

A transition in the automotive industry: How are new mobility technologies affecting value chain governance?

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Abstract

Purpose – New mobility technologies linked to digitalization, connectivity and automation of vehicles are transforming the traditional governance model of the automotive industry value chain. This paper analyses the types of relationships within the value chain as well as how decision-making power and added value are distributed.

Design/methodology/approach – The theoretical framework used in this research integrates the global value chain (GVC) and supply chain management (SCM) approaches. The empirical study consisted of a comparative quantitative analysis among new mobility firms and traditional automotive firms in the Spanish automotive industry value chain.

Findings – The results show that the entry of new actors related to digitalized, connected and automated vehicle technologies are changing traditional relationships. They are relationships of low dependency with durations that depend mainly on the time required for project implementation and are characterized by scarce cooperative practices among these new actors and traditional automotive firms. This transformation is influencing both decision power and added value distribution, in that traditional automotive firms are losing some of the former and control over the latter in favour of these new actors. The results have implications for countries where the traditional automotive industry is present. In the new governance structure, they should change the focus of their policies to the development of the new mobility firms.

Originality/value – The research is supported by an eclectic theoretical framework and by an original empirical study; specifically, a quantitative comparative analysis among the different participants in the automotive value chain.

Keywords New mobility technologies, Digitalization, Autonomous vehicle, Connectivity, Global value chain, Supply chain management, Governance model

Paper type Research paper

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1. Introduction

The evolution of global value chains is currently an area of relevance and interest for researchers and managers (Butollo *et al.*, 2022; Lang *et al.*, 2023; Wuttke, 2023). Among the theoretical approaches that analyse these changes, the global value chain (GVC) approach is perhaps the most used (Bair and Mahutga, 2023; Pérez-Moure *et al.*, 2024; Rísquez and Ruiz-Gálvez, 2024). Analyses carried out in the automotive industry under this approach have mainly been focused on the types of relationships established among firms, the relative positioning of firms, and decision-making power and the distribution of added value within the value chain (Marques *et al.*, 2022). Under the GVC approach, the traditional value chain governance model in the automotive industry is defined by long-lasting relationships and mutual dependence among firms, where decision-making power is concentrated in firms positioned on the first levels of the value chain. This model also features control over value-added activities by automobile manufacturers and by Tier-1 suppliers that coordinate an extensive network of suppliers (Pavlínek, 2020).

The supply chain management (SCM) approach also carries significant relevance in analysis of the automotive industry value chain (Brandenburg, 2016; Britsche and Fekete, 2024). The logistic practices (Britsche and Fekete, 2024), the structure of the supply chain (Sakuramoto *et al.*, 2019), or the relationships between buyers and suppliers (Boubker *et al.*, 2023) are analysed under this approach. Frequent deliveries, proximity of suppliers, or minimum inventories are usual logistics practices in the traditional automotive industry (Dubey *et al.*, 2018). For the traditional automotive industry, the structure of its supply chain is mostly horizontal, depending on a few Tier-1 suppliers and disconnected from Tier-2 suppliers (Sakuramoto *et al.*, 2019). Most previous research states that supply chain management in the automotive industry follows a cooperative model (Huang *et al.*, 2020; Kumar-Singh and Modgil, 2023). This cooperation-based model can be understood as a type of supply based on cooperative relationships that include practices of commitment and involvement (e.g. single sourcing, joint product/services design, supplier development programs, information sharing) (García-Buendía *et al.*, 2021; Moyano-Fuentes *et al.*, 2021) that enable management of the supply chain.

Over recent years, the automotive industry has been undergoing profound changes. The irruption of new technologies linked to digitalization, connectivity, and automation of vehicles has implied the entry of new mobility actors that develop and perform these technologies in order to meet the needs of key emerging services in the current automotive industry (Cohen and Kouvelis, 2021; Llopis-Albert *et al.*, 2021; Pérez-Moure *et al.*, 2023). New mobility technologies include connectivity and data exchange applications (e.g. remote routing technologies, intelligent transport systems, critical software), automation technologies and systems (e.g. advanced driver assistance systems - ADAS, artificial vision and light detection), position and location technologies (e.g. navigation systems), and others (e.g. cybersecurity) (Möller and Haas, 2019; Cohen and Kouvelis, 2021). The appearance of these new actors is especially relevant in the establishment of the new governance model in the automotive industry value chain.

In fact, recent research has analysed that governance model (Pla-Barber and Villar, 2019; More *et al.*, 2024). However, this research has not specifically delved into the changes prompted by the entry of new mobility actors in the model. Some works have studied the impact of these new mobility actors, but from other perspectives, such as social aspects (Docherty *et al.*, 2018), sustainability issues (Rajaeifar *et al.*, 2022), geography (Trippel *et al.*, 2021), or business model implementation (Pérez-Moure *et al.*, 2024). Thus, many aspects of this impact remain unknown, particularly on the governance model of the value chain. The main objective of this research is to analyse the emerging governance model derived from the entry into the value chain of firms linked to new mobility technologies. Thus, the research question posed is:

RQ. What is the governance model in the automotive industry value chain that is resulting from the entry of new mobility actors like?

Responding to this research question, under an eclectic theoretical framework based on the GVC and SCM approaches, this work contributes to defining the types of relationships being established among firms linked to new mobility technologies and traditional automotive firms

in terms of dependence, duration, and cooperation, also enquiring as to how the powers of decision and control over added-value are being redistributed in the automotive industry value chain. Furthermore, the results allow comparison of the differences among the key variables of the traditional model and the emergent governance one derived from the entry of new actors. Those differences also have several implications for the value chain participants and for public policies in those countries with a relevant presence of the automotive industry.

To achieve this objective, the paper is organized into four sections. The following section presents a literature review, including analysis of the governance model and its key elements for the automotive industry value chain. The empirical study is detailed in the second section. The two subsequent sections discuss the results and presents the main conclusions drawn from this research.

2. Literature review

2.1 Theoretical framework for analysing the governance model of the automotive industry

The GVC approach is widely used for studying the governance model of the automotive industry value chain (Kano *et al.*, 2020; Pavlínek, 2020; Rísquez and Ruiz-Gálvez, 2024). Previous findings that have followed this approach point out that the traditional value chain of the automotive industry is governed by automobile manufacturers and by Tier-1 suppliers, which coordinate a network of components manufacturing firms supplying the parts and systems required to assemble vehicles (Pavlínek, 2020). This traditional value chain is focused on the product (vehicle) and the processes for manufacture. It resulted from an ongoing process of outsourcing by automobile manufacturers, which have outsourced a part of their production activities to components firms (Lampón *et al.*, 2022). The traditional value chain is therefore a hierarchical structure where leading firms, positioned on the first levels of the value chain, possess a strong capacity to decide on activities linked to investment, innovation, or location (Kano *et al.*, 2020).

Within the governance model, the types of links established between companies are relevant (Hernández and Pedersen, 2017). Although several links coexist in the automotive industry value chain, they are mostly characterized by lengthy duration and interdependence (Kukkamalla *et al.*, 2021). This means that an important part of the supply relationships is based on long-term contracts (Yeung, 2024), which implies a relative dependence between buyers and suppliers. On the other hand, the power decision and the coordination of activities within the value chain is key in the characterization of the governance model (Brito and Miguel, 2017). The power of decision is concentrated into a few leading firms (automobile manufacturers and Tier-1 suppliers) that decide the operational and certain strategic features of their suppliers (Lejarraga *et al.*, 2016). Moreover, these leading firms coordinate the value chain and develop higher added-value activities (Manello and Calabrese, 2015). Vehicle design or commercial activities are in the hands of automobile manufactures, while the innovation activities linked to product features and to production of the parts, systems, or modules that configure the vehicle are under the control of Tier-1 suppliers (Pavlínek, 2020).

The SCM approach carries significant relevance in analysis of the automotive industry value chain (Brandenburg, 2016; Erfurth and Bendul, 2018). The logistic practices and operational supply chain conditionings (Britsche and Fekete, 2024), the structure of the supply chain (Sakuramoto *et al.*, 2019), or the relationships between buyers and suppliers (Demirbas *et al.*, 2018; Boubker *et al.*, 2023) are addressed under the SCM approach. These aspects help to explain the configuration of the value chain in this industry. Logistics practices are linked to the operational process of supply: the most common are frequent deliveries, proximity of suppliers, or minimum inventories in the traditional automotive industry supply chain (Dubey *et al.*, 2018). These logistic conditionings have an impact on geographical configuration and on coordination issues of global value chain. Regarding the supply chain structure, Sakuramoto *et al.* (2019) highlight that the traditional structure of the automotive industry is horizontal, depending on a few Tier-1 suppliers, and is disconnected from Tier-2 suppliers. They also point out that this structure is currently not the same in all contexts, indicating that a

vertical integration of the automakers with the Tier-1 suppliers existed in the Chinese and Korean automotive industry.

In terms of relationships, most of the previous research based on the SCM approach states that supply chain management in the automotive industry follows a cooperative model (Huang *et al.*, 2020; Lampón *et al.*, 2021), while other authors offer a relatively nuanced perspective, suggesting that even in a cooperation framework, some elements of competition are present (Huang *et al.*, 2020). Although some differences have arisen in terms of definition, most of the literature agrees that traditional supply chain can be understood to be based on relational links built on a commitment to collaborate. This requires that both parties share information including cooperative practices that enable a way of managing the supply chain. These practices define supply relationships among firms in terms of commitment (e.g. single sourcing, long-term supply contracts) and involvement (e.g. joint product design, supplier development programs, information sharing) (García-Buendía *et al.*, 2021; Moyano-Fuentes *et al.*, 2021; Kumar-Singh and Modgil, 2023).

Finally, value chains are being constituted and transformed continually due to multiple factors. It is recognized that modern global value chains thrive on the flexibility and adaptability of their governance structures (Kano *et al.*, 2020). Therefore, the governance model of a value chain is not fixed. The GVC is one of the leading approaches used to analyse these transformations in the automotive industry (Manello and Calabrese, 2015). This approach focuses on the changes in inter-firm relations and in the distribution of power or control of value-added activities (Butollo *et al.*, 2022). At the same time, the SCM approach is used to analyse these changes in terms of collaboration (Al-Doori, 2019), duration of relationships, or structure of the supply chain (e.g. number of suppliers) (Sakuramoto *et al.*, 2019).

2.2 The irruption of new mobility actors and the governance model of the automotive industry

The irruption of technologies related to digitalization, connectivity, and automation of vehicles has implied the entry of new actors into the automotive industry value chain (Llopis-Albert *et al.*, 2021). The new value chain resulting from the entry of these new actors conserves traditional activities related to the physical product (vehicle) and the processes for production. Vehicles require physical components to perform specific functions related to connected and autonomous driving (e.g. telematics control units, ADAS) (Möller and Haas, 2019; Funaki, 2023). At the same time, a significant proportion of activities in this new value chain are services linked to information management and data communication (Arias-Molinares and García-Palomares, 2020; Becker *et al.*, 2020; Khayyam *et al.*, 2020). New actors are focused on the development of such services in order to meet the needs of emerging technologies (Khayyam *et al.*, 2020; Llopis-Albert *et al.*, 2021). In this context, the presence and roles of these new actors in the value chain are especially relevant to analysis of the governance model.

In terms of the duration and dependencies of relationships among firms in the value chain, it is notable that most new mobility actors derive from industries other than the automotive (Llopis-Albert *et al.*, 2021). They come especially from the information and communication industry, where there is development of software for connectivity, big data tools, artificial intelligence, or solutions associated with IoT (Khayyam *et al.*, 2020; Bosler, 2021). These new actors supply buyers from diverse industries, with a market diversification that allows fewer dependent relationships to be established. As regards the duration of relationships, supply contracts related to information and communication technologies and services are signed based on specific projects (Dey *et al.*, 2010). The duration of relationships between buyers and suppliers is directly linked to the implementation of these projects that include analysis of requirements, development, launching, testing, and validation (Murch, 2001). In this context, the two parties have an interest in implementing these digital projects in the shortest time

possible. The extension of relationships after implementing these projects does not range beyond the updating and maintenance tasks included in contracts.

In terms of cooperation, from an operational perspective, the sharing of information is necessary to ensure compatibility in data-exchange between buyers and those suppliers offering digital services (Zeadally *et al.*, 2020). Moreover, recent works find evidence for relational aspects (e.g. relation-specific digital assets, digitally enabled knowledge-sharing routines) that enable both suppliers and buyers to profit from the implementation of digital services (Kamalaldin *et al.*, 2020). Nevertheless, relational aspects are relevant only when supplier and buyer jointly develop the digital service (Eloranta and Turunen, 2015). Although examples of this form of partnership in the development of digital services do exist, most cases are based on supply contracts wherein suppliers act exclusively as providers (Pérez-Moure *et al.*, 2024). These providers offer services through a transactional relationship with buyers, delivering on a specific request; and this is far from a partnership, where some degree of cooperation with buyers would be maintained (Osterrieder, 2021).

Regarding decision power, certain aspects imply that new actors have a relatively high degree of decision power in the automotive industry value chain. On one hand, the new mobility actors base their activities on technologies that the traditional automotive firms have not mastered (Auer *et al.*, 2022). Thus, traditional leading automotive firms have less capacity to influence certain key aspects of supply contracts for products and/or services developed by these new actors, particularly in terms of product/service specifications or the acquisition of assets. On the other hand, there is a link between the positioning of firms in the value chain and the decision power (Arora and Brintrup, 2021). The higher the positioning of a firm in the value chain, the greater its decision power (Veile *et al.*, 2020). Most new mobility actors develop products/services to perform specific connected (e.g. on-board unit) and automation (e.g. ADAS, critical software) functions of a vehicle, supplying these directly to automobile manufacturers (Möller and Haas, 2019). Therefore, most of these new actors are Tier-1 suppliers.

Finally, in terms of control over added value along the value chain, innovation and knowledge-intensive activities are in the focus of the analysis. First, digital, connected, and automation technologies are emergent in the current automotive industry (Leminen *et al.*, 2022; Steinberg, 2022). Although traditional innovation in product and production processes remains a necessity in this industry, innovation related to new mobility technologies has become crucial within this digital context, and they are being developed by new actors (Llopis-Albert *et al.*, 2021). Second, higher added value is linked mainly to knowledge-intensive activities with high requirements in terms of technological skills. Evidence has been found of higher intensity of knowledge in information and communication firms (Tether and Hipp, 2002). As a summary, Figure 1 presents the governance models of the automotive industry value chain.

3. Empirical study

This empirical study has been carried out for the case of Spain, a relevant country within the global automotive industry value chain and especially within the European automotive industry value chain. Seventeen automobile assembly plants are located in Spain, and these produced 2.451 million units in 2023, positioning Spain ninth in the world and second in Europe in terms of production volume (OICA, 2023). Moreover, the parts industry in Spain reached a production value of €40.31 billion in that same year (SERNAUTO, 2023), placing the country sixth worldwide and third in Europe. Spain presents a competitive environment for new projects in the mobility industry. Among its competitive advantages are a solid automotive industry ecosystem, a leading international position, the availability of highly qualified human resources, a complete supply chain, and strong investment in innovation (ICEX, 2021). This industry allocated €6.5 billion to R&D over the five years from 2018 to

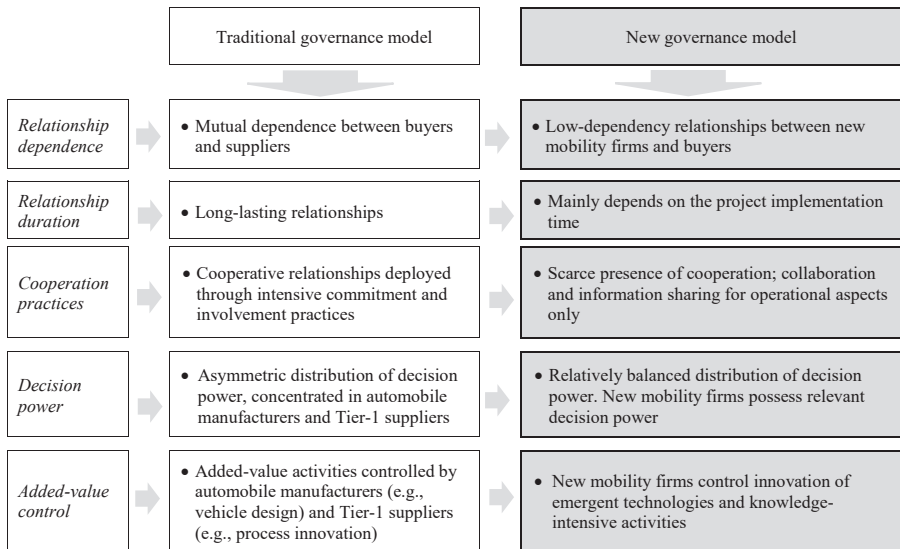


Figure 1. Governance models of the automotive industry value chain Source: Own elaboration

2022, with new mobility technologies accounting for a significant portion of investment (SERNAUTO, 2023).

In this context, the Spanish government is committed to new mobility technologies. The plan entitled *España Digital (2025)* includes a set of measures and investments articulated along strategic axes and aligned with the digital policies set by the European Commission. One of these axes covers digital, innovative, and efficient mobility, aiming for transformation of the mobility model by meeting the new needs of digitalization and connectivity and by promoting both innovation and multi-sectorial collaboration. Moreover, various projects linked to vehicle digitalization, connectivity, and automation technologies are being developed within the Spanish industry (Lampón *et al.*, 2024). For example, *EUMOB*, for analysis of the services and business models that can be developed from data generated by vehicles and infrastructures, *PoDIUM*, which analyses collaborative and connected mobility in cities for the implementation of connected and autonomous vehicles and improvements to traffic. In summary, these data reflect both the ongoing relevance of traditional activities and the strong emergence of new mobility technologies.

3.1 Methodology and data collection

Given the novelty of this research, an original quantitative study was developed. To be precise, a comparative quantitative analysis was used. This approach permits analysis of the key variables of traditional automotive firms and new mobility firms. Adopting a quantitative approach can provide an objective and systematic method for data collection and analysis that helps to eliminate subjective interpretations of data. It is highly reliable as it involves the use of standardized procedures for data collection and analysis. This makes it easier to replicate the study and obtain consistent results, and it ensures that the findings can be generalized (Ratten, 2023).

To obtain the set of traditional automotive and new mobility firms that configure the universe of study, various data sources were used. Spanish traditional automotive firms were identified by selecting those firms in the *AMADEUS* database whose main activity codes were NAICS 3361, 3,362, and 3,363 (Motor Vehicle Manufacturing, Motor Vehicle Body and

Trailer Manufacturing, and Motor Vehicle Parts Manufacturing, respectively). The number of Spanish traditional automotive firms forming part of this universe totalled 198. New mobility firms are under different NAICS codes (e.g. 5,415 Computer Systems Design and Related Services) but it is not possible to identify in the *AMADEUS* database whether they operate in the automotive industry. New mobility firms were identified using an international tech database (*Tracxn*), a Spanish sectorial organization (*AEVAC*), a Spanish technological platform (*M2F Move to Future*), as well as different projects (*EUMOB*, *PoDIUM*, *MoBAE*) related to new mobility. All the new mobility firms found in these sources were revised and verified through their corporate webpage and using the *AMADEUS* database to confirm they accomplished the requirements to become part of the universe under study; specifically, that they were participating in the automotive industry value chain and that they were Spanish. After this process of cleaning, the number of Spanish new mobility companies forming part of this universe totalled 36. The total number of firms (both traditional automotive and new mobility) identified as forming part of this universe was 234. [Table 1](#) resumes the sources used to identify the universe of study.

Since new mobility technologies are still relatively emergent in the sector, data remains in the hands of the firms, and so available information is limited. Although some firms have published reports related to certain elements of the value chain, these contain insufficient information for an in-depth study of the phenomenon. Data had to be gathered directly from the firms, and the use of a questionnaire was selected as the method for collecting data. An external company conducted the fieldwork from September 2021 to January 2023, in order to maximize the response ratio. A sequential methodology was employed, based on three methods (email, telephone, and in-person interviews). The respondents of the questionnaire were Supply Chain Managers who participate in supplier selection and know the key aspects of buyer-supplier relationships in the value chain. [Table 2](#) summarizes the profile of respondents.

The questionnaire was sent to all the companies, and 133 replies were received, achieving a response rate of 55.6% ([Table 3](#) presents the characterization of the sample). In order to assess the representativeness of the sample and its size, the following equation was used [1]; it indicates that the sample size ($n = 133$) regarding the universe size ($N = 234$) has a sample error (e) of $\pm 5.59\%$, for a confidence level of 95% ($z = 1.96$) considering the equal population proportions of the characteristics being studied ($p = q = 0.5$).

$$n = \frac{Nz^2pxq}{e^2x(N - 1) + z^2pxq} \quad (1)$$

Table 1. Sources used to identify the universe of study

Source	Description	Reference
AMADEUS	Database of financial information for companies across Europe	https://amadeus.bvdep.com
Tracxn	Database for tracking Innovative Companies and Emerging Technologies	https://tracxn.com/
AEVAC	Spanish Association for the Connected Autonomous Vehicle	https://aevac.org/red/
M2F Move to Future	Spanish Automotive and Mobility Technology Platform	https://www.move2future.es
EUMOB, PoDIUM, MoBAE	Projects linked to vehicle digitalization, connectivity, and automation technologies in the Spanish industry	https://www.eu-mob.eu https://podium-project.eu/ https://mobae.eu/

Source(s): Own elaboration

Table 2. Profile of the questionnaire respondents

Profile characteristics	Number of respondents	%
<i>Gender</i>		
Male	92	69.2%
Female	41	30.8%
<i>Age</i>		
Over 40 years	83	62.4%
From 30 to 40 years	45	33.8%
Under 30 years	5	3.8%
<i>Education level</i>		
Doctorate	4	3.0%
Master	81	60.9%
Bachelor	41	30.8%
Other	7	5.3%
<i>Experience as supply chain manager</i>		
More than 10 years	69	51.9%
From 5 to 10 years	54	40.6%
Less than 5 years	10	7.5%

Source(s): Own elaboration

Table 3. Characterization of the sample

Traditional automotive firms			New mobility firms		
Products and technologies	Cases	%	Products and technologies	Cases	%
Plastic, rubber, composite products	27	20.3%	Connectivity and applications (remote systems, virtual assistant . . .)	6	4.5%
Metal components for chassis and bodywork	17	12.8%	Position systems (intelligent parking systems, routing technologies . . .)	5	3.8%
Module assembly (seat, cockpit, front end . . .)	12	9.0%	Automation of vehicles (ADAS, artificial vision, light detection . . .)	5	3.8%
Textiles (airbags, seat covers, upholstery . . .)	11	8.3%	Others (cybersecurity, critical software . . .)	3	2.3%
Motorization, transmission, and suspension systems and parts	10	7.5%			
Small metal parts for mechanics (bearings, plates, ties . . .)	8	6.0%			
Others (wiring, exhaust systems, locks, steering columns . . .)	29	21.8%			
Total	114	85.7%	Total	19	14.3%

Source(s): Own elaboration

That is, for this sample size, the sample error is acceptable as the error margin accepted in social science research ranges from 3% to 6%, and an error up to 6% is reasonable for small populations (Fowler, 2013). Moreover, this sample size is the result of a response rate of 55.6%, also considered acceptable, as it goes above the adequate response ratio threshold located between 20% and 45% (Rindfleisch and Antia, 2022).

At the same time, this sample comes from a universe made up of two types of firms: traditional automotive firms and new mobility firms. Therefore, for the sample to be representative, besides its size, the proportion of these types of firms should be the same in the sample universe. Thus, the universe comprises 198 traditional automotive firms and 36 new

mobility firms: 84.6% and 15.4% of the total universe, respectively. The sample comprises 114 traditional automotive firms and 19 new mobility firms: 85.7% and 14.3% of the sample total respectively (see [Table 3](#)). Finally, it is worth commenting on the number of new mobility firms included in the sample. The number of such firms compared to traditional ones is relatively small. In recent works in the context of new technologies related to connected, automated, and shared vehicles, the number of companies identified and analysed is very similar. For example, [Tripl et al. \(2021\)](#) analyse these firms in Canada and Austria, in which they identify 13 and 12 companies related to these technologies located respectively in each of these countries. [Gorachinova and Wolfe \(2023\)](#), identify 13 of these firms in the Canadian region analysed. [Table 3](#) presents the characterization of the sample.

3.2 Questionnaire and variables

Many empirical works have traditionally resorted to management opinion surveys to assess objective facts. It is common to find that these works contain managers' evaluations regarding different aspects included in the questionnaire. However, these evaluations may be biased by many cognitive factors ([Tanur, 1992](#); [Sudman et al., 1996](#)) and can consequently generate certain measurement errors that affect the validity and reliability of the results. In terms of the technical details of the questionnaire used (see [appendix](#)), it was entirely elaborated with quantitative questions, in particular numerical questions (questions 1, 2, 5 and 6) (respondents provide a specific numeric value to the question), alternative choice questions (question 4) (in our case, respondents choose from between three possible alternatives) and binary questions (questions 3 and 7) (respondents provide an answer which limits the responses to two options Yes/No). Questions like these stop the respondents from making subjective assessments or rating aspects on a scale according to their perception, which avoids possible problems of reliability ([Bertrand and Mullainathan, 2001](#)). On the other hand, the questions contained in the questionnaire were extracted from the literature; references and the questions that have been assigned to each variable are shown in [Table 4](#).

As for the validity of the questionnaire, its contents were reviewed and validated by experts. The previous literature considers this practice as one of the most effective ways to validate

Table 4. Variables, definition and questions assigned in the questionnaire to each variable

Variable	Definition	Questions	References
<i>Firm type</i>	Dummy, value 1 if the firm is a new mobility firm; value 0 if the firm is a traditional automotive firm		
<i>Relationship dependence</i>	Revenues from the main buyer as a % of total revenues	1	Qiu (2018)
<i>Relationship duration</i>	Number of years of contractual relationship with a firm's main buyer	2	Liem et al. (2020)
<i>Cooperation practices</i>	Number of cooperative practices with a firm's main buyer (values 0, 1, 2, 3 or 4)	3a, 3b, 3c, 3d	Moyano-Fuentes et al. (2021)
<i>Decision power</i>	Values from 1 (if the firm does not have decision power) to 3 (if the firm has all the decision power)	4a, 4b, 4c, 4d, 4e, 4f	Lampón and Muñoz-Dueñas (2023)
<i>Value-added control</i>	Valued added per employee in thousands of euros	5	Fana and Villani (2022)
<i>Size</i>	Number of employees	6	Sánchez-Infante et al. (2020)
<i>Multinational</i>	Dummy, value 1 if the firm is a multinational (the firm has at least one subsidiary in another country); value 0 if it is not	7	Ahmed et al. (2020)

Source(s): Own elaboration

survey contents (Taherdoost, 2016). In this case, this advice on drawing up the questionnaire came from four academic and professional experts in SCM: two university researchers, a manager from a Tier-1 automotive supplier, and a manager from a mobility consultancy firm. Additionally, a pilot test was conducted on ten respondents. Specifically, the questionnaire was sent to ten firms that had already collaborated in previous studies of the research team. This made it possible to verify that the wording of the questions was understandable, or that the length and order of the questions was suitable and therefore the time given to complete the questionnaire was acceptable. After the pilot test, some of the questions were corrected and the final version of the questionnaire (Version V2) was drawn up and sent to all the other firms. Regarding criterion validity, this is defined as the relationship between the value given by each respondent and a standard (reference indicator) that guarantees to measure what is to be measured. Reference indicators are not always available, as in this case, so in practice we resorted to using questions that have been used previously in other works, and that therefore offer a guarantee of measuring what we aimed to measure (Lim, 2024).

Regarding the variables used in the study, the dependent variable was *Firm type*, defined as a dummy, assigning a value of 1 to new mobility firms and 0 to traditional automotive firms. Five variables related to the key elements of the governance model were included as independent variables. *Relationship dependence*, defined in terms of the percentage of turnover dedicated to the main buyer (Qiu, 2018). *Relationship duration*, defined as the number of years of contractual relationship with the main buyer (Liem et al., 2020). *Cooperation practices*, defined through the number of existing buyer-supplier commitment and involvement practices: (1) supplier development programmes, (2) assistance and training, (3) periodic meetings and visits for information-sharing, and (4) joint product and/or service design and deployment (García-Buendía et al., 2021; Moyano-Fuentes et al., 2021). This is a discrete variable that can take the values 0, 1, 2, 3, and 4. *Decision power*, measured from 1 to 3, with 3 indicating that the supplier decides the contractual conditions, 2 indicating that the conditions are negotiated, and 1 indicating that the conditions are decided by the buyer. This was determined as the average decision power in each of the key aspects of supply contracts in the automotive industry: (1) quality conditions, (2) specification of production process, (3) acquisition of dedicated assets, (4) location, (5) supply conditions, and (6) price (Lampón and Muñoz-Dueñas, 2023). *Value-added control*, defined as the added value per employee (Fana and Villani, 2022). This variable indicates the extent to which the firm controls value-adding activities in the value chain. Finally, two control variables were included in the analysis. A variable related to the size and to the international presence of the firms. *Size* is defined as the number of employees (Sánchez-Infante et al., 2020). *Multinational*, defined as a dummy variable, which is 1 if the firm is a multinational (the firm has at least one subsidiary in another country); 0 if it is not (Ahmed et al., 2020). As a summary, Table 4 presents the variables, their definition, questions that have been assigned to each variable, and references of recent previous works where they were used.

3.3 Analysis

Since the dependent variable *firm type* shows a binary response (1/0; new mobility firm/traditional automotive firm), a logit model was used to estimate the probability of a positive outcome given a set of regressors. This is estimated through maximum likelihood. The econometric model to be estimated is the following equation [2]:

$$\begin{aligned}
 Firmtype_i = & \beta_1 x Relationshipdependence_i + \beta_2 x Relationshipduration_i \\
 & + \beta_3 x Cooperationpractices_i + \beta_4 x Decisionpower_i + \beta_5 x Value_{added}control_i \\
 & + \beta_6 x i + \beta_7 x Multinational_i + \varepsilon_i
 \end{aligned}
 \tag{2}$$

In order to avoid issues of scale in the variables, all were standardized. The performance of the logit model was analysed in terms of its predictive capacity and goodness of fit (Pseudo- R^2). The *McFadden Pseudo- R^2* was applied because it reflects both the criterion being minimized in the logistic regression estimation and the variance accounted for by the logistic regression model (Hemmert *et al.*, 2016). The *IBM SPSS Statistics* software, version 28, was used to perform the logit model and to analyse goodness of fit.

To check the linear correlations between variables, the distribution of the data was previously examined to determine the appropriate test for assessing these correlations. The test for normality by Kolmogorov-Smirnov (sample size >50) was made to test the null hypothesis H_0 : the data of the sample are normally distributed (Das and Imon, 2016). The results of the normality test (statistic; significance) were: *Relationship dependence* (0.116; 0.000), *Relationship duration* (0.124; 0.000), *Cooperation practices* (0.213; 0.000), *Decision power* (0.143; 0.000), *Value-added control* (0.146; 0.000), *Size* (0.308; 0.000), and *Multinational* (0.465; 0.000). These results imply that the data are not normally distributed. The appropriate test for assessing correlations is the Spearman test.

To check potential multicollinearity problems, Variance Inflation Factors (VIF) were computed. All values are close to 1, confirming that multicollinearity is not a serious concern. Additionally, to reinforce the explanation of differences, a descriptive analysis of the variables for the two types of firms is made.

The results are reported in Table 5, linear correlations and VIF are shown in Table 6, and descriptive analysis of the variables is presented in Table 7.

4. Discussion

The logit model shows good performance in terms of goodness of fit, and it presents a good predictive capacity. In terms of the model's goodness of fit (see Table 5), the value of the *McFadden Pseudo- R^2* computation is 0.692. Considering that a *McFadden Pseudo- R^2* value ranging from 0.200 to 0.400 indicates good model fit, and >0.400 an excellent model fit (Hemmert *et al.*, 2016), the model performed reveals an excellent goodness of fit. In terms of predictive capacity (94.7%), the results also confirm its goodness of fit. Moreover, all the variables included in the model are significant. Taking in account that value chains are being

Table 5. Results of the logit model

Variables	Coefficient (Standard error)	<i>p</i> -value
<i>Relationship dependence</i>	-1.286* (0.747)	0.085
<i>Relationship duration</i>	-1.467** (0.698)	0.036
<i>Cooperation practices</i>	-1.501** (0.672)	0.025
<i>Decision power</i>	1.092* (0.651)	0.093
<i>Value-added control</i>	2.597*** (0.711)	0.000
<i>Size</i>	0.281 (0.660)	0.670
<i>Multinational</i>	-2.651** (1.315)	0.044
Number of observations	133	
Predictive capacity (%)	94.7	
<i>McFadden Pseudo-R^2</i>	0.692	

Note(s): *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$
Source(s): Own elaboration

Table 6. Correlations between variables

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	VIF
(1) <i>Relationship dependence</i>	1							1.256
(2) <i>Relationship duration</i>	-0.034	1						1.065
(3) <i>Cooperation practices</i>	0.107	0.048	1					1.139
(4) <i>Decision power</i>	-0.371***	0.144	-0.171**	1				1.333
(5) <i>Value-added control</i>	0.145	-0.061	-0.101	0.037	1			1.194
(6) <i>Size</i>	0.004	0.148	0.268**	-0.059	0.093	1		1.155
(7) <i>Multinational</i>	0.086	0.080	0.164	-0.060	0.226***	0.283***	1	1.167

Note(s): *** $p < 0.01$; ** $p < 0.05$. Spearman's correlation coefficients
Source(s): Own elaboration

Table 7. Descriptive statistics of the independent variables

Variable	Sample	N	Mean	Min	Max	S.D.
<i>Relationship dependence</i>	Traditional automotive firms	114	49.3	1.4	100.0	30.321
	New mobility firms	19	36.7	2.0	80.0	29.730
<i>Relationship duration</i>	Traditional automotive firms	114	17.7	2	38	8.715
	New mobility firms	19	13.8	4	37	9.843
<i>Cooperation practices</i>	Traditional automotive firms	114	2.07	0	4	0.966
	New mobility firms	19	1.21	0	3	0.918
<i>Decision power</i>	Traditional automotive firms	114	2.07	1.0	2.8	0.368
	New mobility firms	19	2.42	2.0	3.0	0.312
<i>Value-added control</i>	Traditional automotive firms	114	37.07	9.96	71.10	12.455
	New mobility firms	19	67.24	32.76	67.24	22.387
<i>Size</i>	Traditional automotive firms	114	151	0	2,926	308.0
	New mobility firms	19	185	4	1,162	337.4
<i>Multinational</i>	Traditional automotive firms	114	0.22	0	1	0.416
	New mobility firms	19	0.47	0	1	0.513

Source(s): Own elaboration

transformed, in this case by the irruption of new mobility actors, these results indicate the GVC and SCM approaches and the variables proposed are valid to analyse this transformation in the automotive industry. They support an explanation of how the governance structure of this value chain is reconfigured (Kano *et al.*, 2020).

Regarding the types of relationships, results suggest that differences exist among those established by new mobility firms and by traditional automotive firms. The *relationship dependence* variable is significant at a confidence level of 90% (see Table 5). This implies that the dependence of new mobility firms upon their buyers is much lower than that of traditional automotive firms. This result indicates that the current value chain is distinct from the traditional one, in which the interaction between buyers and their suppliers generated mutual dependence (Kukkamalla *et al.*, 2021). The diversified markets of these new mobility firms, which operate in diverse industries (Llopis-Albert *et al.*, 2021), allow them relative independence from the traditional automotive buyers. Regarding the *relationship duration* variable, this is significant at a confidence level of 95%. The difference of mean values of the variable for new mobility and traditional automotive firms is at almost four years (see Table 7). These results suggest that the duration of many of the relationships established by new mobility firms with the automotive buyers are related only to the digital services implementation. As regards the *cooperation practices* variable, this is significant at a confidence level of 95% (see Table 5). The mean value for new

mobility firms is at 1.21 out of 4, and for traditional automotive firms at 2.07 out of 4 (see Table 7). This suggests that cooperation practices have scarcely been implemented by new mobility firms in relationships with their buyers. This indicates that these relationships are far from being ones in which cooperation forms a central axis.

Regarding the distribution of power along the value chain, the *decision power* variable is significant at a confidence level of 90% (see Table 5). Furthermore, the mean value of this variable for new mobility firms is at 2.42 (from a maximum of 3), compared to 2.07 for traditional automotive firms (see Table 7). This means that new mobility firms have relatively high decision-making power with respect to traditional automotive buyers in supply contractual conditions. The results suggest that automotive firms have less capacity to influence the key aspects of supply contracts with new mobility actors (e.g. quality conditions, location, or price), particularly because they do not master the development and implementation of these new technologies (Auer et al., 2022). This signifies a break from the traditional paradigm in which decision power was asymmetrically distributed along the value chain, and where traditional leading automotive buyer firms decide these conditions with suppliers (Lejarraga et al., 2016).

The *value-added control* variable is highly significant at a confidence level of 99% in the logit model. The mean values for the variable (see Table 7) present significant differences, with much higher values for new mobility firms than for traditional automotive firms – at €67,240 per employee for new mobility firms, versus €37,070 for traditional automotive firms. These results indicate that new mobility firms control a significant portion of value-added activities in the value chain. This implies, while traditional value-added activities remain in the hands of the leading traditional automotive firms, emerging knowledge-intensive and innovation activities (see Table 3) are controlled by new actors.

Finally, regarding the control variables, *size* is not significant. The traditional automotive and new mobility firms have similar size in terms of number of employees. However, the *multinational* variable is significant at a confidence level of 95%. New mobility firms have a greater international presence than traditional automotive firms. 47% of new mobility firms are multinationals, compared with 22% of traditional automotive firms (see Table 7). This reinforces the result related to the decision power of these new mobility firms, especially geographical terms. These new mobility multinational firms can not only decide some key aspects in the Spanish automotive industry value chain, but also in the global value chain through their subsidiaries in other countries such as the location of the innovation activities.

5. Conclusions

From a theoretical point of view, this research brings an eclectic perspective to the analysis of changes within the automotive industry value chain. In particular, the GVC and SCM approaches have been used to support analysis of the impacts on this chain's governance model caused by the entry of new actors related to connectivity, digitalization, and vehicle automation technologies. The results indicate that the automotive value chain is focused not only on the product (vehicle) but also on services related to information, data management, and connectivity. In this context, the new governance model of the automotive industry value chain is characterized by the establishment of low dependency relationships with durations that depend mainly on the time required for project implementation, as well as by scarce cooperative practices among the new actors and traditional automotive firms. Moreover, in terms of decision power and the distribution of added value, traditional automotive firms have been losing part of their decision power and control over added value in favour of these new actors.

These results have implications for traditional automotive firms and all participants in the value chain, including institutions related to the automotive industry. In the case of automotive firms, these implications are especially relevant for automobile manufacturers in how to best manage their supply chain related to new mobility technologies. Due to the difficulty of establishing long-term and cooperative relationships, automobile manufacturers should implement initiatives to regain some control of value-added and decision power under this new

governance model. A potential initiative could be the acquisition of new mobility firms of relatively small size that provide technologies and services key to the deployment of digital, connected, and automated solutions. Moreover, it would involve forging alliances with the leading digital global providers that currently operate in the automotive industry. Technology integration, licensing agreements, and even joint ventures are alternatives to foster a closer relationship between automobile manufacturers and new mobility firms.

The institutional implications are directly related to the influence of public administrations in attracting those new companies to their territories. Taking into account the redistribution of decision power in the new governance model, governments of countries with significant presence of the traditional automotive industry should favour the development of domestic new mobility firms. Their policies should promote the domestic capabilities related to new mobility technologies. Initiatives focused on generating human capital or innovation activities related to new mobility technologies favour a change from competitiveness based on traditional production activities to competitiveness based on knowledge-intensive activities related to these technologies. This would allow these countries to maintain their position in the global value chain. They also have important implications for society, since they should allow guaranteed levels of activity and employment in this industry in these countries.

Finally, as regards future lines of research, further study could be dedicated to different types of governance models and their impacts on the business performance of value chain participants. Prior studies have not reached consensus on the types of relationships established within the automotive value chain and their impact on results (Wiengarten *et al.*, 2010; Marques *et al.*, 2022). It would be interesting to analyse the business performance of both new mobility firms and traditional automotive firms under the new governance model.

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QUESTIONNAIRE (Version V2)

General information

Firm name:

Interviewee: Experience in SCM: *Educational level:* *Age:* *Gender:* M... F...

Independent variables and questions related

Relationship dependence

1. *What is the percentage of turnover dedicated to the main buyer?*%

Relationship duration

2. *What is the number of years of contractual relationship with the main buyer?*years

Cooperation practices

3.a. *Do you have implemented supplier development programs?* Yes... No....

3.b. *Do you make assistance and training suppliers?* Yes... No....

3.c. *Do you make periodic meetings and visits for information-sharing with suppliers?* Yes... No....

3.d. *Do you make joint product and/or service design and deployment with suppliers?* Yes... No....

Decision power

4.a. *Who does decide the quality conditions?* Buyer.... Negotiated.... Supplier....

4.b. *Who does decide the specification of production process?* Buyer.... Negotiated.... Supplier....

4.c. *Who does decide the acquisition of dedicated assets?* Buyer.... Negotiated.... Supplier....

4.d. *Who does decide the location?* Buyer.... Negotiated.... Supplier....

4.e. *Who does decide the supply conditions?* Buyer.... Negotiated.... Supplier....

4.f. *Who does decide the price?* Buyer.... Negotiated.... Supplier....

Value-added control

5. *What is the added value in thousands of euros per employee?*thousands of euros per employee

Control variables and questions related

Size

6. *What is the number of employees of the firm?*number of employees

Multinational

7. *Does the firm have at least one subsidiary in another country?* Yes... No....

Source: Author's own work

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