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Information Systems and Educational Technologies to Obtain a Driving License in Portugal

Paulo Gonçalves and Vitor Gonçalves

Abstract Modernizing teaching–learning and administrative processes is crucial to meeting the challenges of contemporary society. Consequently, there is an urgent need to analyze the impact of digital transformation and technological innovation on the process of obtaining a driving license in Portugal, highlighting administrative modernization and adaptation to European directives. The Institute of Mobility and Transport (IMT) strictly regulates the driving license process. Therefore, through a literature review, this study's main objective is to explore the implications of digitalization, technological innovation, and disruptive solutions in the public sector, focusing on the driver licensing system. As a result, the role of the Internet of Things and big data in developing government products and services is explored, and educational technology is discussed, highlighting the use of simulators and e-learning platforms certified by IMT, IP (public institute) to improve candidate success and reduce accidents. Reducing bureaucracy and technologies such as augmented reality and artificial intelligence are highlighted as necessary innovations in driver training in the case study presented.

Keywords Driver licensing · Administrative modernization · Educational technology

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1 Introduction

Obtaining a driving license is an important milestone in contemporary society, ensuring mobility and promoting individual autonomy. In Portugal, this process is regulated by the Institute of Mobility and Transport (IMT), which implements strict standards for candidates' theoretical and practical assessment. Technological developments in the public sector, especially through information and communication technologies (ICT) or digital technologies (DT), have made it possible to modernize administrative and educational processes, responding to the demands of an increasingly digitalized world.

With the aim of simplifying and speeding up procedures related to driver licensing, the IMT has promoted the digitization of processes, such as the digitalization of theory exams and the introduction of e-learning platforms. These measures align with European Union guidelines, which encourage member states to adopt technological solutions to increase efficiency, reduce bureaucracy, and promote inclusion.

The relevance of this study lies in analyzing how digital transformation, when applied to the context of driver licensing, can significantly improve the candidate experience while modernizing public services. To this end, this work explores the impacts of ICT on the educational and administrative process, focusing on the DT implemented by the IMT and the challenges they present.

This paper is part of a case study. In this paper, we focus on the narrative literature review to explore the impact of DT on the IMT's educational and administrative process. The literature review allowed a comprehensive and contextualized analysis of the challenges and opportunities presented by digitalization in the public sector, with a particular focus on the driver licensing process. In addition, data was collected through surveys applied to IMT delegates and driving school directors, making it possible to understand how the DT implemented affects practice and user experience [1–3].

2 Literature Review

2.1 Digital Transformation

Digital transformation has been a fundamental pillar in the modernization of the public sector, aiming to increase efficiency, reduce bureaucracy, and improve the services provided to citizens. In Portugal, initiatives like the Digital Transition Action Plan have encouraged public bodies like the IMT to adopt technological tools that facilitate user interaction and optimize administrative processes.

In the case of the IMT, the digitalization of documents such as medical certificates and the introduction of online platforms for theory test applications have allowed services to be more streamlined. This alignment with European Union guidelines

shows how DT can be applied effectively to meet the needs of a complex system such as driver licensing.

In the last years, digital transformation has become essential in both public administration and the private sector, with the aim of increasing efficiency and competitiveness. In public administration, digital solutions are crucial for tackling various challenges, requiring understanding and anticipating the changes involved [4]. These solutions make services more efficient, transparent, and civilized and require the development of infrastructures and human capital to achieve excellence in the public sector [5]. Differentiated stakeholder involvement is needed to achieve sustainable development [6] and ensure institutional competence and effective funding to execute development programs [7]. Technological evolution promotes more inclusive and accessible educational practices, reflecting a commitment to openness and inclusion [8].

Digital advances have been made in the last decade, and even during the pandemic, but digital transformation could face major challenges in the future [9]. In the public sector, it is manifested by increased interactions between governments and citizens, driven by organizational and cultural changes, competitiveness, and a growing focus on the user [10].

The ability of citizens to provide data from different sources to the Internet makes it possible for governments to develop products and services [11]. The European Union has presented a comprehensive plan for digital transformation, warning of the potential associated risks [12]. Digital transformation is a determining factor for companies and public services, influencing various interactions and requiring the rapid adoption of disruptive technologies to maximize their economic potential despite the challenges faced, which require profound organizational changes that influence all aspects of the business [13]. The need to invest in innovative technologies is decisive and can positively impact society through efficient government management [14]. Digital transformation is essential for achieving efficiency and innovation in both the public and private sectors. Still, it requires strategic adaptation and a significant cultural change to be successfully implemented.

2.2 Technological Innovation

Innovation in the public sector has gained prominence due to new forms of governance. More open, cooperative, and interactive approaches challenge conventional management methods, requiring re-evaluating how organizations can be innovative [15].

Technological innovations, including the Internet of Things (IoT) and artificial intelligence (AI) [16, 17], have transformed traditional practices in driver licensing. For example, IMT-certified e-learning platforms offer interactive content that simulates real driving scenarios, promoting better preparation of candidates for exams.

Fig. 1 Management engagement with design

In addition, simulators and augmented reality have revolutionized practical training, allowing candidates to develop skills in safe environments. These technologies not only reduce the risk of accidents during practical training but also promote personalized learning, adapted to the needs of each candidate (Fig. 1).

In the public sector, designing effective infrastructures for storing, processing, and analyzing data is crucial to improving administrative processes. Information systems play an essential role, and it is also important to carry out a more rigorous evaluation of investments in science, technology, and innovation, as current methodologies do not adequately capture their impacts [18–25].

In the public sector, digital transformation requires a detailed analysis of organizational contexts, categories, and interactions, contributing to an in-depth understanding of the process. Approaches that combine creativity and technology are essential in mapping emerging knowledge, emphasizing the importance of academic research in promoting innovation [26]. Design is crucial in improving public services, while mapping and organizing knowledge in emerging sectors requires analysis and comparison of scientific data using bibliometric tools [27].

2.3 Educational Technology

Educational technology has been gaining relevance, driven by technological advances and increased investment in the area [28]. Its application goes beyond teaching,

promoting students' cognitive development, and preparing them for the challenges of contemporary society [28]. The role of educators is essential to integrate technologies and promote an intelligent and adaptive society [29].

The growth of educational technologies is transforming the educational context, offering new pedagogical opportunities adapted to the needs of students [30]. Teachers with technology experience recognize the positive impact on teaching quality and highlight AI's potential to increase access to quality education [31]. Implementing AI must accompany teacher competencies, maintaining their central role in the educational process [32]. Emerging technologies, such as augmented reality and AI, require better preparation of students [33], representing a new educational challenge that requires adequate training [34].

E-learning has a positive impact, adapting to students' needs and widening access to education [35, 36]. To be effective, it must be implemented carefully, ensuring an unhindered educational experience [37], with student motivation being essential for success [38], even if exploiting several recent technologies like Metaverse, virtual, and augmented reality [40, 41]. Increased access to DT can reduce educational inequalities, although using mobile devices has ambiguous effects, and conscious use of technologies is necessary [42, 43]. Obviously, we can say that IMT is aware of this.

Educational platforms play a central role in driver training, especially in today's digital context. IMT-certified platforms provide adaptable content that facilitates learning fundamental road safety concepts and traffic regulations.

Using DT, such as real-time feedback and performance analyses, has helped candidates identify areas for improvement, resulting in higher pass rates. Our case study shows that candidates to acquire a license driving using these platforms are more likely to succeed in theoretical and practical exams, contributing to more effective and safer training. Although there are concerns about the weakening role of teachers, there is also a gap in the effective use of technologies, requiring a balance to promote innovation without compromising pedagogical quality [44, 45].

Although a broader investigation will focus on how the IMT applies these technologies or the impact of their adoption on the process of obtaining a driving license, we must stress that it would also be important to address how these platforms help drivers acquire the skills and knowledge essential for safe driving. However, the reader can find such answers in Gonçalves (2024). Digital technologies in the educational and administrative processes for obtaining a driving license in Portugal Master Thesis (IPB).

Despite the advantages presented, integrating digital technologies into the driver licensing system faces significant challenges. These include resistance to change on the part of some institutions, gaps in the digital literacy of certain users, and the need to guarantee accessibility in regions with limited technological infrastructure.

3 Institute of Mobility and Transport and Driving Schools

It seems important to us to address the IMT process, since it is the entity responsible for issuing driving licenses. IMT is an autonomous public body, part of the state's indirect administration, with headquarters in Lisbon and powers to operate throughout the country. It collaborates with the Ministries of Internal Administration, the Economy and the Sea, the Environment and Climate Action, and falls under the Ministry of Infrastructure. Its structure includes a board of directors, a president and two members, and central and deconcentrated services responsible for its functions. It is responsible for promoting and certifying the qualification of drivers and land transport professionals, including recognizing, licensing, and supervising training and examination bodies. It also defines educational strategies, ensuring their supervision and execution, and establishes guidelines for administrative procedures for professional qualification and certification [46].

3.1 Teaching Driving

The need for a thorough understanding of driving instruction is evidenced by the hysteresis effect, which demonstrates the impact of mental load during this activity [47]. Different driving styles acquired in training can increase human error, raising questions about the effectiveness of teaching methods, which have been the subject of debate in recent years [48]. Some studies suggest that driver education may be ineffective in reducing accidents and may even increase the likelihood of occurrences, especially among young drivers [49]. The importance of training programs in raising awareness of road risks has been recognized [50].

Given the lack of clear evidence on the effectiveness of traditional approaches, many authors suggest integrating technologies to assess driver behavior. The ability to identify hazards is influenced by previous experiences and objectives, and practical assessments using technology can be more effective than traditional methods [51]. The effectiveness of driving education, especially in improving safety, continues to be debated. Some studies point to the need for a diverse, modern, and inclusive education system, adapted to the challenges of digitalization and prepared for the digital age [52]. Creating a more comprehensive education system that meets the needs of different groups of driver candidates can benefit from using driving simulators, a useful technological tool for training all types of drivers [53].

The driver licensing process is complex and controversial, making digital technologies essential in training more aware and safer drivers despite their limitations. The licensing of people with physical disabilities is controversial, especially due to the role of vision, which is the main requirement for driving, despite the importance of hearing [54]. Some authors advocate the need to study the role of vision in traffic accidents to implement measures to reduce road accidents [55] (Fig. 2).

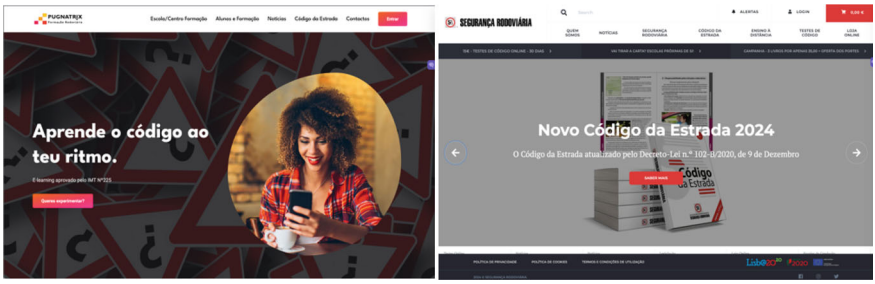

Fig. 2 Management E-learning platforms certified by IMT, IP

3.2 Driving Licenses

According to current legislation, only holders of a driving license can drive on public roads. The first driving license was issued to Karl Benz, the inventor of the first combustion engine car, who was also involved in the first car accident in history [56].

In recent decades, there has been a significant evolution in the process of driver licensing, both in the document's format and in the methods of obtaining and using it [57]. The impact of driving licenses on society can be assessed from different angles, with safety being one of the main ones, playing a central role in protecting the community, regardless of the origin of its holders [58]. Some studies show that driving license renewal alone does not directly affect the accident rate. Although road safety is an important factor in renewal, the data suggests that there is no significant impact on accidents [59]. However, the inexperience of newly qualified drivers, combined with parallel activities such as mobile phone use, significantly increases the risk of accidents [60].

Driving licenses play a fundamental role in the labor market, an essential requirement for various jobs. Some jobs justify investing in obtaining a license [61]. Their influence on inclusion is especially relevant in the context of emigration, where legislation imposes different criteria for emigrants from different countries [62]. Access to a driving license can be more complex for people with disabilities or disorders, but some studies show that these candidates can achieve similar results to the general population [63].

4 Results and Discussion

4.1 Impact of Digital Technologies

The findings highlight the significant role of digital technologies in reducing bureaucracy and optimizing administrative processes. The results of the surveys conducted with district delegates of the IMT reveal that 85% of the participants identified a significant reduction in processing times for issuing driving licenses due to the implementation of electronic medical certificates and online scheduling systems. Furthermore, delegates emphasized the increased transparency and accessibility brought by these innovations, enabling better monitoring of administrative workflows. These findings underscore the importance of continued investment in digital infrastructure to streamline administrative tasks further.

One of the most significant advancements mentioned was the integration of centralized databases, which allowed district offices to access real-time information about candidates and their application statuses. This integration reduced redundancy in data entry and minimized errors, improving overall efficiency. However, challenges such as ensuring system interoperability and addressing technical issues during peak times were also highlighted.

4.2 Integration of Educational Platforms

Digital tools, including educational platforms, have demonstrated their effectiveness in supporting the modernization of driver training processes. Analysis of the data collected from driving schools revealed that 72.7% of the institutions considered these tools satisfactory in meeting their operational needs, while 18.2% evaluated them as unsatisfactory. These tools encompass a range of functionalities, from interactive learning platforms to administrative systems for scheduling and monitoring candidate progress.

Driving schools reported that candidates using e-learning tools were better prepared for practical tests, as they had access to simulated driving environments that allowed them to practice hazard perception and decision-making in a controlled setting. This innovative approach bridged the gap between theoretical knowledge and practical application, fostering safer driving behaviors among new drivers.

Nevertheless, the schools also highlighted some barriers to widespread adoption, such as limited digital literacy among some instructors and candidates, as well as the initial costs associated with platform implementation. Addressing these barriers is essential to ensure equitable access to the benefits of digital learning.

5 Final Considerations

The integration of digital technologies into the administrative and educational processes of driver licensing in Portugal represents a critical step towards modernization. The findings of this study emphasize that adopting tools such as electronic medical certificates and centralized databases has significantly improved efficiency, reduced errors, and enhanced transparency. These innovations have streamlined workflows within the IMT, highlighting the potential of digital transformation to address long-standing administrative challenges.

In the educational context, using e-learning platforms certified by the IMT has demonstrated clear benefits, including better preparation of candidates for theoretical and practical exams. Including interactive learning modules and simulated driving environments has bridged the gap between theory and practice and contributed to fostering safer driving behaviors among new drivers.

However, this study also identifies barriers that must be addressed to maximize the benefits of these technological advancements. Limited digital literacy among some instructors and candidates and the initial costs of implementing these solutions represent significant challenges. Additionally, ensuring system interoperability and addressing technical issues during peak operational times are crucial for sustaining the efficiency gains achieved.

Future efforts should focus on expanding access to digital tools, training stakeholders, and ensuring that technological solutions remain adaptable to evolving needs. Moreover, further research should explore the long-term impacts of these innovations on road safety and the overall effectiveness of the driver licensing system.

In conclusion, this study reinforces the transformative potential of digital technologies in modernizing public sector processes, particularly within the context of driver licensing. By addressing the identified challenges and leveraging targeted innovations, the IMT can continue to enhance its services, ensuring that they are both efficient and accessible to all stakeholders.

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