

Challenges in the Management of Road Safety in Tanzania: The Need for an Integration Framework

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Abstract: Tanzania is hardest hit by daily accident deaths and casualties on the roads. Although various measures have been taken by the government, enforcement agencies and NGOs, accidents and fatalities keep growing at a rate above that of killer diseases like malaria, tuberculosis and HIV. The main causes observed were that road safety has multiple key autonomous stakeholders having different fragmented information systems which are not inter-operable because of being proprietary in nature, thus inhibiting the timely and coordinated sharing of information among them. This paper presents the lessons learned from different stakeholders following a series of workshops and meetings with these key stakeholders to understand the problem from their institutional contexts. Hence, an integration framework is developed and implemented to facilitate enforcement of road traffic regulations and to enable the different stakeholders cooperate and share information efficiently and with transparency in sustained road safety regulations enforcement. It is envisaged that if the integrated platform is successfully adopted, it can reduce the heavy duplication of efforts and investment in incoherent data systems by individual stakeholders in terms of hardware, consumables and personnel resources. The integrated platform for the road safety management system is in place, however, it needs a policy direction from the government to galvanise the major stakeholders.

Keywords: integration framework, road safety, stakeholders, fragmentation

INTRODUCTION

Globally, there has been no overall reduction in death rates arising from road accidents, with losses standing at 1.24 million deaths per year (Toroyan *et al.*, 2013; WHO, 2013). However, there are countries which have successfully reduced the number of deaths on roads while for the others this number is increasing (Steininger and Bachner, 2014; Hughes *et al.*, 2015). The developing countries, particularly the African Region like Tanzania, are the hardest hit by accident deaths at (24.1 per 100,000 population) with the European Region being the lowest hit at (10.3 per 100,000). Recent reports and studies indicate that among other factors, human factors and vehicle conditions account for most road accidents in Tanzania, with human factors dominating at approximately 76.4 % of all causes of road accidents (SUMATRA, 2007). The human factors include impatience, stress, reckless driving, over-speeding,

driving while drunk, using phones while driving, ignoring traffic signs such as pedestrian crossing, wrong overtaking and parking, driving while in stress, obstructing other drivers, etc. Distracting activities while driving include texting, talking on the phone and drinking behind the wheel (Ramasaamy *et al.*, 2009).

There are various measures that have been adopted in Tanzania to curb this worsening situation, including driver training, public awareness campaigns, improvement of roads, increasing fines to unruly drivers, setting speed limits depending on categories of roads, deploying traffic police with speed monitoring devices, mandatory check of vehicles road worthiness and increase of vehicles inspections by the police force (SUMATRA, 2007; Chiduo and Minja, 2001). The measures taken are dynamic but there is no effective and efficient coordination facilitation in place for such efforts with concentration being on accidents while traffic rule violation is a very important factor. Hence, the adopted measures have not produced a significant positive effect in terms of reducing the number of accidents and associated consequences (Baher and Lina, 2004). The impact of these adopted measures is low because of the basic underlying concept which was used in developing an implementation strategy and tools. Firstly, there are multiple key stakeholders in road safety management with full autonomy, operational policies and having different and non-interoperable fragmented information systems even within the same institution. Hence, the stakeholders are unable and/or unwilling to share timely information among themselves or with the public for non-sensitive data and to coordinate their activities and functions. Secondly, the existing systems and associated technologies are proprietary in nature because the specification for such systems were driven by vendors rather than needs to solve particular challenges and means to realize effectively intended objectives (Team, 2007). Therefore, most systems are not interoperable, creating little ownership to the end users, and difficulty in the integration of data and manageability. Thirdly, there is a heavy duplication of efforts and investment in incoherent data systems in terms of hardware, consumables and personnel resources that are poorly managed policy-wise and in execution (Rechnitzer *et al.*, 2000).

The existing fragmentation has led to various challenges including inability to track traffic law offenders, processes of renewal of driving/car licenses not linked to previous traffic offences committed and/or fine payments, use of fake number plates and licenses and renewal of business licenses not linked to offenses and fine settlements. Other challenges are lack of effective and efficient means of capturing traffic offences and timely access to information across the stakeholders involved, verification of fraudulent data, and

handling of road accidents in coordinated manner, and citizens' participation in prevention of road accidents and violation of road traffic regulations (Joumard and Gudmundsson, 2010).

The global report on road accidents (WHO, 2013) stressed the need to have an integrated routine system for reporting road traffic accidents and handling post-crash care to save the lives of the victims (WHO, 2013). Given the disparity between countries in different regions, in terms of the number of vehicles on the roads, quality of the roads and vehicles, and the methods of traffic regulation enforcement, the need for international benchmarking on road safety has also been stressed (Shen *et al.*, 2015). At the same time achieving integrated systems can be very challenging because of mismatch between the higher level government policies and information management in the field (Bax *et al.*, 2014). Various models aimed at improving road safety by addressing the effects of road traffic accidents have been developed, mostly from developed countries, and each with its own merits (Hughes *et al.*, 2015). Given the severity of the road safety problem, the researchers mounted a project with the goal of reducing human injuries, losses and suffering; material and infrastructure losses and damages, social and health impact resulting from road accidents in Tanzania. As part of this project, the researchers conducted a study to investigate the existing challenges in the management of road safety and determine how an effective intervention to these challenges can be realized.

METHODOLOGY

A workshop involving personnel from all key stakeholders was held on 3rd December, 2013 at TCRA conference hall with four key factors in mind; creating awareness of the road safety project in progress, getting stakeholders involvement from the start so as to build sense of road safety project ownership in all of them, to share experiences with stakeholders in the area and to get everyone involved in the road safety project. This was important to the project since it was essential to understand clearly what was on the ground to properly embed local context in any solution developed, avoid duplication of efforts and make acceptability and adoption by the relevant authorities easier. The workshop itself was not enough to realize the goals set for involving all stakeholders since they all had different roles (although some of them overlapped). Hence, several follow-up brain storming sessions and meetings with multiple key stakeholders were necessary and were conducted from July to September 2014 to understand clearly the status of road safety in Tanzania, supporting infrastructure in place, existing systems, plans, underlying operational policies, practices and challenges. Based on the

findings from these meetings and in-depth literature review, several challenges and solutions were identified to address the problem.

Brain storming sessions and meetings were conducted at the stakeholders' localities in order to formulate methods to address the identified challenges. The stakeholders were requested for official appointments leading to meetings with 5-10 officials of the respective institutions. These institutions were SUMATRA, Police Traffic Division, Ministry of Works, Ministry of Transport, TEMESA, NSSF, Ministry of Home Affairs, TANROADS, COSTECH, Ministry of Communication, Science, & Technology, e- Government Agency, Dar es Salaam City Council, and TRA. The authors also wanted to know more about the existing systems and how these systems exchange data within and across the road safety stakeholders.

In order to tackle the primary challenge of information being collected by one stakeholder which needs to be accessed by other stakeholders but not being made available to them, it was considered necessary to develop a modality to integrate the information from the segregated different stakeholders' information systems to facilitate availability to them all. One such challenge was enabling the accidents information to reach all the relevant stakeholders for fast and effective response. For this, it was considered necessary to develop a solution based on smart phones owned by the authorities and stakeholders for collecting and sending the information. This was seen to be a prudent approach since smart phones are increasingly becoming accessible and owned by many citizens and becoming cheaper by the day. Another important area of study was in capturing information on vehicles especially on the roads when traffic regulations and rules violations occur, which necessitate developing methods and a system for automatic monitoring, detection and registering. This is an extensive and challenging area since it presents a wide-ranging scenario. Another important dimension in collection and dissemination of information on road safety aspects is on verification. Hence, simple but reliable methods for the verification of the information sent to the relevant authorities, especially if it was sent by the public, have to be developed.

The implementation of the integration framework was made possible by using open source technologies to ensure interoperability with existing systems and development was based on evolutionary prototyping approach to ensure scalability and flexibility to meet continuous needs and demands of all stakeholders involved. Furthermore, a road safety site web portal for public sharing, updating and uploading accident incidences has been developed.

RESULTS AND DISCUSSIONS

The study has shown that every part of the community is affected in one way or another by road safety, be it in the developed or in developing countries. However, the most affected are developing countries although they have fewer vehicles and driving hours on the roads. The primary factors for these are poor or none existence of cities emergency services, weak policy enforcement mechanisms in coordinated manner, many actors having not coordinating umbrella, data systems with related data which cannot talk to each other, lack of systems in place to support enhancement of enforcement of traffic regulations, rules and procedures, etc. Close observations made in some of the areas that are prone to violations that result in accidents has shown that enforcement has a much higher impact in addressing road accident problems than increasing fines several folds.

Existence of Fragmented Systems Managed by Different Stakeholders

Although road safety management needs to be coordinated in an integrated manner, as shown in Figure 1, various key stakeholders manage their own systems that do not share data. The Tanzania Revenue Authority (TRA) for example, manages three separate systems for car registration, road license payments, and a system for issuance of the road license. The traffic police dealing with traffic regulation enforcement cannot easily access the driver's license number or car registration number for verification purposes. At the sometime, there is an accident reporting system being implemented by the Ministry of Works under the Directorate of Road safety that is not interoperable with other systems managed by TRA. Such systems are not linked to the citizen information systems such as National Identity, voter's registration owned by National Electoral Commission, or birth/death registration systems owned by RITA making it difficult to verify the authenticity/validity of the driver's license, in case of any forgery.

The existing systems hosted by different stakeholders do not see each other since most of their specification were vendor-driven without integration focus even for database systems under one entity. There is a strong sense of ownership by each stakeholder making the integration a significant challenge. This has made traffic regulation and laws offenders get away with any violations and renewal of licenses to have no link to traffic offences or violations committed by the driver or the car owner. Drivers are very impenitent and have very low respect for traffic rules and regulations in the absence of police monitoring, effective booking of offenses, and payment of fines. However, the small police force cannot be everywhere twenty-four hours a day all days. Enforcement has therefore been a problem since information on accident incidents rely on that collected by a sole police officer

manually when they arrive at the scene of the accident physically. It is not easy to access records of activities of any particular officer assigned to a particular road stretch or location. To approach the interactive complexity faced by stakeholders presented in Figures 1 and 2, there must be efforts to bring the stakeholders under one umbrella.



Figure 1: Fragmented Active Road Safety



Figure 2: Fragmented Stakeholders
Key Stakeholders Involved in Road Safety Management and their Roles

The typical stakeholders involved in road safety management at the minimum include:

- *Law enforcers* (Traffic Police Force, TANROAD, SUMATRA, TBS) who deal with enforcement, accident and violation reports, quality inspections, revenue collection, business licensing, inspection certificates, road worthiness of imported vehicles and driver's testing certificates;
- *Fire Brigade* dealing with fire incidents related to accidents on the roads;
- *Hospitals* dealing with attending to accident victims;
- *Drivers* related to driving behavior mind set, driving licenses, offences, and penalties;
- *Citizens/community* related to road usage, reporting incidents, accident and violations;
- *Tanzania Revenue Authority (TRA)* involved with issuing car registration numbers, road licenses, driving licenses, and tax identification numbers (TINNo);
- *Tanzania Road Agency (TANROAD)* linked to setting speed limits, road condition/ improvements, road infrastructure, overtaking status;
- *Insurance Agencies* responsible for issuance of insurance covers, compensating deserving clients;
- *Drivers Training Agencies* (NIT, VETA, JKT, etc.) responsible for training of drivers and issuance of qualifying certificates;
- *Government Ministries* (Ministries of Home Affairs, Health, Transport and Works & Ministry of Local Government and Regional Administration) dealing with policy setting, legal framework, funding of enforcement entities, monitoring and evaluation of existing systems; and
- *Citizen Information Systems* (NIDA, Immigration Department, RITA, NEC): These actors have some interrelationships with the road, drivers or cars, but they work in a Very fragmented way at the periphery to the higher level

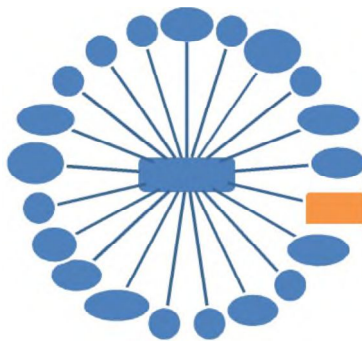


Figure 3: Road Safety Stakeholders



Figure 4: Key Functions in the System Intergration

All these stakeholders are responsible in one way or another in road safety administration and in attending road accidents incidents. They are independent administratively with the same status and autonomy. This makes collaboration and cooperation a very significant factor when addressing road safety issues.

The Interrelationships between Key Actors

Road safety involves the management of roads, cars, and drivers and key actors are involved in this process which is traffic police, Tanzania Roads Agency (TANROADS), Tanzania Revenue Authority (TRA), SUMATRA, Fire Brigade, and the Government Ministries.

Figure 5 indicate some variables and functions associated with each key actor. While ANROAD, Fire Brigade, TRA, SUMATRA, and Traffic Police interact in one way or another in their daily routine handling of traffic offences and road accidents, their electronic systems hardly exchange data or receive data from the citizen/community. This close working relationship at the ground level suggests the need for an integrated system to enable the actors to manage properly the road safety. The key actors have some interrelationships with the road, drivers or cars, but they work in a very fragmented and uncoordinated way with each actor managing their own information systems.

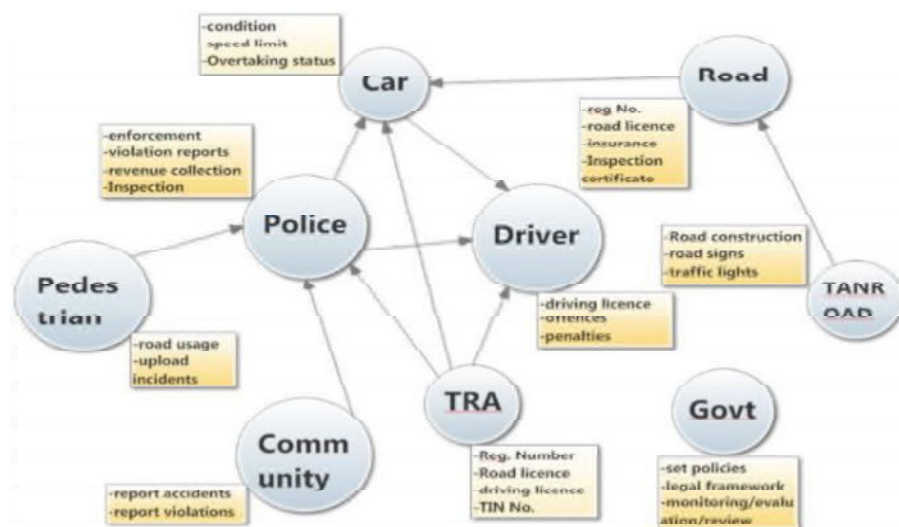


Figure 5: The Interrelationship between Key Actors



**Figure 6: Integration Framework
Proposed Integrated Road Safety Information System**

An integrated framework is needed that integrates road safety services of the different stakeholders and data systems across existing road traffic reporting systems and inclusion of new sub systems, namely silent policing using camera and mobile phones, community policing through mobile phones, and accident management system and mobile phone applications to capture, manage, transmit and retrieve data. The integration framework supports the services of those actors enabling them to share the information in an integrated fashion. Integration of information systems can enhance coordination, optimize utilization of resources, and link offences to offenders, and increase revenue collection.

This integration framework is implemented as an integrated platform (called **Road2**) to capture different scenarios and data such as (i) Recording and transmitting of accident scene (ii) Car registration and user validity (iii) Driving license facility (registration and validation) (iv) Reporting and recording of traffic offence (v) Vehicle and driver offence tracking (vi) Reports and statistics (vii) Insurance Capture. The integrated platform can be accessible to all road safety stakeholders involved.

Road2 facilitates capturing traffic offences using a web application and mobile phones, and it allows information sharing to enable penalizing of all offenders and drivers for changing behavior and thus reducing accidents. The police can report a violation automatically using their mobile phones. Also, once an accident has occurred it should be reported immediately by citizens using

their mobile phones and appropriate post-accident management of victims instituted by all stakeholders involved in a coordinated manner to save lives. Road2 has made it possible for the citizens to report violation/accident information instead of the offenders themselves, thereby widening the enforcement scope to reduce the accidents and traffic violations.

CONCLUSION

Tanzania has been investing in ICT infrastructure by putting in place a metropolitan optical fiber network, national optical backbone, and extensive mobile telephone network offering all kinds of applications therefore setting a good environment for operationalization of e-governance. The political will is very strong, so a holistic national prescribed solution that addresses local context backed by created local expertise is bound to be successful.

The existing countrywide connectivity through a wireless mobile telephone network has set up a good environment for implementation of an integrated electronic system. The use of mobile phones is becoming more and more an integral part of the Tanzanian society, such that even some remote rural areas can now access online services and mobile money systems using low-cost mobile phones. There is also the rapid adoption of e-services in government, albeit in a fragmented manner. Since there is a strong political will and an ICT network infrastructure, it is possible to implement the integrated framework for road safety management to address the challenges of existing fragmentation.

Such integration, however, cannot be achieved without a policy direction from the government since currently road safety issues are partly managed by four government ministries (of works, health, transport, and home affairs) in an uncoordinated manner. Based on experiences from other countries that have attempted to integrate road safety matters (Bax *et al.*, 2014; Hughes *et al.*, 2015), the process of having all stakeholders embrace the use of an integrated information system needs adequate effort, resources, and a policy direction from the government.

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