



AfCAP
Africa Community Access Partnership



Enhancing understanding on safe motorcycle and three-wheeler use for rural transport

Literature Review



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Amend and Transaid

RAF2114A

March 2018

AMEND



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AfCAP Database Details:			
Enhancing understanding on safe motorcycle and three-wheeler use for rural transport and the implications for appropriate training and regulatory frameworks			
Reference No:	RAF2114A	Location	Ghana, Kenya, Tanzania, Uganda
Source of Proposal	ReCAP Project Management Unit	Procurement Method	Open tender
Theme	Transport Services	Sub-Theme	Motorcycles and three-wheelers
Lead Implementation Organisation	Transaid	Partner Organisations	Amend and TRL
Total Approved Budget	GBP 301,445	Total Used Budget	GBP 45,089
Start Date	18 th September 2017	End Date	31 st January 2019
Report Due Date	16 th March 2018	Date Received	16 th March 2018

Abstract

This Literature Review was carried out during the Inception Phase of the research project 'Enhancing understanding on safe motorcycle and three-wheeler use for rural transport and the implications for appropriate training and regulatory frameworks'. The purpose of the review was to generate contextual information to inform the development of research strategies in the project's four focal countries: Ghana, Kenya, Tanzania and Uganda. Initially intended to be an annex in the Inception Report, the decision was taken by the ReCAP Project Management Unit to publish it as a standalone document.

The use of motorcycles has increased greatly in Africa in recent years. Motorcycles are often used as taxis, with riders charging a fare to carry passengers or goods. In rural areas, motorcycle taxis play a crucial role in connecting people to services and farms to markets, and in many countries motorcycles are the most commonly found vehicle on rural roads.

Motorcycle transport is certainly not without risk, including the risk of being injured in a crash. Attempts by governments to regulate the use of motorcycle taxis – both for safety and other reasons – have largely failed, with authorities often unable to keep pace with the rapid influx of motorcycles into the continent and the high demand for their services by local populations. Similar issues apply to motorised three-wheelers, although their numbers are far fewer.

This literature review draws on existing academic and grey literature. It maps the growth in use of motorcycles and motorised three-wheelers in sub-Saharan Africa and examines the benefits and disbenefits of their use as a means of public transport, with a particular emphasis on their use in rural areas. It describes the implications of the existing lack of regulatory frameworks covering motorcycles and three-wheelers, as well as gender, mobility and road safety issues. The review concludes that there are significant gaps in research on this subject in a rural context.

Key words

Motorcycles, motorcycle taxis, three-wheelers, rural transport, rural access, road safety, rider training, regulation, sub-Saharan Africa.

AFRICA COMMUNITY ACCESS PARTNERSHIP (AfCAP)

Safe and sustainable transport for rural communities

AfCAP is a research programme, funded by UK Aid, with the aim of promoting safe and sustainable transport for rural communities in Africa. The AfCAP partnership supports 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 programme follows on from the AfCAP1 programme that ran from 2008 to 2014. AfCAP is brought together with the Asia Community Access Partnership (AsCAP) under the Research for Community Access Partnership (ReCAP), managed by Cardno Emerging Markets (UK) Ltd.

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Acronyms, Abbreviations, Units and Currencies

AfCAP	Africa Community Access Partnership
AfDB	African Development Bank
App	Software Application
AsCAP	Asia Community Access Partnership
BRRI	Building & Road Research Institute (Ghana)
DVLA	Driver Vehicle and Licensing Authority (Ghana)
GBP	Pound sterling
HVI	Helmet Vaccine Initiative
IHIE	Institute of Highway Incorporated Engineers
iMAAP	Microcomputer Accident Analysis Package
iRAP	International Road Assessment Programme
IRAT	Improving Rural Access in Tanzania programme
KEBS	Kenya Board of Standards
MoWT	Ministry of Works and Transport (Uganda)
MTTD	Motor Traffic and Transport Directorate (Ghana)
NAFEBO	National Federation for Boda Boda Operators (Uganda)
NGO	Non-Governmental Organisation
NRSC	National Road Safety Commission (Ghana)
PSV	Passenger Service Vehicle
PTW	Powered Two- & Three-Wheeler
ReCAP	Research for Community Access Partnership
RTIs	Road Traffic Incidents
SACCO	Savings and Credit Cooperative
SUMATRA	Surface & Marine Transport Regulatory Authority
TRL	Transport Research Laboratory
UDSA	Uganda Driving Standards Agency
UGX	Uganda Shilling
UK	United Kingdom (of Great Britain and Northern Ireland)
UKAid	United Kingdom Aid (Department for International Development, UK)
UPF	Uganda Police Force
URA	Uganda Revenue Authority
USD	United States Dollars
WHO	World Health Organisation

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1. Introduction

This literature review was carried out during the Inception Phase of the ReCAP-funded project 'Enhancing understanding on safe motorcycle and three-wheeler use for rural transport and the implications for appropriate training and regulatory frameworks'. The purpose of the review was to generate contextual and other background information to inform the development of research strategies to be utilised in the project's four focal countries: Ghana, Kenya, Tanzania and Uganda.

The research project is being undertaken by a consortium led by Transaid and which includes Amend and TRL.

2. Methodology

The literature review drew on both academically-published literature and unpublished 'grey' literature, with the aim of identifying trends in the rural commercial motorcycle and motorised three-wheeler taxi industry, as well as any gaps in the literature.

The following topics formed the basis of the review and informed the process of formulating key words for the literature search process:

- Existing regulatory frameworks
- Existing training, testing and licensing systems
- Benefits of good motorcycle taxi services in rural areas
- Comparative data on the location and cause of motorcycle crashes (including road type)
- Examples of best-practice – on the government side (regulation and training, testing and licensing), and among motorcycle taxi operators (e.g. self-regulation among associations)

A list of key words and phrases was initially created to facilitate as broad a search as possible. Local names attributed to motorcycles and three-wheelers in the project countries and elsewhere in Africa – 'boda boda', 'okada' and 'achaba' – were identified and linked to various key themes associated with these modes of transport. The two primary databases used to undertake searches of academic and grey literature were Web of Science and Google Scholar, the former with support from Project Team members based at Durham and Makerere Universities.

The Web of Science (formerly Web of Knowledge) is a subscription based service which offers access to relevant multidisciplinary topics for academic researchers. Table 1 shows the key word searches that were carried out using this database.

Table 1. Web of Science Search Words

Boda boda AND rural Africa
Boda boda AND Africa
Boda boda AND Africa
Motorcycle taxis AND Africa
Okada AND Africa
Achaba AND Africa
Motorcycle taxis AND Tanzania
Motorcycle taxis AND Kenya
Motorcycle taxis AND Uganda
Motorcycle taxis AND Ghana

Boda boda AND Uganda
Boda boda AND Kenya
Boda boda AND Tanzania
Boda boda AND rural access
Boda boda AND gender
Boda boda AND women
Motorcycle taxis AND women
Motorcycle taxis AND accidents
Boda boda AND accidents
Boda boda OR okada OR achaba OR motorcycle taxi
Boda boda OR okada OR motorcycle taxi

For Google Scholar searches, a table of key words was formulated (see Table 2). One word was taken from each of the four columns to form the search phrases, for example, ‘Rural Africa AND Achaba AND Uptake AND Gender’. The review then took into account the first five pages returned for each search.

Table 2. Google Scholar Search Words

1	2	3	4
Rural Africa	Motorcycle	Access	History Affordability Profitability Ease of use Personal security Cultural issues
	Motorcycle Taxi <i>Boda Boda</i> <i>Okada</i> <i>Achaba</i>	Uptake	Affordability Profitability Ease of use Personal security Cultural issues
	<i>Oleyia</i> <i>Zemidjans</i> <i>Bajaji</i>	Road Safety	Crash/accident/collision Road death/injury Legislation/law Crash/accident/collision data
	<i>Tuk tuk</i>	Innovation(s)	Affordability Profitability Use/Utilisation Personal Security Cultural Issues Gender
			Gender Legislation Registration Ownership Road safety Gender Legislation Registration Ownership Road safety Helmet wearing High visibility Rider/driver training

The findings from both databases were very similar, perhaps highlighting the scarcity of literature on rural-based commercial motorcycle and three-wheeler use.

The documents obtained through the database searches were supplemented by additional academic literature and so-called ‘grey’ literature sourced by the team’s National Experts and other team

members, which included government statistics, conference presentations and project country newspaper articles.

3. Literature Review Findings

3.1 Introduction

The World Health Organization (WHO) estimates that motorcycles and three-wheelers constitute an approximate share of 33% of all transport modes in sub-Saharan Africa (WHO, 2015). However, the number of motorcycles and three-wheelers varies hugely from country to country. The four countries chosen for this study all have relatively high numbers of motorcycles, and in each of them, three-wheelers are seen as an emerging means of transport. In 2013, Ghana had one motorcycle or three-wheeler for every 74 people, Tanzania had one for every 61 people and Kenya had one for every 60 people (*ibid*). Comparable data for Uganda were not available.

In Tanzania, the number of motorcycles and three-wheelers was almost 60% greater than the number of cars and other four-wheeled light vehicles in 2013. This was not the case in Ghana or Kenya, where the number of cars and other four-wheeled light vehicles exceeded the number of motorcycles and three-wheelers (*ibid*). Comparable data for Uganda were not available.

In Kenya the number of new vehicles continued to grow at an astounding rate with an additional 44,154 motorcycles registering in the first three months of 2015, which was an increase of 74.6% for the same period in the previous year (Nyachieo, 2016).

There is no single source of information differentiating the number of motorcycles from motorised three-wheelers in Africa, but selected sources show that the number of motorcycles far exceeds the number of three-wheelers. For example, in 2014 in Tanzania, there were more than 830,000 registered motorcycles compared with just 53,000 registered three-wheelers (Tanzania Revenue Authority, 2015). The difference in numbers of these two vehicle types is also reflected in the volume of literature available, with there being substantially more literature on motorcycles.

Similarly, there is no source of information on the number of motorcycles and motorised three-wheelers operating in rural areas, or how their numbers in rural areas compare with their numbers in urban areas.

Both motorcycles and motorised three-wheelers are commonly used as taxis in many African countries, charging a fare to carry passengers or goods. They have exploited a niche left by the decline of public transportation systems, particularly in increasingly motorised urban conurbations in Africa (Kumar, 2015).

Much of the literature related to motorcycles in Africa focuses on urban road safety issues, framing motorcycle taxis as one of the principal contributors to this problem.

However, it is recognised that motorcycles make a critical contribution to rural mobility (Starkey, 2011). This mode of transport provides even the most isolated rural communities with a means to access essential services such as healthcare and education, as well as markets, off-farm employment and other opportunities which may have once been beyond reach, and therefore provide a crucial link to the outside world and a possible means of escape from poverty.

The following review of the literature examines the key issues around access and uptake of motorcycles and motorised three-wheelers, in particular their use as taxis, and the challenges

relating to their operation. The review examines issues around affordability, personal security and road safety, and looks at the effect of gender and culture on two- and three-wheeler ownership and use. Finally, the review examines areas where innovative practice has emerged, predominantly in urban areas to date, but which may be applicable to rural contexts.

3.2 Expansion of Motorcycle Use in Rural Sub-Saharan Africa

The value of motorcycles in promoting rural access in Africa has been recognised for many decades. The organisation Riders for Health has promoted their use to support health services in remote areas since 1988. The organisation eRanger developed a motorcycle ambulance that was specifically designed for use in rural areas to strengthen health referrals, which was first used in Sierra Leone and Malawi in 2001. More recently, in 2015 Transaid piloted an emergency transport scheme based on the participation of rural-based motorcycle taxi riders in Uganda. However, the majority of literature on motorcycle usage in Africa, particularly their use as taxis, focuses on urban areas (Transaid, 2015a).

Starkey (2011) suggests that there is a common pattern of motorcycle use which generally starts in congested urban areas, moves outwards to peri-urban areas and then to larger villages, before reaching remote rural areas. A motorcycle's relative ease of operation on poor rural roads and potential to by-pass obstacles such as muddy surfaces, large pools of water and landslides are considerable advantages in these areas.

Nishitatenno and Burke (2014) describe a '*motorcycle Kuznets curve*' whereby motorcycle dependence first increases and then decreases as a country's economy develops, at which point affordability becomes less important in vehicle purchase decisions while safety and comfort considerations come to the fore. The authors suggest that upswings in the numbers of motorcycles are particularly pronounced in countries with high density populations, which is more characteristic of Asian rather than African contexts. However, the current trajectory in sub-Saharan Africa still appears to be significantly upward. Burkina Faso provides an example of a country at the beginning of this process in that motorcycles make up more than three-quarters of the road motor vehicle fleet (*ibid*).

In Anglophone West Africa, Nigeria led the adoption of motorcycles with massive expansion from around 1974 as national income soared with the oil boom. The so-called *Udoji* awards of that year gave substantial salary back-payments to civil servants supporting peak motorcycle imports in 1978 and 1981 (Guyer, 1997). This led to the establishment of motorcycle assembly plants and spare parts manufacturers in Nigeria. By the early 1980s, motorcycles were an established part of the rural transport system in Yorubaland, south-west Nigeria, in that ordinary farmers could afford a motorcycle (*ibid*). By 2000, dealers from the Jos Plateau were travelling to southern Nigeria to buy motorcycles, splitting them into parts to avoid customs duty, and then reassembling them in Jos (Porter, 2002). Critical mass had been achieved in the Jos region by 2000. Well-stocked spare parts dealers-cum-mechanics could be found at major road junctions across the region and even in some quite remote off-road villages. As a proportion of all vehicle ownership, motorcycle ownership was particularly high in off-road villages. In these areas, many owners were vegetable farmers who used their motorcycles to carry inputs to the farm and also operated as occasional taxi drivers based on demand and on their own movements in and out of the village (*ibid*).

In Francophone West Africa, motorcycles and mopeds had also achieved a critical mass by the end of the Twentieth Century (Starkey, 2000). From the early 2000s, the importation of cheap Chinese motorcycles further fuelled expansion of their usage across the continent, especially in West and East Africa and parts of southern Africa. In Cameroon, for example, the value of imported motorcycles, mostly from China, grew from USD 2.1 million in 2001 to USD 8.9 million in 2005 (CCI,

2008). The increase in the scale of motorcycle importation reflected their increased use for personal or private transport, and also the fact that elites recognised their potential as a lucrative new business opportunity if operated as taxis.

3.3 Motorcycle Taxis

Although fares per kilometre for motorcycle taxis are commonly more expensive than other more conventional forms of public transport operating in rural areas, motorcycle taxis have become a significant part of the rural transport make up in a growing number of countries across Africa. This is especially the case where conventional motorised rural transport services are poorly developed (Bryceson *et al*, 2003). Motorcycle taxis offer benefits such as flexible access to the main routes plied by lower-cost public transport services and door-to-door travel, which is of particular use to older and infirm or disabled passengers. They often play a key role in emergency transport provision especially where this relates to health (Porter, 2014). Motorcycle taxis flourish in areas where conventional motor transport services are uneconomical or where difficult terrain makes operation of other types of vehicle challenging, such as in remote rural Tanzania. In rural areas, motorcycle taxis are increasingly acting as feeder services, linking off-road villages to other, more affordable forms of motorised transport services, moving passengers from areas where unmade road networks exist, to paved roads.

The efficiency advantages gained when motorcycle taxis can be contacted by mobile telephones are particularly impressive. For the first time in African rural transport history, rural people now have the potential to access transport on demand using mobile telephones. For people living in remote areas, this new level of connectivity represents a transport revolution. Even if they cannot afford transport on a regular basis, many people can now access it in an emergency, and this is perceived to be of crucial importance to their personal wellbeing (Porter, 2014). The new connectivity offered by the expansion of motorcycle taxis and mobile telephones is likely to transform travel in remote rural locations for some years to come. These developments are also likely to have a wider impact on the nature and organisation of rural transport services, with the extent and nature of change dependent on the local context and wider political economy. Improvements in service quality associated with developments of this type are expected to lead to improvements in journey time, reliability and safety. Reductions in fares are likely to take longer to achieve, and will depend partly on the extent to which competition develops between service providers (*ibid*). The increasing use of mobile money in rural areas will also contribute to the ease at which fare transactions are made (Porter *et al*, 2013).

3.3.1 The Development of Motorcycle Taxi Services in Africa

East Africa

The use of motorcycles as taxis in East Africa dates back to the earlier practice in Uganda of utilising bicycles as taxis. The term *boda boda* (a corruption of 'border-to-border', and a term widely used across eastern Africa) dates from the 1960s when bicycles with a padded cushion fitted over the rear wheel were brought into service in the border region between Uganda and Kenya, mostly to transport passengers but also occasionally goods (Godard, 2002). By the early 1990s, bicycle taxis were competing with light motorcycles (50-80 cc), which also adopted the name *boda boda*. These motorcycles extended the range and load carriage of these services. Local associations of *boda boda* riders have operated in Uganda since the 1990s, as unions or cooperatives.

In rural areas, motorcycle taxis were used principally to move passengers to and from major transport stops. Ugandan government restrictions on imports of vehicles over five years old were relaxed in 1991 and this reportedly aided the expansion in the use of motorcycles, with a significant take-off from around 1994. Larger motorcycles (up to 250cc) came into use in the western border

regions and were used to transport goods over long distances into the Democratic Republic of Congo (*ibid*).

Howe and Davis (2003) note that boda boda riders in Uganda are exclusively male. Various cultural constraints exist surrounding the use of motorcycles by females – both as riders and as passengers. Howe and Davis also noted that mobile telephones were already being used by some riders so that customers could summon them.

Tanzania experienced rapid growth in two- and three-wheelers starting in 2003. From 2008, concerns about safety escalated in response to a steep rise in motorcycle-related deaths (Bishop and Amos, 2015), although this did not slow the increase in numbers of motorcycles and three-wheelers being registered in the country.

In Rwanda, the number of *taxi-motos* (motorcycles) started to grow as people returned to Kigali after the 1994 genocide. Initially the Rwandan government saw these vehicles as a security threat. However, as the sector grew, riders were seen as a means of controlling the urban population through surveillance (Goodfellow, 2015). Reports suggest that up to 4.5% of Kigali's population depend on the service that motorcycle taxis offer for their livelihoods. There are over ten thousand registered motorcyclists in the city, the majority of whom are between the ages of 18 and 35 (Rollason, 2012). As in other countries in the region, motorcyclists in Rwanda are generally of low educational attainment and come from poorer backgrounds and therefore the majority of riders take advantage of leasing agreements with local entrepreneurs. This arrangement has seen the motorcycle sector grow rapidly in Rwanda.

West Africa

In Nigeria, motorcycle taxis are thought to have emerged at around the same time as in Uganda. They were reportedly operating across the Niger-Nigeria border in the mid-1980s (Dille, 2002). *Okadas* (the southern Nigerian term for motorcycle taxis - a term now also widely used across Ghana, Liberia and Sierra Leone) were also reported to be operating in southern Nigeria by the 1990s (Howe and Oni, 1996). By the year 2000, *achabas* (the northern Nigerian name for motorcycle taxis) were common in the rural areas of the Jos Plateau, fuelled by the expansion of irrigated vegetable production and consequent access to cash for motorcycle purchases (Porter, 2002). Achaba operators waited for customers at major rural road junctions, often a dozen or so at any time in one location. Most motorcycle taxi services operating from roadside centres focused on carrying passengers (rarely just goods) on routes out to the off-road villages where the vegetable farms were located, rather than along the paved roads where conventional motorised transport services operated. Motorcycles purchased purely or principally for use as achaba services were particularly common in the roadside villages where some individuals (mostly men) owned a number of motorcycles and employed mostly young, male riders. This encouraged some young men to stay in the rural areas rather than migrate to the city (*ibid*).

In Francophone West Africa, the spread of motorcycle taxis in the 1990s was supported by smuggled cheap fuel from Nigeria, second hand motorcycle imports (including from Nigeria), followed later by importation of new motorcycles from China (Olvera et al, 2012). In Togo, the intense competition presented by urban motorcycle taxis has forced shared (four-wheel) taxis to move out into rural areas. As a result, rural areas appear to be benefitting from improved rural-urban connectivity (Guezere, 2015).

3.4 Uptake and Use

3.4.1 Availability

One significant study on rural transport services found that communities in rural Africa had limited access to transport services when compared to rural communities in non-African countries of a similar economic status (Ellis and Hine, 1998). Inadequate service quality and poor infrastructure lead to higher prices and, in turn, affects affordability and uptake. Venter et al (2014) point to a direct link between poor road conditions and high vehicle operating costs. When combined with low population densities and people's limited means to pay for transport in rural areas, the low demand is an added disincentive for the establishment of financially viable rural transport services. Poor mobility inhibits economic development and acts as a barrier to poverty alleviation among the rural poor and hence is a critical issue from a sustainable development perspective (Kumar, 2011).

The gap in formal transport provision in rural areas is to some extent compensated for by informal public transport (Starkey, 2016b). There is a significant gap in the literature on what incentivises the development of informal transport provision for rural communities in remote areas. However, attempts have been made to measure the degree to which informal transport meets the needs of rural communities (Starkey *et al*, 2013). Olvera *et al* (2016) note that the increase in use of motorcycle taxis, particularly over the last two decades, is a reflection of their ability to meet people's needs.

These vehicles can be seen as drivers of economic growth and development, paving a way for innovative and affordable solutions to accessing healthcare and other essential services in rural areas (Transaid, 2015b). The well documented negative externalities and outcomes associated with two- and three-wheelers, such as the rise in road traffic crashes and their contribution to worsening air pollution, seem so far to have had little impact on their uptake (Howe, 2002).

Motorised three-wheelers (also known in sub-Saharan Africa as auto rickshaws, *tuk-tuks*, *bajaji* and *tempos*) have long been a feature of cities and rural roads in parts of Asia, but are relative newcomers to Africa (Starkey and Njenga, 2010). Motorised three-wheelers arrived later than motorcycles in rural Africa. While they provide better load-carrying capacity than motorcycles, they are not so manoeuvrable, especially on earth and gravel roads, and adoption in rural areas still lags substantially behind urban and peri-urban areas (Starkey, 2011). In Africa, they are known to operate mostly in large urban areas or smaller regional towns, displacing other modes of transport such as animal-carts in some instances. Their widespread use in Asia suggests that they could soon become part of peri-urban and rural transport service provision to a much larger degree in sub-Saharan Africa.

3.4.2 Affordability

The availability of imported motorcycles is indicative of the fact that these vehicles have become relatively affordable to buy. In addition, running costs and repairs and maintenance are cheaper when compared with other modes of transport (Starkey *et al*, 2017). In many African countries, local elites have identified an opportunity to generate income by purchasing motorcycles and three-wheelers and hiring them to local operators (Starkey, 2016b).

For formal modes of transport, fare controls support the need for transportation to be affordable. Privately-owned motorcycle and three-wheeler taxis generally do not abide by price controls and tend to charge what they like. Rural Tanzanian motorcycle taxi fares have been found to be between USD 0.17-0.34 per kilometre, which is considerably more than rural bus fares, which average between USD 0.035 and 0.047 per kilometre (Willilo and Starkey, 2013). Despite this, they are

increasingly patronised by poor communities due to the inadequacy of transport services and the lack of any alternatives (Kumar, 2011).

In rural Uganda, boda boda are between two and seven times more expensive than buses over equivalent distances, but are cheaper than private hire taxicabs. Limited availability of bus and taxicab drivers increases demand for boda boda for both passenger and freight services. However, it is the relatively wealthy, and mostly males (61%), who use motorcycle transport in Uganda (Howe, 2002).

3.4.3 Profitability and Ownership

Profitability for operators of all rural transport modes is generally low (Venter *et al*, 2014; Starkey *et al*, 2013). Specifically in terms of two- and three-wheeler taxis, in both urban and rural settings profitability often depends on the length of the individual rider's working day. This incentivises longer working hours (Olvera, 2016). Some riders prefer to work at night when there is less competition and when higher fares can be charged, although there are well-documented safety and security risks associated with travelling at night.

A study in Togo found that the earnings of owner-operators are significantly higher than those of operators who hire their vehicles (Olvera *et al*, 2016). Profit margins tend to be higher in urban areas. In Uganda, the lack of price controls contributes to operators' potential to generate high profit margins, particularly in urban areas. Other factors influencing operator earnings include the location of operations, local population densities and the reliability of alternative modes of transport. In Kampala, Uganda, urban-based boda boda owner-operators can earn USD 56 per week, while riders who hire their motorcycles earn just over half that amount (USD 30) (although owner-operators have greater outgoings such as repairs and depreciation). However, the sheer numbers of riders who hire the motorcycles they use is indicative of the fact that this industry remains profitable (*ibid*).

In 2014, 53% of riders in one rural area of Tanzania did not own the motorcycles they use (Bishop and Jinadasa, 2014), while in Uganda as a whole in 2002, 56% of riders did not own their motorcycles (Howe, 2002). In southern Ghana, a 2010 study indicated that up to 70% of motorcycle taxi riders did not own the motorcycles that they used (Ablin Consult, 2010). Vehicle owners included police officers, pastors, bankers and others who saw the service as a good investment opportunity (*ibid*). However, there is generally little information on motorcycle taxi, despite this being an important factor in crashes, with crash rates among those who hire being higher than among owner-operators (Bishop and Jinadasa, 2014).

3.4.4 Perceptions of Riders

Starkey (2016a) claims that non-users of motorcycle taxis tend to have a negative perception of these vehicles viewing them as anarchic, unsafe and an inappropriate mode of transport. These attitudes have led to motorcycle taxis bans being put in place in Ghana. Motorcycle riders are perceived by some to be involved in criminal activity, from bag-snatching to bank robbery. In 2014, the Tanzanian Traffic Police Commander banned boda boda from entering and operating in Dar es Salaam city centre, citing the increase in motorcycle-related criminal activity as one of the reasons.

From the riders' point of view, many consider themselves to be at high risk of being victims of crime, and some have developed ways in which to protect themselves. In Uganda, riders have reported the risk of being assaulted by criminals, especially at night, where criminals are widely known to pose as passengers. The loss of their motorcycle or their day's earnings can be catastrophic for a rider with limited alternative means of making a living. More research is needed into riders' perceptions of

their safety, of the service they provide, and of the ways in which motorcycle taxi riding offers some people an alternative to unemployment, under-employment or even a life of crime. A greater understanding of this issue will help to counter-balance the current negative discourse around the links between motorcycle taxis and criminal behaviour.

3.5 Gender and Social Inclusion

Although the relationship between gender and motorcycle and three-wheeler ownership, operation and use in Africa is beginning to be explored in the literature (Kumar, 2011; Peters and Mokuwa, 2017), there is a dearth of information on the relationship between motorcycle and three-wheeler taxis and social exclusion (i.e. access to services particularly for vulnerable groups or individuals), despite the long-standing discourse around the need to promote affordable transport options in hard-to-reach areas.

3.5.1 Ownership and Inclusive Mobility

Motorcycle ownership, whether for personal or commercial use, is far higher among males than it is among females in Africa, following the standard pattern of ownership of vehicles and other assets, where women (especially rural women) tend to suffer disadvantage. Nonetheless, there are some exceptions. Porter (2011) found that some rural women do own motorcycle taxis, although they tend to employ men to operate their vehicles.

Throughout the African continent, the operation of private motorcycles by women appears to be highest in francophone countries such as Burkina Faso. In these countries, women riding motorcycles are more commonly seen in urban areas, as opposed to rural areas.

As far as commercial motorcycle taxis are concerned, rural use is constrained principally by cost. This is an expensive mode of transport in rural areas and affordability combined with other gender-based and cultural constraints mean that motorcycle taxis are generally less accessible to rural women than they are to rural men. On the Jos Plateau, Nigeria, where motorcycle taxis have been utilised widely since the late 1990s, richer people in rural areas were more likely to use them regularly due to the fact that the fares can be as much as double that of a local rural bus fare for shorter distances and triple the bus fare over longer distances. In contrast, in some urban contexts like Douala, Cameroon, the working poor (both male and female), often use motorcycle taxis for short journeys, especially in the absence of other public transport modes (Olvera *et al*, 2012). While the vast majority of motorcycle and three-wheeler riders are men in urban areas of many African countries, in some places this has not prevented their use by women. In Douala, for example, 54% of motorcycle taxis (known locally as '*bendskin*') passengers are women (Olvera *et al*, 2012). The same study found that 69% of passengers are young adults, between the ages of 18 and 34.

Howe and Davis (2003) note that motorcycle travel offers women a level of security relative to walking (countering tiredness, wet weather and undulating terrain) and see this as having a positive impact on usage. Some of the strongest benefits of motorcycle taxi utilisation among women relate to market access and access to transport for health emergencies (Porter *et al*, 2013; Sacks *et al*, 2016). There may also be significant time savings from motorcycle taxi use for women struggling to make a livelihood while managing other household and community responsibilities, as Naybor *et al* (2016) point out in the case of marginalised widowed women in rural Uganda. Motorcycles also offer a way to increase carriage loads (especially perishable products) as compared to head-loading, which is a common but potentially physically harmful task often assigned to women and children (*ibid*). Kaumbutho *et al* (2013) emphasise the high cost of the first stage of produce evacuation - field to collection point - for fresh fruit and vegetables in Kenya, and note that in Meru district changing from head-porterage to the use of motorcycles can reduce overall costs to farmers by roughly one

third. This is in a context where load carrying is a paid-for service, in which case women and girls involved in head portage may therefore experience a downturn in household income with the switch to motorised transport.

The independence that motorcycle taxis offer women has the potential to have a transformative effect on their role in society and this may be resisted by some men (Calvo, 1994). Possibly as a means of controlling movement, the use of motorcycle taxis by women in some parts of Uganda is considered inappropriate in some communities due to the way that passengers are expected to sit astride the motorcycle and their close proximity to the boda boda operator (Porter, 2011). For this reason, despite changing attitudes, women are often observed riding side-saddle, which has safety implications.

The intimacy of motorcycle travel is also a consideration for some users in other countries. For female passengers travelling with male riders, and especially in situations where they are required to hold on to the rider when travelling at speed, this closeness is sometimes considered culturally inappropriate (Gillen, 2016). In Borno State, Nigeria in the 1980s, rural women were very occasionally seen riding pillion on motorcycles to market but always sitting side-saddle, never astride (Porter, 1995). By 2001, on the Jos Plateau in Nigeria, motorcycle taxis were operated mostly by young men and patronised more by men than by women. However, younger women also used the service. Although acknowledging concerns about the speed and dangerous driving of the young male drivers, young women still saw motorcycle taxis as a lifeline, especially when medical emergencies arose, and particularly in the rainy season when four-wheeled vehicles had difficulty negotiating rural roads (Porter, 2002). Since 2004, there have been bans on women riding as passengers on motorcycle taxis in Kano and Zamfara States in Nigeria because this practice is thought to *endanger public morality* (Adamu, 2008). However, it is unlikely that the ban has ever been heavily enforced in rural areas.

The needs of passengers with limited mobility, such as the elderly, expectant mothers and those with short-term illnesses and long-term disabilities, are often not considered by motorcycle taxi operators, thereby limiting their use by these groups (Porter *et al*, 2013; Sacks *et al*, 2016). However, there are many untapped opportunities to promote access to transport for the vulnerable and hard-to-reach. In Uganda, boda boda operators have formed the basis of an emergency transport system providing access to healthcare for pregnant women (Transaid, 2015a). The participation of boda boda riders as part of the emergency transport scheme was a conscious decision incentivised by their ability to promote their services to the wider community and therefore increase demand for their services. Transaid demonstrated that the distribution of operators' telephone numbers, and an emphasis on affordable pricing increased the riders' social standing in the community and, importantly, improved their business.

3.5.2 Employment

In Ghana, motorcycle taxis are an important employment option for young people, with 85% of riders under 30 years old. Although motorcycle taxi operation is almost exclusively a male activity across Africa, Howe and Davis (2003) argue that there are untapped opportunities for women to move into this space. In Uganda in 2003, boda boda (including both bicycle and motorcycle) incomes were estimated to support on average of up to six people for every operator (*ibid*). Young men are commonly attracted to motorcycle driving as an occupation since it is an easy entry point for young people with low educational attainment (Taruwere, 2015). In rural areas it has the advantage of providing year-round income (as opposed to farming which is seasonal), even if a proportion of the income goes directly to the vehicle owner. Some young male riders enjoy being able to ride at high speeds and to take other risks when operating the vehicles. In war-affected Sierra Leone and Liberia, low-skilled young men (including some ex-combatants) whose livelihood options are limited now

operate motorcycle taxis in many remote rural locations, including along footpaths in areas where, as is often the case, road infrastructure is lacking (Burge, 2011; Jenkins and Peters, 2016).

Motorcycle maintenance and repair is a growing support industry across Africa, both for private and commercial motorcycles. As with motorcycle taxi riding, this industry mostly employs men. In Sierra Leone, efforts are now underway as part of a ReCAP programme to support skills training, safety awareness, certification and registration of motorcycle transport businesses involving women operators (Peters and Mokuwa, 2017; Willat, 2017). In Tanzania, the organisation Pikilily is training young women to be motorcycle mechanics. These are positive examples of change in what is largely a male-dominated employment sector.

3.5.3 Wider Impacts

The poor safety record of motorcycles and the impact of crashes on riders' and others' lives were recognised relatively early on (Howe and Davis, 2003) and concerns around rider and passenger safety have grown, including for older passengers (Porter et al, 2013). The young men who drive motorcycle taxis commonly enjoy both speed and risk-taking, rarely wearing high quality safety helmets or providing them for passengers.

Low levels of helmet use are an issue among both men and women. For children, women and older people, the dangers of pedestrian travel in the vicinity of motorcycle taxi operations has become an important issue. Women may face an additional burden when a family member is involved in a motorcycle crash because they tend to be the principal carers at the household level (Kwamusi, 2002).

On the other hand, the very significant potential for motorcycles to save lives in contexts where maternal and new-born mortality and morbidity are high and where transport options are lacking needs to be highlighted. Urban-centric attitudes among policymakers often do not take into account the latter point when introducing motorcycle bans based on high perceived crash rates (Starkey, personal communication, July 2017).

Motorcycles with a sidecar are used in some rural maternal health services as an adjunct to four-wheeled ambulances in more remote areas (as with the eRanger made in South Africa and currently being utilised, for instance, in rural Zambia) providing a much needed means of emergency transport for women and children in particular. Motorcycle ambulances could play a much larger role than they do at present (Hofman *et al*, 2008) in promoting rural access to health services and in supporting women's health rights such as the right to a safe delivery, especially when linked to mobile telephone use, as trials in eastern Zambia have demonstrated. However, repairs and maintenance have been a barrier to full uptake by government bodies unless supported by donor funded projects (Dennis, 2013).

One other area of concern from a gender perspective is the spread of sexually transmitted infections (STIs) to rural areas by motorcycle taxi riders. Nyanzi *et al's* 2004 study in Uganda found that this highly mobile group had above average incomes and considerable opportunities to engage in paid casual sex when operating across urban-rural boundaries. These transactions can leave rural women and girls vulnerable from health and other perspectives.

3.6 Regulation

3.6.1 Regulatory Frameworks

The rapid growth of the motorcycle taxi industry has been possible due to a general lack of strong regulation governing it. In the majority of sub-Saharan African countries, adequate minimum standards of regulation do not exist. The rapid increase in motorcycle use in sub-Saharan Africa (WHO, 2015; Starkey, 2016a) has resulted in governments being slow to respond in terms of the adoption of minimum standards and road safety regulations, and a lack of resources often results in ineffective enforcement. Where standards do exist, such as the mandatory use of helmets by operators and restrictions on the number of passengers at any one time, ineffective enforcement means that these regulations are frequently ignored.

In Togo, specific regulations have been in place since 1996 for commercial motorcycle transport, making it a compulsory requirement for operators to have third party insurance, a vehicle registration certificate and a vehicle inspection certificate. Motorcycles have to be fitted with specific number plates, identification numbers must be displayed, the number of passengers per motorcycle taxi is restricted and helmet use is mandatory (Olvera *et al*, 2016). However, in this example from Togo, as with similar examples from across the continent, enforcement was ineffective.

In Tanzania, regulations requiring riders of motorcycle and three-wheeler taxis to apply for a road service licence came into force in 2011. Three years later only 23% of the total registered number of riders had been issued a licence (Bishop and Amos, 2015). In an attempt to strengthen enforcement of the regulations, attempts were then made to make it mandatory for each rider to be a member of a boda boda association so that responsibility for ensuring compliance could be devolved to association representatives. This too, however, has proved ineffective.

3.6.2 Motorcycle and Three-Wheeler Taxi Bans

Some countries, among them Ghana, South Africa and Zambia, as well as some regions of other countries, such as Adamawa and Borno States in northern Nigeria, have banned the use of motorcycles by fare-paying passengers. Similar bans are preventing motorcycle and three-wheeler taxis from entering certain areas of some cities, including Dar es Salaam in Tanzania and Abuja in Nigeria. Ezeibe *et al* (2017) describe this as effectively victimising informal transport providers via the implementation of “hostile urban policies”.

The rationale for motorcycle and three-wheeler taxi bans include association between motorcycle taxis and crime, and concerns about road traffic injuries. In Enugu, Nigeria, okada riders have been reported as having been linked to serious crime including robbery and even political killings (Atubi *et al*, 2009). In 2012, the Executive Director of the Ghanaian National Road Safety Commission (NRSC) described young men driving motorcycles as “an urban menace”. Bans have been implemented to prevent social and civil unrest and to reduce crash rates (Adamu, 2008). It has also been suggested that bans on motorcycle taxis have been implemented by those with powerful vested interests in conventional public transport services (*ibid*). In some contexts, bans may be politically motivated.

Motorcycle taxis offer an important source of income for many young people who would otherwise be unemployed (Atubi and Ali, 2009). As such, motorcycle taxi bans can have a negative impact on the earning potential of younger people, undermining their ability to support their immediate and extended families. This makes bans difficult to enforce. In Ghana, for example, the use of motorcycle taxis has been banned since 2014. Enforcement of legislation has been successful in limiting the use of motorcycle taxis in central urban locations, but not in peri-urban and rural areas where large

stands of okada riders are widely in evidence (Nelson, 2016). The authorities have often turned a blind eye to the operation of okadas in rural areas (Otteng-Ababio and Agyemang, 2015). Enforcement of the ban on the commercial use of motorcycles in rural areas is virtually non-existent since the operators are perceived to be bridging a much needed gap in transport services (Nelson, 2016). Stand-alone initiatives exist despite this ban where programmes have piloted three-wheelers in setting up an emergency transport scheme for pregnant women experiencing complications to reduce the transport related constraints to accessing maternal health services (Awoonor-Williams, 2014).

3.7 Road Safety in Project Countries

3.7.1 Road Crash Statistics

Globally, an estimated 1.25 million people were killed as a result of road traffic crashes in 2013, with a further 50 million seriously injured (WHO, 2015). Road traffic crashes are set to become the seventh leading cause of death by 2030 (WHO, 2017a), and already kill more young people aged 17-25 years than any other cause.

Globally, a quarter of all road traffic fatalities involve motorcycles or three-wheelers (WHO, 2017a). Riders do not benefit from being inside a 'protective shell' like users of most four-wheeled motorised vehicles, and this puts them at a higher risk of being injured or killed in a crash. Injuries sustained by motorcycle and three-wheeler riders tend to be more serious than those sustained by four-wheeled vehicle occupants, with common serious injuries including head injuries and injuries to the lower extremities including the pelvic region (*ibid*).

Despite having low levels of motorisation, Africa as a region had the highest fatality rate globally in 2013, with 26.6 deaths per 100,000 of the population (WHO, 2015). As motorisation continues to increase in Africa, in the absence of improvements in safety regulation, it is inevitable that fatalities and serious injuries will continue to rise.

WHO (2015) data show that riders and passengers of motorcycles and three-wheelers constitute only 7% of road deaths in Africa, although the report acknowledges the lack of reliable data in many countries. Where robust data exist, they show that the proportion of road deaths and injuries is increasing. Between 2014 and 2017, the proportion of Tanzania's total vehicle fleet that was made up of motorcycles rose from 46% to 54%. In the same period, motorcycle deaths rose from 13% to 22% of the total road deaths.

It is important to consider that while the number and proportion of motorcyclist deaths is increasing, so too is the human burden of road traffic crashes more generally. Pain, grief and suffering resulting from the loss of a loved one goes hand in hand with loss of a livelihood and can plunge a family into generations of poverty. Where victims of road traffic crashes survive, there are often medical expenses, long-term disability and loss of earnings to contend with (WHO, 2017a).

The involvement of motorised two- and three-wheelers in road traffic crashes in rural areas is usually not separately documented in national road crash statistics. In Tanzania, while crash data is not disaggregated by rural/urban roads, it is broken down into regions. Regions which are more predominantly urban rather than rural have a significantly higher number of crashes. This may be due to the presence of paved roads and greater numbers of vehicles travelling at higher speeds, although it is also likely that under-reporting is considerably higher in rural than urban areas, and hence the scale of the problem is unknown. Further research is needed to establish comparability between rural and urban crash data.

Data gathered from the project team's national experts is presented next for the four focus countries in this ReCAP study.

In **Ghana**, it was reported that 17.9% of all road deaths were of motorcyclists in 2015, a reduction of 9.2% from the year before (National Road Safety Commission, 2015). This is an interesting statistic suggesting a decline in deaths involving motorcycles, which differs from the trend seen elsewhere in the study focal countries. This may be in part due to the motorcycle taxi ban that was introduced in 2012. However, it may also be a reporting issue that needs further exploration. According to Afukaar and Peters (2017), motorcyclist deaths are the second highest of all road user deaths in Ghana.

Ghana's Building and Road Research Institute (BRRI) conducts research based on the country's official road traffic crash data, which is collected using an approved standard accident reporting format. Microcomputer Accident Analysis Package (iMAAP) software, developed by TRL in the UK, is used for data storage, retrieval and analysis. Road traffic crash data is available from 1991 to 2015. Analysis of the 2016 crash data is currently in progress. From 2011 to 2015 there were 8,656 motorcycle deaths and injuries combined in Ghana, of which 55.3% (n = 4,790) occurred in urban areas and 44.7% (n = 3,866) in non-urban areas (BRRI, 2016a). The data on non-urban crashes comprises both those occurring on major highways passing through rural areas and rural feeder roads, without being disaggregated.

Of the total motorcycle injuries, 19% (1,642) resulted in death. 634 of these deaths (38.6%) occurred in urban areas, and 1,008 (61.4%) occurred on the non-urban sections of the road network. Hence nearly twice as many motorcyclist fatalities occurred on the non-urban sections of the road network compared to the urban road network. Excessive speeding of motorcycles on the major highways and collisions with other larger motorised vehicles might be one explanation for the higher rates of fatalities on the major non-urban highways.

In **Kenya**, motorcycles account for 13.5% of road deaths (Rugut and Makori, 2015). At one hospital in Naivasha, 36% of patients in the emergency department were found to be motorcyclists who had been involved in a road traffic crash (WHO, 2012; cited in Rugut and Makori, 2015). A survey of 200 injured drivers in Thika town found that 33% were not wearing any protective equipment (Matheka *et al*, 2015) at the time that they sustained an injury. Negligence was the main cause of crashes (33%), followed by slippery roads (21%) and speeding (17.5%). In Kenya, motorcyclists are considered to have an especially poor safety record compared to other road user groups.

In **Tanzania**, between 2008 and 2014, over 700,000 new motorcycles were registered, with the number of new registrations per year increasing from around 45,000 in 2008 to 148,000 in 2014. The increase in the number of motorcycles coincided with the number of officially reported motorcycle deaths, increasing from 309 in 2008 to 1,098 in 2013, then reducing to 928 in 2014 (Tanzanian Traffic Police, 2015, cited in Bishop and Amos, 2015). Two studies in Tanzania reported that most motorcycle crashes (between 75% and 84%) that resulted in the injured motorcyclist being treated in a health facility occurred on tarmac or paved roads. One of these studies reported that higher traffic density on these roads contributed to the reported crashes (WHO, 2017a).

A study carried out by Amend (2015) found that over 70% of all injuries suffered on rural roads involve a motorcycle and that boda boda riders have a 69% chance of being injured in any given year. To put this figure into perspective, the probability of riders being injured is more than 37 times higher in Tanzania than a motorcyclist in the UK. Amend also found that motorcycles are by far the most common type of motorised vehicle using Tanzania's rural roads, in some areas accounting for up to 90% of the total. They noted that over 90% of crashes on rural roads involve motorcycles, that injuries suffered in crashes involving motorcycles on rural roads are more severe than those

involving other transport modes, that road user behaviour is the most common contributory factor in motorcycle crashes on rural roads, and that some element of road design and condition contributes to over half of all motorcycle crashes on rural roads (Amend, 2015).

In Kampala, **Uganda**, Odero (2009, cited in Rugut and Makori, 2015) reports that 50% of road crashes involve motorcyclists. Crash data involving motorcycles are available in the police annual crime and traffic road safety reports. In 2013 there was a reported 12.3% increase in road fatalities involving motorcyclists compared to 2012. According to police data, motorcyclists represented 21.8% of people killed by road crashes and motorcycle passengers represented 8.7% of those who were killed. Looking at those seriously injured, 23.4% were motorcyclists and 14.6% were passengers on a motorcycle (Uganda Police Force, 2013). According to the police annual crime and traffic safety report (2013), more men (79%) were victims of road crashes than women.

There is legislation in Uganda (Traffic and Road Safety Motorcycle Regulations) which stipulates that operators must possess a driving licence, a road worthiness certificate, and use and provide customers with protective helmets (MoWT, 2004). In practice, a large number of operators are not compliant with this legislation. In Uganda these regulations are enforced by the police and there are offences and penalties stipulated in the legislation. In reality, the police are constrained and tend to carry out occasional spot checks and often only after crashes occur.

3.8 Best Practices in Road Safety

3.8.1 UN Road Safety Pillars

The United Nations' Decade of Action for Road Safety specifies the following road safety pillars:

- Road safety management
- Safer roads and mobility
- Safer vehicles
- Safer road users
- Post-crash response

Current best practice in road safety adheres to a 'safe systems' approach. This philosophy recognises the frailty of the human body in the system and suggests that the system needs to be designed to take into account inevitable human error to reduce the risk of crashes and minimise the severity of those that do occur. The lack of a protective shell for the rider and passengers of motorised two- and three-wheeler vehicles therefore presents a significant risk to users of these modes of transport.

While human error is most frequently the main cause of motorcycle crashes, there are wider system elements that will determine both crash occurrence and severity. While it is relatively uncommon for the road itself to be the main cause of a crash, the road environment will often be the main determinant of whether a crash is slight or fatal. For example, a rider may lose control because they misjudge the speed at which a bend can be driven safely, but the injury outcome is often determined by what they hit when they leave the road.

The WHO (2017a) recognises the multidisciplinary solutions required to tackle motorcycle safety in an effective manner. It highlights the need to recognise crashes involving two- and three-wheelers as predictable and preventable. It also argues that resultant death and injury are not inevitable. The manual highlights key risk factors in three main groups:

- Rider risk factors: non-helmet use, alcohol use, excessive and inappropriate speed, rider's age and experience, braking errors, drug use, other risk taking (e.g. fast acceleration, zigzagging etc.), and lack of conspicuosity
- Road environment factors: traffic mix, design of infrastructure, road surface condition, roadside hazards
- Vehicle factors: Stability of vehicle (including maintenance issues) and lack of crash protection

3.8.2 Road Safety Management

It is critical that there is ownership of the issue of motorcycle and three-wheeler safety at a national level, with one agency adopting responsibility for meeting specific targets for these modes of transport. These targets can be overall crash numbers, severity levels and intermediate indicators (e.g. helmet wearing levels).

Another key road safety management activity is ensuring effective legislation is in place. In the case of two- and three-wheelers, legislation may include:

- Helmet and protective clothing legislation
- Training and licensing requirements (particularly for commercial operators)
- Roadworthiness and maintenance standards of vehicles
- Overloading – number of passengers/amount of goods carried

The collection and analysis of crash data is also critical to ensure that the problem is adequately understood, and interventions are directed at solving the real issues underpinning motorcycle and three-wheeler crashes. Furthermore, collection of crash data allows targets to be tracked and evaluation to be undertaken. Crash data needs also to be supplemented with data on intermediate indicators such as:

- Helmet wearing surveys
- Speed surveys
- Wearing of protective and reflective clothing
- Vehicle roadworthiness and maintenance surveys
- Number of passengers/amount of goods carried
- Rider's age and level of experience
- Training and licensing

Where motorcycles and three-wheelers are used widely as a form of public transport, regulation is a key tool to improving safety (WHO, 2017a). One study in Kenya reported that less than half of the motorcycle taxi operators interviewed knew of the required licence for riding a motorcycle, less than half had taken a driving test, and most did not know of any government legislation regulating their operations (Nasong'o, 2015). The same study found that operators typically speed, overload their bikes, and rarely use their headlights. 63% of the operators wore a reflective jacket and helmet. More than half had previously been involved in a crash, but most of these crashes had not been reported to the police.

3.8.3 Safer Roads and Mobility

The road itself can have an influence on both the likelihood and severity of two- and three-wheeler crashes (WHO, 2017a). The UN Decade of Action Global Plan (United Nations, 2011) recognises the

importance of improving the inherent safety of roads for motorcyclists, alongside other vulnerable road users such as pedestrians and pedal cyclists. The WHO (2017a) powered two and three wheeler (PTW) manual highlights four main risk factors for motorcycle safety relating to the road environment: traffic mix, design of infrastructure, road surface condition and roadside hazards.

Research by Chepngetich (2016) showed a significant statistical relationship ($p < 0.05$) between road structure and crashes in Bomet County, Kenya. The study found that crashes mostly occurred on footpaths and marram roads which have not been constructed well.

Due to a lack of protection provided by the vehicle, the motorcycle rider is more vulnerable to poor infrastructure safety standards than four-wheeled vehicle occupants. This is reflected in the International Roads Assessment Programme (iRAP) models, which highlight the fact that the risk factors for motorcyclists are much greater than those for vehicle occupants. In the iRAP models, motorcyclists are particularly vulnerable to high operating speeds, roadside obstacles (including some designed to protect vehicle occupants), lack of median separation, poor road surface condition, inadequate alignment, excessive use of road markings and poor junction design.

The WHO manual similarly identifies specific design elements that result in poor outcomes for motorcycles and three-wheelers including: lane and shoulder width, surface friction, curve type and radius, horizontal and vertical sight distances and turning provision. Traffic calming measures such as speed humps do not take into account the detrimental impact they can have on the safe operation of motorcycles and three-wheelers. Uneven road surfaces, deterioration in the road including potholes, unpaved curbs, manhole covers, bumps, drainage, spillages, poor road markings and debris are road surface factors that have been shown to increase the risk of crashes.

Various guidelines have been written to improve motorcycling safety, such as the Institute of Highway Incorporated Engineers (IHIE) guidelines to improve safety for two- and three-wheelers through engineering and integration. While these are thorough, good quality documents, their applicability in rural Africa may be limited. More relevant to the rural African situation are the African Development Bank's (AfDB) Road Safety Manuals that introduce a pragmatic approach to Road Safety Audit (of new roads and schemes) (AfDB, 2014b) and Road Safety Inspection (the review of the safety of existing roads) (AfDB, 2014a). The manuals specifically mention the importance of motorcycle safety, and encourage road safety engineering practitioners to take the perspective of the motorcycle rider when undertaking their assessments.

The DFID-funded programme Improving Rural Access in Tanzania (IRAT) included the development of advice on how District Engineers can improve motorcycle safety on low volume rural roads (Bishop, 2017). The advice includes:

- Ensure all roads are wide enough for a motorcycle to pass a four-wheeled vehicle safely
- Provide a safe riding surface
- Give special consideration to the use of parallel concrete strips as they create serious safety concerns for motorcycles
- Ensure the surrounding environment is 'forgiving'
- Encourage the use of appropriate speeds
- Provide signs to warn of hazards and restrictions

3.8.4 Safer Vehicles

Safer vehicles can be achieved through the application of high safety standards for imported or manufactured vehicles, roadworthiness inspections and proper maintenance. WHO (2017a) states

that the stability of motorcycles depends on travel speed and on there being sufficient grip (friction) between the tyres and the road surface. The quality and grip provided by tyres is therefore critical to maintaining stability. Although there is limited empirical evidence regarding roadworthiness for two- and three-wheelers and its contribution to crashes, mechanical defects of other motorised vehicles contribute to crashes (*ibid*). In low and middle income countries there is widespread illegal modification of powered-two-wheelers into three wheel vehicles in order to carry passengers or goods.

It has been noted by the experts involved in this ReCAP research that some new motorcycles imported into Tanzania are fitted with aluminium advertising plates riveted facing sideways to the front mudguard. One such example is the SanLG 125, as seen in the following image. This plate can act as a knife blade in the event of a collision with a pedestrian and cause horrific injuries beyond the severity of the collision itself. Previously, the UK discontinued the requirement in 1975 for a front number plate fitted in this same manner on a motorcycle for this very reason. These front number plates gained the moniker ‘pedestrian slicer’ (Figure 1).



Figure 1: The ‘pedestrian slicer’

In Ghana according to the 2012 road traffic regulations (specifically LI 2180), all vehicles (including motorcycles and three-wheelers) are required to undergo regular tests to ensure that they are fit for use.

Tanzania developed the Road Traffic (Periodical Mandatory Vehicle Inspection) Regulations in 2014. Under these Regulations, all vehicles including motorcycles and tricycles are required to undergo periodic inspection. However, due to lack of facilities and funding, the legislation has not been implemented.

In Uganda, the Ministry of Works and Transport awarded outsourced vehicle inspection to the SGS Group under *Safe Drive Uganda*, a road safety initiative intended to ensure roadworthiness and reduce death and injury on Ugandan roads. Vehicle maintenance remains the responsibility of the vehicle owner and the Ugandan police carry out periodic spot checks in an effort to improve vehicle roadworthiness.

3.8.5 Safer Road Users

Rider behaviour in the use of motorcycles and motorised three-wheelers is a key determinant in road crashes. Their small size, the lack of protection, and having only two or three wheels in contact with the ground, makes them more susceptible to loss of control and puts their riders and passengers at greater risk of serious injury. Their small size also allows them to pass between traffic. This is a reason for their popularity, but also encourages dangerous driving. Examples of dangerous behaviour related to motorcycles and motorised tricycles are commonplace in Tanzania (Bishop and Amos, 2015). These include:

- Driving at speeds inappropriate for the surrounding conditions
- Dangerous overtaking and undertaking
- 'Jumping' red traffic lights
- Driving on pedestrian footpaths
- Driving on the wrong side of the road
- Carrying more than the recommended number of passengers
- Carrying dangerous and unsecured loads
- Failure to use safety equipment such as indicators, helmets and protective clothing
- Failure to use lights at night
- Turning off the engine and coasting downhill
- Using mobile phones while driving
- Drink- and drug-driving

Tumwesigye *et al* (2016) note that many factors contribute to motorcycle rider injuries. These include the young age of many riders, being under the influence of alcohol, riding a motorcycle with a low engine capacity, limited riding experience and the length of a working day.

The WHO (2017a) noted key risk factors for motorcycle traffic injury as:

- Non-use of helmets
- Use of alcohol and drugs
- Speeding, traffic mix
- Roadside hazards
- Vehicle stability
- Braking errors

According to the WHO (2017), road safety interventions that target all road users form the basis of successful road safety management in high-income countries. These include registration and licensing systems, and strict enforcement – with penalties – of road safety laws. In some low- and middle-income countries most two- and three-wheelers are not registered, and studies show that riders who are unlicensed tend to be involved in crashes more than those who are licensed.

Research that investigated commercial motorcycle riders' perceptions of risk and road safety in urban Nigeria identified three key contributing factors. Risk-taking was perceived as generally acceptable; risk-taking was perceived to be an intrinsic part of this particular occupation; risk-taking was seen as a way to make ends meet. The study suggested that there is a need for adequate regulation as regards training and licensing of riders in order to shift these perceptions (Karau, 2015).

Much of the road safety literature relating to motorcycles focuses on use of helmets. Wearing a crash helmet is an obvious factor in reducing injury and death. The literature highlights the need for effective, consistent and proper use of crash helmets. The need for legislation mandating the wearing of appropriate helmets by all riders of motorcycles is obvious. Passmore *et al* (2010) identified the key contributions to the successful implementation of helmet legislation. These included the need for the highest level of political support, unequivocal legislation requiring all riders and passengers to wear helmets on all roads at all times, and stringent and consistent enforcement with substantial increases in fines applied to offenders.

This is all in line with the UN's Global Plan for the Decade of Action for Road Safety (United Nations, 2011): Activity 4, to set and seek compliance with laws and evidence-based standards and rules for motorcycle helmets to reduce head-injuries. According to the WHO (2017b) wearing a motorcycle helmet can reduce the risk of death by almost 40% and the risk of severe injury by approximately 70%. Effective enforcement of motorcycle helmet laws can increase helmet-wearing rates and thereby reduce head injuries (WHO, 2017b).

However, not wearing a helmet is commonplace in many countries in sub-Saharan Africa. In Ghana, one study showed that only 42% of riders and about 17% of all motorcycle pillion riders (passengers) used crash helmets, but this fell to 37.3% and 13.7% respectively if the criteria involved wearing a helmet and having a chin strap fastened (Ackaah and Afukaar, 2010). In Uganda, Roehler *et al* (2013) found that 30.8% of riders and less than 1% of passengers wore helmets. Nguyen *et al* (2016) found that while 73.3% of surveyed riders in Moshi, Tanzania consistently wore helmets, 82.5% of the helmets observed were either damaged or did not fit the rider properly.

In Ghana, no specific helmet wearing rate has been set as a national target. Use of crash helmets is mandatory for both rider and passengers according to the Road Traffic Act 2004. Helmet use is influenced by factors including climatic conditions and the time of day, among others. With reference to one particular study in Tamale (Duku, 2010) the majority of riders within the central business district used helmets, while few used them on the outskirts of town. Use of helmets in southern Ghana was seen to be relatively high compared to northern Ghana. Helmet wearing by riders and passengers in Ghana is generally low. Higher helmet wearing rates are associated with riders and passengers in the Greater Accra region in the south compared to the northern parts of the country (BRRI, 2016b). This could be attributed to high level of awareness of the safety implications of not using helmets in the south as compared to the north (Ablin Consult, 2010). In one study, speed measurements of all categories of vehicles were carried out in two rural settlement areas along a major highway in Ghana (Derry *et al*, 2007). Over 95% of the vehicles travelling at the sites exceeded the posted speed limit of 50 km/h for the settlement areas. Most of the vehicles were through-traffic passing through the localities. Excessive speeding of motorised vehicles is a crucial contributory factor to the high incidence of road traffic injuries and deaths in countries like Ghana (Afukaar and Peters, 2017).

A recent study in Ghana indicated factors facilitating helmet use to be a feeling of protection (62%), awareness that it is mandatory (20%) and presence of police (15%). Discouraging factors included the perception that usage disturbs head and hearing ability (63%) and long distance trips (54%) (Seidu *et al*, 2017).

A study conducted in Nandi County, Kenya, established possible risk factors associated with motorcycle use and safety. During the study, 80% of motorcyclists wore helmets and 21% wore reflective clothing. However, only 1.3% of passengers wore helmets. No passenger was observed to wear reflective clothing.

The WHO (2017a) Manual presents a case study on setting helmet standards in Kenya. The Kenyan Road Traffic Act requires motorcycle riders and their passengers to wear helmets that meet a national standard. Rather than articulating the standard itself, the law makes reference to a standard set out in a separate legal text by the Kenyan Board of Standards (KEBS), established in 1974 as the body in charge of testing, approving, stamping and monitoring a variety of products. While the helmet legislation in the Road Traffic Act may remain constant over the years, the way it is written allows the standard to be modified and updated without the need to change the legislation. In 2012, the Kenya Board of Standards/Vehicles Technical Committee (TC122) finalised a revision to the national helmet standard (KS77). Although the law is in place and the standard approved, in order for the standard to be put into effect it needs to be “published” by regulation and gazetted by the Minister of Transport. A 2014 study commissioned through the Bloomberg Initiative for Global Road Safety in Kenya into the availability and access to helmets meeting the new standard found that such helmets were largely unavailable on the Kenyan market. To date, the new standard is yet to be gazetted by the Ministry of Transport, allowing implementation of the standard and enforcement of the related law to be delayed until standard helmets are more widely available.

A report by Chalya *et al* (2014) found that helmet use in Tanzania was significantly associated with shorter periods of hospitalisation and reduced mortality, while Almeida *et al* (2016) observed that in Brazil, full face helmets had greater oral and maxillofacial (jaw and face) region protection than open faced helmets. Consistent use of crash helmets was identified by Mwakapasa (2011) as a challenge amongst many riders (67.6%) in Tanzania, who chose not to wear the helmet they carried for short journeys or journeys where they did not expect to meet a police officer.

In Uganda, there is a national motorcycle helmet law which applies to riders and passengers, but no helmet standard has been mandated. Enforcement of this law is still worryingly low scoring one out of a possible ten (WHO, 2013). The helmet law is commonly broken with riders and passengers citing heat, or the possibility of getting lice or an infection, as reasons for non-compliance. Political interference has also been cited as one of the factors affecting the implementation of road safety laws.

As well as literature on helmets, there is also literature that provides recommendations for enhanced rider education and training. According to the WHO (2017a) the introduction of compulsory training and a skills test to obtain a motorcycle permit or licence has been shown to be an effective intervention in two- and three-wheeler safety.

A study into the effect of motorcycle rider education in Thailand on risk behaviour and injuries found that injury rates were significantly lower two years after an education intervention when comparing intervention and control populations.

In Ghana there are no training schools for motorcycle riders (Ablin Consult, 2010). Studies indicate that most of the motorcycle riders lack formal training. They either learned to ride through family, friends or self-tuition. The majority of these riders do not possess valid licences (Nelson, 2016). Training has been limited to initiatives such as collaboration between the DVLA, the National Road Safety Commission (NRSC) and the Motor Traffic and Transport Directorate (MTTD) to train riders of motorcycles and three-wheelers before issuing licences. Riders of motorcycles are required by law to hold a Class A licence which permits them to operate such vehicles.

A study in Kenya (Nasong’o, 2015) looked at the compliance of motorcycle public transport services with Road Safety Regulations in Kitale Municipality. The study found that over 80% of riders acquired riding skills informally from their fellow operators, and less than half were tested by traffic police and issued with licences. A study on causes and trends of public transport motorcycle crashes in

Bungoma County, Kenya found that human error was the leading cause of the crashes. The authors proposed that motorcycle savings and credit cooperatives (SACCOS) for voluntary enforcement and pooling of resources, and also to aid riders in case of injuries and death, should be explored and pursued (Singoro *et al*, 2016).

In Tanzania, motorcycle and three-wheeler rider training for both personal and commercial use is provided by very few training institutions. However, under the provisions of the Tanzanian Road Traffic Act, it is stated that a person applying for a driving licence of any class is required to attend theoretical and practical instruction at a registered driving school, and that this training should be conducted by a certified driving instructor. The Road Traffic Act section 19.-(1) states clearly that "No person shall drive any class of motor vehicle, on a road, unless he is the holder of a valid driving licence issued to him in respect of such class of motor vehicle." In spite of the Act, many motorcycle riders in rural areas operate without a driving licence or with an expired driving licence.

In Tanzania, Transaid (2015b) found that the majority of driver training schools do not offer any motorcycle training. Of those that do, the majority only offer classroom-based theory training as opposed to practical training or any training specific to carrying passengers. Transaid found that most driving schools are located in major urban centres. With minimal enforcement ability in rural areas, there is little demand for training and licensing, meaning that riders have to travel for many miles to urban centres to receive training which is often undesirable as it means missing valuable days of work.

In Uganda, training is available for riders but it is principally carried out as part of projects. Amanyire and Kasiima (2017) notes that motorcycles used as a means of public transport are ridden by untrained or 'ill-trained' riders. Motorcycle rider training schools are practically non-existent and motorcycle riders do not receive any rider training (Zanule, 2015). The Inspectorate of Vehicles is mandated to test learner drivers and riders (Uganda Police Force, 2013). However, the majority of the riders do not go through a driving school to get training and therefore lack the required competence (Kwamusi, 2002). A few driving schools do offer formal training, including the Uganda Driving Standards Agency (UDSA). There are some organisations such as the Uganda Red Cross Society and Vivo Energy which have trained small numbers of motorcycle riders. In 2014, Vivo trained a total of 1,200 boda boda operators on road safety behaviour.

The Uganda Police Force (UPF) is responsible for enforcing laws related to road traffic and safety through its directorate of traffic and road safety. However, they often only carry out spot checks, leaving the operational behaviour of the commercial motorcyclists to be enforced mainly by the associations to which the motorcycle riders belong. Several projects have conducted education campaigns about road safety. For example, the Uganda Vaccine Helmet initiative, Uganda injury Control Centre (now closed) and SafeBoda.

These issues are not exclusive to the four countries included in this project. According to Sanusi and Emmelin (2015), in Nigeria over 90% of commercial motorcyclists are not formally trained and do not have the required licence to ride, which contributes significantly to the high incidence of traffic injuries among this group.

In a study in Tudun-Wada Zaria, Nigeria, Sufiyan and Ahmad (2012) considered knowledge, attitude and compliance among commercial motorcyclists. They proposed a range of strategies to reduce motorcycle crashes. These included:

- The training of motorcycle riders
- Observing speed limits

- Improved roads
- Not driving while under the influence of drugs/ alcohol
- Not carrying more than one passenger
- Improved enforcement by police
- Proper motorcycle maintenance
- Wearing protective clothes/ helmets/ boots
- Wearing reflective jackets
- Not driving while tired.

In some African countries, attempts have been made to improve motorcycle and three-wheeler safety through the associations or unions of riders. Riders are required to join associations, and to adhere to their rules, which may include, for example, using helmets and carrying only one passenger. However, documented success in improving safety through the associations and unions is limited.

In Uganda, these unions are organised by the operators themselves and they control the market. Each district has an association. In Kampala, for example, the National Federation for Boda Boda Operators (NAFEBO) was set up in 2000. This national federation largely focuses its influence among riders in Kampala, although there are 30 branches nationwide. The unions are powerful organisations with over 70,000 members in Kampala alone. While there is no formal entry control, the unions effectively control the market and deny entry to non-members. The unions' income depends on the number of motorcycles affiliated to them and this acts as an incentive to restrict entry into the market for non-members. Each rider must pay a fee in return for a right to operate. The role of unions beyond granting access to the market is limited, however the unions are representative bodies for riders with substantial political clout (Kumar, 2011). Members of the associations pay an annual entry fee in the range UGX 6-10,000¹. The association represents them in cases of harassment by security personnel, traces members in cases of theft, or their relatives if there is an accident, and through their 'stage committees' enforce discipline and hygiene through fines, suspension of membership and the right to operate, and other sanctions. In some cases, the association also plays a savings and credit role for members although Howe (2002) reports there being a history of instability associated with the unions that most operators belong to, with recurrent takeovers, financial mismanagement and organisational collapse.

In Tanzania, it has been noted by Transaid and Amend that regulation of motorcycle taxis and three-wheelers may present opportunities to improve safety, for example related to helmet-wearing and numbers of passengers carried. Regulations set at a national level have the potential to encourage and enable associations, drivers and owners to self-regulate, for example through associations requiring all members to wear helmets and provide helmets for their passengers.

3.8.6 Post-Crash Response

The chances of survival of road crash victims is much improved if the patient arrives at the correct hospital (one with appropriate equipment and clinicians with trauma skills) for treatment within the 'golden hour' after a crash has occurred. As well as the golden hour, there is also the 'platinum ten': the first 10 minutes after a crash where key emergency services need to reach a badly injured casualty (such as those unconscious and trapped) to improve their chances of survival. Once a casualty has arrived at hospital they may need complex treatment and long term rehabilitation (Vanderschuren and McKune, 2015).

¹ At the time of the study in 2002, UGX 6,000 was equal to approximately GBP2.40 (xe.com).

In Uganda, there is limited formalised post-crash response, with no vital registration system, no emergency room-based injury surveillance system, and no emergency access telephone number. The road traffic and safety department of the police does, however, have a traffic command centre and toll-free lines which are used to respond to crashes (Uganda Police Force, 2013). Transport for people in an emergency is a challenge. Less than 10% of the seriously injured are transported by ambulance. There is no pre-hospital emergency service to help improve the transit to hospital and no emergency medical training for doctors and nurses (WHO, 2015). For those who reach hospitals, this has led to poor outcomes, especially those experiencing serious injuries as a result of a road traffic crash (Kobusingye *et al*, 2002).

One study in Uganda found that road traffic crashes contributed 51% (n=470) of all trauma patients seen. Of the patients admitted after road traffic crashes, 73% were due to boda boda crashes (n=344) (Kigera and Naddumba, 2010). Of the patients admitted; one-third arrived more than one hour after injury and the average time for arrival of those who died was 45 minutes.

According to the WHO (2017), there is evidence that in comparison to urban areas, traffic crashes in rural areas may have a two to three times' higher fatality rate, even after controlling for injury severity. There are indications that the time it takes to receive medical care may be a contributing factor to this.

The starting point for effective post-crash response is a clear national health strategy that specifically tackles road traffic crashes and sets clear roles and responsibilities of emergency services and health care providers. As for all road traffic victims, improved survivability and reduction in the level of injury for riders of two- and three wheelers can be achieved through the smooth operation of the emergency care chain.

Specific training relating to first aid for motorcycle casualties is needed. It is important for anyone administering first aid to a motorcyclist after a crash that the helmet is only removed if the rider has stopped breathing and resuscitation is required. Removing a helmet can exacerbate any spinal injury that the rider may have suffered and could lead to paralysis or death. The WHO (2017) manual suggests that while general pre-hospital care standards, such as a quick response time and the application of uniform treatment protocols, are shown to be effective for minimising the risk of severe injury and death associated with road crashes, two interventions specific to two- and three-wheelers have been shown as promising: on-site helmet removal and on-site application of a cervical collar brace to the injured individual(s).

The WHO (2017a) also presents two important tables that consider the existing evidence and suggest measures and interventions that are likely to improve the safety of motorcycles and three-wheelers:

Table 3.1 Key measures and specific interventions for improved PTW safety

Key measures	Specific interventions	Effectiveness		
		Proven	Promising	Insufficient evidence
Safer roads and mobility	Exclusive motorcycle lanes	Proven		
	Protected turn lanes and widened shoulders or lanes		Promising	
	Removal of roadside hazards		Promising	
	Speed limiters and traffic calming structures		Promising	
	Improving road surface conditions		Promising	
	Modifying the composition of roadside barrier building material			Insufficient evidence
Safer vehicles	Antilock brake systems (ABS)	Proven		
	Headlights at night		Promising	
	Daytime running headlights		Promising	
	Configuration to enhance stability			Insufficient evidence
	Airbags for motorcycles			Insufficient evidence
	Intelligent transport systems			Insufficient evidence
	Brake lights			Insufficient evidence
Safer road users	<i>Setting and enforcing legislation</i>			
	Mandatory helmets	Proven		
	Helmet standards	Proven		
	Strengthening penalties	Proven		
	Demerit point system		Promising	
	<i>Wearing reflective and protective clothing</i>			
	Reflective clothing use		Promising	
	Protective clothing use		Promising	
	Thermal resistant shields			Insufficient evidence
	<i>Regulating and licensing PTWs</i>			
	Mandatory registration of vehicles and licensing of PTW operators	Proven		
	Graduated licensing system		Promising	
	Age restrictions for children riding or as passengers on PTWs			Insufficient evidence
	Restriction on multiple pillion passengers			Insufficient evidence
	Periodic inspection for mechanical defects			Insufficient evidence
	Minimum height for pillion passengers			Insufficient evidence
	Smaller engine size for learner riders			Insufficient evidence
	<i>Training</i>			
	Compulsory skill test for motorcycle permit	Proven		
	Post-licence training			Insufficient evidence
Post-crash response	On-site helmet/collar brace removal		Promising	

Key measures and interventions for improved safety (WHO, 2017a)

Table 3.3 General road safety measures and specific interventions that could improve PTW safety

Key measures	Specific interventions	Effectiveness		
		Proven	Promising	Insufficient evidence
Minimizing exposure to high-risk scenarios	Expanding public transport	■		
	Setting and enforcing speed limits	■		
Modifying PTW use behaviour	Setting and enforcing alcohol impairment legislation (randomized breath testing)	■		
	Prohibiting mobile phone use while driving/riding			■
	Social marketing	■		
	Introduction of uniform treatment protocol		■	
Improving post-crash medical care and response times	Quick response time		■	
	Offer early rehabilitation	■		
	First aid training			■
	Mandatory health insurance			■
				■

General measures and interventions for improved safety (WHO, 2017a)

3.9 Innovation

The increase in use of motorcycles and three-wheelers as a means of public transport in sub-Saharan Africa was initially an innovation in itself, making use of a transport mode originally intended for private use only. It was an innovation that arose to meet the growing needs of populations to access services in the context of the collapse of many of the state run public transportation agencies and limited regulation of private sector public transport providers (Olvera *et al*, 2012).

While this phenomenon initially grew to service the needs of urban populations, motorcycle taxis have since become a vital means of influencing greater mobility in rural areas through the ability to provide bespoke door-to-door services in areas without all-weather road infrastructure. This section will examine how some of the issues introduced in previous sections are being addressed through innovation.

3.9.1 Innovations in Affordability

In an environment where motorcycle taxis and three-wheelers constitute an informal means of public transport and where little regulation exists, operators are free to set their own prices at will, which is particularly the case in low density rural areas where competition is limited. Therefore, affordability is a key challenge for people living in rural areas. As part of an integrated health programme in Uganda, Transaid (2015a) found that boda boda operators employed exploitative pricing strategies for health emergencies where patients were charged up to twice the usual price for a particular journey.

Incentivising motorcycle taxi operators to address issues of affordability in a rural context is challenging. Innovations in this area usually take place within individual projects. In one such project, to increase access to maternal health care services in Uganda, boda boda operators were

incentivised to reduce their prices for pregnant women in return for the community-wide promotion of participating operators' services. The aim was to increase demand for their services and hence increase their household income. Qualitative surveys indicated that this was achieved in most cases. Costs for pregnant women reduced by up to 41.6% as a result of this intervention (Transaid, 2015a). Also in Uganda, Pariyo *et al* (2011) describes a transport voucher scheme where boda boda operators were reimbursed by programme funders for journeys made by pregnant women and resulted in an increased uptake of health care services due to improved access to transport.

3.9.2 Innovations in Access and Utilisation

Motorcycle taxis are in general meeting the mobility demands of transport users whose needs are not met by other modes of transport. Motorcycle taxis' unique selling points are their ability to reach areas where no roads exist and the bespoke nature of the door-to-door service they provide. In so doing, motorcycle taxis contribute to greater access to transport for hard to reach communities. The door-to-door service offered by motorcycle taxis is potentially transformative for elderly or infirm passengers in terms of their ability to access health services.

However, many two and three-wheeler motorised vehicles do present a challenge where comfort is an issue (Porter *et al*, 2013). Innovations in design have attempted to address this, such as the development of the highly-regarded eRanger which was designed to strengthen health referral systems. These motorcycle ambulances have been used in Afghanistan, Ethiopia, Kenya, Liberia, Malawi and South Sudan amongst other countries (Norman, 2012). In addition, local manufacturers such as Zambikes and Developing Technologies in Zambia, and Pulse in Uganda have developed ambulance stretcher trailers which can be easily attached to motorcycles specifically targeting the elderly and infirm who may find it difficult to travel using conventional two- or three-wheelers (Transaid, 2015a).

In a bid to improve health outcomes by improving access to health centres, the Tanzania Rural Health Movement has trained local boda boda riders to become first responders in rural areas. The use of Beacon software offers them an SMS message-based system whereby text messages are sent from the scene of the emergency, at which point first responders are dispatched (Hingi *et al*, 2016). This initiative fills a gap in contexts where conventional dispatching technologies are not affordable. As highlighted earlier, the proliferation of mobile phones in rural and urban areas in sub-Saharan Africa is important in the effort to increase access to essential health (and other) services.

Motorcycle taxi riders have been able to build strong customer bases thanks to the widespread nature of mobile phone ownership. In a study in Kibaha District, Tanzania, all except one boda boda operator owned a phone, and most riders reported having the telephone numbers of previous clients stored on their devices (Porter *et al*, 2015). While smart phones and internet access remain limited in rural areas, the potential for further innovation is being demonstrated in an urban context in offering operators new ways to attract business. Specific initiatives aimed at broadening the range of users through ride-hailing smartphone applications are already well established in some urban areas. SafeBoda in Uganda is making use of mobile technology which gives users the means to arrange transport via a software application, as well as making payments in the same way (Nesbitt-Ahmed and Fraser, 2017). Making payment up front also has the potential to reduce exploitative pricing and also the need to carry cash. Whilst initiatives such as this potentially widen the appeal of this means of transport there is some way to go before their adoption is possible in a rural context.

3.9.3 Innovations in Ownership and Profitability

The availability of relatively low-cost Chinese or Indian manufactured motorcycles and the potential return on investment has led to owners purchasing a number of vehicles and then placing them in

the hands of operators who pay a rental fee. The motorcycle taxi industry provides an income to a great many young male riders in a context where sourcing formal employment is challenging.

Low levels of ownership, where operators pay a daily or weekly fixed rate fee to the owner, and then keep the balance, encourages long hours and high speeds contributing to higher road traffic incident rates (Porter, 2016). The potential benefits of increasing the number of owner-operators are widespread and could lead to a significant increase in safe operator behaviour. *Tugende* in Uganda and *Kiva* in Kenya are both initiatives that offer access to credit for people wanting to own their own motorcycle taxis via a hire purchase scheme (Shell Foundation, 2012). With a schedule of affordable down-payments, boda boda operators contribute a portion of their income and are able to purchase their motorcycles within two years. Tugende's motorcycles are fitted with tracking software to manage the risk of supplying credit to applicants. To date, 900 Tugende beneficiaries have fully paid off the cost of their vehicles, with a further 2,000 currently in the process of doing so. Initiatives such as this have the potential to favourably alter the uptake of motorcycle taxi and three wheeler transport services by women, particularly if they proactively target women as potential beneficiaries.

While female motorcycle taxi riders can be found in northern Uganda, they are still significantly under-represented in other countries. Initiatives such as Tugende and Kiva have the potential to actively promote a pro-female approach to the operation of motorcycle taxis in an attempt to correct the gender imbalance within the industry. This approach could go some way to addressing what studies have shown to be primary concerns for female passengers, which include a lack of professionalism on the part of the boda boda riders, and concerns for safety and security (Howe, 2003). An interesting parallel is that in Delhi, India, the police force has introduced all female motorcycle squads to tackle the rising incidence of harassment against women and girls (Dhillon, 2017).

Some innovative initiatives are currently trying to address the gender imbalance in the motorcycle taxi and related industries. A social enterprise called *Pikilily* operating in Mwanza, Tanzania, runs a community-orientated motorcycle workshop staffed mainly by women offering repair services and road safety and maintenance training. This workshop is also refurbishing motorcycle ambulances, and women from the workshop will operate the ambulances as a means of emergency transport.

3.9.4 Innovations in Personal Security Innovations

The reputation of urban boda boda riders in Tanzania is such that there have been instances where other road users have employed tactics to intimidate riders and in some cases have purposefully knocked them down. *Mwananchi*, a national newspaper, reported in 2015 that in response, riders belonging to a particular *stand* or group often nominate other riders as de facto boda boda 'police'. If an incident occurs, the boda boda police will quickly travel to the scene to gather information to report to the police and to ensure action is taken for the wellbeing of their colleague.

A concern which is often reported in rural areas by operators of motorcycle and three-wheeler taxis is regarding the potential threat of theft, particularly at night. To minimise this, operators have been reported to travel in groups of two or more after dark (Transaid, 2015a).

Emerging technologies which allow payment via mobile phones have the potential to reduce the security threat, as operators carry less cash on their person. The *Twende* app which is supported by the mobile phone network Tigo in Tanzania uses the *Tigopesa* system of payment whereby money is transferred to the operator's account (Mcdubus, 2017). This method of payment is limited to Dar es Salaam at present.

3.9.5 Innovations in Road Safety

Wherever motorcycle and three-wheeler taxis are a major means of public transportation in sub-Saharan Africa, it is common to hear anecdotes about hospital wards devoted solely to dealing with the consequences of motorcycle-related road traffic crashes. While these vehicles play a key role in urban and rural mobility, the current inadequate safety standards must be improved.

SafeBoda in Uganda provides an option to citizens concerned about the safety of travelling by boda boda in the form of a smartphone application. The organisation has recruited more than 1,000 riders, each of whom adhere to a strict code of conduct which pledges that riders will obey local traffic regulations and will ensure that their motorcycle is properly maintained. In addition, each rider is required to undergo road safety training and is obliged to wear a high visibility vest. As well as having to wear a helmet, riders must also carry one for their passengers. The initiative generates revenue by taking 15% of each passenger fare that was booked via their ride-hailing 'app' (Rosen, 2017).

Emerging technologies are providing another means of self-regulation through customer rating of motorcycle taxi operators. This mechanism is available on many of the software applications that have been developed as ride-hailing services in Kenya, Tanzania and Uganda. Whilst uptake of the use of mobile technology to order transport is, to date, limited, future developers foresee this method as a means of passengers being able to rate drivers and choose riders according to the ratings they are given.

In relation to low helmet use, Sumner *et al* (2014) carried out a study in Tanzania whereby free helmets and reflective clothing were distributed to a group of boda boda riders to investigate uptake of this safety equipment. However, the findings showed an insignificant increase in the adoption of these items compared with a control sample. The riders reported candidly that uptake of the safety equipment was unlikely to occur unless levels of effective enforcement increased, a conclusion shared by other studies (Mwakapesa, 2011; Roehler, 2013). The Helmet Vaccine Initiative, which works in Tanzania and Uganda continues to campaign to raise public awareness and advocate to governments for more effective enforcement. In Tanzania, HVI has investigated establishing a factory to manufacture helmets locally, although this has not yet borne fruit.

3.9.6 Innovations in Legislation and Regulation

Until recently 'tolerated' by the authorities, the motorcycle taxi sector is now often criticised by governments, other public transport providers and the general public. What is becoming increasingly clear is that a continuation of laissez-faire or ad hoc regulatory control is inappropriate in the face of increasing concern over the safety record of motorcycle taxis. However, it is also important that any increase in regulation takes into account the mobility needs of less privileged users.

As highlighted earlier in this report, there has been mixed success in terms of the introduction of new legislation. Kigali, Rwanda, is perhaps the best example of effective regulation of the motorcycle taxi sector in Africa. It is mandatory for *moto taxi* riders to be a member of one or two associations. The associations act as intermediaries between motorcyclists and banks and between motorcyclists and motorcycle owners, facilitating the purchase of motorcycles. The associations operate driving schools, and offer credit to members and perform various other development functions (Rollason, 2012).

The associations are responsible for the security of the motorcycle taxi sector in Kigali. Until recently, the sector was widely viewed as lawless and dangerous. Robbery, theft and violent crime were common, with motorcyclists as both victims and perpetrators. There were large numbers of

unauthorised and in many cases unlicensed riders. At least since 2008, the two associations have made great efforts to improve this situation, through tougher licensing rules, the use of numbered gilets for registered riders and other measures. In 2012, the associations launched a joint security branch with uniformed security guards patrolling the city to check motorcyclists for infringements. This has been accompanied by the development of a database recording details of all registered motorcycle taxis in Kigali, as well as their owners and riders. Motorcyclists agree with the leadership of both organisations that their physical security has markedly improved over recent years (*ibid*).

Successful regulation has also been noted in Cotonou, Benin. The regulation of *zemidjan* operators now means that it is mandatory for operators to register their vehicles, wear yellow vests with their registration numbers printed and visible on them, wear helmets and pay a monthly operating tax to municipal authorities (Godard, 2013). Yet despite efforts in many other countries in sub-Saharan Africa, this level of effective regulation is uncommon.

Elsewhere, however, attempts to improve regulation have not been successful. In Uganda, measures taken to mandate motorcycle riders to carry two helmets and reflective jackets were reversed in the face of opposition from operators and owners. In 2004, President Museveni repealed legislation to regulate the sector, in the face of much hostility (Goodfellow and Titeca, 2012).

In the absence of strong legislation and regulation, innovations have focused on developing mechanisms for self-regulation. The formation of voluntary associations is one such mechanism. While in urban areas the growth of motorcycle and three-wheeler taxi associations is largely seen as politically motivated, associations in rural areas often take the form of a self-help mechanism (Starkey, 2016b). Rural associations are often known to compensate riders during absenteeism due to work related injuries. In addition, membership of associations can also be a means for riders to access credit with the associations acting as guarantors (*ibid*).

As mentioned above, some countries operate localised bans preventing the use of motorcycle and three-wheeler taxis in certain parts of large cities such as Abuja, Dar es Salaam and Monrovia. An interesting way of circumventing the ban on three-wheeler taxis, locally known as '*bajaji*', has emerged in Dar es Salaam. When *bajaji* were first introduced to Tanzania, they were almost exclusively used by people with physical disabilities, and different regulations are applied to these people than able-bodied people. As a result, disabled *bajaji* riders have managed to establish themselves as the only operators in central Dar es Salaam (Barber personal communication, November 2017).

With no minimum standards for the use of motorcycle and three-wheeler taxis in most countries in sub-Saharan Africa, there is little demand for formal driver training by operators of these vehicles. In Tanzania the training that is available is largely theory-based (Transaid, 2015b). The NGO Amend (2015) found that of a random sample of 125 boda boda riders in Kililo district, only 25% of them were licenced to ride and only five had received formal training. Attempts to standardise rider training in Tanzania are underway, with the development of a motorcycle taxi training curriculum and the adoption of these standards, thereby offering the potential to improve rider training.

4. Conclusions

While numerous studies have documented the benefits of motorised two- and three-wheelers in Africa, a greater number have focused on their negative aspects, primarily in terms of the road safety risks that they present. However, while being a motorcycle taxi rider or passenger is undoubtedly risky, the sheer numbers and scale of uptake in many countries in recent years

demonstrates that many people believe the benefits offered by two- and three-wheelers outweigh the risks.

The urban focus of much of the published and unpublished literature highlights a gap in knowledge relating to rural areas. Official government statistics on road traffic crashes often do not provide sufficient detail on their exact locations, hence understanding of the magnitude of crashes on rural roads is limited. No study has made a direct comparison of the severity of motorcycle-related injuries sustained in crashes on urban roads with those sustained in crashes on rural roads. However, the literature would seem to suggest that severity tends to be lower on rural roads with the nature of crashes being different in that they often involve no other vehicles.

While the need to improve safety of rural motorcycle riders and passengers is undeniable, a balance must be struck between safety and the crucial role motorcycles currently play in improving lives in rural areas. The literature highlights examples of safety initiatives that may be appropriate for researching further in order to understand their effectiveness, appropriateness and potential for scalability.

There is generally very little literature related to motorised three-wheelers which largely remain an urban phenomenon in those countries of sub-Saharan Africa where they are present. The lack of research is reflective of the fact that, while numbers are increasing, they are far less common than motorcycles.

Going forward a summary of the key areas for further research includes:

- **The motorised three-wheeler taxi sector:** What is its role in the wider transport sector? How does it compare to the motorcycle taxi sector in terms of safety, participation, ownership and profitability? Where and how do three-wheelers operate? What is their role in promoting rural access and driving economic growth?
- **Piloting of initiatives to correct gender imbalances in the sector:** What are effective ways to promote greater ownership and participation of women in the motorcycle taxi sector (and in related industries such as maintenance)? What role can motorcycle taxis play in helping to correct gender imbalances in mobility and access to services? How can motorcycle taxis help to promote the health rights of women and girls?
- **Exploration of the relationship between motorcycle taxi services and social inclusion:** How do motorcycle taxis promote social inclusion of hard-to-reach individuals and groups, such as the disabled or women who lack social support? Can riders be given training in social inclusion and therefore drive change in this area? Can female-only taxi services help to increase the mobility of women who lack social support and who hence have poor access to essential services? What are the specific safety considerations when transporting individuals who have limited mobility?
- **Increasing understanding of rural road safety:** How can data collection and analysis be improved to provide a better understanding of road safety in rural areas? What can be done to improve access to comparative data on motorcycle crashes and outcomes in urban and rural areas?
- **Innovations to better regulate the sector:** What are the opportunities and challenges presented by taxi rider associations, particularly their role in promoting improved regulation? How can mobile phone technology be better used to promote rider and

passenger safety and convenience for passengers? How can access to case study material on effective implementation of government safety legislation be improved, to enable sharing between countries?

- **Research into the cost-benefits of motorcycle taxis compared to alternative modes of transport:** What are the economic, social, safety and other benefits of motorcycle taxis compared to the alternatives? What do these findings imply for the current bans in place in various African countries?

This review of literature presents the current body of knowledge on the subject of motorcycles and motorised three-wheelers in sub-Saharan Africa, with an emphasis on their use as a means of rural transport. There is still more to investigate in this domain, and this ReCAP research project will address some of the gaps in knowledge to expand the evidence base and improve our understanding of this complex subject.

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