Institutional dynamics and road accidents in the road haulage sector: the moderating role of information communication technology

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Abstract

Purpose – The purpose of this study is to investigate the influence of institutional dynamics on road accidents and whether this relationship is moderated by information and communication technology (ICT).

Design/methodology/approach – The study adopted a quantitative approach with 133 respondents. Research hypotheses were tested in AMOS version 21. In addition, moderated regression analysis was used to test the moderating role of ICT on the relationship between institutional dynamics and road accidents.

Findings – The results show that vehicle maintenance, policy enforcement, safety culture, driver training and driver management positively influence road accidents. Moreover, the study established that ICT moderates the relationship between institutional dynamics and road accidents.

Practical implications – The results of this study serve as a practical guideline for policymakers in the road haulage sector. Managers may gain insights on how to design effective interventions to reduce road accidents.

Originality/value – This research contributes to the existing body of knowledge by exploring previously unexplored moderating paths in the relationship between institutional dynamics and road accidents. By highlighting the moderating role of ICT, the study sheds new light on the institutional dynamics that influence road accidents in the context of road haulage companies.

Keywords Institutional dynamics, Road accidents, Information and communication technology, Structural equation modeling, Moderated regression analysis, Safety culture

Paper type Research paper

1. Introduction

Road accidents are a major and growing cause of death and injury to people in both developing and developed countries. Recent statistics highlight a concerning surge in global road fatalities, indicating that, if unaddressed, this issue could surpass the impact of diseases such as HIV and malaria by 2030 (United Nations Economic Commission for Africa, 2021). Despite several attempts by various stakeholders to curb the soaring number of road crashes, the annual number of road fatalities remains exceptionally high. The road haulage sector is not an exception as it grapples with a high rate of fatalities, causing economic burdens, tragic

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loss of life, an emotional toll on affected families and insurance costs (Pöllänen *et al.*, 2021). Although the sector is considered the lifeblood of many economies in terms of employment creation, easing the cost of doing business and facilitating the movement of cargo around various markets, road accidents present a host of challenges that demand urgent attention and comprehensive solutions (Elmrghni, 2022).

Previous studies investigated the causes of road accidents. For instance, Khyara *et al.* (2022) highlighted human factors as influential factors in road traffic accidents in Morocco. In South Africa, Adeniji *et al.* (2020) also observed human factors, including risky driving behaviors and mechanical issues, such as tire failure and defective brakes. Similarly, Mustapha *et al.* (2022) pointed out concerns, such as careless driving and drunk driving in Uganda (Balunywa, 2022). On the other hand, Khadka *et al.* (2021) stressed the importance of managing stress, preventing drunken driving and ensuring proper fleet maintenance to address road accidents. Similarly, Khyara *et al.* (2022) emphasized effective driver training, strategic routing, timetabling and compliance as critical strategies for alleviating the impact of road accidents.

Zimbabwe is experiencing road fatalities that mirror wider regional and global patterns. The country has witnessed a 35% increase in traffic crash fatalities, from 1,291 in 2010 to 2,000 in 2019. Despite regulations and penalties, the rate of road traffic accidents in Zimbabwe remains alarming, with an average of five deaths every day (United Nations Economic Commission for Africa, 2021). This surge emphasizes the urgent need for action to address the escalating number of fatalities. Extant literature points out key risk factors for road fatalities in Zimbabwe, including reckless driving, traffic law violations, inadequate driver training and lack of enforcement. In addition, the use of a "target system" in the road haulage sector has placed drivers under undue pressure for unsafe practices and noncompliance with speed limits (Muchaendepi *et al.*, 2018). A relatively well-developed body of literature has investigated the causes of road accidents (Elmrghni, 2022; Adeniji *et al.*, 2020; Mustapha *et al.*, 2022; Balunywa, 2022). However, research specific to the road haulage sector remains limited, prompting a notable research gap in this context.

Although the causes of road accidents are well documented in the existing literature, a distinct void exists regarding the extent to which institutional dynamics influence road accidents, particularly for firms in the road haulage sector. Extant literature has examined the use of information and communication technology (ICT) in the road haulage sector (Wang *et al.*, 2015; Muchaendepi *et al.*, 2018; Tob-Ogu *et al.*, 2018; Chatti, 2020; Chiparo *et al.*, 2022), but the moderating role of ICT in the relationship between institutional dynamics and road accidents has not been addressed. This creates a yawning research gap that this study aims to address. This study aims to fill this gap by using institutional theory, safety culture theory and a technology acceptance model (TAM) to examine the influence of institutional dynamics on road accidents in the road haulage sector, along with the role of ICT in this relationship. The findings of this study provide a comprehensive framework for how road haulage companies can use institutional dynamics to devise strategies and interventions aimed at reducing road accidents.

A structured approach is used to address these questions. The remainder of this paper is organized as follows: First, it provides an overview of institutional dynamics, ICT, road accidents and the development of research hypotheses. Finally, this study discusses its findings, implications, limitations and potential future research directions.

2. Theoretical framework

2.1 Theory underpinning the study

The primary theoretical frameworks for this study are institutional theory, safety culture theory and the TAM. Institutional theory examines how organizations and their behaviors

are influenced by norms, rules and institutional structures (Meyer, 2021). This theory was used to examine how institutional dynamics in the road haulage sector shape safety practices and policies and how these institutional dynamics interact with ICT to influence road accidents. On the other hand, safety culture theory focuses on understanding the values, beliefs, attitudes and behaviors related to safety in an organization (Wiegmann *et al.*, 2007). This theory was used to investigate the effect of institutional dynamics on the development of safety culture in road haulage companies. It also provides insights into how ICT can shape a safety culture through communication, training and monitoring mechanisms. Furthermore, this study used the TAM to examine how information and communication technologies are used (Theoharakis and Mylonopoulos, 2022). TAM examines factors that influence an individual's acceptance and use of technology, such as perceived usefulness and ease of use. The application of this theory helps road haulage companies to understand and integrate ICT solutions into their operations to improve road safety.

2.2 Institutional dynamics

Institutional dynamics refer to the processes that shape the behavior, structure and functioning of institutions within a society or organization (Spandler, 2018). It involves the study of how institutions evolve, adapt and respond to internal and external changes as well as how they influence individuals' actions, beliefs and decision-making processes. Understanding institutional dynamics is crucial for assessing the stability, effectiveness and adaptability of institutions in addressing societal challenges and achieving their objectives (Naveed *et al.*, 2022). In the context of fleet management, several institutional factors (e.g. safety culture, policy enforcement, driver management and training) can significantly influence road accidents.

2.3 Safety culture

Safety culture refers to the attitudes, beliefs, perceptions and values that an organization and its employees share regarding safety in the workplace. It encompasses collective norms and behaviors related to safety that are ingrained in an organization's daily practices (Bisbey *et al.*, 2021). A positive safety culture places high priority on preventing accidents, injuries and other safety-related incidents (Adjekum and Tous, 2020). Top management must lead by example and demonstrate genuine commitment to safety. This involves providing necessary resources, setting clear safety objectives and actively participating in safety initiatives. Furthermore, establishing effective two-way communication channels through which employees can voice safety concerns, offer suggestions and receive feedback is crucial for identifying and addressing potential safety issues (Ahamad *et al.*, 2022).

2.4 Vehicle maintenance

Vehicle maintenance refers to the regular upkeep and servicing of motor vehicles to ensure their safe and efficient operation (Karim *et al.*, 2016). Proper vehicle maintenance is essential to prolong the life of a vehicle, prevent breakdowns, maximize fuel efficiency and ensure the safety of passengers and other road users. It involves a range of activities, from basic routine checks to complex repairs (Joiner *et al.*, 2023).

2.5 Driver training

Driver training refers to the process of educating and instructing drivers on how to operate motor vehicles safely and responsibly (Chiparo *et al.*, 2022). The goal of driver training is to develop the knowledge, skills and attitudes necessary for drivers to become competent,

confident and law-abiding. Proper driver training plays a crucial role in reducing accidents, improving road safety and promoting driving behavior.

2.6 Driver management

Driver management is defined as the process of effectively overseeing and supervising drivers (Kanyepe, 2023). This involves various activities aimed at ensuring the safety, efficiency and compliance of drivers while they are on the road. Driver management is essential for organizations that rely on transportation services and want to maintain high standards of safety and performance (Chiparo *et al.*, 2022).

2.7 Road accidents

Road traffic accident occurs when a vehicle collides with another vehicle, pedestrian, animal, road debris, or other stationary obstruction, such as a tree or utility pole (Khyara *et al.*, 2022; Yahaya and Abubakar, 2022). These collisions can lead to various outcomes, ranging from injury and death to vehicle or property damage. Multiple elements contribute to the heightened risk of such collisions, encompassing vehicle design, operational speed, road infrastructure, environmental conditions, driver proficiency, potential impairments and driver conduct (Giummarra *et al.*, 2021). Road vehicle accidents result in fatalities, disabilities and substantial financial burdens both for society and the individuals directly affected (Mphela *et al.*, 2021).

2.8 Information communication technology

ICT represents the forefront of technology, enabling seamless communication, storage, retrieval and transmission of information through diverse electronic channels (Demestichas and Daskalakis, 2020). ICT, with its cutting-edge technologies, empowers efficient data processing, management and exchange, revolutionizing communication, work, education and information access across multiple vital domains (Ahammed *et al.*, 2023). Notably, ICT's influence also extends to critical areas, such as road accidents, where it significantly advances accident prevention, streamlines traffic management and enhances overall transportation efficiency.

2.9 Development of hypotheses and research model

Literature confirms that proper vehicle maintenance reduces the occurrence of road accidents (Babić *et al.*, 2022). Joiner *et al.* (2023) have observed that regular maintenance including inspections, tune-ups and servicing, helps keep a vehicle in an optimal working condition. This is supported by Suman *et al.* (2022), who explained that properly maintained vehicles are less likely to experience mechanical failure or breakdown, thereby reducing the risk of accidents caused by sudden malfunctions. Well-maintained brakes, tires, steering systems and lights improve handling, stability and overall vehicle performance (Huang *et al.*, 2023). Modern vehicles are equipped with various safety systems such as anti-lock braking system (ABS), electronic stability control (ESC), airbags and traction control. Regular maintenance ensures that these safety systems function correctly and can provide the intended protection in the event of a collision or emergency (Petrescu, 2020). Appropriate tire inflation, regular rotation and tread depth checks contribute to optimal traction, improved handling and shorter braking distance. Well-maintained tires provide a better grip on wet or slippery roads, thereby reducing the risk of skidding and loss of control (Huang *et al.*, 2023). Firms can promptly identify faults when vehicles are regularly maintained, thereby preventing accidents caused by vehicle-related failures. Through proper vehicle maintenance, drivers

can minimize the chances of such emergencies and ensure their safety as well as the safety of others. Thus, we formulate the following hypothesis:

H1a. Vehicle maintenance positively affects road accidents.

Prior studies have confirmed a positive relationship between policy enforcement and road accidents (Ram and Chand, 2016). Policy enforcement ensures that drivers adhere to traffic regulations and laws. Strict enforcement of speed limits, seatbelt usage, traffic signal compliance and other traffic rules discourages risky behavior, encourages safe driving practices and reduces accidents, injuries and fatalities on roads (Shermurotov, 2023). In addition, effective policy enforcement acts as a deterrent to dangerous driving behaviors such as drunk driving, distracted driving and aggressive driving (Parsons, 2017). Knowing the consequences of violating these policies, drivers are more likely to think twice before engaging in risky actions (Yang *et al.*, 2022). The enforcement of policies related to reckless driving behaviors, such as overtaking in dangerous situations, tailgating and lane violations, helps to prevent accidents (Adavikottu *et al.*, 2023). In addition, policy enforcement helps to ensure vehicle safety standards, such as compliance with maintenance and inspection requirements and enforcing regulations related to vehicle safety equipment (e.g. seat belts, airbags and brakes) (Halder *et al.*, 2020). A study by Uzondu *et al.* (2022) found that organizations can promote a culture of safety and cultivate positive attitudes through policy enforcement. In summary, policy enforcement has a significant effect on road fatalities by promoting compliance with traffic regulations, deterring dangerous behavior, preventing recklessness, improving vehicle safety standards, increasing public awareness and encouraging responsible road user behavior. Thus, we hypothesize as follows:

H1b. Policy enforcement has a positive effect on road accidents.

Literature confirms that safety culture significantly influences road accidents. Safety culture includes collective values, attitudes, beliefs and behaviors regarding safety within an organization or society (Bisbey *et al.*, 2021). A positive safety culture promotes strong commitment to safety, proactive risk management and continuous improvement (Zwetsloot *et al.*, 2020). A strong safety culture instills a safety mindset among individuals and promotes the understanding that safety is a top priority and should not be compromised (Adjekum and Tous, 2020). This mindset encourages individuals to prioritize safe behaviors, make responsible decisions and take appropriate actions to prevent accidents (Ahamad *et al.*, 2022). Additionally, a positive safety culture promotes adherence to traffic laws, vehicle maintenance requirements and safe equipment usage (Mokarami *et al.*, 2019). In a positive culture, individuals are held accountable for their actions, reinforcing the importance of safe practices and consequences for noncompliance (Lee *et al.*, 2018). By nurturing a positive safety culture, organizations can create an environment in which road safety is prioritized by aligning behavior with safe practices, thus reducing road accidents, injuries and fatalities and creating safer roadways for all users. Thus, we hypothesize as follows:

H1c. Safety culture has a positive effect on road accidents.

Literature confirms a positive relationship between driver training and road accidents (Zhao *et al.*, 2019). Driver-training programs enhance drivers' understanding of traffic rules, regulations and safe driving practices, empowering them to navigate roads safely and legally (DeNicola *et al.*, 2016). Training in defensive driving techniques helps drivers to maintain situational awareness, observe traffic patterns and make proactive decisions to avoid accidents (Koesdwiady *et al.*, 2016). Drivers undergo comprehensive training to identify potential risks, including pedestrians, cyclists and other vehicles, while skillfully assessing the level of risk involved in diverse driving scenarios (Pradhan *et al.*, 2009). This equips them with the necessary expertise to navigate roads safely and responsibly, ensuring the

well-being of all road users and promoting a culture of heightened awareness and caution on streets. Driver training programs typically address the risks associated with impaired driving, including driving under the influence of alcohol or drugs, drowsy driving, or distracted driving (Higgins *et al.*, 2017). Additionally, driver training can influence driver attitudes and behaviors, thereby promoting a safety-oriented mindset. By instilling a sense of responsibility and accountability, training can help reduce aggressive driving behaviors and promote a culture of mutual respect. Thus, it is hypothesized that:

H1d. Driver training has a positive effect on road accidents.

Literature confirms that driver management positively influences road accidents (Douglas and Swartz, 2017). A thorough driver management process, including driver recruitment and selection, helps to identify, hire and qualify drivers (Metz *et al.*, 2007). They added that evaluating factors, such as driving records, qualifications and experience, helps firms choose drivers with a lower risk of engaging in unsafe behaviors or causing accidents. Effective driver management ensures that drivers comply with road safety regulations and internal company policies such as speed limits, mandatory rest periods and proper use of safety equipment. In addition, regular performance assessments, such as reviewing driving records, analyzing telematics data and conducting driver evaluations, allow organizations to identify areas for improvement or patterns of risky behavior (Siami *et al.*, 2020). In addition, proper driver management includes implementing strategies to effectively manage driver fatigue, such as scheduling regular rest breaks, ensuring sufficient rest periods and promoting a culture that values driver well-being. By addressing fatigue-related risks, driver management increases alertness and reduces the likelihood of fatigue-related accidents (Dawson *et al.*, 2012). Furthermore, establishing open lines of communication allows the reporting of safety concerns, sharing of important information and providing support to drivers. Thus, it is hypothesized that:

H1e. Driver management has a positive effect on road accidents.

There is scant literature on the moderating role of ICT in the effect of aggregate institutional dynamics factors on road accidents. ICT enables the collection and analysis of vast amounts of data related to accident records, traffic patterns, driver behavior and road infrastructure conditions (Zhu *et al.*, 2018). The use of advanced data analytics and visualization tools helps organizations gain valuable insights into the factors contributing to accidents, identify high-risk areas and develop targeted interventions to improve road safety (Noy *et al.*, 2018). In addition, ICT facilitates the real-time monitoring and surveillance of road conditions, traffic flow and driver behavior (Hsu *et al.*, 2015). The use of technologies such as closed-circuit television (CCTV), vehicle tracking systems and intelligent transportation systems helps organizations promptly detect potential safety risks, thereby alerting drivers, rerouting traffic, or deploying emergency services to mitigate these risks (Fries *et al.*, 2008). Timely and accurate information regarding road conditions, accidents, detours and safety advisories can be disseminated through various channels including mobile apps, websites, social media and electronic message boards (Jeong *et al.*, 2021). This helps raise awareness, educate road users and encourage responsible behavior on the road. ICT-enabled intelligent-driver-assistance systems (IDAS), such as lane departure warning systems, adaptive cruise control and collision avoidance systems, can significantly enhance road safety (Gaur and Sahoo, 2022). Furthermore, ICT can support the delivery of driver training and education programs through e-learning platforms, interactive simulations and virtual reality experiences (Monahan *et al.*, 2008). ICT-based training programs can reinforce institutional efforts to promote road safety by reaching a larger audience and ensuring consistent and standardized training practices. Thus, it is hypothesized that:

H2a. ICT moderates the effect of vehicle maintenance on road accidents.

H2b. ICT moderates the effect of policy enforcement on road accidents.

H2c. ICT moderates the effect of safety culture on road accidents.

H2d. ICT moderates the effect of driver management on road accidents.

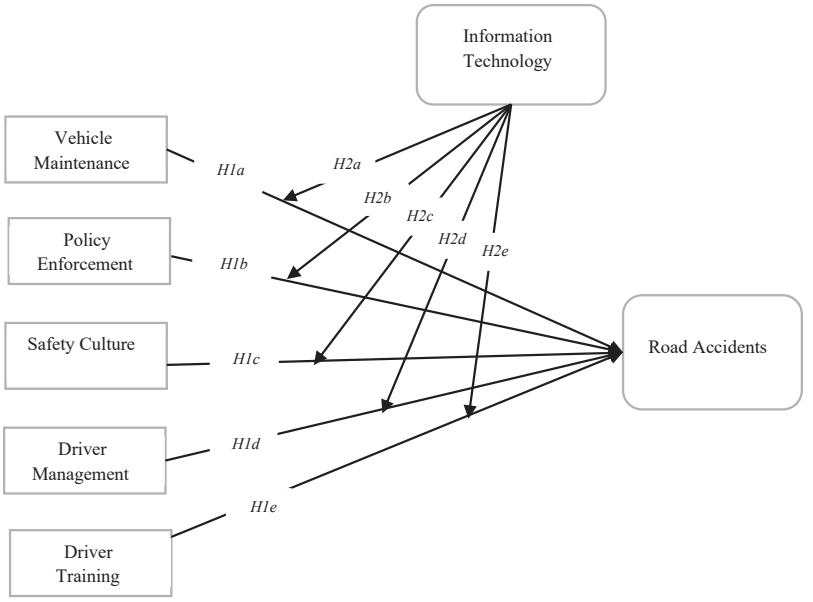
H2e. ICT moderates the effect of driver training on road accidents.

Based on the preceding discussion, the proposed research model is illustrated in Figure 1.

3. Research methods

3.1 Sample selection and data collection

This study used a cross-sectional research design where data were collected once. This design was used because it involves the investigation of a specific phenomenon occurring at a specific time (Saunders *et al.*, 2019). Data were collected from eight major road haulage companies in Harare, Zimbabwe, between November and December 2022. Companies were conveniently selected based on ease of access. The records indicate that these companies collectively employ 200 employees. Following the guidelines from Krejcie and Morgan (1970) formula, the sample size was comprised of 133 people. Subsequently, 133 questionnaires were distributed to employees within the selected eight companies. Permission to collect data was first sought from each organization. To guarantee that the information gathered would be analyzed in confidence, respondents were assured that the survey would be anonymous, and their consent was obtained prior to their participation. A simple random sampling method was used to select respondents. Simple random sampling was used to enhance randomness and reduce bias within each of the eight selected companies to choose respondents. In



Source(s): Author's own work

Figure 1.
Research model

addition, sample random was used to minimize the likelihood of intentional or unintentional bias in the selection process (Makumi *et al.*, 2021). A total of 133 questionnaires were distributed, and 110 of them were returned and considered useable for the survey, giving a response rate of 84.6%.

3.2 Respondents profile

The demographic profile of the respondents shows that 67% of the respondents were male, and 43% of the participants were between the ages of 36 and 56. Furthermore, 44% of the respondents had a bachelor's degree. Additionally, it was noted that most respondents had more than three years of working experience.

3.3 Measurement instrument and questionnaire design

All variables were measured using a comprehensive five-point Likert scale, ranging from 1 = "strongly disagree" to 5 = "strongly agree." The questionnaire was divided into seven main sections to cover a wide range of relevant factors: respondents' demographic characteristics, safety culture, vehicle maintenance, policy, enforcement, driver management, driver training and information, communication technology and road accidents. To ensure that the study was appropriately operationalized and captured the concept of the measured study variables, the study borrowed measurement items from prior related studies. Table 1 shows the measurements of the variables.

3.4 Data analysis techniques

The data were subjected to statistical analysis using SPSS version 20. Cronbach's alpha coefficient was employed to assess internal consistency among the study variables. Exploratory factor analysis (EFA) was conducted to validate the items used in the study, enabling data transformation, hypothesis testing and data scaling. Factors loading below 0.5 or exhibiting double loading were removed, while loading above 0.5 were retained. The study hypotheses were tested using structural equation modeling (SEM) in Amos version 21, chosen because of its suitability for complex models with multiple variables (Hasman, 2015). This study explored the moderating impact of information communication technology on the relationship between institutional dynamics and road accidents using moderated regression analysis.

4. Results

4.1 Measurement model

The study used maximum likelihood estimation (MLE) to estimate the measurement model and institutional dynamics were treated as a second-order construct represented by safety culture (SAC), vehicle maintenance (VEM), policy enforcement (POE), driver management (DRM) and driver training (DRT). To determine convergent validity, the study used model fit indices, standardized factor loadings (λ), critical ratios (CRs) and average variance extracted (AVE). The study used the CMIN/DF (χ^2/Df), goodness-of-fit index (GFI), adjusted GFI (AGFI), normed fit index (NFI), Tucker–Lewis index (TLI), comparative fit index (CFI) and root mean square error of approximation (RMSEA). The measurement model showed suitable model fit indices [x2/df = 2.224, CFI = 0.951, AGFI = 0.840, TLI = 0.929 and RMSEA = 0.061]. Evaluation of the measurement model indicated that all observed items were significantly and strongly loaded on their underlying constructs. Table 2 shows that all the constructs demonstrated high reliability, with the alpha coefficient (α) exceeding the recommended threshold of 0.7. The CRs exhibited significant values at $p < 0.001$, and all AVE values for the measured constructs surpassed the required threshold of 0.5 (Fornell and

Variable	Code	Measure	Source
Safety culture	SAC1	Our leadership team encourages open communication about safety concerns	Ahamad *et al.* (2022)
	SAC2	Employees are aware of potential hazards in their work environment	
	SAC3	Safety procedures and guidelines are clearly communicated and easily accessible	
	SAC4	Our leadership encourages learning from safety incidents to prevent recurrence	
Vehicle maintenance	VEM1	Our vehicles receive scheduled maintenance as recommended by the manufacturer	Chiparo *et al.* (2022)
	VEM2	Regular safety checks are conducted on the vehicle's critical components (brakes, tires, lights, etc.)	
	VEM3	Vehicle maintenance strictly complies with safety and quality standards	
	VEM4	Maintenance records for the vehicle are consistently updated and well-maintained	
Policy enforcement	POE1	Management demonstrates a commitment to upholding and enforcing policies effectively	Foroutaghe *et al.* (2020)
	POE2	Employees are held accountable for following the organization's policies	
	POE3	Violations of policies are consistently addressed and appropriately handled by management	
	POE4	There are clear consequences for noncompliance with organizational policies	
Driver management	DRM1	Drivers demonstrate a responsible attitude towards road safety	Elvik (2022), Chiparo *et al.* (2022)
	DRM2	Drivers are cautious and alert while driving, especially in challenging conditions	
	DRM3	Drivers actively avoid distractions such as mobile phones while on the road	
	DRM4	Drivers promptly report any issues or faults with their vehicles that may affect road safety	
Driver training	DRT1	Driver training provides a better understanding of road signs and their meanings	Sun *et al.* (2019), Chiparo *et al.* (2022)
	DRT2	The training enhances the knowledge of defensive driving techniques	
	DRT3	The training equipped drivers with the skills necessary to avoid accidents on the road	
	DRT4	The training improves awareness of potential hazards on the road	
Information communication technology	ICT1	The road safety applications available are effective in providing real-time traffic updates	Aflabo *et al.* (2020), Chiparo *et al.* (2022)
	ICT2	The user interface of GPS systems or navigation tools is intuitive and easy to use	
	ICT3	ICT features in vehicles help in minimizing distractions while driving	
Road accidents	ROA1	There has been an increase in the total number of reported accidents	Hammad *et al.* (2019), Saladié *et al.* (2020)
	ROA2	The number of people who died because of road accidents has increased	
	ROA3	The economic impact of accidents in terms of medical costs, property damage, legal fees and insurance costs has increased	

Source(s): Authors' own work

Table 1. Measurement of variables

Constructs	Items	λ	CRs	α	Mean value	Standard deviation
Safety culture	SAC1	0.721	–	0.864	3.50	0.911
	SAC2	0.704	8.519***			
	SAC3	0.602	10.186***			
	SAC4	0.714	12.626***			
Vehicle maintenance	VEM1	0.727	–	0.911	4.02	0.779
	VEM2	0.705	10.921***			
	VEM3	0.732	9.784***			
	VEM4	0.655	11.657***			
Policy enforcement	POE1	0.721	–	0.887	4.23	0.845
	POE2	0.603	11.722***			
	POE3	0.611	9.854***			
	POE4	0.661	12.245***			
Driver management	DRM1	0.731	–	0.905	3.97	0.785
	DRM2	0.714	8.549***			
	DRM3	0.607	11.170***			
	DRM4	0.804	10.636***			
Driver training	DRT1	0.703	–	0.923	4.02	0.885
	DRT2	0.744	11.911***			
	DRT3	0.712	9.742***			
	DRT4	0.674	13.657***			
Information communication technology	ICT1	0.613	12.802***	0.877	4.11	0.832
	ICT2	0.607	9.054***			
	ICT3	0.631	10.711***			
Road accidents	ROA1	0.718	–	0.824	3.98	0.907
	ROA2	0.715	9.529***			
	ROA3	0.655	11.106***			

Table 2.
Reliability and construct validity test

Note(s): CR is fixed; $^{***}p < 0.001$
Source(s): Authors' own work

Larcker, 1981). Moreover, all standardized factor loadings for the items exceeded the minimum cut-off of 0.6 (Bagozzi and Yi, 1988). The preconditions for convergent validity were satisfied. Table 2 presents the constructs, items, λ, CR and α. Discriminant validity was established using the Fornell–Larcker criterion. Using the Fornell and Larcker (1981) criterion, the square root of each construct's AVE exceeded its respective intercorrelations, as shown in Table 3.

Constructs	SAC	VEM	POE	DRM	DRT	ICT	ROA
Safety culture (SAC)	*0.710*						
Vehicle maintenance (VEM)	0.227	*0.743*					
Policy enforcement (POE)	0.301	0.403	*0.695*				
Driver management (DRM)	0.313	0.221	0.227	*0.680*			
Driver training (DRT	0.227	0.202	0.217	0.202	*0.791*		
Information communication technology (ICT)	0.299	0.311	0.302	0.311	0.381	*0.602*	
Road accidents (ROA)	0.313	0.211	0.220	0.304	0.223	0.311	*0.621*

Table 3.
AVEs and SICCs

Note(s): Diagonal elements in italic represent AVEs
Source(s): Authors' own work

4.2 Structural equation modeling

Research hypotheses H1a, H1b, H1c, H1d and H1e were tested in AMOS version 21. The Model fit indices were acceptable: CMIN//DF = 3.169; GFI = 0.871; AGFI = 0.901; NFI = 0.939; TLI = 0.837; CFI = 0.808 and RMSEA = 0.042. Results of the hypothesis test are presented in Table 4.

Table 4 indicates that H1a, H1b, H1c, H1d and H1e are statistically supported. The findings imply that there is statistical support for direct relationships among SAC, VEM, POE, DRM, DRT road accidents (ROA). In addition, H2 was tested using moderated regression analysis. The results presented in Table 5 show the interaction between aggregate institutional dynamics, information communication technology and ROA. The moderating effect of ICT on vehicle maintenance ($\beta = 0.610$, $t = 1.045$), policy enforcement ($\beta = 0.585$, $t = 3.072$), safety culture ($\beta = 0.147$, $t = 2.028$), driver training ($\beta = 0.488$, $t = 6.120$) and driver management ($\beta = 0.751$, $t = 5.022$) This suggests that information communication technology moderates the effect of vehicle maintenance, policy enforcement, safety culture, driver training and driver management on road accidents.

5. Discussion and conclusions

This study examined the moderating role of ICT on the effect of institutional dynamics on road accidents. The results showed that vehicle maintenance positively influences road accidents (Babić *et al.*, 2022). This implies that most companies in the road haulage sector fail to conduct regular maintenance on all their fleets, thus exposing themselves to road accidents. This finding is supported by the findings of Suman *et al.* (2022), who observed that properly maintained vehicles are less likely to experience mechanical failure or breakdown, thereby reducing the risk of accidents caused by sudden malfunctions. Petrescu (2020) explained that appropriate tire inflation, regular rotation and tread depth checks contribute to optimal traction, improved handling and shorter braking distances. The study also confirms a positive relationship between policy enforcement and road accidents. This means that policy enforcement ensures that fleet users, including drivers, adhere to traffic regulations, laws and other company fleet management policies. This finding validates the institutional

Table 4.
Hypothesis testing

Hypotheses	Hypothesized relationship	SRW	CR	Remark
H1a	Vehicle Maintenance → Road accidents	0.269	10.176***	Supported
H1b	Policy Enforcement → Road accidents	0.414	11.335***	Supported
H1c	Safety Culture → Road accidents	0.245	9.235***	Supported
H1d	Driver Training → Road accidents	0.327	11.441***	Supported
H1e	Driver Management → Road accidents	0.361	12.944***	Supported

Source(s): Authors' own work

Table 5.
Moderated regression

Hypothesis	Relation	β-value	*t*-statistic	*p*-value	Decision
H2a	ICT*VEM → ROA	0.610	1.045	0.041	Supported
H_{2b}	ICT*POE → ROA	0.585	3.072	0.022	Supported
H_{2c}	ICT*SAC → ROA	0.147	2.028	0.019	Supported
H_{2d}	ICT*DRT → ROA	0.488	6.120	0.007	Supported
H_{2e}	ICT*DRM → ROA	0.751	5.022	0.010	Supported

Note(s): *$p < 0.05$, **$p < 0.01$ (One-tailed)
Source(s): Authors' own work

theory that organizations are influenced by their norms, rules and institutional structures. The findings of this study also corroborate the findings of Shermurotov (2023), who pointed out that strict enforcement of speed limits, seatbelt usage, traffic signal compliance and other traffic rules discourages risky behavior, encourages safe driving practices and reduces accidents, injuries and fatalities on roads. Similarly, Uzondu *et al.* (2022) found that organizations can promote a culture of safety and cultivate positive attitudes through policy enforcement.

Additionally, this study confirmed that safety culture significantly influences road accidents. When the findings are compared to those of other studies, safety culture includes collective values, attitudes, beliefs and behaviors regarding safety within an organization or society (Mokarami *et al.*, 2019; Zwetsloot *et al.*, 2020; Ahamad *et al.*, 2022). It becomes clear that a positive safety culture creates an environment in which road safety is prioritized to reduce road accidents, injuries and fatalities. The study also established that driver training positively influenced road accidents. This finding corroborates that of DeNicola *et al.* (2016), who found that driver-training programs enhance drivers' understanding of traffic rules, regulations and safe driving practices, empowering them to navigate roads safely and legally. Similarly, Higgins *et al.* (2017) explained that driver-training programs typically address the risks associated with impaired driving, including driving under the influence of alcohol or drugs, drowsy driving and distracted driving. Additionally, driver training can influence driver attitudes and behaviors, thereby promoting a safety-oriented mindset.

Moreover, this study confirmed that driver management positively influences road accidents. These results are in line with the work of Dawson *et al.* (2012), who explained that addressing fatigue-related risks contributes to increased alertness and reduces the likelihood of fatigue-related accidents. Moderating influence of vehicle maintenance ($\beta = 0.610$, $t = 1.045$), policy enforcement ($\beta = 0.585$, $t = 3.072$), safety culture ($\beta = 0.147$, $t = 2.028$), driver training ($\beta = 0.488$, $t = 6.120$) and driver management ($\beta = 0.751$, $t = 5.022$) on road accidents. There is a paucity of literature on the moderating role of ICT in the effect of institutional dynamics on road accidents. Therefore, this result broadens existing knowledge on the influence of institutional dynamics on road accidents. Zhu *et al.* (2018) pointed out that ICT enables the collection and analysis of vast amounts of data related to accident records, traffic patterns, driver behavior and road infrastructure conditions. The use of advanced data analytics and visualization tools helps organizations gain valuable insights into the factors contributing to accidents, identify high-risk areas and develop targeted interventions to improve road safety (Noy *et al.*, 2018).

5.1 Practical implications

This study examines the effect of institutional dynamics on road accidents within the road haulage sector and explores the moderating influence of ICT in this relationship. The findings of this study offer significant insight into the role of safety culture in improving road safety. Notably, an unexpected finding that emerged from this study is that ICT moderates the effect of institutional dynamics on road accidents. This study recommends that policymakers in the road haulage sector create a positive safety culture characterized by openness and recognition of employees' contributions. This empowers managers to establish an environment that promotes accident reduction by encouraging employee participation in safety programs. In addition, managers should ensure that policies deter unsafe behavior, promote compliance with regulations and create a safer environment through education and accountability. Firms should be compelled by law to have and own their own breathalyzers to address the problem of noncompliance with the aspects of drunk driving. Drivers were tested with breathalyzers before and after the trip. Moreover, firms should continuously invest in driver training and development to deal with errant driver behaviors and negative driving habits.

Leveraging ICT can help firms to promote safer and accident-free work environments. The firm should prioritize the adoption of modern technologies such as driver assistance systems, telematics and real-time data analytics to regulate driver speed. In addition, firms can use on-board speed-monitoring mechanisms for vehicle self-regulation to curb negative driving habits. Furthermore, firms should ensure that they regularly service their vehicles to ensure that they are safe, reliable and in good working condition.

5.2 Implications for future studies

This study aims to investigate the moderating role of ICT on the effect of institutional dynamics on road accidents within the road haulage sector in Zimbabwe. This may limit the generalizability of the findings. Therefore, future studies can be conducted in other sectors, such as passenger transport and in other geographical areas to provide additional insights into the relationship between institutional dynamics and road accidents. Moreover, future studies could investigate the barriers that impede ICT adoption in the road haulage sector. Furthermore, other future studies should also use other moderating and mediating variables.

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