

CLIMATE CHANGE ADAPTATION IN THE AFRICAN ROADS SECTOR: CONSTRAINTS, OPPORTUNITIES AND POLICY CHALLENGES

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ABSTRACT

Roads play a vital role in strengthening the socio-economic development of regions in sub-Saharan Africa by providing local communities with critical connections between essential market points, service towns and infrastructure. The United Nations Environmental Programme describes the African continent as a 'vulnerability hotspot' for climate change. During the past four decades, African countries have experienced more than 1 500 recorded weather-related disasters. These disasters impact on affected countries' economies and, in particular, on rural communities and their livelihoods. Changes to the region's climate are causing widespread damage to road infrastructure and its associated assets. Rural accessibility is being compromised by climate variability in a number of countries for significant periods of the year, adversely affecting livelihoods and associated socio-economic development, both directly and indirectly. Although climate commitments have been undertaken by many countries in the region, policy has not always been translated into action in all sectors and the transport sector (especially rural roads) has not featured strongly when countries consider climate change actions. To enhance the capacity of roads authorities to reduce the current and future impacts of climate change on rural roads, a project was initiated by the Africa Community Access Partnership (AfCAP), a research programme funded by UK Aid, to focus on climate adaptation in this sector. Through research and knowledge sharing, the objective was to compile pragmatic, cost-beneficial engineering and non-engineering procedures and guidance that could be used to direct roads sector institutions to address climate threats. A methodology for carrying out climate adaptation assessments for rural roads was developed and packaged into a handbook and series of linked guideline documents. The project further looked at addressing capacity enhancement in the AfCAP partner countries to ensure a strong focus on embedment and uptake. The study focused predominantly on three AfCAP countries, namely Mozambique, Ethiopia and Ghana. In order to embed climate change adaptation into the respective national transport authorities, several constraints had to be addressed. Two prominent issues emerged, with the first being the lack of in-country collaboration between sectors when dealing with climate change science, and the second being gaps in policies that address climate change in the transport sector. These constraints have affected the capacity of the national transport authorities in the various countries to incorporate climate change risk and vulnerability into their planning systems. The project therefore provided an opportunity to address these challenges and to enable the practical implementation of climate change adaptation in the roads sector.

1 INTRODUCTION

1.1 The climate change issue

According to the United Nations Framework Convention on Climate Change (UNFCCC), global changes in average temperatures, seasonality and the increasing frequency and magnitude of extreme weather related events, as well as other climate change related impacts have already begun to occur [1]. The faster these climate related changes occur, and the longer adaptation efforts are put-off, the more difficult and expensive it will become to address the associated impacts that more severe climate changes will bring. According to a number of the UN's Inter-governmental Panel on Climate Change assessments reports, the African continent will be the hardest hit by Climate Change [2]. Due to its geographical position, Africa is particularly vulnerable given its considerably limited adaptive capacity, which is exacerbated by widespread poverty [3]. Climate change is therefore a significant threat, not only to the continued economic growth of the continent, but also to the sustainable livelihoods of its vulnerable populations.

Climate change became an internationally recognised issue in 1992 with the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) - the main international agreement on climate action. Since then there have been numerous climate action agreements, all aiming to get support from member countries. The core objectives are to limit global temperature increases and climate change, and to better cope with the inherent impacts [4]. Fifty-four African countries are members of the UNFCCC, and most have also signed the Paris Agreement within the UNFCCC, which deals with greenhouse gas emissions mitigation, adaptation and finance starting in the year 2020 [5] [6]. The Climate and Development Knowledge Network [7] subsequently identified a number of challenges that countries typically face when trying to up-hold their climate change commitments. These include how to:

- Build awareness of the need for, and benefits of, action among stakeholders, including key government ministries;
- Mainstream and integrate climate change into national planning and development processes;
- Strengthen the links between subnational and national government plans on climate change;
- Build capacity to analyse, develop and implement climate policy; and
- Address resource constraints for developing and implementing climate change policy.

1.2 Research objectives and approach

Considering the climate threats posed to Africa's development and to address some of the above-mentioned challenges, the Africa Community Access Partnership (AfCAP), a research programme funded by UK Aid, commissioned a project that started in April 2016 to produce regional guidance on the development of climate-resilient rural access in Africa through research and knowledge sharing within and between participating countries. The objective was to assist in the development of a climate resilient road network that reaches fully into and between rural communities. This paper reflects on the experiences gained from work undertaken in three of the AfCAP partner countries namely, Mozambique, Ethiopia and Ghana and focusses on the policy and information challenges that were faced. It is believed that other African countries face similar challenges, and may benefit from the experiences gained through the work on this project.

The overall aim of the AfCAP Climate Adaptation Project (AfCAP Project) was to deliver sustainable enhancement in the capacity of AfCAP partner countries to reduce current and future climate impacts on vulnerable rural road infrastructure. The approach taken was circular [8] where science-based research undertaken to identify climate hazards, vulnerability and impacts on rural road infrastructure was integrated with decision-centric processes for prioritising adaptation options, implementation through demonstration sections and both policy and practical embedment of pragmatic, cost-beneficial engineering and non-engineering procedures. Core to this approach was the extensive engagement with stakeholders, based on the recognition of the importance of appraising local-specific current and future climate threats, and organisational pathways for the uptake of engineering and non-engineering recommendations.

1.3 Background to climate variability and change within the context of rural accessibility

Over the last century, Africa¹ has experienced dramatic changes in climate, including the steady increase in the frequency and magnitude of extreme weather-related disasters which have, and continue to cause widespread damage to road infrastructure and associated assets. Climate related natural disasters remain a compromising threat to the continents rural accessibility for increasingly long proportions of the year, creating both direct and indirect adverse effects on livelihoods and associated socio-economic development. In the past four decades (1978-2018) African countries have experienced more than 1,500 recorded weather-related disasters (meteorological, hydrological and climatological) [9]. These disasters impact on affected countries' economies and, in particular, on rural communities and their livelihoods. The impacts of these weather-related hazards were also felt across all economic sectors and infrastructure [10]. Many communities and countries are socially and economically vulnerable to extreme climate events as low adaptive capacity and a high exposure to natural hazards have resulted in the death of more than 600 000 people (the vast majority due to droughts), left 8 million people homeless (99% due to flooding and storms) and affected an estimated 500 million people over the past four decades [9].

The African continent is facing a potential direct liability of over \$ 150 billion to repair and maintain existing roads damaged by temperature and precipitation changes directly related to projected climate change. The liability does not include costs associated with impacts to critically-needed new roads, nor does it include indirect socio-economic effects generated from dislocated communities and from loss of rural access [11]. It is estimated that an additional 230 million people will live in rural areas in the 15 AfCAP supported and partner countries by 2050, making rural accessibility a high priority [10].

2 METHODOLOGY

To address climate adaptation and related challenges in the roads sector in the context of this project, it was necessary to follow a methodology consisting of several general steps (Figure 1). Each step would help the team progress towards the embedment of climate adaptation outcomes at a range of levels ranging from informing national policies, through regional and district planning, down to practical guidance on adaptation delivery at rural road level.

The starting point was to consider what had been done previously to incorporate climate change science and information into the road and transport sectors. This was often also

¹ Focus predominantly on Southern Africa

initiated at the national level, where countries committed themselves through signing international climate change conventions. Research into climate related risk and vulnerabilities was undertaken in order to determine the type of adaptation measures required, as well as to determine where and to what extent these measures should be implemented. Considering the nature and extent of risk and vulnerability, adaptation options were developed to address both engineering and non-engineering issues. Several road demonstration sites were selected to enable hands-on capacity enhancement within each of the three participating AfCAP countries, namely Mozambique, Ethiopia and Ghana. Policy issues (although also part of the non-engineering issues) were also specifically addressed in the roads/transport ministries to enable and ensure proper embedment within systems, structures and design guidelines. To address embedment, and to reflect on preceding steps, a series of training sessions were held per participating country. Using the illustrated framework (below), this paper will reflect on each of the main activities/components to identify constraints, opportunities and policy challenges.

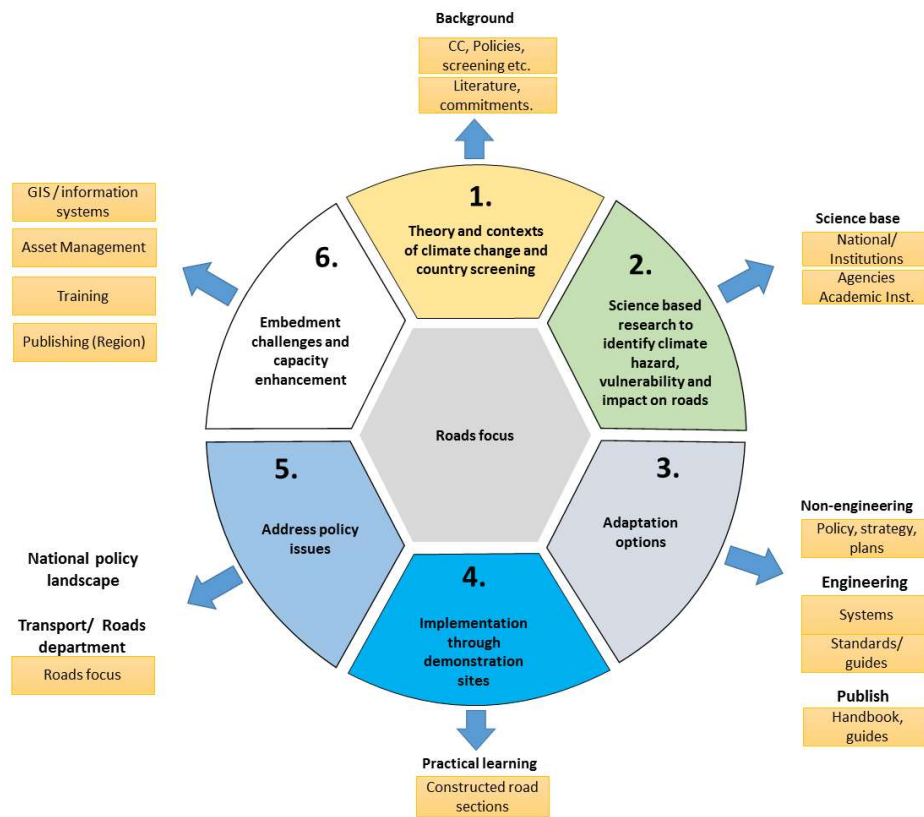


Figure 1 - Simplified stepwise method to address climate change adaptation in the roads sector.

2.1 Theory and contexts of climate change and country screening (step 1)

To get an understanding of climate change and to what extent it had featured within the participating partner countries at the onset of the project, visits and engagements with officials from the various countries' transport ministries, departments and agencies (MDAs) were undertaken. At the same time research was carried out to determine the country level exposure and its subsequent undertakings to address climate change risks nationally. Literature was reviewed to determine how much research had been conducted on climate change across sectors and related to transport infrastructure within the country and the wider region. The need for investigating the extent of climate change research stems from the fact that although it is not a new issue, it is still considered a contentious topic, and

furthermore, it has not filtered down through all sectors of government. To aid uptake that leads to policy level changes, climate change research has to be supported by scientific evidence. Determining the extent and scope of available evidence is an important step towards identifying any gaps.

Since the 1980's when climate change began to feature in international literature, there has been an almost exponential growth in publications related to the topic globally, but the most significant contributions to the 'pool' of published literature items occurred after 2000, as is illustrated in Figure 2 [12]. Comparing Africa's climate change literature output to that of the rest of the world, it is evident that the number of publications stemming from the continent is much lower than that of other regions in the world. Further searching at a country level (for the three AfCAP countries) made it apparent that climate change and its associated implications had not been considered widely (or equally) in all sectors.

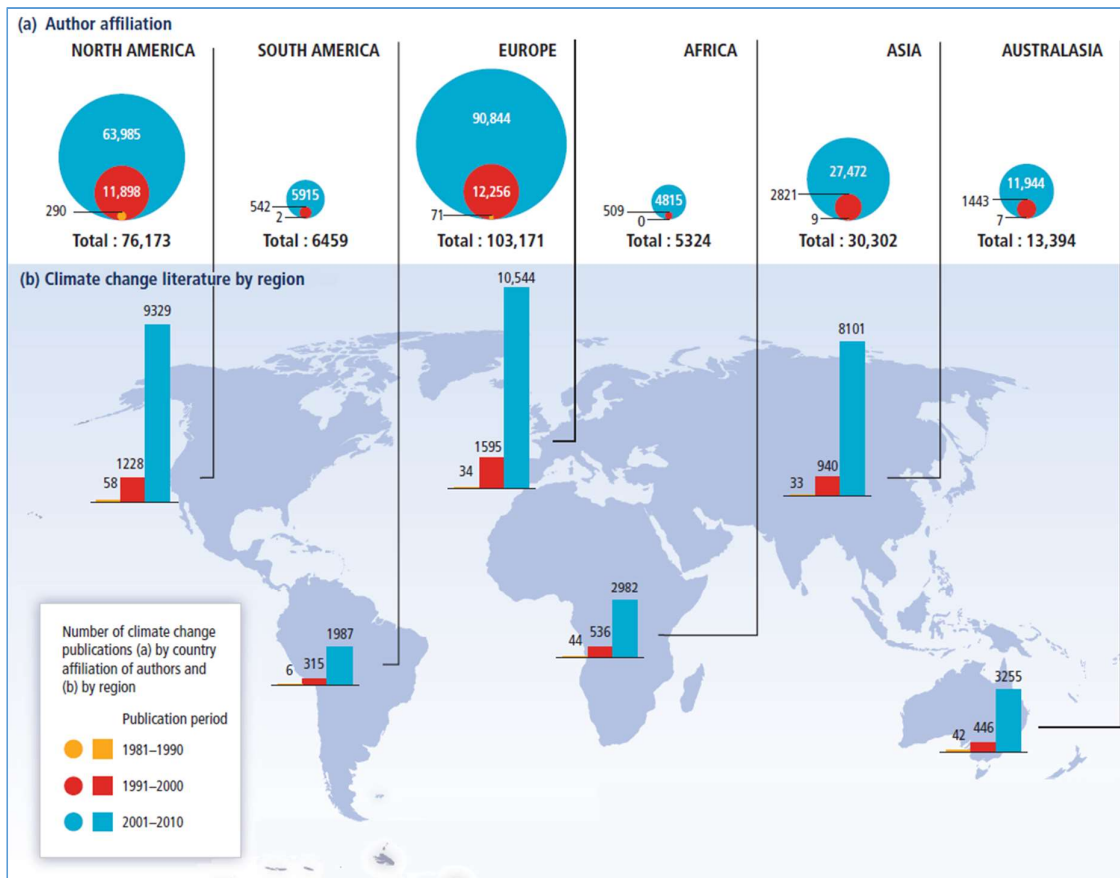


Figure 2 - (a) Number of Number of publications in English (as of July, 2011) summed by country affiliation of all authors of climate change publications and binned into IPCC regions. Each publication can be counted multiple times (i.e., the number of different countries in the author affiliation list). (b) Number of climate change publications in English with individual countries mentioned in title, abstract, or key words (as of July, 2011) binned into IPCC regions for the decades 1981-1990, 1991-2000, and 2001-2010. A publication may be counted multiple times if more than one country is listed. [12]

The general scarcity of good data with which to inform planning in Africa accentuates the difficulties of policy development [13] [14]. While the three participating AfCAP countries are all signatories to the United Nations Framework Convention on climate change and all had made commitments under their respective Nationally Determined Contributions, the

majority of climate science work had been undertaken in the environmental- and agricultural sciences, and very little research was undertaken in the transport sector in general, or the roads sector in particular. This situation confirmed the need for a project such as the AfCAP climate adaptation initiative. When reflecting on the roads sector, it appears that broad spectrum climate and disaster risk screening has not been incorporated in transport (roads) departments (considering Mozambique, Ethiopia and Ghana). High level disaster and climate risk screening tools have been developed by the World Bank to support project planning and inputs to project submissions [15]. These tools, however, do not provide a suite of data items at a sub-national scale or allow for road linked climate information. Additionally, climate change indicators are either not present within national road asset management systems² or are limited in their consideration [16] [17] [18]. These constraints also guided the work focus of the project, which served as an opportunity to address these gaps, the core objective being to embed climate change considerations into the planning and operational activities of (rural) roads departments.

2.2 Science-based research to identify climate hazard, vulnerability and impact on roads (step 2)

Reviewing the information base on climate change and its particular relevance to roads across the three countries, it became clear that differences exist in the way climate change is viewed. Often the country level emphasis is firstly on the implications for livelihoods, considering the impact on agriculture, given the dependence of many African countries on agriculture to sustain livelihoods. The roads departments engaged did not have in-house information-bases that reflected information on climate hazards and vulnerabilities. This however does not mean that such information-bases do not exist within the countries. Often other national departments, agencies or universities have information systems that can be used. Climate research are often conducted by the respective environmental ministries, universities, national disaster centres, meteorology departments/agencies within the various countries. This can provide a (developing) national science base that can be utilised by roads departments to consider climate risks for roads. In most cases however there is not a competence or function within roads departments that are responsible for, or that can practically utilise such a base of climate information. Road-focused climate adaptation assessments, at the time of the study, were largely missing from the planning and maintenance systems applied within participating countries – with the exception of World Bank funded projects that required the use of the World Bank climate screening tools. The need to develop a climate assessment framework that could be applied across various African countries was identified in the project. It also presented an opportunity to review current practice for climate assessments and to improve on prior approaches. Furthermore, it also presented the opportunity to consider the level of detail (grain) of information available in the various countries.

2.2.1 *Developing a methodology for carrying out climate adaptation assessments for rural roads*

The starting point was to understand how climate change is viewed in the context of the roads sector. This was done through researching previously conducted studies. It was also important to determine the impacts of climate hazards that countries in the region had been experiencing and continue to experience, as this would form part of the subsequent new methodology. It soon became clear that climate change content was largely missing from the planning and operations of roads departments. No methodology existed where

² Considering Ethiopia, Ghana and Mozambique

finer grained sub-district level spatial information could be applied to identify roads (or segments of roads) where the risks of climate change had to be addressed.

On reviewing continental and country level literature (including past climate and natural climate related disaster observed trends), the following climate change effects were noticed occurring to varying degrees in most parts of sub-Saharan Africa [10]:

- Increased temperatures (average, minimum and maximum temperatures, as well as increases in the number of very hot days per year);
- Decreased precipitation and longer drier periods;
- Greater rainfall variability;
- Increases in extreme weather events – violent storms, heavy precipitation, heat waves, etc. resulting in increased flooding;
- Rising sea-levels;
- Northward migration of the tropical cyclone belt; and
- Increased wind speeds.

A geospatial, semi-quantitative method for assessing climate risk and vulnerability was developed consisting of five key phases and is described in the Climate Threats and Vulnerability Assessment Guidelines (available on the ReCAP website <http://www.research4cap.org> [19]). The first three phases deal with identifying the main regional climate risks with respect to rural roads, where the current and projected climate information would be obtained using climate models. The last phase deals with the incorporation of climate threat indicators into asset management systems to identify roads where maintenance and climate adaptation interventions should be prioritised. This assessment method outlines at a national level (in terms of districts) where roads are most vulnerable to a changing climate and provides key geographic information to support decision makers in identifying high-risk districts in terms of climate impacts on road infrastructure [20]. High-risk areas can be identified and interpreted as areas that should be prioritised for road construction, adaptation or maintenance in the light of changing climatic conditions. The method provides information that can be used to support the development of a climate adaptation strategy for rural access roads and guide investment decisions. This is done using existing data on the road network, vulnerable populations and climate change in combination with what is known about best road design principles in order to determine where roads could potentially be most affected by changes in climate and socio-economic patterns.

The last two phases, consist of exporting results into the national Road Asset Management System (RAMS) to be used to determine where in-depth local level road risk and vulnerability assessments would be most beneficial, as well as for extracting summaries needed in identifying adaptation options. In some cases, this process may be iterative.

2.2.2 Challenges and opportunities - Information

One of the main challenges in this project deals with sourcing information used in the above-mentioned assessments. To formulate a national climate threat picture, documents, data and statistics from country level assessments indicating the type, frequency and intensity of historical climate induced disasters had to be sourced. In order of priority, the following are suggested resources for obtaining this information:

- Firstly, it is assumed that national data on historical climate threats are maintained and archived by the relevant national meteorological department and/or disaster

management office. As the starting point, data should be sourced from these national authorities.

- Secondly, technical reports by the Intergovernmental Panel on Climate Change (IPCC) and The Nature Conservancy (TNC) can be consulted for background information.
- Lastly, knowledge sharing workshops with active role-players such as the national meteorological department and disaster management office, should be conducted.

The investigation into historical climate data archives, country level assessment reports and knowledge sharing workshops inform the process of identifying the climate threats most affecting the vulnerability of roads. From this enquiry, the driving forces of vulnerability should be identified, and flagged for further analysis in this assessment process.

There are several open source data repositories that can be used to source different data types used to perform a district-level risk and vulnerability analysis. The first priority however should be to source national scale GIS datasets from MDAs. When the existing data quality varies and cannot be used for the district-level assessment, open source data repositories can be used as an alternative. In-country custodian data can be sourced from the following places:

- National departmental authorities (e.g. National Disaster Authority, National Meteorological Agency);
- Road asset management systems;
- Country wide Spatial Data Infrastructure (if implemented);
- Country specific assessment reports, including reports by development partners such as the World Bank;
- Previous studies; and
- Commercial data vendors.

Although the use of national (own) data is preferred in the short term, other open source information bases can be harnessed until such a time when these items can be replaced by in-house country level data. Climate models form an important part of any climate analysis as it assists scientists to understand the past, present and especially possible future climate trends. The predictions of climate models can help decision-makers to prioritise environmental and planning issues drawing from scientific evidence [21]. At the start of the project it became apparent that existing climate models for the Central and Southern African region were coarse (grid length larger than 50 km). Such models do not allow for the use of more detailed climate information within countries. As climate modelling is not an exact science, two global climate models were selected, namely, the Australian Community Climate and Earth System Simulator (ACCESS1-0) and the French National Meteorology Research Centre Model Version 5 (CNRM-CM5). The output of both models was selected for further downscaling to a very high resolution of 8 km grid length over the three participating AfCAP countries. Using these two downscaled models, the projected changes for the following four climate variables were analysed for the periods 2021 to 2050 and 2071 to 2100:

- Average annual rainfall (mm);
- The annual number of extreme rainfall events (defined as the occurrence of more than 20 mm of rain over a period of 24 hours);
- Annual average temperature (°C); and
- The annual number of very hot days (defined as days when the maximum temperature exceeds 35°C).

This resulted in a set of high resolution climate change data that extended across relatively large sub-regions of the African continent.

2.3 Adaptation options (step 3)

Part of the challenge of achieving the research objective ‘to identify, characterise and demonstrate appropriate adaptation procedures’ was to convey the information as well as to apply adaptations options in each country. The approach selected to package (and guide) the application of adaptation options addressed during the project was to develop a handbook with three accompanying guideline documents (see Figure 3). The Adaptation Handbook was developed as an overarching document and illustrates the fundamental principles, processes and steps required for climate resilience. Detailed information that supports this process regarding the actual adaptation approaches and measures are included in the accompanying guidelines covering Change Management, Climate Threats and Vulnerability Assessment, and Engineering Adaptation.

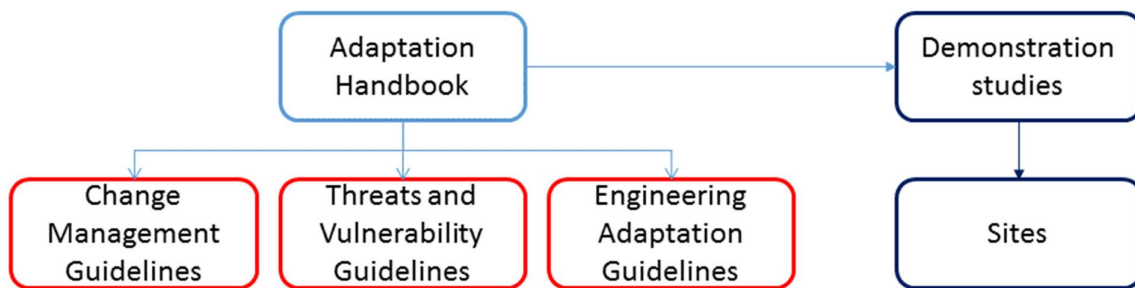


Figure 3 - Document set for application of adaptation options.

The Climate Adaptation Handbook provides relevant information on climate adaptation procedures for rural road access, along with instructions on an appropriate methodology to identify and address climate threats and asset vulnerability with the aim to increase the resilience of rural roads for the foreseeable future. It has been developed to cover a range of climatic, geomorphologic and hydrological circumstances commonly applicable to the three study countries, Ethiopia, Ghana and Mozambique, but equally applicable to any of the other Sub-Saharan African countries. These guides also document the research to identify climate hazard, vulnerability and impact on roads and the engineering options that could be considered for different hydro-meteorological threats. The adaptation approaches and options listed are also linked to the design of demonstration sites constructed during the project in each of the three countries.

2.3.1 Challenges and opportunities

Capturing and presenting adaptation options to users presented a unique challenge, especially when considering that it included not only policy, but also engineering and non-engineering issues. These items are not all relevant to officials dealing with roads in national departments. To address this, three more detailed guideline documents were produced, dealing with the aspects of policy, engineering and non-engineering separately. In order to expose, inform and train the users on the content of these documents it became necessary to have training sessions on these items with the various roads MDAs in the participating countries and other relevant stakeholders in the climate change/adaptation space. The training-of-trainers on these aspects was also considered necessary to ensure wider in-country capacitation (especially focussing on the roads sector).



Figure 4 - Training workshops

Between 2016 and 2019 a series of 11 multi-day demonstration, embedment and train-the-trainer workshops were held between the three participating countries (Figure 4). The workshops formed the base for demonstrating and implementing the use of the Handbook and Guideline documents, and focused not only on information dissemination, but more critically on capacity building through education and practical, structured training. The workshops engaged the GIS and engineering professions of the various roads MDAs, to equip them with the skills and resources needed to initiate climate adaptation action in their respective countries.

2.4 Implementation through demonstration (step 4)

A requirement emerging from the project was the need to develop practical environments where engineers and technical staff could apply various components such as local level screening as well as the relevant engineering solutions on a new constructed site. During the project, sites were identified (one site in each of the three partnering countries) by the relevant roads departments. These sites, once approved, would be constructed and adapted in accordance with climate resilient designs. At the time of writing this paper, none of these sites had been approved. As an alternative to demonstrate proposed resilient adaptation measures, a number of flood damaged sites in Mozambique were selected. One such site is illustrated in Figure 5.

At each of these sites, adaptation measures were designed and implemented and a conventional repair solution was carried out as a control at a nearby site. The costs of each of the adaptation measures compared with the control section were carefully monitored for later benefit/cost analyses.



Figure 5 - Example site in Mozambique's Gaza Province, where the road has been adapted to address overtopping-induced erosion

Figure 5 shows the before and after measures implemented at a damaged concrete ford as an example. Similar exercises were carried out at sites that showed poor road performance, ineffective culvert performance and erosion of the road at the ends of a concrete ford after an extreme storm event. Several challenges did however arise during the process of establishing these practical demonstration sites.

2.4.1 Challenges and opportunities

The implementation of such demonstration sites required several training sessions to be held. Funding constraints resulted in delays with the construction of the demonstration sites. Subsequent planned training sessions could therefore not harness the use of these sites. The location of sites also posed accessibility challenges – sites located in rural region far away from the major centres (where a large portion of engineers are based along with education and training institutions that train engineers) were not preferred. Where possible, sites located close to the major centres were identified. Practical sites are also important when considering new site/area assessments. In-country trainers have to be trained to provide relevant education to engineers and technical staff. Vulnerable sections of new road construction or maintenance projects should also be considered for practical training opportunities and developed as such. Such projects could, and should, therefore also serve as opportunities for training and strengthening the local skills on site-relevant adaptation options.

2.5 Addressing policy issues (5)

Considering the policies of three countries during the project it became noticeable that policies on climate adaptation for road and transport were largely absent. Where present, roads are usually represented as a subset of all infrastructure, including energy and water supply, but it is more common for adaptation policies to be multi-sectoral and to cover agriculture, energy, forestry etc. Development partners, in particular the World Bank, have recognised the importance of establishing specific policies and strategies dealing with climate change for the road sector and accordingly developed project related tools to assist in the projects they fund. Policy development is usually an integral part of strategic planning, programming, implementation and feedback process – see Figure 6. Policy sets the scope and content of strategic planning for programmes and plans which, when implemented, will create more sustainable rural access. Monitoring and evaluation will provide evidence and experience that can be fed back to modify or improve policy. The final hurdle however lies in implementation, achieving it results in the grounding of policy.

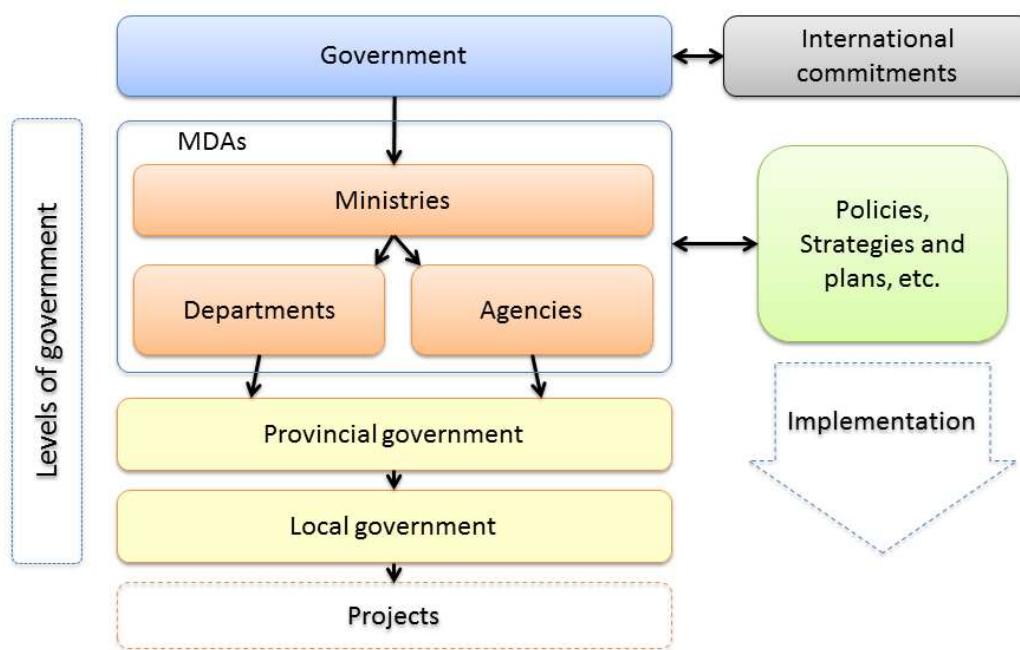


Figure 6 - Generalised government structure with policy links.

Table 1 provides a high-level 3-country summary of core climate change policies at both a national scale and subsequently focussing only on the transport sector specifically. After countries commit to the UNFCCC, they are required to outline the steps to be followed to address Climate Change in their respective Intended National Determined Contributions. It is clear when reviewing Climate Change policies at country (national) level that a lot has been done in countries such as Mozambique, Ethiopia and Ghana, all of which have several policy and strategy documents that sets out their national policy intent. National policies often focus on their regional economic interests first – mostly dealing with livelihoods. In most cases there is also often a strong link to the national economic or developmental policies. The following table compares the key policies and related challenges for the three countries, Mozambique, Ethiopia and Ghana.

Table 1 - Comparison and listing of the main national and transport policies.

Mozambique	Ethiopia	Ghana
Country level climate change commitments:		
Signatories to United Nations Framework Convention on Climate Change Intended National Determined Contributions		
National Climate Change Policies:		
National Climate Change and Mitigation Strategy	Climate Resilient Green Economy (2011)	National Climate Change Policy (2014)
	Growth and Transformation Plan	National Climate Change Adaptation Strategy (2012)
	Ethiopia National Adaptation Plan	National Climate Change Committee
Key National Climate Change Institution:		
Ministry of Land Environment and Rural Development	Ministry of Environment and Climate Change	Ministry Environment, Science Technology and Innovation

Mozambique	Ethiopia	Ghana
National Climate Change Policy Challenges:		
Poor coordination between sectors	Lack of adaptation actions to address vulnerable sectors such as transport	Policies focus on agriculture (economy)
Limited capacity for mainstreaming	Gaps in existing policies	Policies only mention infrastructure but no details on roads
No affective adaptation	Policy implementation – lack enforcement and capacity	Weak coordination between sectors – lost opportunities
Independent actions often project related and directed by development partners	National policies focus on economic growth	Sporadic actions – project driven
		No affective mitigation and adaptation
Transport/Roads Policies:		
Roads Sector strategy (ANE)	Climate Resilient Transport Sector Strategy	National Transport Policy
		Integrated Transport Plan for Ghana
Key Transport (roads) Institution:		
National Roads Administration (ANE)	Ethiopian Roads Agency (ERA)	Ministry of Roads and Highways - Department of Feeder Roads
Transport/Roads Policy Challenges		
Sector policy needs roads adaptation	Needs own Climate Change Policy	Policy does not reflect climate change
Requires climate change policy	Requires leadership and responsible entity	Not sufficient design know how to address climate change, especially related to maintenance

2.5.1 Challenges and opportunities

When reviewing national climate change policies, several challenges emerged, including the lack of coordination between government MDAs. Although a climate change capability exists in these countries, these are not optimally used. Road infrastructure was often missing or largely lacking in their inclusion in national policies. Actions taken on climate change have been sporadic and partly project focused. When considering the various transport and roads departments specifically, a policy gap often existed dealing with climate change specifically. Where climate change is mentioned it reflected intent, but practical actions were generally not featured. This is evidenced by it not featuring in road asset management systems. Within national institutions responsible for roads there needs to be a responsible department and person to lead climate change implementation across the institution. Such a department can also lead cross-sectoral cooperation. There are however positive movements in the transport policy space in these countries as new policies, strategies and plans are reflecting the need to include climate change adaptation.

One example where the AfCAP work has contributed to current policy development processes is Ghana: The latest Sector Medium Term Development Plan of the Ministry of Roads and Highways (MRH) included the need to review the Transport Sector Policy on Climate Change. Additionally, the MRH also requested the AfCAP team to provide comments on the Transport Ministries' new Research Policy especially as it relates to the inclusion and use of climate science related work. The AfCAP work done in Ghana has also been requested by the Ghanaian Environmental Protection Agency for inclusion in their Forth National Communications report to the UNFCCC which is currently being drafted.

2.6 Embedment (step 6)

Included in the research work undertaken in the preceding period, the aim of the AfCAP programme is to move forward and to address issues of embedment and implementation. A further objective is, through embedment, to enhance the capacity of countries to address climate resilience. It must be noted that the three featured countries have already developed several policies to address climate resilience across various sectors. The main objective of the AfCAP work deals with the transport sector (specifically roads- and related infrastructure), and as such the primary focus, as indicated in the diagram in Figure 7, is for embedment within the roads sector. It is however important to note that there is a strong linkage with the broader national climate change environment especially considering access to climate change science data.

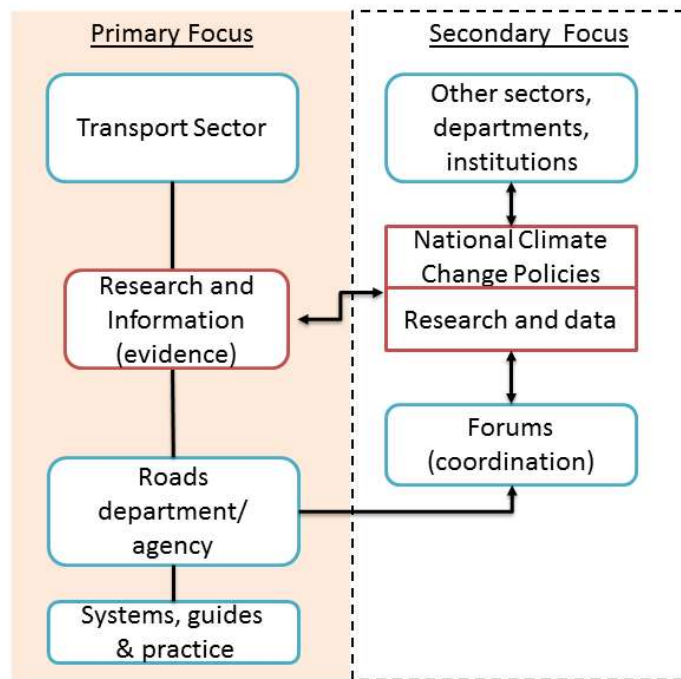


Figure 7 - The dual focus of embedment

Often structures exist where climate science information is shared – roads departments have to become part of such structures or forums in order to establish relevant linkages and gain access to information. The geospatial nature of climate change data implies that road MDAs need to develop their capacity to deal with geospatial climate change data in order to relate it to the roads data. The AfCAP project training sessions investigated the GIS capabilities within roads departments of the three countries and found that although it is present in various degrees of skill, linkages of such systems with RAMS has not been operationalised. The opportunity exists when such systems are upgraded or replaced, to

ensure that it can accommodate climate change risk screening information. Lastly, road design guidelines also have to reflect climate resilient designs and there is a need for such documents to be updated. The engineering guideline document produced by the AfCAP project contributes to this by incorporating climate resilient adaptation designs.

3 DISCUSSIONS AND CONCLUSIONS

In reviewing policy documentation and related literature, it is noticeable that climate change is increasingly being featured across Southern Africa due to the increasing awareness of the risks brought about by climate change. Country commitments have also obliged countries to take action – reflecting climate change in national policies and linking these to the respective national economic development plans. Most of the focus in dealing with climate change policy has been at high level and climate change has been more prominently focussed on core economic sectors and on its impact on the countries' development paths. Considering roads in general and access roads in particular, it is clear that climate change has only featured to a limited extent. It has been mostly project focused and sporadic in the sense that it features only when required (as in the case of World Bank funded projects). More recent work in the region has led to the update of road design guidelines – for example for Mozambique.

Considering the climate change science base, it is noticeable that it is largely missing from road MDAs and where present, its role is limited. Where climate change science is being addressed and analysed by other MDAs in countries, these evidence bases have not been harnessed by the respective road MDAs to inform policies or to be incorporated into planning systems. This can be largely attributed to a lack of collaboration and coordination between government departments and institutions. This results in a lack of awareness of what information exists that could inform a range of users. In the transport sector (across the three countries) there is also no person, department or institution tasked with the responsibility to actively address the issue of climate change as it relates to roads. Considering the transport policies of the three participating countries, it is only recently that new policies are featuring climate change more prominently. Policies related to incorporating climate change screening into road asset management systems have been lacking. The AFCAP project focused on RAMS systems and considered the opportunity to incorporate climate screening spatial data. The extent of RAMS systems varies but all can accommodate the transfer of road linked GIS data.

Lastly, embedding climate change into the operations of road departments is not a once-off exercise. It requires ongoing capacity development within road MDAs to take advantage of what climate science can contribute to the planning, management and maintenance of roads.

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