



Logistics business model evolution: digital platforms and connected and autonomous vehicles as disruptors

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Abstract

Business models are being transformed by increasing digitalization of the economy and the emergence of technological systems. In logistics, through innovation and the implementation of information processing systems using digital platforms and the integration of Connected and Autonomous Vehicles (CAV), the transformation of business models is being bolstered. However, the digitalization of the business fabric and the predisposition to integrate into logistics platforms will condition business evolution. This paper aims to reveal the evolutionary trends in the business models of companies in the road freight transport sector, and also to outline the benefits and main barriers faced by managers in creating, delivering, and capturing value in a business environment characterized by the emergence of new business models, digital logistics platforms and CAVs. Through qualitative research based on interviews with strategy managers and senior executives from mobility and technology companies, the findings reveal the importance of business integration on digital platforms to optimize resources and deliver better services. By managing aggregated data from CAVs, digital platforms will enable personalized and comprehensive services through omni-channel delivery. By creating single interfaces for contracting, customer care and customer service, platforms enable companies to specialize in specific services and increase profitability while covering complete needs through cross-company collaborations.

Keywords Business models · Contingency theory · Digitalization · Digital Platforms · Connected and Autonomous Vehicles (CAV)

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1 Introduction

The economic and social situation of recent years is characterized by growing uncertainty due to the health crisis, geostrategic factors, shortages of materials, high inflation and rising rates. This situation coincides with a change in consumer habits and trends. In addition, the globalization process increases the need for competitiveness through innovation-based processes, products, and services (De Vet et al. 2021). This change has a great impact on the road freight transport as it develops in an extremely competitive market subject to technological innovations, changes in regulatory frameworks and social trends that result in higher demands from customers in terms of service quality and costs (Flint et al. 2005; Turienzo et al. 2022a). Throughout history, road freight transport has evolved to adapt the vehicles to increase the capacity and services offered (Mom and Kirsch 2001). In the same way, factors such as the environment (Kumar and Alok 2020) or the technological adaptation to be able to circulate through new road infrastructures (Ferrari 2009) have been essential for the evolution of road freight transport. Therefore, companies should consider digital innovation as a driver for the development of business opportunities (Wagner 2008).

The competitiveness of road freight transport and logistics services companies is increasingly dependent on their ability to implement or adopt innovations that provide them with competitive advantages (Panayides and So 2005; Conrad & Figliozzi, 2010; Bhargava et al. 2020). In terms of functionalities, digital innovations can be classified as in five areas: (i) automation (e.g., Connected and Autonomous Vehicles - CAVs); (ii) interaction (e.g., mobiles or internet); (iii) data (e.g., big data); (iv) connectivity (e.g., sensors); and (v) transactions (e.g., blockchain) (Trischler and Li-Ying 2023). These innovations are the consequence of the research and development of products or services that are aimed for use in society (Pertuz and Perez 2020). As a consequence, managers integrate innovation management into a company's strategic plan (Babkin et al. 2015). In addition, they must incorporate procedures as digital innovation management taking due to the reduction of time available to adapt existing business models to innovations (Urbinati et al. 2018).

The digitalization of mobility-related sectors is reinforced by the introduction of technologies linked to CAVs (implemented on truck or on light commercial vehicles) favoring business platforms (Gawer and Cusumano 2013). Successful business platforms integrate participants in value creation by interrelating stakeholders (government, business, and society) around a global technology (Zhao et al. 2019). Various researchers have identified the potential advantages of CAV in terms of reduction of accidents associated with human errors (Papadoulis et al. 2019; Turienzo et al. 2023) and safe dangerous freight transport (Bhargava et al. 2020). In addition, CAV allows an optimization of distribution routes in real time (Conrad & Figliozzi, 2010) but also in environmental and economic impact through new business models (Bansal et al. 2016; Gruel & Standford, 2016; Liu et al. 2017; Nikitas et al. 2019; Cabanelas et al. 2023). In parallel, CAV is can provide a solution to the truck driver's short-

age of the Europe (DHL 2022). Companies, and particularly technology companies, aim to position themselves, diversify their services into new market propositions and increase competitive advantages by combining these advantages and taking advantage of the disruptive nature of CAVs (Marletto 2019).

Innovations, as a determining factor in the competitiveness of companies (Krašnicka et al. 2018), generate a favorable environment for the growth of the economy through access to new markets (Marvel and Lumpkin 2007) and business models (Palos-Sánchez et al. 2021; Medina et al. 2022). Business models are those business mechanisms that generate, create, and deliver value to their customers (Bouncken et al. 2021; Paiola and Gebauer 2020). The value provided by the company is perceived by consumers when consuming services or products from the platforms (Cennamo 2021). Design process of business models in coordination with clients results in a better accuracy in the services to their needs, generating more value (Chesbrough 2011). The customer bases their perception of the value based in multiples factors, as price and trust (Ruiz-Alba et al. 2021). Therefore, it is essential that their operations are aligned with trends that allow them to recognize and understand the key elements that affect their business model (Parida et al. 2019). However, the assimilation and adaptation of disruptive innovations is not trivial and, because of their complexity, they are volatile and uncertain (Foss and Saebi 2016; Schoemaker et al. 2018). Moreover, the investment required to adapt a traditional logistics firm to new technologies slows down the process (Linde et al. 2021). In parallel, the low investment and asset requirements of firms based on digital business models or platforms lead to strong growth because they find it easy to pick up on needs and deliver value to their customers (Parker et al. 2016; Ruutu et al. 2017; Hagiú and Altman 2017). Consequently, disruptive innovations alter the business landscape by enabling access to new markets with lower entry barriers (Marvel and Lumpkin 2007; Teece and Linden 2017). Therefore, innovations bring with them both opportunities and threats to firms in a business domain (Christensen and Raynor 2003).

Several previous studies have analyzed negative impact of disruptive innovations on sectors with several difficulties to adapt their business models due their localization and internal characteristics of the company like technology obsolescence, financial leverage, law restrictions or workforce (Osiyevskyy and Dewald 2015; Täuscher & Laudien, 2017). As consequence, is detected a transition between differs business models such as taxi companies and mobility-as-a-service (Turienzo et al. 2023), retail and e-commerce (Täuscher & Laudien, 2017). This situation is amplified in those geographical areas such as Spain, where 82.9% of the companies in the transport sector have less than 10 employees and only 0.4% have more than 250 workers (MITES, 2023). Despite the digitalization objective of the European Commission, only the 10% of the enterprises associated to logistics sector reached a high level of digitalization in 2016 (European Commission 2016). For this reason, it is important to analyze disruptive technological innovations in depth and to propose strategies for adapting business models to ensure the viability and survival of companies (Deephouse et al., 2017; Rachinger et al. 2018). Therefore, this study aims to clarify the trends and evolution of business models in traditional sectors such as road freight transport, made up of multiple small or self-employed companies and characterized by dependence on physical documents and little information management. However, despite

the great importance of the concept of platforms and alliances that maximize the use of data in mobility-related business models (Turienzo et al. 2023), this relationship concept that is scarcely studied.

From the perspective of Contingency Theory (McAdam et al. 2016), research explores the adaptation of road freight transport models and activities to alterations in digitalization. Innovations associated to digitalization or business models based on (digital) logistics marketplace platforms and CAVs, offer advantages to take future business opportunities (Donaldson 2006). In addition, digitalization allows the interaction between customers and shippers to optimise and clear the market for logistics services. This analysis has gained importance due to the rapid growth and number of digital start-ups or unicorns. More than 1,000 digital start-ups have reached capitalizations in excess of USD 1 Billion (CB Insights, 2022). The rapid evolution and degree of innovation of digital technologies associated with mobility and, especially, their implication in the viability of business models has led to the need to analyze the impact on traditional businesses in depth. Answers are therefore sought, using qualitative research techniques based on interviews with managers and strategy developer managers of multinationals in sectors interrelated with road freight transport, to the following questions:

RQ1: How will road freight transport models evolve with the integration of logistics platforms and autonomous vehicles?

RQ2: Where, how and by whom will the creation, capture and delivery of value perceived by the customer be concentrated?

The questions posed will help understand how CAV implementation affects other interrelated technologies and business models (Monios et al., 2019). Due to the high degree of novelty of the research topic, exploratory qualitative approach methodologies supported by Grounded Theory are used (Johnson 2015). For this purpose, in-depth interviews are conducted, which make it possible to aggregate the most valuable, in-depth information from senior managers in traditional industrial sectors that work with and integrate innovative technological solutions (Creswell 2007). The heterogeneity of the sample offers a wide variety of perspectives that provide a holistic approach. The methodology employed, together with results analysis using MAXQDA PLUS software, allows matrices to be obtained to extract concepts and study strategic implications, opportunities and threats linked to technological innovation in the field of mobility, business platforms and logistics (Kuckartz 2014).

The paper is structured in six sections that explain and detail the research. The following sections include the literature review, which analyzes the evolution of business models due to technological innovations. The third section describes the qualitative case study methodology. The fourth section explains the results and, finally, the fifth section shows the discussion of the research questions and provides conclusions.

2 Literature review

2.1 Business adoption of disruptive innovations

Firms base their competitiveness on process improvement and on the inclusion and harnessing of innovation (Tellis et al. 2009; Krašnicka et al. 2018). The innovation factor varies according to its characteristics, being more influential in radical or disruptive innovations (Christensen 1997). Disruptive innovations change the business landscape by creating new markets and enabling the economy to grow (Marvel and Lumpkin 2007). However, a highly innovative environment not only creates opportunities, but also poses threats to established companies in a given market (Christensen and Raynor 2003; Volberda et al. 2021). Disruptive innovations are even considered one of the main challenges facing managers (Kraus et al. 2019).

Disruptive innovations comprise disruptive business models and disruptive technologies (Christensen and Raynor 2003). Researchers have analyzed the business processes (Bessant 2003) and managerial aspects that, due to their cross-cutting impact, favor, delay, or even impede the adaptation of companies to the different innovations. The attitude and digital aptitude of management is a determining factor, with the degree of openness to new experiences (George and Zhou 2001) or tolerance to ambiguous environments (Schoemaker et al. 2018) being key. In small companies or SMEs, however, the main factor is the manager's personal determination and commitment to a particular innovation (Groote et al., 2021). In parallel, in larger firms the diversity of specialization of board members (Goodstein et al. 1994), location of resources (O'Brien, 2003), and a climate that favors learning (Madjar et al. 2017) are all key aspects. However, the great heterogeneity of the managerial structures and characteristics of firms continues to expose the need for further study of the impact and assimilation mechanisms of disruptive innovations in diverse sectors (Hu and Hughes 2020).

Nevertheless, innovations are only monetized if the marketed products or services maximize their advantages by having transformed business models (Chesbrough 2010). Business models are defined as the logic that captures, generates, and delivers value to customers through services or products (Teece and Linden 2017). In addition, they describe relationships and operations with stakeholders (Zott et al. 2011). These operations, based on the unique characteristics of each firm, are intended to generate value and revenue for the firm (DaSilva and Trkman 2014; Osiyevskyy and Zargarzadeh 2015). Digitalization, which is affecting traditional business models, creates opportunities for businesses that were born digital (Volberda et al. 2021).

Consumers, like businesses, are evolving towards "smart" as a result of the cost reduction in digital technologies (Internet of Things, Smart devices), integration, and acceptance (Parida et al. 2019). Therefore, the digitalization of sectors is increasing competitiveness by reducing entry barriers to markets dominated by traditional firms (Teece and Linden 2017). The current high pace of innovation, marked by technological diffusion, is exponentially increasing the available data, data analysis tools and machine learning that offer competitive advantages to pioneering companies (Hanelt et al. 2021). In addition, CAV innovation is shifting paradigms, constituting multi-sector value chains (Turienzo et al. 2022b) and driving the business relocation

for better environmental conditions (Turienzo and Lampón 2022). These technologies, which are being integrated into vehicles, will provide a wealth of information to mobility-related businesses with the full deployment of CAVs (Turienzo et al. 2023). Therefore, information and communications technology (ICT) will have to be considered as a core element of business (Matt et al. 2015).

Multinational companies, aware of the importance and criticality of digitalization, are prioritizing transformation (Warner & Wagner, 2019). However, transformation is progressing at a slower pace than innovation because of the risk associated with not amortizing the necessary investment and returning value (Linde et al., 2021). Therefore, experts point out that technological leadership is no guarantee of business success (Volberda et al. 2021). Moreover, the complexity and ambiguity of the business environment (Foss and Saebi 2016) is focusing attention on innovation management because of its determinant role (Li et al. 2017). Consequently, companies need to develop a Digital Business Model Innovation (DBMI) strategy that modifies the procedure for capturing, creating, and delivering added value (Veit et al. 2014; Parida et al. 2019; Trischler and Li-Ying 2023). However, in general terms this is a phenomenon that is scarcely studied by managers in traditional and small companies (Li et al., 2020), especially in mobility-related sectors. Consequently, there is a need to support managers in the digital transformation process (Gong and Ribiere 2021).

2.2 Strategic management and the impact of digital platforms

The business models of companies are the result of the strategies adopted and decisions made by managers and stakeholders (Casadesus-Masanell and Ricart 2010). In recent decades, and particularly in innovation and technology management environments, the importance of the characteristics of different typologies of business models has increased (Massa and Tucci 2014). Companies should carefully consider how to adapt their business models to maximize the opportunities of digital transformation (Rachinger et al. 2018) and minimize the threats (Volberda et al. 2021). Management strategy must be focused on creating efficient, prosperous, and digital business models that cannot easily be imitated (Ghezzi and Cavallo 2020). Strategic decisions have relevant implication, as the transformation must enhance, extend, and redefine the generation and delivery of value by integrating digitalization (Li 2020). Consequently, four different levels of digitalization are detected: (i) trivial (limited usage of digital tools without a business model integration, e.g. as exclusive use of digital tools in marketing or websites); (ii) informative (partially implemented on decision process through, e.g. ERP, CMR) (iii) partially integrated (implemented on optimization manufacturing and value creation process, e.g. real-time data capture systems, robotics and industry 4.0); and (iv) full digitalization of the business model (Kiel et al. 2017; Rachinger et al. 2018).

Despite the complexity, customer demand for digital and smart services (Parida et al. 2019) and the improvement potential of technologies make it necessary to create and evolve innovative business models that create or maintain competitive advantage and ensure business viability (Parida et al. 2019; Li 2020). Due to their great importance, it is essential for managers to seek out and analyze the innovations adopted by new digital models (Kohtamaki et al. 2019). Strategies should not only focus on

the classical elements of business models, but also on the awareness of digital transformation, acceptance of platform architecture and internalization of start-up culture (Rohn et al. 2021). Therefore, strategic decisions should be based on knowledge of innovations and their repercussions on the core elements of business models (Parida et al. 2019).

Digital types of innovations (e.g., CAVs, internet, big data, IoT) (Trischler and Li-Ying 2023) have three main internal components: content, experience, and service or product delivery platform (Weill and Woerner 2015); and two external ones: users and other business models or platforms (Blaschke et al. 2016). High levels of competitiveness are favoring the adoption of these innovations and giving a leading role to digital platforms to the detriment of traditional business models (de Reuver et al. 2018). These platforms (e.g., Alphabet, Amazon, Alibaba), due to their digital status, are characterized by low investment and high growth rates (Hagiu and Altman 2017; Ruutu et al. 2017).

In addition, logistics marketplace platforms, based on digital platforms, provide easy access, purchase, or trading of a large number of products and services with freedom of timing and geographic availability through digital technologies that connect customers and businesses (Parker et al. 2016). These, through platform economies, offer opportunities to those that adapt to the new landscape, and numerous disadvantages to those that keep away from the new trends (Volberda et al. 2021). Digital platform economies transform the value creation process and do away with the traditionally necessary resources (e.g., financial, physical facilities, raw materials, patents) that bring advantages to a specific company (Parker et al. 2016; van Alstyne and Parker 2017). Platform-business models dispense with controlling the delivery of the product or service (van Alstyne et al., 2016) and have as their main differentiating value the ability to connect the different actors (customers and companies) to facilitate transactions and information exchange (Rohn et al. 2021). The absence of tangible (and expensive) assets allows them to grow very quickly (Tan et al. 2015).

In spite of a continuing need for traditional businesses to deliver their services or products, these emerging business models pose a threat to companies that do not take advantage of the opportunities of the digitalization of their environment (Christensen and Raynor 2003; Volberda et al. 2021). The digitalization and connectivity of vehicles will offer a wealth of information (Turienzo et al. 2023) and thus possibilities for the integration of platforms (Parker et al. 2016). As consequence, autonomous and connected vehicles could impact on current business models (value creation and employment) due to the impulse digital business associated to mobility due generation of data. However, the possible impact on the implementation of digital platforms and the consequent transformation of business models in logistics and, especially in road freight transport, have scarcely been studied.

3 Methodology

The research was developed using exploratory techniques. Qualitative methodologies are appropriate in novel fields of study, such as business strategies linked to the impact of disruptive innovations (Stake 2010; Johnson 2015). Through the appli-

cation of systematic methodologies in qualitative research, especially Grounded Theory, it is possible to theorize and hypothesize (Yancey Martin and Turner 1986; Strauss and Corbin 1994), especially in social and potential market studies (Jones et al. 2005). By collecting data and subsequently analyzing them, Grounded Theory enables the generation of explanations that identify business opportunities by studying the views of expert participants (Creswell 2007).

The participation of highly qualified managers provides information of great value, the analysis of which enables an understanding of the strategic lines of companies linked to a given sector (Creswell 2007). The unpredictable nature of disruptive innovations (e.g., digital platforms) and their application in business models (e.g., logistics) makes it essential for the business fabric to have a high capacity for adaptation under Contingency Theory in order to maximize benefits and reduce risks (Donaldson 2006). In this sense, the compilation and analysis of detailed descriptions through interviews with experts allows conclusions to be extrapolated and generalized (Elharidy et al. 2008).

The sample of expert candidates for the research was designed to maximize business points of view. The experts, with extensive experience in mobility-related sectors, are involved in business strategy, the search for new markets or business opportunities, and maximizing the profitability of business resources. To this end, 69 candidates were selected from managers, strategy managers, senior consultants in the fields of telecommunications, oil (with service areas), logistics, electrical suppliers, repair workshops, road infrastructure, insurance companies, and consultancy firms. The interviewees are characterized by working in large companies with headquarters in Spain and Portugal that base their activity on logistics services ant to providing full services transport ecosystem. Through the selection of participants from large companies belonging to multiple related sectors, but not involved on vehicles manufacturing, it is possible to obtain a complete vision of the technologies, international trends and requirements of the logistic sector without being influenced by the reluctance and limitations inherent to be included on the CAV development process. In addition, the selection of complementary sectors allows maximizing reflection from multiple business and sector perspectives. Furthermore, to maximize the scope of the study and allow global extrapolation, the companies selected had in common a strong international character with a global presence in many cases (Table 1).

The selected candidates were contacted by email, professional social media (LinkedIn), or telephone. In the first contact, their suitability was assessed, based on technical and strategic knowledge related to mobility, as well as job functions, and those who met the desired characteristics were asked to participate in a prearranged interview.

In addition, the design of open-question interviews using a script with rhetorical interview design allows information from the entrepreneurial ecosystem to be maximized by answering 5 W questions (who, what, when, where and why)+How (Myszewski 2013). The script, which consisted of open-ended questions, was tested in an interview. Once it was validated, the interviews were conducted individually to maximize the information collected and not influence the participants, researcher participation being kept at a minimum (Kuckartz 2014). The questions in the script were centered around three main areas:

Table 1 Characteristics of the sample

Business Sector	#	Professional role	Business relationship
Assurance	#1	Business transformation manager: new markets and diversification	Depending on the Incoterm, the risk of damage to the merchandise may lie with the buyer or carrier. Therefore, the selected mobility method is a factor to consider
Business development	#2	Economic promotion manager	The incorporation of CAVs implies the need to adapt and create new logistics centers in the industrial parks
Consultancy	#3	R&D manager	CAV brings the need of developing innovation projects in logistics companies
	#4	Senior strategic mobility consultant	The characteristics and possibilities of CAVs lead to the need to adapt the business models of transport companies
	#5	Strategy and new business manager	
	#6	Strategy manager	
	#7	Start-ups manager and developer	The technological revolution enables opportunities for the incorporation of new agents in the logistics chain
Electric supplier	#8	Mobility and future needs detection manager	The electrification of autonomous trucks shows the need to implement contactless carders or plug-in systems
Engineering	#9	Manager of R&D: infrastructure and telecoms	Construction and telecommunications companies must develop projects that allow autonomous logistics to be pioneers
Gas stations	#10	Business and business strategy manager	The payment of fuel must be made by telematics means that validate high amounts (greater than €1000) without the supervision of the driver
	#11	Corporate strategy manager	The supply can be provided by autonomous trucks that must be unloaded
Infrastructure Buildings	#12	Lifecycle manager	CAV (trucks) modifies the driving patterns and the maintenance of the wear of tread
	#13	Digital excellence for mobility manager	Travel infrastructure managers must integrate security and communication elements in accordance with the CAVs
Logistics	#14	Manager director	CAVs may allow the increase in transport capacity by eliminating rest periods
Mobility-as-a-Service	#15	Strategy Regional Manager	CAVs may consider changes in mobility services and reduction of human resources, but incorporate others like delivery service
Repair Workshop	#16	General manager	Workshops must implement repair or recalibration procedures for electronic systems associated with the CAVs
Telecommunication	#17	Strategy and technological integration manager	The integration of interconnected elements is critical for implementation of CAVs to maximize the benefits
	#18	Innovation projects managers (5G)	The development of pilot projects that improve communication (IoT) through 5G networks are essential to prepare the infrastructure for future needs

- Main disruptive innovations and technological characteristics associated with CAVs and the digital environment that affect business models.
- Characterization of future business models according to the needs forecast.
- Time term for implementation and adaptation of current business models to business platforms.

The interviews, conducted between February 2020 and February 2021, ranged in length from 35 to 98 min. Likewise, the information gathered amounted to 951 min of recording. In order to increase the capacity for detailed analysis, and with prior authorization from the participants, the interviews were recorded and transcribed. To complete the transcripts and results, notes and reflective comments regarding the behavior of participants were included, totaling 168 pages (Spry and Pich 2020). Furthermore, analysis and sampling (through interviews) were conducted simultaneously, creating a dynamic research environment that improved the quality of the information (Glaser and Strauss 2009).

Analysis of the large amount of information collected was conducted by implementing agile coding methodologies (Johnson 2015). In addition, an analysis based on systematic understanding was implemented on the information obtained through the expert interviews (Mayring 2014). Following recommendations from Grounded Theory, the analysis was complemented by the formulation of qualitative matrices that synthesize the perspectives and interpretations resulting from the interviews conducted (Borda et al. 2019; Johnson 2015). The matrices were developed and reduced using MAXQDA PLUS software, and, furthermore, summaries of thematic matrix grids, code clouds (graphically indicating the terms or expressions with the highest frequency of occurrence), and coded textual fragments were obtained (Kuckartz 2014). The patterns revealed, as well as interrelationships and the strength of the terms used, shown by the graphs, reveal trends and recommendations for adapting business models (creation, delivery, and capture of value) to the new disruptive innovations analyzed. In parallel, the research findings were reinforced by a manual analysis of the transcripts, which revealed quotes and statements from the interviewees (Braun and Clarke 2006).

The research implemented triangulation techniques that increase the reliability of the results and reduce the distortion of interpretation associated with qualitative research (King et al. 2009). The design of triangulation strategies is appropriate to better understand phenomena in complex research contexts (Thurmond 2001), which include strategies linked to the formulation and adaptation of business models in the face of innovations that cause uncertainty. Based on triangulation, an investigation was established considering three perspectives, named as vertexes. The most relevant quotes (vertex 1) and the matrices obtained (vertex 2) were complemented on Table 2 by analyzing the perceptions and reactions observed during the interviews, which constitute vertex 3.

Table 2 Triangulated results

Strategy	Matrix relation	Related quote	Behavior
The CAV as a driver of model change	Very strong: CAV, platforms. Moderate: Cloud, V2V technology, Geolocation. Slight: IoT, IA, Big data	#7-Q1; #17-Q1	Eager
Overcome legal barriers for data use	NA	#1-Q1	Doubts regarding the existence of other barriers
Integration of the ecosystem under digital platforms	Very strong: Platform. Strong: CAV, Mobile App. Moderate: Data sharing	#8-Q1; #7-Q2	Confidence in the integration of the value chain
Rapid assimilation of innovations in order to be competitive	Strong: Business size influences on the adaptability	#2-Q1; #3-Q2	Strong assertion that if things are not digitalized, they will be unviable
Monitor new business actors	Strong: Platforms. Moderate: IA, Big data, IoT	#4-Q1	Concern over the risks in the face of new actors
Create ad hoc services based on the information available on digital platforms	Strong-moderate: Big data. Moderate: Platforms, CAV, Data sharing	#4-Q2; #8-Q2; #10-Q1; #11-Q1	Serious assertion that understanding the customer is fundamental in services creation
Facilitate contracting of unified services	Strong: platform, CAV. Moderate V2V technology. Slight: IA	#6-Q1; #11-Q2	Emphasis on the perception of unified logistics
Information as recurrent revenue	Strong-moderate: Big data. Moderate: CAV, Data sharing. Slight: CAV	#10-Q2; #18-Q1	Concern about how to charge

4 Results

4.1 Summary of the results

The data collected in the interviews have been classified by concepts. This recompilation, that generates the vertex 1 of the research. For this purpose, the most relevant and significant answers and comments from the messages conveyed by participating

experts were selected. For a better understanding, Table 3 only shows those aspects that are most relevant for the experts and among which there is consensus. Likewise, in order to facilitate later referencing, the main statements have been identified following a meaningful nomenclature (*#partner number - Q quote number of each partner*).

4.2 Analysis and triangulation of results

The results reveal that customer-perceived value has changed with increased information and digitalization. The integration of digital platforms and CAVs into the current system will increase the efficiency of the system as a whole (see quote #7-Q1). On the one hand, logistics companies have an increasing need to employ a network of physical service providers to increase their service performance (e.g., in terms of delivery times, tracking, capacity, etc.) and decrease costs (#8-Q1). However, this evolution is not exempt from technological risks specific to the vehicle (#3-Q1) and to the infrastructure and connectivity that allow the maximization of its potential and integration in platforms (#9-Q1:), or regulatory risks (#1-Q1). Despite these risks, the benefits for consumers and operators will encourage all physical providers of logistics or mobility services to operate under a single platform, which can be combined to provide a single service (#7-Q2).

In addition, the matrix defined as vertex 2 reflects the interrelationship between technologies and business models alterations according with experts. Integration and business model changes are supported by alterations in the evolution of the value appreciated by the user (Fig. 1). End-users do not value who provides the service efficiently and at the lowest possible cost (#7-Q3). In this sense, autonomous vehicles favor their own management to be done by apps or digital platforms (#13-Q1). Users will value personalized service and not just cost, and it will be possible to create services tailored to their particular needs (#4-Q2). The business model and the conception of the logistics service must have the customer at the center (#10-Q1), and so it is increasingly important to know the customer (#8-Q2). Therefore, ICT tools (e.g., Artificial Intelligence, image processing, databases) supported by CAVs are increasingly necessary to create and offer services (#11-Q1). Moreover, the company does not only have to offer a logistics service, as value creation should also be linked to simplification in the process of contracting the service (#14-Q1).

In parallel, the results obtained show that, like value creation, delivery has to be redefined. Digitalization carries with it the idea that human interaction is dispensable (#5-Q2), with digital platforms being the main means of customer contact (#6-Q1). Through digital platforms, integrated companies must be coordinated to offer a single logistics or delivery service (#11-Q2), increasing the value of the service. Furthermore, digitalization affects value capture. Not only can companies monetize the logistics service, but the knowledge and analytics gained through digital platforms can become the main source of revenue (#10-Q2, #18-Q1). The logistics service itself will have lower costs, and therefore business profits, but repeat usage can offset this reduction in profitability (#16-Q1). This change is particularly important for physical service providers, as part of the profit will go to the platform for integrating and

Table 3 Main ideas commented on

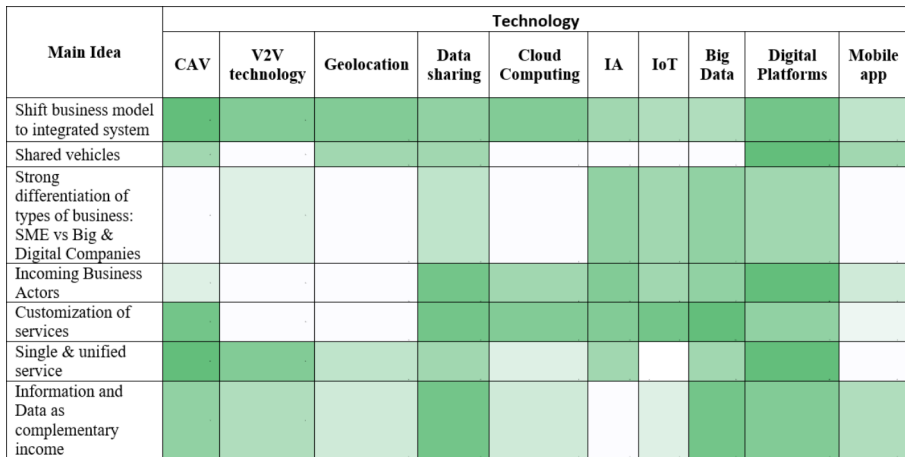
Main Idea	Behavior	Quote
Change of business model (CAV as driver)	Eager	#7-Q1: With CAVs, you will have a much richer system in Mobility as a Services and logistics, with a more efficient transport based on digital contracting platforms. #17-Q1: Autonomous car is an impulse. All companies have to move to the Cloud. It is the concrete way to digitize. Thus, it will enable business models based on platforms.
Change of business model (legal and infrastructure barriers)	Doubts regarding the existence of other barriers	#1-Q1: Taking in account GDPR, the general data protection regulation, of the data that companies will have to save. For example, geolocation is highly sensitive data. #3-Q1: One of the problems that the autonomous vehicle has is that it is very dependent of satellite positioning systems [...] The problem is that, in certain areas, it is often difficult for the satellite to take the point in order to position it. #9-Q1: In the environment of digitization, Artificial Intelligence, Big Data ... Cloud computing [...] but there is still not full communication vehicle-infrastructure.
Change of business model (Ecosystem integration)	Confidence in integration of the value chain	#8-Q1: What is necessary and essential is that everyone can their products move from a point of origin to a point of destination with the greatest flexibility and combining not necessarily a single service, but several. The combination of operators through a single seller will achieve it and reduce cost #7-Q2: Entertainment business, infotainment, services, and logistics... for some they will be similar to the ones you had. Camera and mobile are the same now on your mobile, so different logistics and MaaS providers could be the same.
Change of business model (Differentiation, business typology)	Strong assertion that if things are not digitized, they will be unviable	#5-Q1: It is going to do even more big the gap between big companies and small companies because giants like Amazon and I suppose that the El Corte Inglés [...], or the department stores will have a much greater capacity to reach the customer. #2-Q1: There are still many companies that do not have electronic platforms webs. They have a website as a demonstration, but they do not use it as a sales platform, which seems inconceivable [...] something like Covid is what causes them to finally take the initiative. There must be an external impulse that forces the SMEs to modernize. #3-Q2: Strategy managers have to be open to innovations, including the modification requirement linked to business ecosystem, but overall they should be involved in connectivity, digitization, IA, IoT and platforms... but some SME still operate just in paper.
Change of business model (Importance of new actors)	Concern over the risks in the face of new actors	#4-Q1: Big companies work very slow. They are incapable of keeping pace with the innovation of small start-up type companies, [...], which are capable of envisioning the future [...]. Ultimately, those giants end up buying the start-ups, because there is always a moment when they realize that they are five years behind [...]. The second is digitization, it can bring you much closer to customers, as they can lower your internal costs [...] and allow people to be thinking [...] companies have too valid people doing tasks that are worthless.

Table 3 (continued)

Main Idea	Behavior	Quote
Value creation (Services based on data analysis)	Strong assertion that understanding the customer is fundamental to creating a service	<p>#7-Q3: I rather see transformations of the current model with different variants and above all with a very large impact on cost reduction. Companies should do parcel with less resources</p> <p>#13-Q1: I think the key is that it will be more efficient. What is really going to change is the issue of ownership. An autonomous car does not have to be owned by a self-employee. An autonomous car will be able to be an element of shared use under applications to produce benefits.</p> <p>#4-Q2: There are companies which have a lot of data right now without experience on certain business and they could use it to personalize an experience and to enter on any business and shake it.</p> <p>#8-Q2: I think the main competence is understanding the customer.</p> <p>#10-Q1: The creation of value for me is always very consumer oriented. What can you contribute to the consumer? What the consumer is looking for in this case is to move in the shortest possible time with the lowest possible cost. Today a point has been added which is sustainability.</p> <p>#11-Q1: Companies are used to the fact that the data has always been free but now that data, artificial intelligence, and everything there is on it has a cost. The companies will have to compete for that data due to access to it will allow create better services.</p> <p>#14-Q1: The main thing to deliver value is that the customer is reachable. In logistics services there are 2 points that the customer appreciates, that the package arrives and that simple contracting process.</p>
Value delivery (facilitate contracting unified services)	Emphasis on the perception of unified logistics	<p>#5-Q2: I believe that the value proposition and value delivery of this type of services will have to substitute the human treatment</p> <p>#6-Q1: The way to reach customers is going to be different. It will be different, more digital. The digital vehicle, through digital platforms, may be a commercial tool to reach people.</p> <p>#11-Q2: Autonomous car can be ... you use it more for taxi-like mobility services [...] In the sense that, if you have deliver a package in a scooter, then a bike, then an autonomous car, it is offered by a single unique solution.</p> <p>#12-Q1: CAV is going to generate more movement, but... it does not mean more traffic. The increment of movement will be compensated with combining services through digitalization.</p>

Table 3 (continued)

Main Idea	Behavior	Quote
Value capture (information as revenue)	Concern about how to charge	<p>#3-Q3: There is a value, let us say economic. Global economic in the face of society saving time, fuel, economic savings, avoiding congestion, etc. Clients may pay more for environmental friendly services.</p> <p>#10-Q2: They are going to know us all because Google and Facebook already know us. As I said before, there is no choice but to use WhatsApp and if it is free it is because thanks to it you know us. It is clear that they use it for personalized advertising data. Digital platforms could provide this information to these companies.</p> <p>#15-Q1: The client will be willing to acquire the services through intermediary apps. Therefore, you will pay for the service to these and not to the true providers of the service.</p> <p>#16-Q1: The key is to be specialists, be advisors and serve the client. You do not have to do business to be done, you have to make and retain customers with a good service and not want to earn money in an operation but earn it little by little.</p> <p>#18-Q1: I believe that new lines of business will emerge from this data processing. From that image processing. That more than selling the information the key is to do an analysis of that information and sell that analysis.</p>



No relationship  Strong relationship

Fig. 1 Affinity matrix: business and technological concepts

distributing payments and services (#15-Q1). However, increased environmental and social awareness could increase revenues received (#3-Q3).

In addition, experts point out that the business model changes accelerated by CAVs (#17-Q1) will not affect all companies equally. Innovative SMEs will have a chance to achieve leadership due to the limited capacity for integration of disruptive innovations by globalized companies based on traditional business models (#4-Q1). However, there is a high risk of SME closures and destruction of the business fabric based on traditional business models due to the low acceptance of digitalization (#2-

Q1; #3-Q2) and scarce financial resources and knowledge (technical and of customer needs) to undertake the necessary adaptation compared to large companies (#5-Q1).

On the other hand, the implementation of vehicles with CAV technology will have an impact on service provider sectors such as gas stations, insurance companies, workshops, and car parks due to the advantages of communication with the vehicle and passenger (former driver), since they will be able to implement information exchange systems. Information between vehicle-operator (#7-Q1; #7-Q2) and telematics marketing (#15-Q1). This circumstance modifies the capture and creation of value thanks to better planning and more efficient models based on B2B associated with MaaS and logistic enterprises (#13-Q1; #4-Q2). At the same time, infrastructure development and engineering companies must acquire data (#11-Q1) to find out the new needs of vehicles and design based on it. Finally, the CAVs will increase the demand for telecommunication infrastructures, especially increasing the potential of companies linked to the telecommunication sector (#3-Q1; #9-Q1).

5 Discussion and conclusions

On the one hand, the results reveal that technology is not a disruptor in itself, but that there is a change in business models aligned with the social characteristics and needs of customers, confirming the Contingency Theory (Christensen and Raynor 2003). However, the change of business models and transition to digitized and digital platform-based systems that meet customer needs must be tailored to the company's characteristics and capabilities, and the general barriers and drivers (Teece and Linden 2017).

On the other hand, the research confirms that competitiveness is based on exploiting innovation (Krašnicka et al. 2018). In this sense, and answering RQ1, the potential of connected and autonomous vehicles is much broader than the increase in transportation efficiency associated with the absence of drivers. CAVs will have an information-generating capacity that will enable the transformation of logistics as it is currently known, through integration into digital platforms. These platforms will allow the creation of synergies between mobility services for passengers and for parcels or delivery. Through the implementation of digital platforms, 5G technology and AI, these routes can be optimized to provide better service and cost savings, allowing passenger mobility companies (UBER, Cabify, Taxi, etc.) to diversify their business by creating services in alliances with major logistics companies (DHL, FEDEX, etc.).

Therefore, disruptive innovations promote and create new potential markets for companies, allowing the economy to grow (Marvel and Lumpkin 2007) and establishing new business models (Christensen and Raynor 2003). Regarding RQ2, the third vertex of the research obtained from the results confirm that the generation of value must be done by maximizing use of the information available (Table 2). This information from digital platforms and CAVs, among other sources, will allow companies to formulate their services in a way that meets the expectations of their customers efficiently. In parallel, digital platforms will enable the delivery of comprehensive services, offered through collaboration among various enterprises which can thus capture value jointly. Therefore, business models will evolve by redefining

the logic that captures, generates, and delivers value (Teece and Linden 2017) and confirming the interrelationship between business models and stakeholders pointed out by Zott et al. (2011).

In turn, the platforms will allow logistics companies to optimize service by using real-time data from CAVs in combination with logistics platforms. Knowledge of the location of means and their available capacity will generate rapid exchanges between them, which will enable delivery points to be readapted. This incorporation and adaptation of technology would make it possible to absorb the increase in logistical needs and minimize investment. However, for this to happen, it is essential that large companies, and especially SMEs, develop a DBMI strategy that allows them to adapt the process of capturing, creating, and delivering added value (Trischler and Li-Ying 2023) as technologies and social trends evolve. Adapting strategies, through platform economies, offers opportunities to those that adapt to the new landscape, and numerous disadvantages to those that stay away from the new trends and may become unviable by not taking advantage of the opportunities of the digitalization in their environment (Christensen and Raynor 2003; Volberda et al. 2021).

Therefore, digital platforms will be a central element in the optimization and exploitation of the technical capabilities of CAVs and return routes (and ease of cargo capture). In addition, the data generated and the ability to analyze aggregated data from vehicle fleets (carriers and haulers), shippers, consignees and receivers will provide logistics platform management companies with a high level of decision-making power, which is greater than that of the fleet owners themselves through direct subcontracting. Therefore, the need is revealed to evolve current business models and adapt them to use data, which are a key business competitiveness factor.

5.1 Theoretical implications

The research carried out points out the importance of developing redesigns of digital business models together with the user. In this sense, the paper reveals that the cooperation in the design phase allows companies to maintain a business model (process of capturing, creating, and delivering added value) differentiated from possible competition. Therefore, the research expands the application of business model innovation theories to the field of platform-based logistics. It also confirms the need to implement DBMI for on time adaption of business models to technological innovations in order to maximize the viability and prosperity of the economic fabric. Finally, the research confirms the validity of Contingency Theory in strategy formation in environments that are changing (technologically and socially).

5.2 Managerial implications

According to the results, the advantages offered by the technology are causing great interest on the part of logistics operators in the implementation of autonomous vehicles since, based on the data generated in them and the use of AI, it is possible to optimize routes in real time, to increase efficiency. Similarly, the implementation of platform-based business models can lead to the development of business models that extend services to offer freight forwarding and passenger movement services. In

addition, logistics operators and government entities are aware of the need to implement technologies that mitigate the shortage of drivers that threatens to limit trade. As consequence, the research reveals the importance of adopting technology and assimilating changing customer needs and values in the design and planning of business models.

In concordance, various components of the business model must be redefined. The creation of the value generated has to be adapted to the growing logistical needs, but also to offer services tailored to the needs of each customer. Value delivery must be an integrated and complete service provided by the platform to the customers. For its part, value capture must be transformed into services with lower profitability, but greater repeatability and based and centralized on digital platforms that, in turn, centralize the collections and payments from the different actors.

The logic envisaged for the new business models must be based on integrated and collaborative management with service providers, collaborators and even shared services or alliances with current competitors. Digital platforms will foreseeably concentrate companies in the logistics or mobility sector. Platform-based concentration and coordination will facilitate this collaboration between agents oriented towards personalized customer service in a sustainable way, without increasing the pressure on infrastructures thanks to shared means and co-loading systems.

Furthermore, companies should use digital platforms to unify services that allow them to offer services operated by different companies, maximizing the benefits of collaborations without the customer losing added value. Likewise, the platforms will boost the omni-channel, by creating single portals for contracting, customer care and service. At the same time, the services offered through the platforms must be designed according to customer requirements. Consequently, they should consider environmental factors (defining the type of vehicles), economic factors, timetables, and consumer flexibility. Cooperation through digital platforms can achieve cost savings that make it possible to meet environmental requirements (electrification, hydrogen, etc.) and improve service by maximizing cost containment through increased efficiency and maximized use of resources.

On the other hand, the implementation of technology and digitization in transport through CAVs has implications in the sectors that provide services to drivers (e.g., gas stations, insurers, workshops, parking). CAV implementation will enable information exchange systems between vehicle and these service sectors. As consequence, business agent could plan operations based on real time information and transform their business towards more efficient B2B models associated with MaaS and road freight transport companies. Lastly, infrastructure buildings, telecommunication developers, engineering firms and consulting companies should consider to develop strategies to adapt their designs or products to the CAV requirement.

5.3 Limitations and future research

The research undertaken has limitations associated with qualitative methodologies. Planning for a change in business models towards those based on digital platforms requires a high degree of innovation linked to the digitalization and characteristics of future vehicles, changing and evolving customer needs, and increasing technology.

For that reason, very few companies (and experts) are anticipating such a change. This circumstance limits the sample of experts and thus the collection of strategic insights. As a consequence, the results are limited in scope to the participating sample, so quantitative studies are recommended to confirm the conclusions drawn.

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