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HUMAN FACTORS INFLUENCING THE RELIABILITY AND SAFETY OF VEHICLES, KENYA CASE STUDY

Czynniki ludzkie wpływające na niezawodność i bezpieczeństwo pojazdów, studium przypadku Kenii

Abstract: *This paper investigates how human decisions and actions in maintenance practices influence the reliability and safety of vehicles in the Kenyan transportation sector. It specifically addresses several human factors that play a crucial role in influencing the reliability and safety of vehicles. Neglecting the manufacturer's recommended maintenance schedule, employing inadequately skilled maintenance personnel, utilizing substandard replacement parts, and exhibiting poor driving habits emerge as key contributors to the compromised reliability and safety within the country's road transportation sector. The research underscores the substantial implications of these human factors, shedding light on their profound influence on the overall condition and security of vehicles in the Kenyan transportation landscape. This paper aims to contribute valuable insights for improving maintenance practices and fostering a safer and more reliable environment within the country's transportation sector, ultimately promoting enhanced safety standards and operational efficiency.*

Keywords: maintenance, reliability, human factors, road vehicles

Streszczenie: *W artykule dokonano analizy wpływu decyzji i działania człowieka w zakresie procesu obsługi na niezawodność i bezpieczeństwo pojazdów w kenijskim sektorze transportu drogowego. Zaniedbanie zalecanego przez producenta harmonogramu konserwacji, zatrudnianie niewystarczająco wykwalifikowanego personelu konserwacyjnego, wykorzystywanie części zamiennych poniżej akceptowalnego standardu i wykazywanie złych nawyków jazdy przez kierowców, to kluczowe czynniki przyczyniające się do obniżonej niezawodności i bezpieczeństwa w sektorze transportu drogowego w kraju. Mają one istotny wpływ na ogólny stan i bezpieczeństwo pojazdów w kenijskim krajobrazie transportowym. W artykule dokonano analizy istniejących praktyk w zakresie*



eksploatacji wybranej klasy środków transportu i sformułowano uwagi ukierunkowane na możliwość poprawy praktyk w zakresie użytkowania i obsługiwanania, z ukierunkowaniem na poprawę bezpieczeństwa i wydajności operacyjnej.

Słowa kluczowe: obsługa, niezawodność, czynniki ludzkie, drogowe środki transportu

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1. Introduction

The safety and dependability of vehicles within the transportation sector play a crucial role in influencing public safety, economic efficiency, and the overall well-being of society. Human errors resulting from inadequate vehicle maintenance or driver negligence account for a significant number of road accidents in Kenya. Globally, road traffic accidents pose a substantial public health issue, with the World Health Organization (WHO) reporting an annual death toll of 1.35 million people due to such incidents [1, 2]. According to the WHO and other sources, the death rate is highest in African countries, with an indexed estimate ranging from 25 to 34 per 1,000,000 population. According to a trend analysis of road traffic incidents for the year 2020, Kenya's fatalities and injuries have grown by 26% and 46.5%, respectively, since 2015. Incidences involving vulnerable road users (pedestrians, motorcyclists, cyclists, passengers, and pillion passengers) have increased by more than 300% over the same period. RTAs (road traffic accidents) are projected to cost a country 3-5% of its GDP in terms of Medicare, insurance, and lost output, with low- and middle-income countries accounting for 93% of all global accidents [3]. Because of the consequences, accidents are a social issue that all stakeholders should consider.

Numerous approaches and solutions have been explored and implemented in traffic research, yielding different levels of effectiveness. Implementing speed regulations is a widespread and logical measure, supported by international evidence highlighting the risks associated with excessive speeding [4]. The enhancement of road infrastructure through the incorporation of intelligent street systems designed to accommodate diverse mobility requirements has been identified as a measure to enhance safety [5]. The adoption of contemporary technologies is seen as a means to continuously monitor and enhance the interdisciplinary domain of road transport [6].

However, in the Kenyan road transportation framework, there is a scarcity of comprehensive investigations exploring how human decisions impact maintenance practices and subsequently influence the reliability and safety of vehicles. The effectiveness of this sector is heavily dependent on the trustworthiness of both vehicles and infrastructure. Nevertheless, the human aspect of maintenance procedures introduces a level of intricacy that warrants thorough scrutiny. Human factors, which include the choices and behaviors

of individuals engaged in maintenance activities, assume a crucial role in shaping the overall reliability and safety of the transportation system.

Selected issues related to the analysis of causes and response strategies of road traffic accidents in Kenya, trend analysis and fatality causes on Kenyan roads, factors influencing maintenance of roads in Kenya, and mortality caused by road traffic injuries, were presented appropriately in the publications of [7–10].

The paper focuses on selected human factors influencing the reliability and safety of vehicles in the Kenya case study.

2. Research problem and research methodology

In response to the escalating fatality rates resulting from traffic-related incidents, this study delves into the impact of human decisions and actions in maintenance practices on the dependability and safety of vehicles within the Kenyan road transportation sector. Employing a comprehensive mixed-method approach that integrates quantitative analysis and qualitative assessments, the research endeavours to shed light on the intricate dynamics influencing vehicle reliability and safety.

To gather insights, a questionnaire was administered to a diverse group comprising maintenance personnel, transportation authorities, and road users in Kenya. Additionally, the study draws upon data sourced from the National Transport and Safety Authority (NTSA) online database, the regulatory body responsible for overseeing safety and transportation in Kenya. The NTSA database provides two primary categories of information for public awareness and safety promotion: daily reports and fatal accident reports spanning the entire nation. By combining these diverse data sources, the research aims to provide a comprehensive understanding of the factors contributing to road accidents and fatalities, thereby paving the way for informed interventions to improve road safety in Kenya. Due to the increased cases of deaths arising from traffic road accidents, this paper investigates how human decisions and actions in maintenance practices influence the reliability and safety of vehicles in the Kenyan road transportation sector.

3. Results

Research revealed a positive, intricate relationship between human factors and maintenance practices in Kenya's transportation sector. Preliminary results reveal specific decision points where human interventions significantly impact the reliability and safety of vehicles. Moreover, training and adherence to maintenance protocols are areas identified for improvement.

Today, Kenya continues to lose a significant number of lives. The fatality rate depicted in Figure 1 for the period 2014 – 2023 underscores the persistent challenges in reducing traffic-related fatalities.

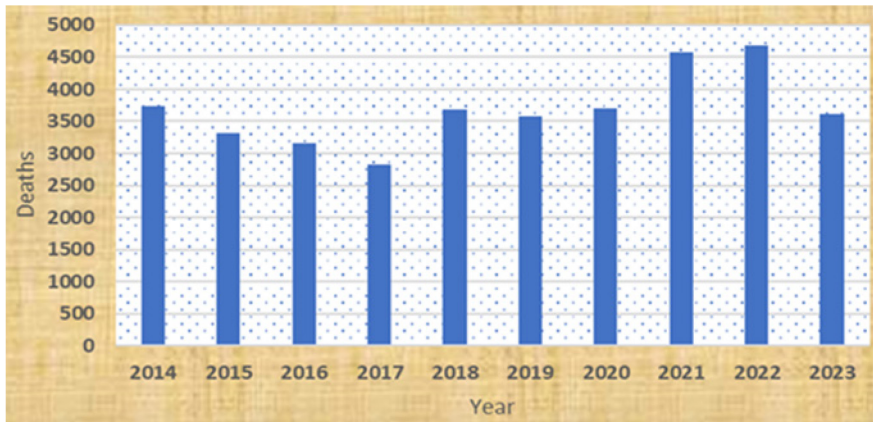


Fig. 1. Kenyan road accident deaths between 2014 and 2023. Road fatalities for the last 10 years (2014-2023), National Transport and Safety Authority [11]

For road safety, specific human decisions during maintenance processes are critical. The research findings have revealed the following information:

1. failure to adhere to the manufacturer’s recommended maintenance schedule constitutes 31%,
2. poor driving habits constitute 25%,
3. incompetent maintenance personnel constitutes 24%,
4. poor quality of the replacement parts constitutes 20%.

We can conclude that human decisions/actions during maintenance have a significant impact on the safety and reliability of vehicles in Kenya.

The importance of human decisions and behaviors for vehicle safety and reliability within the context of Kenyan road transportation is undeniable. Specifically, deviating from the manufacturer's recommended maintenance schedule has proven to be critical. Unskilled maintenance professionals and the use of poor replacement parts during maintenance procedures exacerbate the repercussions, both of which significantly contribute to vehicle reliability and safety.

The interaction of these variables emphasizes the need to adhere to maintenance requirements. Additionally, road user behaviour is an important factor in vehicle reliability and safety in Kenya's road transportation system. Among these issues, poor driving habits emerge as the most prevalent human decision affecting vehicle dependability and safety. Recognizing the linked nature of these human-driven variables sheds light on the entire

impact of individual decisions on the broader landscape of road safety and vehicular reliability in Kenya, spanning from maintenance procedures to driving behaviour. As a result, addressing these human influences holistically is critical for building a safer and more dependable road transportation environment.

The competence, skills, and training of maintenance personnel play a pivotal role in guaranteeing the dependability and safety of vehicles. The research, which concentrated on essential skills for vehicle maintenance personnel, yielded the following insights:

1. safety awareness (in general) accounts for 24%,
2. technical proficiency (in general) constitutes 23%,
3. preventive maintenance expertise, encompassing both knowledge and practice, accounts for 23%,
4. attention to details (skills) constitutes 16%,
5. regulatory compliance (knowledge and adherence to regulations) accounts for 14%.

Safety awareness, technical proficiency, and preventive maintenance expertise stand out as the most critical attributes required by maintenance personnel. Safety awareness ensures a heightened sensitivity to safety protocols, while technical proficiency signifies a mastery of the technical intricacies involved in vehicle maintenance. Preventive maintenance expertise emphasizes the importance of proactive measures to enhance vehicle longevity and performance. Attention to detail and adherence to both national and vehicle regulations were recognized as pivotal skills for maintenance personnel. The meticulous focus on details ensures precision in maintenance tasks, contributing to overall vehicle reliability. Compliance with regulatory standards ensures that maintenance activities align with legal and safety requirements. Together, these skills form a comprehensive toolkit for maintenance personnel, encompassing technical proficiency, safety consciousness, and regulatory compliance, all of which are crucial for maintaining the reliability and safety of vehicles.

4. Conclusions

The paper aims to contribute valuable knowledge to the field of road transportation management by exploring the often overlooked but crucial role of human factors in maintenance practices. By understanding how human decisions and actions influence safety and reliability, policymakers can formulate targeted interventions to enhance the overall effectiveness of maintenance processes. The ultimate goal is to create a safer, more reliable road transportation system in Kenya, thereby fostering economic growth and ensuring the well-being of its citizens.

In order to improve the overall efficiency of maintenance procedures and foster a safer and more dependable road transportation system in Kenya, several recommended interventions and strategies are proposed. Firstly, there is a need for refresher training and

education programmes designed for both maintenance personnel and drivers. These initiatives aim to update and enhance the skills and knowledge of individuals involved in road maintenance and driving, ultimately contributing to improved safety and reliability.

Additionally, a crucial step involves advocating for preventive maintenance practices. This approach emphasizes the importance of regular inspections and timely repairs to prevent potential issues, promote the longevity of vehicles and reduce the likelihood of accidents. Furthermore, the integration of contemporary technological systems into vehicles is suggested to enhance their performance and safety features. This involves adopting up-to-date technologies that can contribute to more efficient and secure road transportation. Strict enforcement of traffic regulations by the traffic control police is deemed essential to ensure compliance and adherence to safety measures. This includes rigorous monitoring of traffic rules and imposing penalties for violations, thus creating a deterrent effect. Lastly, efforts should be directed towards creating public awareness and sensitization campaigns on road safety. By educating the general public about responsible road behavior, the likelihood of accidents can be reduced, fostering a collective commitment to a safer road transportation environment in Kenya.

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