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Representations of truck platooning acceptance of truck drivers, decision-makers, and general public: A systematic review

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A R T I C L E I N F O

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A B S T R A C T

Truck platooning, involving two or more automated trucks virtually linked in a convoy through vehicle automation and communication technologies, has become a core topic in the long-haul freight transport industry. Despite its potential benefits – fuel efficiency, reduced carbon emissions, operation cost savings, improved road safety, and alleviated traffic congestion – further research is required to understand the representations of technology acceptance that will mediate its adoption across different stakeholders. This study presents a systematic review of the representations of decision-makers, truck drivers, and the general public on truck platooning acceptance. A total of 35 papers were included in the review and grouped into (i) studies with no platooning experience, (ii) studies with a simulated platooning experience, and (iii) studies with an on-road platooning experience. Representations were extracted using thematic analysis to synthesize the perspectives of each stakeholder and organized in themes. Even when similar themes emerged, representations highlight each stakeholder singular perspective. Although decision-makers have a more positive outlook on the potentialities of the technology, they are concerned about several obstacles related to its implementation and risks that may undermine the promised efficiency benefits of truck platooning. Regarding general public, peripheral drivers are mainly concerned about the reliability and safety of truck platooning and the potential traffic conflicts. Truck drivers denote the potential advantages in driving comfort and road safety, but highlight their concerns about employment, the reliability of the automation, loss of driving pleasure, trust in the platooning systems and their elements, and additional stress associated with the reconfiguration of their activity by the technology. Meanwhile, considering the role of experience, when the technology was experimented on-road, representations became more positive. Still, although these experiments are closer to real-world context, they only focused on basic driver-truck interactions and did not account for multitask driving scenarios, nor explored truck drivers' employment concerns.

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1. Introduction

Truck platooning has been proposed as a potential solution for some of the prominent issues affecting the road freight transport industry (Sivanandham & Gajanand, 2020). Conceptualized as a virtually connected convoy of two or more automated trucks driving cooperatively, it uses cooperative adaptive cruise control (CACC), an extension of adaptive cruise control (ACC) that incorporates dedicated short-range communication (DSRC) to enable vehicle-to-vehicle (V2V) communication, to share vehicle information (acceleration, speed, and position) and automate coordinated longitudinal control between vehicles (Yang et al., 2018, 2021). By controlling the speed and distance, gaps between vehicles can be minimized and speed variations can be controlled, making efficient use of drag aerodynamics to decrease fuel consumption, consequently leading to reductions of CO_2 emissions, and operation cost savings (Bhoopalam et al., 2018). The reduced distances between vehicles in the platoon can also potentially alleviate traffic congestion by saving space and increasing road capacity and throughput (Shladover et al., 2015). Furthermore, increasing automation may also help with the shortage in truck driving professionals (IRU, 2023) and promote road safety by mitigating crash causes such as driver's fatigue, sleepiness, or distraction (Kaiser et al., 2022).

However, the benefits of increasing automation on the driving activity are not equally distributed among all elements of the system, as the platooning system allocates trucks and their drivers to different roles depending on the order of the vehicle in the convoy and the capabilities of the automated driving systems. A large-scale deployment of fully-automated vehicles on public roads is not yet foreseeable, as the technology is still evolving (Shahandashti et al., 2019). Until then, vehicle automation, and truck platooning in particular, will pass through intermediate development stages (Working Group on Connectivity and Automated Driving, 2022). During the first stage of implementation, the first truck in the platoon assumes the leading position and its driver is expected to manually drive the vehicle, establishing a reference for other vehicles to follow. All the remaining trucks in the convoy follow the leading vehicle and automatedly adapt to the behaviour of the vehicle(s) ahead, as well as to other external factors, such as road obstacles or other vehicles cutting into the platoon. In turn, drivers in the following positions are expected to monitor their vehicle while in automated driving mode and be ready to take over when required (Sivanandham & Gajanand, 2020). While the most known classification of automation levels is the six-level classification (0–5) proposed by SAE International, the EU-funded project ENSEMBLE has developed a two-level classification specifically for truck platooning: Platooning Support Function (corresponding to the initial stage described above) and Platooning Autonomous Function (with fully-automated following trucks). The technical details of both classifications can be found at (SAE International, 2021) and (Willemsen et al., 2022).

The differentiation between platoon leaders and followers is far from trivial, challenging the expected benefits of the technology. In terms of fuel reduction, only the vehicles in the following positions are able to, in theory, exploit the potentiality of drag aerodynamics, which may be an obstacle to the intention of assuming the leading position and the formation of mixed-company platoons. From the point of view of the work activity, the distinctive roles of the leading and following positions also present different challenges to truck drivers that may not always benefit the reduction of human errors. Drivers in the leading position will have an increased responsibility that expands beyond their vehicle to the entire platoon, with potential risks related to workload. Meanwhile, drivers in the following positions are expected to engage in the role of monitoring the automated driving task for long periods of time, with implications to drivers' alertness and situation awareness that may hinder the takeover process, particularly when drivers are required to quickly and adequately react to critical events (Simões et al., 2022).

Truck drivers' workplace is also expected to change to adapt to the technological requirements of truck platooning, potentially offering opportunities to further improve drivers' workflow and working conditions, such as the introduction of technologies to monitor drivers' state, or improvements of the comfort level of the cabin space to promote rest quality and the ability to engage in other activities while driving in automated mode (Fröhlich et al., 2018). While these changes may offer new prospects, the opportunities that arise may rather conflict with current working regulations and, thus, require further changes at regulatory and legal levels. Moreover, a complex balance must be attained between these new opportunities for resting or concurrent activities, and the need to monitor the system and be ready to take over (Simões et al., 2020; Soares et al., 2021a, Soares et al., 2021b).

Meanwhile, even the most encouraging results of truck platooning in fuel and CO_2 emissions reductions have been produced in optimal conditions, with many potential factors affecting potential savings, such as the position in the platoon, inter-vehicle distance, load differences, time needed for platoon formation, and conditions for driving at high speeds (Pająk & Cyplik, 2020). Beyond the potential advantages of the platooning technology and the limitations to their implementation, its adoption and usage is, ultimately, dependent on the level of acceptance of the technology from the industry decision-makers (e.g., company directors and freight managers), the frontline users of the technology (truck drivers), and the general public (peripheral drivers) that will necessarily interact with the platooning system on the road.

Nonetheless, recent European directives, with ambitious goals regarding emissions and road crashes are pushing towards more sustainable and safe transport solutions (European Commission, 2020; Working Group on Connectivity and Automated Driving, 2022). The urgency of developing new road freight transport solutions, together with the great number of arguments in favour and opposed to truck platooning, has led to an increase in studies concerned with the acceptance of this technology.

The introduction of new technologies, such as vehicle automation, in the transport sector has been studied through the lenses of several theories of technology acceptance models (Rahman et al., 2017). Among the most frequently adopted are the Technology Acceptance Model (TAM) (Davis, 1985, 1989), the Theory of Planned Behaviour (TPB) (Ajzen, 1991), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). These models estimate the intention and the actual use of a technology by defining the components of behavioural intention and the influence relationships between these components, and other factors that may moderate that influence or add to it.

According to TAM, behavioural intention is determined by the attitude towards using a technology – the positive or negative feelings about using it – which may be influenced by beliefs about the perceived usefulness and ease of use of that technology (Davis, 1985). These beliefs may have a direct influence on behavioural intention, regardless of their role on the attitude towards the technology (Davis, 1989). TPB suggests that, in addition to the attitude towards using the technology, beliefs about perceived behavioural control (the perception of how ease or difficulty it is to perform the behaviour) and subjective norm (the perception if others think one should or not use a technology) also play a role (Ajzen, 1991; Fishbein & Ajzen, 1975). UTAUT adapts factors from previous theories and proposes that performance and effort expectancies, as well as social influence, impact behavioural intention. Moderating these relations, are factors such as age, gender, experience, and voluntariness. In addition to behavioural intention, actual use behaviour is also influenced by beliefs in the existence of organizational and technical infrastructure conditions supporting that usage (Venkatesh et al., 2003).

These theories can be mobilized in the analysis of different stakeholders' representations of truck platooning, as it is the scope of this paper. The analysis of those representations is necessarily plural, in a way that it constitutes either as reference systems for understanding reality or an expression of the co-existence of different perspectives and different ways of seeing that reality, and this is because representations are ultimately "… a function of the different place that each one occupies both in the company and in society" (Oddone et al., 1981, p. 200).

However, the widespread dissemination and use of the concept of representation does not always allow for exploring its singularities, in the context of different scientific traditions. Without intending to be exhaustive, we can distinguish two conceptions of representation. On the one hand, the "social representation" supported by categories of analysis and concepts considered stabilized. On the other hand, the notion of "operative representation", in the sense that it supports, accompanies, and values action (Lacomblez, 2018), and integrates the point of view of the work activity. Rather than correct or incorrect mental representations of truck platooning, we are instead interested in the representations that will mediate the use of the technology and may be actively constructed by that usage (Lacomblez, 2018; Ochanine, 1969; Weill-Fassina, 1990). The intrinsic relationship between the concepts of representations and acceptance suggests that their study is complementary.

As truck platooning evolves as a technology and several benefits to its implementation are suggested, there is an increasing push for implementation. However, the success of the implementation of truck platooning is, to a large extent, dependent on the acceptance of the technology. The main drivers of acceptance can be gauged and thoroughly identified by analysing the representations towards the technology. Through a systematic review of previous studies on truck platooning acceptance, we can extract information regarding the stakeholders that have participated in those studies, their knowledge regarding truck platooning, and their representations about the implementation of the technology.

In this way, the main objective of this research is to identify and analyse the representations of truck platooning technology that have been reported in previous studies in order to unveil acceptance levels from different stakeholder groups. To achieve that, we have conducted a systematic literature review following the PRISMA framework (Page et al., 2021). Our focus were studies that provide self-report and behavioural measures of acceptance from relevant stakeholder groups emerging from the literature. The results were structured in a matrix comprising (i) the perspective of the emerging stakeholder groups (decision-makers, truck drivers, and general public), and (ii) the platooning experience (studies with no platooning experience, studies with a simulated platooning experience, and studies with an on-road platooning experience). A total of 16 themes were extracted from the literature. The matrix allowed for a comparison of representations between the stakeholders and the evolution associated with experience. Moreover, a thematic bi-dimensional analysis exposes the gaps in the literature, showing which themes and perspectives are still missing. With this paper, we intend to deliver a synthesis of critical knowledge that is otherwise scattered across different studies. Moreover, the structured approach that resulted from the different groups and dimensions reported in the literature provides a blueprint for future research. To the best of our knowledge, no other study has attempted to provide a systematic review of this specific topic to this date.

This work is part of the project TRAIN – Mapping risks and requirements for truck platooning using a driving simulator. TRAIN develops a multidisciplinary and multidimensional approach to truck platooning. The project aims at, on the one hand, mapping risks and requirements for truck platooning and identifying technology acceptance factors, and, on the other hand, assessing truck platooning road safety. For the first part of the study, we have conducted qualitative research, where this literature review was developed in parallel with participatory research methods (focus groups and questionnaires), and for the latter part, the project will include driving simulations.

The remainder of this paper is organized as follows. The second section presents the method adopted, including the description of the PRISMA steps and criteria for inclusion or rejection of the studies found. In the third section, we present the results and characterize the three groups of studies included according to the experience. Then, the themes and representations are extracted and discussed. Finally, we make some conclusions and considerations about future research.

2. Method

As truck platooning is a multidisciplinary domain, we have analyzed different and complementary perspectives as a way to develop a holistic approach on the acceptance of the technology and its impacts on truck drivers, logistics businesses, and other key stakeholders. Nonetheless, we opted for an inductive type of research in which our starting point was the observation, in this case, of existing literature, and stakeholders' opinions. In this way, this literature review substantiates the next stages of the project TRAIN, focusing on consulting relevant actors in the truck platooning ecosystem and bringing relevant scenarios into discussion. From this point forward, we will describe the method used for the literature review presented in this paper.

For this systematic review we have followed the guidelines of the preferred reporting items for systematic review and *meta*-analysis protocols (PRISMA) 2020 statement (Page et al., 2021). We have included in our review peer-reviewed journal articles, authored book chapters and conference papers, published from January 2010 to July 2022. Conference abstracts, project reports, dissertations/thesis, and grey literature articles were excluded, as well as publications in languages other than English (e.g., German or Japanese). Given the focus of our research topic, only studies that provided an informative measure (self-report, behavioural) of truck platooning acceptance were considered for the review. Regarding population, we have not defined specific inclusion or exclusion criteria, and therefore different stakeholders were included that were later aggregated through the analysis into stakeholder groups. Selected studies showed that truck platooning representations reported in the literature include the perspective of (i) end-users (truck drivers), (ii) decision-makers related to the adoption of the technology, i.e., logistics companies represented by key stakeholders (business executives, operations managers, fleet managers, etc.), and (iii) other road users and drivers that may interact with the platoon.

To define our search strategy, we have built a matrix to identify key concepts and generate key terms from which we have selected the prompt included in our search query:

(automated OR autonomous OR convoy OR platoon* OR self-driving) AND (truck*) AND (accept* OR adopt* OR benefit* OR fear* OR feel* OR impact* OR opinion* OR perception* OR perceive* OR risk* OR trust* OR vantage*) NOT (robot* OR tractor*).*

We have used the same query (with only minor platform specific variations) to search for titles, abstracts and keywords in the Scopus, Web of Science, and TRID databases, and retrieved the search results for each database on July 28th, 2022.

The selection process was conducted using the Rayyan software, a free web and mobile application that uses semi-automation to aid the screening processes (Ouzzani et al., 2016). RIS files with the results of each database were loaded into the software, which automatically identifies duplicated records. Next, one author reviewed the metadata for each record, filtering errors and confirming the duplicates that were accurately detected by the software. Errors and duplicates were excluded and the pool of resulting records was automatically categorized as “Undecided” by the software for screening. The same author, screened the titles and abstracts using the software interface to categorize the records for exclusion (“excluded”), inclusion (“included”), and further screening (“maybe”). Additionally, criteria were associated to each decision tags related to inclusion and exclusion. The software creates pools of records for each category of decision, and separately pools for each tag, helping to inform other reviewers of the reasons behind each decision, while also quantifying each step of the selection process. Following the initial screening, two other authors screened the titles and

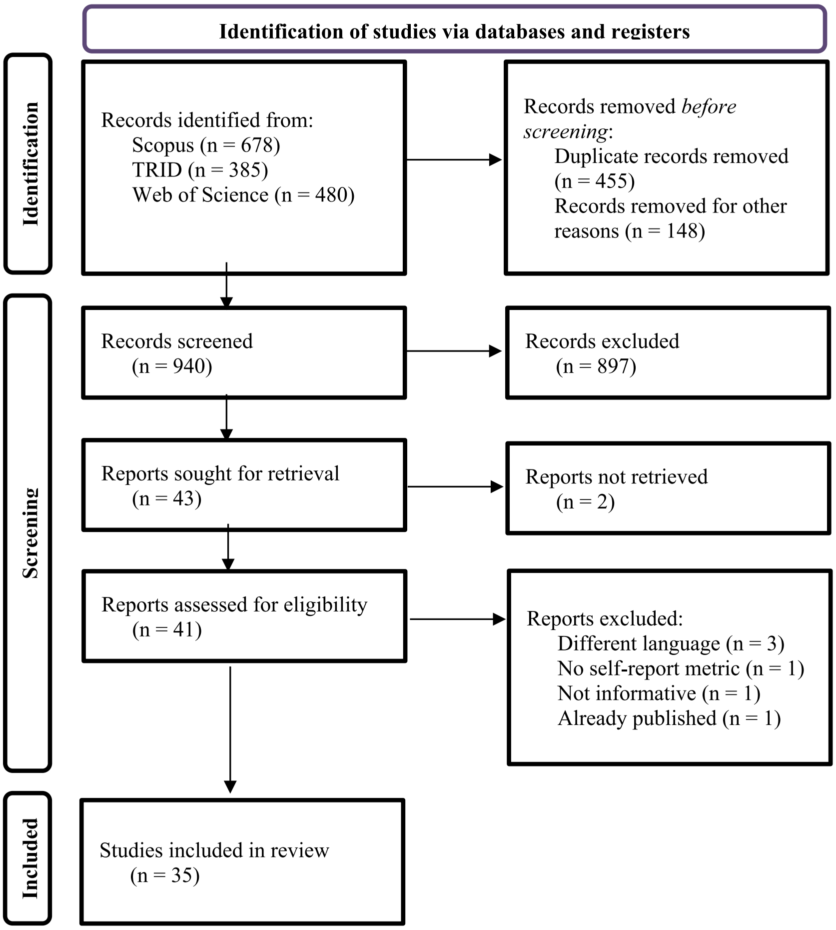

Fig. 1. Research selection process flow diagram using the preferred reporting items for systematic review and *meta*-analysis protocols (PRISMA), retrieved and adapted from Page et al. (2021).

abstracts of the records categorized as "maybe", using the same process, until no records remained in this category. The retrieval of the reports and the screening of their full content for eligibility were executed by the initial author.

Fig. 1 displays a flow diagram using the preferred reporting items for systematic review and *meta*-analysis protocols (PRISMA; retrieved and adapted from Page et al., 2021) to represent the results of the selection process. From the 1543 records identified in our search, 455 were removed after being identified as duplicates. Additionally, 148 records were removed for not complying with the parameters of our search strategy, such as records published before 2010 or non-applicable records (e.g., complete books and conference proceedings). The resulting 940 records were screened for inclusion. Of those, 897 of the records were excluded for: (i) not complying with the type of publication criteria (i.e., abstracts only, project reports, dissertations/thesis, and grey literature articles), (ii) being outside of the scope of our topic (e.g., military, health, mining, and automation), (iii) having a broader focus (e.g., automated vehicles of other types, public transport, pavement engineering, and traffic engineering), or (iv) not containing the targeted metrics (e.g., armchair opinions, modelled simulations, or technological tests). From the 43 reports sought for retrieval, we were unable to retrieve two papers from conference proceedings. After retrieval, three reports were excluded for being written in German or Japanese, one because of the absence of self-report and behavioural metrics (Davila et al., 2013), one because the employed methodology was not informative enough about our object of research (Anderhofstadt & Spinler, 2020), and another because it described an entire project, only offering information that was published in detail before 2010 (Lank et al., 2011).

Data collection was executed by one author by summarizing the selected studies and extracting key information to describe the studies' characteristics and results, that were further condensed and organized in table format. A synthesis was developed by four authors through thematic analysis (Braun & Clarke, 2006). First, by categorizing key results in affinity diagrams, and then, by identifying the resulting themes and consolidating information around each group of stakeholders to capture their specific representations. We observed that studies vary mostly around two dimensions: stakeholders and platooning experience. Accordingly, we aggregated the synthesis of themes and representations into three stakeholder groups that emerged inductively from the analysis of the selected papers:

- Decision-makers: any stakeholder with decision power over truck platooning operations, whose representations may impose constraints to implementation;
- Truck drivers: professional drivers of heavy vehicles for road freight transport;
- General public: every other road user who may interact with a platoon.

The first dimension (stakeholders) was in line with our systemic approach, in which we have identified the importance of decision-makers as adopters of the technology, even if they do not use it directly (Duarte et al., 2023). Platooning experience was selected as a second dimension, as representations would change depending on the experience stakeholders had (none, simulated, or on-road).

3. Results

The analysis of the 35 selected studies showed that experience played an important role in the representations developed by participants. For that reason, studies were grouped by type of platooning experience included, namely: (i) studies with no platooning experience, (ii) studies with a simulated experience, and (iii) studies with an on-road experience (Table 1). Before presenting the themes extracted from the analysis, this section characterizes the studies from the perspective of the decision-makers, general public, and truck drivers to facilitate the extraction of the representations of each group.

3.1. Studies with no platooning experience

In Table S1 (see Supplementary Material), we present a characterization of the 18 studies included in our review that assess truck platooning acceptance with no platooning experience (Bishop et al., 2017; Castritius et al., 2020b; Dubljević et al., 2022; Eitrheim et al., 2022; Fritschy & Spinler, 2019; Fröhlich et al., 2018; Müller & Voigtländer, 2019; Münch et al., 2021; Neubauer et al., 2020; Orii et al., 2021; Paddeu & Denby, 2022; Pudasaini & Shahandashti, 2020; Richardson et al., 2017; Sindi & Woodman, 2021; Sternberg et al., 2020; Talebian & Mishra, 2022; Trösterer et al., 2017; Wendel et al., 2020). Studies are described by the automation scenario

Table 1
Studies by experience type.

Studies with no platooning experience	Studies with simulated platooning experience	Studies with on-road platooning experience
Bishop et al., 2017; Castritius et al., 2020b; Dubljević et al., 2022; Eitrheim et al., 2022; Fritschy & Spinler, 2019; Fröhlich et al., 2018; Müller & Voigtländer, 2019; Münch et al., 2021; Neubauer et al., 2020; Orii et al., 2021; Paddeu & Denby, 2022; Pudasaini & Shahandashti, 2020; Richardson et al., 2017; Sindi & Woodman, 2021; Sternberg et al., 2020; Talebian & Mishra, 2022; Trösterer et al., 2017; Wendel et al., 2020	Borojeni et al., 2016; de Bruijn & Terken, 2014; Duffield & Krupenia, 2015; Fank et al., 2021; Friedrichs et al., 2016b; Gwak et al., 2022; Hjälmdahl et al., 2017; Nakamura et al., 2010; Richardson et al., 2018; Zhang et al., 2019; Zheng et al., 2014	Castritius et al., 2021; Castritius et al., 2020a; Friedrichs et al., 2016a; Hashimoto, Kato, & Tsugawa, 2015; Yang et al., 2018, 2021

that frames the study, the objective of the investigation, the sample, and the assumed methodological options.

The paper presented by Castritius et al. (2020a) is not included in this section, even though it presents a perspective of acceptance before a platooning experience, as that perspective is used as a baseline for comparison after a platooning experience, and therefore will be presented later (see Studies with On-road Platooning Experience).

At this level of analysis, we found mostly studies that inquire about the representations associated with the introduction of automated truck technology in the road freight transport sector, among those who can more or less directly impact that process, and be impacted by it. This is the level of analysis that congregates the greatest variety of perspectives, not only from different stakeholders (academic researchers, company owners or directors, fleet managers, general public, logistics managers, politicians, schedulers, site managers, transport planners, truck drivers, technology developers, and union and association representatives), but also from different vehicle automation and connectivity scenarios.

Most studies rely on self-reported measures, such as interviews and surveys, but literature search and observation are also employed to understand stakeholders' perspectives. The detail of the analysis varies greatly, with some studies providing only descriptive accounts of key insights, others analysing self-reported content for the themes, some providing scores and ratings from questionnaires, and yet others providing models or scenario projections based on quantitative analyses.

3.2. Studies with simulated platooning experience

Table S2 (see Supplementary Material) presents the characterization of the 11 studies included in our review that examined truck platooning acceptance after a simulated platooning experience (Borojeni et al., 2016; de Bruijn & Terken, 2014; Duffield & Krupenia, 2015; Fank et al., 2021; Friedrichs et al., 2016a; Gwak et al., 2022; Hjälmdahl et al., 2017; Nakamura et al., 2010; Richardson et al., 2018; Zhang et al., 2019; Zheng et al., 2014). Studies are described by the objective of the research, the sample, the methodology, and the scenario that frames the study, which, in this case, may focus on the level of automation, specific platooning manoeuvres, the position in a platoon, or the use of a human–machine interface (HMI).

With the exception of de Bruijn and Terken (2014), where the platooning experience was simulated through paper prototyping, all other studies were conducted in a driving simulator. In Zheng et al. (2014), an on-road platooning experience mimicking the conditions of a simulated experience is also described with similar results. As that report was substantially less detailed than the driving simulator experience, we have included the study in this subsection.

We found studies that were exploring concepts of human–machine interaction and/or testing specific platooning driving scenarios by assessing users' preference and performance in a simulated environment. For that reason, stakeholders' representations focus on truck and peripheral drivers, and the explored scenarios are also restricted to platooning manoeuvres or critical incidents.

A large spectrum of physiological, behavioural and self-report metrics was employed to measure drivers' state (e.g., eye movement, physiological activation, situational awareness, sleepiness, and workload), driving behaviour (e.g., acceleration and deceleration, crash occurrence, inter-vehicle distance, lane positioning, steering wheel reversals, reaction and response time, and speed), and acceptance (e.g., comfort, controllability, satisfaction, trust, usability, and user experience).

3.3. Studies with on-road platooning experience

Table S3 (see Supplementary material) presents the characterization of the six studies included in our review that analysed truck platooning acceptance after an on-road platooning experience (Castritius et al., 2021; Castritius et al., 2020a; Friedrichs et al., 2016b; Hashimoto et al., 2015; Yang et al., 2018, 2021). Studies are described once again by the objective of the research, the sample, the methodology, and the scenario that frames the study, which most often includes the employed platooning technology, specific platooning manoeuvres, the position in a platoon, or traffic conditions. Although in Hashimoto et al. (2015) participants are not truck drivers and vehicles are not trucks, we have decided to still include this study, as truck platooning was considered in the conceptualization and implications of the results. As we have previously stated, in Castritius, Hecht, et al. (2020), truck drivers' acceptance before a platooning experience is also reported, but as the study focus on the comparison of the results obtained before and after the on-road platooning experience, we have included this study in this subsection.

We found studies that reported the experience of driving in a platoon from the driver's perspective, on the road, using real vehicles, and most times under real traffic conditions. As such, only technologically-viable scenarios of automation (SAE level 2) were targeted. In terms of manoeuvres, most studies focus on the platooning scenario of driving in close proximity with another vehicle in the platoon, with one study also analysing the merging and splitting from a platoon.

Given the naturalistic nature of this type of studies and the targeted scenarios, most of them analysed driving behaviour, with a focus on distance metrics. The experience of driving in platoon and drivers' preferences and acceptance were evaluated through interviews and self-report questionnaires.

3.4. Themes and representations in the acceptance of truck platooning

In this subsection, we present the results of the thematic analysis, first by providing an overall view of the extracted themes, and then by grouping the representations associated with the highlighted themes for each stakeholder group. As several studies have mixed samples of stakeholders, we only have associated a representation to a group when that connection was made sufficiently clear in the original study.

For decision-makers, we have categorized each representation associated with the acceptance of truck platooning under themes

Table 2
Matrix of themes concerning truck platooning's acceptance by stakeholders and platooning experience.

	No platooning experience	Simulated platooning experience	On-road platooning experience
Decision-Makers	• Employment challenges (Eitrheim et al., 2022; Müller & Voigtländer, 2019; Münch et al., 2021; Richardson et al., 2017; Sindi & Woodman, 2021), • Workplace and workflow changes (Eitrheim et al., 2022; Münch et al., 2021;Richardson et al., 2017; Sindi & Woodman, 2021; Trösterer et al., 2017), • Attitude towards automation (Bishop et al., 2017; Münch et al., 2021; Richardson et al., 2017; Sindi & Woodman, 2021), • Trust (Bishop et al., 2017; Münch et al., 2021). • System reliability (Trösterer et al., 2017; Münch et al., 2021; Sindi & Woodman, 2021), • Data and cybersecurity (Münch et al., 2021; Richardson et al., 2017; Sindi & Woodman, 2021), • Road safety (Eitrheim et al., 2022; Münch et al., 2021; Pudasaini & Shahandashti, 2020; Richardson et al., 2017), • Infrastructure and traffic issues (Müller & Voigtländer, 2019; Münch et al., 2021; Paddeu & Denby, 2022), • Efficiency (Bishop et al., 2017; Eitrheim et al., 2022; Münch et al., 2021; Paddeu & Denby, 2022; Sindi & Woodman, 2021; Trösterer et al., 2017), • Legal issues (Eitrheim et al., 2022; Müller & Voigtländer, 2019; Münch et al., 2021; Pudasaini & Shahandashti, 2020; Richardson et al., 2017; Sindi & Woodman, 2021), • Finance (Münch et al., 2021; Paddeu & Denby, 2022; Sindi & Woodman, 2021)		
General Public	• Attitude towards automation (Castritius et al., 2020b), • Traffic issues (Castritius et al., 2020b)	• Attitude towards automation (Gwak et al., 2022)	
Truck Drivers	• Attitude towards automation (Castritius et al., 2020a; Dubljević et al., 2022; Orii et al., 2021; Neubauer et al., 2020; Richardson et al., 2017; Trösterer et al., 2017), • Driving comfort (Castritius et al., 2020a; Richardson et al., 2017; Trösterer et al., 2017), • Driving pleasure (Castritius et al., 2020a; Dubljević et al., 2022; Neubauer et al., 2020; Richardson et al., 2017), • Legal issues (Richardson et al., 2017), • Perceived ease of use (Castritius et al., 2020a; Neubauer et al., 2020; Trösterer et al., 2017), • Perceived usefulness (Castritius et al., 2020a; Neubauer et al., 2020; Pudasaini & Shahandashti, 2020; Trösterer et al., 2017), • Employment challenges (Castritius et al., 2020a; Dubljević et al., 2022; Orii et al., 2021), • Road safety (Castritius et al., 2020a; Neubauer et al., 2020; Pudasaini and Shahandashti, 2020; Richardson et al., 2017; Trösterer et al., 2017), • Trust (Castritius et al., 2020a; Neubauer et al., 2020; Richardson et al., 2017), • Workplace and workflow changes (Castritius et al., 2020a; Neubauer et al., 2020; Pudasaini and Shahandashti, 2020; Trösterer et al., 2017)	• Driving pleasure (de Bruijn & Terken, 2014), • Perceived usefulness (de Bruijn and Terken, 2014; Richardson et al., 2018), • Trust (Fank et al., 2021; Hjälmdahl et al., 2017)	• Driving comfort (Castritius et al., 2021; Castritius et al., 2020a; Yang et al., 2018) • Perceived ease of use (Castritius et al., 2020a), • Perceived usefulness (Castritius et al., 2020a), • Road safety (Castritius et al., 2020a; Friedrichs et al., 2016a), • Trust (Castritius et al., 2020a; Friedrichs et al., 2016a), • Workplace and workflow changes (Castritius et al., 2020a)

Table 3
Decision-makers' representations of truck platooning acceptance.

Themes	Representations	Studies (*N*)
Attitude towards automation	Complete automation of the process, from loading to unloading, would be beneficial	1
	Current and future automated features in trucks are perceived positively	1
	Driver acceptance depends on getting an initial group of respected drivers to share their experience and perspective	1
	Having a mixed fleet of normal and automated vehicles may be more beneficial	1
	Preference for automated vehicles that can also be manually driven	1
	Drivers feel patronized by driver assistance technology and tend to resist it	1
	Environmental benefits of platooning may be valued by governments and public opinion	1
	Media will focus on negative coverage, influencing public opinion negatively	1
	Worry about drivers' attitude towards platooning	1
Data and cybersecurity	Need for platform standardization and greater cooperation between companies	1
	Concern about data privacy, security and misuse	1
	Cyberattacks may affect the entire supply chain	1
	Doubt about the cybersecurity of automated trucks	1
	Local networks within vehicles in the platoon are open doors to cyberattacks	1
	Missing support for information sharing between companies when forming mixed companies' convoys	1
	Vulnerability of data transmissions between vehicles	1
Efficiency	Automated trucks could benefit lead times by improving efficiency, scheduling, and the utilization of loads	1
	Automated trucks will need to travel at reduced speeds for security and legal regulation reasons	1
	Differences in equipment, loading, and speed of the vehicles in the platoon may lead to difficulties in maintaining the platoon	1
	Fuel efficiency as a potential benefit	3
	Fuel savings alone are unlikely to be sufficiently appealing for adoption	1
	Current road infrastructure may impair efficiency	2
	Inability to solve the major problems in the sector	1
	Information sharing between companies may help optimize backloads	1
	It is unclear how drivers would be incentivized to form platoons	1
	It is unclear where and when platooning should be used	1
	Need for a fair system to distribute fuel benefits of being in a following position among companies	1
	Regulations may impose speed limits that affect lead time	1
	Scheduling and backloads optimization may improve lead times	1
Employment challenges	Automated trucks could help with driver shortages	2
	Automation may reduce the number of employees, particularly in the long-term	2
	Differences in leader and follower responsibilities should be reflected in remuneration	1
	Drivers' intervention for non-driving tasks will still be necessary	3
	New operator and supervision jobs may be created	1
	New technology and securing methods would be required to compensate for the role of the driver in securing, checking, and re-securing the load	1
	Non-driving tasks could be allocated to other roles to disburden drivers in the leading position	1
	Passive role of the following position may reduce the attractiveness of truck driver's career	1
	Reductions in hourly rates when drivers are not actively engaging in the driving task	1
	Scepticism about scaling down requirements for drivers in the following position	1
	Skilled drivers will still be required and hard to find	1
	Specific training needs may be required	1
Finance	Additional costs associated with system functioning, maintenance, and failure	1
	Automated trucks should provide cost-saving benefits when compared with manually-driven trucks	1
	Fuel saving may compensate upfront costs over time	1
	Fuel and labour cost savings are not enough to justify the investment	1
	Implementation of platooning will lead to an increase in costs for transport companies	1
	Introduction of automated trucks will require high upfront costs	1
	Labour cost savings may be beneficial	1
	Labour cost and lead time reductions are preferable than fuel savings	1
	Lead time savings are preferable to reductions in driver cost	1
	Platooning technology development high costs will result in high market prices	1
	Platooning will be incentivized through tax reliefs due to ecological benefits	1
	Reliance on manufacturers and service providers may create economic barriers to smaller logistic companies	1
Infrastructure and traffic issues	Convoys should circulate in a dedicated lane	1
	Inability to have dedicated lanes for platooning	1
	Lack of infrastructure for platooning in customer areas and industrial yards	1
	Limits to payloads of highway bridges	1
	Potential blocking of highway entrances and exits	1
	Interruptions to platooning use induced by the behaviour of other vehicles	1
	Proliferation of truck convoys	1
Legal issues	Lack of a universally valid legal framework for platooning	1
	Liability for damaged goods and personal injuries	4
	Need for improved hours of service regulation	4
Road safety	Automation will reduce the risk of difficult truck manoeuvres	1
	Chain crashes due to small size gaps and short time windows for take over	1

(*continued on next page*)

Table 3 (*continued*)

Themes	Representations	Studies (*N*)
	Compliance, safety, and accountability will be improved	1
	Demand more knowledge and testing of platooning safety effects	1
	Doubts about safety of automated trucks	1
	Increase in drivers' monotony and distraction	1
	Increase in driving safety	1
	Reduction of drivers' awareness and reaction ability	1
	Vehicles breaking into the platoon may promote crashes	1
System reliability	Concern about potential malfunctions	2
	Concern about the impact of malfunctions in the entire platoon and surrounding vehicles	1
	Danger of on-road software updates	1
	Error messages can have an unsettling effect on the driver	1
	Impact of adverse weather conditions on network connections, vehicle sensors, and navigation systems require platooning to be switched off	1
	Viability of platooning between vehicles with equipment from different manufacturers	1
Trust	Drivers mistrust current driver assistance technologies	1
	Interfleet operations require trust, assurance, and interoperability	1
	The leading position requires additional trust from drivers in the following positions	1
Workplace and workflow changes	Automation may increase drivers' workplace attractiveness	1
	Concern about performance of drivers in manual driving after driving or resting in automated driving mode	1
	Decreased social contact	1
	Drivers may find team participation in the platoon rewarding	1
	Drivers may lose driving pleasure	1
	Drivers may lose the feeling of being in control	1
	Drivers that appreciate independence and freedom may feel pressured	1
	Drivers will be able to engage in parallel activities while in automated driving mode	1
	Drivers will have more opportunities for relaxation	1
	Drivers will need to be prepared and focused to initiate driving on request	1
	If there is not a clear distinction between driving, resting and parallel task moments, the driving task may become more stressful	1
	Sufficient time for drivers to become aware of the need to transition is required	1

around which decision-makers' attitudes and beliefs about truck platooning gravitate. A total of 11 themes were identified:

1. Attitude towards automation (e.g., worry about drivers' attitude towards platooning);
2. Data and cybersecurity (e.g., doubts about the cybersecurity of automated trucks);
3. Efficiency (e.g., fuel efficiency as a potential benefit);
4. Employment challenges (e.g., whether automated trucks could help with driver shortages);
5. Finance (e.g., higher upfront costs for the introduction of automated trucks);
6. Infrastructure and traffic (e.g., inability to have dedicated lanes for platooning);
7. Legal issues (e.g., liability for damaged goods and personal injuries);
8. Road safety (e.g., need for more knowledge and testing of platooning safety effects);
9. System reliability (e.g., concern about potential malfunctions);
10. Trust (e.g., drivers' mistrust towards current driver assistance technologies);
11. Workplace and workflow changes (e.g., drivers' ability to engage in parallel activities while in automated driving mode).

A similar approach was employed to categorize the general public's representations, resulting in two themes:

1. Attitude towards automation (e.g., concern about the reliability of the platooning technology);
2. Traffic issues (e.g., blocking of entrances and exits in highways).

For truck drivers, we have also considered the factors pointed in the reviewed acceptance models (Fröhlich et al., 2018; Richardson et al., 2017; Wendel et al., 2020) as a reference to organize their representations, resulting in ten themes:

1. Attitude towards automation (e.g., annoyance to the experience of automated features);
2. Driving comfort (e.g., increase in driving comfort with automated trucks);
3. Driving pleasure (e.g., loss of the joy/pleasure of manual driving);
4. Employment challenges (e.g., fear of being made redundant, dispensable, or losing the job);
5. Legal issues (e.g., liability in case of crash);
6. Perceived ease of use (e.g., driving in a follower's position can be stressful due to reduced gaps between vehicles);
7. Perceived usefulness (e.g., inability to solve the major problems in the sector);
8. Road safety (e.g., concerns about the small gaps between vehicles and rear-end collisions);
9. Trust (e.g., fear of losing control over the vehicle);

10. Workplace and workflow changes (e.g., no relieve from daily tasks due to the need for constant monitoring of the system).

The thematic analysis exposed a total of 16 themes that were organized in a matrix of stakeholders' groups and type of experience (Table 2). Themes such as attitude towards automation, perceived ease of use, or perceived usefulness are common factors on both the original technology acceptance models presented in the introduction and those we have reviewed, while driving comfort, driving pleasure, road safety, and trust are themes that have emerged prominently from the technology acceptance models adapted to truck platooning (Fröhlich et al., 2018; Richardson et al., 2017; Wendel et al., 2020). Additionally, the reviewed studies did not contribute equally to the themes that emerged, with some studies contributing with representations for several themes, and others not providing enough information to extract a representation.

This analysis showed that themes are not evenly distributed by stakeholder, nor by type of experience. On the one hand, some issues are naturally only being explored in the perspective of truck drivers, being associated with the system's usability, while other issues are being studied from the perspective of decision-makers, related to management concerns. On the other hand, some concerns are being analysed from the perspective of the three groups, as it is the case of *attitude towards automation*. The fact that *trust*, from the perspective of truck drivers, has been studied with no platooning experience, with simulated experience, and with on-road experience, allows to analyse the evolution of drivers' trust towards truck platooning and is an example of the importance of experience, as it is discussed further ahead.

Since there were no studies focused on decision-makers with any type of experience, we can speculate that those studies are not being conducted, as drivers are the ones testing the systems. However, involving decision-makers in that kind of study could be beneficial to contextualize drivers' concerns. This may be a relevant gap in the literature to address.

After having identified the themes, we have analysed the representations present in these studies. Tables 3, 4 and 5 synthesize the representations of the different stakeholders concerning truck platooning: decision-makers, general public, and truck drivers, respectively. When analysing the representations by only considering the stakeholders' perspectives, some contrasts were found, evidencing the need for more holistic studies in this topic. In the next section, we discuss the complementary and contrasting issues unveiled by the representations present in the literature.

4. Discussion

The variety of representations found illustrate the diversity of perspectives presented in the literature. It is worth noting that, as it was visible with the themes, there are, as expected, far less studies focused in the acceptance of the general public. The representations from this group's perspective about truck platooning emerge from studies that considered themes related to automation and traffic (Castritius et al., 2020b; Gwak et al., 2022) and seem less refined, reflecting a lack of dissemination and public debate on this topic when compared to those who are the most involved in the freight transport activity.

Concerning decision-makers' acceptance of truck platooning, the outlook is tendentially more favourable to the technology in terms of the potential efficiency and productivity gains, particularly for technology developers and company managers (Pudasaini & Shahandashti, 2020). Although several dimensions of representations focused on potential obstacles to truck platooning implementation and to the expected benefits, it is worth noticing that some of the studies that were richer in decision-makers' representations were already focused on assessing the risks, obstacles, and impacts of truck platooning (Eitrheim et al., 2022; Münch et al., 2021; Sindi & Woodman, 2021).

Concerning truck drivers' representations, it was noticeable the role of experience on the acceptance of truck platooning. Before any platooning experience, studies present truck drivers' representations as mostly neutral or negative, as reinforced by Pudasaini and Shahandashti (2020) and Richardson et al. (2017), with no strong tendencies towards ease of use, potential relief from monotonous driving, or enjoyment, and with several concerns about the changes in their work activity, and the safety and reliability of automation technology outweighing the expected benefits. When participating in simulated experiences, and given that they are especially suited to test in-development concepts and critical events, some of the results mirror the experience of unpleasantness with stressful situations or still unrefined user experiences (de Bruijn & Terken, 2014). Nevertheless, when truck platooning was experienced closer to the intended final state and on-road, the representations of truck drivers were mostly favourable. This is particularly evident in Castritius et al., (2020a), as the use of a pre-test post-test design examined truck drivers' acceptance before and after experiencing platooning and revealed a positive change. However, it should be noted that even when this experience is closer to the reality of truck platooning, it is still a highly constricted and controlled slice of that reality, removed from the larger context of work-related issues that preoccupy truck drivers. Notwithstanding, this analysis should be done with prudence, since the (re)construction of the operative representations related to the use of automated vehicles is not compatible with punctual experiences, but rather demands an extended period of time.

Overall, it is interesting to see how some representations can contrast within the same group. For instance, regarding driving comfort, drivers may consider the potential for truck platooning to increase it, but, when considering the ease of use, truck platooning

Table 4
General public's representations of truck platooning acceptance.

Themes	Representations	Studies (*N*)
Attitude towards automation	Concern about the reliability of the platooning technology	1
Traffic Issues	Blocking of entrances and exits in the highway	1
	Issues with cut-in vehicles	1

Table 5
Truck drivers' representations of truck platooning acceptance.

Themes	Representations	Studies (*N*)
Attitude towards automation	Annoyance to the experience of automated features	1
	Car drivers will be irritated by small gaps and long convoys	1
	Concern about the decision-making process in complex situations	1
	Concern about potential malfunctions	1
	Concern about the reliability of the platooning technology	3
	Doubts about the safety of highly automated trucks	1
	Scepticism about the implementation of automated trucks	1
	Tendency to turn off current driver assistance technologies	1
Driving comfort	Driving with platooning technologies is comfortable	2
	Driving maintaining small gaps between vehicles is comfortable	1
	Expectation of a "white wall" when driving in the following position	1
	Increase in driving comfort with automated trucks	1
	Opportunities for relaxation with automated trucks	1
Driving pleasure	Boredom/lack of enjoyment/unpleasantness of driving in a platoon	2
	Driving in the leading vehicle will be more interesting	1
	Loss of autonomy due to a more restrictive driving process	1
	Loss of the joy/pleasure of manual driving	2
Employment challenges	Concern that truck drivers are not heard in the process	1
	Concern with the welfare of the truck driving community	1
	Disagreement that eliminating "unsatisfying and potentially unhealthy" driving jobs could be positive	1
	Fear of being made redundant, dispensable or losing the job	2
	Non-driving tasks will still require human intervention	1
Legal issues	Concerns about the fulfilment of work regulations while driving in automated mode for long periods	1
	Legal liability in case of crash	1
Perceived ease of use	Adaptation to small gaps between vehicles is quick	1
	Dealing with complex conditions (traffic, weather, etc.) will be challenging	1
	Driving in the following position will be very stressful due to reduced gaps between vehicles	1
	Driving in the leading position will be more exhausting	1
	Driving in the leading or following position will be easy	1
	Learning to use platooning technologies will be easy	1
	Platooning is easy to learn and to use	1
	Requirements for platooning are not very high	1
	Specific training needs may be required	1
	Stress of driving in a platoon	1
	Simplification of the driving task is not expected	1
	Struggle to imagine performing parallel tasks while in automated driving mode	1
	Undecided if the platooning system will be easy to use	1
Perceived usefulness	Fuel savings will only occur in test tracks	1
	Improved productivity	1
	Inability to solve the major problems in the sector	1
	It would be more useful if drivers in the following position did not have to monitor the system all the time	1
	Platooning is environmentally friendly	1
	Platooning will achieve fuel saving in the future	1
	Sceptical about the real goals of the technology (environmental benefits vs. labour cost savings)	1
	Unsure if platooning is a good idea	1
	Unsure if platooning will prevent traffic jams	1
Road safety	Anticipate that passenger vehicles will underestimate the danger and cut-in the gaps	1
	Broken-down vehicles on the hard shoulder may be a potential danger	1
	Concern or fear about additional crashes with platooning	1
	Concern about the small gaps between vehicles and rear-end collisions	2
	Drivers prioritize information that is temporally and physically closer to their safety	1
	Increase in driving safety	3
	Reduced crashes	1
	Safety benefits are not expected	1
Trust	Experienced the system as reliable and learned to trust in it	1
	Fear of losing control over the vehicle	1
	Fear of system failure or hacker attacks	1
	Feeling of losing control while joining a platoon	1
	HMIs that help drivers with manoeuvres can increase trust	1
	It is scary and difficult to trust the system, but it gets better with experience	1
	Lack of trust in the driver of the leading vehicle	1
	Loss of feeling of being in control	1
	Trust in all drivers in a platoon as a prerequisite	1
	Trust in the technical system as a prerequisite	1
	Would rather not activate the platoon system in adverse weather conditions	1
Workplace and workflow changes	Ability to change positions in the platoon may be beneficial	2
	Decrease in social contact	1
	Increase in the attractiveness of truck driver's workplace	1
	No relieve from daily tasks, due to constant monitoring of the system	1
	Opportunities for performing other activities	1

can be seen as a stressful experience. The role of drivers' acceptance is noted even by decision-makers, but at the same time some studies show that drivers are concerned about not being heard in the process. Moreover, the representations that we found in the literature expose the uncertainty that still exists in themes such as road safety, data privacy and cybersecurity, and legal issues.

Considering the implications of the gathered themes and representations to technology acceptance models, it is important to distinguish that although truck drivers' themes such as attitude towards automation, driving comfort, driving pleasure, perceived ease of use, perceived usefulness, road safety, and trust have received input from factors that were modelled in a few of the reviewed studies (Fröhlich et al., 2018; Richardson et al., 2017; Wendel et al., 2020), the representations under these themes hail from a much more diverse pool of studies, as illustrated in Table 2. This offers not only further support for those dimensions in truck drivers' platooning acceptance, but also further qualitative insight to these dimensions and their interconnections.

Trust appears to be a factor in truck drivers' acceptance, with some direct positive influence over the intention to use truck platooning technology and being positively influenced by the perceived ease of use, perceived usefulness, driving comfort, driving pleasure, and road safety (Fröhlich et al., 2018; Wendel et al., 2020). The representations we have gathered under the theme of trust help to elucidate that trust is both a requisite for truck platooning and its absence a source of fears about the reliability of the system and the driver's control over it.

Driving comfort and driving pleasure appear to be relevant factors for truck drivers' trust and overall intention to use truck platooning technology (Richardson et al., 2017; Wendel et al., 2020). Although both factors relate to driving experience, we note that the representations grouped under the themes derived from these factors have a very different valence in their quality. While the promise of driving comfort may be alluring to improve truck drivers' trust and intention to use the system, the loss, rather than a gain, of driving pleasure appears to be prevalent among truck drivers' representations.

The role of driving experience in the acceptance of truck platooning has been recognized (Castritius et al., 2020a; Dubljević et al., 2022; Neubauer et al., 2020; Richardson et al., 2017; Trösterer et al., 2017), but only in Wendel et al. (2020) driving comfort and driving pleasure were modelled as individual factors. Although both may have a positive influence in truck drivers' trust, it may be worth analysing their direct and distinctive role in the overall intention to use truck platooning technology. As hinted by the polarity between the representations in both themes, these dimensions may have an inverse effect in platooning acceptance that could account for the disparities noted in the literature (Neubauer et al., 2020; Richardson et al., 2017).

Similarly, although road safety associated with truck platooning technology appears to positively influence trust and the intention to use the technology, truck drivers' representations under the theme of road safety reveal that both positively- and negatively-valent representations are prevalent among drivers. It would possibly be interesting to model the relations between positive and negative expectations in road safety and other factors, in a similar vein to what has been made for more classical dimensions of technology acceptance (Fröhlich et al., 2018).

We also highlight the relevance of work-related themes in truck drivers' representations, and the need for dimensions like employment challenges and workplace/workflow changes to be considered in the modelling of truck platooning technology acceptance. Unlike in consumer-oriented technologies, such as driver assistance technology for non-commercial vehicles, the introduction and further implementation of truck platooning technology will bring considerable changes to truck drivers' workplace, workflow and potentially to their employment (Fröhlich et al., 2018; Trösterer et al., 2017).

While workflow improvements have been previously considered as a subfactor of perceived usefulness in Fröhlich et al. (2018), given the implication and relevance of work-related dimensions, we argue that they should be considered beyond perceived usefulness. Classical models of technology acceptance, such as TPB and UTAUT, consider factors such as subjective norm, social influence, and facilitating conditions, which are possibly more aligned with the preoccupations reflected in truck drivers' representations regarding the employment challenges brought by truck platooning. As such, we believe that these dimensions should be prioritized in future models of truck drivers' platooning acceptance.

Finally, although we have only found technology acceptance model adaptations that modelled truck drivers' acceptance of truck platooning technology (Fröhlich et al., 2018; Richardson et al., 2017; Wendel et al., 2020), the similarities and differences in stakeholders' representations and themes point towards directions in the adaptation of these models to the specificities of truck platooning and their expansion to other stakeholders beyond truck drivers.

5. Conclusions

In a quest for sustainable, safe and efficient transport, efforts are being made to further develop truck platooning technology. As the adoption of the technology is dependent on its acceptance, we have developed a systematic literature review, aiming at identifying current representations reflected in existing studies. Following the PRISMA guidelines, we have found 35 studies that fitted our criteria. Our goal was not to find scientific support pro or against truck platooning technology, but rather to collect information about reported representations. Most of these studies are devoted to professional drivers' acceptance of truck automation while missing the influence of work context and organisation (Silva & Cunha, 2022). Following the scientific tradition of work psychology and activity ergonomics (Daniellou, 2005; Lacomblez et al., 2007), we suggest that previous work experience shapes "operative representations" and can be more than a moderating variable in acceptance of truck platooning.

In this sense, our presentation of the reviewed studies and their thematic analysis unfolded by highlighting two dimensions: stakeholders' perspective and platooning experience. We will continue by arguing how these dimensions may interact to provide a dynamic picture of the representations about truck platooning that may elucidate the different levels of acceptance of the technology. Regarding platooning experience, as already argued by Cunha et al. (2022), the analysis of technology acceptability should be situated in relation to the experience in using such technologies. The access to "operative representations", supported by the experience in real context, with its constraints and difficulties, should be the starting point in the design of automated systems. This is an important challenge in the research and implementation of truck platooning, considering that there are still few studies in real-world contexts. As for the stakeholders' perspectives, the representations found confirmed the importance of this dimension, as decision-makers are more concerned about business and operations efficiency, while drivers show more concerns about the driving task itself.

Several themes (16) have emerged from our analysis, with some degree of overlap between stakeholders. The themes were analysed considering both reported dimensions (stakeholders and experience). It is however relevant to understand that, even when the themes are similar, the representations from different stakeholders mirror the singularity of each group's perspective. This is particularly noticeable in themes such as employment challenges, which have emerged both for decision-makers and truck drivers, where decision-makers' managerial concerns contrast with truck drivers' fears about the sustainability of their work activity.

As far as our research allowed to understand, most studies focused on how acceptable the interaction with the technology is, and how to improve the technology to make it more acceptable, but lack focus on how the technology can actually improve truck drivers' working conditions.

The contrasting representations presented in the reviewed literature reveal uncertainty and confirm the need for future studies, not only about the impacts on the working conditions, but also concerning design and development topics such as (i) system reliability and feasibility, (ii) road safety, (iii) data and cybersecurity, and (iv) legal frameworks.

Regarding the limitations of our study, it is worth noting that most of the representations collected in our thematic analysis can be found in studies without simulated or on-road platooning experience. Other limitations may come from the inclusion criteria that might have led us to reject insightful studies from grey literature.

The bi-dimensional structure of this analysis contributed with valuable insights that offer the possibility of developing an action plan targeting the different stakeholder groups identified in the literature to address their concerns. Moreover, we have identified possible lines of research that will be integrated into our future work, alongside with identified limitations. Namely, we are engaging with several stakeholders, such as logistics companies and carriers, drivers, road operators, and regulators. From that survey, we expect to contribute with more knowledge about topics that we were not able to discuss at this moment, such as the future of freight business models and the integration of automation in multimodal supply chains, thus contributing to a holistic study of the road freight transport evolution.

Despite recognising the challenges associated with driving studies in a real context when the maturity of technology is not yet given, in the next stage of the project TRAIN we will integrate contextual information about work environments where professional drivers work, in simulation experiences, followed by interviews with truck drivers. This is a possible compromise for now, with some inescapable limits concerning what driving in a truck platooning might look like, but a first step towards a better understanding of the reconfiguration of work experience within automated driving systems.

CRediT authorship contribution statement

Vladimiro Lourenço: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Sérgio Pedro Duarte:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **António Lobo:** Writing – review & editing, Project administration, Methodology, Funding acquisition, Conceptualization. **Sara Ferreira:** Writing – review & editing, Project administration, Funding acquisition, Conceptualization. **Liliana Cunha:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary material

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