

# **Uptake and Embedment as Key Elements of a Sustainable Rural Transport Research Programme**

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## **1 Introduction**

### **1.1 Background**

Rural transport facilitates the cost-effective transport of people and goods and is an essential component in providing safe, reliable, affordable and sustainable mobility for rural populations. Although applied research can and should play an increasingly significant role in improving the effectiveness and sustainability of this infrastructure, there remain barriers to be overcome in ensuring speedier application of the research outcomes. These barriers can, at least partially, be the result of a lack of focus within research programmes on the delivery of uptake and embedment as the end-product of research. Undertaking high quality applied research in any field should no longer be considered adequate without ensuring the outcomes are taken up, used effectively, and embedded in accepted good practice, or as national policy. This is particularly relevant within the rural transport sector where constrained budgets and a vulnerable sector environment demand that money spent on research is used to the maximum effect. (Greening et al, 2008)

The Research for Community Access Partnership (ReCAP) is a UKAID-DFID funded initiative comprising AsCAP (Asian Community Access Partnership and AfCAP (African Community Access Partnership) and the previous South East Asian Community Access Programme (SEACAP). Its aim is to improve accessibility of the rural poor in Africa and Asia to economic opportunities through applied research and by strengthening the evidence base on more cost effective and reliable low volume roads and transport services (Cardno UK Ltd, 2015).

As the programme enters into the final phase the focus is moving to what happens subsequently in the post-ReCAP period and on measures that can be undertaken to ensure the best outcomes are embedded into local practice, the stated objectives in the ReCAP programme framework are realised and that people in the partner country accrue the benefits. ReCAP has taken on board lessons learnt from previous research programmes and has structured its applied research on rural transport projects within a framework that includes dissemination, uptake and embedment as integral programme elements alongside capacity development.

### **1.2 This Paper**

This paper develops the concept of research as a deliverer of knowledge, evidence and innovation that must have a clear sustainability target as regards uptake and embedment within relevant policies, practices and procedures. This paper outlines the key issues of research up-take and embedment based on experience from previous community access programmes and describes the key issues have been incorporated within the current overall research strategy.

## 2 Rural Transport Research

### 2.1 Context

Over the last few decades, the UK's Department for International Development (DFID) and others have committed significant resources into researching relevant themes and optimum solutions to increase rural access in developing countries. This may be seen within the context of a long history of transport research and its effective application. Organised and committed road research in Europe probably began in France at l'Ecole Nationale des Ponts et Chaussées around 1747, whilst the first technical road journal –Annales des Ponts et Chaussées – began in 1830, and the formal road research body, the Laboratoire des Ponts et Chaussées was established in 1831. Possibly the first piece of major road research was that conducted by Thomas Telford, in the 1830s. Telford, faced with the task of designing new roads to meet the increased freight traffic of the Industrial Revolution, undertook what we would now term pavement trials researching the performance of teams of horses and oxen hauling loads over roads of different slopes and with different surfaces conditions, leading to benefit/cost analyses of various road proposals (Lay 2006). The challenges in designing appropriate transport research and following it through to uptake and embedment are not new.

The ability of LVRR practitioners to identify problems and to devise solutions that provide sustainable cost-effective access for the rural poor is a key factor in the overarching aims of poverty reduction and socio-economic development. The current role of research in improving rural transport was recognised in the recent Vientiane Declaration on Sustainable Rural Transport towards Achieving the 2030 Agenda for Sustainable Development (2017). The Declaration speaks to the link between research and improved rural access by a requirement to “utilize the outputs of research for innovative methodologies to provide more sustainable and appropriately-engineered rural connectivity.” The declaration was adopted by representatives of 23 member and 14 observer countries of the 10th Regional Environmentally Sustainable Transport (EST) Forum in Asia (Cook et al, 2017).

During the past 20 years or so, DfID, the World Bank and other donors have supported research and knowledge transfer on various aspects of rural infrastructure specifically with the aim of reducing costs and increasing the effectiveness of the provision of such roads for rural and peri-urban communities. Much of this targeted research has been particularly successful, resulting in innovative and unconventional approaches that can provide highly beneficial and cost-effective solutions for low volume roads in these counties through, for example, the use of alternative sustainable road surfacings. However, resistance to the implementation of new techniques remains a major challenge to the transfer and application of new knowledge in the transport sector. This is partly due to the inherently conservative nature of the civil engineering profession and the normally lengthy path from research to full implementation, which typically requires a much longer length of time than the timescale of most donor-funded research initiatives.

The problem of take-up and embedment of research outcomes has always been a challenge for the transport sector and similar concerns are also often expressed in other sectors. Comparisons often made with the health sector, where there is always understandable pressure to bring new medicines and practices developed through research into general use as soon as possible (Koon, 2012). Kroon noted that in the health sector the divide between rural transport research and policy can be substantial in many low and middle-income countries (LMIC). Both supply and demand factors may be responsible for this. On the supply side, the limited local pool of human and financial resources has constrained the production of quality research, but equally, clear pathways for research to

influence policy are severely limited. One reason for this is the bureaucratization of policy making, in which, researchers and research institutions currently have only a minor role and a policy making culture that gives little importance to evidence-based research. These comments are equally applicable to the rural transport sector.

## 2.2 Aims and Outputs

Applied research within the rural transport sector covers a very wide range of topics, including both engineering and non-engineering issues, but all centred around the newly emerged concept of Sustainable Mobility for All (Sum4All, 2017). In its strategic way forward ReCAP has rationalised the range of issues into three action groups;

- Provision of access
- Preservation of access
- Effective use of access

ReCAP views these groups as part of a seamless spectrum that should drive and strategically guide rural transport research and provide a clear focus for its uptake and embedment within not only country-specific action plans but also the much broader, high-level, targets, Table 1. Key to this approach is the need for a broadly based cross-sectorial, inter-ministerial and holistic approach to rural transport research.

**Table 1 Key Action Groups and Typical Project Types**

<b>Groups</b>	<b>Typical Issues</b>
Provision of access	Network planning Road designs Materials use Local requirements
Preservation of access	Asset management (maintenance) Climate impact Axle loading Funding models
Effective use of access	People transport including gender issues Freight transport Transportation funding models Road safety

## 2.3 Challenges to Uptake and Embedment

Historically, Lower Income Countries (LICs) have generally been reluctant to embark on research in most sectors, including transport. However, most LICs now have thriving universities and produce many graduates in engineering and social sciences. Given the evidence of a link between research and economic development, it is surprising that some LICs have failed to recognise the need to invest in research. Perhaps of greater concern is that in some countries where a research capability has been previously developed in the transport sector, this has decreased in effectiveness leading to a decline in the contribution of research to local development.

Many of the embryonic Research Centres being established under ReCAP are staffed by young engineers with limited research or project experience. Consequently, they may not have had actual experience in dealing with all the various components required to ensure the effective and efficient

delivery of projects and may not have had basic training in research methods nor experience of working within the constraints of a public-sector environment.

Historical experience from previous rural transport research projects has indicated the significant challenges in moving research forward into embedment; in summary these are:

1. Research projects may often be measured in months or a couple of years, whilst moving research into policy can, and frequently does, take several years.
2. The requirements for decision makers to be fully informed on research outputs in clear terms and for them to have confidence in this research.
3. Decision makers need to be made much more aware of the social, economic and financial benefits of applying research outputs.
4. Effective links between researchers and policy and decision makers are difficult to establish and nurture.
5. Research targets and outputs have not always been designed around specific rural transport need as defined by key stakeholders
6. Personnel in many LIC in overseas government departments often have relatively little control over where they are placed and are often transferred between departments at relatively short notice. When this happens, technical expertise, authority within the department, commitment to the project and policy towards research can change and considerable effort expended in developing relationships can be lost.
7. Responsibilities for roads and transport can fall within different ministries. For example, research on road infrastructure might fall within the responsibility of a Ministry of Works and research into transport services might fall under a Ministry of Transport or a Ministry of Rural Development. This means that local champions are needed in more than one Ministry.
8. There are few incentives for government stakeholders to effect change, especially if these are perceived to carry some risk. For example, unlike in the private sector, there is often little or no financial reward or increased career prospects from adopting innovation.
9. Researchers always appreciate that there is a degree of risk in research but it is unrealistic to expect contractors or consultants to adopt research outcomes on the basis of perceived risk without the protection of formal standards or specifications.

## **3 Overcoming Challenges: Theory of Change**

### **3.1 Key Concepts**

Traditionally, researchers have looked at moving their outputs forward in linear fashion through a series of linked stages, Figure 2. Although understandable, this is in reality an over-simplification of a complex and often iterative process.

**Figure 1 The Research to Embedment Chain**

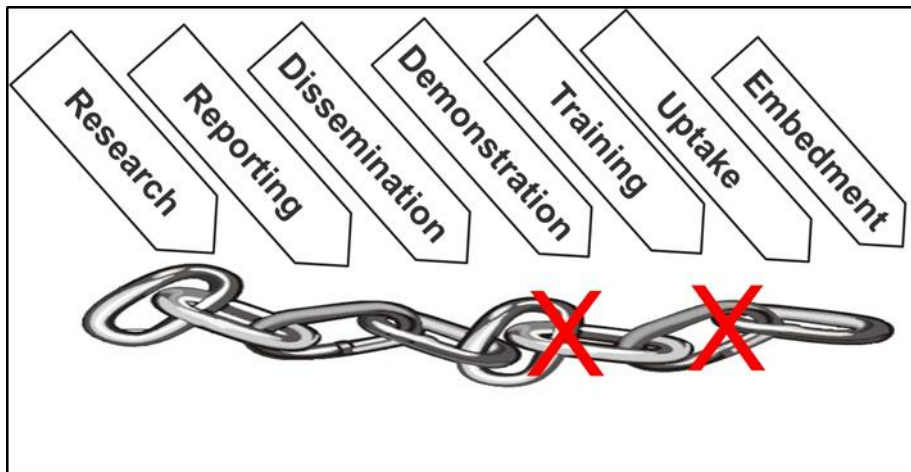


Figure 2 illustrates a realistic concept of there being several dimensions, or layers, of influence that need to be penetrated, or drilled down into, to link into policy and decision making. Most transport research is initiated, reported and disseminated at the two outer layers. It is rare, for example, for dissemination workshops to include key 3<sup>rd</sup> layer players and even rarer to include 4<sup>th</sup> layer policy and decision makers.

**Figure 2 Layers of Research Embedment (after Wolfe 2013)**

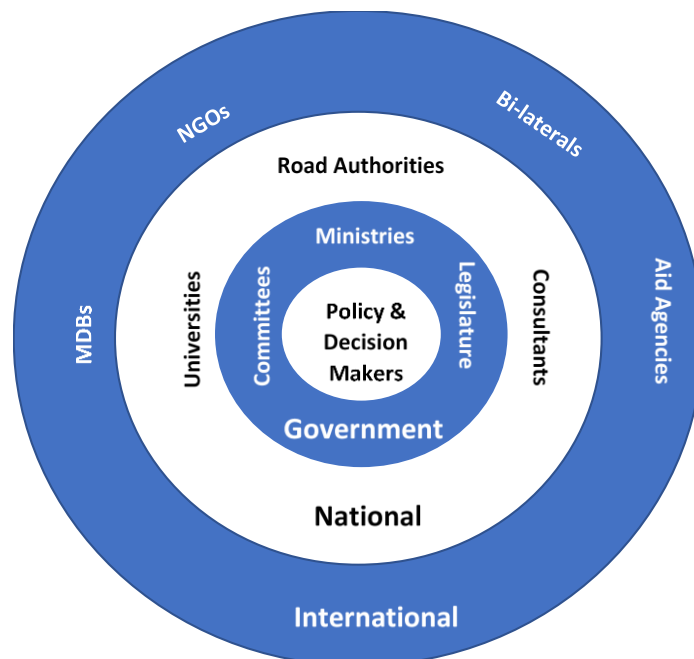


Table 2 examines the various stages along the pathway to embedment and the targeting of policy and decision makers and Table 2 outlines a possible scale of progress taking into account the Figure 2 concept.

**Table 2 Key Issues on the Pathways to Embedment**

Link	Activity	Challenges	Comment
Research	Within a framework of Terms of Reference and Quality Management. Compilation of the research findings, analysis and conclusions.	Focus required on quality management	Usually few issues if effectively managed by experienced researchers
Dissemination	The knowledge transfer or distribution of the research outcomes to identified stakeholders. Traditionally undertaken through workshops and distribution of hard copy reports, manuals etc	Dissemination to key actors from policy makers to local stakeholders.	Usually well undertaken with known stakeholders but frequently limitations on reaching outside the immediate sector contacts. Needs focus on electronic media distribution. Links with MDBs.
Demonstration	The validation of the research outcomes through trials and monitoring. Commonly incorporated in projects	Significant question marks as to the ongoing monitoring of assumptions and outcomes.	Very effective, eg pavement trials, but only if there is a follow-up in terms of commitment to monitoring and analysis
Training (Capacity Building)	Instruction or guidance to key stakeholders or operatives concerned with wider application of the research. In the past this activity has either been essentially an end-of-project action or short separate activity	Requires more in-project focus.	Historical tendency for this to be a late-project add-on rather than a central project activity.
Uptake	The use or application of the research evidence at a major project level by practitioners and/or policy makers.	Generally not well addressed as an integral part of research projects.	Situation improving with increased development of links with MDB projects. Still a shortfall in terms of linking with core decision makers
Embedment	The formal inclusion of the research outcomes in Government policy, or mandatory standards, specifications and manuals.	Largely ignored as a project activity. Significant timescale problems.	Still a shortfall in terms of linking with core decision makers

Theory of change (TOC) is an approach that is increasingly being used by research projects to design, plan for and evaluate the impact of their research. (Wolfe, 2016). It maps out the expected pathways or links between a project's activities and its intended impact, whilst taking into account different contextual factors that might influence change. The Theory of Change (TOC) may be considered as a process of mapping backwards and considering what outcomes, then outputs, then activities, are needed to reach the goal and what needs to be in place for each of these to happen. Thinking through how research evidence might be communicated, taken up and applied by stakeholders in different country contexts from the outset can strengthen the design of the whole research process and maximise its prospects for impact.

Proximity to a decision-making core (Figure 2) can hold key advantages to institutions such as Transport Research Units (TRUs,) which allow them to better embed their outputs.

### 3.2 General Lessons to be Learnt

A key aspect of research is that it should be relevant to decision-makers' needs. For research to cater to this relevancy, it is important to create opportunities for the development of personal relationships between researchers, research institutions and decision makers to improve information flow. Personal engagement with research users is key. It is through collaborating and building relations with stakeholders that we can ensure that research is relevant, researchers have a reputation for credible research and have strong and trusting relationships with policymakers.

There is a case for not only monitoring project execution by progress reports but also by regularly adjusting targets and indicators to reflect events which will both increase and decrease impact on outputs and embedment. In many projects in the sector the outputs depend on active collaboration by a government organisation in the partner country. This can include a financial contribution. However, there are instances in many programmes, where commitments given at the outset of projects have not always been fulfilled by partners for various reasons. When this occurs, it can have a significant impact on projects.

The use of Workshops and Guidelines are essential components of raising awareness and of gaining support, especially in the context of research projects in countries with no existing research facility in the sector. However, past experience has shown that workshops do not necessarily result in uptake. Pledges relating to up-take and embedment made at workshops do not always result in subsequent action, especially if these involve significant changes that are outside the scope of workshop delegates and this particularly applies to actions that requires change in government policy.

Workshops are effective at raising awareness by government practitioners, contractors and consultants of new techniques, methodologies and materials but experience has shown that contractors of road infrastructure, in particular, require additional on-site training (e.g. construction of trial/demonstration sections) if they are to confidently and effectively embrace new initiatives

Changes often require intervention at a high political level which is often beyond the direct influence of both local practitioners, programme managers and research contractors. There is possibly a case for greater involvement at a diplomatic/donor level to improve the prospects for up-take and embedment as well for accelerating the process

Local problems need local solutions and knowledge transfer in the field of rural transport must not only respond to a clearly defined need, it must also be compatible with local transport environments. Project-level connections made through personal contacts between decision makers and local and international bodies (MDBs, NGOs), facilitate the embeddedness of research outputs. Furthermore, possessing multiple memberships facilitates the embeddedness of research institutions. Koon (2017) notes that key stakeholders can play the role of both researcher and decision maker in the health arena.

The importance of collaborative planning at the research design stage greatly increases the potential for embeddedness of the research outcomes. The quality of linkages is also facilitated by linking key policy-making and research institutions through strategic networks. The involvement of research institutions in policy making also increased when research institutions played multiple roles

The reputation of the research institution is a factor in determining its ability to embed in the decision-making environment. The reputation of the research institution gives its work credibility as does having reputable researchers on committees. For these reasons, decision makers are inclined to associate their work with reputed research institutions and individuals, conferring greater embeddedness on the latter.

Legislation, is seen to be a necessary factor for embeddedness and in many LIC countries it has played an important role in the enforced use of new standards and specifications based on sound research (Intech Associates, 2016).

Whilst Guidelines and workshops are part of the process towards embedment, they have little impact on practice and policy unless the recommendations are written into enforcement documents such as national policies, standards and specifications

A local champion in the partner country, who can facilitate research projects and influence outcomes is normally identified and becomes the main contact. In countries with a Research Centre, this person is normally the person heading the Centre. In others, it is usually a senior person within the relevant department (usually government) and is responsible for the day to day supervision and execution of the research. In terms of embedment, this person, depending on the position held, can also be expected to either adopt the outcomes directly or to lobby senior government personal to do so.

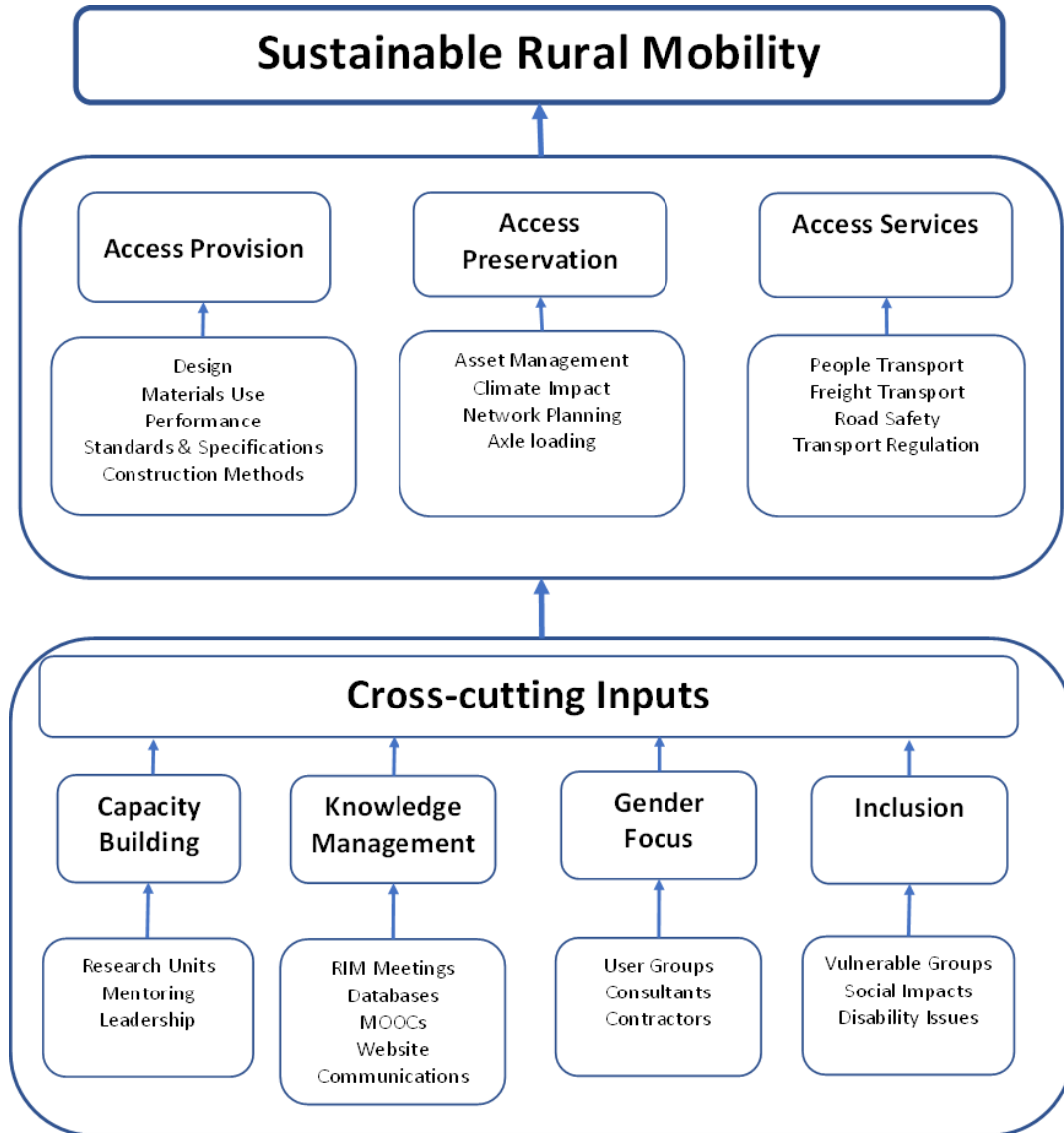
## **4 The ReCAP Programme**

### **4.1 Research Strategy**

ReCAP includes within it a wide range of project types from desk studies, through to practical demonstrations of applied research in a broad field of rural transport issues. A strategy has been developed to best deal with this envelope of activities that has a clear focus on up-take and embedment as identified end targets as well as including knowledge transfer and capacity development in an integrated, holistic, approach to research. This approach, as noted in Section 3.1, also encompasses the idea of rural transport as an access continuum under an overall concept of rural mobility, Figure 3. This focus is in line with the overall UKAID-DFID targets of making the research outputs and research capacity sustainable beyond current programmes.



Figure 3 The ReCAP Way Forward Strategy



ReCAP appreciates that projects proposed for action need to be assessed in terms of likelihood of success not only in terms of successful research outcome but also in terms of application and embedment. Table 3 summarises key issues to be assessed. It may be useful to score each factor on say a 1-5 basis, as an aid to identifying the uptake and embedment risks. From the point of view of identifying a positive way forward, an early identification of these risk factors can allow modification of the project aims and objectives to reduce embedment risk.

**Table 3 Uptake and Embedment Risk Assessment**

<b>Component</b>	<b>Requirement</b>
1. Politically supported	The research programme and its continuing development should be compatible with an identified national policy or a need for a policy, driven by established government and is supported in all its aspects at the local levels as well as the highest level.
2. Meets Key Needs.	The research outcomes meet a need that has been identified by key stakeholders. There is an appreciation of issues such as: community acceptance and participation, gender equality, and protection of vulnerable groups.
3. Financially sound	Adequate funding in place for actually taking forward the research outcomes beyond project funding with a funding mechanism identified for long-term continuance and application of outcomes.
4.High Quality Research	The project will be undertaken and disseminated by highly competent researchers with an established reputation in the required fields. The research team has a clear quality control plan in place and that this will be overseen by appropriate quality assurance procedures.
5.Institutionally possible	The research programme has a potential institutional home with the necessary resources, knowledge and experience to carry forward the outcomes. This home must have a clear leadership and career progression framework with sufficient skilled managers and researchers.
6. Economically viable	The benefits accruing from a continuing research programme and its application in terms of social and economic developments must be greater than its initial and on-going costs.

## 4.2 Tools to Meet the Challenge

Based on the lessons learnt from preceding programmes and an appreciation of the need to be both flexible and innovative in approach, ReCAP have incorporated a range of procedures and processes within the overall strategy aimed specifically at enhancing research and research output sustainability and also based around the key requirements outlined in Table 3. These are outlined below:

1. Proposals for research projects are identified by individual partner countries or by groups of countries through national or regional Steering Committees.
2. Approval of research programmes by relevant regional steering committees is required.
3. Mandatory bi-annual regional steering committee meetings.
4. Focus on establishment of partner-country research units to take ownership of research.
5. Procurement of research service providers that has a heavy emphasis on appropriate experience.
6. Inclusion of a major Leadership Development initiative as a flagship project
7. A professional mentorship programme in research processes as well as technical and social issues(currently under development). Training/mentoring provided by ReCAP will particularly help young professional to understand the mechanisms involved in undertaking research, facilitate embedment of research outcomes and contribute to the sustainability of Research Centres.
8. Establishment of effective project working groups or steering committees with an aim of facilitating contact between the research and the core decision makers (Figure 2).
9. Mandatory application of an internal double-review processes for project Concept Notes, Terms of Reference and research outputs.

10. Use of an independent Technical Panel of highly experienced international experts not only to give an overview of project design and on output technical excellence but also to facilitate external contacts.
11. Requirement to include cost-benefit assessment within all relevant research projects; as well as commissioning specific projects on Cost Benefit Analysis research outcomes (Petts et al 2017).
12. The need for research outcomes to be incorporated in standards and manuals as an important part of the embedment process.
13. Importance given to the use of demonstration trials and their analysis as key evidence to inform key decision makers.
14. Recognition that project progress and financial plans need to be realistically aligned with the budget constraints of partner countries.
15. An Executive Committee that is tasked with the overall strategic direction of ReCAP.

### 4.3 Pathways to Embedment

The pathways to embedment for research projects will be specific to their particular research environment, however the following examples are reasonably typical of these different pathways in general.

1. LVRR principles included at high level international discussion through association with a new UN-World Bank based Sustainability Mobility for All (SuM4All) initiative.
2. Ethiopia LVRR research uptake into local roads programme through development of a bespoke Ethiopian Road Authority (ERA) Road Research Unit (Sampson et al, 2014): see Table 4.
3. Vietnam LVRR research uptake into projects followed by embedment into new standards and specifications through cooperation between World Bank, DFID and Ministry of Transport decision makers (Cook et al 2016); see Table 5.

The high level SuM4All example is different from project level engineering-based and transport service issues; rather than looking forward to embedment in this case core policy makers are looking back down the pathway for support in terms of evidence. SuM4All has been identified by ReCAP as a focus for its transport research embedment and is exploring how to work most effectively with SuM4ALL to support the necessary supply of scientific data and evidence that SuM4All requires for its monitoring function through a global tracking framework on mobility. ReCAP research knowledge will be used to inform high level policy and essentially link broad long term global strategic aims with the practicalities of movement along diverse pathways that need to balance a number of sometimes differing aims; for example the potential conflicts between increased access and road safety, environment protection and increased fossil fuel use.

Key informing topics within the Rural Access sector are, for example:

- Development and use of appropriate indices (eg the Rural Access Index -RAI)
- Local linkages for decision-makers to garner evidence
- Road maps of development based on ReCAP research development model
- Holistic approaches to rural access issues
- The importance of standards and specifications

**Table 4 The Ethiopian Example**

Challenges	Response
<b>Research.</b> Need for confidence in quality of research. High quality research facilities recently established but recruitment and retention of experienced staff a potential issue.	Local staff working in parallel with international specialists. In longer term. Increased access to options for post-graduate qualifications and preferential salary adjustment.
<b>Dissemination.</b> Requirement to disseminate LVRR research throughout a federal-based system and down to local levels.	Drafting and then updating of LVRR manuals with active participation of a Working Party. Wide distribution of manuals. Ongoing commitment to dissemination workshops involving key actors at all levels.
<b>Demonstration.</b> Need to overcome resistance to change by demonstrating the practicality and effectiveness of research.	Encouragement for commitment to long-term monitoring of trials. Commitment to long-term monitoring of trials essential to calibrate performance with local changes in pavement environment. ARE involved in monitoring of sections built under AFCAP.
<b>Capacity Building.</b> Perceived lack of capacity both in research and in its application.	Training of research personnel and advice to local practitioners in the application of new manuals and practices. Training has been carried out but refresher trainings need to be held. Role for mentoring to be developed.
<b>Uptake.</b> Resistance to uptake LVRR manuals into project use, for example with small contractors is required.	Closer links to be developed with the small-scale private sector to ensure uptake.
<b>Embedment.</b> Embedding of LVRR manuals into ERA policy making them a requirement for all Government LVRR projects.	Political support developed. But closer links with policymakers in transport sector required.

**Table 5 The Vietnam Example**

Challenges	Response
<b>Research.</b> A clear need for specific research on the sealing of LVVRs identified. Challenge on how to design and implement effective research.	Early establishment of a project Steering Group comprising researchers, Ministry of Transport (MoT), DIFID, World Bank and local university staff and local specialists.
<b>Dissemination.</b> Requirement to disseminate LVRR research throughout a centralised and highly structured system from central level down to village level.	Drafting of reports and guidelines in both English and Vietnamese. Regular meetings and workshops at central and provincial level into a feedback loop. Active participation of a Steering Group members.
<b>Demonstration.</b> Need to convince conservative elements both within the World Bank and within Ministry of the cost-effectiveness of the sealed LVRR options.	Key phase of research based around the construction of a series of pavement trials using a range of local materials and sealing options compared with standard control options. Active involvement of MoT research bodies, engineering and non-engineering.
<b>Capacity Building.</b> Perceived lack of capacity both in research and in its application by local consultants and contractors.	Local contractors guided by international specialists using specific “training” trial sections. More formal training of research personnel and advice to local practitioners in the application of new manuals and practices. Use of the trial sections as training sites for researchers
<b>Uptake.</b> Conservative and bureaucratic resistance to change within the prevailing system.	Development and eventual acceptance of detailed specifications for the new options. Support from key members of the Steering Group and contacts into the decision making “core”.
<b>Embedment.</b> Resistance to any change that is not initiated at the highest levels.	Political support developed and progress made on the broad principles of LVRR sealing but resistance still to be overcome on some detail.

## 5 Summary

Research continues to have an important role in support of improving rural road transportation both in terms of the roads themselves and the services that use them. The full benefits of research can only be achieved if the outcomes are fully taken-up and in the longer term fully embedded in good practice guidance and in appropriate rural development policy.

The up-take and embedment of good rural transport research has in the past not been fully addressed by the researchers and only the last decade has the full implications of meeting the challenges been realised. Lessons can be learnt from past experiences, not only from within the transport sector, and these are now gradually being taken on board. Through application of concepts such as the Theory of Change here is now a clearer recognition of the component drivers of change and the models to apply at project level.

The ReCAP initiative, in particular, has made significant strides in applying key lessons within a research strategy that includes capacity building, knowledge transfer and stakeholder involvement in a holistic approach to research and is sustainable up-take and embedment.

## 6 Acknowledgements

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