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Abstract: All around the world, the automotive industry is undergoing profound transformations that are affecting the living and labour conditions of thousands of workers throughout the sector. One hegemonic rationale offered to explain (and thereby justify) these changes is the sector's ongoing process of decarbonisation – its attempt at addressing both climate change and the depletion of oil reserves – and the central element in that process has been the transition to electric vehicles. This article presents the hypothesis that the possible paths to decarbonisation are not one but many, as indicated by the different profitability strategies currently being pursued in the manufacture of electric vehicles. Nevertheless, the goal of decarbonisation has sometimes served as an ideological alibi for the imposition of certain systems of organisation of production over others, especially at plants in semi-peripheral European regions (such as Spain). The success of such technological determinism will ultimately depend on the local culture of collective bargaining and the capacity of workers to resist unsatisfactory conditions.

Keywords: decarbonisation; automotive industry; technological determinism; Spain; VW; SEAT; PSA-STELLANTIS.

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1 Introduction

Electric vehicles now constitute the main option for European automotive manufacturers on the path to decarbonisation, and within some assembly plants – especially those located in semi-peripheral regions such as Spain (Wallerstein, 2011) – the transition from combustion engines to electric vehicles has served as an alibi for imposing certain forms of reorganisation of labour. The central hypothesis of this article is that the current transition need not adhere to any single path; rather, various strategies are conceivable and might prove equally profitable, but with different effects on the living and labour conditions of workers and the future of both automotive plants and their host regions.

In order to address our principal research question, we have opted for a multiple-case-study methodology that permits identification of the specific elements characterising the transition to electric vehicles across the three assembly plants examined. As suggested by Yin (2014), such a methodology favours both the framing of questions and analysis when the focus is on contemporary events, making this approach optimal for studying ongoing phenomena (Goodrick, 2020).

The period of 2009 to 2022 serves as our time-frame for study. The three plants analysed represent 60% of vehicle production in Spain, thus forming a representative sample; also, this selection brings together two distinct business groups (of the six now producing vehicles in Spain) and three plants manufacturing distinct product ranges (commercial vehicles like the Berlingo at Stellantis Vigo; urban vehicles like the Polo at VW Navarra; and compact cars like the León at SEAT Martorell).

The selected case-study protocol and the collection of qualitative and quantitative data for this research are the result of several investigations conducted within the same research group. For a better understanding of the complexity of this research, a summary of the steps carried out can be found in the Annex (Table A1).

The article is divided into three parts. First, we address the general dynamics of the sector in response to the crises of production and reproduction suffered throughout the period of analysis. We then present our case studies, differentiating between the decarbonisation and profitability strategies of the automotive groups and the

organisational choices adopted at each of the manufacturing plants analysed. Finally, we present our most relevant conclusions.

2 Decarbonisation as a techno-centric alibi in Europe: the electric vehicle and its interconnection with modular architecture

In 1996, a monograph published by the Spanish journal *Sociología del Trabajo* presented a new research program from the Gerpisa international network on the implementation of a Japanese model of production in automobile manufacturing plants located in the West (Boyer and Freyssenet, 2001). This issue brought together diverse case studies showing how a certain variety of 'Toyotism' (based on lean production and just-in-time fulfilment) was the only possible route for competitiveness among Western brands, particularly those specialised in the manufacture of mid- and low-range vehicles and located in the European periphery (Castillo, 1996; Wallerstein, 2011). The title of the monograph was a clear nod to an analogous phenomenon that occurred in the 1940s with the 'arrival of the assembly line to Europe' (Fridenson, 1987).

What then prevailed in these plants of the European periphery were light manufacturing systems based on the fragmentation of processes, as well as the simplification and outsourcing of tasks to auxiliary firms under the 'tense flow' of just-in-time deliveries (Durand, 2004). Elsewhere, in plants of central and northern Europe, other options such as 'reflexive production' for high-end vehicles proved equally competitive. A paradigmatic example of the latter was the case of the Volvo plant at Uddevalla, where on-demand manufacturing was achieved through the formation of highly qualified work-teams and 'quality circles' (Pardi et al., 2020; Olejniczak et al., 2020).

From those investigations and their discussion within the GERPISA network was born the theory of production models. Simply put, this theory seeks to overcome the traditional method of classical sociology for classifying production systems around old and new forms of work organisation by further considering the different profitability strategies that may pertain. This includes articulation of the forms of organisation of production (product design, human resource management, commercial strategies, and work organisation – both along business chains and within plants) as well as the forms of organisation of reproduction of the labour force, making it possible to identify distinct ways of obtaining surplus value from two possible ideal viewpoints. In one, the relative surplus value is obtained from an increase in labour productivity (more goods produced under the same workload, where the time needed for reproduction of the labour force decreases); in the other, the absolute surplus value is obtained through intensification of work (producing more goods under a greater workload, which increases the cost). In the jargon of production models, these two routes have been formalised as the 'high-road' and 'low-road' of development. Secondly, the theory of production models allows the identification of profitability strategies at different levels, whether national or regional, or at multinational group level, or by manufacturing plant, or even by production line or workplace. At each of these levels, higher-level conditions or determinants establish the frameworks of strategic option and therefore the possibility of choosing from among distinct methods of organising production that are more or less painful for the worker, as demonstrated (for example) by Jürgens and Krzywdzinski (2016) in their study of the

different strategies of automobile manufacturers in plants located in the BRICS countries. Thirdly, this theoretical approach incorporates a dynamic vision of production relations, seen as subject to constant transformation, while the strategy for profitability being followed at any given moment affects or conditions the possibilities and paths of the system's future production and reproduction.

As an example, and in general terms, the spread of new forms of work organisation based on light manufacturing gave way to an accumulation model characterised by the globalisation of goods and capital markets and the advent of a kind of predatory, extractivist capitalism that met its limits early in the 21st century and manifested in the global crisis of 2007 (Piketty, 2022).

At present, the technological transformations required to face our ecological crisis are being conditioned by pressures from business groups and national interests, organised into diverse lobbies[1] that seek to guide the industry along a certain path of decarbonisation (for the case of Europe, see Akpinar, 2017, among others). These tensions at the European level have resulted in a strong focus on the electric vehicle (EV), leaving aside alternatives adopted in other regions such as the hydrogen-powered fuel-cell vehicle (FCV)[2] manufactured in the Asian market by Toyota and Honda (Bouacida and Berghmans, 2022). Other possible energy alternatives include vehicles powered by gas (CNG and LPG) or synthetic fuels. In fact, the EU agreement of 28 March 2023[3] that allows an exemption for synthetic fuels beyond 2035 gives this latter option a bit of scope; and yet decarbonisation in Europe has so far been identified exclusively with implementation of the electric vehicle (Begley et al., 2015, 2016). According to a public officeholder linked to the Ministry of Transport, Mobility, and Urban Agenda of the Government of Spain:

> "The European Commission is betting on a transition based on technological non-neutrality and exclusively electrical technology, leaving aside others such as synthetic fuels or hydrogen. This amounts to a conditioning of how to reach the objective of emissions reduction, thereby influencing the different strategies and speeds of application being carried out by the different European manufacturers. Automotive employers' lobbies are known to be among the most powerful and best organized. Also, the 'Dieselgate' scandal greatly damaged the sector's reputation, and the European institutions can't afford another similar case for reasons of reputation vis-à-vis the United States and other countries. In fact, VW is the manufacturer betting the most heavily on the EV." (Excerpt from the interview of 12 May 2022)

The focus on electric cars in Europe has also been strongly determined by strategies for profitability implemented since the late 1990s by multinational groups in the sector and aimed at dealing with a second critical factor: the depletion of an expansive profitability model based on just-in-time manufacturing systems and the relocation of activities. This strategy, pursued through the modular design of both vehicles and production processes, was imposed in many manufacturing plants with practically no resistance under a justification of new desires that had arisen within demand (Jullien and Pardi, 2011). Modular design allows a vehicle to be divided into pre-assembled sub-units that can be mass-produced. These are then combined in different ways in the final assembly chain, on demand and on a small number of modular platforms, thus permitting within the same plant the manufacture of a wide variety of vehicles of different brands and ranges (Lampón et al., 2017). Standardisation of such modules and the simplification of final assembly also facilitated greater intensification of work as well as reductions in labour

costs [Fujimoto, (2017), p.131].[4] This system also made it possible to mainstream competition in costs among final assemblers and between suppliers through the auctioning of models, sets, and subsets at a global level. In many instances, this competition has been transferred directly to the labourers, who are forced to compete through the lowering of their working conditions (López-Calle et al., 2020). At the same time, to the extent that modularisation increases the number of production lines per plant, it allowed the automation of certain phases.[5]

Thus in many instances automation serves as a device in business strategies to increase control as well as work intensity (Cirillo et al., 2021). Nonetheless, automation is usually presented as the effect of a neutral and relatively autonomous process of technological innovation required to ensure constant increases in labour productivity, where companies are inevitably compelled to lay off workers.

> "The company's announcement of a 30% reduction in the number of workers needed to produce the electric car has to do with technological changes and efficiency. Activities such as quality control, logistics, and many others are being robotized, because they have more money to invest, and by investing more they get more revenue from production. Therefore, the difference isn't due to a 30% reduction in parts but to the technological changes and robotization that they're implementing. For example, with respect to painting: before, there was visual control by more than 30 workers along each line (there are four production lines at Martorell); now they operate large arcs that can see much better than the human eye, so the prior template will virtually disappear. […] Speaking as assemblers, we're not much affected by the change from installing an electric motor rather than a combustion engine." (Excerpt from the interview of 2 March 2022 with a CGT member in the company committee of SEAT Martorell)

Moreover, modularisation has gone hand-in-hand with the ultra-concentration of brands into fewer and fewer multinational groups – that is, an intensification in the sector of the process of capital centralisation. Thus the leading manufacturing companies in the market have forged alliances (Renault-Nissan) or made acquisitions among themselves (Volkswagen and Porsche AG, or PSA and the Opel brand of General Motors), and all the business groups in the sector have become multi-brand, with each company manufacturing different brands of vehicles. One consequence of this process is a blurring of identity between a manufacturer's brand and the characteristics of the cars produced by each company (engine, safety, design, etc.).

All of this has meant that at semi-peripheral plants, such as those in Spain, the transition from light and just-in-time manufacturing to multi-model assembly through the modularisation of production allows what might be termed 'algorithmic production' in terms of profitability strategies. In terms of organisation, the logistical-financial principle displaces the principle of lean production (where a differentiated product is manufactured and delivered at the right time). Under algorithmic production, the question becomes one of local and timely activation and deactivation of both capital and human resources based on the profitability ratios that each contribute in a given product. This further translates into relationships between companies (and between companies and workers) based more on availability and cost than on flexibility. In technical terms, relations are articulated through devices such as 'design for manufacture', Kanban systems for control of suppliers, lengthening of just-in-time deliveries from top-level direct suppliers, etc. (Rísquez-Ramos, 2022).

It must be remarked that when coming in contact with the technological heterogeneity currently prevailing in the transition to EVs, the trend toward standardisation (promoted by the modularisation of production) has been generating tension in terms of the profitability of modularised production. However, under this general dynamic – as occurred in the past with the Japanese model, and with light manufacturing (Vidal, 2022) – manufacturers can choose from among various alternatives when planning the production of their different models and the organisation of work in the plants that assemble those models.

For instance, as demonstrated by Muniz and Belzowski (2017), two distinct approaches are being taken to integrate production of the electric vehicle. While some plants have adapted their modular platforms to enable the manufacture of electrical devices (adapted electric platform), others have developed new modular platforms (new electric platform). The choice of approach is affected by the costs of developing and maintaining a new modular platform, as well as the possibility of benefiting from the development of a new EV, potentially with unique capabilities such as extended range or performance. Ford provides an example of the first approach, with multi-brand platforms (Volvo-Ford) and vehicles of different sizes; in order to achieve economies of scale in EV production, Ford has opted for a modular platform shared with other cars of greater volume. Stellantis has also taken an Adapted Electric Platform approach, as described below. On the other hand, VW in 2015 announced its commitment to manufacturing electric cars on a new modular platform dedicated to small and mid-sized versions of its various brands. As stated by the Head of the UGT at SEAT Martorell:

> "We are going to unify the group's two general vehicle-building platforms into a new platform called SSP, which is a system similar to Tesla's. These vehicles will require 10 hours of production work per operator/car, and this format will debut at the new factory in Wolfsburg. The Trinity model of Volkswagen will be manufactured there. [...] From that point, for all the brands, we'll have to be quick and innovate to be able to attract new investments to this type of platform and to build models, especially from 2028-2029." (Excerpt from the interview of 25 May 2022)

Our hypothesis is that the decisions made at group level are also somewhat determined by the productive and social conditions present in the plants where models are manufactured (see Section 3.2). The evident diversity of possible approaches indicates that various paths coexist in the transition to electric vehicles, and that the techno-centric business discourse of 'one best way' is merely an alibi to bolster the imposition of specific choices.

3 Automotive groups and Spanish plants on the road to the EV

3.1 Decarbonisation and profitability strategies of Stellantis and VW

In this subsection, we explain how Stellantis and VW are handling the transition to EV. To that end, we analyse their EV production targets and decisions related to the modular platforms used, along with their profitability strategies and adaptation to the new context of decarbonisation. It is important to first note that across recent decades, the Stellantis and VW automotive groups have evolved in similar ways in terms of capital concentration through mergers and acquisitions, giving rise to corporate networks where

diverse brands and models coexist, and this has defined the complexity of both their strategies for profitability and their specialisation of production, as well as the organisational and productive models of each group. On one side, VW has a long tradition of acquisitions of smaller companies including Audi, SEAT, Skoda, Bentley, Bugatti, Lamborghini, Porsche, Ducati, MAN, and Scania. On the other side, Stellantis was created in 2021 through the merger of the French group Peugeot Société Anonyme - PSA (Peugeot, Citroën, Opel, DS and Vauxhall) and the Italian-American group Fiat Chrysler Automobiles - FCA (Fiat, Alfa Romeo, Lancia, Maserati, Jeep, Chrysler and Dodge, among others). In recent years they have respectively ranked second and fourth among the world's largest automotive groups.

As mentioned above, one crucial issue in the transition to the EV is the design of the modular platform for production. In the case of the VW Group, the transition to the electric vehicle has maintained a priority of standardisation and simplification of designs and processes. Through specific platforms for electric cars (called the scalable systems platform, or SSP), to be unified by 2028, the group aims to reduce the complexity of process and assembly times by 30%. Its main objective is to be the world leader in the electromobility market before 2025 through its 'NEW AUTO' strategy (with investments of more than €89 billion).

In the context of the transition to decarbonisation, Stellantis has based its strategy on the simplification of platforms under a strategy for profitability based on volume, standardisation, and cost reduction. In this way, the group intends to dilute and reduce differentiation between models, which will further intensify competition. Indeed, this automotive manufacturer prompts questions of 'cannibalisation' as might occur among similar models with different brands following successive mergers, especially for demand segments in the mid- and mid-to-low ranges. Stellantis presented in 2022 a plan for electrification of its fleet entitled 'Dare Forward 2030' – a commitment to EVs with long-range batteries and the goal of constituting 100% of production in Europe and 50% in the USA by 2030. To date, 40 traditional combustion vehicles have been electrified through multi-energy platforms, with six of these models already produced at Vigo. The future plan is to assemble the electric models on four specific modular platforms termed STLA (small, medium, large, and frame), thus standardising the 100%-electric models for the coming decades. A key element in the strategy of this group (unlike those of PSA or FCA) is that, given a unified electrification process on these four platforms, the strategy for profitability will depend on the ability to share components, thus further increasing standardisation and the modularisation of assembly processes (Rísquez and Ruiz-Gálvez, 2022). Specifically, all new models will be designed for both PSA and FCA, narrowing the range of segments and models within the group to just four electric platforms. Electric vehicles will share another drive module (EDM) and will be built on a transversal, longitudinal architecture. The assignment and implementation of these platforms at the Stellantis Group level is not yet final. Indeed, at present, despite a strategic plan with very specific production objectives, the group has not yet definitively decided as to which plants will use these specific platforms for EV production.

As regards profitability strategy, the transition to EVs in Spain seems to likewise imply a significant change in the traditional productive allocation of Spanish plants, and in the volume and diversity strategy for the manufacture of mid- and low-range models for this market segment in general. The VW Group intends as an element of decarbonisation to move toward a strategy based on obtaining greater profitability per

vehicle with a better brand of higher prestige. Generally speaking, however, the EV will move the group toward mergers of brands and a simplification of models, responding to the so-called 8-20-80 formula. As explained by Thomas Schäfer, CEO of Volkswagen and Head of Volume Brands,[6] VW is seeking new formulas to increase efficiency by 20%, at an 8% return on investment for each unit, thereby representing 80% of the group's total revenues. This strategy would appear to entail the establishment of regional areas where technology, models, and competition are shared among plants – in this case on the Iberian Peninsula, which will come to specialise in smaller vehicles, assembled on smaller platforms and with a relatively high technological component (in terms of both connectivity and autonomy). This would amount to a very specific specialisation of Iberian production into three variants: CUPRA, Volkswagen, and Skoda. Perhaps for these reasons, this policy has been institutionally supported through PERTE VEC,[7] which will provide financial resources for the imminent construction of a battery factory at Sagunto. Currently, following an agreement between the VW Group and the Spanish Ministry of Industry, it is estimated that five electric models will be assembled with a very specific pattern of specialisation, being economical and small in size.

Moreover, the VW Group has followed a policy of standardisation of production based on the essential principles of the Volkswagen production system. Thanks to the simplification of designs, logistics, and parts and components, costs were gradually reduced, and advantage was taken of the economies of scale derived from this strategy. Thus a network of global suppliers was created that favours the reduction of costs and flexibility around the specificities of production. By way of transversal platforms, it has been possible for VW to permanently reduce costs and intensify competition between plants, and this strategy has involved the adaptation and standardisation of processes within final plants as well as in supply and auxiliary factories and centres. At the same time, all of this means a relative reduction of uncertainties around the future of the plants, strengthening in some way the bargaining power of the workforce. In the case of VW Navarra,[8] the group has already announced the allocation of two small EV models at an investment of €250 million. Assigned for 2025, this supposes the use of one of the production lines for these models, translating to a reduction in production of 60,000 vehicles per year and approximately 500 jobs within the factory.

Although the allocation of models and platforms in the case of SEAT is even more uncertain, at present it is similarly expected that two CUPRA EV models will be assembled at Martorell; these will be produced in smaller quantities than the current SEAT but will be more profitable and key to the group's results. Thus the prior strategy based on the SEAT brand (mass production of a low-cost, diversified, generalised model) seems to have been abandoned in favour of a new profitability strategy: "all the brands are now launching a CUPRA; that is, all the groups are running from the volume strategy toward a more exclusive and profitable per-vehicle strategy" (according to a representative of the SEAT Works Council). For this reason, debate continues around whether to electrify the SEAT León. If not, the final SEAT vehicle will be assembled in 2028–2029.

This change in strategy will imply a 30% reduction in production volume; therefore, if a new platform and new electric vehicle models are not assigned, or the loss of employment is not complemented by new productive activities linked to research and development, then the plant will not maintain its current production capacity. In short, despite the uncertainty generated by the transition to the electric car, the VW Group has

in fact already established a clear project for implementation of the electric vehicle in Spain.

The strategy of Stellantis in recent years has been marked by a search for profitability through volume and diversity at a global level (and based on the permanent reduction of costs begun in 2000[9]). Modularisation has allowed the group to combine its volume and diversity strategy in an efficient way, in terms of costs. Throughout the group's extensive history of mergers with other brands, the most significant requirements characterising its production and organisational models have been the standardisation and simplification of models through the gradual reduction of modular platforms – a prior strategy built around economies of scale and based on the reduction of fixed, labour, and supply costs (Rísquez-Ramos, 2022) and consolidated across decades through the lean production model and through organisational methods based on just-in-time manufacturing.

The transition to EVs also means the transformation of supply chains and the values of components. Although analysis of the effects on suppliers and their current situations exceeds the breadth of this investigation, the issue of relocation and internalisation of parts-and-components production will be crucial for both groups in capturing added value and control throughout the production chain. Many traditional elements of high added value (engine, gearboxes, transmissions) will become obsolete and thus require some reconfiguration of the value chain. A gradual reduction in the volume of production of combustion-engine components will persist through the decarbonisation period (until 2035) alongside the addition of new EV components. Currently, the EV elements with the greatest added value are the batteries, the electric motor, and the specific software. The production and positioning of these along the chain will be key in the race to electrification. Up to now, some of these components have been supplied by the Chinese company Contemporary Amperex Technology and by Lithium Energy Japan. However, with the present aim of gaining control over production of batteries and electric motors,[10] Stellantis has been creating joint ventures with other brands in the sector. Its policy of specific cooperation agreements with other companies in the sector proposes to share platforms with other manufacturers in an increasingly heterogeneous market context. On the battery side, Stellantis formed a joint venture with Mercedes Benz and Total Energies to produce in Douvrin (France), Kaiserslautern (Germany), and Termoli (Italy), and the group is negotiating with the Spanish Government the implementation of a gigafactory in Spain using the resources for batteries afforded by the PERTE VEC II. The group aims to produce electric motors through a joint venture (Emotors) with the company Nidec Leroy Somer, with production of 1 million motors by 2024.

Unlike at Stellantis, the VW Group's electrification process includes the development of its own software and hardware (presented as keys to differentiation, development, and gains in competitiveness) rather than subcontracting these factors to third parties. The VW Group also foresees greater participation and involvement in the development and manufacture of batteries, and through CARIAD the group intends to build a unified architecture for all its brands. Meanwhile, VW will reinforce its Asian development competence through the creation of a joint venture between CARIAD (60% participation) and Horizon Robotics, opening possibilities for a competitive space in the Chinese market.[11] Also, the group's 'Future: Fast Forward' project was accepted by PERTE VEC resolution and will thus receive the most public resources from the European Next Generation funds (€397 million). This effort is being led by SEAT and Volkswagen and involves an investment of €10 billion in Spain, with one-third allocated to the battery

gigafactory at Sagunto. The project's objectives are: electrification of the factories at Pamplona and Martorell; creation of an entire chain ecosystem for electric car batteries; localisation in Spain of the network of 'essential' EV components; and the development and execution of a training, digitisation, and circular economy program.[12]

3.2 Organisational possibilities at Stellantis Vigo, VW Navarra and SEAT Martorell

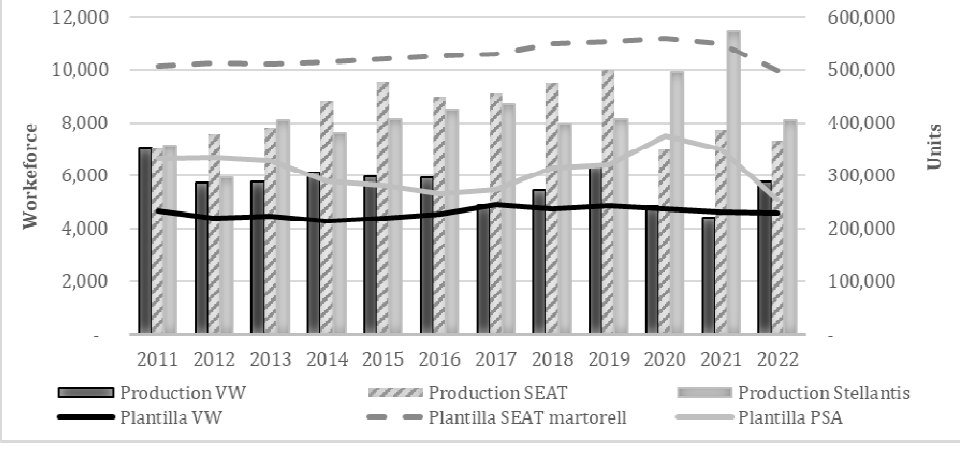
In this subsection we focus analysis at the level of the selected manufacturing plants. We characterise the positions of Stellantis Vigo, VW Navarra, and SEAT Martorell in regard to different productive variables, and we examine how each is facing the current context of the transition to EV in the post-pandemic era. As regards SEAT Martorell and VW Navarra, the specialisation of production assigned by the VW Group on the Iberian Peninsula has been characterised by mid-range and category B models, small in size and with a mid-sized (under 1,500 cm^3) gasoline engine, mainly oriented to the regional European market (as the VW Polo built at Navarra has historically been). Despite the fact that the SEAT brand carries special importance in Spain, due to its origins, this has not translated to the allocation of models of higher added value, or to improvements in the productive specialisation of the plant at Martorell. In fact, as we shall discuss, the group's future strategy design toward the EV dispenses with the SEAT brand, replacing it with the CUPRA. SEAT Martorell currently produces five models: three from SEAT (Ibiza, Arona, León), two from CUPRA (León, Formentor), and one from Audi (A1). At VW Navarra, a single model (the VW Polo) was produced until 2018. With the acquisition at Navarra of the MQB 00 platform, the VW Group awarded two more models, the T-Cross and the Taigo, thereby increasing competition among group plants. However, although these two final assembly facilities share a similar specialisation of production, the allocation of brands is quite limited, giving priority to VW Navarra for vehicles of the VW brand. As one union representative of the Works Council at SEAT Martorell lamented: "VW Navarra is the jewel in the crown".

Specifically, the plant at Vigo is among the group's most productive and profitable in Europe. One principal characteristic is that the plant's model for organisation of production is structured on a 'bi-flow' system featuring two assembly lines (M1 and M2): passenger cars are assembled on the CMP multi-energy modular platform (line M1), while vans are assembled on the EMP2 multi-energy modular platform (line M2). Currently, six electric version models are being assembled on these same lines.[13] However, Stellantis has not yet decided the allocation of all of the EV-specific STLA platforms, and at present the group intends to continue electrifying models on its mixed platforms. The high production capacity and variability on which the Vigo plant's strategy for profitability is based has served to heighten intra-group competition in Europe (Rísquez-Ramos, 2022), especially among those factories that employ the CMP platform, such as the plants at Figueruelas (Spain), Poissy (France), Trnava (Slovakia), and more recently Kenitra (Morocco). In the manufacture of vehicles designed for the EMP2 platform, the Vigo factory competes mainly with French plants at Mulhouse and Sochaux and (to a lesser extent) the plant at Rennes.

Examining certain key economic variables at the three manufacturing plants, as shown in Figure 1, we would highlight that the SEAT plant has ranked highest in production and number of employees in Spain during most of the years in our research period. This is a final assembly facility as well as an engine factory and R+D+I technical

centre including the Center for Development Prototypes (CPD) and the Design Center at Martorell, supported by production of SEAT components at El Prat de Llobregat (SEAT Barcelona). Thanks to a specialisation in vehicles of lower added value, both production and workforce numbers grew in recent years, even through the worst moments of the 2008 crisis [Ruiz-Gálvez Juzgado, (2017), p.111]. However, this plant began reducing its production in 2020 in a trend that appears to converge with EV activity to be assigned to the Martorell plant.

Figure 1 Production and workforce by plant (2011–2022)



Source: Authors' elaboration based on data offered by the companies in their audited annual accounts

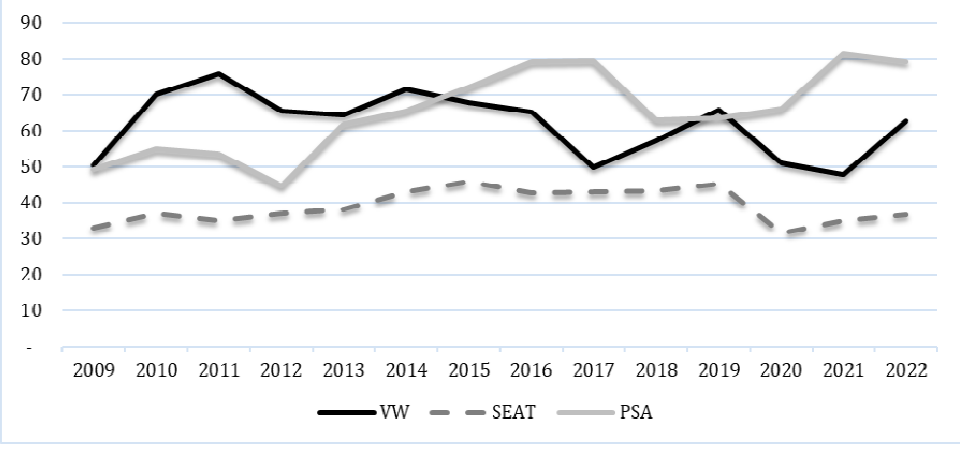
Unlike SEAT Martorell and Stellantis Vigo, the plant at VW Navarra is relatively small in size. Throughout its history, this has been the VW Group's Polo plant, focused on assembling a single model under a strategy of high volume and permanent cost reduction. Starting in 2017, however, the Navarra plant began to assemble new models, expanding its profitability strategy toward diversification, and this launching of new models broke with a trend that had persisted since 2011. In 2019, the plant managed to recover the production levels of prior years, but the outbreak of pandemic and a lack of supplies decreased this volume in subsequent years.

As shown in Figure 1, the Stellantis plant at Vigo, Galicia, is among the largest factories in Spain and continues to grow, surpassing even the SEAT Martorell plant in 2019 following a merger with General Motors and leading to production of some of its models. Production grew by 43% from 2012 to 2021, breaking records in 2020 and 2021 in the midst of the pandemic and the subsequent supply crisis in the sector. At the same time, during those two years of maximum production, the company reduced its workforce – by 7% in 2021 and by 27% in 2022. As a result, productivity per worker/unit produced at the Stellantis plant (Figure 2) increased by 78% over a decade, exceeding the average productivity for both Spain and Europe. However, this apparent increase in productivity actually derived from the outsourcing of many tasks, reduction of the workforce, and intensification of work (Rísquez-Ramos, 2022).

In short, we find that in recent years these plants have diverged in evolution, leaving them at different starting points with regard to their EV strategies, and we find evidence

of continuous shifts throughout the research period in the groups' strategies toward the electrification of their fleets. Although all pursue the same objective – the goal of producing 100% EVs by 2035 – the strategies of the manufacturing plants are far from identical.

Figure 2 Productivity (units per employee) (see online version for colours)



Source: Authors' elaboration based on data offered by the companies in their audited annual accounts

Meanwhile, in the face of regulatory requirements and product changes, the technological determinism that still pervades the strategies and communications of some large automotive groups has led to claims of only one viable path for reorganisation. In reality, however, varied strategies for profitability always coexist, with varied effects on working conditions within the companies that form part of the production process. A deterministic discourse can triumph precisely when the capacity for social or political responses to business decisions is narrow, and it is often present in organisational changes made around models of lower-path development, characterised by products of relatively low added value, jobs that require lower qualification, and low salary costs (Boyer and Freyssenet, 1996). This translates into low bargaining capacity for the workers' collective, which is normally very fragmented, scarcely unionised, and relatively replaceable. For example, it has been shown [Vazquez et al., (2018), p.201] that the current level of conflict when proposing a change to an automotive design determines the manufacturer's choice of either a modular architecture (in the absence of conflict) or an integrated architecture (when conflict is present).

At Stellantis Vigo, collective bargaining has historically been articulated around a majority union of corporate or 'right-wing union' type (SIT-FSI):

> "There's no negotiation here, no works council here – there's nothing here. There are no accidents, there's no discomfort... everyone is happy and content. Not because people aren't fed up, but because we've had a majority union in the company for 40 years. It's like a feudal relationship of lords and vassals, order and obey…" [Excerpt from the F.G.S. Confederal Secretary for Collective Bargaining of the Galician Inter-Union Confederation and employee of Stellantis Vigo (13 April 2023) during participation in the seminar 'Transition to EV: Industrial Repositioning and Employment Impact']

This lack of opposition has likely helped the company to systematically use the flexibility of labour management as a mechanism to adapt the workforce to changing forms, rhythms, and volumes of production. Adjustments in the workforce at Vigo have been undertaken through dismissals of temporary personnel, the promotion of early retirement for senior workers, and zero replacement rates, but most fundamentally through different types of employment regulation (EREs).[14] At the same time, during the interviews key interlocutors highlighted the tendency to outsource tasks and subcontract to other companies in parallel with reductions in staff, which would explain the increase in the productivity ratio per unit produced that this plant has exhibited.

Following the 2020 implementation of the Temporary Employment Regulation Filing (ERTE) by the Spanish Government as a response to the COVID-19 crisis,[15] the Vigo plant has carried out five waves of ERTEs (two in 2020, one each in 2021 and 2022, and another in 2023), eventually returning to use of the ERE and affecting 100 persons over 59 years of age. It is striking to note that, precisely in those years when the plant has achieved its best production results, the company continued to use these tools for personnel adjustment.

In the cases of SEAT Martorell and VW Navarra, the strategies for adapting the workforce to changing production needs or crisis contexts have likewise been resolved through ERTEs, though not as a structural tool for annual adjustment. During the pandemic, both centres applied ERTEs (in 2020 due to COVID, and in 2021 and 2022 due to the lack of supply of some components). At present, ERTEs from 2022 have been extended for SEAT (after evaluating the scenario of great uncertainty that the works council foresees for 2023) and for VW Navarra (due to a lack of semiconductors). In visits to the SEAT Martorell plant, we also verified use of the 'rotating ERTE', which seeks to distribute the available workload among all workers, thereby avoiding temporary layoffs.

In any case, each negotiation of a new agreement tends to raise the spectre of model assignments, as has occurred at the VW Navarra plant: recent reports of the imminent end of Polo production at Navarra in 2024 and the threat to 2,000 jobs struck a new blow that has both diminished and conditioned the workers' negotiation capacity for the next agreement (to begin in coming weeks). Another example was the latest SEAT agreement (2022–2026) in which salary increases was subordinated to the allocation of a new model of EV. Here we find differences in terms of the intensity acquired by this moderation and the considerations that workers manage to obtain. In the case of SEAT Martorell, workers waived a portion of their agreed salary for 2023 as an expression of 'good business practices' by the group toward the plant, and this will materialise in the assignment of various models for four- or eight-year periods.[16] In subsequent years, salary increases will be conditioned to the evolution of the consumer price index (CPI) from the prior year, amounting to latent salary moderation (or even loss of purchasing power) in exchange for maintaining production of the assigned models.

In the case of VW Navarra, recent agreements also reflect the maintenance of purchasing power: in 2018, the CPI; in 2019 and 2020, the CPI plus 0.5%; in 2021, the CPI plus 0.5%. But because there was no inflation in this period, the salary was frozen; in 2022 and 2023, an agreement was signed for the CPI plus 0.4%. Thanks to the fact that this agreement is in force until December 2023, salary conditions have been protected against strong inflation.

The same has occurred with respect to reductions in workforce, which according to union representatives have been accepted so long as they were 'non-traumatic'. According to the Head of the UGT at SEAT Martorell:

> "We remain strongly subject to European regulations, and we're also suffering from this in the factories, because the transformation won't prevent the 30% reduction in working hours. This has an impact on employment, because it will mean dismissals from platforms. We at SEAT will have a surplus of 2,800 workers by the end of 2025. We have a half-agreement with management to remove 1,330 workers through suspension of contracts for those who turn 61 in the next five years. They'll have an exit package with 70% salary plus seniority, and the company would pay a special agreement with Social Security for between four and five years, so when they reach retirement age they'll leave with 100%. Then, until 2028, we must continue advancing on issues. […] For example, the generation aged now between 50 to 55 years will be 57 or 58 when we get to the electric car, and the location will be difficult. Therefore, we have to find specific plans to be able to remove these workers, including myself – that is, to find that non-traumatic transformation tool on the issue of employment in the sector." (Excerpt from the interview of 25 May 2022)

In the same way, unions start from the premise that the disappearance of certain essential components in the transition to EVs need not directly imply a correlative loss of employment. In the words of a CGT member in the company committee of SEAT Martorell:

> "Of the 2,500 people who might be redundant at SEAT, 1,200 are in the Gearbox plant. In addition, a factory for batteries or for motors (rotor and extender) could be installed there, but they've said no, they'll do that in Győr (Hungary) or wherever. Therefore, it isn't that people are talking about jobs being destroyed because the electric car is coming, but because of strategic and industrial decisions, and above all robotization and digitization. In short, the threat that jobs will automatically disappear due to the appearance of the electric car is not exactly true." (Excerpt from the interview of 2 March 2022)

At Stellantis, on the other hand, the process of wage devaluation at the plant was already consolidated in the agreement for 2016 to 2019 (Rísquez-Ramos, 2022). At the signing of the latest agreement, in force from 2020 to 2023, moderation and salary adjustment were combined. For 2020, the salary tables were updated by 0.8%, equal to the CPI of 2019; therefore, real salaries did not increase. In 2021 there was no nominal increase, given a deflation of 0.5%, while for 2022 and 2023 the salary increase was different. In the first place, and very significantly, salaries at the plant are comprised of a base salary and another portion agreed to individually with each worker. For 2022, the base salary rose 3.5% and the individual salary another 3.5%, with inflation for the prior year amounting to 6.5%. That is to say, this is a formula that gives rise to a salary loss, although the company itself explains this by calling it an increase equal to inflation. This same mechanism will be used in 2023; that is, there will be nominal increases of 2.85% for the base salary and another of 2.85% for the individual portion.

The relatively greater bargaining power of VW Group workers – linked to the greater integration of high-value vehicle components and the commitment to manufacturing vehicles with higher added value – has manifested in greater 'density' and 'frequency' of worker-company negotiations, and in fewer losses in purchasing power (known to be widespread throughout the sector due to both wage moderation and growing inflation). Thus, in accordance with the theory of production models, and considering that the three

plants here examined are located in a semi-peripheral economy in Europe, we observe that both VW Navarra and SEAT Martorell are following a relatively 'high-road' of development, while Stellantis Vigo is pursuing an organisational option closer to a 'low-road' of development.

4 Conclusions

The particular manner in which the crisis around reproduction of the accumulation model has been solved at the European level is in some way affecting the approach to problems of profitability in the sphere of company production. In short, this determinism is operating as a self-fulfilling prophecy – it is at once performative and gives rise to a field of regulatory and technological competitiveness that, in turn, moves companies to present this approach as the only way to survive. Pardi et al. (2020:4) explain the phenomenon as follows:

> "This is not a future conceived and understood as a product of present evolution; rather, the present is being shaped by visions of more or less distant futures based on the promises of digital technologies. In other words, those who control these visions guide the behavior and expectations of companies, politicians, and workers."

However, the organisational possibilities and management of human resources at the plants examined are not limited to such determinations. The dialectic between the profitability strategies of the groups and the bargaining power of the workers has determined distinct options. For example, in the case of Stellantis, and the Vigo plant in particular, the permanent adjustment of working conditions through flexibility mechanisms – internal, external (staff reductions and outsourcing), and through wages – has allowed improvements in productivity (by unit produced per employee) based on a deterioration of working conditions. And while we also find in the case of SEAT a threatening discourse that naturalises the workforce reductions required by VW, the truth is that the effects on labour and salary adjustment have not been as severe as those experienced at the Stellantis Vigo plant.

Faced with the alibi of productive overcapacity, the strong competition among plants that share a similar specialisation of production holds the Vigo facility in a state of continuous uncertainty; the plant has sought stability by reducing costs as a way of attracting capital – without real opposition from the majority union. Thus, as a result of the transition to the electric vehicle, the assembly plant at Vigo (Galicia) now competes with plants located mainly in Italy and the UK that have already produced similar models of previous brands. This will have effects not only on the final assembly plant but on the larger environment comprising the production chain – and ultimately on the region's automotive parts-and-components industry.

Meanwhile, the relatively strong bargaining power of the VW Group workers (linked to greater integration of high-value vehicle components, plus a commitment to manufacturing vehicles with higher added value) has engendered greater 'density' and 'frequency' in worker-company negotiations as well as fewer losses in purchasing power, known to be widespread throughout the sector due to wage moderation and growing inflation.[17]

As indicated by the theory of productive models, in the context of a techno-centric paradigm guided by the thesis that profitability can be obtained in only one way at any given historical moment of technical advance and organisation of work systems (the old 'one best way' of Taylorism), room still exists for various profitability strategies with various effects on working conditions. As depicted in Figure 2, a large part of the increase in productivity at Stellantis Vigo has been due to the outsourcing of tasks and the intensification of work; and while the VW Group plants show lower productivity rates per employee, they have proven to be fully viable and competitive.

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Notes

1 In Europe, the automotive industry directly accounts for at least 10% of the manufacturing sector (European Automobile Manufacturers Association) and extends to employment in other sectors including those for metals, chemicals, textiles, electronics, logistics, etc.

2 Referring to vehicles with hydrogen fuel cells that produce energy through an electrochemical process, replacing the traditional combustion engine (Fujimoto, 2017).

3 https://es.euronews.com/my-europe/2023/03/28/alemania-se-sale-con-la-suya-la-ue-acuerda-una-exencion-para-los-combustibles-sinteticos.

4 Fujimoto had already indicated in 2007 that when the architecture of automobile manufacture is more integrated (with most components installed in the final vehicle assembly line), the work is more highly qualified, while the costs of design and evolution of the vehicles decrease (making it possible to manufacture more limited series). On the other hand, in modular architecture, work becomes both more specialised and less skilled, and the competitiveness strategy is based on the reduction of labour costs, permitting economies of scale (Fujimoto, 2007).

5 Mokudai et al. (2021) show how some manufacturers insert digital technologies ('machine learning' – data acquisition by sensors using 'digital twins' and other forms of artificial intelligence) to automate their production processes.

6 See news article *Volkswagen Navarra Maintains 295,020 Cars in Its Production Program for 2023* (2023) 12 May, News VW Navarra [online] https://vw-navarra.es/.

7 See Gobierno de España (2021) and, more specifically, the conditions of the PERTE VEC to the VW Group. These are government financial assistance programs to support strategic sectors in the technological transition.

8 See Zabaleta (2022) *VW Navarra Officially Confirms that It Will Manufacture Electric Vehicles*, 25 November, Noticias de Navarra [online] http://www.noticiasdenavarra.com/.

9 This focus on reduction of costs was started by the PSA group and has continued since the creation of Stellantis.

10 Currently, the Japanese company Nidec manufactures electric motors at the group's plant in Tremery (France) and plans to locate an electric motor factory in Serbia.

11 See news article *Volkswagen to Strengthen its Regional Development Competence for Autonomous Driving in China through a Joint Venture between CARIAD and Horizon Robotics* (2022) 12 October, News VW Navarra [online] https://vw-navarra.es/.

12 See news article *Future: Fast Forward Partners Register the Project with PERTE VEC with the Ambition of Making Spain a Hub for Electric Vehicles in Europe* (2022) 4 May, News VW Navarra [online] https://vw-navarra.es/.

13 The M1 assembly line equipped with the CMP multi-energy modular platform manufactures the Peugeot 301, Citroën C-Élysée, and Peugeot 2008 models, while the M2 assembly line builds vans based on the EMP2 multi-energy modular platform, specifically the Citroën Grand C4 Spacetourer model, Citroën Berlingo, Peugeot Rifter/Partner, Opel Combo, Toyota Proace City, and soon the Fiat Dobló. The factory produces electrified versions of all vehicles except the 301, C-Élysée, and Grand C4 Spacetourer models.

14 See Rísquez-Ramos (2022) Subsection 9.2.2.3 and annex VIII for a summary of these ERTEs. This centre carried out six ERTEs between 2011 and 2019.

15 For more information on COVID-related ERTEs, see http://www.miites.gob.es.

16 Article 39 of the collective agreement.

17 See point 7.1.3 in Ruiz-Gálvez Juzgado (2017) and point 9.3 in Rísquez-Ramos (2022).

Annex

Stages of research

In the first phase, we defined the research question and selected the methodology. We then conducted the literature review based on previous work and the most recent literature.

In the second phase, we approached the multiple case study using a mixed methodology combining qualitative and quantitative data (Tashakkori and Teddlie, 2021). We began with an exploratory study at the sectoral level. To this end, we collected and processed previously extracted information that was functional to our objective. At

the same time, we designed the structure of the interviews and questionnaires according to the people to be consulted and the interview format.

The sample design was planned with key interlocutors, trying to interview the different actors in the process. For the initial research we conducted a total of six stays, three in Navarra (between 2015 and 2017) and three in Vigo, Galicia (between 2017 and 2019) and one visit in Catalonia. During this period, we conducted 55 semi-structured interviews with 71 people. More recently, in 2021 and 2022, to deepen the analysis of the most recent milestones in the transition to electric vehicles, we conducted another eight interviews, six individual and two group interviews (for a total of 11 interviewees).

Subsequently, once this qualitative information was obtained, the data were transcribed, categorised, coded using grounded theory and the information was selected. The collation and comparison of the information from the three studies allowed for an excellent triangulation of the research data (Yin, 2014).

In the final phase, we completed certain validation tasks and analysis of results, in order to reach our conclusions. This research is still alive in response to ongoing changes still in progress.

Table A1 Stages of research

1st stage: methodology design and exploratory phase	Study selection	Study selection: representative automotive factories in Spain owned by foreign companies	
		Research question: are different profitability strategies and organisational options possible in the process of decarbonisation?	
	Methodology design	Identify a multiple-case study	
	Literature review	Literature on: productive models and modularisation	
2nd stage: case studies	Case studies design	Define the information-collection strategy: combination of quantitative and qualitative research resources	
	Sample design	Design of the total sample: two distinct automotive groups (Stellantis and VW), three assembly plants (Galicia, Catalonia, and Navarra)	
	Data-collection plan: define the collection strategy	*Collection of quantitative and qualitative data from past research*	
		New quantitative data collection:	
		Case studies approach phase	Sources: economic and financial information from the sample companies, trade union bulletins, public and private databases (ORBIS, REGCON), news, etc.
		Sectoral data	Spanish Association of Automobile Manufacturers (ANFAC)
			International Organization of Motor Vehicle Manufacturers database (OICA)
		New qualitative data collection:	
		Redesign of questionnaire and interview structure	
		Selection of interlocutors by profiles	
		Sending questionnaires. Received 13 questionnaire responses	

Source: Authors' elaboration

Table A1 Stages of research (continued)

2nd stage: case studies	Field work	Review of the 54 semi-structured interviews conducted Conducting eight semi-structured interviews: six individual and two group interviews with a total of 11 persons Reduction data: transcription, categorisation, coding of data, and selection of information. Total interviews: • 63 semi-structured interviews conducted with 82 persons • interviews with union representatives: 13 group, 5 individual, and 10 telephone interviews • five individual interviews with managers • interviews with governments and institutions: one group interview and two via telephone • interviews with experts: one group interview and six individual interviews
Final stage: validation, analysis, and conclusion	Validation	Validation of the methods used with expert researchers and specialists from other disciplines Constructive validity: relating the information obtained from both studies to the research question Confirmation and validation of the results obtained through collective work sessions with the interlocutors
	Analysis	Analysis of the results obtained through quantitative data and qualitative information. Comparison of the two studies.
	Conclusion and report	

Source: Authors' elaboration