ECONOMIC GROWTH THROUGH EFFECTIVE RURAL ROAD ASSET MANAGEMENT

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ABSTRACT

The sustainable provision of road infrastructure in developing countries is essential for allowing the rural population to access markets, basic services and employment opportunities. However, with limited funds available and low management capacity in rural roads agencies, a large proportion of the rural road network in Africa remains in poor condition. Priority is given to national roads, and when funds are available for rural roads they are used to reconstruct roads in poor condition rather than for maintenance of the existing network. The socio-economic impact of interventions on rural road networks is seldom measured.

The Research for Community Access Partnership (ReCAP) is supporting research aimed at fostering higher levels of accountability and introducing sound road asset management practices in rural road agencies. The research methodology is user-driven towards development and implementation of an appropriate specification for rural road asset management. Rural road agencies in five countries are using a customised self-evaluation questionnaire to rate their performance in road asset management and thereafter develop action plans for self-improvement. The process results in a rating for each agency known as the Road Sector Sustainability Index (RSSI). The RSSI is defined as "the extent to which the necessary policies, funding, institutional, technical and operational capacity are in place to ensure the sustainable provision of rural roads".

The research process also includes the development of appropriate network management systems in the project areas. Basic indicators of road condition and network asset value have been developed including a "Road Condition Index", "Network Functionality Index" and "Road Asset Preservation Index". These indicators enable the agency to track changes in road condition and report to decision makers at the local and national level. A third research component has the road agencies collecting data to determine the socio-economic impact of rural road maintenance activities on communities. The methodology uses simple before and after comparisons. Data on a selected set of socio-economic indicators is being collected at ten representative business centres in each project area.

The results of the research components are reported by each participating road agency to their peers annually allowing sharing of experiences as part of a learning and capacity building process. A key finding of the project is the need to build a conducive policy environment for rural road management, encourage involvement of stakeholders and widen the options for sustainable funding of road maintenance works.

1. INTRODUCTION

1.1.   Background to the Project

The United Kingdom (UK) Department for International Development (DFID) is supporting a research programme for the rural transport sector in Africa and Asia. The Research for Community Access Partnership (ReCAP) is active in 12 countries in Africa and five countries in Asia. The focus of the partnership is on strengthening the evidence base for more cost effective and reliable low volume roads and transport services, thereby influencing policy and practice in the participating countries. ReCAP is building on a long history of UKAid-funded research initiatives in the rural transport sector.

ReCAP is supporting several regional research projects in Africa and Asia. One of these projects is the "Economic Growth through Effective Road Asset Management" (GEM). Sierra Leone, Uganda, Zambia, Tanzania and the Western Cape Province of South Africa (RSA) are participating in the project, but the research process and outcomes are being shared with other ReCAP-participating countries. The Implementation Phase of the GEM project commenced in July 2016 and is expected to end in 2020.

1.2.   Purpose of the Project

The purpose of the GEM project is to achieve economic and social benefits for local communities as a result of improved performance in road asset management. The focus of the project is on the management of low traffic rural road networks under the responsibility of sub-national roads agencies.

1.3.   Objectives of the Project

The objectives of the project are as follows:

- Develop a framework for measuring performance in road asset management appropriate to sub-national rural road networks and apply it in selected project areas;
- Develop simple and appropriate tools for monitoring road condition and apply them in the project areas;
- Develop simple indicators of economic and social impact of rural roads and monitor them in the project areas; and
- Achieve incremental (and measurable) improvements to asset management performance in the project areas.

1.4.   Approach

The approach to the project is intended to foster self-reliance in road agencies and encourage greater accountability to road users and other sector stakeholders. The participating roads agencies are being assisted through technical assistance to identify weak areas in the management of their road network and to address the weak areas using the available resources.

1.5.   Participating Agencies

The roads agencies that are participating in the project are:
- Tonkolili District of Sierra Leone;
- Chongwe Municipality of Zambia;
- Kamuli District of Uganda;
- The Uganda National Roads Authority - UNRA (as a rural road agency);

- The Tanzania Rural and Urban Roads Authority (TARURA) and the districts of Kilindi, Mufindi and Mbinga; and
- The Department of Transport and Public Works of the Western Cape (RSA).

The local authority road agencies preside over similar networks of rural roads. Some of the roads have a gravel wearing course but many are earth roads. Parts of the network are not accessible at all times of the year, particularly in Tonkilili, which experiences very high rainfall. All of the local authorities have low capacity for road asset management and may go for long periods of time with no funding for road maintenance.

UNRA is responsible for the primary trunk road network in Uganda, secondary roads and a network of unpaved tertiary roads. The rural road network under UNRA is generally at a higher level than the network managed by Kamuli District. UNRA operates an effective GIS-based network management system from the Head Office in Kampala. The UNRA asset management systems are far more advanced than the systems used at the district level.

TARURA was established in 2017 to manage rural roads that previously were the responsibility of the District Councils. The engineering personnel at district level were transferred to TARURA and now operate independently of the councils. TARURA operates as a commercialised road agency, with all maintenance works contracted to the private sector.

The Western Cape Province of South Africa is responsible for a road network of about 32,000km, of which about 6,700km is paved. Responsibility for roads is delegated to the Department of Transport and Public Works which implements sophisticated road management systems within its Road Asset Management Plan. The Western Cape is participating in the GEM project as an example of good practice in rural road asset management.

Representatives of the participating roads agencies meet annually in the Project Implementation Team (PIT). The purpose of the PIT meeting is to enable the agencies to present the analysis of the data they have collected and their Asset Management Action Plans. Openness in the sharing of information is an important component of the capacity development process.

2. STATUS OF ROAD ASSET MANAGEMENT IN AFRICA

Institutional reforms were implemented in the road sector in Africa under the Road Management Initiative (RMI) in the I990s and early 2000s. These reforms resulted in improvements to the policy and institutional environment for roads, including increased commercialisation of road management [1]. The establishment of road maintenance funds in many countries resulted in improvements to the funding of road maintenance. However, these reforms have tended to benefit national road networks, with less impact on low traffic rural roads.

Key issues affecting the provision of rural roads include:
- Many countries lack an effective policy framework that commits the government to both provision and preservation of rural access roads. There is a tendency to prioritise construction over maintenance, because construction is viewed as politically more rewarding.

- Institutional roles and responsibilities for the rural road sector are often not clear, with decentralisation policies in place but a lack of overall leadership by central government in providing direction, funding and technical oversight to local authorities to take responsibility for road maintenance.
- Funding is inadequate to meet the costs of construction and maintenance of rural roads.
- There is a lack of collaboration between local governments and communities in preparing rural access network plans and lack of transparent prioritisation processes for upgrading and maintenance works.
- Very few roads agencies implement asset management systems which include network definition and asset registers, road condition monitoring, cost information on works activities, analysis and reporting of data collected etc. Levels of service are not clearly defined and communicated with road users and communities. Annual valuation of rural road infrastructure assets is seldom carried out.
- Technical standards for the design, construction and maintenance of rural access roads are not always appropriate to local conditions. There is a continued reliance of gravel as a wearing course material despite dwindling supplies, high maintenance costs of gravel roads, and health risks due to dust.
- The capacity of the private sector to carry out maintenance works in rural areas remains weak due to an inadequate and unpredictable work load. Procurement procedures are often inefficient leading to long periods when no maintenance is carried out.

3. FRAMEWORK FOR MEASURING PERFORMANCE IN ROAD ASSET MANAGEMENT

3.1. Purpose of the Performance Monitoring Framework

The GEM project has developed a framework for measuring the performance of roads agencies in road asset management. The GEM project is focused on the management of rural roads, but the framework may be applied to any road agency. The purpose of the performance monitoring framework is to enable roads agencies to assess their overall performance. Agencies can compare their performance with a minimum benchmark of expected performance and with the performance of other agencies in the same country or in the region. Roads agencies can use the framework to monitor changes in their performance over time and to identify weak areas in their road asset management.

3.2. Road Preservation Pyramid

The requirements for effective road asset management can be described in terms of the six building blocks of the Road Preservation Pyramid (Figure 1). The base of the pyramid is the "External" building block, which includes high-level political support and related government policy upon which the attainment of all the other factors depends. A conducive external environment and a national policy supporting road preservation are prerequisites for ensuring that there are supportive institutional arrangements and technical capability to manage the planning, funding and organisation of road preservation.

Figure 1 - The Road Preservation Pyramid

Effective road asset management depends on good performance of road agencies under all of the six building blocks [3]. Good performance is not guaranteed, for example, by simply installing an off-the-shelf asset management system in a road agency, or through the procurement of equipment for force account maintenance operations.

3.3. Questionnaire

The GEM project has developed a questionnaire which enables a roads agency to assess its performance under the six building blocks of the Road Preservation Pyramid. The questions were designed to be pertinent to a rural road agency, simple to understand and easy to answer. Each question requires a "yes" or "no" answer.

The questions under the External building block assess the existence of an asset management policy that is relevant to the rural transport sector, supported by senior decision makers and adopted at the highest level in government. Stakeholder engagement by the road agency is assessed in terms of the level of informed consultation and open communications in order to understand stakeholder needs and expectations. The level of engagement by the roads agency with other ministries and sector agencies is assessed.

The questions under the Institutional building block assess a range of issues contributing to the performance of the agency. These include whether:
- the agency has a corporate vision and mission statement which considers stakeholder needs and expectations;
- the basic levels of service for roads been defined;
- emergency responses are in place and understood by key members of staff;
- the agency's organisational structure identifies roles, responsibilities and competencies of key staff and is aligned with its AM policy, strategies, objectives and plans;
- the agency provides training opportunities for staff; and
- road agency engineer salaries are comparable with private sector positions.

The questions under the Financial building block assess the existence of stable, adequate and sustainable funding for road maintenance. This includes whether an annual valuation is carried out of road infrastructure assets, a costing framework is in place for determining

unit costs of works, a budgeting and programming processes is in place for a prioritised maintenance and investment plan, and whether there are adequate financial accounting and auditing procedures in place.

The questions under the Management building block assess the existence of an appropriate asset management system that contains network definition (road and bridge inventory information) and network condition data and facilitates the preparation of prioritised annual, medium and long-term maintenance and development plans.

The questions under the Technical building block assess the existence of:
- an adequate road referencing system and inventory;
- a system for systematic and documented data collection for all principal road assets;
- annual visual condition assessment surveys;
- annual gravel loss surveys;
- asset utilization estimates and forecasts, including the existence of bottlenecks on the network.

The questions under the Operational building block assess the efficiency of operations at road agency including planning and scheduling of maintenance, procurement of service providers and technical compliance. Procurement of services is assessed in terms of appropriate type of contract, outsourcing of non-core activities, scheduling of maintenance works and technical auditing.

3.4. Analysis of the Questionnaire Results

The structure of the questionnaire includes four questions under each topic included under each of the six building blocks. The maximum score for each topic is therefore four. Each building block typically includes about seven topics. The average of the scores for each topic gives a score (out of four) for each building block.

In discussions with the agencies in the participating areas, it was realised that the building blocks contribute to different extents to achieving satisfactory asset management performance. Therefore, it was necessary to assign weightings to each building block in the process of combining scores to build up the Road Sector Sustainability Index (RSSI) for each agency

The building blocks are weighted according to their perceived importance towards sustainable road asset management. The External building block was given the highest weighting of 2 as it is regarded as the most important determinant of performance. The Institutional, Financial, Management, Technical and Operational blocks were then given weightings of 1.8, 1.6, 1.4, 1.2 and 1.0 respectively. The weightings reflect the area of each building block in the pyramid.

The weightings are converted to coefficients by dividing the weighting by the sum of all of the weightings. The coefficients are then multiplied by the self-assessment questionnaire score for each building block to yield a score for each block. The sum of these results gives the "Road Sector Sustainability Assessment Score". The maximum value for this score is 4. This score is divided by four to give the Road Sector Sustainability Index (RSSI) applicable to the road agency. The derivation of the RSSI for a typical rural roads agency is shown in Figure 2.

A comparison of the RSSI measured in the GEM participating roads agencies is included in Table 1. There are some significant improvements in the reported indicator values since the baseline of 2016. In some cases, this is related to initial misunderstanding of the road agencies of the meaning and implications of some of the questions.
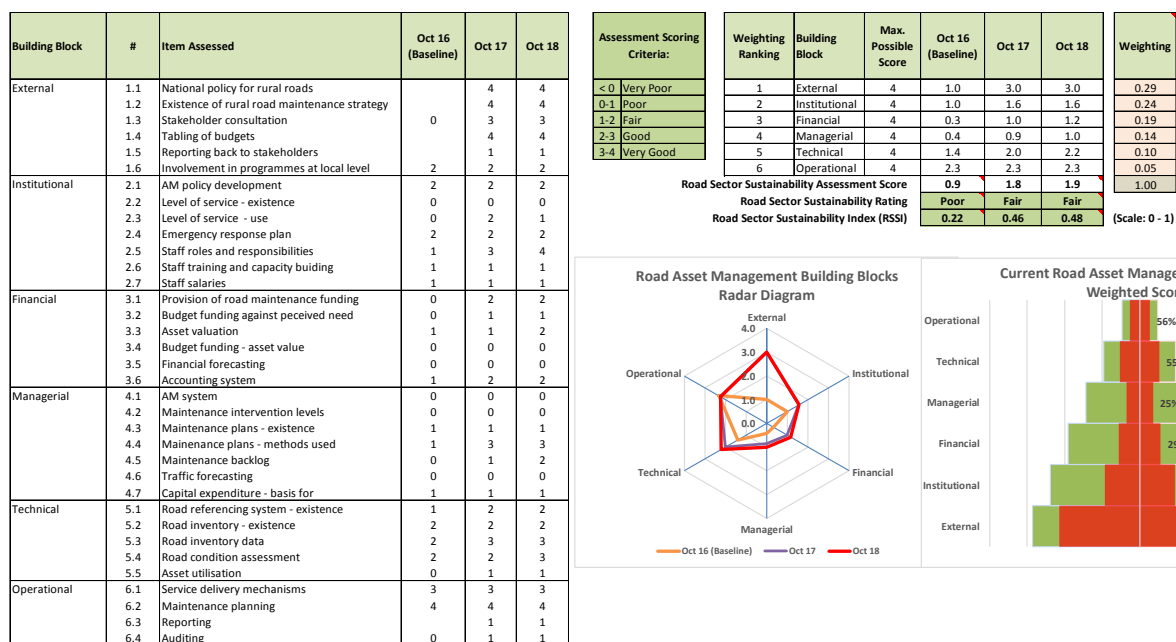
Building Block	#	Item Assessed	Oct 16 (Baseline)	Oct 17	Oct 18
External	1.1	National policy for rural roads		4	4
	1.2	Existence of rural road maintenance strategy		4	4
	1.3	Stakeholder consultation	0	3	3
	1.4	Tabling of budgets		4	4
	1.5	Reporting back to stakeholders		1	1
	1.6	Involvement in programmes at local level	2	2	2
Institutional	2.1	AM policy development	2	2	2
	2.2	Level of service - existence	0	0	0
	2.3	Level of service - use	0	2	1
	2.4	Emergency response plan	2	2	2
	2.5	Staff roles and responsibilities	1	3	4
	2.6	Staff training and capacity buiding	1	1	1
	2.7	Staff salaries	1	1	1
Financial	3.1	Provision of road maintenance funding	0	2	2
	3.2	Budget funding against peceived need	0	1	1
	3.3	Asset valuation	1	1	2
	3.4	Budget funding - asset value	0	0	0
	3.5	Financial forecasting	0	0	0
	3.6	Accounting system	1	2	2
Managerial	4.1	AM system	0	0	0
	4.2	Maintenance intervention levels	0	0	0
	4.3	Maintenance plans - existence	1	1	1
	4.4	Mainenance plans - methods used	1	3	3
	4.5	Maintenance backlog	0	1	2
	4.6	Traffic forecasting	0	0	0
	4.7	Capital expenditure - basis for	1	1	1
Technical	5.1	Road referencing system - existence	1	2	2
	5.2	Road inventory - existence	2	2	2
	5.3	Road inventory data	2	3	3
	5.4	Road condition assessment	2	2	3
	5.5	Asset utilisation	0	1	1
Operational	6.1	Service delivery mechanisms	3	3	3
	6.2	Maintenance planning	4	4	4
	6.3	Reporting		1	1
	6.4	Auditing	0	1	1

Assessment Scoring Criteria:	
< 0	Very Poor
0-1	Poor
1-2	Fair
2-3	Good
3-4	Very Good

Weighting Ranking	Building Block	Max. Possible Score	Oct 16 (Baseline)	Oct 17	Oct 18	Weighting
1	External	4	1.0	3.0	3.0	0.29
2	Institutional	4	1.0	1.6	1.6	0.24
3	Financial	4	0.3	1.0	1.2	0.19
4	Managerial	4	0.4	0.9	1.0	0.14
5	Technical	4	1.4	2.0	2.2	0.10
6	Operational	4	2.3	2.3	2.3	0.05
Road Sector Sustainability Assessment Score			0.9	1.8	1.9	1.00
Road Sector Sustainability Rating			Poor	Fair	Fair	
Road Sector Sustainability Index (RSSI)			0.22	0.46	0.48	(Scale: 0 - 1)

Road Asset Management Building Blocks Radar Diagram

Current Road Asset Management Pyramid - Weighted Scores

Figure 2 - Analysis of Asset Management Self-Assessment Scores

Table 1 - Sustainability Indices for GEM Participating Roads Agencies

	Sustainability Indices										
AM Building Block	Tonkolili Sierra Leone		Chongwe Zambia		Kamuli Uganda		UNRA Uganda		Western Cape		Tanzania[a]
	2018	Change since baseline	2018	Change since baseline	2018	Change since baseline	2018	Change since baseline	2018	Change since baseline	2018
External	0.71	-1%	0.75	200%	0.67	-11%	0.58	56%	0.54	8%	0.63
Institutional	0.25	1%	0.39	57%	0.21	50%	0.57	23%	0.79	69%	0.58
Funding	0.25	2%	0.29	250%	0.29	40%	0.54	44%	0.71	14%	0.63
Managerial	0.25	3%	0.25	133%	0.18	0%	0.64	100%	0.75	24%	0.58
Technical	0.15	-1%	0.55	57%	0.50	25%	0.70	40%	0.75	15%	0.65
Operations	0.19	-1%	0.56	-4%	0.31	25%	0.63	0%	0.75	13%	0.83
Road Sector Sustainability Index (RSSI)	0.37	1%	0.48	114%	0.39	6%	0.59	44%	0.69	25%	0.65

[a] 2018 was the first year of data collection by Tanzania.

3.5. Road Agency Action Plans

The analysis of the questionnaire scores enabled each participating road agency to identify specific actions required to identify shortcomings in their road asset management. Action Plans were prepared and were monitored and supported by the GEM advisory team during their routine visits to the project areas.

4. MONITORING OF ROAD CONDITION AND ASSET VALUATION

4.1. Road Condition Monitoring

Road condition is an indicator of performance in road asset management. Improvement in road asset management is expected to translate into improved road condition. This results in lower transport costs and improved availability of transport.

The objective of undertaking road condition surveys is to identify structural and functional defects on roads. The data generated must be of an appropriate quality and reflect, as far as possible, the actual situation on the ground.

An inventory of roads and drainage structures was prepared by each participating road agency as part of their baseline studies. The inventory data is held in paper form, but the agencies have set up simple Excel databases that hold the inventory data as well as condition monitoring data and analysis results.

Road condition surveys were undertaken annually by the participating roads agencies. The method adopted was based on the conventional visual inspection of roads whereby defects observed on 5km road segments are rated on a scale of 1 to 5 according to their "degree" and "extent". This method is described in the Technical Methods for Highways (TMH) 9 from South Africa [4]. The defects that are assessed include gravel loss, usable road width, erosion of the carriageway, erosion of the side drains, potholes, corrugations, rutting and impassability.

The scores for each defect are given weightings depending on the perceived importance of a particular defect and combined into a single score representing road condition. This is known as the Road Condition Index (RCI). The RCI can be aggregated to a network level to give the Network Condition Index (NCI).

A standard method for calculating the RCI is given in TMH 22 "Road Asset Management Manual" [5]. TMH 22 defines additional indices of road condition, which has also been adopted for the GEM project. These include the "Road Functionality Index (RFI)", which is an appraisal of the road in terms of functional characteristics that affect the quality of use, notably comfort (convenience) safety, congestion and operating cost. The RFI is obtained from the degree and extent of potholes, rutting and corrugations recorded on each road link. The RFI can be aggregated to determine a value for the network level, which is known as the "Network Functionality Index (NFI)".

The values of the road condition indices for the rural road networks that that being studied under the GEM project are summarised in Table 2.

Table 2 - Road Condition Indices (2018)

Index		Tonkolili (Sierra Leone)	Chongwe (Zambia)	Kamuli (Uganda)	UNRA	Tanzania[b]	W. Cape
Length of road network (km)[a]	Gravel	154	136	133	380	310	265
	Earth	84	114	0	0	285	33
NRCI		0.44	0.57	0.63	0.52	0.56	0.55
NFI		0.50	0.58	0.62	0.46	0.57	Not reported

[a] Each roads agency selected a network of roads to study under the GEM project. This is a part of the total network under the responsibility of the agency.
[b] Average of the indices for the three districts in Tanzania that are participating in the project.

The road condition indices are rated as "very good", "good", "fair", "poor" or "very poor" based on the criteria in Table 3. Most of the rural road network in the GEM participating areas is in fair or poor condition.

Table 3 - Rating of condition indices

Value	Rating
> 0.85	Very Good
70 – 85	Good
50 – 70	Fair
30 – 50	Poor
< 30	Very Poor

4.2.   Road Asset Valuation

Road asset valuation is being used under the GEM project to calculate the current and future value of the road asset portfolio in each agency. The process for estimating the asset value is as follows:
- A structured inventory is established indicating the type and length of each road in the selected network;
- The expected useful life of the road formation and pavement are determined (typically 50 years for the road formation and 7 years for the gravel wearing course);
- The condition of the pavement and road formation are established through the condition surveys;
- The remaining useful life of the pavement and formation are determined based on the current condition;
- Unit rates are set for the calculation of replacement cost of the formation and the pavement; and, finally
- The Current Replacement Value (CRV) and Current Asset Value (CAV) of each road are calculated.

The "Road Asset Preservation Index (RAPI)" was used under the GEM project to monitor performance of a road agency in the preservation of their road assets. The RAPI is defined as the road network Current Asset Value (CAV) divided by the road network Current Replacement Value (CRV). The values of the CRV, CAV and RAPI for the rural road networks that that being studied under the GEM project are summarised in Table 4. It is noted that an accurate assessment of the CAV requires physical measurement of the

thickness of the gravel wearing course, which is not yet being carried out in the project areas.

Table 4 - Road Asset Value, Preservation and Funding Indices

Index		Tonkolili (S. Leone)	Chongwe (Zambia)	Kamuli (Uganda)	UNRA	Tanzania[a]
Length of road network (km)	Gravel	154	136	133	380	310
	Earth	84	114	0	0	285
CRV (USD million)		7.5	6.3	4.3	11.7	5.22
CAV (USD million)[b]		5.5	5.0	3.7	10.1	4.17
RAPI		0.73	0.78	0.85	0.86	0.80

[a] Total road network and total of CRV and CAV values for the three participating districts.
[b] 2018 values.

It can be seen from the CRV values in Table 4 that the rural road networks represent a major asset to the local authorities. It is therefore of significant concern that very little funding was provided for maintenance of the GEM road networks for the duration of the project, particularly in the local authority areas.

4.3.   Relationship between Road Asset Management and Road Preservation

The Road Sector Sustainability Index (RSSI) is a measure of the road asset management maturity of an agency while the Road Asset Preservation Index (RAPI) is a measure of the extent of preservation of the road assets. The relationship between these values for the road agencies participating in the GEM project is shown in Figure 3 (2018 values). TARURA and UNRA have relatively high RSSI scores because they are national road authorities, and therefore are placed above the trend line on the graph. In both cases the RAPI is calculated on a small part of the rural road network that is under the responsibility of the authority and its condition may not be representative of the entire network.
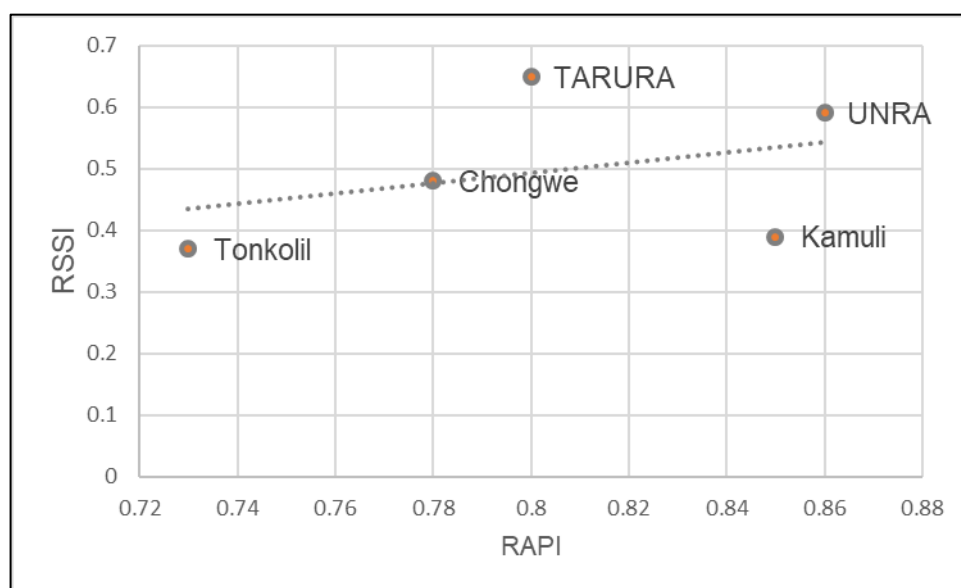

Figure 3 – Relationship between RSSI and RAPI

An assumption of the GEM project was that an increase in the maturity of the road asset management of an agency translates to improved preservation of its road assets. The data

presented in Figure 3 show a trend of increasing RAPI with increasing RSSI which supports this assumption. However, it is noted that there may be a long time lag between the achievement of improvements in some of the building blocks of the road preservation pyramid (which results in an improved RSSI) and improved road condition, particularly when funding for maintenance of the roads is not available. This is the case with TARURA, which was recently established and has adopted sound asset management systems, but these are yet to translate into improved road condition.

5. ECONOMIC AND SOCIAL IMPACT OF RURAL ROADS

5.1. Collection of Social and Economic Indicators

A basic assumption of the GEM project is that that improved rural road asset management will result in improved road conditions and thereby contribute towards a general improvement of the socio-economic condition in rural communities. Road improvements are expected to result in reduced transport costs and improved access to local services, economic administrative centres and employment opportunities. To demonstrate this, a set of socio-economic data was collected in the participating areas. A baseline of data was collected in 2016 and was repeated annually for the duration of the project.

Ten villages or trading centres were identified in each of the project areas. The road agency organised teams to collect the required data using a form prepared by the GEM advisory team. The indicators that were collected included:
- Distance of the Trading Centre (TC) from the District Center (DC);
- Average travel time to the District Center;
- Number of transport operators from the DC to the TC;
- Fares on public transport – light vehicles and bus/combi;
- Cost of freight transport – trucks and light vehicles;
- Number of available trips to the DC per day on a normal day;
- Road Safety – Number of accidents on the road serving the TC for the past year;
- Prices of basic goods exported from the TC;
- Prices of basic goods imported into the TC; and
- Number of shops/kiosks in the TC.

The initial analysis of the social and economic data has drawn some relationships between geographical location of the trading centres, the condition of the access road and the availability and cost of transport [6]. However, these comparisons were constrained by the lack of maintenance on the project roads, which would have resulted in improvements to the condition of some roads, and the short time frame since the start of the project.

5.2. Using the Social and Economic Data

A key objective of the socio/economic component of the GEM project is to increase awareness within the road agency and the local authority of the direct relationship between road condition and the well-being of rural communities. The collection of quantitative data in the trading centres was supported by qualitative information obtained from local residents on how their livelihoods depend on the availability of reliable road access. These data can be fed into communications activities carried out by the local authorities as part of their stakeholder consultation processes. This includes convincing decision makers at the national level to give more attention to the importance of rural roads.

5.3.   Relationship between Road Condition and Livelihoods

Qualitative data collected from respondents in local communities illustrates the impact of the road condition on their day to day life. For example, residents noted that fares on motorcycle taxis increased when it rained, and the price could rise by as much as three times at night due to concerns about reduced visibility combined with poor road conditions. Freight costs are also affected by the road condition. Truck owners reported higher costs of operation when the road is in a poor state, while those who hire trucks reported increased cost of hire when the road condition deteriorated (Box 1). This has a direct impact on the sources of income of rural communities.

Box 1 – Increased freight transport costs due to poor road condition

> "Due to the numerous potholes and the slippery nature when it rains, I'm forced to drive in a higher gear which ruins the truck's engine … In the rainy season, I can spend about 5 million Shillings to repair and service the truck… My worst time is between March and June (the rainy season) when I can take 10 days without working due to the fear of spending more on operating the truck. I am currently contemplating leaving the transporting business for farming because of the rising repair costs."
>
> Truck owner and driver.

Poor roads also affect access to social services. Those in need of the services may not be able to access them and those providing the services may not be able to reach the location where they can provide the services. The comments by a midwife (Box 2) were echoed by teachers regarding access to schools and patients regarding access to medication.

Box 2 – Effect of poor road conditions on access to services

> "I use a boda boda to get to work and it takes 30 minutes to get to work when the road has been graded, about 40 minutes when the road is poor condition and about an hour in the rainy season. At the flooded sections, boda bodas have to be carried and people use canoes to get across. In March and April this year (2018) I failed to get to work for about 7 days because of the poor state of the road due to heavy rains."
>
> Midwife living 15km from the health centre in Uganda.

6. CONCLUSIONS: ACHIEVING IMPROVEMENTS TO ASSET MANAGEMENT PERFORMANCE

The GEM project has devised a series of tools that can be used to measure and monitor the performance of roads agencies in the management of their road assets. These tools are designed to function with relatively little data and detailed analysis. The GEM performance indicators can be used by a roads agency to track changes in its performance over time. They can also be used to compare the performance of roads agencies within the same country or region. Roads agencies are able to identify specific actions that need to be taken to improve their performance.

It is evident from the data collected that centralised roads agencies (e.g. UNRA, TARURA and the Western Cape) are better equipped to manage rural road networks than decentralised agencies (local authorities). Centralised roads agencies tend to have more technical and management capacity and more direct access to funding.

Local authority roads agencies have limited internal capacity for road asset management. This includes the difficulty in retaining qualified staff due to the low salary scales. However, by far the biggest challenge facing local authorities in the establishment of sustainable road asset management is the lack of predictable funding for maintenance. The lack of funding not only constrains the amount of maintenance work that can be carried out, but also constrains the development of more effective asset management systems in the roads agencies. Agency staff are not able to implement improved systems without funding for the works.

The maintenance of roads in good condition has a direct impact on the well-being of local communities. When roads are in poor condition the cost of transport increases for both passengers and freight. Local residents may not be able to reach the nearest clinic to receive treatment. The journey time for teachers and medical staff to reach their place of work increases. At certain times of the year they may not be able be travel to work.

The institutional reforms implemented under the Road Management Initiative (RMI) in the I990s and 2000s resulted in improvements to the policy and institutional environment for roads in Africa. The establishment of road maintenance funds resulted in improvements to the funding of road maintenance. However, until road user charges are truly ringfenced for maintenance and allocated fairly between national and local roads agencies, these reforms will continue to have a minimal impact on rural road networks and the local economy.

7. ACKNOWLEDGEMENTS

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