amenities and housing to the poor are collected and
Analytical Hierarchy Process (AHP) methods for slum development analysis

collated at a single source. State Governments and Urban Local Bodies have been conducting their own surveys and maintaining data base. However, such data banks broad uniformity across the country.

<table>
<thead>
<tr>
<th>Hierarchy of Parameter</th>
<th>Layer for Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 categories</td>
<td>4\textsuperscript{th} Layer</td>
</tr>
<tr>
<td>2 criteria</td>
<td>3\textsuperscript{rd} Layer</td>
</tr>
<tr>
<td>3 sub-criteria</td>
<td>2\textsuperscript{nd} Layer</td>
</tr>
<tr>
<td>4 indicators</td>
<td>1\textsuperscript{st} Layer</td>
</tr>
<tr>
<td>5 value of indicator</td>
<td>Value as per range</td>
</tr>
</tbody>
</table>

Selection of Categories for Criteria

Selection of Categories for Criteria based on Government of India Ministry of Housing & Urban Poverty Alleviation guideline in view that data can be analyses model runs for any city/town. Three stage detail survey to be carried out by each town/city.

Categories

1. Slum status/ basic information on slum
2. Land status
3. Demographic profile of slum
4. Housing status of slum
5. Economic status of slum
6. Access to physical infrastructure
7. Education facilities
8. Health facilities
9. Social development/welfare
10. Occupation status of slum

Each category has sub criteria, Criteria and indicator based on Government of India (GOI) formats.
Selection of Criteria for Indicators:

Detail interpretation of each criteria and their indicator as per Ministry of Housing and Urban Poverty Alleviation (MoHPA) Guideline. (Attached Annexe-1)

Indicators are selected to identify urban households or individuals who are in or at-risk into urban poverty beforehand. Based on this hypothesis, urban poverty level of a household or individual can be measured by various indicators. For instance, the housing criterion is used to reflect the quality of his or her dwelling. Some programs (e.g. housing subsidy scheme) use a housing criterion as their only means of measuring poverty, it is notable that housing criterion is measured and scored independently in this method and only as one dimension for measuring urban poverty. Housing criterion with other criteria makes up an overall measure for urban poverty identification of surveyed households.

The multidimensional definition of poverty, it is difficult to encompass all indicators for impracticable by only one survey, such as vulnerability criteria. This alternative measurement is designed with 65 indicators grouped into 10 criteria.

1. SLUM STATUS/ BASIC INFORMATION ON SLUM (A)

   1. Age of Slum (Aa1……Aan)
   2. Whether located in Core City/Town or Fringe area (Ab1……Abn)
   3. Physical Location of Slum (Ac1……Acn)
   4. Is the Slum Notified/Declared (Ad1……Adn)
   5. Type of Area surrounding Slum (Ae1……Aen)

2. LAND STATUS: B

   1. Ownership of Land where Slum is Located (Ba1……Ban)
   2. Please specify Ownership of Land at present (Bb1……Bbn)

3. DEMOGRAPHIC PROFILE OF SLUM: C

   1. No of House hold (Ca1……Can)
   2. Slum Population (Cb1……Cbn)
   3. Density (Cc1……Ccn)

4. HOUSING STATUS OF SLUM: D

   1. Type of housing: Da
      1.1 Pacca: (Dai1……Dain)
      1.2 Semi pacca: (Daj1……Dajn)
      1.3 Kachcha: (Dak1……Dakn)
2. Average % of land ownership: \( Db \)
   - 2.1 With Patta (\( Dbi1 \ldots \ldots Db in \))
   - 2.2 Possession Certificate/ occupancy Right: (\( Dbj1 \ldots \ldots Dbjn \))
   - 2.3 Encroached Privet Land: (\( Dbk1 \ldots \ldots Dbnk \))
   - 2.4 Encroached Public land: (\( Dbl1 \ldots \ldots Dbln \))
   - 2.5 On Rent: (\( Dbm1 \ldots \ldots Dbmn \))
   - 2.6 Other: (\( Dbn1 \ldots \ldots Dbnn \))

5. ECONOMIC STATUS OF SLUM: \( E \)
   - 1. Average % of Monthly Income of House hold in slum: \( Ea \)
     - 1.1 Less then Rs. 1000 (\( Eai1 \ldots \ldots Eain \))
     - 1.2 Rs. 1000 to 2000 (\( Eaj1 \ldots \ldots Eajn \))
     - 1.3 Rs. 2001 to 3000 (\( Eak1 \ldots \ldots Eakn \))
     - 1.4 Rs. 3000 above (\( Eal1 \ldots \ldots Ealn \))

6. ACCESS TO PHYSICAL INFRASTRUCTURE: \( F \)
   - 1. Connectivity to City-wide Water Supply System (\( Fa1 \ldots \ldots Fan \))
   - 2. Weather the Slum is prone to flooding due to rains (\( Fb1 \ldots \ldots Fn \))
   - 3. Frequency of Garbage Disposal (\( Fc1 \ldots \ldots Fcn \))
   - 4. Arrangement for Garbage Disposal (\( Fd1 \ldots \ldots Fdn \))
   - 5. Frequency of Clearance of Open Drains (\( Fe1 \ldots \ldots Fen \))
   - 6. Approach Road/Lane/Constructed Path to the Slum (\( Ff1 \ldots \ldots Fn \))
   - 7. Distance from the nearest Motorable Road (\( Fg1 \ldots \ldots Gfn \))
   - 8. Internal Road (\( Fh1 \ldots \ldots Fn \))
   - 9. Weather Street light facility is available in the Slum (\( Fi1 \ldots \ldots Fin \))

7. EDUCATION FACILITIES : \( G \)
   - 1. Pre -Primary : \( Ga \)
     - 1.1 Pre -Primary Anganwadi under ICDS: (\( Gai1 \ldots \ldots Gai \))
     - 1.2 Pre -Primary Municipal pre – school (\( Gaj1 \ldots \ldots Gajn \))
     - 1.3 Pre -Primary Private pre – school (\( Gak1 \ldots \ldots Gakn \))
   - 2. Primary school : \( Gb \)
     - 2.1 Primary Municipal (\( Gbi1 \ldots \ldots Gbin \))
     - 2.2 Primary State Government (\( Gbj1 \ldots \ldots Gbjn \))
     - 2.3 Primary Private (\( Gbk1 \ldots \ldots Gbkn \))
   - 3. High school : \( Gc \)
     - 3.1 Primary Municipal: (\( Gci1 \ldots \ldots Gcin \))
     - 3.2 Primary State Government (\( Gcj1 \ldots \ldots Gcjn \))
     - 3.3 Primary Private (\( Gck1 \ldots \ldots Gckn \))
4. Adult Education: Gd (Gd1…..Gdn)
5. Non-formal eructation : Ge (Ge1…..Gen)

8. HEALTH FACILITIES: H
1. Urban Health Post : Ha (Ha1…..Han)
2. Primary Health Centre: Hb (Hb1…….Hbn)
3. Government Hospital: Hc (Hc1…….Hcn)
4. Maternity Centre: Hd (Hd1.....Hdn)
5. Private Clinic : He (He1……..Hen)
6. Registered Medical Practitioner : Hf (Hf1…….Hfn)
7. Ayurvedic Doctor/Vaidya: Hg (Hg1…..Hgn)

9. SOCIAL DEVELOPMENT/WELFARE: I
1. Community Hall : Ia (Ia1…...Ian)
2. Livelihood/Production Centre: Ib (Ib1….Ibn)
3. Vocational training/Training-cum-production Centre: Ie (Ie1….Icn)
4. Street Children Rehabilitation Centre : Id (Id1….Idn)
5. Night Shelter: Ie ( Ie1…Ien)
6. Old Age Home : If ( If1…..Ifn)

10. OCCUPATION STATUS OF SLUM : J
1. Average % of Occupation Status of slum: Ja
   1.1 Self- employment: Jai (Jai1…..Jain)
   1.2 Salaried: Jaj (Jaj1…..Jajn)
   1.3 Regular Wage: Jak (Jak1…..Jkn)
   1.4 Casual Labour: Jal (Jal1…..Jln)
   1.5 Other: Jam (Jam1…..Jmn)

IDENTIFICATION OF INDICATOR RANGE

Despite of the multidimensional nature of poverty, poverty measurement must focuses on some indicators. The choice of indicators may respond to philosophical preconceptions, to data limitations or as the results of analysis, poverty measures range from statistical techniques to participatory studies where poverty indicators are revealed with the population being studied. These measures can be grouped into four major categories. For example Category “A denoted as under:

Slum Status/ Basic Information on Slum (A)
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicator</th>
<th>Code</th>
<th>Value of indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE of Slum</td>
<td>1 to 3</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>3.1 to 5</td>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>5.1 to 10</td>
<td>3</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>10.1 to 20</td>
<td>4</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>20 to 30</td>
<td>5</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>above 30</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Slum Notification</td>
<td>yes</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>under process</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Whether located in Core City/Town or Fringe area</td>
<td>Core City/Town</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Fringe Area</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Type of Area surrounding Slum</td>
<td>Residential</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Industrial</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>Commercial</td>
<td>3</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>Institutional</td>
<td>4</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Mix land use- Residential +Commercial</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Mix land use- Residential +Industrial</td>
<td>6</td>
<td>0.7</td>
</tr>
<tr>
<td>Land Use</td>
<td>Count</td>
<td>Value</td>
<td>Code</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>Mix land use- Residential</td>
<td>7</td>
<td>0.3</td>
<td>Ae4</td>
</tr>
<tr>
<td>+ institutional</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mix land use- Commercial</td>
<td>8</td>
<td>0.5</td>
<td>Ae5</td>
</tr>
<tr>
<td>+ Institutional</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mix land use- Commercial</td>
<td>9</td>
<td>0.9</td>
<td>Ae6</td>
</tr>
<tr>
<td>+ Industrial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>49</td>
<td>0.5</td>
<td>Ae7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical Location</th>
<th>Count</th>
<th>Value</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Along Nallah</td>
<td>1</td>
<td>0.4</td>
<td>Ba1</td>
</tr>
<tr>
<td>(Major Storm water Drain)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Along Other Drains</td>
<td>2</td>
<td>0.7</td>
<td>Ba2</td>
</tr>
<tr>
<td>Along Railway Line</td>
<td>3</td>
<td>0.6</td>
<td>Ba3</td>
</tr>
<tr>
<td>Along Major Transport</td>
<td>4</td>
<td>0.9</td>
<td>Ba4</td>
</tr>
<tr>
<td>Alignment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Along River / Water Body</td>
<td>5</td>
<td>0.2</td>
<td>Ba5</td>
</tr>
<tr>
<td>Bank</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On River / Water Body Bed</td>
<td>6</td>
<td>0.3</td>
<td>Ba6</td>
</tr>
<tr>
<td>Others (Hazardous or</td>
<td>7</td>
<td>0.8</td>
<td>Ba7</td>
</tr>
<tr>
<td>Objectionable)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (Hazardous / Non</td>
<td>8</td>
<td>0.2</td>
<td>Ba8</td>
</tr>
<tr>
<td>Objectionable)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notification</th>
<th>Count</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>under process</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
METHODOLOGY

There are national level slum survey formats are finalized by Ministry of Housing and urban poverty alleviation in 2009 the development of slum analysis based on the input data of survey so evolution of strategies based on equal perform. Other official figure like census not gives specific attention to Poverty/ slum profiling.

Analytical Hierarchy Process (AHP)

Analytic hierarchy process (AHP) is a methodological approach which implies structuring criteria of multiple options into a system hierarchy, including relative values of all criteria, comparing alternatives for each particular criterion and defining average importance of alternatives. It was developed as a reaction to the finding that there is a lack of common, easily understood, and easy-to-implement methodology to enable the making of complex decisions. The wide AHP applicability is due to its simplicity, ease of use and great flexibility. The Analytic hierarchy process (AHP) is a powerful and flexible decision making process to help people to set priorities and make the best decision when both qualitative and quantitative aspects of a decision need to be considered. By reducing complex decisions to a series of one-on–one comparisons, then synthesizing the results, AHP not only helps decision makers arrive at the best decision, but also provides a clear rationale that it is the best.

The principle of comparative judgments -

This principle implies comparison of pairs of all elements in a certain hierarchy taking into consideration superior hierarchy. Comparing pairs is necessary because local priority of elements must be defined, taking into consideration their superior element.

The principle of hierarchic composition or synthesis -

The principle of hierarchic composition is applied to multiply the local priorities of the elements in a cluster by the 'global' priority of the parent element, producing global priorities throughout the hierarchy and then adding the global priorities for the lowest level elements.
Develop matrixes that compare the criteria with themselves and the alternatives with each criterion. Use a scale of relative importance. Paired comparisons is a scientific process in which the smaller or lesser element serves as the unit and the larger or greater one is estimated as a multiple of that unit. Although one can say that here too we have guessing but it is very different because we know what we are supposed to do and not just pull a number out of a hat. Therefore one would expect better answers from paired comparisons. If the person making the comparisons knows nothing about the elements being compared, his outcome would be just as poor as the other. But if he does know the elements well, one would expect very good results. AHP enables a person to make pairwise comparisons of importance between decision elements (e.g., child indicators influencing a parent indicator, evaluators evaluating a leaf indicator) with respect to the scale shown in the following table.
### Comparative Importance

<table>
<thead>
<tr>
<th>Importance</th>
<th>Definition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equally important</td>
<td>Two decision elements (e.g., indicators) equally influence the parent decision element.</td>
</tr>
<tr>
<td>3</td>
<td>Moderately more important</td>
<td>One decision element is moderately more influential than the other.</td>
</tr>
<tr>
<td>5</td>
<td>Strongly more important</td>
<td>One decision element has stronger influence than the other.</td>
</tr>
<tr>
<td>7</td>
<td>Very strongly more important</td>
<td>One decision element has significantly more influence over the other.</td>
</tr>
<tr>
<td>9</td>
<td>Extremely more important</td>
<td>The difference between influences of the two decision elements is extremely significant.</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>Intermediate judgment values</td>
<td>Judgment values between equally, moderately, strongly, very strongly, and extremely.</td>
</tr>
</tbody>
</table>

### Slum Level Parameter Analysis:

The proposed method includes both qualitative indicator such as (Community recreational facility, education and health facility) and quantitative indicator such as (Nos. of H.H, density, income level and infrastructure status) to measure multi dimensional deprivation of urban slum. The method is mainly composed of three steps, Firstly identification of Indicators

Secondly calculate the Hierarchy of weights like

- Indicator to Sub indicator
- Sub Criteria to Criteria
- Criteria to Categories
- Categories to City wide parameter

Thirdly Find Slum development score (Aggregate Slum score)
Layer-1

Indicators
Ministry of Housing and Urban Poverty Alleviation Guideline
Total 72 nos Indicators, In 10 Categories

Denoted 1,2,3………..n
Eg. Age of Slum Indicator then
0-3 Year Code-01
3-5 Year Code-02
... Code-n

Layer-2

Sub Criteria
Some criteria has these group

Denoted I,j,k………..n Code-i1…i..n

Layer-3

Categories
Categories is group of criteria and indicator

Denoted

Slum wise calculation

Layer-3  Categories  SDS-L3

Layer-2b  Criteria  SDS-L2

Layer-2a  Sub-Criteria  SDS-L2

Layer-1  Indicator  SDS-L1
L1 – Level -1

Age of Slum (Aa1……Aan)

Whether located in Core City/Town or Fringe area (Ab1……Abn)

Physical Location of Slum (Ac1……Acn)

Is the Slum Notified/Declared (Ad1……Adn)

<table>
<thead>
<tr>
<th>Age of Slum</th>
<th>Whether located in Core City/Town or Fringe area</th>
<th>Aa</th>
<th>Ab</th>
<th>Ac</th>
<th>Ad</th>
<th>Ae</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aa</td>
<td>1.00</td>
<td>5.00</td>
<td>0.14</td>
<td>3.00</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Ab</td>
<td>0.20</td>
<td>1.00</td>
<td>0.20</td>
<td>2.00</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Ac</td>
<td>7.00</td>
<td>0.33</td>
<td>1.00</td>
<td>5.00</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>Ad</td>
<td>0.33</td>
<td>0.33</td>
<td>0.20</td>
<td>1.00</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Ae</td>
<td>2.00</td>
<td>0.50</td>
<td>0.50</td>
<td>4.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

0.041
0.002
0.882
0.000
0.076
Consistency Index (C.I) = \( \frac{n_{\text{max}} - n}{n - 1} \)

\[
\begin{align*}
\text{C.I.} & = \frac{5.29 - 5}{5 - 1} \quad = \quad 0.0725 \\
\text{Random Index (R.I)} & = 1.98 \frac{(n - 2)}{n} \\
\text{R.I.} & = 1.34\frac{(5 - 2)}{5} \quad = \quad 0.8055 \\
\text{Consistency Ratio} & = \frac{\text{C.I}}{\text{R.I}} \\
\text{C.R.} & = \frac{0.0725}{0.805} \quad = \quad 0.09
\end{align*}
\]

Slum development Score of Sub Criteria to Criteria

\[
\text{SDS L1 (Layer1)} = \sum_{i=1}^{n} \text{Score of Indicator-(Aai1……..Aain)} \times \text{Weights of Indicator}
\]

\[
\text{SDS L1 (Layer1)} = \text{Indicator} \times \text{Weights}
\]

Slum Development score Layer-2

\[
\begin{align*}
\text{SDSL11} & \quad \text{SDSL12} \quad \text{.........SDSL1n} \\
\text{SDSL12} & \quad \vdots \\
\text{SDSL1n} & \\
\text{SDSL21} & \quad \text{SDSL22} \quad \text{.........SDSL2n}
\end{align*}
\]

\[
\text{Layer-2 Sub Criteria/Criteria} = \text{Layer-3 Categories}
\]

\[
\begin{align*}
\text{SDS-L2 (1…n)} & \\
\text{SDS-L3 (1…n)} &
\end{align*}
\]

\[= (Aa \times Ab \times Ac \times Ad \times X \times Ae)^{1/5}\]

\[= (Aa \times Ab \times Ac \times Ad \times X \times Ae)^{1/5}\]

\[= (Aa \times Ab \times Ac \times Ad \times X \times Ae)^{1/5}\]

\[= (Aa \times Ab \times Ac \times Ad \times X \times Ae)^{1/5}\]
Calculate Slum Development Score (SDS)

For calculating the aggregate of Slum development score depends on the different layers of score and their weights

$$\text{SDS} = \text{SDSL1} + \text{SDSL2} + \text{SDSL3}$$

<table>
<thead>
<tr>
<th>Indicator*Weights</th>
<th>*Weights of Criteria/Sub Criteria</th>
<th>*Weights of Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>L2</td>
<td>L3</td>
</tr>
</tbody>
</table>

Results of Slum Development Score (SDS)

As the AHP methods use for calculation SDS with the objective is to development slums in terms of Housing and Infrastructure. So the weights for calculate through AHP pair wise compression focus on that criteria. The pair wise comparison for different categories is depends for development of strategies. Particularly for housing and infrastructure development strategies categories A,B,D,E play important role.

STRATEGIES OF SLUM DEVELOPMENT

The SDS gives the value of the slum development need of priority at same time it defends that at which range to be relocating or redevelop. For these Local Corporation has to play major role. Generally following are the ideal range for strategies. For translation of strategies depends on city. The border value of strategic translation required on site present status+ Local Corporation view for development. The SDS results give the direction of development for strategies of development like relocation, redevelopment or up gradation. The internal planning for redevelopment depends on public participation and community mobilization. The

Public participate value is not consider in analysis but it’s useful for further development.

1. Relocation: SDS value from 6.51 to 10

Relocation is the case where the tenability of land and other categories like land tenure, surrounding land use, density and other criteria where there has to be relocation. The proposal of relocation focus on further criteria likes;

Alternatives to resettlement should be fully explored before any decision is taken to move people.

Relocation distances should be minimized to reduce the impact on livelihoods.
Resident dwellers must be provided with some choice of alternative sites and where feasible, an alternative rehabilitation package.

Any urban development project that leads to the involuntary resettlement of communities must make provision to cover the costs of R & R.

All stages of the resettlement process including the transition and follow-up periods should be closely monitored and supervised by the ULB with community representatives.

2. Redevelopment: SDS value from 4 to 6.5

Modify Existing Planning Framework: All existing planning instruments such as Physical planning of area, Land Use Plans etc should be modified to ensure that slums and informal settlements can be properly integrated into the wider urban area.

Community Based Approach: All physical upgrading and improvement in informal settlements should adopt a Community Based Approach with the active involvement of members of the community at every stage of design, implementation, and maintenance of services and assets.

Service delivery on individual household basis: provision of housing and basic services such as water, sanitation and electricity should be provided on an individual household basis and may even precede the granting of full tenure rights. Individual connections will improve operations, maintenance, and facilitate recovery of user charges and thus improve the overall environment.

3. Upgradation: SDS value from .1 to 3.99

The guiding principles and expected outcomes for Slum upgradation categories to be kept in focus while planning and implementing the following basic infrastructure and services are outlined as:

Water supply: Quantum, duration, timing and water quality are the four critical factors in planning water supply delivery. Dual and standby systems, such as piped supply supported by local hand-pumps should be considered as a means of helping to address these four factors.

Sanitation: ULBs should avoid constructing community latrines within slum/informal settlements as these quickly degenerate on account of poor operations and maintenance (O&M) thus becoming counterproductive to public health.
Pedestrian and Vehicular Access Ways: Paved access for pedestrians and/or vehicles will greatly improve overall accessibility. Paved access will encourage investment in the community and promote physical integration with neighboring areas.

Storm Water Drains: Drains in slums serve the dual purpose of carrying sullage water from individual houses as well as draining storm water. It is crucial to integrate the outfalls of such drains with the city’s main drainage system.

Electricity: Individual house connections will greatly enhance the comfort and safety of living and working conditions for residents.

Solid Waste Collection: Sustained awareness campaigns and provision of waste collection receptacles will facilitate a cleaner environment.

Improving Access to Social Services: Basic services of health, education and access to credit are crucial for human capital development and reduce the incidence of poverty. Improved access to social services would also help building up the capacities of poor and empowering them to improve their own living conditions and quality of life.

REFERENCES


