MEASURING RURAL ACCESS INDEX
Methodology and Application

Atsushi Iimi
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Rural Access Index – Share of rural population who has access to an “all-season road” within 2 km (approximately, 25-minute walk)

Rural Access Index developed originally by Roberts et al. (2006) – Globally, 1 billion people or 68% of total rural population were left unconnected

- Original method in 2006
  - Based on household surveys
  - Statistical modeling if no HH survey is available
- Methodological challenges
  - Data availability – No regular update
  - Inconsistency across countries
  - Sampling at national level – Little operational relevance

Renewed interest in the SDG context – RAI is one of a few global indicators in the transport sector

**SDG Target 9.1**

“Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all”

- **Indicator 9.1.1**: Proportion of the rural population who live within 2 km of an all-season road

- **Indicator 9.1.2**: Passenger and freight volumes, by mode of transport
  - Aviation
  - Road, rail, inland water, pipeline
  - Led by ICAO; International Transport Forum; UNECE; UNCTAD
New methodology – Conceptually the same, but measured differently using new spatial data and technologies for sustainability and operational relevance

Main principles of the new methodology

- Sustainability
- Consistency
- Simplicity
- Operational relevance

To calculate RAI, use and overlap 3 spatial data

Road condition
Road network
Population

See World Bank (2016) for more details
Where do people live? – Detailed global population data, e.g., WorldPop, GPW, etc. or national census data

Global population data

<table>
<thead>
<tr>
<th>Source</th>
<th>Resolution</th>
<th>Year</th>
<th>Update</th>
<th>Input data?</th>
<th>Reproducible</th>
<th>Urban/Rural</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>LandScan – Oak Ridge Labs</td>
<td>30 arc seconds (~1 km)</td>
<td>2012</td>
<td>Annual</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td><a href="http://www.orl.gov/sci/landsca/n/">http://www.orl.gov/sci/landsca/n/</a></td>
</tr>
<tr>
<td>UNEP Global Population Databases</td>
<td>2.5 arc minutes (~5 km)</td>
<td>2000</td>
<td>None</td>
<td>Available</td>
<td>Yes</td>
<td>No</td>
<td><a href="http://na.unep.net/siouxfalls/datasets/datalist.php">http://na.unep.net/siouxfalls/datasets/datalist.php</a></td>
</tr>
</tbody>
</table>
Where do roads exist? – National road network data owned by road agencies, or commercial database, or open data

- Pros and cons
  - Different coverage – Govt data vs. OSM
  - Consistency with classified road network
  - Costs of data management – Free OSM
  - Voluntary, ad hoc update in OSM

Example of Zambia

(Govt data) (OpenStreetMap)

Available road network data

<table>
<thead>
<tr>
<th>Available road network data</th>
<th>Availability</th>
<th>Access</th>
<th>Consistency</th>
<th>Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government data</td>
<td>Road agencies, statistical offices</td>
<td>Subject to country policy</td>
<td>Consistent with official network</td>
<td>Govt responsibility</td>
</tr>
<tr>
<td>Collected by mobile applications</td>
<td>By RoadLab etc.</td>
<td>Free application</td>
<td>Consistent with official data</td>
<td>Every time when a survey is carried out</td>
</tr>
<tr>
<td>Commercial data</td>
<td>e.g., DeLome database</td>
<td>Commercial license</td>
<td>Consistent across countries</td>
<td>Regularly updated</td>
</tr>
<tr>
<td>Open data</td>
<td>e.g., OpenStreetMap</td>
<td>Free and open</td>
<td>Vary across countries</td>
<td>On an ad hoc, voluntary basis</td>
</tr>
</tbody>
</table>
RAI is sometimes sensitive to urban-rural delineation

In RAI calculation, urban areas need to be excluded using GRUMP data

- Different urban-rural classifications are available
  - Global databases – Global Rural Urban Mapping Project (GRUMP) in 1990
  - National administrative definition
  - New method to delineate cities, urban and rural areas endorsed by the UN Statistical Commission
    - UN. (2020). “A recommendation on the method to delineate cities, urban and rural areas for international statistical comparisons”
Road conditions? – Key for successful RAI calculation and update
➔ A wide variety of technologies are available
Road conditions – Normally, road agencies own Road Asset Management (RAM) systems and update regularly

- “All-season road”?  
  - “All-season road” is defined as a road that is motorable all year round by the prevailing means of rural transport (often a pick-up or a truck which does not have four-wheel drive). Predictable interruptions of short duration during inclement weather (e.g. heavy rainfall) are accepted, particularly on low volume roads. A road that it is likely to be impassable to the prevailing means of rural transport for a total of 7 days or more per year is not regarded as all-season. (Roberts et al., 2006)

- Normal RAM data may not have all-season variable  
- Conversion needed based on individual country context (weather, road specification, etc.)

Coverage, completeness and level of detail differ across countries

Example of “all-season” roads based measured IRI

<table>
<thead>
<tr>
<th>Condition</th>
<th>Paved road</th>
<th>Unpaved</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary</td>
<td>Secondary</td>
</tr>
<tr>
<td></td>
<td>Condition</td>
<td>Gravel</td>
</tr>
<tr>
<td>Very good</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Good</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Fair</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Poor</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Bad</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

Example – Ethiopia

81.3 million people live in rural areas
Example – Ethiopia

85,880 km of roads

31% of roads are in “good” condition – equivalent to all season roads
Example – Ethiopia

RAI = 21.6%
In the MENA region, new RAI method was applied to several countries (see World Bank “Rural Access Update 2017/18”)

- Largely relying on open data
  - WorldPop
  - OpenStreetMap; damaged roads by civil war
  - Classified roads in OSM are assumed to be all-season

<table>
<thead>
<tr>
<th>Country</th>
<th>Rural population (million)</th>
<th>Population with access (million)</th>
<th>RAI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iraq</td>
<td>18.760</td>
<td>11.889</td>
<td>63.4</td>
</tr>
<tr>
<td>Jordan</td>
<td>1.341</td>
<td>0.958</td>
<td>71.4</td>
</tr>
<tr>
<td>Lebanon</td>
<td>0.030</td>
<td>0.028</td>
<td>92.6</td>
</tr>
<tr>
<td>Syria</td>
<td>8.580</td>
<td>7.720</td>
<td>90.0</td>
</tr>
</tbody>
</table>

Operational relevance – RAI is calculated at the national and subnational levels, allowing to identify potential needs in rural access within a country and guide its rural road programs.

Consistency
Regional connectivity based on RAI in Eastern and Southern Africa

Granularity (subnational data)
In Madagascar, prioritizing rural road programs, based on RAI, agricultural production, poverty, …

Normally, poverty is higher where rural access is limited.
As of now, RAI were updated in 25+ countries... Two typical challenges to calculate RAI, and more importantly, to use RAI in road sector operations

1. Regular data collection
   - Responsibility of governments or road authorities
   - A wide variety of new technologies to collect data

2. Interface between RAMs and RAI calculation tool
   - Traditional RAM data are not georeferenced
   - Govt data may not be comprehensive
   - Multiple datasets (national/local)
Resources

Questions?

aiimi@worldbank.org