

Artificial Intelligence for Intelligent Road Communication: Systems and Strategies in Cameroon

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Abstract: Road safety in Cameroon remains a major concern, with thousands of deaths and significant economic losses recorded annually. Traditional road communication strategies have shown limited effectiveness, revealing a gap between the messages disseminated and their appropriation by road users. In this context, artificial intelligence (AI) emerges as a strategic resource to rethink prevention and traffic regulation. Intelligent Transport Systems (ITS) and digital tools such as navigation applications, smart sensors, and connected vehicles provide new opportunities for interactive, predictive, and adaptive communication. The study adopts an empirico-inductive methodology based on observation, documentary analysis, and international comparison. The theoretical framework combines Shannon and Weaver's mathematical theory of communication, Habermas's theory of communicative action, Crozier and Friedberg's sociology of regulation, and ITS approaches. The analysis highlights both media and non-media strategies, while demonstrating the concrete contributions of AI to traffic fluidity, accident reduction, and road governance. It concludes with the challenges and prospects of implementing intelligent road communication adapted to the Cameroonian context.

Keywords: Artificial intelligence, road communication, intelligent transport systems, road safety, urban mobility, in-communication.

1. Introduction

Road insecurity in Cameroon remains a major problem, with more than 3,000 deaths recorded in 2021 and economic losses estimated at nearly 200 billion CFA francs (Anadolu Agency, 2021). Despite awareness campaigns and traditional communication mechanisms, accidents persist and reveal a gap between the messages disseminated and their appropriation by road users. The problem this research seeks to address is, therefore, the limited effectiveness

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of traditional road communication strategies in the face of the growing complexity of urban mobility and the increase in traffic. In this context, Artificial Intelligence (AI) emerges as a strategic resource for rethinking road communication. Studies on Intelligent Transport Systems (ITS) show that AI can streamline traffic, reduce accidents, and optimize infrastructure (Zhang & Zhao, 2020; Chen et al., 2021). Moreover, digital tools such as navigation applications, smart sensors, or connected vehicles (Papadimitratos et al., 2009; Li & Wang, 2019) offer new perspectives for interactive, predictive, and user-adapted road communication. Thus, the scientific issue guiding this study can be formulated as follows: despite traditional road communication mechanisms, insecurity persists in Cameroon, revealing a disconnect between the messages disseminated and their appropriation by users. Artificial Intelligence, through Intelligent Transport Systems and digital tools, appears as an innovative solution. Two research questions arise: How can Artificial Intelligence improve the effectiveness of road communication in Cameroon in terms of the prevention and regulation of user behavior? And what AI-based devices and intelligent communication strategies can address the limits of traditional approaches and contribute to reducing road insecurity? The methodology adopted is empirico-inductive, starting from observed facts (statistics, existing mechanisms, technological innovations) to build a theoretical reflection. The study relies on documentary and qualitative analysis of road communication strategies and the contributions of Artificial Intelligence, taking Cameroon as the field of study and placing it in perspective with international experiences. The theoretical framework mobilized is based on the mathematical theory of communication (Shannon & Weaver, 1949), which makes it possible to analyze message transmission and obstacles related to noise or information loss; the theory of communicative action (Habermas, 1987), which highlights the social and normative dimension of communication and the search for consensus among actors; the sociology of regulation (Crozier & Friedberg, 1977), which helps to understand the interplay of actors and the margins of maneuver in the implementation of public policies; as well as theories of Intelligent Transport Systems (ITS), which show how AI can transform regulation and road communication. The reflection will unfold in three sections: the first will present the theoretical and methodological foundations; the second will analyze strategies and mechanisms of intelligent road communication, distinguishing media and non-media approaches; the third will highlight the concrete contributions of Artificial Intelligence in road prevention and regulation in Cameroon, while identifying challenges and futures perspectives.

2. Theoretical and Methodological Foundations of Road Communication in Cameroon

In Cameroon, road communication faces fragile infrastructure and weak regulation. The examination of theoretical and methodological foundations highlights the structural limitations of current road signage and awareness mechanisms. This analysis reveals the complexity of interactions between users, regulatory authorities, and communication technologies—interactions marked by a lack of institutional coordination and a limited capacity for innovation. This systemic incoherence contributes to the persistence of major dysfunctions, whose socio-economic consequences include high accident rates, chronic congestion of transport networks,

and negative environmental externalities. In this sense, road communication appears not only as an issue of behavioral regulation but also as a strategic field where social logics, public policies, and technological innovations intersect. It serves as a basis for integrating intelligent strategies and Artificial Intelligence into this sector.

2.1 Present State of Road Infrastructure

Cameroon has a road network estimated at 121,873 km, of which only 8.4% are paved. The predominance of unpaved roads accentuates regional disparities and weakens mobility, particularly in rural areas (Aukmer, 2024). This fragility is most acute in the Far North and East regions, where the majority of dirt roads become impassable during the rainy season, leaving certain localities permanently isolated. For example, the routes linking Maroua to Kousseri or Bertoua to Yokadouma frequently experience traffic interruptions, causing delays in the delivery of agricultural products and increasing transport costs.

In the Far North and East, the predominance of dirt roads that become unusable in the rainy season isolates many communities. The study notes that the Maroua–Kousseri and Bertoua–Yokadouma axes are often disrupted, leading to delays in agricultural supply chains and higher transport costs. This situation concretely illustrates how the low proportion of paved roads exacerbates regional disparities and undermines mobility, especially in rural areas where access to markets and essential services depends on these infrastructures.

These realities show how the limited share of paved roads restricts access to markets and essential services, thereby aggravating territorial inequalities and reinforcing the vulnerability of rural zones. In response, the National Development Strategy 2020–2030 (SND30) enabled the construction of more than 2,150 km of additional roads (MINEPAT, 2020). However, these efforts remain insufficient to meet demographic growth and rapid urbanization (Impact Echos News, 2025). Beyond physical infrastructure, road signage and regulation systems also present serious shortcomings. In several cities, traffic lights are defective or absent, while horizontal markings are often faded. These deficits contribute to chaotic traffic regulation and reduce users' ability to anticipate risks (KalaraNet, 2016).

Thus, the current state of Cameroon's road network is characterized by :

- A low proportion of paved roads;
- Increased vulnerability of rural areas during the rainy season;
- Persistent territorial inequalities in access to markets and services ;
- Insufficient modernization efforts despite the SND30 ;
- Major deficits in traffic signage and regulation.

2.2 Key Challenges Faced

One of the main challenges of road communication in Cameroon can be understood through a systemic reading that draws on the mathematical theory of communication (Shannon & Weaver, 1949), the theory of communicative action (Habermas, 1987), and the sociology of regulation (Crozier & Friedberg, 1977). These approaches highlight the institutional fragmentation and technological lag that weaken traffic regulation. From this perspective, the

methodology adopted is empirico-inductive: it relies on the observation of existing mechanisms, documentary analysis, and the examination of technological innovations to understand the limitations of the road system. The analysis reveals an almost total absence of modern devices such as traffic sensors, dynamic signs, or automated systems, reflecting a weak integration of innovations. This deficiency limits the ability to anticipate traffic flows and adapt regulations in real time. It is further aggravated by the limited adoption of ICTs in road management, with databases and monitoring applications remaining rudimentary and unable to support effective governance. In addition, deficient institutional coordination is evident: municipalities, law enforcement, and transport agencies often act in isolation, undermining the coherence of prevention policies and reducing their impact. Together, these factors reveal a systemic crisis in which the lack of interoperability and technological modernization compromises the construction of effective and sustainable road communication (Observatoire du Développement Sociétal, 2024).

As a result, the limitations of the road system have particularly severe effects. On the social level, in 2024, Cameroon recorded more than 3,000 road accidents in seven months, causing 256 deaths and 254 serious injuries (Actu Cameroun, 2024; Cameroun Web, 2024). These tragedies, linked to deteriorating infrastructure and the absence of adequate signage, generate a high social cost. On the economic level, chronic traffic jams in major cities lead to significant productivity losses. At the African scale, road congestion costs approximately USD 314 billion per year due to lost time, increased pollution, and accidents (Notre Afrik, 2024), and Cameroon, with its high urbanization, is no exception to this trend. Finally, the environmental impact is also concerning, as road congestion increases energy consumption and pollutant emissions, contributing to air degradation and rising noise pollution.

3. Intelligent Road Communication in Cameroon: Towards an Integrated Approach

Intelligent road communication is conceived as a progressive approach aimed at integrating digital technologies and regulatory mechanisms in order to improve the safety, fluidity, and sustainability of transport. In technologically advanced countries, it combines autonomous vehicles, sensors, dynamic signage, and digital platforms to provide comprehensive, real-time information, thereby strengthening environmental awareness and coordination among traffic actors (Neuvition, 2022). However, Cameroon has not yet reached this stage. Here, reflection should rather be oriented towards a gradual adaptation, prioritizing realistic and accessible solutions such as improving conventional signage, introducing functional traffic lights, using mobile navigation applications, and establishing reliable databases for traffic monitoring. Likewise, Cerema (2019) points out that intelligent transport systems encompass technological and telecommunication devices applied to roads to enhance safety, efficiency, and regulation while limiting environmental impacts. In the Cameroonian context, these principles can be mobilized through modest but essential tools such as basic sensors to measure traffic flows, local digital platforms to inform users, or regulatory mechanisms adapted to urban and rural realities.

Intelligent road communication thus targets several stakeholders: users (drivers, pedestrians, passengers), public authorities (municipalities, law enforcement, ministries), and private operators (transport companies, technology firms). In Cameroon, it aims to strengthen road safety, streamline traffic, improve economic productivity, reduce environmental impact, and promote more coherent and interoperable governance. This section will be structured around three axes: first, the examination of public policies and the regulatory framework; second, the analysis of technological approaches adapted to the Cameroonian context; and third, the study of stakeholder involvement in the implementation of intelligent road communication.

3.1 Public Policies and Regulatory Framework

Intelligent road communication cannot develop effectively without a solid institutional foundation. Government plans for the modernization of transport constitute an essential lever, as they define strategic priorities in terms of infrastructure, integration of digital technologies, and project financing. These plans aim to strengthen sustainable mobility, improve road safety, and reduce the negative externalities associated with transport.

Moreover, traffic and safety standards and regulations play a decisive role in the operationalization of these policies. They establish technical standards for the installation of intelligent devices (sensors, dynamic signage, real-time management systems) and frame the responsibilities of the various actors (the State, local authorities, private operators). The existence of a coherent regulatory framework ensures not only compliance with international standards but also the protection of users and the effectiveness of public policies.

At the national level, Cameroon took an important step in August 2024 with the adoption of the action plan of its National Strategy for Road Safety and Foresight 2024–2030. This plan, validated by the Ministry of Transport and its partners, is based on five pillars: road safety management, road and mobility safety, vehicle safety, user safety, and post-accident care. It constitutes a strategic framework that aligns public policies with international standards and progressively integrates intelligent devices for traffic regulation.

In October 2024, the government also announced new safety measures for interurban freight vehicles, in line with presidential instructions. These measures include strengthened monitoring campaigns and stricter enforcement of violations, with particular emphasis on the interurban transport sector. They reflect a determination to more strictly regulate road practices and reduce risks linked to overloading and dangerous behavior.

Furthermore, the Ministry of Transport (MINTRANS) has multiplied prevention and awareness campaigns for users, while developing partnerships to modernize infrastructure and integrate digital technologies into traffic management. These actions are part of a proactive governance approach, in which the State and local authorities play a leading role in establishing a coherent regulatory framework.

These empirical illustrations highlight that intelligent road management in Cameroon does not rely solely on technological innovations, but on a solid institutional and regulatory foundation. Current government plans and regulations reflect a political will to modernize the sector, protect users, and promote sustainable mobility.

3.2 Technological Approach

The development of intelligent transport systems relies on the integration of advanced technological devices capable of transforming traffic management and user safety. The deployment of sensors and smart cameras constitutes an essential first step. These devices allow for the continuous collection of data on traffic density, vehicle speed, and risky behaviors, thereby providing an empirical basis for proactive regulation. Real-time traffic management systems represent a second pillar. Through the instant analysis of flows and the dissemination of updated information, they facilitate rapid decision-making by authorities and help reduce congestion, improve fluidity, and prevent accidents. Finally, digital communication platforms between users and authorities strengthen interactivity and transparency. They enable drivers and citizens to receive alerts, reports incidents, and access reliable information on the state of the road network. These digital tools foster participatory governance and better coordination among the various actors in the transport system.

From a theoretical perspective, this dynamic can be illuminated by Manuel Castells' theory of the network society (1996), which argues that digital technologies do not merely transmit information but reconfigure social and institutional relationships. Applied to the road sector, this means that the introduction of sensors, automated systems, and digital platforms is not simply a technical improvement, but induces a transformation in governance modes, user behaviors, and relations between citizens and institutions. In other words, these devices structure and transform social practices themselves, embedding mobility within a network logic where interconnection and interactivity become central. Thus, intelligent road communication perfectly illustrates Castells' thesis that technological innovations shape social and organizational structures, redefining the modalities of regulation and participation in the transport sector.

This dynamic is exemplified by the **Ym@ne Driver project**, deployed since 2022 in partnership between MTN Cameroon, CAMTRACK, and the Ministry of Transport. This system is based on the installation of smart cameras embedded in vehicles, capable of detecting in real time risky behaviors such as speeding, drowsiness, mobile phone use while driving, or failure to wear seat belts. In January 2025, more than 32,800 cases of speeding and 14,900 cases of non-use of seat belts were recorded thanks to this system, demonstrating its effectiveness in data collection and accident prevention. In South Africa, comparable initiatives for intelligent traffic management have been deployed in major metropolitan areas, notably Johannesburg and Pretoria. These projects rely on the installation of road sensors and automated regulation systems, aimed at reducing chronic congestion and improving road safety through the integration of digital platforms accessible to citizens.

3.3 Stakeholder Involvement

The success of intelligent technologies applied to traffic management depends on the coordinated mobilization of institutional, economic, and social actors. The role of the State and local authorities is central, as they define strategic orientations, ensure infrastructure financing, and guarantee the implementation of public policies. Their action helps create a coherent

regulatory framework and promotes the integration of innovative technologies into road management.

Public-private partnerships serve as a complementary lever. They allow for the pooling of resources, accelerate the deployment of technological devices (sensors, digital platforms, real-time management systems), and strengthen operational efficiency. Technology companies and transport operators contribute their expertise and capacity for innovation, while public institutions provide regulation and oversight.

Citizen awareness and driver training also represent an essential dimension. Intelligent road communication cannot achieve its objectives without user engagement. Awareness campaigns, road safety education, and continuous driver training foster better appropriation of digital tools, encourage responsible behavior, and help reduce accident risks.

From a conceptual standpoint, this configuration can be illuminated by the analysis of Michel Crozier and Erhard Friedberg in *Actors and Systems* (1977). Organizations should not be understood as static structures, but rather as concrete systems of action within which actors possess margins of freedom and zones of uncertainty they strive to control. Applied to intelligent traffic management, this means that the effectiveness of technological devices depends not only on their technical performance but also on the ability of different actors (State, local authorities, private companies, citizens) to cooperate, negotiate, and build compromises.

Intelligent road governance thus appears as a complex system of action, where success relies on the articulation between institutional constraints, technological innovations, and social behaviors. In this regard, Jules, a driver for a travel agency, interviewed during our field study, illustrates this dynamic:

We now receive real-time alerts on traffic conditions and accident-prone areas. This helps us adapt our driving and avoid dangerous situations. But without genuine awareness campaigns and monitoring from the authorities, these technologies would remain underused.

All these elements demonstrate that the effectiveness of technological devices is inseparable from user engagement and institutional support, echoing Crozier and Friedberg's (1977) analysis of the decisive role of interactions among actors within concrete systems of action.

4. Governance, Regulation, and Social Acceptability of Intelligent Technologies

The diffusion of intelligent technologies in transport cannot be reduced to their technical performance alone. Their effectiveness depends on a solid institutional foundation, coherent regulation, and social acceptability—essential conditions for ensuring sustainable mobility. As Crozier and Friedberg (1977) demonstrated with the notion of concrete systems of action, organizations operate through dynamic interactions among actors, while McLuhan (1964), through his technological determinism, reminds us that innovations transform social and institutional practices. Applied to intelligent traffic management, this dual theoretical framework emphasizes that the success of technological devices depends as much on cooperation among actors and user trust as on their technical performance.

From this perspective, three dimensions emerge as central and will be the subject of in-depth analysis:

- The institutional and regulatory framework, which defines strategic orientations and ensures the coherence of public policies;
 - Public-private partnerships and financing mechanisms, which allow resources to be pooled and accelerate the deployment of technological devices;
 - User awareness and training, which are indispensable for ensuring the social appropriation of innovations and strengthening road safety.
- Here's the English translation of your passage, keeping the academic tone intact:

4.1 Institutional and Regulatory Framework

The effectiveness of intelligent technologies applied to traffic management depends on the existence of a robust institutional and regulatory framework capable of ensuring their harmonious integration within public transport policies. The role of the State and local authorities is central here, as they define strategic orientations, provide infrastructure financing, and oversee the implementation of measures within a logic of shared governance. Beyond public action, the establishment of norms and technical standards is an essential condition for guaranteeing the interoperability of intelligent systems, the reliability of collected data, and user safety. These standards help create a homogeneous environment in which sensors, digital platforms, and real-time management systems can operate in an integrated manner. Finally, harmonization with international standards, such as those of ISO or the International Telecommunication Union (ITU), gives these initiatives a global dimension. It promotes the compatibility of solutions deployed in Cameroon with international practices, while strengthening the credibility of national policies in the field of intelligent mobility. This institutional and normative framework thus constitutes an indispensable foundation for the success and sustainability of technological innovations in road management.

4.2 Public-Private Partnership and Financing

The implementation of intelligent technologies in traffic management requires considerable financial resources and diversified technical expertise, making the public-private partnership (PPP) an indispensable strategic lever. Public institutions, by defining national priorities and ensuring regulation, create a favorable framework for investment, while private companies contribute technological know-how, innovation capacity, and operational flexibility. This model of cooperation not only enables the pooling of resources but also accelerates the deployment of digital infrastructure, sensors, and real-time management systems. Moreover, mixed financing promotes better risk distribution and ensures project sustainability by integrating mechanisms of control and transparency. From an international perspective, the experience of many countries shows that PPPs are an essential condition for the growth of intelligent transport systems, combining the regulatory authority of the State with the entrepreneurial dynamism of the private sector. In this logic, the examination of certain African experiences illustrates the scope of public-private partnerships in the deployment of intelligent

traffic technologies. In Cameroon, several pilot initiatives have been launched, notably in Douala and Yaoundé, where projects for the modernization of road signage and the integration of connected sensors have been carried out through cooperation between local authorities, the State, and technology companies. These measures aim to improve urban traffic management and reduce congestion while strengthening road safety. Similarly, in other African countries such as Morocco, Rwanda, and South Africa, the use of PPPs has made it possible to finance digital mobility platforms, optimize public transport systems, and develop adaptive traffic light management solutions. The results of these experiences indicate that project success depends on a coherent articulation between public regulation, private innovation, and citizen participation, which confirms the relevance of public-private partnerships (PPP) as a strategic lever for the development of intelligent transport systems in Africa.

4.3 User Awareness and Training

The success of intelligent technologies applied to traffic management cannot be ensured without the active participation of users. Indeed, the social dimension constitutes an essential pillar of their effectiveness, since technological devices, however advanced they may be, remain dependent on the behaviors and practices of drivers. Raising citizen awareness about the use of digital tools such as navigation applications, alert systems, or real-time communication platforms helps build trust and promotes sustainable appropriation. At the same time, continuous driver training plays a decisive role in adapting to innovations by developing digital skills and encouraging responsible behaviors. Road safety education campaigns, prevention programs, and participatory initiatives contribute to establishing a shared safety culture, where the user becomes an active participant in intelligent traffic regulation. On a global scale, accumulated experiences demonstrate that social acceptability and user training condition the sustainability of intelligent transport systems, ensuring their harmonious integration into everyday mobility practices.

5. Contributions and Impacts of Artificial Intelligence in Intelligent Road Communication

The integration of Artificial Intelligence (AI) into transport systems opens new perspectives for intelligent road communication, particularly in the Cameroonian context. AI based devices contribute to improving road safety through intelligent incident detection and driver assistance, thereby reducing the number of accidents. In addition, the optimization of road traffic is reflected in reduced congestion, time savings, and enhanced efficiency for the various transport actors. On the socio-economic and environmental level, AI helps reduce costs related to accidents and delays, while contributing to lower CO₂ emissions. It also stimulates job creation in the technology sector, strengthening the sustainability and competitiveness of mobility systems.

However, in Cameroon, the implementation of intelligent road management remains embryonic and faces several challenges. On the one hand, basic infrastructure (paved roads,

functional signage, traffic lights) is insufficient, limiting the effectiveness of digital devices. On the other hand, institutional fragmentation and a lack of coordination between municipalities, law enforcement, and transport agencies hinder the integration of innovations. Added to this are financial and technical constraints, notably the absence of reliable traffic sensors, weak road databases, and limited adoption of ICTs by public and private actors. These obstacles reflect a structural delay in the adoption of intelligent transport systems and explain the difficulty in anticipating flows or regulating traffic in real time.

In light of these limitations, it appears necessary to propose a more reliable model of intelligent management adapted to Cameroonian realities. This model should be based on three pillars:

- A strengthened infrastructural foundation, including the rehabilitation of existing roads, the installation of functional traffic lights, and the improvement of horizontal and vertical signage;
- A gradual integration of digital technologies, through the installation of basic sensors to measure flows, the development of local platforms for traffic monitoring, and the use of mobile applications accessible to users;
- An interoperable and inclusive governance system, fostering coordination between public authorities, private operators, and users, to ensure coherent and sustainable regulation.

Thus, the contributions of AI go beyond the purely technical dimension to fit into a broader logic of transforming mobility practices and road governance. In the Cameroonian context, the implementation of this transformation requires a gradual approach based on infrastructure modernization, ICT integration, and coordinated institutional governance.

5.1 Improving Road Safety

Artificial Intelligence (AI) today constitutes a major lever for strengthening road safety by providing innovative solutions that go beyond traditional approaches to prevention and control (Kumar, 2024). Intelligent detection systems, based on real-time analysis of traffic flows and driver behaviors, make it possible to anticipate risky situations and significantly reduce the probability of accidents (Butt & Shafique, 2025). For example, embedded sensors and smart cameras can identify anomalies such as fatigue, distraction, or failure to respect right-of-way rules, and trigger immediate alerts (PIARC, 2023). In addition, AI supports the development of driver assistance devices and semi-autonomous vehicles capable of handling certain critical maneuvers (emergency braking, lane keeping, speed regulation). These technologies help limit the impact of human error, which represents a large share of accident causes (IEEE, 2022). From a broader perspective, the integration of these tools into public mobility policies promotes a proactive approach to road safety, where prevention is reinforced by the predictive capacity of algorithms (El Mokhi et al., 2025). Thus, the contribution of AI to road safety is not limited to a simple technical improvement but constitutes a systemic transformation that combines

technological innovation, institutional regulation, and social acceptability, conditioning the success of intelligent road communication systems (Batiebo et al., 2023).

5.2 Optimizing Traffic Flow

Artificial Intelligence (AI) is a strategic tool for optimizing traffic flow, enabling adaptive and predictive management of circulation. Intelligent regulation systems, based on real-time analysis of data from sensors, cameras, and digital platforms, help reduce congestion by dynamically adjusting traffic light durations, directing vehicles to alternative routes, and anticipating congestion zones (El Mokhi, Erguig, Hmina, & Hachimi, 2025). This approach reduces the saturation of roadways and improves fluidity in high-density urban areas. Moreover, AI contributes to time savings and increased productivity by reducing delays linked to daily travel. Predictive algorithms allow for more efficient trip planning, resulting in shorter travel times and improved punctuality of public transport services (Batiebo, Koné, N'Guessan, & Aman, 2023). These time gains have a direct impact on economic productivity, limiting losses caused by traffic jams and enhancing business competitiveness. The optimization of traffic flow through AI goes beyond the purely technical dimension and fits into a systemic logic where urban mobility becomes more sustainable, more efficient, and better adapted to user needs (IEEE, 2022).

5.3 Socio-Economic and Environmental Impact

Artificial Intelligence (AI) applied to intelligent road communication generates outcomes that extend beyond the strictly technical sphere to encompass socio-economic and environmental dimensions. Economically, intelligent systems applied to urban mobility help reduce costs associated with accidents and delays, lowering financial losses linked to material damage, medical care, and activity interruptions (Nikolova, 2025). Predictive systems and driver assistance devices help limit human errors, resulting in a significant reduction of public and private expenditures related to road safety. Furthermore, the optimization of traffic flows through intelligent algorithms promotes time savings and increased productivity, improving the punctuality of public transport and reducing delays in professional and logistical travel (Batiebo, Koné, N'Guessan, & Aman, 2023). These gains strengthen business competitiveness and contribute to the overall efficiency of urban economies. On the environmental level, AI contributes to reducing CO₂ emissions by limiting traffic jams and promoting more efficient trip management. Reduced time spent in traffic lowers fuel consumption and improves air quality, aligning with sustainability and ecological transition goals. Finally, the rise of intelligent technologies in the road sector stimulates job creation in the technology field, fostering the emergence of new skills related to data analysis, intelligent system maintenance, and digital solution development. Thus, the socio-economic and environmental impact of intelligent technologies applied to urban mobility confirms their role as a catalyst for sustainable transformation, where safety, efficiency, and ecological responsibility combine to improve citizens' quality of life.

6. Challenges and Prospects in Cameroon

The development of intelligent transport systems in Cameroon faces several challenges that condition their effectiveness and sustainability. On the technical and financial level, the high cost of intelligent infrastructures such as sensors, cameras, and integrated management systems constitutes a major obstacle in a context where public budgetary resources are limited and private financing is insufficient. Added to this is the lack of local expertise specialized in artificial intelligence, which increases dependence on foreign know-how and slows down both the implementation and maintenance of projects. Institutional and cultural challenges are also significant, as inter-institutional coordination between ministries, local authorities, and private operators remains insufficient, leading to fragmented initiatives and weak effectiveness of public policies. Moreover, social acceptability and resistance to change represent important barriers, since part of the user population expresses mistrust toward autonomous technologies due to concerns related to safety, data confidentiality, and trust in institutions. Despite these constraints, prospects appear promising. The development of autonomous vehicles adapted to the African context represents a strategic opportunity, taking into account local specificities such as road conditions, urban density, and driving behaviors. Regional integration, through the establishment of intelligent road corridors in Central Africa, could strengthen connectivity and the fluidity of cross-border exchanges, while promoting the harmonization of technological standards. Finally, opportunities for local research and innovation offer the possibility of developing endogenous solutions adapted to Cameroon's socio-economic realities, while stimulating the training of new skills in advanced algorithmic solutions applied to mobility.

7. Conclusion

The analysis conducted in this article highlights that artificial intelligence applied to road communication constitutes a major lever for transforming urban mobility in Cameroon. Its contributions are reflected in improved traffic flow, reduced accidents, optimized socio-economic costs, and better consideration of environmental issues. By integrating intelligent devices such as automated traffic light management, predictive risk detection, and real-time flow analysis, AI helps establish safer, more efficient, and more sustainable mobility.

However, the success of this transition cannot rely solely on the technological dimension. It requires the development of an integrated national strategy capable of bringing together institutional, economic, and social actors around a common vision. Such a strategy must combine technological innovation, legal regulation, appropriate financing, and citizen awareness in order to guarantee the coherence and sustainability of initiatives.

From this perspective, several recommendations emerge for progressive and inclusive implementation, notably: strengthening local capacities through training and research in intelligent systems; developing public-private partnerships for financing and infrastructure maintenance; promoting social acceptability through awareness campaigns; and fostering regional integration through intelligent road corridors in Central Africa. Thus, intelligent road communication in Cameroon should not be seen as a mere technical modernization, but as a

systemic and inclusive transformation, capable of sustainably redefining mobility conditions and improving citizens' quality of life.

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