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Stakeholder Perceptions on Community Road Infrastructure Protection Measures and Technology

A Qualitative Case Study from Tanzania

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Abstract : Globally, heavy vehicle overloading has become a real threat to lives and the quality of community transport infrastructure (CTI or roads). This qualitative case study research was undertaken in Tanzania to investigate and develop a deeper understanding of CTI stakeholder perceptions on current CTI protection/intervention measures. Based on key informant interview responses, six themes were developed: 1) *socioeconomic development*, 2) *civic education and responsible leadership*, 3) *road quality and budget*, 4) *law enforcement*, and 5) *use of high technology*. These findings indicated that CTI stakeholder perceptions in Tanzania matched the current literature. Weighbridges and police blocks are the most common CTI protection measures against vehicle overloading; yet, their efficiency and effectiveness is highly affected by corruption and delays. It is strongly recommended that governments and other stakeholders must immediately adapt the use of new technology: The *CTI Device* for automatic regulation of vehicle overloading as proposed by Mushobozi and Arafath (2023).

***Index Terms*: Roads, technology, weighbridges, education, leadership, law enforcement, socioeconomic development.**

I. INTRODUCTION

In many developing country, *community transport infrastructure* (CTI) or *roads* have become an important factor and determinant of socioeconomic growth, competitiveness, and thus, sustainable community development (Osei–Kyei & Chan, 2016; Szajowski & Włodarczyk, 2021). Cherlow (1981) emphasized that in transportation planning, the quality of road network infrastructure holds a considerable value and plays a significant role in terms of money and travel-time savings. Also, good roads are positively associated with accessibility, employment opportunities, and productivity in the agricultural sector (Iimi, 2022; Matas et al., 2015).

Most of the time, the funds invested in constructing CTI or roads come from different stakeholders such as bilateral and multilateral organizations, and local tax payers' money through governments. However, such funding is usually very limited and must be honored and safeguarded (Csapó, 2021; Yen et al., 2020). Yet, roads are being damaged and destroyed in many ways by user destruction, especially through reckless, illegal vehicle overloading (Islam & Dinar, 2021; Marwan et al., 2019; Zhang et al., 2019).

Vehicle overloading not only damages roads, but also causes traffic accidents, injuries, and unnecessary deaths. As such, the proper use and protection of all roads should be highly encouraged and regulated for sustainability purposes (Marwan et al., 2019; Zhang et al., 2019). To keep good maintenance of roads, governments have installed weighbridges, and each road system has been clearly marked with weight demarcations—usually indicated in tons as 10t or 10T. Such weight limitations and weighbridges are important to reduce road surface damage, protect and maintain the quality of the roads in their lifespan, improve safety, reduce road accidents and unnecessary deaths, and save already limited financial resources. Yet, vehicle overloading has persisted in many countries including in Tanzania (Islam & Dinar, 2021; Moiloa, 2010; Zhang et al., 2019).

II. NEED OF THE STUDY

Tanzania has a road network of about 85,000 km with a replacement value of US$ 2.5 million (Tanzania National Roads Agency) [TANROADS], 2011). Good roads are important for socioeconomic development of any country. They facilitate accessibility and competitiveness; rise land values and production; and increase employment opportunities across development sectors (Osei–Kyei & Chan, 2016; Szajowski & Włodarczyk, 2021).

Globally, only 30 percent of roads in the average low-income countries are paved; in Tanzania, only three (3) percent of roads are paved (Asher et al., 2016). Asher and colleagues found evidence that low-income countries get poor value for money in road construction and maintenance. The authors revealed that road costs are positively correlated with corruption and weak governance;

and poor maintenance leads to unnecessary reconstruction. They also found an annual loss of nearly $150 billion due to poor delivery of public services; with vehicle overloading being the major factor in increasing road construction and maintenance costs.

Overloading is a very serious global transportation problem. It plays a considerable role in quick deterioration of CTI or road systems (Balash & Odd, 2007). Moreover, according to Moiloa (2010), overloading causes both significant damage to road infrastructure and is attributed to a substantial contribution to road safety risks. As such, many lives are lost annually in Sub-Saharan African countries due to accidents caused by reckless driving, fatigue, and illegal overloading (Schietekat & Booysen, 2013). Globally, annual records indicate that about 1.2 million people die, and over 50 million people are injured in road accidents related to overloading (Islam & Dinar, 2021; Zhang et al., 2019). Thus, there is a need to seriously regulate (i.e., identify, monitor, and control) overloaded heavy transportation vehicles, especially in Sub-Saharan African countries where the problem is dire.

As such several mechanisms have been put in place to regulate overloading. Such measures include weighbridges, non-tariff barriers, and police road blocks. However, the efficiency and effectiveness of such techniques have been undermined by severe corruption and unnecessary delays (Bowen, 2018; Chebon, 2019). Due to corruption, researchers have assessed and commended the use of improved technology to regulate overloading and reduce corruption (Bowen, 2018; Moiloa, 2010; Terer, 2015).

Noteworthy, funds for construction and maintenance of roads at good standards are very limited. Therefore, protection of the already built roads in order to preserve the investment is inevitable so as to reduce costs and maximize the socioeconomic benefits of such investment in roads (Asher et al., 2016; Csapó, 2021; TANROADS, 2011; Yen et al., 2020).

III RESEARCH METHODOLOGY

The purpose of this qualitative case study research was to develop a deeper understanding of stakeholder perceptions on current CTI protection measures/interventions against vehicle overloading. This section presents the research plan and methods for data collection, analysis, and presentation of the findings.

3.1 Population and Sample

The targeted population included the following groups of individuals: truck and bus drivers (*n*=5), commercial crop business dealers (*n*=5), owners of trucks (*n*=5), development stakeholders (*n*=5), pedestrians (*n*=5), motorcyclists (*n*=5), traffic police officers (*n*=5), and government officials (*n*=5). These individuals were assumed to have experience and information about both the study area and phenomenon in relation to the purpose of this investigation. As such, purposive sampling technique was used to identify key informants and select a purposive sample on the basis of their unique characteristics in relation to the studied phenomenon (Gibson & Brown, 2009).

For the puprose of research planning, the current study targeted a sample size of 40 key informants. However, due to unavoidable limitations beyond the researcher's control (e.g., lack of reliable internet access), only nine (9) individuals timely responded to the interview questionnaire as identified in Table 1. According to Creswell and Poth (2018), even one (1) *case* (key informant) can be sufficient for a qualitative case study research design. Thus, nine participants were herein deemed sufficient.

Table 1
Sample Size

Type of Respondents	*Sample Size*	
	Targeted	*Actual*
Truck and bus drivers	*5*	*1*
Commercial crop business dealers	*5*	*1*
Owners of heavy vehicles	*5*	*1*
Development stakeholders	*5*	*1*
Pedestrians	*5*	*2*
Motorcyclists	*5*	*1*
Traffic police officers	*5*	*1*
Government officials	*5*	*1*
Total	*40*	*9*

3.2 Data and Sources of Data

Qualitative research is not limited in terms of methods and data sources. It use single or multiple data sources while allowing the researcher to pay attention to participants' words and actions as they respond to interview questions or related actions and events (Rwebugisa, 2020). In this study, the primary source of data was the key informants' writted interview responses.
For this qualitative case study, data were collected using key informant written response interview method. The nine (9) participants provident written responses to twelve (12) specific, open-ended questions. The data were collected between in March 2023.
To ensure accuracy and ethics for the trustworthiness of the research (Rwebugisa, 2020), data for this study were collected under the auspices of the DMI-St. Eugene University. Moreover, the researcher observed all ethical principles including confidentiality, privacy, and no harm to participants.

3.3 Theoretical Framework

The vehicle overloading problem is perversive in the transportation system and requires deliberate transformation in terms of leadership, engineering, technology, enforcement, etc. (Bowen, 2018; Maqbool, 2019; Moiloa, 2010; Terer, 2015). Therefore, this study adopted the Transformational Leadership Theory (Bass 1985; Burns, 1978). In leadership, the transformational theory refers to the leadership approach that causes change in people and systems (Bass, 1985). Ideally, transformational leadership creates substantial change in the followers with the aim of developing them into leaders. When applied, it aligns followers' goals with the

leaders' vision. Thus, followers adopt the interest of the institution as their own; it helps governments and organizations to take on huge systemic change such as that needed to overcome corruption and eliminate vehicle overloading.

IV. RESULTS

Five interrelated themes were developed from the data analysis to represent stakeholder perceptions about CTI (roads) protection against vehicle overloading. Such themes include: 1) *socioeconomic development*, 2) *civic education and responsible leadership*, 3) *road quality and budget*, 4) *law enforcement*, and 5) *use of high technology*.

4.1 Socioeconomic Development

Nearly all the nine (9) respondents recognized CTI or roads as very important, common, and useful means of the transportation of goods and services, and a key influencer of socioeconomic development. For example, Dan (pseudonym), the commercial crop dealer noted:

> In Tanzania, roads have improved a lot. Bad roads hinder development. They delay movements of goods and services. With good roads, the economy grows faster, businesses run properly, and people get emergency services on time. Good roads are iconic symbols of development.

In addition to Dan's comments about the socioeconomic importance of roads, Halen, a pedestrian in Dar es Salaam, emphasized:

> Roads are a major and useful means of transportation. Quality roads easy movements of goods and services, they facilitate access to services like hospitals and farms, they encourage people to own private cars, and attract investor who generate employment opportunities. However, poor roads read to economic failure.

Moreover, Pius, owner of heavy vehicles, underlined, "*Good roads facilitate countrywide connectivity and facilitate efficient movements and productivity in all aspects.*" However, five respondents, namely, Marko (government official), Antoni (bus driver), Joy (development stakeholder), Jose (police officer), and Rich (motorcyclist), noted the persistent rural-urban gap in terms of the quality of roads. For example, Rich stated:

> Roads are good for business development. However, in Tanzania, not all places are well-connected with good roads. Most rural areas still have poor roads when compared to most urban areas.

4.2 Road Quality and Budget

The concept of road quality and budget come up frequently in the responses when participants answered questions about the notion of overloading. Participants were asked questions about their perceptions of overloading, reasons for overloading, and social and economic disadvantages of overloading. All participants perceived overloading as a destructive habit; they associate it with CTI damages.

Five respondents including Halen, Marko, Antoni, Joy, and Rich defined overloading as: "*having many cars carrying too much load beyond the weight limits.*" Nearly all participants note that the quality of many roads in Tanzania was not of the standard quality. They identified reasons including, "*overloading, corruption, cheap labor, use of low-quality materials, poor construction, misuse of roads, small budget, irresponsible leadership, poor science and technology, and rainwater.*" When asked about why drivers overload their vehicles, Pius identified the "*lack of education*" as a reason, while all other seven respondents mentioned: "*profit maximization, intentionality, and shortage of vehicles.*" For example, Jose, emphasized:

> Most drivers overload their vehicles intentionally in order to maximize profits by saving of fuel and trips. There is also a shortage of vehicles, which also influences overloading.

However, Pius hold a different perception, he stated: "*No driver wants punishments. I think its simply lack of knowledge.*"

Moreover, almost all respondents emphasized that in order to construct and maintain good quality roads, there is a need for setting a sufficiently enough budget to facilitate use of: "*proper and high pavement materials, use of high technology, hire of highly qualified engineers*." Antoni explained:

> If I had an opportunity to improve anything about roads in Tanzania, I would set enough budget to ensure construction and maintenance of good quality roads, especially in rural places. However, there must be responsible leaders and government officials to ensure construction of good quality roads.

4.3 Civic Education and Responsible Leadership

To combat vehicle overloading and maintain roads at good quality and standards, all respondents proposed the use of civic education and responsible leadership. For example, Halen expounded: "*There must be accountable government officials to construct high standard roads*." Joy added: "*Responsible leaders and*

government officials are needed to ensure construction of good quality roads." Moreover, Pius introduced the weighbridge ideas and emphasized:

> In Tanzania, there are weighbridges in every region to control overloading. There a need for education and responsible leaders and government officials to ensure compliance.

4.4 Law Enforcement

"*Strict law enforcement*" is another suggestion made by five respondents. The respondents emphasized that Tanzania has many laws, legal instruments, and agencies responsible for quality transportation systems. However, they lamented the poor enforcement of such laws and regulations. For example, Rich, stated:

> Tanzania has many laws but they are not enforced. If I had an opportunity to do anything about the quality of roads in Tanzania, I would apply strict law enforcement to safeguards our roads.

Joy expounded: "*It is the lack of strict enforcement of our laws that fails us*."

4.1.1.5 Use of High Technology

Finally, at least six respondents not only blame the lack of technology as a reason for poor roads but also emphasized that in order to construct, protect, and maintain good quality roads, Tanzania needs to use high technology. For example, Halen stated:

> Roads in Tanzania are of low quality because most are built with cheap labor, low quality materials, and low technology in such a way that it cannot accommodate heavy trucks. Moreover, roads should be constructed by high technology that suits weather and climatic conditions in Tanzania. Technology can help in many ways to protect our roads and curb corruption especially at the weighbridges.

Finally, Marko provided a good summary:

> Public infrastructure in Tanzania can be protected first by formulation of strict laws to govern it, second by providing civic education about road use and lastly, setting of enough budget for periodic road maintenance and repair in both urban and rural. The use of high technology can help to eliminate corruption by traffic police officials who allow those who misuse the roads to go unpunished.

V. DISCUSION AND CONCLUSION

The purpose of this qualitative case study research was to develop a deeper understanding of stakeholder perceptions on current CTI protection measures/interventions.

The findings were summarized into five themes, representative of the CTI stakeholder perceptions on overloading and protection of roads against it. These themes include: socioeconomic development, civic education and responsible leadership, road quality and budget, law enforcement, and use of high technology. It is very amazing that these stakeholder perceptions in Tanzania matched most of the literature (Asher et al., 2016; Balashi & Odd, 2007; Bowen, 2018; Chebon, 2019; Moiloa, 2010; Terer, 2015).

Furthermore, when asked about the social and economic disadvantages of vehicle overloading, the participants identified destruction or damage to roads and the potential for causing road accidents, death, and injuries. Similar shortcomings have been found by other researchers (Islam & Dinar, 2021; Marwan et al., 2019; Zhang et al., 2019). Finally, Terer (2015), recommended the use of technology to combat overloading. In their responses, the participants overwhelmingly supported Terer's recommendations and gave a green right to the need for use of high technology to regulate vehicle overloading.

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