Stefan Guga

A transition delayed – the Romanian car industry in the slow lane to electromobility

Abstract

This article reviews the state of the automotive industry in Romania and its level of preparedness for electrification scenarios associated with the drive to reduce CO2 emissions across Europe stemming from the EU's 'Fit for 55' package. The author considers the main features of the industry in Romania, which typically revolves around the production of models for export given the low levels of domestic car ownership and amidst strong imports of older, and more polluting, second-hand vehicles from western Europe. Despite healthy relative growth, sales of battery electric cars remain marginal and, critically, there is little competence within the country in the area of electrification, its plants having been geared around the internal combustion engine. On top of that, there is no apparent urgency around developing a compensatory electric battery industry. The author concludes that this can only imply a delayed electrification, but the chief worry is what that means for jobs and skills within Romania, as well as the implications for a two-speed Europe in this area, too, with central and eastern Europe being left further behind.

Keywords*: automotive industry, electrification, value chains, CO2 emissions, public policy, east-west convergence*

Introduction

The accelerating transition to electric vehicles and the rapid shift to a new mobility paradigm imply major challenges for the European car industry and its supply chain. This massive and unprecedented disruption raises legitimate questions about the future role of central and east European countries in the European value chain as fast-track electrification is pushing car manufacturers to rethink their industrial and commercial strategies on their way to carbon neutrality.

This article looks at the peculiarities of the powertrain transition in the car industries and markets of Romania, one central and east European country in which this industry has played a major role in socioeconomic development in recent decades, being home to two highly successful automotive plants specialised in low-cost vehicles. Specific to the CEE region, the trajectory of car sites in Romania strongly depends on strategic decisions made in companies' headquarters located outside the country. The question today is whether Romania will join the technological transformation early on, or rather be kept as a low-cost manufacturing base for relatively low-end internal combustion engine (ICE) technologies. The answer has deep implications for the country's employment prospects.

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The article is organised as follows. In the first section, we present the main features of the Romanian car industry, describing the factors that have sustained its development over the years and discussing the unusually strong weight of suppliers in the ecosystem as well as their strong dependence on Germany. In the second section, we look at the main characteristics of the Romanian car market, chiefly the role of imported second-hand cars, the marginal share of battery electric vehicles (BEV) in new car sales as well as poor networks of charging stations. More generally, we illustrate the already visible risk of a two-track Europe in the race for decarbonisation, with widening east-west inequalities. Here we also look at data on emissions from the perspective of the environment as well as at the market for electric vehicles (EVs) in Romania, together with developments in the charging infrastructure. We next turn to the challenges of electrification based on original equipment manufacturer (OEM) strategies and forecast data that suggest a significant relative delay in the EV transition, before summing up the expected employment effects of electrification. Even if the impact might be limited in vehicle assembly plants, it could be strongly negative in powertrain, transmission and ICE-related component manufacturing plants, putting many thousands of jobs at risk in the medium term.

Industry overview

Similar to other central and east European countries within the EU, the automotive industry in Romania has grown over the past two decades into the country's largest manufacturing industry, creating nearly one-fifth of manufacturing value added before the disruption of Covid-19 (Figure 1). This is significantly higher than most western countries with large automotive industries, with the exception of Germany, although it is considerably lower than other countries in central and eastern Europe, including Czechia, which is an exceptional case, as well as Slovakia and Hungary. Furthermore, the share of the Romanian car industry in total gross value added reaches 2.5 per cent, much higher than the average for the EU as a whole of 1.7 per cent.

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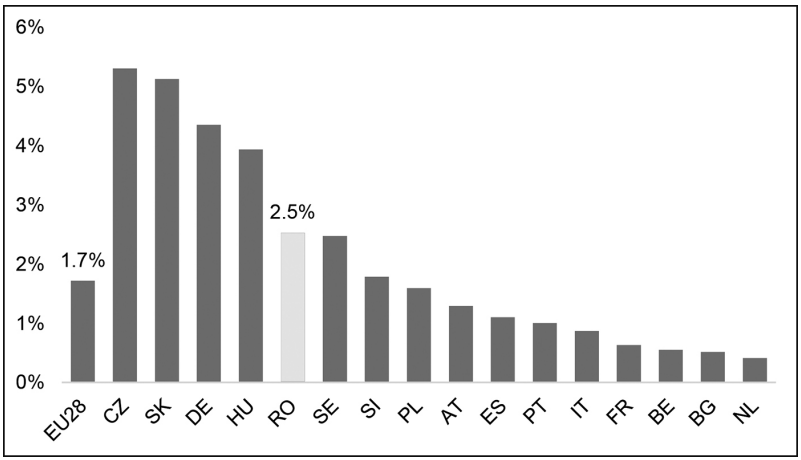
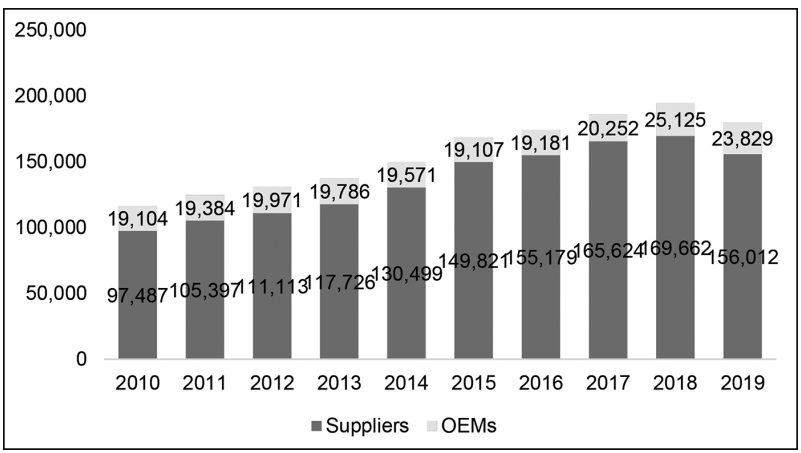
Figure 1 – Gross value added in the EU car industry, as % of total, 2019



Source: Eurostat.

In terms of employment, the picture becomes even more nuanced. With 180 000 people (Figure 2), Romania ranked fifth in the EU before the pandemic when it came to the number of people working in the industry, surpassing Italy and Spain. Furthermore, no less than 15.2 per cent of manufacturing employment was in automotives, second only to the 16.2 per cent registered in Slovakia (ACEA 2022).

Figure 2 – Employment in the Romanian car industry



Source: Eurostat.

The importance of the automotive industry for employment grew significantly during the 2010s, growing from 2.1 per cent in 2010 to a peak of three per cent in

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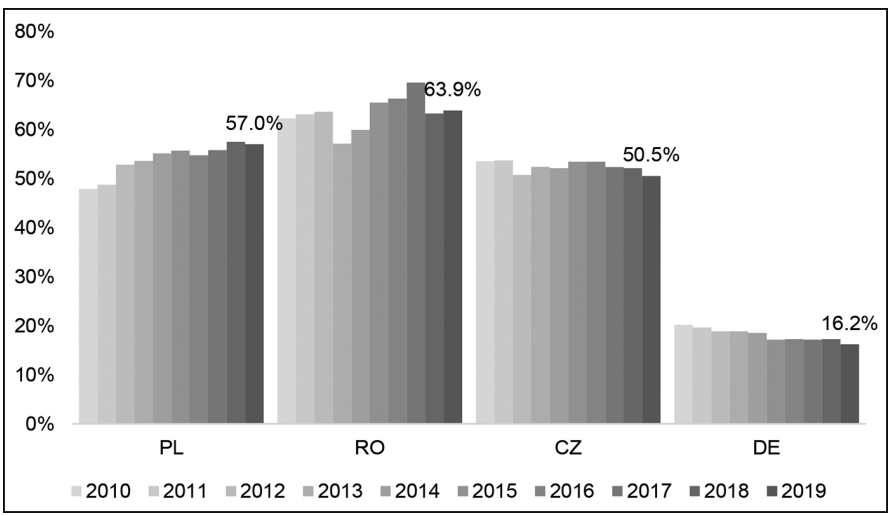
2018. In comparison, employment in the German automotive industry remained fairly stable in the context of the overall labour market, despite a 6.5 per cent increase in automotive employment between 2010 and 2019. In other words, the car industry has acted as a major driving force for employment in Romania during the past decade, growing visibly faster than the rest of their economies, beginning to lose some ground only in 2019 when it registered the first decline in employment in a decade.

Overall, the industrial profile is typical of the car industries of other countries of central and eastern Europe, with the supplier industry being much larger than vehicle manufacturing, although in Romania this is more true than of either Poland or the Czechia; and here it is also growing unlike in Czechia (and indeed in Germany, at a much lower level) where it has been extremely stable over the last decade and even slightly declining (Figure 3). In 2019, 64 per cent of turnover in car manufacturing in Romania was attributed to the supplier industry compared to less than 20 per cent in Germany.

Figure 3 – Share of suppliers in total car industry turnover



Source: Eurostat.

In terms of employment, the asymmetry is even more obvious: suppliers accounted for nearly 87 per cent of total car industry employees in Romania, compared to just 31 per cent in Germany (Figure 4).

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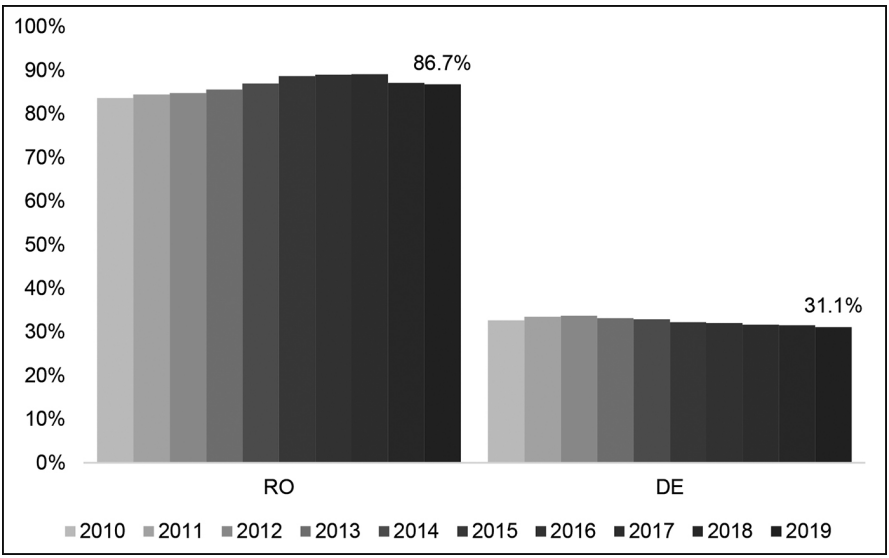
Figure 4 – Employment in the car supplier sector (% of total car industry employment)



Source: Eurostat.

The Romanian supplier industry is also much larger, even accounting for country size, than that in other central and east European countries. A specific feature in the region's automotive landscape is also that the supplier industry is not just significantly larger than vehicle assembly but that it has also continued to grow faster; this is not the case with Czechia or Slovakia, where the combined share of suppliers began to decrease in the second half of the 2010s (Guzik et al. 2020). In 2019, Romania ranked third in the EU when it came to the number of employees in automotive suppliers; only Germany had more people working in the industry supply chain.

This high share of suppliers, and the contrasting development to countries like Germany, is part of the broader growth of transnational automotive supply chains in Europe and the accompanying east-west differences in specialisation. Differences in labour costs between countries have undoubtedly been the main driver of this, with Romania still having the smallest average labour costs in the EU automotive industry in 2019, as it had been in 2010 (Figure 5).

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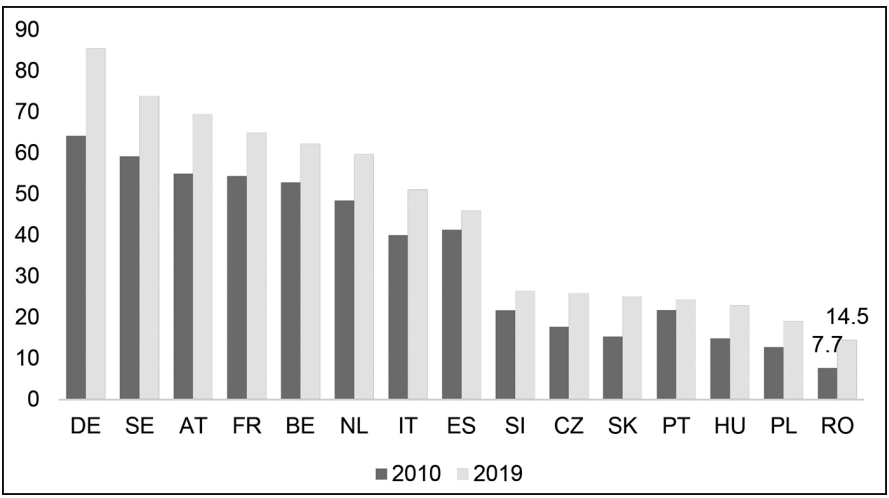
Figure 5 – Average labour costs in the car industry (000 euros per employee per year)



Source: Eurostat.

In policy terms, perhaps the most significant comparison is that, in 2019, an employee in the Romanian automotive industry cost, on average, just 17 per cent of that of a German employee. This difference has become smaller over time (it was 13 per cent in 2010), but there is little reason to speak of genuine wage convergence. In absolute terms, the gap to western Europe has actually increased: if the average automotive employee in Romania was, in 2010, 57 000 euro per year cheaper than in Germany, by 2019 this cost difference had increased to 71 000 euro per year. Roughly speaking, therefore, relocating jobs to central and eastern Europe has, in fact, become more advantageous over time, despite tight labour markets and sustained wage growth right across the region, not less.

Catalysed by low labour costs, the Romanian industry has grown primarily as a result of western foreign direct investment: only seven per cent of automotive employees worked in domestically-owned companies in 2018 (Figure 6). German companies are the most important employers (accounting for 32 per cent), but US, Japanese and French companies (all with roughly equal shares) also have a significant presence. Contrasting the shares of employment by ownership to the shares of turnover, domestic capital shrinks to just four per cent, suggesting that local firms typically have subordinate roles. A significantly higher share of turnover in comparison to employment is registered for OEM-originating countries (the US and, particularly, France), indicating much higher productivity and the impact of such activities compared to suppliers. The huge difference between the shares in employment and in turnover of Japanese companies (14 per cent vs. five per cent) is a stark example of specialisation in low-cost parts and components. Large Japanese suppliers such as

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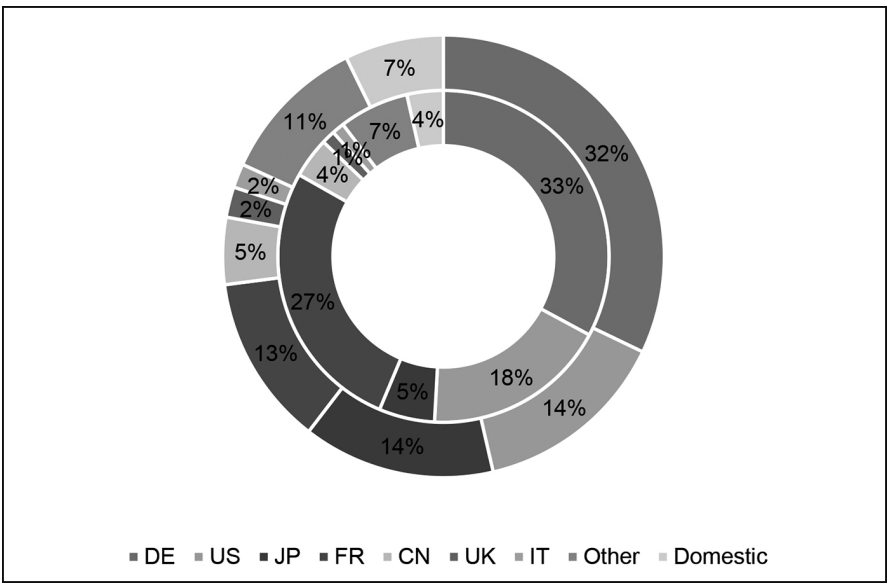
Fujikura, Takata or Yazaki have a substantial presence producing low value added but labour intensive products like wiring and cable harnesses.

Figure 6 – Ownership in the Romanian car industry: by employment (outer circle); and by turnover (inner circle), 2018



Source: Eurostat Foreign Affiliates Statistics.

As regards their foreign trade profiles, wiring (including cable harnesses) is Romania's most important export product from the automotive supplier industry and Romania is by far the most important producer of automotive wiring in the EU (Guga 2019). This is probably the best example of its specialisation in low cost, low value added, labour intensive manufacturing. In contrast to wiring, which hires tens of thousands of people working in a large number of plants across western and central Romania, the production of gearboxes and associated parts is concentrated in just three plants, of which only two are fully export oriented, but the sector has a comparable export significance — gearboxes and associated parts are the second largest group by export value. Importantly, the gap between the two is much larger in favour of wiring if we consider the balance of trade, which is due to gearbox imports by Ford Craiova and, possibly, to the low degree of local integration of the two gearbox plants owned by Daimler. Romania is not an important exporter of internal combustion engines as the two engine plants in the country are captive to local OEMs. It does, nonetheless, export combustion engine parts such as pumps.

Vehicles are, however, the single most important export product. Exports of utility vehicles are negligible, but exports in the passenger car segment have grown continuously during the past two decades, actually surpassing the value of exports from

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Poland, where utility vehicle exports are significant, in 2015. In terms of the balance of trade in passenger cars Romania registers an increasingly large trade surplus, partly explained by the significant increase of production in Romania but also by its small market for new vehicles (see next section for more details).

No less than 45 per cent of Romania's automotive parts exports go to Germany. If we include other countries in the region where German OEMs have vehicle assembly operations (Hungary, Czechia, Slovakia and Poland), then the importance of German supply chains becomes even more significant. Integration into German supply chains far outweighs the impact of OEMs' local presence: Romania's exports to Russia, France, North Africa and Turkey are strongly tied to the supply chain of the Renault-Nissan-Mitsubishi Alliance but, even when combined, they pale in comparison to the size of exports to Germany.

Table 1 – Light vehicle assembly plants (000)

Plant	Group	2008	2014	2019	2028 (forecast)
Craiova	Ford	2	68	141	234
Mioveni	Renault-Nissan (Dacia)	243	334	350	366
Total		246	402	490	599

Source: IHS Markit.

Romania has only two OEMs with vehicle assembly operations (Table 1). The IHS Markit forecast assumes both Romanian plants will be working at full capacity in the next years, possibly with a capacity increase at Dacia — total current capacity in Romania is of around 550 000 vehicles (350 000 at Dacia and 200 000 at Ford). The increased volumes forecast for both Ford Craiova and Dacia Mioveni mean that Romania will actually overtake Poland in terms of vehicle production volumes before the end of the decade.

Both Dacia and Ford have their own engine plants on the same sites as vehicle assembly which, in 2019, produced a total of 627 000 units (527 000 in Mioveni, 150 000 in Craiova); Dacia also produced 504 000 gearboxes in its highly integrated plant in Mioveni. The only other powertrain capacities in the country are Daimler's two gearbox plants in Cugir and Sebeș which, combined, produced 777 000 gearboxes in 2019.

Similar to the supplier industry, these plants function primarily as production locations for export, with companies making very limited investments in non-production activities such as R&D. The comparison to Germany is striking: whereas in 2019 Germany produced ten times more light vehicles than Romania, its R&D personnel was 47 times more numerous than in Romania (Table 2). Even though automotive R&D has increased visibly, the growth of German R&D has outmatched this.

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Table 2 – Car industry R&D personnel and expenditure

		2011	2012	2013
Total R&D personnel (FTE)	Germany	90 829	108 134	139 331
	Romania	593	2277	2985
Researchers (FTE)	Germany	57 057	68 466	92 837
	Romania	306	632	1316
R&D expenditure (euros/capita)	Germany	203	264	340.3
	Romania	2.6	4.8	8.3

Source: Eurostat, OECD.

As with wages, it is clearly unrealistic to speak of east-west convergence in this respect despite some obvious degree of industrial upgrading in the countries of central and eastern Europe.

Such major differences are also apparent when it comes to the structure of and growth trends in domestic vehicle markets. In the future, these could suggest different implications for Romania when it comes to the transition to electric vehicles.

Market overview

The Romanian automotive market is not substantial, either in volume or in relative terms. With about 162 000 new car sales in 2019, the Romanian passenger car market ranks third among countries in the region behind Poland (556 000) and Czechia (250 000).

Before the Covid-19 crisis, new car sales had strong momentum: between 2013 and 2019 they almost tripled, showing an impressive compound annual growth rate of 18.7 per cent compared to 4.2 per cent across the EU, the United Kingdom and EFTA combined. Certainly the market was not spared by the Covid-19 crisis, with new car sales dropping by 22 per cent in 2020, highly similar to the decline in the European market (24 per cent). In 2021, in the context of the worsening semiconductor crisis that led to a further decline in sales in Europe (1.5 per cent), the Romanian market fell by 4.1 per cent.

Primarily due to lower disposable incomes in the region of central and eastern Europe compared with western European countries, Romania is at the bottom of the European ranking in terms of new car registrations per 1000 inhabitants (see also Pardi, this volume). In 2019, this ratio was only 8/1000 compared with an average of 30/1000 for Europe with more than half of Romanian households (54 per cent) not owning a vehicle in 2020 compared, for instance, to just 15 per cent in France. Looking at the number of passenger cars in use per 1000 inhabitants, Romania records just about the lowest rate in Europe, at 376/1000 compared to a Europe-wide average of 560/1000, and ahead only of Latvia. It should be noted, however, that Romania recorded the strongest growth in this indicator in 2020, with an increase of 12 per cent against 0.9 per cent for the EU average.

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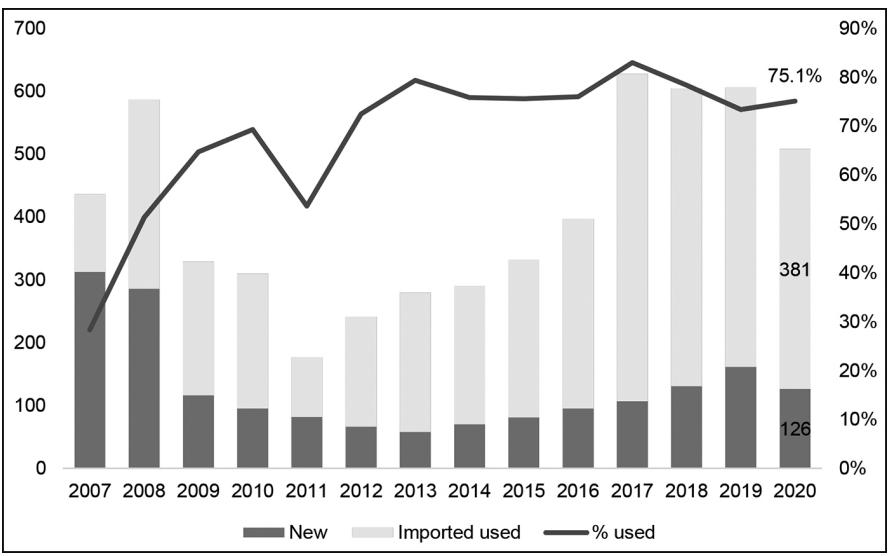
If the limited purchasing power of households is hampering the local growth potential for new car sales, at the same time, and from a socio-cultural perspective, car ownership remains a strong structuring factor of social status for many citizens in the countries of the region. As a combined effect of these factors, the growth of vehicle car fleets remains largely driven by the import of used vehicles, mainly from Germany, while the financial constraint weighing on households naturally works in favour of the second-hand vehicle market.

The significant share of used vehicles imported into Romania (Figure 7) makes its vehicle fleet among the most polluting in Europe. The ratio between the number of imported used vehicles and the number of new car registrations has been over 70 per cent in all of the last decade, with the abolition of the national vehicle tax (the 'environmental stamp') boosting the import of used vehicles in 2017 above 80 per cent and leading to an increase of almost ten per cent in the car fleet (Romania Insider 2022).

Figure 7 – New passenger car registrations vs. imported used cars (000)



Source: Syndex (data: ACEA).

More importantly, in 2017, only a couple of years after the Dieselgate scandal broke, Romania imported 520 000 second-hand cars, of which 370 000 (70 per cent) were old and highly polluting diesels, according to ICCT (see Table 3).

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Table 3 – Second-hand cars imported into Romania and their composition (2017)

	Total number of imported cars	Number of diesel cars imported	Average diesel NOx emissions (mg/km)
All imported cars	520 000	369 100	1014
Pre-Euro 1	2900	700	1339
Euro 1	10 300	3900	1339
Euro 2	79 300	38 700	1149
Euro 3	228 700	153 600	1029
Euro 4	132 900	112 200	951
Euro 5	59 900	55 400	1029
Euro 6	5900	4500	415

Source: ICCT.

Romania won't at all be alone in this situation, which perfectly illustrates the way in which an element of car pollution has been exported from western Europe to central and eastern Europe in the context of stricter engine standards in the wake of Dieselgate. It also tends to deepen the already significant inequalities between western European countries and those in central and eastern Europe in the race for decarbonisation; it is already possible to see the risk of a two-track Europe emerging on the horizon in the strategic field of car electrification.

Environmental impact

CO_2 emissions from newly registered cars remain well above the European average. In 2020 average CO_2 emission of new cars registered across the EU/UK/EFTA (excl. Switzerland) region was 107.8g CO_2/km, but this figure reached 115.4g in Romania as a result of the above figures.

Meanwhile, although there has been a strong surge in mild hybrid registrations, sales volumes of BEVs and plug-in hybrid vehicles (PHEVs) are still marginal. As in most CEE countries, electrification started late in Romania in the absence of proactive policies and significant financial resources dedicated to alternative motorisations during the period before Covid-19 compared with those implemented in western and northern Europe. However, we are now seeing a sharp acceleration in the sale of hybrid vehicles: volume remains insignificant but sales in this segment have more than doubled, reaching 30 000 units, or one in four vehicles sold.

Table 4 highlights the significant relative progress made in 2021 in terms of electric car sales as a share of new car sales, accompanied by a significant drop in the sales of internal combustion engine vehicles, in comparison with the average right across the EU/UK/EFTA. The latter is evidently in a different place on the growth curve, but there is, quite clearly, a switch beginning to take place within the Romanian market.

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Table 4 – Annual change in new car registrations by fuel type (2021/20), %

	Romania	EU+UK+EFTA
Petrol (ICE)	-28.5	-17.4
Diesel (ICE)	-43.2	-33.1
Mild hybrids	115.2	58.5
PHEV	153.9	68.5
BEV	122.9	63.4
Other	71.9	29.2
Total PCs	-4.1	-1.5
BEV+PHEV	131.2	65.7
Mild hybrids+BEV+PHEV	118.6	61.9

Source: Syndex (data: ACEA).

The combined share of BEVs and PHEVs in new car sales in 2021 in Romania was seven per cent (of which five per cent were BEVs), driven by strong purchasing incentive policies. In comparison, the European average was already close to 20 per cent, due largely to an impressive surge in sales in Germany.

In 2021, the Ministry of Environment doubled the budget for its Rabla Plus programme, which offers subsidies for the purchase of electric and hybrid cars, to around 82 million euros. Under the programme, BEVs are subsidised to the value of 10 000 euros (50 000 lei), PHEVs ($\leq$50g CO_2/km) to one of 4000 euros (20 000 lei) and hybrids to 600 euros (3000 lei). A scrappage bonus of 1300 euros (6500 lei) is also granted for vehicles older than eight years, while electric vehicles are exempt from registration tax. Romania also provides a contribution of a maximum 2500 euros for charging stations (<22kW) and 30 000 euros for fast charging points (>22kW).

In terms of charging infrastructure, however, Romania lags behind with one of the least developed networks in Europe. According to the European Alternative Fuels Observatory (EAFO 2021), at the end of 2020 Romania had around 500 charging points compared to nearly 45 000 in Germany and in France and 66 000 in the Netherlands. Looking at the number of charging points per 100 kilometres of road, Romania had at the end of 2020 the fifth lowest ratio in Europe, at 0.5 compared with 19.4 in Germany and 47.5 in the Netherlands, a country six times smaller. At the end of 2021, the number of publicly accessible EV charging points in Europe increased by 46 per cent, while the current average ratio of 22kW-equivalent publicly accessible charging points installed per 1000 passenger cars on the road was estimated to be 1.9 while Romania stood at 0.3. The leading markets at the end of 2021 were Norway (20), Netherlands (8.3) and Iceland (7.6), which once again illustrates the huge gap between western Europe and central and east European countries in the race for electrification (ACEA 2022).

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Electrification prospects and impact on the car industry value chain

Vehicle assembly

The most recent forecast available suggests a significant delay in the EV transition for the automotive industry in Romania in comparison to Europe as a whole (IHS Markit 2022). Such an assessment is far from surprising given the relatively limited market potential for still expensive EVs and the country's specialisation in smaller and cheaper vehicles which are not a priority for electrification (Pavlínek 2022). The share in total production volumes of light vehicles that are full hybrid and pure electric is forecast to remain below 50 per cent by 2028 compared to almost 70 per cent in Europe. According to this forecast, Romania would produce more full hybrid vehicles (BEV: 16 per cent share of production), with the mild hybrid vehicles already in production expected to become the main powertrain option in the second half of this decade. By 2028, light internal combustion engine vehicles (ICEV) would comprise just 11.5 per cent of production in Romania versus less than 3.6 per cent in Europe overall.

Ford has announced it will produce a light commercial vehicle with a pure electric powertrain option starting from 2024, although this is expected to have only limited initial volumes. In the longer run, starting from 2030, Ford has announced the intention of producing only pure electric vehicles in Europe. These plans of course include the Craiova plant and we can assume that the next Puma, coming in the second half of the decade, will have an electric option from the start. For Dacia, management has been explicit about its intentions to delay electrification as long as possible since the still high cost of EV technology poses significant challenges to Dacia's low-cost business model. However, in February 2022 Renault announced it would launch a pure electric Dacia vehicle in 2024, although it remains to be seen whether it will be produced in Romania or elsewhere. For now, the brand's only battery electric vehicle, the Spring, is imported from China. In the absence of high volumes, a scenario in which a pure electric Dacia vehicle is produced elsewhere in Europe is very much a possibility.

Powertrain and transmission manufacturing

Regardless of the pace of electrification, Romania's vehicle assembly plants should not be affected in the long term; indeed, IHS Markit forecasts show no major decline in volumes which means assembly employment should remain stable or even increase. The same cannot be said for powertrain plants for which the decline is expected to be quite dramatic in Romania, with both of the country's captive engine plants (Ford Craiova and Dacia Mioveni) producing significantly lower volumes by the end of the decade and a strong decline after the 2024 peak (Figure 8).

Behind these forecasts lie several factors. First, the sourcing of EV powertrains from OEMs' core countries: Germany for Ford; France (prospectively) for the Renault-Nissan-Mitsubishi Alliance. Second, those captive engine plants are forecast to convert from ICE to mostly mild hybrid engine production at lower volumes, with OEMs sourcing most of their full hybrid powertrains from other sites. Third, export opportunities would dwindle as pure electric vehicles gain market share in Europe

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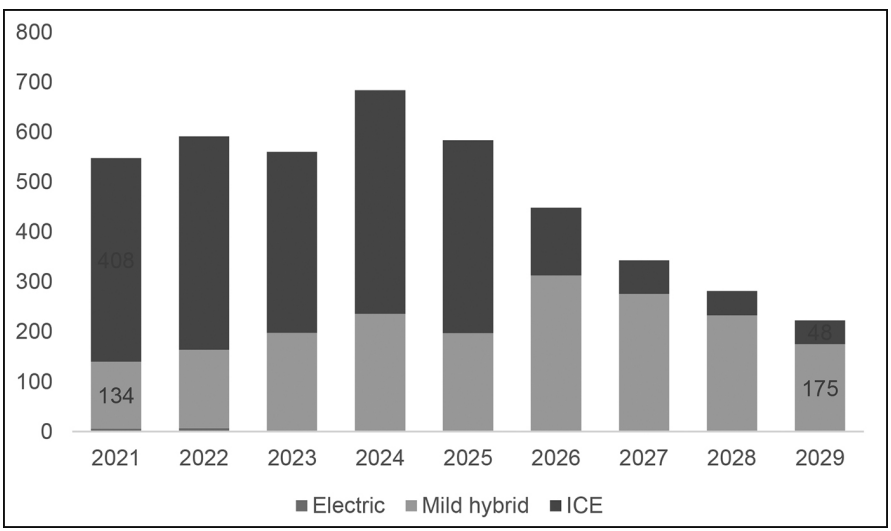
and while the engine plants do not make the transition to pure electric powertrain production.

The situation is yet more complicated for transmission plants. Predominantly, pure electric vehicles have transmissions integrated into their electric drive units, which means that plants specialising in transmission manufacturing face a highly uncertain future. Indeed, forecasts from February 2022 show a significant decline in transmission production volumes during the second half of this decade, with the two Romanian plants especially affected by the shift to electrified powertrains. Dacia transmission volumes are expected to decline with the shift to full hybrids, which is not surprising if local engine manufacturing does not itself transition to full hybrids. For Daimler's transmission production in Romania, the prospects are even worse since the group is likely to make a full EV transition faster than OEMs operating in lower price segments, while its operations in Romania are geographically isolated from the group's vehicle assembly plants. Due to this latter factor, a transition to e-drive manufacturing is difficult to envisage since it is unlikely that bulky and heavy e-drives would be shipped in large volume over long distances. Conversion to smaller parts for EV powertrains might still be an option, but this would in any case be a downgrade for Romania in terms of complexity and value added.

Figure 8 – Engine production volume forecast by type (000)



Battery manufacturing

At least in principle, battery manufacturing offers job creation opportunities for suppliers within the BEV value chain.

However, Romania has not recorded any significant investment in battery cell manufacturing on its territory to date. For example, the future BEV versions of Ford's models assembled in Craiova will apparently source their battery cells from

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Hungary, which benefits from the presence of Korean cell manufacturers Samsung SDI (3 GWh) and SK Innovation (7.5 GWh in 2022), as well as the presence of major German OEM assembly lines.

Moreover, the Romanian public authorities have so far shown limited interest in developing local large-scale battery manufacturing operations. Even the National Recovery and Resilience Plan is vague on this subject, aiming to foster the growth of local battery manufacturers but without any clear targets or assessments of viability. At present, the only battery specialist in Romania is Rombat, which has historically produced 12V vehicle batteries and which is now trying to develop its capabilities in the manufacture of battery cells in collaboration with a local start-up. Rombat is, however, a relatively small company with limited financial capacity and it cannot make investments on the scale required. A significant increase in pure electric vehicle volumes at either Mioveni or Craiova is difficult to imagine in the absence of local battery production capabilities, but this is unlikely to happen before the end of this decade.

Expected employment effects

As discussed above, the share of automotive employment in total manufacturing employment in Romania is among the highest in the EU: in absolute terms, before the pandemic the automotive industry directly hired 180 000 people in Romania.

Existing assessments of the employment impact of electrification vary widely. For instance, a recent PwC (2021) study for CLEPA highlights the potential job impact of an EV-only scenario. Here, based on the European Commission's 'Fit for 55' proposals for the reduction of CO_2 emissions, PwC anticipates a 43 per cent net decrease in ICE-related jobs (i.e. 203 000 job losses) between 2020 and 2040 within the EU/UK/EFTA. For Romania, the study predicts that ICEV employment would increase first by 57 per cent (32 000 job gains) between 2020 and 2030 (due to hybrid transition), but then fall sharply with a net loss of 49 per cent of the workforce (28 000 losses) in 2040 compared with 2020.

Electrification should not have a negative impact on employment in vehicle assembly plants. Indeed, since vehicle production volumes are forecasted to increase, we can expect employment also to increase, perhaps less visibly in plants that, today, have a relatively low level of automation, such as Dacia.

If current forecasts prove realistic, however, the impact of electrification should be strongly negative for employment in powertrain plants. In Romania, Daimler's two transmission plants employ around 3000 people, Ford has approximately 1000 people working in engine assembly in Craiova and 4000 people work in Dacia's powertrain plant. Overall, therefore, around 8000 jobs (or 4.4 per cent of total automotive employment) are directly at risk in a full electrification scenario and if no pure electric powertrain capacities are developed in Romania. Such a scenario is actually highly unlikely, since both Ford and Dacia should, in any case, maintain some powertrain employment (in battery pack assembly, for example). Strictly based on volume forecasts, employment in engine manufacturing could decline by as much as 70 per cent by 2028.

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The impact on transmission manufacturing employment could be even more severe (a drop of 75 per cent by 2028), with comparatively worse prospects in the longer term. The potential loss of these jobs would have significant negative implications beyond these numbers since these are highly complex activities in comparison to the rest of the Romanian automotive industry.

Beyond engine and transmission plants, the impact of electrification for suppliers is difficult to assess with precision. Looking at Romania's automotive export profile, apart from gearboxes, components which are directly tied to ICE powertrains (ICE pumps, exhaust components, radiators, filters, ignition parts) have a low share in total exports. Wiring and cable harness manufacturing is the most significant export product and is also by far the most important sector in terms of employment. Even if much of the wiring produced today is for ICE powertrains, electric vehicles will require more wiring, and certainly not less, which means there is no automatic risk to these jobs in Romania. Some job losses might happen, however, if companies decide that product changes bring opportunities to relocate production in countries with even lower labour costs, such as Moldova or Serbia, where the automotive wiring industry has been growing in recent years.

The impact of powertrain electrification on direct automotive employment in Romania should be limited from a quantitative point of view, even if some job losses are unavoidable in the light of forecasts showing no substantial investments in EV powertrain manufacturing capacities. The immediate and direct impact would primarily concern engine and gearbox plants. Indirectly, electrification could offer companies an opportunity to reshuffle their investments geographically and some sites in Romania could suffer due to product reallocation.

The impact on the ground could nonetheless be severely felt given the high geographic concentration of automotive employment. In Argeș county, for example, almost 28 000 people (18 per cent of all employees) work in the automotive industry, around half of them being directly employed by Dacia. The two Daimler gearbox plants are in Alba county, which has a relatively low share of automotive employment (4.3 per cent). Other counties in the central and western regions of the country are much more heavily dependent on automotive employment and, even if there is no clearly visible risk for most of them at this time, the lack of a clear approach to the challenges of electrification on the part of both the regional and the central authorities raises some concern. In contrast to OEMs, most suppliers have limited sunk investments and have, so far, focused on pure assembly operations based on labour cost advantages. Moreover, many of the initial investments were generously subsidised via state aid, with the government pursuing purely quantitative employment targets. These companies thus have limited incentives to pursue potentially costly large-scale transformations, while the government would have to consider qualitative industrial transformation goals and possibly make significantly larger funds available. For the moment, such possibilities are entirely theoretical.

Conclusions

The automotive industrial profile of Romania is in many ways typical of central and eastern Europe: high dependency due to foreign ownership; very strong growth

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over the past decades, resulting in increasing economic and social importance at national level; and export specialisation driven by labour cost advantages versus western Europe. The Romanian automotive industry is nonetheless very different from that of Hungary, Czechia, Slovakia or Poland, the main difference being that vehicle manufacturing is dwarfed by automotive suppliers exporting primarily to Germany. Within this landscape, Romania has become Europe's number one manufacturer of automotive wiring and cable harnesses.

Marketwise, the overall landscape in both countries is likewise typical of CEE: low sales volumes of new vehicles due to low disposable incomes; a very high share of used vehicles imported from western Europe; and aging and relatively more polluting vehicle fleets. Importantly, Romania has become a major destination for diesel vehicles offloaded by western Europeans in the wake of the Dieselgate scandal. At the same time, sales of electric vehicles remain subdued due to low incomes and despite substantial government incentives. The prospects of this situation being reversed are far from positive and the task has thus far proven to be beyond the government. The very weak development of charging infrastructures compared to other EU countries is a good example of these difficulties.

Given these industrial and market features, it is difficult to imagine a scenario in which powertrain electrification (in terms of both manufacturing and sales) would not be delayed. If for vehicle manufacturing per se we are likely to be talking about a delay of a few years, but overall the same trajectory as in western Europe, there is nevertheless much more uncertainty regarding the large supplier industry. In Romania the manufacture of ICE transmissions and components has soared over the past decade but there is little indication of any investments replacing these activities that are bound to disappear as electrification progresses.

There are reasons why a smooth transition to electrified powertrains is bound to face particularly significant headwinds: the country's fiscal weaknesses mean that it could struggle to muster the necessary resources to invest in infrastructure, technology and market stimulus, not least in developing battery manufacturing competences and facilities which could, at least to some extent, compensate for job losses in other areas.

Estimates on the employment impact of electrification range from the insignificant to the dramatic. According to our own assessment, the direct employment impact of the loss of engine and transmission manufacturing would be of less than five per cent of total automotive employment. In the context of low-cost industrial specialisation, however, the loss of these jobs would be much more significant, since these are highly skilled and high value added jobs of which Romania is much in need. The geographical concentration of these jobs also raises important questions concerning the full social and economic impact of job losses in ICE technology manufacturing. So far, sadly, these questions have not sparked major public debates nor stimulated adequate policy responses.

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