



ReCAP
Research for Community Access Partnership



Consolidation, Revision and Pilot Application of the Rural Access Index (RAI)

Progress Statement No. 2
(March 2019 to June 2019)



Robin Workman
Kevin McPherson

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For further information, please contact:

Robin Workman, Principal International Consultant, TRL: rworkman@trl.co.uk
TRL, Crowthorne House, Nine Mile Ride, Wokingham RG40 3GA, UK

ReCAP Project Management Unit
Cardno Emerging Market (UK) Ltd
Clarendon Business Centre
Level 5, 42 Upper Berkeley Street
Marylebone, London W1H5PW



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Abstract

The overall aim of this project is to develop a harmonised approach to data collection and measurement of the Rural Access Index that is relevant, consistent and sustainable. The project will facilitate scaling up the implementation of the RAI across United Nations (UN) member countries. The current phase, Task Group 2 (TG2), will consolidate existing and proposed approaches to data collection and revise the RAI methodology in collaboration with the World Bank and other stakeholders. The ultimate aim is to eradicate inconsistencies in data collection, meet international standards and provide a clear framework for data validation.

Since the Inception period a number of activities have been undertaken and good progress has been made towards the project goal. All pilot countries have been visited; Ghana, Malawi, Myanmar and Nepal; and draft supplemental guidelines have been developed to enhance the current RAI methodology. This has been presented to stakeholders and feedback is being incorporated with a view to producing the final document. Options for hosting and publishing the RAI data are also being explored.

Key recommendations include the engagement of Azavea to develop a calculation interface for the Rural Access Index (RAI), increasing joint partners to the custodian, raising awareness and the profile of RAI, considering local partners with specialist geospatial expertise for TG3. A list of potential recommendations for further development have also been identified.

Key words

Rural, Roads, Access, Poverty, Index, SDG, Methodology, Geospatial

Research for Community Access Partnership (ReCAP)

Safe and sustainable transport for rural communities

ReCAP is a research programme, funded by UK Aid, with the aim of promoting safe and sustainable transport for rural communities in Africa and Asia. ReCAP comprises the Africa Community Access Partnership (AfCAP) and the Asia Community Access Partnership (AsCAP). These partnerships support knowledge sharing between participating countries in order to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources. The ReCAP programme is managed by Cardno Emerging Markets (UK) Ltd.

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Acronyms, Units and Currencies

AARS	Asia Association on Remote Sensing
ADB	Asian Development Bank
AfCAP	Africa Community Access Partnership
AfDB	African Development Bank
AsCAP	Asia Community Access Partnership
a.s.l.	above sea level
CERSGIS	Centre for Remote Sensing and Geographic Information Systems
DESA	Department of Economic and Social Affairs
DFID	Department for International Development
DRRD	Department of Rural Road Development
FGD	Focus Group Discussion
GBP	British Pounds
GIS	Geographical Information System
GRIP	Global Roads Inventory Project
HDI	Human Development Index
HDM-4	Highways Development and Maintenance (management system)
IAEG-SDGs	Inter-agency and Expert Group on SDG Indicators
IMT	Intermediate Means of Transport
IRI	International Roughness Index
LSMS	Living Standards Measurement Study
MDA	Ministries, Departments and Agencies
ML	Machine Learning
NSO	National Statistical Office
NSS	National Statistical System
ONS	Office of National Statistics
OSM	Open Street Map
PIARC	World Road Federation
PMU	Programme Management Unit
RAI	Rural Access Index
RCMRD	Regional Centre for Mapping of Resources for Development
ReCAP	Research for Community Access Partnership
SDG	Sustainable Development Goal
SSA	Sub-Saharan Africa
SuM4All	Sustainable Mobility for All
TG1	Task Group 1
TG2	Task Group 2
TG3	Task Group 3
TRL	Transport Research Laboratory
TT	Travel Times
TT19	Transforming Transportation 2019
UK	United Kingdom (of Great Britain and Northern Ireland)
UKAid	United Kingdom Aid (Department for International Development, UK)
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
US	United States
VOC	Vehicle Operating Cost

Contents

Abstract	ii
Key words	ii
Acronyms, Units and Currencies	iii
Executive Summary	3
1 Introduction	3
2 Activities and Progress	4
2.1 Visits and stakeholder meetings	4
2.2 Progress of Tasks	4
2.3 Revised Workplan	6
3 Trial Country Liaison	6
3.1 Details of Trial Countries	6
4 Catalogue of Previous Data	8
5 Progress of a Refined Measurement Process	9
5.1 Population Distribution	9
5.2 Road Network	10
5.3 Road Condition	10
5.4 Supplemental Guidelines to the RAI Methodology	10
5.5 Secondary Indicators	11
6 Publishing and Storage of Data	11
7 Key Recommendations	12
7.1 Raise the Profile of RAI	12
7.2 Dissemination of Project Details	12
7.3 Include Unclassified Networks	13
7.4 Engage Azavea to Create a Web-Based Interface for RAI	13
7.5 Explore Feasibility of a Mobile Phone Data Trial	13
7.6 Increase the Number of RAI Partners	13
7.7 Stakeholder Workshop	13
7.8 Carry out Regional Mini-Workshops	13
7.9 Exploring Funding Options	13
7.10 Consider Local Associations as Partners	14
7.11 Risks and Mitigations	14
7.12 Potential Additional Work	15
8 Next Steps	15
8.1 Finalise Supplemental Guidelines and Measurement Framework	15
8.2 Finalise secondary indicator	16
8.3 Carry out Country Trials	16
8.4 Presentations at international conferences	16
8.5 Stakeholder Workshops	16
9 References	17
Annex A: Presentation at TRL on 5th April 2019	18
Annex B: RAI Working Group Minutes	24
Annex C: Meeting with ReCAP, UN and UKONS in Rwanda	29
Annex D: Meeting: WorldPop in Southampton	31
Annex E: Secondary Indicator Options	33
Annex F: Potential Funding Sources for TG3	35
Annex G: Workplan	38
Annex H: RAI Kick-off meeting in Ghana	39
Annex I: Visit report – Myanmar and Malawi	40
Annex J: Introductory Report for PIARC WRC Conference	45

Annex K: Results Achieved in Reporting Period52
Annex L: Steps for Next Reporting Period53
Annex M: Budget and Inputs54

Executive Summary

The team has made good progress towards the expected milestones required for this Progress Statement No. 2. The requirement is to provide preliminary results from trialling of the measurement framework and key recommendations as regards the way forward for working towards Task Group 3 (TG3), including potential funding sources and development partners.

The team has developed draft supplemental guidelines that are designed to complement the existing methodology used by the World Bank in 2016. This guideline uses similar principles, but introduces the concept of ‘accessibility factors’, which can be used to estimate the all-season status of a road network. This would be used where road condition is not available or unreliable, and where there is little prospect of the local roads authority being able to collect the condition data. It is a low cost and sustainable solution to measure RAI.

The team has maintained liaison with key stakeholders, and attended the United Nations (UN) Big Data workshop in Rwanda, at which the UN Global Platform was presented and discussed. The team also held a seminar at the TRL offices in April 2019 to present progress and the concept of accessibility factors in order to gain feedback from stakeholders. A Rural Access Index (RAI) Working Group meeting was held in May 2019. Valuable interactions, feedback and information were received from these events, which has facilitated progress of the project.

Four countries have been confirmed as trial countries: Ghana, Malawi, Myanmar and Nepal. They have all been visited at least once and trials are under way to test the RAI measurement process where sufficient data has been made available. Data has been hard to collect from most countries, which has restricted progress.

Key recommendations have been made to include the engagement of Azavea to develop a calculation interface for RAI, increase the number of joint partners to the custodian (World Bank), raise awareness and the profile of RAI and consider local partners with specialist geospatial expertise for TG3. A list of potential development ideas have also been identified, as well as potential funding sources.

1 Introduction

The overall aim of this project is to develop a harmonised approach to data collection and measurement of the RAI that is relevant, consistent and sustainable and can be scaled up for implementation of the RAI across UN member countries.

The current phase, Task Group 2 (TG2), is designed to consolidate existing and proposed approaches to data collection and revise the RAI measurement process in collaboration with the World Bank and other stakeholders. The revised process should aim to eradicate inconsistencies in data collection, meet international standards and provide a clear framework for data validation.

This process is expected to raise the profile of the RAI by putting in place clear data-quality standards and robust analytical methods. This will enhance the RAI’s reliability as an indicator (in terms of accuracy and repeatability) and should increase the number of countries using it.

The measurement of the RAI has been adopted as Sustainable Development Goal (SDG) indicator 9.1.1 and was promoted to a Tier II indicator by the Inter-Agency and Expert Group on Sustainable Development Goal Indicators (IAEG-SDGs) in December 2018. To progress to Tier I, RAI data must be measured regularly for at least 50% of UN countries.

2 Activities and Progress

Progress Statement 2 is required to 'provide preliminary results from trialling of the measurement framework, and key recommendations as regards the way forward for working towards TG3, including potential funding sources and development partners'.

Since the first progress statement a number of activities have been undertaken and good progress has been made towards the project goal. These activities have been summarised in the following sections.

2.1 Visits and stakeholder meetings

The team has visited all four trial countries at least once. Myanmar has been visited twice, because the first visit was very much an introductory visit and it took some time to appoint an RAI coordinator. All four trial countries were visited in March 2019, with a follow-up visit to Myanmar in June 2019.

Several other meetings have been held by video conference or telephone, with a wide variety of stakeholders over the past four months, with the more important ones shown in Annexes to this report. The key events are:

- A lunchtime seminar was held at TRL on 5th April 2019 to present the initial guidelines on the RAI measurement process to stakeholders and a wider audience. A summary is shown in Annex A.
- An RAI Working Group meeting was held on 15 May 2019 via WebEx, the minutes of which can be seen in Annex B.
- Kevin McPherson visited the Rwanda UN Big Data conference from 1st to 3rd May 2019, along with representatives from ReCAP and Azavea. Minutes of a meeting with UK ONS and UN can be seen in Annex C.
- The team has also visited WorldPop at Southampton University on 30th May 2019, to clarify the population datasets provided by WorldPop, how it is collected and how it can be used for measuring RAI. Minutes can be seen in Annex D.

Regular meetings have also been held with the World Bank and other stakeholders via Skype.

2.2 Progress of Tasks

The following tasks were identified in the Inception Report. A brief summary of progress is shown below, with more details following in the report and Annexes. It should be noted that many of these tasks contribute to the supplemental guidelines and other deliverables, and are not stand-alone documents as such.

2.2.1 Coordinated framework

Coordination with the previous practitioners of RAI has helped to identify the issues that need to be investigated, and develop a coordinated framework. This project is emphasising the need to fully involve the National Statistical Offices (NSOs) in endorsing the RAI calculations for a country, and integrating the reporting of RAI with reporting of other SDGs.

2.2.2 Scaling up spatial data

Previous meetings with various World Bank departments and providers, as well as other technology providers, have helped in assessing the potential for scaling up the use of spatial data. The present methodology for using geospatial data is broadly appropriate, but needs some supplemental

guidance to ensure that all countries are able to easily measure RAI in an accurate and sustainable way. Alternative technologies have also been explored for enhancing the RAI in the near future.

2.2.3 Agree data standards and quality assurance

The team is still in the process of developing guidelines on how to select the most appropriate data for the RAI, in terms of quality and coverage. This will be included in the supplemental guidelines.

2.2.4 Catalogue of RAI data

The team has contacted all of the main stakeholders with respect to collecting information and creating a catalogue of RAI data. To date little historical data has been made available. It is very unlikely that a comprehensive database of RAI historical information will be possible, and the methodology by which RAI has been calculated has typically not been well-documented. The supplemental guidelines being developed under this project emphasise the need for accurate documentation and formal datasets.

2.2.5 Establish a mechanism for collecting new RAI data

The team is using the experience from the trial countries to develop an appropriate mechanism for collecting new RAI data, given the issues and problems experienced by these countries. The team is considering various options for collecting, managing, quality assuring and publishing the RAI data and indicator measurement, including use of the World Bank DataBank (for data storage) and the UN Global Platform (for data management and calculation).

2.2.6 Feasibility of an accuracy range

The Status Review report (Vincent, 2018) suggests determining accuracy ranges across countries and adopting the use of correction factors to address known inaccuracies in datasets. The team has developed a method to measure RAI that uses 'accessibility factors', which supplements or foregoes the need to collect road condition data. This is explored in more detail in Section 6 and will be included in the supplemental guidelines.

2.2.7 Viability of secondary indicators

The team is exploring the possibility of developing secondary indicators to account for alternative access, for example by motorcycle or waterway accessibility. This is being explored and developed in line with Sustainable Mobility for All (SuM4All) publications: the Global Roadmap of Action and the Rural Access Companion Paper (SuM4All, 2019a; SuM4All, 2019b); a draft note can be seen in Annex E.

2.2.8 Custodian framework

The team has revised the framework for collection of RAI datasets presented in the first progress statement, based on feedback from key stakeholders. Figure 1 in Section 7 shows the revised draft. This will also be included in the supplemental guidelines.

2.2.9 Trial the measurement framework in four countries

Four trial countries have been confirmed: Ghana, Malawi, Nepal and Myanmar. Some data has been collected from all countries, but the volume and quality of data is variable. Valuable lessons have been learned from these visits that will help to shape the measurement framework and inform future adjustments to the methodology. Further information on the countries visited can be seen in Section 4.

A trial measurement of RAI has been undertaken in Malawi, which will be refined during the next scheduled visit to Malawi in July 2019. This will be used as an example calculation in an Annex of the

Supplemental Guideline. The trial highlighted some issues in the data collected for population and road network, which essentially needs consideration and endorsement by the various government agencies in Malawi that are responsible for the definition and publication of this and other indicators.

2.2.10 Identify funding sources

The team has identified potential funding sources; a draft list can be seen in Annex F. The team will enlist the assistance of the Department for International Development (DFID) and the Research for Community Access Partnership (ReCAP) to approach potential funders for TG3.

2.2.11 Framework for scaling up RAI data collection

This task will be addressed towards the end of TG2, when the experience from the four trial countries has been fully analysed.

2.2.12 Recommendations on the way forward in TG3

This task will be part of the Final TG2 Report and will be addressed following the completion of the country trials.

2.3 Revised Workplan

The workplan can be found in Annex G. The schedule remains valid and the project is expected to complete on time.

3 Trial Country Liaison

The four trial countries proposed in the first progress statement have been confirmed and visits have been made. The countries are Ghana, Malawi, Nepal and Myanmar.

3.1 Details of Trial Countries

Progress in the trial countries is summarised as follows:

3.1.1 Ghana

Ghana was visited from 18 – 22 March 2019. The key partner agency is the Feeder Roads Department and the counterparts assigned are Mr. Martin hMensa and Mr. Ebo Biney. A kick-off meeting was held with key stakeholders, as shown in Annex H. At this meeting it was learned that the Kwame Nkrumah University of Science and Technology (KNUST) is being funded independently by World Bank to research SDG 9.1.1.

- Mapping data is in Geographic Information System (GIS) format, but is not up to date. Feeder Roads Department initiated a revision process two years ago but are still waiting for feedback from some districts. TRL has formally requested the data; this is considered as sensitive in Ghana but a decision has just been made to make the data available to the project.
- Road condition data has also been revised under the same initiative as the mapping. However, it is not complete or up to date. A field trip was made to Volta district and the local engineer was consulted, who confirmed that he should be able to identify the all-season status of rural roads in his area.

- Population data: Ghana Statistical Services (GSS) were visited. The last census was in 2010 and they are currently using projected figures. A new census is due in 2020, but there seems to be some doubt about whether it will take place. GSS are being supported by UK ONS to measure SDGs and have a dedicated department for that purpose. GSS are planning to measure SDG 9.1.1 with assistance from UK Office of National Statistics (ONS) and have arranged for the National Aeronautics and Space Administration (NASA) to deliver a training course on geospatial techniques to support this. They were not aware that ReCAP was supporting a refined measurement process. GSS confirmed that the urban definition includes settlements with 5,000 people or more. Boundaries were not provided.

3.1.2 Malawi

Malawi was visited from 19 to 23 March 2019. The key partner agency is the Malawi Roads Authority and the counterpart assigned is Mr. Francis Dimu. A kick-off meeting was held and the visit report can be seen in Annex H.

- Road Network mapping data for the national road network was recently updated and is complete, however there is some uncertainty over the status of the unclassified network - if and how it should be included in the RAI calculation, and how the all-season aspect can be assessed.
- Road condition is not collected for unpaved roads. TRL was informed that all roads in Malawi are all-season, apart from possibly a small number of roads in the south where rainfall tends to be higher and more extreme. District Engineers should have a good idea of the all-season status of rural roads.
- Population data: National Statistical Office (NSO) was consulted. A census was undertaken in 2018 and has now been published; NSO can provide the GIS boundaries of enumeration areas that were used for the national census

3.1.3 Nepal

Nepal was visited on 28 February and 1 March 2019, and 7 to 10 March 2019 (with Myanmar visit in between). Key partner agency is the Department of Local Infrastructure (DoLI) and the counterpart assigned was Jeevan Guragain (the counterpart has since been reassigned and is now Mr. Mahesh Neupane, also of DoLI).

- Road Mapping was acquired from the Rural Access Programme (RAP), which provided the rural road mapping for DoLI under this DFID funded programme. Mapping is incomplete and only includes the rural network. Department of Roads were visited and a letter was written to provide the strategic road network mapping in GIS, but this was not possible to achieve within the timescale of the visit, due to staff absences.
- The condition of rural roads is not measured by DoLI, so no road condition data is available for the rural network. Provincial Engineers should however have a good idea of the all-season status of rural roads.
- Population data: In Nepal the National Planning Commission is responsible for measuring SDG indicators. It was not possible to meet with them during this visit. The Central Bureau of Statistics was visited but the relevant people were not available to meet. The team met with Robert Banick of World Bank, who is undertaking research to map accessibility in Nepal. They also met with Prashant Malla, who has been involved with various mapping and accessibility projects over the past 15 years in

Nepal. These interactions were useful and contributed to the development of the 'accessibility factor' process.

3.1.4 Myanmar

Myanmar was visited initially from 3 to 6 March 2019. This was an initial introductory visit with ReCAP representatives to introduce the project. A kick-off meeting was held; the Department of Rural Road Development (DRRD) is the key partner agency and it was agreed that a counterpart would be assigned at a later date.

A counterpart was later assigned, Mr. Yelin Tun. A second visit was then arranged from 3 to 8 June 2019. An initial meeting was held and the visit report can be seen in Annex I.

- DRRD provided GIS mapping for Myanmar, although it is not yet complete. DRRD estimate that it will be completed by the end of June 2019. The attributes attached to the data are very simple, road length and coordinates, but this will be enhanced with other data in the revision process, such as surface type, condition, width, etc.
- Condition is not measured formally for rural roads. However, the mapping update process has assigned a condition to most roads based on the perception of the local engineer. It is expected that the local engineers would be able to provide an assessment of the all-season status of rural roads.
- Population data: Myanmar population data is available on the Central Statistics Organisation (CSO) website, but the CSO do not hold the raw data and do not have GIS boundary information. Boundaries are based on set criteria and are the responsibility of one of the Government Ministries, although CSO could not confirm which one. It was therefore not possible to arrange a further meeting with the responsible Ministry. Population data is disaggregated by rural and urban, so there must be defined boundaries. DRRD will explore further and confirm.

Before the trial country visits it was assumed that the SDGs were being actively measured and monitored by local agencies. In fact there was little evidence of this, except in Ghana where there is in-country support from UK ONS to the GSS to measure and monitor the SDGs. Most SDGs that are reported are done so by the custodian, using data that is openly available, for example population or agriculture data. In this respect the measurement of the RAI is quite challenging for countries because it involves data that is not regularly collected and updated, including the location of 'rural' populations, all-season status of roads and road mapping. It also requires more than one department or ministry to liaise over data collection and analysis, which can also provide barriers to success.

4 Catalogue of Previous Data

There are two main sources of historical RAI data:

- The original study in 2006
- The geospatial study in 2016

Despite meeting with all past and current World Bank staff involved in both the 2006 and 2016 RAI studies, it has not been possible to collect any raw data, although the measurement results are available. However, the more recent data should become available when the latest World Bank RAI report for 15 countries is released.

World Bank has proposed that data be stored on their DataBank database, managed by the Development Data Group of the Bank. The team is also exploring the possibility of developing an RAI calculation tool and publishing the results on the UN Global Platform, which is a newly developed website. ReCAP is in the process of procuring Azavea to develop this aspect of the RAI.

5 Progress of a Refined Measurement Process

A draft measurement process was developed (labelled as a 'Refined Methodology') and presented to key stakeholders on April 5th 2019 at TRL offices in Wokingham, UK. This presentation can be seen in Annex A. ReCAP, Azavea and CitiLogik attended in person, 25 stakeholders joined online including some country representatives and the AfDB.

Following advice from the World Bank it is recognised that wholesale changes to the indicator could jeopardise its position at Tier II, because it was promoted based on the current methodology. If the methodology were to change substantially it could be argued that the promotion should be examined because a different methodology is now being used. The document was subsequently adjusted and renamed as the 'Supplemental Guidelines' for measurement of the RAI.

With this in mind, any changes are being focused on the measurement process and are referred to as such. Therefore the 2016 methodology itself remains valid, but additional options will be provided such as the 'accessibility factors' which can be used as a proxy for road condition. Any small changes to the methodology will be refinements.

Some of the key issues encountered are described next.

5.1 Population Distribution

WorldPop has been explored and is still considered as the most appropriate population dataset for measuring RAI, as the most accurate and highest resolution population global database available. It is also freely available, provided as open source data and reconciles its information to national census figures, although the process to do this still needs to be fully understood. It does not define the boundary between rural and urban, so this should be determined by each country in line with current UN guidelines. UN is still working on the DegUrba methodology, but until this is formalised it is recommended that country definitions of rural and urban are used. The supplemental guidelines state that the MODIS (Moderate-resolution Imaging Spectroradiometer) (2008) data should be used rather than GRUMP (Global Rural-Urban Mapping Project) (1995) as the default; although if country-specific rural/urban boundaries are available, then they should be used by default.

The possibility of using 'total population' instead of the rural population was discussed at the ReCAP Inter-Regional Implementation Meeting (IRIM) event and was considered as a possibility. However, despite the advantages that this would have in terms of data manipulation, feedback from World Bank and others cast doubt that this would be too significant a change to the methodology to precipitate a demotion of SDG 9.1.1 back to Tier III. Including urban areas would also create larger datasets that are more difficult to store and handle, with urban road datasets being processed unnecessarily. There was discomfort too that it would cease to be a rural indicator if the rural aspect of population were to be removed. This feedback, along with the experience from trial countries that rural/urban boundaries are actually well known and well defined in most cases, led to the team retaining the original RAI definition of 'rural population'.

Key Finding:

In WorldPop, updates are not currently 'automatic'. Country updates occur when there is a specific project to fund them. For RAI purposes, countries should therefore confirm that WorldPop data is

reconciled with latest census data that has been projected in line with country estimates, and if possible work with WorldPop to disaggregate that data below the sub-national level.

5.2 Road Network

Some countries have accurate and up to date mapping in GIS format, others do not. OpenStreetMap has good coverage in urban areas, but less so in many rural areas. A decision therefore has to be made as to the most complete and accurate mapping source, but also one that can be approved by the road authority and formally published for RAI. There is a need for roads agencies to be encouraged and supported to upload information to OSM and reconcile it with their networks, standards and specifications. This would also have benefit to other sectors that use roads data and information.

Key Finding:

OSM has many attributes and details for classification of roads, but these do not by default match those presently used in each country. It is necessary to adjust the attributes for each country in order to match the prevailing system and allow the government agency to officially report OSM data as relevant and accurate to country data. Guidance will be needed in this area.

5.3 Road Condition

The term ‘all-season’ is not a very common reference in most countries. The definition used by the original authors of the RAI, and still valid, is however quite hard to measure accurately as it does not adequately define ‘temporarily unavailable during inclement weather’. This definition was discussed at the IRIM in Nepal and it was concluded that roads should be closed for not more than 7 days per year to be considered as all-season. Accessibility factors are being explored as an alternative, or a complement, to road condition in defining ‘all season’.

Key Finding:

Many countries do not measure rural road condition, especially for unpaved roads. Even if road condition is present and reliable, it may not necessarily indicate accurately the all-season status of a road or network of roads.

5.4 Supplemental Guidelines to the RAI Methodology

The refined measurement process in the form of ‘supplemental guidelines’ has been drafted and will be completed by the end of September 2019, in time for presentation at the PIARC WRC 2019 conference. The guidelines follow the structure shown below:

- Background & Introduction
- Roles and Responsibilities
- National Agency Coordination
- Supplemental Guidelines to the Methodology
- Publishing the Results Nationally
- Quality Assuring the RAI
- Publishing the Results Internationally
- Timetable for Calculation
- References
- Annex: Case Study calculating RAI using Quantum GIS (QGIS)

These supplemental guidelines are designed to provide logical steps in the process for any country to calculate RAI. They address the practical requirements, such as the need for coordination between different government agencies and ministries in the country, as well as providing technical guidance in the calculation process. They also provide guidance on using open source data and propose an alternative to using road condition as a measure of all-season status through the use of accessibility factors. This is focused on enabling countries to collect/interpret data and measure the RAI using minimal resources in an accurate and sustainable way.

5.5 Secondary Indicators

The Status Review Report (Vincent, 2018) suggested that, in addition to the main and crucial work of finalising and promoting the methodology and guidelines for SDG Indicator 9.1.1, the development of a complementary SDG Indicator that better reflects the full range of rural access issues should be considered.

The idea of developing an additional and secondary RAI value is to reflect the use of intermediate means of transport, including motorcycles. If motorcycles can reach 'off-road' villages, rural people have greater access and connectivity to the road network. Similarly, in rainy seasons, some roads can be unmotorable for conventional vehicles like cars and minibuses, but motorcycles may be able to maintain all-season access. In such circumstances, the reality of rural access may be better reflected by an additional RAI value that includes rural infrastructure (roads and trails), which provide all-season access for motorcycles.

Such an additional RAI measurement may also be appropriate for countries where water-transport is important. Villages that are located along river banks, inland waterways or on islands, may be more than two kilometres from the road network, but if they have motorised launches that connect them to landing stages on the road network, they may be considered (by that country) to have appropriate rural access. The SuM4All companion paper to the 'Global Roadmap of Action toward Sustainable Mobility' (SuM4All, 2019b) recognises that a different index would need to be derived for alternative access, such as waterborne transport, and that RAI does not at present deal with this adequately. It includes an example of water transport on Lake Victoria and the type of access that can be provided.

This additional RAI value should not affect the standard RAI value that will still be calculated in all cooperating countries. The additional RAI calculation is likely to require different infrastructure-related databases, probably linked to hi-tech methods, such as mobile phone signals and/or satellite imagery.

A draft paper on secondary indicators has been produced and can be seen in Annex E.

6 Publishing and Storage of Data

The diagram presented in the first progress report has been revised following consultation with ReCAP, World Bank, UK ONS, UN and others, and is shown in Figure 1. Although the final location of data and calculation tools is not confirmed, the indications for inclusion are positive with both the World Bank DataBank and the UN Global Platform.

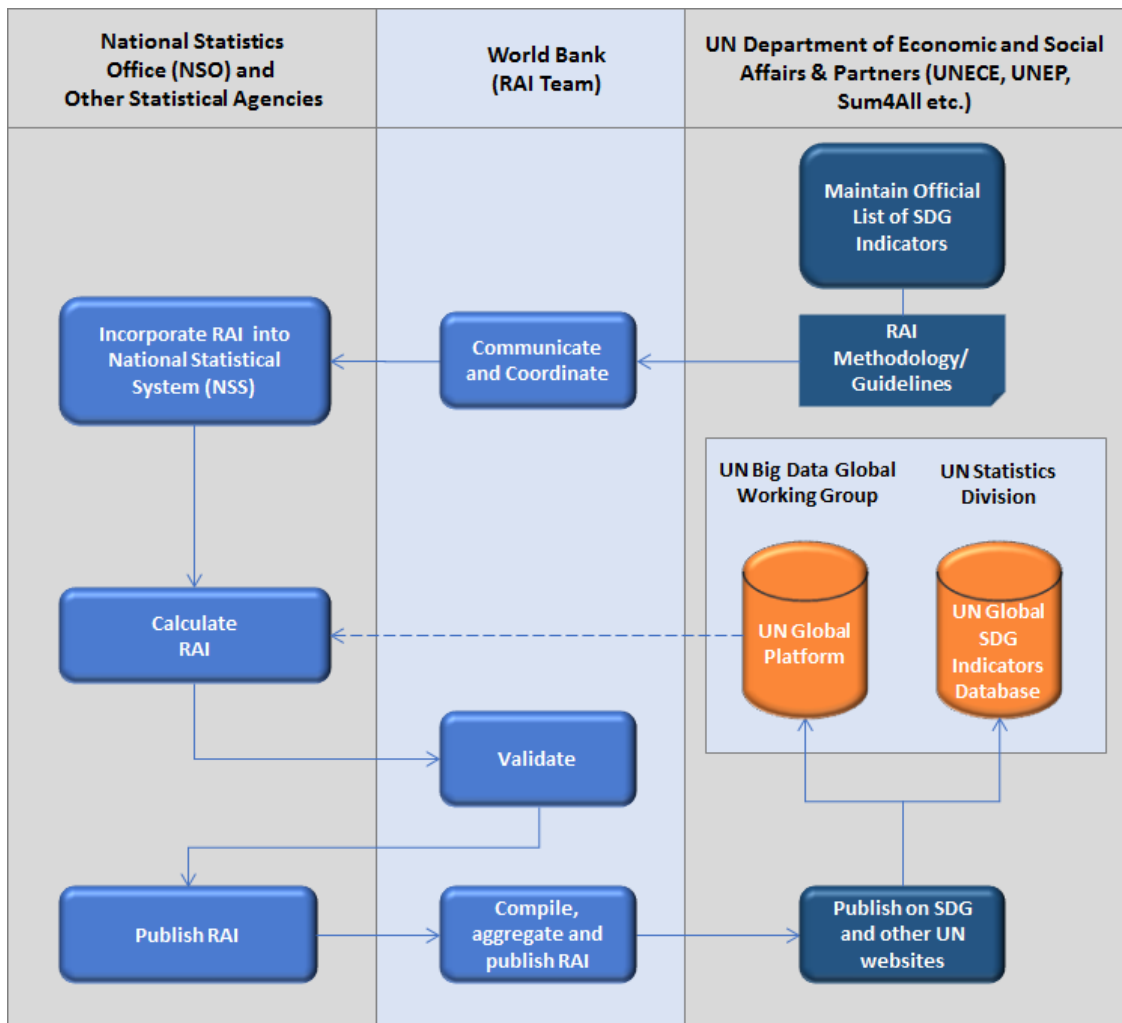


Figure 1: Process for Publication of RAI

7 Key Recommendations

The draft key recommendations for the remainder of TG2 and TG3 are shown as follows:

7.1 Raise the Profile of RAI

The possibility of raising the profile of RAI by involving managers at a higher level within the World Bank has been discussed. The RAI team within the Bank is in agreement in principle and are making enquiries on the best way to achieve this, following recent restructuring. This should be implemented within TG2.

7.2 Dissemination of Project Details

During the country trials, it became evident that local agencies and even local donor agencies were not aware of this project. Some were attempting to measure RAI without being aware that the measurement process could change. It was agreed that World Bank and other donors would inform country offices and partners of the current project. This should also be implemented within TG2.

7.3 Include Unclassified Networks

The supplemental guidelines include recommendations to include unclassified networks in the RAI where they provide the level of access required by the definition of the RAI. Although the term 'classified' means different things in different countries, if roads are able to provide access they should be included regardless of whether they are classified or not. It is however expected that a higher proportion of unclassified roads will not be all-season.

7.4 Engage Azavea to Create a Web-Based Interface for RAI

This recommendation was made in the first progress report and is in process. Azavea will develop a software framework for an RAI calculation tool that will provide the processing capacity to enable the calculation of RAI for every country globally. This framework will support the utilisation of publically available datasets, including WorldPop and NASA's Gridded Population of the World (GPW), v4, OpenStreetMap (OSM), and GRUMP Rural/urban data, among other potential datasets. This engagement is expected to start in TG2 and continue into TG3.

7.5 Explore Feasibility of a Mobile Phone Data Trial

CitiLogik has demonstrated that there is potential for mobile phone data to be used to track the movement of people, especially though the presentation at the lunchtime seminar on 5th April 2019 at TRL. They have agreed to provide an outline cost estimate for such a trial, but approximate costs are likely to be in the region of £60-70,000. This is a potential input to TG3 if an external funding source can be found.

7.6 Increase the Number of RAI Partners

ADB have submitted a letter to become a joint partner in SDG 9.1.1 to the World Bank. This is being processed and is expected to be confirmed soon. The project team is in liaison with AfDB and has agreed to visit their offices in Abidjan, Côte d'Ivoire to make a presentation to senior managers, in association with the World Bank via conference call to Washington, to raise awareness of the requirements and commitments to becoming a joint partner. This is expected to happen in July 2019. Other potential partners are also being explored and could come on board within TG2 or TG3.

7.7 Stakeholder Workshop

The stakeholder workshop for TG2 is planned to coincide with the Permanent International Association of Road Congresses (PIARC) World Road Conference in Abu Dhabi in October 2019. Steering Committee members will be attending directly with ReCAP, so it is recommended that at least one RAI counterpart is facilitated to attend under the RAI project. This would be funded from the Provisional Sum of £30,000.

7.8 Carry out Regional Mini-Workshops

It is recommended that at least one regional mini-workshop is to be held in TG2 to gain feedback on the supplemental guidelines and explore the development of the accessibility factors. The workshop will be held in Malawi as they have the best datasets, and it is expected that Ghana participants will be invited to attend.

7.9 Exploring Funding Options

It has been suggested that ReCAP, DFID and World Bank help to facilitate the search for funding for TG3, as more appropriate organisations to request development funding. The team has prepared a list of potential funding sources and will draft a letter to request that funding (see Annex F).

7.10 Consider Local Associations as Partners

In the first progress report it was proposed that local geospatial associations could be considered as partners or suppliers who could provide local geospatial information. These entities are based locally and many are jointly funded by countries regionally and could therefore be called upon to provide information for SDG monitoring. The following were identified:

- Regional Centre for Mapping of Resources for Development (RCMRD), which is based in Nairobi and has 20 member states in Eastern and Southern Africa.
- Centre for Remote Sensing and Geographic Information Systems (CERSGIS), which has several members in West Africa.
- The Asia Association on Remote Sensing (AARS), based in Japan and with 23 country members.
- The African Association of Remote Sensing of the Environment (AARSE).
- Centro de Pensamiento Estratégico Internacional (CEPEI) is a think tank on sustainable development that supports countries to measure and report the SDGs.
- Global Partnership for Sustainable Development Data, a network of 300 members, including governments, private sector, civil society, international organisations, academic institutions, foundations and statistics agencies who support governments to report SDGs.

The team has visited CERSGIS in Ghana, who would be willing to associate with the project if required. There is a possibility to engage with these institutions in TG3 to facilitate the measurement in up to 30 countries.

7.11 Risks and Mitigations

A number of risks and mitigation measures were outlined in the Inception Report. These are updated here:

- SDG 9.1.1 has been promoted to Tier II so changes to the methodology will be limited. This has been discussed with World Bank and other stakeholders and the presentation of any refinements has been managed appropriately.
- To date, stakeholders have remained committed to the project.
- At this stage the team is confident that an improved system to reliably and sustainably measure the RAI is being developed.
- The details of data collection in 2006 are still limited and the team is unlikely to be able to obtain any more details, but this is not considered to be a significant problem.
- Historical data has not been forthcoming, and is unlikely to be available to the project because the RAI calculations were often made in country and the data has not been stored centrally. The 2016 data may be made available from the World Bank if it is still available at the country level. TRL would be dependent on the World Bank to provide this information.
- Funding for TG3 has not yet been secured, but this is unlikely to be forthcoming until some results in TG2 have been published. The team is continually exploring funding options and ongoing commitment by ReCAP countries. The ReCAP SRO at DFID is actively exploring avenues for funding by donor partners.
- Overseas trips and workshop arrangements are ongoing, so this risk remains current.
- Health and safety risks associated with overseas travel are being actively managed by TRL.

7.12 Potential Additional Work

As the project has proceeded and evolved, a number of issues have arisen that could warrant additional inputs in TG2, TG3 and beyond:

- Azavea are in the process of being engaged to develop a calculation tool for the RAI. This will undoubtedly involve input from TRL. If there is any liaison necessary beyond the scope of the original ToR a discussion will be initiated with PMU to seek additional time.
- A draft QGIS procedures manual has been developed for the refined measurement process, in line with the existing methodology published in 2016 by the World Bank. This manual provides sufficient detail for an experienced user of QGIS to manipulate data to measure RAI. This is not a specific requirement of the Terms of Reference, but has been developed as part of the RAI Supplemental Guidelines. There is almost no limit to the detail that could be included in such a document, but if more detail is required a discussion will be initiated with PMU to seek additional time to complete a more comprehensive user manual.
- There is potential to draft a Procedures Manual on updating OSM with a country's road network data. Assuming that OSM is a key resource for SDGs, this would have significant importance not only for RAI, but for other national and international indicators, national government agencies and NGOs particularly for health planning, education planning, disaster planning, and possibly for SuM4All. This is not part of the Terms of Reference but can be developed as an addendum if required.
- If WorldPop is also to be a key resource for RAI and other SDG indicators, it would be desirable to develop a formal note on how to engage WorldPop and how to best use their resources. It is particularly important when using WorldPop to ensure that the figures used are reconciled to official national census figures and are officially reportable by the NSO in each country.
- There is significant potential for using WorldPop data in a wider sphere for road network planning purposes, and we feel that effort should be made to engage with road network planning organisations to demonstrate the potential uses of WorldPop data. The QGIS procedures already developed highlight 'by-products' of RAI calculation showing linear development along roads and highlighting areas which lack access to all-season roads, and highlighted that many roads organisations could use such data for planning and monitoring purposes. There may be some scope for incorporating such products into the GRID3 project which is part-funded by DFID and which is being implemented by United Nations Population Fund (UNFPA) and WorldPop in four African countries (Nigeria, Mozambique, Zambia, Democratic Republic of Congo (DRC)). While this is not directly related to RAI, it could be a useful addition to the portfolio of information around the subject of SDGs. This is the type of document that could potentially be useful for SuM4All.

8 Next Steps

The next steps in the project, up to the next deliverable of the Draft RAI Supplemental Guidelines, are as follows:

8.1 Finalise Supplemental Guidelines and Measurement Framework

The refined Supplemental Guidelines and Measurement Framework will be completed during September 2019 and circulated to key stakeholders for comment. A revision process will ensue and a final version will be completed within one month.

8.2 Finalise secondary indicator

Details of the proposed secondary indicator will be finalised and circulated to stakeholders for comment.

8.3 Carry out Country Trials

The team is planning to make further visits to all countries, including a workshop in Malawi in August, to:

- bring together the main stakeholders in RAI to discuss the best way to measure and process the indicator
- share the revised measurement process for feedback
- discuss the possibility of testing the accessibility factors by using examples in each country

It may also be possible to invite participants from Ghana to this event, in order to share experiences and come to a consensus on the way forward.

Further visits will also be made to Nepal and Myanmar with a similar aim.

8.4 Presentations at international conferences

The following events are expected to provide opportunities to present and discuss RAI and the current project:

- A paper has been submitted to the PIARC conference in Abu Dhabi in October 2019.
- A paper has been submitted to the T2 conference in Maputo, Mozambique. This was originally planned for August 2019, but has recently been postponed until November 2019. This is just within the contract period for TG2 of this project, but if it is delayed further alternative arrangements may need to be made for presenting the paper.

8.5 Stakeholder Workshops

The stakeholder workshop has been arranged for the PIARC WRC conference in October in Abu Dhabi. A half day workshop will be hosted by the project with ReCAP, World Bank and other stakeholders. The workshop introductory report can be seen in Annex J. A mini-workshop is planned for Malawi in August 2019.

The recommendations will be further refined and included in the final report, and the team will continually explore financial commitment and funding for TG3 over the coming months.

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Annex A: Presentation at TRL on 5th April 2019

TRL THE FUTURE OF TRANSPORT

Consolidation, Revision and Pilot Application of the RAI

Robin Workman & Kevin McPherson

April 2019

The three factors of RAI

A geo-spatial approach

- Population distribution • Where do people live?
- Road network • Where do roads exist?
- Road condition • All-season roads?

Definition of RAI

- Rural Access Index (SDG 9.1.1) = ‘the proportion of the rural population living within two kilometres of an all-season road’.

All-season = “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), with some predictable interruptions of short duration during inclement weather (e.g., heavy rainfall) allowed.”

- The RAI is defined as ‘the proportion of the rural population living within two kilometres of an all-season road’.
- Identify the ‘rural’ population
- Identify where it lives
- Produce a GIS rural population layer

Aim and Objective

- Aim is to develop, propose and obtain agreement on a **harmonised approach** to data collection and measurement of the Rural Access Index that is **relevant, consistent and sustainable**.
- Objective is to **scale up** implementation of the RAI across UN member countries in order to advance the status of **SDG Indicator 9.1.1 to Tier II** and eventually **Tier I** in the tier classification of the SDGs.

- The RAI is defined as ‘the proportion of the rural population **living within two kilometres** of an all-season road’.
- Identify where the roads are
- Identify best source of mapping
- Produce a GIS map layer

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- The RAI is defined as ‘the proportion of the rural population living within two kilometres of an all-season road’.
- Identify road condition
- Interpret data to identify ‘all-season’ roads
- Possibility to use mobile data
- Produce a GIS ‘all-season’ layer

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Potential Data Sources / Processing / Platforms

- Local sources of data (NSOs, Roads authorities etc.)
- Existing and emerging on-line resources, e.g. :
 - World Pop
 - Global Rural-Urban Mapping Project (GRUMP)
 - OpenStreetMap (OSM)
 - Global Roads Inventory Project (GRIP)
 - UN Global Platform
- Imagery
- Mobile Phone data
- Machine Learning

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Carry out Trials

Country	RAI history			Data				Other	
	2006	2016	2018	Cov'ge	Mgmt.	Quality	Issues	Environ't	Mapping
Ghana	✓			G	G/F	G/F	Y	Tropical	G/F
Malawi	✓		✓	G	G/F	G	Y	Savanna	G
Nepal	✓	✓		G/F	G/F	G/F	Y	Mountain	G/F
Myanmar				U	U	U	Y	Monsoon	U

- Engage with NSO and roads organisations
- Review data for completeness and quality
- Analyse data in GIS format
- Support local partners to measure RAI

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Discussions with Potential Service Providers and Experts

There are huge research efforts going on in many areas including earth observation, machine learning, and alternative data sources

- Azavea
- Citi Logik

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Organisational Aspects


The chart illustrates the organizational structure of the RAI project. It is divided into four main columns representing different entities: National Roads Agency, Rural Roads Agency, National Statistics Office (ONS), and World Bank (WB). Each column contains a hierarchy of roles and responsibilities. For example, under the National Roads Agency, there is a 'Coordinating Agency Method' box, which leads to 'Project National Roads' and 'Project Rural Roads'. The National Statistics Office (ONS) is responsible for 'National Statistical Service (NSS)' and 'Census Information'. The World Bank (WB) is involved in 'Support International Risk Assessment' and 'Collaboration of Data, Policy, and Evidence'. The chart also shows 'Working with Citi Logik for Analytics Services' and 'Working with Azavea for Analytics Services'.

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- Azavea:**
 - Azavea is an open source, social mission company advancing the use of technology for lasting social, civic and environmental impact.
 - Work with UN, World Bank, IADB, etc.
 - This is relevant to the RAI project because we are considering whether UN Global Platform can be used to host/publish the RAI
 - Rob Emenuelle – VP of R&D, developing innovative solutions
 - Fernando Ramirez – Leads Global Business Development
- CitiLogic**
 - Systems engineering led, data analytics firm, providing access to data for transport analysis.
 - Work with HE, TfL, DoT.
 - This is relevant to the RAI project because of the potential to use mobile data to monitor movement of people and potentially whether a road is all-season or not.
 - Philippe Perette – Associate Director, Head of Analytics
 - Martin Williams – Leads International Business Development

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RAI: Summary of findings from Trial Countries

April 2019

Trial countries


Country	RAI history			Data				Other	
	2006	2016	2018	Con/Con	Mgmt	Quality	Issues	Estimate	Mapping
Ghana	✓			G	G/F	G/F	Y	Tropical	G/F
Malawi	✓		✓	G	G/F	G	Y	Savanna	G
Nepal	✓	✓		U/I	U/I	U/I	Y	Mountain	U/I
Myanmar				U	U	U	Y	Monsoon	U

Key: G=Good, F=Fair, P=Poor, U=Unknown, Y=Yes, N=No




Ghana

Major Findings




- RAI History**
 - Last formal RAI measured in 2006 **44%** using core welfare indicator questionnaire
- Population Distribution**
 - Revised in 2012 under local project (MRH & GSS) funded by EU **66%** using household questionnaires (6,000 HHs)
- Road Network**
 - Currently there are other agencies considering SDG 9.1.1 measurement:
 - KNUST University (supported by WB – in a research capacity)
 - Ghana Statistical Service – supported by UN Habitat and NASA
 - GIZ – Linking with GSS




Ghana

Major Findings




- RAI History**
 - Last census in 2010: 24,658,823 (2010) and 30,200,000 (2020 projected)
- Population Distribution**
 - Rural population = 49.1% (2010, GSS)
 - 37.9% of rural population are poor (UNICEF, 2016)
- Road Network**
 - Urban / Rural Areas**
 - Areas with settlements of 5,000 people or more are considered as urban
 - All other areas are rural




Ghana

Major Findings




- RAI History**
 - Ghana Highway Authority (GHA) 62,221 km
 - Department of Feeder Roads (DFR)
 - Department of Urban Roads (DUR)
 - District roads (informal)
- Population Distribution**
 - GIS maps established in 2006, revised in 2012. Have been updating since 2017, but so far only 3 provinces have reported the data (maps and road condition).
- Road Network**
 - No formal process to apply to add roads to the network. In practice the district will upgrade to a gravel road and then ask Department of Feeder Roads (DFR) to adopt. DFR will then assess and consult with Ministry before deciding on adoption, but roads are seldom rejected.





Ghana

Major Findings




- RAI History**
 - Condition determined using achievable speed and visual assessment, for rural roads.
- Population Distribution**
 - Comprehensive condition assessment training in 2017, only three provinces have reported results.
- Road Network**
 - In consultation, local engineers and technicians would be aware of which roads are all-season or not. Up to 30% of unpaved roads could be closed for > 7 days per year, due to the tropical climate.





Ghana

Major Findings




- RAI History**
 - Details of last RAI in 2012 have been provided, questionnaire based.
- Population Distribution**
 - GSS to provide additional data on population projections, geo-spatial training and RAI measurement by other agencies (GIZ).
- Road Network**
 - Liaise with KNUST University, who are researching RAI measurement, supported by World Bank.
- Road Condition**
 - Check data from WorldPop and OSM for coverage, quality and relevance.
- Action Plan**




Malawi

Major Findings




- RAI History**
 - World Bank draft report "Measuring Rural Access: Update (2017/18)" RAI = 23.1 (2016)
- Population Distribution**
 - Estimate was based on incomplete road network mapping, survey of road conditions using a smartphone application, rural boundaries from CIESIN satellite imagery (1995), and WorldPop (2010). Little consultation / engagement with Malawi authorities.
- Road Network**
- Road Condition**
 - Malawi Growth and Development Strategy (MGDS) reporting to UN by Ministry of Finance, Economic Planning and Development: RAI = 38.0 (2018)
- Action Plan**
 - MGDS estimate believed to have been developed from Household Surveys




Malawi

Major Findings




- RAI History**
 - Malawi NSO recently completed 2018 census
- Population Distribution**
 - Malawi NSO intending to conduct analysis & comparison of WorldPop data and compare with its own georeferenced 2018 census data
- Road Network**
 - Urban / Rural boundary is the responsibility of Department of Surveys (under Ministry of Transport & Public Infrastructure)
- Road Condition**
 - Urban / Rural boundaries are defined but not published as shapefiles - there are 30 urban areas
- Action Plan**




Malawi

Major Findings





- RAI History**
 - Official Classified Network 15,451 km
- Population Distribution**
 - However, additional 9,400 km of "unclassified" roads was recommended in year 2006 for incorporation into the Classified Network, but this has not yet been ratified by Ministry of Justice.
- Road Network**
 - Some of these roads were rehabilitated / upgraded under programmes such as the Rural Infrastructure Development Programme (RIDP)
- Road Condition**
 - True Road Network therefore estimated to be around 25,000 km
- Action Plan**
 - Malawi Roads Authority (MRA) is a "one-stop-shop" for all road inventory, condition data and road network mapping for the country – Department of Surveys should use MRA mapping



Malawi

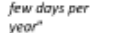
Major Findings

- RAI History**
- Population Distribution**
- Road Network**
- Road Condition**
- Action Plan**

General consensus is that, for the ~25,000 km of roads, they can all be regarded as "all-season"

"Even the unclassified roads are never truly impassable for more than a few hours or a few days per year"



Malawi

Major Findings




- RAI History**
 - NSO, Ministry of Transport, MRA, Dept of Surveys to coordinate and agree definitions as follows
- Population Distribution**
 - Road Network: that the ~25,000 km should represent the public road network for reporting purposes
- Road Network**
 - Road Network Condition: that all public roads are regarded as "all-season" or, alternatively, discuss further a definition and data collection method
- Road Condition**
 - MRA to identify the ~9,400 km in mapping using Open Street Map (OSM), satellite data as appropriate, and consolidate it and update with any new roads etc.
- Action Plan**
 - NSO to review Census Data against WorldPop, and liaise with World Pop on findings & recommendations



Myanmar

Major Findings




- RAI History**
- Population Distribution**
- Road Network**
- Road Condition**
- Action Plan**

- No formal RAI measured (WB methodology)
- Was measured as part of ADB study in 2016
- Measured as 36%, using a spreadsheet model.
- Assumed that villages are distributed uniformly, estimated the length of road necessary to connect all villages and compares to the existing network.
- Study did not involve government! Was carried out under an ADB project and several assumptions made.

Myanmar

Major Findings




- RAI History**
- Population Distribution**
- Road Network**
- Road Condition**
- Action Plan**

- 52,450,000 (2015) and 52,920,000 (2016), used MMIS census
- Rural population = 70.59% (2014, MMIS), 84% of rural population are poor (UN, 2012)
- Rural Area**
Areas classified by the General Administration Department as village tracts. Generally they are areas with low population density and a land use which is predominantly agricultural.
- Urban Area**
Areas classified by the General Administration Department as wards. Generally these areas have an increased density of building structures, population and better infrastructural development.


Myanmar

Major Findings



- RAI History**
- Population Distribution**
- Road Network**
- Road Condition**
- Action Plan**

- Roads latest figures (2017 statistical report)
- 151,298 km total, of which 39,076 km are paved
- Need to increase network to 260,000 km in order to connect all villages (from 2016 report)



Myanmar

Major Findings




- RAI History**
- Population Distribution**
- Road Network**
- Road Condition**
- Action Plan**

- Unknown.... so far
- All-season? ... long wet season....




Myanmar

Major Findings




- RAI History**
- Population Distribution**
- Road Network**
- Road Condition**
- Action Plan**

- Counterpart assigned to the project
- Need to collect data on population, road network and all-season
- Initial visit during dry season and roads looked motorable, but long wet season so apparently many roads not all-season by 7-day definition
- Need to visit Myanmar Statistical Information Service on next visit




Nepal

Major Findings




- RAI History**
- Population Distribution**
- Road Network**
- Road Condition**
- Action Plan**

- World Bank draft report "Measuring Rural Access Using New Technologies" (2016):
 - RAI = 17% (2006) based on household surveys
 - RAI = 54% (2016) because additional feeder road data was taken into account
- 2006 RAI was subject of a PhD by one of the World Bank authors, so more detail than other countries in 2006.




Nepal

Major Findings




- RAI History
- Population Distribution
- Road Network
- Road Condition
- Action Plan

- Familiar with WorldPop.
- Project ongoing to digitise all households in the provinces, one province completed already. Has highlighted some potential issues with WorldPop data.
- 2016 study distributed district population (for 75 districts) evenly on a grid basis, but may have caused errors in mountainous terrain.




Nepal

Major Findings




- RAI History
- Population Distribution
- Road Network
- Road Condition
- Action Plan

- Official Strategic Road Network (SRN) of ~ 57,000 km (2013).
- Department of Roads (DoR) responsible for SRN.
- Department of Local Infrastructure (DOLI) responsible for Local Roads. Local government reorganisations in 2018/19 have led to creation of 7 provinces with responsibilities for planning and maintenance.
- Road Network centerline data has been reconciled and uploaded to Open Street Map (OSM) under World Bank "Measuring Inequality of Rural Access" project (2018).





Nepal

Major Findings




- RAI History
- Population Distribution
- Road Network
- Road Condition
- Action Plan

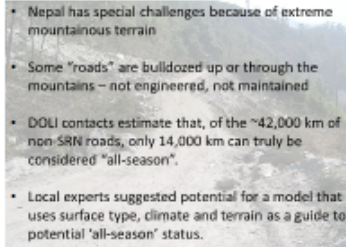

Nepal

Major Findings




- RAI History
- Population Distribution
- Road Network
- Road Condition
- Action Plan

- Nepal has special challenges because of extreme mountainous terrain
- Some "roads" are bulldozed up or through the mountains – not engineered, not maintained
- DOLI contacts estimate that, of the ~42,000 km of non-SRN roads, only 14,000 km can truly be considered "all-season".
- Local experts suggested potential for a model that uses surface type, climate and terrain as a guide to potential 'all-season' status.


Nepal

Major Findings



- RAI History
- Population Distribution
- Road Network
- Road Condition
- Action Plan

- Nepal has special challenges because of terrain – a model should be developed similar to the approach taken by World Bank on modeling time taken based on terrain and differences in travel times between wet and dry seasons.
- Need to meet with National Planning Department, who have responsibility for reporting SDGs.
- Liaise with current World Bank project to explore synergies.
- Explore using walking time rather than distance for some areas of Nepal, consider as example for other mountainous countries.



The next presentation discusses the draft methodology, that is forming based on the experiences from these trial countries



Annex B: RAI Working Group Minutes

RAI Working Group Meeting

15th May 2019

Attendance:-

WB: Atsushi Iimi (AI), Adam Diehl (AD), Umar Serajuddin (US),

DFID: Liz Jones (LJ),

ReCAP: PMU - Annabel Bradbury (AB), Technical Panel - John Hine (JH)

TRL: Robin Workman (RW), Kevin McPherson (KM)

Azavea: Ross Bernet (RB), Fernando Ramirez (FR)

Apologies: Simon Ellis (WB), Richard Malinga (AfDB), Jeremy Aguma (AfDB), Muneza Alam (WB), Mohammed Alsayed (IsDB), Matthew Steel (ONS), Alistair Edwardes (ONS), David Salter (ADB), Jamie Leather (ADB), Colin Gourley (DFID), Paul Starkey (TRL), Jasper Cook (ReCAP TP), Joseph Haule (ReCAP PMU), Andy Tatem (WorldPop)

1. Response to Actions of Previous Minutes – Annabel Bradbury (AB)

1. Action: Follow up with Umar about where other WB SDG indicator data is kept/maintained... is it within UN?
 - a. SDG Indicator data for which the WB is custodian are stored on the World Development Indicators (WDI) database¹ or the World Bank's DataBank².
 - b. The WDI database covers datasets that have significant geographic coverage. Smaller datasets with less country coverage (<50 countries) are kept in the World Bank's DataBank. Both the WDI and DataBank are open access to the public. Umar Serajuddin manages the DataBank.
2. Action: Acquire authorisation from ADB and AfDB to be partner agencies for SDG 9.1.1, and Umar Serajuddin to inform IAEG-SDGs once authorisation is obtained.
 - a. ADB have written to the World Bank confirming their agreement to be a partner agency for SDG 9.1.1. AfDB are discussing with their senior management about committing to be a partner agency, and waiting for TRL to present the RAI work at AfDB in June.
 - b. TRL have established an email forum for RAI stakeholders (comprising MDBs) to engage with the SDG community on the RAI supplemental approach, with a view to providing a feedback mechanism on the project.

¹ World Development Indicators (WDI) is the World Bank's premier compilation of cross-country comparable data on development, containing 1,600 time series indicators for 217 economies and more than 40 country groups, with data for many indicators going back more than 50 years: <http://datatopics.worldbank.org/world-development-indicators/>

² DataBank is an analysis and visualisation tool that contains collections of time series data on a variety of topics: <https://databank.worldbank.org/data/home.aspx>

- c. US proposed an online meeting of the development partners to discuss roles and responsibilities.

Action: US to provide information on how RAI data can be uploaded to the DataBank/WDI, the 7 criteria used to measure suitability of data for these databases, and how the UN access and utilise the SDG data published in these databases. US to respond to ADB letter; also to consider scheduling meeting with development partners, to include WB input on the roles and responsibilities of SDG partners.

2. Overview of Supplemental Approach to RAI Methodology – Kevin McPherson (KM)

1. KM highlighted the main aspects of the supplemental approach to the RAI methodology as described in the implementation document circulated, and the accompanying slides.
2. Little has changed technically since 2016. The 2019 update can be regarded as an ‘implementation manual’ for the 2016 methodology, which provides step-by-step procedures to improve the uptake and accuracy of the online data sources; provides for use of local data sources; and provides clear responsibilities for calculation and publication.
3. The intention is for NSOs to work with online data sources such as WorldPop and OSM to try to ensure that country level data matches these global geospatial datasets as closely as possible and at an appropriate level of granularity.
4. All season aspect has been refined – proposed use of an Accessibility Factor, allowing countries to produce an estimate of passability for different regions where surface type, terrain and climatic factors are different to the norm, and where road condition data is unavailable or unreliable.
5. JH – proposed a short note that explores passability criteria (see attached for 1991 paper on the subject by Phil Paige Green), describing where and when impassability is likely to take place – to assist road agencies to target spot improvements and inform decision making. TRL will take this into consideration.

Rural-Urban Definitions for RAI:

6. A discussion followed about whether RAI could be measured as a proportion of total population, rather than just rural population – the assumption being that 100% of the urban population live within 2 km of an all season road. The World Bank advised against this approach as it would change the definition of RAI and risk demotion to Tier III. TRL confirmed that differentiation of rural population can be addressed if NSOs publish country specific urban-rural boundary data on their websites, for open access by the public, ensuring urban-rural definitions are consistent.
7. LJ wants the team to be cognisant of challenges, particularly if NSOs don’t agree to publish rural-urban boundary data on their websites.
8. JH asked why can’t we adopt the proportion of total population living >2 km from road, because anyone in that category will, by definition, be rural. Just a case of changing the denominator.

9. AI – important to focus on rural definition. US reiterated that we have to maintain existing definitions of rural and urban for all SDG indicators – noting that countries would prefer to use their own definitions.
10. KM – would have to get urban road network data too if we were to consider the whole population.
11. RW – including the whole population and road networks would increase the data volume and processing requirements. Initial investigations suggested variations in rural/urban definitions, but country visits confirmed that the NSO in each country does actually know the official definition, but different definitions are used because the official definition is not usually published.
12. TRL will take comments on board, and explore further.

Accessibility Factor:

13. LJ – Where else has accessibility factor been used? What do the other trial countries think of it, or WB?
14. JH – uncommon to be on an impassable paved road. What is relevance of IRI on paved vs. unpaved roads? Overwhelmingly, inaccessibility on unpaved roads is from weak, erodible or soft soils and localised flooding, and drainage issues etc.
15. RW/KM – The accessibility factor provides a sustainable approach as a proxy for measuring ‘all-season’ road access, so that countries can collect data without physical condition surveys where engineers have to visit all roads (which most countries don’t do at present). Accessibility index allows passability to be measured spatially. TRL plan to ground truth in country to test against the index. Plan to get country feedback. Have also asked stakeholders to respond on methodology by end May. Bound by the original definition – all-season and roads closed due to unseasonal weather (interpreted as up to 7 days per year).
16. US – Overall assessment of the approach presented by TRL is that it needs to be supplemental, can’t change the 2016 methodology, otherwise it will risk being demoted to Tier III again. He is happy that the direction of TRL’s project is to supplement the existing 2016 method, rather than to modify it.
17. AI/AD – Benefit of the supplemental approach is that it provides flexibility by country, and enables NSOs to validate against global geospatial data sources. The original 2016 methodology should remain unchanged: that is the global *Geospatial measurement of RAI based on a) rural population distribution, b) road network location, and c) accessibility*. Supplemental approaches can be adopted to implement the methodology, and to facilitate endorsement by individual countries.
18. LJ – the implementation document prepared by TRL should reflect the work of the SuM4All and the Rural Access Working Group (RAWG), in particular how the RAI intersects with the Rural Access companion paper (see attached for the companion paper and policy measures).
19. RW – Feedback on the draft has been requested by the end of May 2019.

3. Azavea Involvement in Proof of Concept for RAI Calculation Tool – Annabel Bradbury (AB)

1. AB introduced the scope of work for Azavea who will prepare a proof of concept for the RAI calculation tool. Azavea will develop a software framework for an RAI calculation tool that will enable the calculation of RAI for every country globally. The generation of RAI data for every country globally using open data will enable the comparison of results for countries that have generated RAI values using country-specific datasets.
2. RB described the basis for developing the proof of concept to generate RAI data for every country globally, and country specific data for the 4 trial countries being investigated by TRL.
3. AD – keep WB in the loop as Azavea proceed. WB feedback from Task Team Leaders (TTL) in country needs to be fed back to the TRL team.
4. TRL plan to have more face to face meetings with WB (and Azavea) to exchange intel.
5. TRL is also planning to visit WorldPop at end of May to discuss the scope and protocols for NSOs to work with WorldPop to improve accuracy of WorldPop data

4. Outcome of discussions with ONS/UNDESA about testing the RAI Tool on UN Global Platform – Annabel Bradbury (AB)

1. At the 5th International Conference on Big Data for Official Statistics, held in Kigali, Rwanda from 29 April to 3 May 2019, the ReCAP PMU, TRL and Azavea met with Ronald Jansen, Assistant Director at the United Nations Statistics Division, and Mark Craddock at the UK Office of National Statistics (ONS) who manages the UN Global Platform (UNGP). They seemed excited about the RAI work, and are keen to put a note on the UNGP Marketplace website to highlight it. They also agreed that the RAI tool can be tested on the Global Platform. A short note has been prepared which is attached.
2. LJ - Have any other indicators been presented on the website?
3. SDG 6.6.1 (water related ecosystems) has a web-based platform to monitor global freshwater ecosystems, which is also being piloted on the UN Global Platform. No other SDGs are currently calculated centrally on the UN Global Platform.
4. LJ –Note to record each country doing voluntary assessment on the goals. Report from UK perspective.
5. RW mentioned that the UK ONS and WorldPop are also supporting other countries NSOs with staff and resources, such as those in Rwanda and Ghana.

5. Overview of WB DataBank for Publication of RAI Data and Reporting – Adam Diehl (AD)

1. World Bank's DataBank is a data hosting and sharing platform where all sorts of data is published. It also hosts the SuM4All transport data portal. WDI is also hosted in the same online space. Data stored in the DataBank can be scaled up for inclusion on the WDI once there is enough country coverage. The DataBank doesn't calculate data, it just publishes data/reporting.
2. AD – the DataBank allows topic-specific collections to be created to host lots of types of data i.e. country time series of RAI data, that is picked up by the UN, and can publish district level result maps, supporting metadata etc.
3. LJ – How can we get RAI into WDI?

Action: US to provide details on how to get RAI data into WDI/DataBank.

6. Obtaining Financial Commitment for Application of the RAI in up to 30 Countries – Robin Workman (RW)

1. Funding sources including MDBs, bilaterals, philanthropic charities (including UNGP long term). See attached for preliminary list of potential funding sources.
2. Funding mechanism – funds would have to come to the ReCAP PMU from funding sources and then be dispersed to TRL in order to fulfil Phase 3 of their contract and scale up to ~30 countries.
3. TRL to arrange further discussions on funding with DFID/WB and other MDBs. Demand should come from country authorities where possible. TRL will prepare letter/request for funding, to be proposed by appropriate partners.

7. AOB

- RW – Would be beneficial to disseminate information on the project to countries as some duplication is occurring. TRL to prepare documents to disseminate information on the project, ideally via NSO's (and UK ONS), DFID country offices and World Bank TTLs (through the MDBs?)
- LJ – can World Bank provide a status on the IDA 19 negotiations? Is there a possibility of the RAI being an IDA 19 indicator in the WB results framework
Action: AI to follow up on IDA 19 negotiations. LJ happy to discuss with WB further.
- Not mentioned during the meeting, but TRL are seeking representatives from MDBs (World Bank, UN, ADB, AfDB, PIARC) at the RAI workshop to be held during the PIARC World Road Congress (WRC) in Abu Dhabi (Tuesday 8 October). See workshop overview and programme attached. Please notify Robin Workman if you are planning to attend the WRC in October.
- Next meeting RAI WG meeting will be in late July 2019.

Annex C: Meeting with ReCAP, UN and UKONS in Rwanda

5th International Conference on Big Data (29th April to 3rd May 2019)

Meeting held on 2nd May, 2019

Kevin McPherson attended the [5th International Conference on Big Data for Official Statistics](#) in Kigali, Rwanda, on May 2nd and 3rd. Attendance was part of the TRL project Consolidation, Revision and Pilot Application of the Rural Access Index (RAI).

The United Nations Global Working Group (GWG) on Big Data for Official Statistics was created under the UN Statistical Commission in 2014. The GWG provides strategic vision, direction and the coordination of a global programme on the use of new data sources and new technologies, which is essential for national statistical systems to remain relevant in a fast-moving data landscape. Big Data could fill gaps, make statistical operations more cost effective, enable the replacement of surveys and provide more granularities in outputs e.g. in support of the monitoring of the SDG goal of 'leaving no one behind'. The GWG built the UN Global Platform as a collaborative environment to work together as a global statistical community and to learn together sharing knowledge, data and methods for all countries in the world.

The RAI has now been adopted as Sustainable Development Goal (SDG) indicator 9.1.1. It is an important benchmark for the rural roads sector and has an impact on the work carried out in the sector.

TRL is preparing a revised methodology for calculation of the RAI, and is looking to publish the RAI in the UN Global Platform. We have also been discussing with Azavea (a US software company) on the design of a tool that could automatically calculate RAI from online geospatial data sources. In the longer term, Azavea is looking to incorporate such a tool into the UN Global Platform.

Other stakeholders related to the TRL project are UK-ONS (Office of National Statistics) who have set up the UNGP and who are supporting that platform until March 2020; WorldPop from Southampton, UK who provide an online portal that provides geospatial population data suitable for calculation of the RAI.

The intention in the long term would be for an RAI calculation tool to be integrated within the UN Global Platform. This would encourage NSOs and other responsible agencies worldwide to use the UNGP to calculate SDGs and other national and international indicators. It could be a catalyst for promoting SDG 9.1.1 to Tier 1 status. It would also prompt countries to update global open data sets such as road network data in Open Street Map (OSM), and to coordinate with other open data initiatives such as WorldPop to refine population estimates down to the level of the enumeration area, generating spin-off benefits for national and international efforts to improve such fundamental data sets for planning and monitoring purposes.

As discussed at the meeting, we are in agreement for the 9.1.1 indicator to be integrated into the UN Global Platform as a pilot for countries to view and explore. It will demonstrate capabilities and value as countries embrace open source tools made available for SDG development and reporting.

Meetings / discussions on RAI were held at the conference on 2nd May on the direction of a tool for calculation of RAI within the UNGP:

- UN Global Platform (Roland Jansen, Assistant Director)
- ReCAP (Annabel Bradbury)
- Azavea (Fernando Ramirez, Ross Bernet)
- Justin Saunders (sub-consultant to TRL on the RAI)
- UK ONS (Mark Craddock; Gavin Philips)

Other discussions on RAI implementation were held:

- WorldPop (Tracey Li, Shengjie Lai)
- African Development Bank (Rafik Mahjoubi)
- Ghana Statistics (Samuel K Annim)
- Rwanda Office of Statistics (Florent Bigirmania)

Annex D: Meeting: WorldPop in Southampton

Meeting with WorldPop in Southampton, 2019

Present:

Andy Tatem (AT) (Director of WorldPop and Flowminder)

Robin Workman (RW)

Kevin McPherson (KM)

TRL gave overview of the highlights of the draft refined RAI methodology, highlighting portions where use of WorldPop is described. TRL requested that WorldPop review the draft methodology and provide any comments with regards to use of WorldPop data.

WorldPop Datasets

AT highlighted that there are now different datasets available via WorldPop website (individual countries, whole continent, global per country). Individual country data sets are based on older efforts to map population data per country, using a tailored set of geospatial inputs using different methods and time periods (at 5 year intervals 2005, 2010, 2015, etc. to match Gridded Population of the World time series). Not all countries are represented in the individual country data sets. The global per country data sets, on the other hand, are focused on consistent construction of 100m grid cells for each year, and annual estimates are available for all countries.³

Individual country datasets: WorldPop output data is adjusted to match UN national estimates - as described in the metadata file associated with each dataset under the 'individual countries'.

The 'global per country' data sets are also adjusted to UN estimates (although there is no explicit mention of this in the metadata under the global per country datasets).

It would be possible for WorldPop to publish data sets adjusted to local country estimates, however those are not currently published on WorldPop website.

Data Disaggregation and Metadata

Regarding disaggregation, the metadata also does not indicate at what level the WorldPop data has been reconciled (i.e. whether at national level, enumeration area level etc). A separate list is being prepared by WorldPop.

AT indicated that they can reconcile data at household level if such data is made available by NSOs (WorldPop has a separate project funded under DFID to work with Nigeria, DRC, South Sudan, Zambia and Mozambique – all ReCAP countries – and will be investigating reconciliation at household level with these countries). KM indicated that the recent population census completed by Malawi NSO was also georeferenced at the household level.

If any country wishes to engage with WorldPop to reconcile data down to enumeration areas or down to household level, then the data requirements are straightforward (essentially,

³ For RAI purposes, the methodology should specify use of the global per country data sets since these will be produced in future using a consistent WorldPop methodology.

geographic boundaries of the enumeration areas, along with population projections and/or percentage growth rates per year).

Data from some countries often has QA issues (e.g. overlapping polygons, gaps in polygons etc) that have to be addressed before calculation and publication of WorldPop data.

WorldPop has no standard data agreement for data sharing with NSOs, they have worked to date on an individual country basis.

Urban / Rural Boundaries

AT indicated that the European Commission Global Human Settlement Layer (GHSL) project has been working on a standardised approach to define urban centres and rural areas, based on satellite data, and that this approach is being considered as part of the UN Expert Group on Statistical Methodology for Delineating Cities.

<https://ghsl.jrc.ec.europa.eu/index.php>

RAI methodology should continue to monitor developments in this area, with potential to using this layer as an alternate or parallel indicator with which to calculate RAI in the event that country-specific data is not available.

International Boundaries

WorldPop typically relies on the national boundary as defined by the individual country's census data, although recognises that the FAO Global Administrative Unit Layers (GAUL) dataset as defined in the RAI methodology is the generally accepted data set.

By-Products of RAI

TRL discussed the map of 'by-products' of RAI showing linear development along roads and highlighting areas which lack access to all-season roads, and highlighted that many roads organisations could use such data for planning and monitoring purposes. AT mentioned the GRID³ project which is part-funded by DFID and is being implemented by UNFPA and WorldPop in four African countries (Nigeria, Mozambique, Zambia, DRC).

TRL should investigate potential collaboration with the GRID³ project for promoting RAI by-products.

Mobile Phone Network Projects

WorldPop have access to mobile phone network data in a number of countries, including Ghana and Nepal (both trial countries under RAI). TRL should consider small pilot projects for investigation of mobile phone network data in these countries as part of Phase III to help corroborate Accessibility Factors.

Annex E: Secondary Indicator Options

Requirements for improving the measurement of rural access (Vincent, 2018).

Requirement	Approach	Comments
Address national concerns that the RAI does not truly reflect the reality of contemporary modes of rural access.	Allow the measurement of one <i>additional</i> value of the 'country RAI' modified to take into account local issues.	Only one additional value may be added. Reasons for using an additional measurement must be clearly explained (for example rural transport is dominated by modes of transport that do not require a conventional all-weather road), and a clear methodology must be explained and reviewed by the NSO to the same quality standard as the conventional RAI measurement.
Address international concerns that the RAI does not address the full range of rural accessibility issues, such as access to facilities (health centres, schools, markets etc.) and the provision of appropriate sustainable transport services.	(i) Develop an alternative, additional, SDG Indicator that better reflects the full range of rural access issues.	Cooperation and liaison with the SuM4All initiative could assist in developing a suitable SDG Indicator.
	(ii) Develop an alternative approach of assessing the compliance of the national rural access development plan with an internationally specified standard, and then measure progress towards achieving this plan. Annex 7 includes a proposal for how this might be done.	The SuM4All initiative could assist in developing an international standard of what a national rural access development plan should include, and how progress against such a plan can be measured.

The TG1 Report (Vincent, 2018) suggested that in addition to the main and crucial work of finalising and promoting the methodology and guidelines for SDG Indicator 9.1.1, two other avenues could be explored.

- a) Allowing for an additional country-specific value of the RAI modified to take into account local issues.
- b) Development of an alternative, additional, SDG Indicator that better reflects the full range of rural access issues.

Additional RAI value

The idea of developing an additional and secondary RAI value is to reflect the use of intermediate means of transport, including motorcycles. If motorcycles can reach 'off-road' villages, the rural people have greater access and connectivity to the road network. Similarly, in rainy seasons, some roads can be unmotorable for conventional vehicles like cars and minibuses, but motorcycles may be able to maintain all-season access. In such circumstances, the reality of rural access may be better reflected by an

additional RAI value that includes rural infrastructure (roads and trails) that provide all-season access for motorcycles. This figure is likely to be higher than the standard RAI measurement. Such an additional RAI measurement may also be appropriate for countries where water-transport is important. Villages that are along river-banks or on islands, may be more than two kilometres from the road network, but if they have motorised launches that connect to them to landing stages on the road network, they may be considered (by that country) to have appropriate rural access. Therefore, the suggestion is that there should be scope for one optional, additional value of the RAI that reflects well the access issues of that country. Vincent (2018) stressed that this optional, additional RAI value should be rigorous and defensible, and acceptable to the NSO.

This additional RAI value should not affect the standard RAI value, which will still be calculated in all cooperating countries. The additional RAI calculation is likely to require different infrastructure-related databases, probably linked to hi-tech methods, such as mobile phone signals and/or satellite imagery.

The current research will concentrate on the standardised RAI methodology but will engage with interested countries where it is felt the standard RAI underestimates the true picture of rural access. As the additional value is optional, a standardised methodology is not required in the short term. Were the additional values be found to be popular and increasing, the various experiences could be distilled into a separate guideline to promote more standardised measurements.

Alternative access indicators

Vincent (2018) noted there were various international concerns that the RAI does not address the full range of rural accessibility issues, such as access to facilities (health centres, schools, markets etc.) and the provision of appropriate sustainable transport services. He suggested two possible approaches:

- i) Develop an alternative, additional, SDG Indicator that better reflects the full range of rural access issues. This could be achieved in cooperation and liaison with the SuM4All initiative.*
- ii) Develop an alternative approach of assessing the compliance of the national rural access development plan, with an indicator based on progress towards achieving the national plans.*

The first option may have traction in the medium term. There is significant interest in the development banks and donor agencies for having better access, mobility and rural development indicators, which could be additional to the SDG 9.1.1. The World Bank has produced several documents discussing possible indicators, including those by Sum4All.

The second option was based on examples from climate-change agenda where 'Nationally Appropriate Mitigation Actions' (NAMA) were allowed to overcome the problems of standardisation of approaches in very different countries and situations. However, this was in the context of a specific, UN-backed climate-change international framework. No such framework exists on rural access issues, and there appears little prospect of one in the short or medium term. Therefore, this option will not be explored further by the TRL team.

Annex F: Potential Funding Sources for TG3

MDBs and other development agencies

World Bank

Consistently say no funding available. National offices are funding specific projects, i.e. support to KNUST in Ghana to research how to measure RAI.

UN Agencies

Potentially UNECE and UNEP as partners to SDG 9.1.1. UN Habitat are funding training to measure SDG 9.1.1 in Ghana, with support from NASA.

ADB

Indicated that they are interested to become partners to SDG 9.1.1. Potential to fund via projects to some extent.

AfDB

Indicated that they are interested to become partners to SDG 9.1.1. Potential to fund via projects to some extent.

IADB

Have made contact with the relevant people. P Starkey to follow up.

IsDB

No contact yet.

EU

No contact yet.

DFID (ReCAP)

EIB

Already have a contact and have enquired about funding

OPEC (OFID)

Objective is to reinforce financial cooperation between OPEC Member Countries and other developing countries, by providing financial support to the latter for their socioeconomic development. OFID's support has been consistently high to the Transportation sector and ranges from construction and rehabilitation of roads, seaports and airports, to railways, inland waterways and urban mass transit.

NASA

Providing GIS based training to GSS in Ghana to measure SDG 9.1.1

UKRI (UK Research and Innovation)

<https://www.ukri.org/research/global-challenges-research-fund/>

Global Challenges Research Fund UKRI ODA funds are administered primarily through the [Newton Fund](#) and the [Global Challenges Research Fund](#).

Grants for research in developing countries

Newton fund <https://www.ukri.org/research/international/newton-fund/>

International partnerships <https://www.ukri.org/research/international/international-partnerships/>

International funding opportunities <https://www.ukri.org/research/international/international-funding-opportunities/>

FIC <https://www.ukri.org/research/international/fund-for-international-collaboration-fic/>

Satellite Applications Catapult

UK Space Agency

European Space Agency

Australian Space Agency (established a data hub in West Africa)

Philanthropic Foundations

Gates Foundation

Focus on Poverty, health etc.

Open Society Foundation (Soros)

Open Society focuses on the establishment of democracy through programs that advance good governance, justice, education, public health and independent media in more than 70 countries in Europe, Asia, Africa and Latin America.

Ford Foundation

The foundation's nine focus areas are: democratic and accountable governance, economic fairness, educational opportunity and scholarship, freedom of expression, human rights, metropolitan opportunity, sexuality and reproductive health and rights, social justice philanthropy, and sustainable development.

William and Flora Hewlett Foundation

Funds global development programs on governance, education, improved policy analysis and better access to agricultural markets for farmers in developing countries.

UN Foundation

The foundation gives its entire revenue to global development with a focus on child health, climate change, peace and security, and poverty eradication. Its future endeavours are expected to center on women's health, the plight of women and girls in poor countries, and the elimination of preventable diseases such as measles, malaria and polio in the developing world.

John D. and Catherine T. MacArthur Foundation

International programs focus on human rights and international justice, peace and security, conservation and sustainable development, higher education in Africa and Russia, migration and human mobility, and population and reproductive health.

Rockefeller Foundation

The organization's focus areas are international in scope: basic survival safeguards, global health, climate and environment, urbanization, and social and economic security. With the creation of the Asian Cities Climate Change Resilience Network in 2009, funding for

environment-related projects, particularly those focused on mitigating the effects of climate change, is expected to rise.

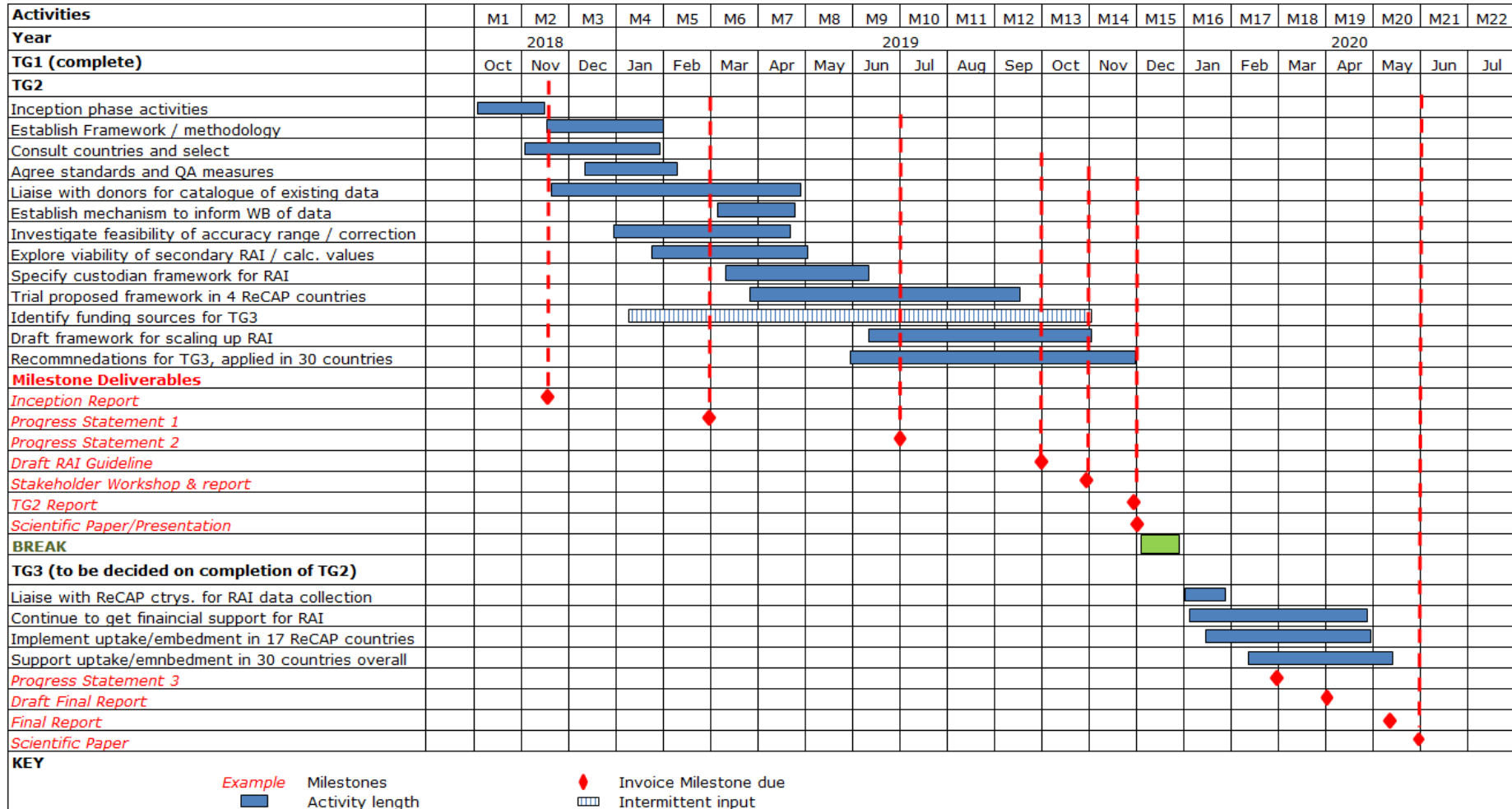
Bloomberg

Focusing on five key areas: the arts, education, the environment, government innovation, and public health.

Google

Extend the reach of non-profit innovators by connecting them with funding, tools, and volunteers from Google. These innovators are the believers-turned-doers that have made a huge impact on their communities and have a vision for creating change at scale. Efforts are focused in three areas where we believe we can make an impact - Education, Economic Opportunity and Inclusion.

Annex G: Workplan



Annex H: RAI Kick-off meeting in Ghana

RAI kickoff in Ghana

19th March 2019 – 11am at MRH

Hosted by Department of Feeder Roads at Ministry of Roads and Highways (MRH)

Attended by about 20 people from MRH, Feeder roads and Ministry of Transport.

Robin Workman presented RAI project and what is expected of Ghana (Paul Starkey presented IMPARTS project).

Questions/feedback:

Q: What if the data is for different years? i.e. population 2015, maps 2018, etc.?

A: Adjustment factors will need to be used.

Q: Country needs to own the process. Should be useful for the country itself, not just for reporting to WB.

A: RW noted that at present service type indicators are more useful, and the trend is in that direction, but we need to retain RAI as only SDG rural access indicator.

Q; What about the differences between countries in terms of all-season and rural/urban, and don't we still have the issues as in 2016, how can this be avoided.

A; We are looking at sensitivity analysis and how correction factors can be used. Also looking at how to compare population between countries i.e. population density, to provide a parallel figure.

Annex I: Visit report – Myanmar and Malawi

Notes on Myanmar RAI visit (4 – 7 June, 2019)

R Workman, TRL

Activities:

- Initial meeting with DRRD, 5/6/2019, follow up with GIS expert at DRRD offices
- Visit to Central Statistics Organisation, Naypyidaw, met Director Ms. Nyein Nyein Maw
- RW spoke with World Bank representative in Myanmar, offered to put him in touch with infrastructure advisor based in Laos.
- RW visited ADB offices in Park Royal hotel to introduce to Mr. Date
- Wrap up meeting with DRRD, 7/6/2019

Roads data:

- DRRD provided latest GIS data on roads. DRRD GIS data will be updated by end June 2019 with all DRRD roads and attributes such as ownership, classification, width, condition, beneficiary households and population, all-season or dry-season access, traffic. Other agencies for roads are:
 - Department of Highways, Main roads (no GIS data yet)
 - Border Affairs, Rural roads (no GIS data yet)
 - Dept. of Rural Devt. Short rural roads, village to village, GIS data is present.
- Action: DRRD to provide as much GIS data on all roads as possible, including updated DRRD data by end June 2019. Upload to TRL Dropbox.

Road data details:

There are some anomalies in the excel spreadsheets that hold the roads specific data in DRRD. This should be standardised before the GIS files are updated, i.e.:

- Road classification: DR = DoH, DRD = DRRD, recommended to classify all as either Major, Secondary, Tertiary or Rural
- Also need definition for motorcycle tracks, i.e. do they fall into the categories above, i.e. rural..?
- Road surface type: Gravel = Macadam, Laterite = Kankar, Bituminous = DBST or Premix
- Recommended that the categories are: Paved (concrete, bitumen,) and Unpaved (macadam, kankar, earth) – to be decided by DRRD
- Road width in metres
- Road condition Good/Normal/Fair/Poor/Bad are all used. Recommended that only three descriptions are used: Good, Fair (Normal) and Poor (Bad) – which is in line with most international standards
- Beneficiary households: Potentially useful for RAI, but we need to know how far the villages/populations are from the road? Apparently every settlement is allocated to a road
- Beneficiary population: as above....
- All-season access: Check if the definition of all-season is the same as RAI, i.e. motorable all year, but can be closed for up to 7 days due to bad weather. Yes or No category
- Dry season access: Defined as access provided only during dry season – so essentially not all-season. Yes or No category
- Traffic: Vehicles per day – not important for RAI
- **Action:** DRRD to explore criteria for data i.e. distance to villages, and decide on consistent criteria for roads data and include in revised GIS files.

- **Action:** RW will share any relevant international documents that will inform this subject.

Population data:

- CSO/MMSIS do not have raw data for population or rural/urban boundaries. This will be held by respective ministries. MIMU may also have data (based in Yangon under UNDP). Population is available per district on the website, but per village and per village tract is also possible (not in English?).
- RAI requires population data at highest resolution possible, and geo-referenced if possible. WorldPop data (<https://www.worldpop.org/>) can be used, but must be reconciled to official Govt. of Myanmar data, so need to check this.
- Not clear where urban/rural boundary data is held, possibly General Admin dept., Ministry of Home Affairs, or Survey Dept. Population is disaggregated by urban and rural so there must be well defined boundaries. This information is essential for RAI.
- **Action:** DRRD to identify relevant source for data and get official population and boundary data, ideally as GIS shapefiles, and put on TRL Dropbox site.
- **Action:** RW to make contact with MIMU for more population data.

Maintenance:

- DRRD only recently formalised maintenance and maintenance planning/prioritisation, which is based on road condition. Periodic, routine and emergency maintenance.
- **Action:** RW agreed to share guidelines and forms on road condition assessment used in other countries. These would need to be adjusted for Myanmar.

Climate and terrain maps:

- Ministry of Transportation has meteorological maps of Myanmar. Rainfall can be as high as 200 inches (5,000 mm) per year, but varies in intensity. Terrain maps also useful to identify mountainous areas, which are up to 3,000 masl.
- Features of climate and terrain were discussed, agreed that three trial areas could be tested to develop accessibility factors for Myanmar. This would involve interviews with district engineers who know the roads well, in order to identify roads that are all-season, to produce broad zones for all-season road assessment.
- **Action:** DRRD to suggest area/s that could be used for ground truthing trials to develop accessibility factors for Myanmar. Arrange for district engineers to visit Naypyidaw during next TRL visit (maybe July) to determine all-season roads in the trial areas.
- **Action:** RW to develop questionnaire for district engineers and share with DRRD.

Planning rural roads:

- DRRD confirmed that they want to use RAI to plan rural road development. This would be most useful if RAI were calculated at district level. RW noted that this would depend on the quality of data and whether it is disaggregated to that level.
- **Action:** RW to inform the disaggregation level possible for RAI, after assessing available data.

PIARC conference workshop:

- TRL are running a half-day workshop at the PIARC WRC conference on Abu Dhabi in October 2019: <http://www.aipcrabudhabi2019.org/events/world-road-congress-2019/event-summary-9cdd9b3dccc450991da91decda350b4.aspx>
- RW expects that ReCAP will invite someone from DRRD to attend. This will be arranged with ReCAP directly.
- **Action:** ReCAP to invite to PIARC conference

- **Action:** RW to make contact with Henrike Bracht at World Bank in Laos to inform him of the RAI work.
- **Action:** RW to copy notes to all present at meeting (some will need to send their emails to RW in advance).

Notes on Malawi RAI visit (18 – 22 March, 2019)

K McPherson, TRL

Activities:

Initial meeting with Malawi Roads Authority (MRA), with Francis Dimu (Planning Engineer, and ReCAP Coordinator), Chisoma (Dan) Kauma (Road Data Manager), and Chikumbutso Mpanda (Transport Economist) (18/3/2019)

Met with Ministry of Transport, Kelvin Mphonda (Deputy Director of Roads), Solomon Mwasinga Chirambo, Senior Economist, Joel Kassam (Statistician), Madalo Nyambose (Director of Planning) (Lilongwe, 18/3/2019 and 22/3/19)

Presented and discussed RAI with Malawi National Statistics Office (NSO), Jameson Ndalawa (Deputy Commissioner of Statistics), Andrew Jamali (Statistical Officer), Kingsley Manda (Statistical Officer), Lamede Million (Statistics Officer) (Zomba, 20/3/19)

Short field trip to sample “unclassified road” 20 km north of Blantyre (20/3/19)

Met with Blantyre City Council (Blantyre), Grant M.Z. Sichali (Director of Engineering Services), Sekani Malopa Gondwe (Deputy Director of Engineering Services) (21/3/19)

Met with DFID, Malawi (Sarah Pannell, Team Leader, Learning and Innovation) (Lilongwe, 22/3/19)

Met with Department of Surveys (Alice Gwedeza) (Lilongwe, 22/3/19)

Roads Authority:

Official classified network for Malawi is well-defined and mapped by MRA, amounting to some 15,541 km. However, a 2006 Road Classification study 2006 recommended re-classification of additional 9,478 km into the Public Road Network under the Public Roads Act. However, those re-classification recommendations have not been implemented, yet many of those roads clearly provide an important rural access function and, in some cases, are maintained by the national or district roads authorities on an informal basis in response to requests from local village councils.

In terms of the “all-season” aspect, representatives from both MRA and Ministry of Transport indicated that even if roads are impassable from flooding, it is likely a temporary occurrence (perhaps 1 – 2 days before it is passable again). There would be very few roads in Malawi that would really be considered “impassable” for any length of time (and that may be because of logistics of availability and mechanisms to hire a contractor, as opposed to the condition of the road. Condition data is not collected on unpaved roads. Also, if there are any instances of impassability, they are not recorded systematically.

Ministry of Transport:

Madalo Nymbabose indicated that the Ministry had been looking to include “rural accessibility” as an indicator in the Transport Sector Performance Monitoring Framework, but were unsure as to how to collect or measure it, so very interested in the outputs of this project.

Also that Ministry / NSO have traditionally not worked together closely, and the responsibilities [for RAI and other transport statistics] are unclear. Ministry is hoping that this project will help in formalising that relationship.

National Statistics Office:

Malawi is completing its 2018 population census, at this time it is still being encoded.

It was noted that Malawi NSO data is geo-encoded, so that NSO can in theory identify population at the level of the household. While the geo-encoded data will not be published, it could be used by NSO to cross-check and refine WorldPop data. It was discussed that NSO would look to work with WorldPop to help ensure that WorldPop was consistent with NSO data for 2018.

NSO has digitised the road network internally, based on satellite imagery obtained for their census planning activities. NSO to get together with MWRA to compare versions and agree definitive network and mapping. It was claimed that Dept of Lands and Surveys is ultimately responsible for this, and may have some data, however NSO has done this as a separate exercise.

It was also discussed that the network classification on Open Street Map (OSM) is inconsistent with the MWRA definition. Also, raised the issue of the “classified” versus “unclassified” network. NSO was concerned that Open Street Map (OSM) is not definitive, and is open, so that Malawi responsible agencies have no control over it. The definitive mapping for the road network should be held by the Department of Surveys, in consultation with MWRA. Also, the road network to be included in RAI should be agreed within Malawi.

In terms of roles and responsibilities:

- National Statistical System (NSS) Strategic Plan is currently under revision, and will include Malawi’s commitments to SDGs. NSO is also producing a NSO Strategic Plan, in line with the NSS Strategic Plan. Both to be ready in draft form by June 2019.
- The Ministry of Finance, Economy and Development (MFED) is responsible for indicators and publication. They make the call for statistics. MFED also present annual reports to UN General Assembly, which includes all indicators.
- Malawi actually reported RAI in their Annual Report to UN (not as SDG 9.1.1, but as part of the Malawi Development Goals) as 38% in 2016/17. It is believed that this calculation was based on household surveys. Given the discussions today, concerning “urban”, “all-season”, and what constitutes the road network, NSO is unaware how this 38% figure was calculated, and will discuss further with other relevant agencies.

DFID:

DFID at present in Malawi is not supporting NSO directly, although does support other agencies in their production of statistics.

Department of Surveys:

Department of Surveys technically responsible for all official geographical data, although happy to delegate individual areas to agencies (including MRA).

Ministry of Local Government is technically responsible for definition of urban areas. Department of Surveys has geographical representations of these urban boundaries.

Department of Surveys does publish geographical data to the MASDAP website (<http://www.masdap.mw/>), but has not yet posted Urban / Rural Boundaries because “there was no demand for them”.

Actions:

- TRL to produce draft methodology, and circulate for comment
- NSO happy to participate in the process and work to agree responsibilities
- NSO / MWRA / Ministry of Planning in the meantime to work towards agreeing a definition of the network for RAI, and also agreeing the definition of “all-season”, for Malawi.

Annex J: Introductory Report for PIARC WRC Conference

Introductory Report FOR:

RAISING THE PROFILE OF THE RURAL ACCESS INDEX AS A VITAL SDG INDICATOR FOR MEASURING RURAL DEVELOPMENT AND CONNECTIVITY

Tuesday 8th October 2019, 14:00 to 17:30

XXVIth World Road Congress

Abu Dhabi, United Arab Emirates

6 – 10 October 2019

Date: 15th May 2019

Authors: Robin Workman

Topic of the WORKSHOP

Exploring challenges with measurement of the RAI in Low Income Countries and proposals to increase the sustainability, accuracy and consistency of RAI measurement, with a view to future options

The Rural Access Index (RAI) has been adopted as Sustainable Development Goal (SDG) 9.1.1. This is the only indicator for rural accessibility included in the SDGs. Rural access is a significant factor in rural development and poverty, so the effective and sustainable measurement of this indicator is important for international development assistance.

This workshop will explore the challenges associated with measuring this indicator and will propose ways to increase its sustainability, accuracy and consistency, based on the DFID funded research project which is tasked with refining the measurement process for SDG 9.1.1.

Preparation of the WORKSHOP

The following organisations and team have been involved in organising the workshop:

From TRL:

Robin Workman

Kevin McPherson

From ReCAP:

Annabel Bradbury

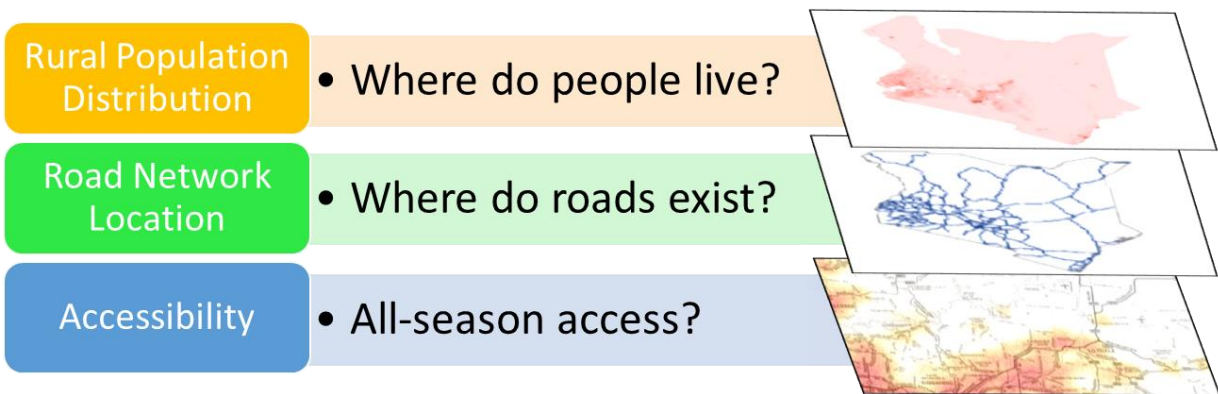
Presentation of each of the issues

This workshop is focused on the Rural Access Index (RAI), which was originally developed as a poverty indicator for rural access and has been adopted as SDG indicator 9.1.1. The RAI measures the proportion of the rural population who live within 2 km of an all-season road. The RAI cuts across many of the themes of WRC 2019, primarily Access and Mobility and Infrastructure, with a focus on rural roads and the potential for using Artificial Intelligence.

It was originally developed and measured in 2006, using interpretation of existing household questionnaires, and some modelling techniques. This provided a baseline for more than 60 countries, but measurements were not continued. In 2016 ReCAP and the World Bank (the RAI custodian) coordinated to develop a new methodology that used geo-spatial data to measure the RAI, and trialled it in eight countries in Africa and Asia.

This included using three layers of geo-spatial information to define the RAI:

- Rural Population
- Road Network Location
- Road Condition (all-season or not)



When the 2016 results were compared to the original results there were some inconsistencies, which led to the RAI project currently being undertaken by TRL, which is designed to establish a process that is sustainable and can be used representatively in a wide range of different countries and environments. The RAI has recently been promoted to Tier II of the SDG global indicator framework. Ultimately, the challenge for the custodian is to reach Tier I, which involves 50% of UN countries in all regions regularly measuring the indicator. This project will test the refined methodology in four countries, Ghana, Malawi, Myanmar and Nepal, extending to a total of 30 countries.

Initially there will be a presentation of the background to the RAI and the various methods used so far to measure it, and what the issues have been. The RAI project under ReCAP is trialling a new process to measure RAI using accessibility, with the potential for this to supplement the existing methodology from 2016, so experiences will be fed back from two of the trial countries.

The main discussions will take place around the consultant's proposals to refine the RAI measurement process and how it can be made more sustainable, accurate and reliable.

Questions that will be addressed during the WORKSHOP

The two main parts to the workshop will address two key questions:

- Session 1: What are the challenges with measurement of the RAI in low income countries?
- Session 2: How can the sustainability, accuracy and consistency of the RAI be enhanced?

Session 1

This workshop is designed to explore the issues that have led to inconsistent measurement of the RAI and to propose a refined process that will ensure a more sustainable, accurate and consistent measurement. A select panel has been composed of sector experts from across the world who will discuss the refined RAI process and its application, especially in Low Income Countries (LIC). The audience will also be encouraged to participate through feedback sessions in both workshop and plenary format. It is expected that at least two representatives from the trial countries will be represented on the panel.

The first session of the workshop will focus on the three main geospatial layers that are necessary to produce the RAI, which are explained below:

Population layer

Reliable population data is available globally, free at source and linked to national census data. However, these population databases do not provide rural and urban boundaries, which are an essential input to the indicator, but for which there is no uniform global definition. The United Nations Statistics Division (UNSD) advises that, because of national characteristics each country

should decide which areas are classified as urban and rural. There is an initiative to instil some consistency using a Degree of Urbanisation (DegUrba) methodology, to better reflect national circumstances. A recent meeting of the UNSD recommended engagement on the DegUrba approach by the Inter Agency and Expert Group on SDG Indicators (IAEG-SDGs) to help with monitoring SDG indicators.

Road location layer

To measure the RAI using geospatial techniques it is important to know the full extent of the road network and where it is located. Many LICs do not have complete GIS coverage of their rural road network, but there are several sources of mapping available, which are derived from various techniques to map roads. However, although these sources tend to have good coverage in urban areas, they tend to be less comprehensive and accurate in rural areas, which are the most important for measurement of the RAI.

Road condition layer

In addition to establishing the road network location, it is necessary to determine which roads are 'all-season'. Past RAI assessments have interpreted all-season as a function of paved or unpaved roads, and/or have interpreted it from road condition. Few countries formally measure the condition of their rural roads, but approximations of the International Roughness Index (IRI) can provide an estimation of condition. However, this is not always regarded as an accurate assessment of 'all-season', especially for unpaved roads.

The first session will explore these issues in more detail and look at the challenges faced by LICs in routinely measuring the RAI.

Session 2

The second session will focus on the refined process of measurement being developed by TRL, which is designed to provide consistency in RAI measurement and make it easier and more sustainable for LICs to measure and report RAI in the future on a regular basis. The data available in each country will vary because countries typically collect data for many different purposes, and will collect data in the most efficient and cost effective way to suit their needs. In order to develop a sustainable system, different types and even different qualities of data should be allowable, so the process needs to account for this and provide different ways to assess and adjust the data, to be relevant and useful for the RAI.

Population data measurement

With regards to the definition of urban/rural boundaries, individual country definitions should be retained for purposes of RAI measurement, but a parallel measure of population based on density or settlement size should be used in order to allow better comparison between countries.

Road location measurement

It is recommended that countries use OpenStreetMap (OSM) as a tool to both update their own networks, as well as to upload data to OSM. In this case OSM would eventually become the most reliable global source of road mapping and would be freely available.

Road condition measurement

If the 'all-season' nature of a road could be measured directly, or estimated accurately, this would enhance the precise measurement of RAI and improve its sustainability. At present this is interpreted from road condition. The team are considering several options to determine the all-season nature of a road more directly.

Check data quality

The quality of the RAI measurement is dependent on the quality of the data used. It is understood that a variety of data quality issues will arise in RAI data collection. The team is working towards a framework or checklist that can be used to assess data quality before it is accepted into the RAI assessment.

Correction Factors

When a systematic error is identified, for example if it is known that the extent of the rural road network is under-represented in a GIS analysis, a suitable country or region specific correction factor should be calculated and applied. The method used to calculate any such correction factor must be fully documented and reviewed by a statistician.

Calculation of RAI

The calculation of the geospatial RAI is essentially carried out in GIS software, using the three different layers that are selected. A new guide will be produced for RAI calculation using examples from freely available software. Different data collection methods and processes will be covered in this methodology, including ways to account for and adjust data that is known not to be 100% accurate or complete.

Alternative indicators

In some countries it is apparent that rural transport has become dominated by Intermediate Means of Transport, such as motorcycles. In such cases measurement of RAI is still required, but the process is being refined to allow measurement of an alternative value, based on local interpretation of all-season access to any transport service within 2 km. This would include tracks regularly used by motorcycle taxis.

Establish a measurement and reporting framework

There is no formal measurement and reporting framework for SDG 9.1.1. The team have proposed a process that can be followed by the custodian, partners and countries to collect data, report and store data, as well as presenting it on an appropriate platform. This process will evolve as more partners become involved and as tools and services emerge.

Future options for measuring RAI

A number of alternative options have been explored for measuring the RAI in the future. Prominent amongst these is the use of mobile phone data, which is increasingly being used for transport surveys and to monitor traffic in real time. There is therefore potential for mobile data to indicate whether a road is being used, and how fast the people using the road are travelling. This could be used to estimate when a road is closed and how long for, and therefore whether a road is considered as all-season or not. With the expansion of mobile phones in developing countries, and in Africa especially, this possibility is becoming increasingly plausible.

The use of satellite imagery is another possibility to identify all-season roads. This potential has been researched by ReCAP in five countries in Africa and found that manual assessment of road condition is possible to an accuracy of between 65% and 85%, depending on the type of road and the number of condition levels used. However, the trials used very high resolution satellite imagery which is relatively expensive to procure, although it would save funds normally spent on traditional driven visual condition surveys, and reduce any associated logistical issues.

Organisation of the WORKSHOP

Chair: DFID (tbc)

Moderator: Annabel Bradbury

Plan and timing: Tuesday 8th October 2019

Time	Topic/Presentation title	Speaker (title, role/position, organisation, location, if applicable include PIARC Technical committee)
14:00 – 14:05	Introduction to workshop	Workshop Chairperson - DFID
14:05 – 14:10	Introduction to the RAI project	Annabel Bradbury
14:10 – 14:15	Introduction to the RAI	Robin Workman
14:15 – 14:40	RAI Measurement Process, Data Collection and Analysis	Kevin McPherson / World Bank representative
14:40 – 14:45	Country experience of RAI measurement – Ghana/Malawi	Country representative
14:45 – 14:50	Country experience of RAI measurement – Nepal/Myanmar	Country representative
14:50 – 15:30	Questions and Panel Discussion	Representatives from World Bank, UN, ADB, AfDB, PIARC, ReCAP, TRL
15:30 – 16:00	<i>Coffee break</i>	
16:00 – 16:10	Proposals for RAI accuracy, reliability and sustainability	Kevin McPherson
16:10 – 16:20	Potential for future technological options for RAI measurement	Robin Workman
16:20 – 17:00	Audience interaction, group work, power votes	Workshop, managed by TRL
17:00 – 17:30	Panel discussion	Representatives from World Bank, UN, ADB, AfDB, PIARC, ReCAP, TRL

Panel Discussions:

The panel discussion will address the following questions:

What are the challenges with measurement of the RAI in low income countries?

How can the sustainability, accuracy and consistency of the RAI be increased?

Conclusions

Conclusions will be drawn from the workshop session and panel discussions.

References

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- World Bank, 2018. Atlas of Sustainable Development Goals; From World Development Indicators. World Bank, Washington DC.

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Annex K: Results Achieved in Reporting Period

Progress against workplan.

Activity	Expected Progress for Reporting Period	Actual Progress for Reporting Period	Deviation	Challenges	Corrective Action / Comment ⁴	
					Action	By Whom?
- TG2, Inception Period	Completion by November 2018	Completed on time	None	None		RW
- TG2, Progress Statement #1	Completion by end February 2019	Completed on time	None	None	Revision based on ReCAP feedback	RW / KM
- TG2 Progress statement #2	Completion by end June 2019	Completed on time	None	None		RW / KM
- Draft RAI Guideline	Completion by end September 2019					
- Stakeholder Workshop Report	Completion by end October 2019					
- TG2 Report	Completion by end November 2019					

⁴ If appropriate (i.e. if planned activities were not implemented) then signal what actions will be taken by whom to address deviations from the workplan.

Annex L: Steps for Next Reporting Period

Workplan for next reporting period to 30th September 2019.

Activity	Expected Progress for Reporting Period	Planned sub-activities
Finalise Methodology	Completion	
Visit all four countries and collect data	Completion	
Trial RAI in four countries	Complete all trials	Trial measurement procedures and test the accessibility factors in each country, if possible, using local knowledge of all-season roads
Analyse data	Analyse data	
Draft RAI Guidelines	Produce first draft of RAI Guidelines	
Draft recommendations	Complete first draft of recommendations	

Annex M: Budget and Inputs

Deliverable (Reports)	Payment schedule	Month No.	Deadline	Fees to be paid (£) plus reimbursables	Status
Inception Report	15%	1	9 th November 2018	61,072.50	Paid
Progress Statement #1	15%	4	28 th February 2019	61,072.50	Paid
Progress Statement #2	15%	8	30 th June 2019	61,072.50	Pending
Draft RAI Guidelines	30%	12	27 th September 2019	122,145.00	Pending
Stakeholder workshop report	10%	14	1 st November 2019	40,715.00	Pending
TG2 report	15%	15	29 th November 2019	61,072.50	Pending
Total	100%			407,150.00	