Infrastructure Planning

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Grid Electrification

**Study Goal:** We seek to find the answers of following questions:

- How does the per-unit cost of grid construction vary with penetration rate?

- How does rural population structure affect the cost of infrastructure investments?
Ruhiira, Uganda
Ruhiira, Uganda
Optimal Grid Network

http://invisibleroads.com/movie.swf
Homogeneity Index (H-index)

- H-Index = Actual Network Length / Max. Possible Network Length
- Actual MID / Max Possible MID
  MID: Mean Interhousehold Distance

Actual Network Length = 7 + 2 + 3.5 + 7.5 + 0.4 + 5 + 0.1 + 2 + 0.5 + 0.5 + 3 + 7.5 = 39
Max. Possible Network Length = 7 + 7 + 7 + 7 + 7 + 7 + 7 + 7 + 7 + 7 + 7 + 7 = 84
H-Index = 39 / 84 = 0.46
<table>
<thead>
<tr>
<th>Site</th>
<th>Maximum Possible MID(100) (m)</th>
<th>Actual MID(100) (m)</th>
<th>Density (structures / km²)</th>
<th>H-Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mbola</td>
<td>313</td>
<td>99.7</td>
<td>11.70</td>
<td>0.32</td>
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<tr>
<td>Potou</td>
<td>218</td>
<td>54.3</td>
<td>18.80</td>
<td>0.22</td>
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<td>Ruhiira</td>
<td>134</td>
<td>56.9</td>
<td>64.30</td>
<td>0.42</td>
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<tr>
<td>Tiby</td>
<td>215</td>
<td>32.7</td>
<td>25.00</td>
<td>0.15</td>
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<tr>
<td>Sauri</td>
<td>82</td>
<td>41.6</td>
<td>176.10</td>
<td>0.51</td>
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<td>Ikaram</td>
<td>274</td>
<td>46.5</td>
<td>14.83</td>
<td>0.17</td>
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<td>Mayange</td>
<td>140</td>
<td>47.5</td>
<td>58.95</td>
<td>0.34</td>
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<tr>
<td>Pampaida</td>
<td>303</td>
<td>72.7</td>
<td>13.08</td>
<td>0.24</td>
</tr>
</tbody>
</table>

**Homogeneity Index (H-index)**
Micro Density Variation Index (MDVI)

- Count the number of structures in a small sized square which spans the entire region
- Calculate sample coefficient of variation
  - Standard Deviation/ Mean
Example: Pampaida, Nigeria
MDVI=4.376594
Max. Possible MID=303
H-Index: 0.24

Estimation for Actual MID = 0.24*303 = 72.2
Mean Cost (MID) of Network

- Mbola, Tanzania
- Potou, Senegal
- Ruhiira, Uganda
- Tiby, Mali

Households connected (%) vs. MID (m)
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