



## The Contribution of Rural Transport to Achieve the Sustainable Development Goals

### Key Messages on Rural Transport and Sustainable Development Goals



Improved rural transport drives sustainable rural development and national growth



Better rural transport is key for food security and zero hunger



Poor rural transport condemns the poor to stay disconnected and poor



Additional money and commitment is needed to develop and maintain rural road networks and transport services



Better rural transport calls for local solutions to local challenges

Jasper Cook\*, Rob Petts\*\*, Caroline Visser\*, Alice Yiu\*\*

\* Research Community for Access Partnership

\*\*Partnership on Sustainable, Low Carbon Transport

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ReCAP Project Management Unit  
Cardno Emerging Market (UK) Ltd  
Oxford House, Oxford Road  
Thame  
OX9 2AH  
United Kingdom



## **Abstract**

Rural transport plays an indispensable role in achieving more than half of the Sustainable Development Goals (SDGs) and fulfilling the promise of the 2030 Agenda for Sustainable Development to 'leave no one behind'. Although there is no dedicated SDG target on rural access, there are numerous linkages between rural access and the SDGs. Successful scaled-up implementation of rural transport will contribute to realizing SDG 1 to alleviate poverty; SDG 2 to achieve zero hunger and ensure food security; SDG 3 to ensure health and well-being; SDG 4 to provide access to education; SDG 5 to empower women in rural areas; SDG 6 to facilitate access to clean water and sanitation; SDG 8 to promote inclusive growth and economic opportunities; SDG 9 and SDG 11 to contribute to sustainable infrastructure and communities for all; and SDG 13 to increase climate resilience and adaptation in rural areas. In addition to indirect linkages to SDGs and associated targets, there is a direct linkage to rural access in SDG indicator 9.1.1 (Proportion of the rural population who live within 2 km of an all-season road) developed by the Interagency Expert Group on Sustainable Development Goals.

To underscore the critical role of rural transport in achieving the SDGs, a set of key messages has been developed in the framework of the UKAid funded Research for Community Access Partnership (ReCAP), facilitated by the Partnership on Sustainable, Low Carbon Transport (SLoCaT), to explain how rural transport plays a key role in realizing the SDGs.

This paper analyses the contribution of rural transport in achieving the SDGs through the lens of the five key messages, based on research and evidence from a wide range of authoritative sources including ReCAP and preceding programmes.

## **Key words**

Sustainable Development Goals, Poverty alleviation, Food security, Rural access, Asset Management

## **RESEACH 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.

**See [www.research4cap.org](http://www.research4cap.org)**

## **Acronyms, Units and Currencies**

AFCAP	Africa Community Access Partnership
ASCAP	Asia Community Access Partnership
CBA	Cost Benefit Analysis
DFID	UK Department for International Development
EST	Regional Environmentally Sustainable Transport Forum
HDM	Highway Development and Maintenance
HLAGST	High Level Advisory Group for Sustainable Transport
ICT	Information and Communications Technology
LVR	Low Volume Rural Road
RAI	Rural Access Index
RECAP	Research for Community Access Partnership
SDG	Sustainable Development Goals
SLoCaT	Partnership on Sustainable, Low Carbon Transport
SuM4ALL	Sustainable Mobility for All Initiative
UK	United Kingdom (of Great Britain and Northern Ireland)
UKAid	United Kingdom Aid (Department for International Development, UK)
UNCRD	United Nations Centre for Regional Development

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## **1 Executive summary**

Rural transport plays an indispensable role in achieving more than half of the Sustainable Development Goals (SDGs) and fulfilling the promise of the 2030 Agenda for Sustainable Development to 'leave no one behind'. The provision of safe, reliable, and affordable rural transport infrastructure and services is essential to facilitate rural access to markets, services, enterprise and employment opportunities, the delivery of health and education, to increase agricultural production, to develop modern supply chains for crop delivery, to prevent food loss, and hence achieving zero hunger and alleviating poverty. Rural transport is indeed an essential rural facilitator for SDG fulfilment.

Although there is no dedicated SDG target on rural access, there are numerous linkages between rural access and the SDGs. Successful scaled-up implementation of rural transport will contribute to realizing SDG 1 to alleviate poverty; SDG 2 to achieve zero hunger and ensure food security; SDG 3 to ensure health and well-being; SDG 4 to provide access to education; SDG 5 to empower women in rural areas; SDG 6 to facilitate access to clean water and sanitation; SDG 8 to promote inclusive growth and economic opportunities; SDG 9 and SDG 11 to contribute to sustainable infrastructure and communities for all; and SDG 13 to increase climate resilience and adaptation in rural areas. In addition to indirect linkages to SDGs and associated targets, there is a direct linkage to rural access in SDG indicator 9.1.1 (Proportion of the rural population who live within 2 km of an all-season road) developed by the Interagency Expert Group on Sustainable Development Goals.

To underscore the critical role of rural transport in achieving the SDGs, a set of key messages has been developed in the framework of the UKAid funded Research for Community Access Partnership (ReCAP), facilitated by the Partnership on Sustainable, Low Carbon Transport (SLoCaT), to explain how rural transport plays a key role in realizing the SDGs. The key messages are:

- 1. Improved rural transport drives sustainable rural development and national growth**
- 2. Better rural transport is key for food security and zero hunger**
- 3. Poor rural transport condemns the poor to stay disconnected and poor**
- 4. Additional money and commitment is needed to build and maintain rural road networks and develop sustainable rural transport services**
- 5. Better rural transport calls for local solutions for local challenges**

This paper analyses the contribution of rural transport in achieving the SDGs through the lens of the above five key messages. It is based on research and evidence from a wide range of authoritative sources. These key messages can drive short-term advocacy for the need to allocate more financial and human resources to improving rural transport infrastructure and services, and can additionally form the basis of a long-term research agenda to build further evidence on ways to increase rural access and to create lasting institutional change through uptake and embedment of this evidence.

## 2 Introduction

Rural transport plays an indispensable role in achieving more than half of the Sustainable Development Goals (SDGs) and fulfilling the promise of the 2030 Agenda for Sustainable Development to 'leave no one behind'. The provision of safe, reliable, and affordable rural transport infrastructure and services is essential to facilitate rural access to markets and services such as education and health facilities, enterprise and employment opportunities, increase agricultural production, develop modern supply chains for crop delivery, prevent food loss, and hence achieving zero hunger and alleviating poverty.

Rural access is primarily defined as the distance to all-season roads and transport services (SuM4All, 2017),<sup>1</sup> and additionally includes the distance to market and basic services, as well as first/last-mile<sup>2</sup> connectivity with appropriate infrastructure and services. The provision of affordable, reliable, and inclusive rural transport infrastructure and services is at the heart of rural access.

Rural communities in developing countries are often completely disconnected from the major roads, rail lines, and public transport services that enable access to the economic and social activities and opportunities in cities (HLAGST, 2016).<sup>3</sup> Rural access is thus a main driver in solving the first/last mile problem and enabling the rural poor to emerge from poverty and overcome social exclusion by connecting their goods to markets and linking rural areas to market towns, large cities, and the global marketplace.

Although there is no dedicated SDG target on rural access, there are numerous linkages between rural access and the SDGs. Successful scaled-up implementation of rural transport will contribute to realizing SDG 1 to alleviate poverty; SDG 2 to achieve zero hunger and ensure food security; SDG 3 to ensure health and well-being; SDG 4 to provide access to education; SDG 5 to empower women in rural areas; SDG 6 to facilitate access to clean water and sanitation; SDG 8 to promote inclusive growth and economic opportunities; SDG 9 and SDG 11 to contribute to sustainable infrastructure and communities for all; and SDG 13 to increase climate resilience and adaptation in rural areas. In addition to indirect linkages to SDGs and associated targets, there is a direct linkage to rural access in SDG indicator 9.1.1 (Proportion of the rural population who live within 2 km of an all-season road<sup>4</sup>) developed by the Interagency Expert Group on Sustainable Development Goals.

### 2.1 Functions of rural transport

Rural Transport is widely accepted to be the principal physical communications facility for rural communities to connect them to the national principal or main road, or waterway network.

Rural Transport comprises two distinct and complementary elements:

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<sup>1</sup> Sustainable Mobility for All Initiative (2017). Universal Access (Rural): Narrative document (working document, not yet publicly available).

<sup>2</sup> The First/last mile is the concept of the segment of transport that links the rural homes and farmers to or towards the nearest motorable rural road or a produce collection point, or access to other services. It is usually the most challenging linkage with the outside world. 1 mile = 1.61 km approx. The sentence does not explain "last-mile" as used by the UN in the Mobilizing Sustainable Transport for Development report.

<sup>3</sup> High-level Advisory Group on Sustainable Transport (2016). Mobilizing Sustainable Transport for Development. Available at: <http://bit.ly/2dV1ivX>.

<sup>4</sup> An all-season road is a road that is motorable all year round by the prevailing means of rural transport.

**Mobility** is characterised by the transport means available - both motorised and non-motorised - for people to transport themselves and their goods, and for services to be provided. The means are typically owned and operated by individuals or the private sector.

**Transport Infrastructure** is the rural roads, tracks, trails, paths, watercourse structures and footbridges, as well as rural waterways and their transfer facilities. The **infrastructure** enables, or constrains, the **mobility**. Responsibility for the provision and maintenance of transport infrastructure usually falls to the central or local government, or the communities themselves. In the past, limited availability of government resources has often meant that the burden of transport infrastructure provision and maintenance has fallen mainly on the poor rural communities; the stakeholders least able to contribute in resource or knowledge terms. The result has often been that poor rural transport infrastructure has seriously constrained mobility.

Rural development is not only a question of social equity, but is also crucial for national economic growth. Good rural road infrastructure and services promote connectivity and social cohesion. They drive agriculture, trade, commerce and industry as well as accessibility and mobility to knowledge, jobs, health, education, and the social and economic facilities necessary to counteract poverty and social exclusion. Countries cannot function efficiently and develop socially and economically without efficient, affordable, sustainable and appropriately climate resilient urban, inter-urban and rural transport infrastructure and services.

The Rural Access Index (RAI), which was developed by Roberts, Shyam, and Rastogi (2006),<sup>5</sup> is one of the most important global development indicators in the transport sector and is embedded in the SDG monitoring framework as indicator 9.1.1. In the initial study, the RAI was estimated at 68.3% based on household surveys, leaving a rural population of about one billion unconnected to a good quality road network. Initiatives have been launched to refine the system of assessment.<sup>6</sup> Fewer than 40% of rural Africans live within two kilometres of an all-season road. This is by far the lowest level of rural accessibility in the developing world.

## 2.2 Key Messages on Rural Transport and SDGs

The Research for Community Access Partnership (ReCAP) is a UKAid funded research programme on rural transport bringing together the Africa Community Access Partnership (AfCAP) and the Asia Community Access Partnership (AsCAP). Facilitated by the Partnership on Sustainable, Low Carbon Transport (SLoCaT), ReCAP promotes sustainable rural access as a key component of the implementation strategies for achieving SDGs.<sup>7</sup> The aim is to ensure inclusion of rural transport in the high-level, multi-lateral development discourse on sustainable transport and rural development, underwritten by ReCAP research evidence.

To underscore the critical role of rural access in achieving the SDGs, a set of key messages<sup>8</sup> has been developed under this joint advocacy project to explain how rural transport plays a key role in realizing the SDGs. The key messages were developed through a consultation process with feedback and input gathered from more than 130 stakeholders in the rural transport sector. They are:

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<sup>5</sup> Roberts, P., Shyam, K.C., & Rastogi, C. (2006). Rural Access Index: A Key Development Indicator. Transport Papers TP-10. The World Bank Group, Washington, DC.

<sup>6</sup> World Bank & Research for Community Access Partnership. (2016). Measuring Rural Access: Using New Technologies.

<sup>7</sup> More information on the ReCAP funded rural access advocacy project is available at [www.slocat.net/ruraltransport](http://www.slocat.net/ruraltransport)

<sup>8</sup> Partnership on Sustainable, Low Carbon Transport (2017). Promotion of Sustainable Rural Access in the implementation of the 2030 Global Agenda on Sustainable Development: Key Messages Consultation Analysis. London: ReCAP for DFID. Available at: <http://bit.ly/2pj0an7>.

1. **Improved rural transport drives sustainable rural development and national growth:** Good rural road infrastructure and services promote connectivity and social cohesion, drive commercial activities as well as accessibility to social and economic facilities necessary to counteract poverty, isolation and social exclusion.
2. **Better rural transport is key for food security and zero hunger:** Improving rural access can lead to lower costs for farm inputs and lower transport costs for marketed outputs, thus increasing agricultural production to enhance food security.
3. **Poor rural transport condemns the poor to stay disconnected and poor:** Access to markets and employment opportunities through better rural transport infrastructure and services is an essential pre-condition to generating rural income and thus reducing poverty.
4. **Additional money and commitment is needed to build and maintain rural road networks and develop sustainable rural transport services:** Existing funding sources need to be expanded and new funding sources need to be developed, piloted and implemented not only for building but also for managing and maintaining the asset.
5. **Better rural transport calls for local solutions for local challenges:** Rural access challenges require local-resource-based solutions that are compatible with the local road environment conditions.

This paper analyses the impacts of rural transport in achieving the SDGs through the lens of the above five key messages. These key messages can drive short-term advocacy for the need to allocate more financial and human resources to improving rural transport infrastructure and services, and can also form the basis of a long-term research agenda to build further evidence on ways to increase rural access and to create lasting institutional change through uptake and embedment of this evidence. It is clear that improved inter-sector understanding and cooperation is required to achieve the SDGs. The Key messages provide a guiding framework for cooperation and delivery.

### **3 Key Message 1: Improved Rural Transport Drives Sustainable Rural Development and National Growth**

Rural transport facilities and services are indispensable elements for unlocking the country's growth and equity potential.

There is now clear evidence from historical and current data that rural access is an important driver of poverty alleviation and that, conversely, lack of such access inhibits economic development and national growth. Consequently, there is a requirement for tailored interventions to improve the welfare of the poorest groups including the construction and sustainable maintenance of basic rural access roads. In South East Asia, Warr (2010)<sup>9</sup> indicated that by providing households with dry season road access, rural poverty incidence could be reduced permanently from the then 33% to 29.7%. A further reduction to 26% could be obtained by providing all rural households with all-season road access.

The Asian Development Bank, in an example from Laos, emphasized the key role that effective access plays in agricultural development:

*'Without access to the more remote upland villages from the national highway, impacts from interventions would have been significantly less. The rehabilitated roads reduced transport costs, freight rates, vehicle operating costs, and travel times, making better equipped and better qualified*

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<sup>9</sup> Warr, P. (2010). Roads and Poverty in Rural Laos; An Econometric Analysis. In: *Pacific Economic Review*, 15: 1, 152–169.

*health and education services more accessible to the local population. Rehabilitation of the access roads and village tracks is therefore considered a necessary and very effective means of achieving the project outcomes'.<sup>10</sup>*

Studies in Vietnam<sup>11</sup> have shown statistically that rural roads are an important factor for economic growth and at the household level they increase employment and income. The implication is that improving rural roads increases access of people to public services and markets. However, it also indicated that improving rural roads alone is not enough and that there has to be parallel improvement in other infrastructure, such as markets and schools. Improvement in rural road networks and rural transport services are key drivers of socio-economic development but are by no means the whole solution.

A more general systematic review by Hine et al (2016)<sup>12</sup> established that the expansion of the rural road network has a positive impact on poverty reduction. The review established a strong direct relationship between rural transport infrastructure and reducing transport costs and increasing traffic volumes. Conclusions were based on 56 studies undertaken, with the majority from Sub-Saharan Africa but with others from Asia, South America and the Middle East.

The review presented strong evidence that, over the medium to long term, development of the rural road network leads to an increase in employment, income and consumption, and expansion of the agricultural sector. There is evidence to suggest that the health impacts are generally positive, but increased connectivity is also shown to lead to an increase in communicable diseases.

Figure 1 shows the percentage of the 54 studies showing a beneficial effect for some of the key characteristics investigated.

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<sup>10</sup> Asian Development Bank. (2007). Project Completion Report Lao People's Democratic Republic: Shifting Cultivation Stabilization Pilot Project. Manila.

<sup>11</sup> Cuong, N.V. (2011). Estimation of the impact of rural roads on household welfare in Vietnam. In: Asia-Pacific Development Journal 18 (2): 105-135.

<sup>12</sup> Hine, J., Abedin, M., Stevens, R.J., Airey, T., & Anderson, T. (2016). Does the extension of the rural road network have a positive impact on poverty reduction and resilience for the rural areas served? If so how, and if not why not? A systematic review. London: EPPI-Centre, Social Science Research Unit, UCL Institute of Education, University College London.

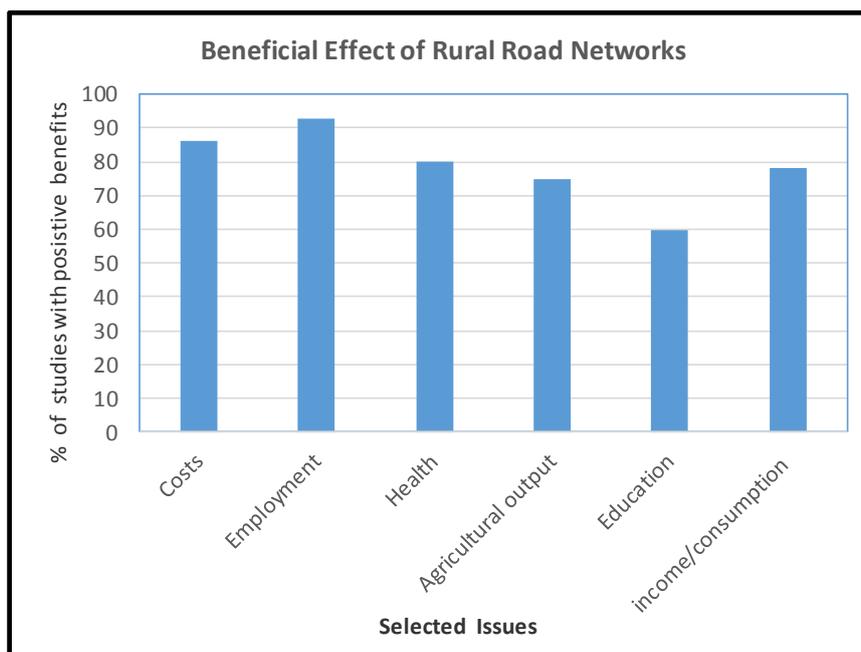


Figure 1. Beneficial effects of rural road networks (after Hine et al, 2016)

In terms of Cost Benefit Analysis (CBA), current work is being undertaken by ReCAP on the benefits of improving rural road surfacing type from unsealed to sealed in Vietnam.<sup>13</sup> This work followed on from an earlier study on the economic value to AfCAP countries of improved sealed access as opposed to unsealed access<sup>14</sup>. Both these studies have convincingly shown the strong benefits accruing from improved (all-season) rural access roads.

There is strong evidence that the greatest benefits from transport investment (for individuals and national GDP) come from connecting villages to the road network. Evidence from Ethiopia, Ghana, Nepal, Uganda and elsewhere shows that upgrading footpaths to basic motorable roads provides very substantial benefits.<sup>15</sup> It is however necessary to ensure that the roads are maintainable. The same source advises that analyses from China showed that the greatest returns to investments came from the construction of low-volume rural roads. The investment in such roads had a greater influence on poverty reduction and national GDP than investments in better-quality, higher-volume roads. Investment in rural roads, particularly the initial connectivity, leads to greater school enrolment (evidence from many countries including Bangladesh, Ethiopia, India, Morocco, Pakistan and Vietnam). Investment in rural roads also leads to better staffing at village primary schools (evidence from India, Zambia and elsewhere).

Vietnam demonstrates the potential for application of knowledge and proactive rural transport initiatives for individual and national benefit realisation. Analysis of the 2002 National Living Standards survey demonstrated a very strong correlation between poverty and lack of accessibility of the population (within 2km) to an all-weather road<sup>16</sup>. From a tertiary road network that was almost universally unpaved and unmaintained in 2004 (2% paved), the Government invested in the

<sup>13</sup>Petts, R., Hine, J., Nguyen, T.P.H., & Pham, G.T. (2017). Cost/Benefit Analysis of SEACAP trials in Vietnam. London: ReCAP for DFID.

<sup>14</sup>Carruthers, R. & Nogales, A. (2013). Economic Cost, Benefit and Value for Money Analysis of AfCAP Research Outputs -Final Report. Sutton: Crown Agents.

<sup>15</sup>Starkey, P. & Hine, J. (2014). Poverty and sustainable transport: How transport affects poor people with policy implications for poverty reduction. A literature review, for ODI, UN-Habitat and SLoCaT.

<sup>16</sup>Intech-TRL, 2006, Rural Road Surfacing Research, SEACAP 1, Final Report.

upgrading of about 80,000km of these community access roads to low-maintenance, paved standard; to 58% of that network in just over 10 years.<sup>17</sup> From 2004 to 2014 the Vietnamese economy grew more than 3-fold. Poverty incidence fell substantially over the same period so that by 2014 only 8.4% of the population was assessed to be below the national poverty line.<sup>18</sup>

Policy-makers, through political, operational and community structures and mechanisms, must develop the necessary will and cooperation to identify and resolve the rural access and mobility challenges. New cross-sector consultation and collaboration platforms will be necessary on the local, national and regional level. Cooperation between all stakeholders is required to develop the policy framework, strategies, problem-solving methods, delivery arrangements and capacity, and resource mobilization to ensure mutually beneficial and sustainable transport infrastructure and services that are safe, appropriate, affordable, resilient and 'fit for purpose'. For example, on a global level, the Sustainable Mobility for All initiative (SuM4All) is a multi-stakeholder collaboration platform that aims at transforming the global transport sector and make mobility equitable, efficient, safe and clean. Its focus is on the development of a Global Tracking Framework for sustainable transport. One of the strategic themes of SUM4ALL is Universal Access, including Rural Access.

#### **4 Key Message 2: Better Rural Transport is Key for Food Security and Zero Hunger**

It is estimated that to feed its expected 9.3 billion population by the middle of this century, the world will need to raise global food production by around 70%.<sup>19</sup> A food-secure world requires that those currently living in rural poverty become able to produce agricultural surpluses, allowing them to sell the excess for income, to invest in better agricultural practices and to insure against the bad seasons that will inevitably come, from time to time, and raise themselves from poverty.<sup>20</sup> Both agriculture and transport sectors face climate resilience challenges.

Some 450 million smallholder farmers around the world face poor marketing linkages. Additionally, the farming practices are characterized by low productivity due to dependence on family labour, lack of access to affordable capital, resources and inputs such as seeds, fertilizers, irrigation equipment and machinery. Smallholders remain dispersed and non-aggregated.<sup>21</sup>

Significant improvements in rural transport infrastructure and transport services need to be achieved to allow these substantial challenges to be met. Effective and more resilient rural transport infrastructure and services will be the essential 'enabler' for agricultural production and other rural activities. To achieve the SDG Goal 2 on Zero Hunger, the SDG Indicator 9.1.1 (Proportion of the rural population who live within 2 km of an all-season road) will be an important monitor of progress towards food security and hunger eradication.

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<sup>17</sup> Petts, R., Hine J., Nguyen, T.P.H. & Pham, G.T. (2017). Cost/Benefit Analysis of SEACAP trials in Vietnam. London: ReCAP for DFID.

<sup>18</sup> Asian Development Bank (2017). Poverty in Viet Nam. Available at: [www.adb.org/countries/viet-nam/poverty](http://www.adb.org/countries/viet-nam/poverty)

<sup>19</sup> Food and Agriculture Organization of the United Nations. (2009). Global agriculture towards 2050, High Level Expert Forum - How to Feed the World in 2050.

<sup>20</sup> KENDAT, IFRTD & TCP International (2013). Rural Logistics for Smallholder Farmers to Meet New Agricultural Market Demands - A planning framework for improving the efficiency of transport services in the high value agricultural sub-sector, replicable in other values chains. Sutton: Crown Agents.

<sup>21</sup> DGDA. (2012). Dalberg Global Development Advisors 2012: Catalyzing Smallholder Agricultural Finance.

Experts on economic growth in Africa note that among all regions of the world, Africa trades the least within its region. Increasing access to domestic and regional markets is seen as key to poverty reduction, food security, and economic growth, as well as a necessary step to improve the continent's capacity to trade with the rest of the world.<sup>22</sup>

Better rural transport infrastructure and services will be required to improve rural access and urban linkages, improve access to markets, lower transport costs, reduce crop wastage, increase food security and increase production on a diminishing global land resource, depleted by nutrient flows to the urban centres. Improved rural transport will allow investments and rural based value chains (agro-industries) with associated rural employment and economic development leading to more self-reliant rural communities. Transport needs analysis must consider the complete transport chain encompassing inputs to the farms and all linkages and activities between the farming units (especially 'first/last mile'<sup>23</sup>) and the consumer.

A study in China<sup>24</sup> also found that the poverty-reduction effect per unit of additional agricultural R&D investment ranked second only to investment in rural education. Government spending on rural infrastructure (roads, electricity, and telecommunications) had substantial impact in reducing poverty and inequality as well, owing mainly to improved opportunities for non-farm employment and increased rural wages.

Transport is a major constituent of the final market price of produce, and high prices affect both the producer and the consumer. For consumers, reducing transport costs can reduce the price consumers pay. Should food become unaffordable, it becomes inaccessible and food security ceases to exist. On the producer side, transport costs vary according to factors such as commodity type, distance, efficiency, perishability, but typically constitute 3.5% to 25% of the market price. Farmers tend to only receive 30% to 50% of the final market price and the difference goes to transport costs<sup>25</sup>. If transport supply fails producers, large losses can result. It is estimated that in Tanzania, typically 10% to 40% of the harvest remains stranded and as much as 89% of this is due to inadequate supply of transport.<sup>26</sup> Improved access roads and transport leads to increased income and food security.

A study in Kenya<sup>27</sup> found that the costs of perishable produce transport over the first two kilometres probably accounts for around 10% to 20% of the net income that farmers would derive from their sale and production. At the same time, it has been found that the conventional methods of transport used (e.g. backloading, animal transport, motorcycle transport) costs 16 to 30 times more than lorry and truck transport, on a per ton/km basis. Hence there are potentially huge benefits to be gained by improving 'first/last mile' transport, through better infrastructure and load consolidation.

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<sup>22</sup> Romanik, C.T. (2008). An Urban-Rural Focus on Food Markets in Africa, The Urban Institute.

<sup>23</sup> 1 mile = 1.61km approx..

<sup>24</sup> Fan, S, Zhang, L., & Zhang, X. (2002). Growth, Inequality, and Poverty in Rural China - The Role of Public Investments, for the International Food Policy Research Institute.

<sup>25</sup> Were-Higenyi, F. (2010). Rural transport, agriculture and food security - outcome of the SSATP/Africa College workshop at IITA. Ibadan, Nigeria.

<sup>26</sup> Lane-Visser, T., M.Vanderschuren, and W. De Clercq. (2014). An Interdisciplinary Investigation into the Linkages between Transport, the Environment, Climate Change, Hydrology, Agriculture and Food Security in the rural Letaba District, Limpopo Province, South Africa, Africa Research for Community Access Partnership. Sutton: Crown Agents.

<sup>27</sup> Njenga P., Wahome G., & Hine, J. (2014). Pilot Study on First Mile Transport Challenges in the Onion Small Holder Sector. Sutton: Crown Agents.

A key finding of a review of Rural Transport in Sub Saharan Africa<sup>28</sup> is that there is now an emerging convergence between the agricultural and rural development and transport communities in their understanding and approaches to making smallholder and rural households the direct targets of efforts to promote rural growth.

This cooperation could be further enhanced by the adoption of proven agricultural tractor technology, in appropriate circumstances, to unpaved rural road maintenance. An AfCAP study in Zambia concluded that there are clear cost and sustainability advantages for the introduction of such approaches<sup>29</sup>. The utilization of the low-capital investment equipment could be raised to commercially viable levels in the typical high credit charge (and scarce credit availability) economies of the developing world; benefiting both the agricultural and rural transport sectors with lower unit costs.

Improved agricultural production can reduce hunger by supplying both urban and rural areas with nutritious and sufficient food all year round. Improving rural access can lead to lower costs for farm inputs and lower transport costs for marketed outputs (e.g. 'First/last mile' transport), thus increasing the margins and incentives for the farmer and raising agricultural production.

Improvement in rural transport will lead to better knowledge application for good practice, reduced crop wastage, higher yields, enhanced production and development of local agro-industry which can improve food security. It will also promote rural employment and economic development with more self-reliant rural communities.

Close cooperation and mutual understanding of the agricultural and rural transport sectors will be a vital factor to stimulate the needed increase in food security and global food production.

Coordinated efforts across the sectors are required for inter alia:

- Improved all season access for rural communities (especially 'first/last mile');
- Improved, appropriate and affordable rural transport services to reduce transport costs;
- Knowledge and affordable access to resources for both improved and sustainable agricultural production and marketing, and the efficient transportation of inputs and outputs;
- Cross-sector dialogue and cooperation to optimize the use of available resources and synergies, and increase food production efficiently and sustainably, providing producers with an equitable livelihood;
- Effective monitoring of progress toward SDG Goal 2 through Indicator 9.1.1 and other means.

## **5 Key Message 3: Poor Rural Transport Condemns the Poor to Stay Disconnected and Poor**

Most of the world's poor people<sup>30</sup> live in rural areas isolated by distance, terrain and poverty from employment and economic opportunities, markets, healthcare and education.<sup>31</sup>

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<sup>28</sup> Banjo G., Gordon H., & Riverson, J. (2012). Rural Transport - Improving its Contribution to Growth and Poverty Reduction in Sub-Saharan Africa, SSATP Working Paper No. 93.

<sup>29</sup> Intech Associates & Clanview Civils, 2016, Scoping Study for Establishment of Pilot Project to implement tractor-based road maintenance approaches in Zambia. London: ReCAP for DFID.

<sup>30</sup> The international poverty line is currently defined at \$1.90 or below per person per day using 2011 United States dollars purchasing power parity (ppp) (UN).

<sup>31</sup> Starkey, P., & Hine J. (2014). Poverty and sustainable transport: How transport affects poor people with policy

Rural isolation is also linked with poor health (unnecessarily high peri-natal mortality) and low school enrolment.

Without monetary income possibilities, access to 'development inputs and facilitators' and reasonable prospects of all-season access and agricultural produce being collected and transported at a motivational price when harvested, rural poor are locked into a state of subsistence survival, deprivation and isolation.

After more than 100 years of the motor vehicle era, many developing regions still have sub-optimal road transport networks with less than 20% of routes to all-season standard of trafficability.<sup>32</sup>

Many people live more than two kilometres from the nearest all-season road and have to walk for over thirty minutes to reach it to access any services, deliveries or collections. In remote areas, communities may be more than a day's walk from a functioning roadway, which makes it difficult to market produce, access health care and education; with slow and inefficient head loading and animal haulage the only options available to them.

There is much evidence that building roads (and/or trails and footbridges) to connect rural communities to the road network provides numerous benefits and reduces the numbers of people in extreme poverty.<sup>33</sup> Trails and roads enable safer and faster access to markets and services. They also make it more likely that service providers (vaccination teams, extension workers, teachers, personnel transportation and goods haulage) are attracted to and available in rural areas.

Recent research studies and reviews have shown that typical transport infrastructure investments have stimulated economic growth, but tend to benefit the 'non-poor' most.<sup>34</sup> People with resources will benefit more from the better access to employment markets, healthcare and education. The rural poor have not had the accessibility or resources to take advantage of the opportunities afforded by better transport infrastructure. Future sector investments must be more focussed to avoid further impoverishing poor people.

The provision of all-season rural access through serviceable roads will unlock the opportunities for the poor to escape their past disconnection. Rural poor benefit significantly from well-designed rural infrastructure investments and reduction in travel time and costs.<sup>35</sup> Smoother and more efficient motorized road transport can facilitate a shift to higher-value perishable products. Households, both poor and non-poor, can substantially increase the share of their income coming from off-farm employment. Access to markets, knowledge and agricultural inputs determines agricultural production. Only the expectation and achievement of adequate and sustained all-year access will encourage and enable farmers to optimise their production and thus generate rural growth. The 'first/last mile' in taking agricultural products to markets often poses the largest challenge in terms of physical access, costs and reliability. Head loading or animal transport of goods on poor routes is expensive and time consuming. Isolation extends to all services required for rural wellbeing and development.

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implications for poverty reduction. A literature review, for ODI, UN-Habitat and SLoCaT.

<sup>32</sup> World Bank. (2008). *Safe, Clean, and Affordable Transport for Development*. The World Bank Group.

<sup>33</sup> Starkey, P., & Hine, J. (2014). *Poverty and sustainable transport: How transport affects poor people with policy implications for poverty reduction*. A literature review, for ODI, UN-Habitat and SLoCaT.

<sup>34</sup> Starkey, P., & Hine, J. (2014). *Poverty and sustainable transport: How transport affects poor people with policy implications for poverty reduction*. A literature review, for ODI, UN-Habitat and SLoCaT.

<sup>35</sup> Starkey, P., & Hine, J. (2014). *Poverty and sustainable transport: How transport affects poor people with policy implications for poverty reduction*. A literature review, for ODI, UN-Habitat and SLoCaT.

Since ownership of private vehicles is scarce in rural areas, transport services provide the only way to travel longer distances. Complementary action and regulation on rural transport are needed to facilitate reliable, safe, and affordable transport services for passengers and freight to ensure the full use of appropriate and sustainable rural transport infrastructure.

## **6 Key Message 4: Additional money and commitment is needed to develop and maintain rural road networks and transport services**

### **6.1 Appropriate management of rural road assets and whole-life costing**

Rural road infrastructure has been an important national asset but poor management and maintenance have led to loss of asset value and impaired all-season access for rural communities.<sup>36</sup>

The road transport infrastructure asset usually represents the largest physical public investment in developing nations. The road asset value as a percentage of GDP is, for example, 10% in South Africa and an astonishing 65% in Malawi.<sup>37</sup> Despite the vital importance of this national infrastructure asset, in the recent past, generally poor management has led to widespread loss of asset value and impaired all-season access for many communities, resulting in increased road user costs, reduced access to markets and services, and disconnection from economic and social opportunities.<sup>38</sup>

In terms of infrastructure, transport sector investments tend to be concentrated on the main road networks. Rural roads receive much less attention and resources.<sup>39</sup> Furthermore, the asset management capabilities generally reduce substantially when it comes to the preservation and enhancement of the tertiary or rural access road networks. Also, road authorities are often unable to compile and deliver credible justification documentation for funding of their investment and preservation programmes, due to lack of suitable data and management systems.

Spending on roads in Sub-Saharan Africa averages just below 2% of GDP, with substantial variance across countries.<sup>40</sup> This compares with the 1% of GDP that is typical in industrialized countries, and the 2–3% of GDP found in fast-growing emerging economies. However, in some cases, allocations need to be up to about 5% of GDP to preserve and enhance the existing networks. Current financing levels and management approaches are clearly not adequate to achieve required affordable and sustainable expansion of rural transport as well as the preservation of existing rural road networks. Existing funding needs to be allocated and made to perform more efficiently.

However, even with improved sector efficiencies, it is clear that the resources being allocated to the rural transport sector are substantially sub-optimal. Possible new funding and resourcing sources need to be identified and developed, piloted and implemented not only for building but also for

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<sup>36</sup> O'Neill, P., Petts, P., & Beusch, A. (2010). Improved Asset Management – Climbing Out Of The Road Sector Pothole!

<sup>37</sup> Gwilliam, K., Foster, V., Archondo-Callao, R., Briceño- Garmendia, C., Nogales, A., & Sethi, K. (2008). Africa Infrastructure Country Diagnostic, Roads in Sub-Saharan Africa. World Bank.

<sup>38</sup> World Bank. (2008). Safe, Clean, and Affordable Transport for Development, The World Bank Group's Transport Business Strategy for 2008-2012.

<sup>39</sup> Burrow, M.P.N., Geddes, R.N., Pinard, M.I., Gongera, K., Bopoto, C, Ghataora, G.S., Gillett, S., & Petts, R. (2016). Specification for Rural Road Asset Management Performance. Mombasa: iTRARR. Paper presented at the International Transport Research and Road Conference (iTRARR) 2016.

<sup>40</sup> Gwilliam, K., Foster, V., Archondo-Callao, R., Briceño- Garmendia, C., Nogales, A., & Sethi, K. (2008). Africa Infrastructure Country Diagnostic, Roads in Sub-Saharan Africa. World Bank.

managing and maintaining the road assets in whole-life-cycle terms. A new asset management approach is required<sup>41</sup> that ensures that:

- National rural road assets are inventoried and valued, and their vital economic and development role are understood by all stakeholders
- Asset management good practice is introduced to cost effectively deploy the available resources to preserve and enhance the rural road networks
- The economic and social benefits of all-season access for rural communities are measured and reflected in resource justifications and allocations to the sector
- There is a more rational balance of funds deployment between preservation of the existing assets and enhancement of the networks
- The attributes and limitations of earth, gravel and paved road surface options are understood and applied in the most cost-effective circumstances
- Resources are allocated to support decision making and management information systems and application of research and good practice
- An 'enabling' framework is put in place to encourage and facilitate the provision of affordable and safe transport services to the rural communities.

Under the umbrella of AfCAP, research is ongoing to assist Sub-Saharan African countries in improving their rural road asset management practices.<sup>42</sup> The initiative is cooperating with the national stakeholders to develop a framework for self-assessment of asset management performance, tools for road network asset valuation and condition monitoring, indicators of social and economic impacts of rural roads, and a framework for capacity development in the participating roads agencies.

It is necessary to introduce and embed an asset management culture and life cycle cost management practices. This will substantially increase cost-effectiveness of the available resources and transport provision, and encourage further investments in rural activities and communities. A whole life approach to the financing of high volume roads has been in place for many years using models such as Highway Development and Maintenance (HDM)<sup>43</sup> but it is only in the last 10 years or so that a similar approach has been adopted for investments in rural roads with relatively low traffic flows and carrying a high proportion of light vehicles, including users of non-motorised transport.<sup>44</sup>

Fact and evidence based awareness creation is required to create the dedicated political will at all levels as a pre-condition for success both in the case of additional funding for new infrastructure as well as for improved maintenance. Sustainability of rural access requires the political will to prioritize maintenance and preservation of the existing road assets, coupled with spot improvement strategies for cost-effective enhancement. Partnership of stakeholders and real commitment from them based on awareness of the characteristics and key role of the sector are essential to enable rural transport to deliver the vital support for the SDG attainment.

## **6.2 Provision of transport services**

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<sup>41</sup> O'Neill, P., Petts, P., & Beusch, A. (2010). Improved Asset Management – Climbing Out Of The Road Sector Pothole!

<sup>42</sup> Research for Community Access Partnership (ReCAP). Economic Growth through Effective Road Asset Management. Available at: <http://www.research4cap.org/SitePages/AssetManagement.aspx> [Accessed on 19 June 2017]

<sup>43</sup> WRA: World Road Association, Highway Development Maintenance Module (HDM): <http://www.hdmglobal.com/>

<sup>44</sup> Burrow, M.P.N., Geddes, R.N., Pinard, M.I., Gongera, K., Bopoto, C, Ghataora, G.S., Gillett, S., & Petts, R. (2016). Specification for Rural Road Asset Management Performance. Mombasa: iTRARR.

For rural transport services, less conventional modes of transport, such as motorised and non-motorised rickshaw-type vehicles, motorcycles, etc. are popular modes of transport in many rural areas. Operators of these types of vehicles need roads with relatively low levels of road roughness to provide financially viable low-cost transport services. Poorly maintained gravel roads with high levels of roughness inhibit the provision of such services, impede access and also negatively impact on road safety. Greater recognition of the road network as a high value national asset has been an important factor in improving road maintenance in many countries, which together with the change to whole-life costing for the provision of rural transport infrastructure, has resulted in low-volume sealed roads being provided at much lower levels of traffic.<sup>45</sup> Whilst all well-maintained roads significantly reduce vehicle operating costs for all types of vehicles, roads with a sealed surface provide levels of roughness that provide a favourable operating environment that encourage the provision of the low-cost and low-carbon forms of transport that are essential for providing access in rural communities. Therefore, this change of approach to life-cycle costs and benefits is playing an important part in road authorities increasing the provision and financing of transport infrastructure and services in rural areas.

In the framework of the earlier mentioned AfCAP research, sector guidelines have been developed to benchmark performance criteria associated with: sectoral efficiency; institutional effectiveness; life cycle processes; asset management support systems; data; asset management plans; and maintenance benefit outcomes and; network condition.<sup>46</sup>

The provision for transport services is very much left up to the informal market. The absence of efficiently functioning markets may hamper their improvement. To address these issues, additional research and increased collection of basic information is recommended; new approaches to regulating rural transport services; incorporation of rural transport services in government and donor rural infrastructure programmes; appropriate subsidy schemes for rural transport services; and innovative use of modern Information and Communications Technology (ICT) are required to support improved rural transport services<sup>47</sup>.

## **7 Key Message 5: Better Rural Transport Calls for Local Solutions for Local Problems**

Rural access challenges require local resource-based solutions that are compatible with the local road sectors and conditions. Local policies, strategies and action plans need to be developed to ensure that access and affordable transport services are available to all rural community members, including women, children, elderly, disabled and any other disadvantaged groups. Local solutions must be developed to optimize and mobilize the use of local knowledge, innovation, human resources, enterprises, community structures, materials and other physical resources for rural transport development.

Over the last few decades the UK Department for International Development (DFID) and others have committed significant resources into researching optimum solutions for local transport. A number of key lessons have been learnt that are now being taken up and absorbed in good practice for sustainable rural transport. Foremost amongst these lessons are:

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<sup>45</sup> Cook, J.R., Petts, R.C., & Rolt, J. (2013). Low Volume Rural Road Surfacing and Pavements - A Guide to Good Practice.

<sup>46</sup> Burrow, M.P.N., Geddes, R.N., Pinard, M.I., Gongera, K., Bopoto, C, Ghataora, G.S., Gillett, S., & Petts, R. (2016). Specification for Rural Road Asset Management Performance. Mombasa: iTRARR.

<sup>47</sup> Hine J. Huizenga C. Willilo S., 2015, Financing Rural Transport Services in Developing Countries: Challenges and Opportunities, Discussion Paper, SLoCaT.

- The recognition that rural access is most effective when it takes into account a range of impact factors known collectively as the ‘Local Road Environment’ (Figure 6.1)
- Rural roads and the transport that runs on them must be ‘Fit for Purpose’ as defined by the needs of all rural community members
- Future climate variability poses significant threats to recent gains made in developing all-season rural access networks. These threats and consequent impacts are a function of local vulnerabilities and the frequently local nature of the climatic events.

Experience and research from recent decades has allowed the requirements for affordable, sustainable and environmentally compatible rural road design and provision to be identified as summarised in Figure 2.

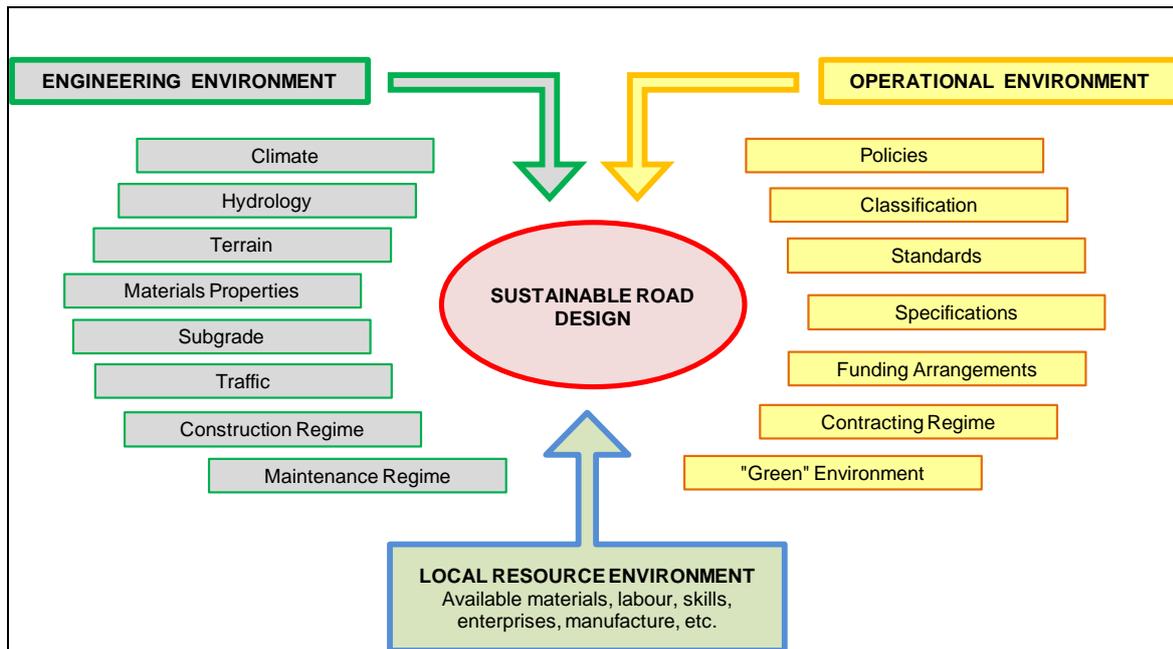


Figure 2. Local Road Environment Impact Factors<sup>48</sup>

These requirements pose significant challenges that have led to a basic principle arising out of recent DFID-funded research that effective rural access must be local resource based and compatible with the relevant country road sector; the engineers and technicians who will design the roads, the contractors and labourers who will construct them, the villagers who maintain them; the construction materials that are available and be compatible with inclusive local transport service requirements.

The following notes exemplify and summarise some of the key issues relevant to local solutions:

**Construction Materials:** For rural access the use of local materials is always a priority, and the issue must be; ‘what design options are compatible with the available materials?’ rather than seeking to find material to meet (often internationally derived) standard specifications, as is the case with higher level roads. Designs may need to be modified to suit locally available material resources.

<sup>48</sup> Cook J R, Petts R C, Rolt J. 2013. Low Volume Rural Road Surfacing and Pavements A Guide to Good Practice. Research Guide, for UKAID-DFID funded Africa Community Access Programme (AFCAP). See: [http://research4cap.org/\\_layouts/15/start.aspx#/SitePages/Rural%20access%20library.asp](http://research4cap.org/_layouts/15/start.aspx#/SitePages/Rural%20access%20library.asp)

Local Traffic: Although recent research indicates that the relative influence of traffic on Low Volume Rural Roads (LVRRs) is often less than that from other road environment parameters, the risk of axle overloading and damage on light road pavements needs to be countered at a local level.

Local Construction Regime: Key elements at rural access level are issues such as the experience and skill of the contractors or construction groups, quality control and supervision. The involvement of the community (including women's groups) should be encouraged; it gives them the opportunity to acquire the skills for future infrastructure development and maintenance. It follows however that design options must be compatible with the local contracting experience or be linked to significant local capacity building initiatives.

Policies: Local transport policies must provide the framework for effective decision making processes related to local roads and the transport that uses them.

Standards (Geometry and Safety): Options may be required to accommodate a wide range of users from pedestrians through to trucks. The local traffic mix must be taken into account in the basic road geometry including the use of wide shoulders for pedestrian or bicycle use, and around schools and community centres. Conflicts between motorised vehicles and pedestrians or bicycles are a major safety problem in mixed traffic LVRR. For LVRRs there are sound arguments on safety grounds for keeping traffic slow in mixed traffic environments rather than aiming for higher design speeds as is the case for larger roads.

Technical Specifications: These define and provide guidance on the design and construction criteria for rural access to meet the required level of service. Specifications appropriate to the local engineering environment are an essential element of an effective enabling environment. It should be recognised that the technical specifications for community access may be used mainly by local small contractors or community groups, most of whom will have limited experience in road building procedures other than those associated with unsealed gravel wearing course construction.

Transport Services: Locally focused Transport services that are affordable, accessible, reliable, inclusive and safe should be adapted to local circumstances and with the appropriate incentive structures for safe and reliable service provision.

Climate resilience: Lastly, local approaches are key to recognise and counter climate threats with enhanced deployment of the available resources through a better balance of design, construction and maintenance issues and factors. Effective, localised, asset management systems will allow the available limited resources to be targeted, in support of better resilience of rural transport systems.

## **8 Conclusion**

Rural transport plays an indispensable role in achieving more than half of the SDGs and fulfilling the promise of the 2030 Agenda for Sustainable Development to 'leave no one behind'. Improvement in rural transport infrastructure and services will facilitate access to markets, employment and enterprise opportunities, education and health facilities, and other social services, which are key elements for rural development and economic growth on individual and national level.

## 8.1 Vientiane Declaration on Sustainable Rural Transport

The role of rural transport in achieving the SDGs is reflected in the *Vientiane Declaration on Sustainable Rural Transport towards Achieving the 2030 Agenda for Sustainable Development*<sup>49</sup>, which was recently adopted by representatives of 23 member countries and 14 observer countries of the Regional Environmentally Sustainable Transport (EST) Forum in Asia, convened by the United Nations Centre for Regional Development (UNCRD).<sup>50</sup> The Declaration demonstrates the collective commitment of government authorities, development agencies, civil society and other relevant stakeholders in the EST region to promote inclusive, affordable, accessible and sustainable rural transport infrastructure and services, in order to facilitate improved access to basic utilities and services of the rural poor and vulnerable groups.<sup>49</sup>

The Declaration recognizes that essential steps to achieve the SDGs in the rural sector include ‘developing and maintaining rural transport infrastructure (e.g. footpaths, tracks, trails, farm and feeder roads, railroads, waterways, bridges and drainage systems); expanding rural transport service networks to promote education and health in isolated areas; and improving rural transport access to provide enabling environments for trade and commerce’.<sup>49</sup> The Declaration also acknowledges that improved rural transport infrastructure and services are a key enabler to increased rural resiliency, rural empowerment and rural socio-economic transformation through poverty eradication, hunger elimination, social integration, increased food security and improved supply chain logistics. In addition, climate adaptive and disaster resilient transport investments in rural areas can help secure all-season access to markets and essential services and prevent isolation of fragile or remote communities, thus contributing to economic development and well-being.

## 8.2 Role of Rural Transport Research in Achieving the SDGs

Through the Declaration, EST member countries committed to give ‘due priority to rural transport projects and initiate the development of national strategies and policy frameworks’.<sup>49</sup> It is the process of embedment of research evidence in these strategies and frameworks that is key to having research contribute to the achievement of the SDGs.

The Vientiane Declaration also speaks directly to the link between research and improved rural access by stipulating to ‘utilize the outputs of research for innovative methodologies to provide more sustainable and appropriately-engineered rural connectivity’.<sup>49</sup>

The key role of research in support of the SDGs and associated declarations is the provider of high quality relevant data to drive and inform the rural transport policies and provide the evidence on which to base the innovations that are essential to deliver the technical solutions to overcome the clear challenges.

A number of areas relevant to the above SDGs have been identified for further research and embedment in the national strategies and in planning at devolved levels:

1. **Sustainable asset management:** as recognized in the Vientiane Declaration, rural access comprises both the construction and upgrading of new rural links to connect rural communities to key transport axes, as well as sustainable maintenance of existing infrastructure.<sup>49</sup> As alluded to in chapter V, effective and timely road asset management is of

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<sup>49</sup> United Nations Centre for Regional Development. (2017). *Vientiane Declaration on Sustainable Rural Transport towards Achieving the 2030 Agenda for Sustainable Development*. Adopted at the 10th Regional Environmentally Sustainable Transport Forum in Asia, 14-16 March 2017, Vientiane, Lao PDR.

<sup>50</sup> United Nations Centre for Regional Development. (2017). <http://bit.ly/2r7qGk5>.

key importance to retain the value of the rural road networks and keep them fit for their intended purpose under wide ranging conditions. Effective asset management requires the efficient use of available funding, feeding into appropriate planning and prioritization of interventions.

2. **Ways to enhance the climate and disaster resilience of rural transport networks:** Research on possible climate adaptation measures in Africa has led to the development of strategies and recommendations for effective adaptation of rural road networks that are currently being piloted in three African countries.<sup>51</sup> This research could be expanded to other developing regions to cater for local and regional conditions and provide policy makers and planners with the most effective and efficient investment options.
3. **Measuring rural access accurately and effectively:** According to the Rural Access Working Group of the SUM4ALL initiative, rural access is defined by the distance to good quality roads.<sup>52</sup> The RAI features as SDG indicator 9.1.1 to measure progress on rural access. Work is ongoing to re-examine the RAI methodology and further develop it with funding of DFID through ReCAP. The aim with the updated methodology and increased coverage is to raise the RAI from Tier III to Tier I or II indicator.
4. **Stronger links between the roads we build and the transport that uses them.** While there is strong evidence of the effectiveness of rural access in development terms (see chapter 2), there is far less information on whether this rural access could be delivered in a better manner. In other words little has been done to back-analyse how effective road projects have been in delivering sustainable 'fit for purpose' access at the most effective whole-life costs and usefulness. Very little attempt has been made to review design assumptions on the key impact factors so that future projects can adapt to lessons learnt.

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<sup>51</sup> Research for Community Access Partnership (ReCAP), Climate Adaptation: Risk Management and Resilience Optimisation for Vulnerable Road Access in Africa. Available on: <http://www.research4cap.org/SitePages/Climate%20Adaptation.aspx>

<sup>52</sup> SUM4All Rural Access Working Group. (2017). Universal Access (working document, not yet publicly available).