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## Editorial

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### Tommaso Pardi

Ecole Normale Supérieure de Paris – Saclay,  
Bât Lapalace, 61, Avenue du Président Wilson,  
94235 Cachan Cedex, France  
Email: [tpardi@ens-paris-saclay.fr](mailto:tpardi@ens-paris-saclay.fr)  
Email: [tpardi@gerpisa.ens-cachan.fr](mailto:tpardi@gerpisa.ens-cachan.fr)

### Giuseppe Giulio Calabrese\*

CNR-IRCrES,  
Via Real Collegio, 30, 10024 Moncalieri, Italy  
Email: [giuseppe.giulio.calabrese@ircres.cnr.it](mailto:giuseppe.giulio.calabrese@ircres.cnr.it)  
\*Corresponding author

**Biographical notes:** Tommaso Pardi is a senior researcher at the CNRS (IDHES), France, and Director of Gerpisa Network of Research on the Car Industry. He is teaching Economic Sociology at the ENS Paris – Saclay. His main areas of research are economic sociology, sociology of markets, organisational studies and sociology of work with a particular focus on the automotive industry. His current projects concern Industry 4.0, the EV revolution and the reorganisation and internationalisation of automotive R&D.

Giuseppe Giulio Calabrese is a senior researcher at the CNR-IRCrES (Research Institute on Sustainable Economic Growth of the National Research Council, former CNR-Ceris) of Moncalieri, Italy which he joined in 1988. He taught as a Visiting Professor in Managerial Economics at the University of Turin and Polytechnic of Turin. He is the Editor-in-Chief of the *International Journal of Automotive Technology and Management* and member of the International Steering Committee of Gerpisa. His main areas of research are focused on industrial organisation, SMEs, technological innovation, industrial policy, balance sheets analysis and automotive industry.

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Two years after the beginning of the COVID crisis, its impact on the automotive industry is still unclear. On the one hand, massive state interventions have softened the simultaneous demand and supply shocks generated by national lockdowns and we will probably see their real damages on companies and jobs only when these exceptional measures will fade away. On the other hand, the collateral disruptions of the supply chain (the global chip shortage) triggered by the COVID crisis have blurred the picture making difficult to understand what is due to what and where the industry will eventually stand when things go back to ‘normal’.

However, it is already clear that the COVID crisis has contributed in accelerating a series of transformations that the automotive industry was already undergoing before the crisis. In this special number, we look in particular at two of them: the electrification of vehicles and the digitalisation of manufacturing processes that have become more prominent during the last two years.

Electrification is finally coming and is coming faster than we expected with governments and OEMs both rushing to announce the end of the production and sales of ICE cars by 2030–2035. In a similar way to the impact of the 2008 financial crisis, the states' interventions to support national automotive industries triggered by the pandemic have increased the pressure on OEMs to reduce emissions and accelerate their green transitions. In such, an accelerated context is extremely difficult to keep track of what is happening in all the relevant technological domains involved: who is doing what, with whom and how different regulations and public policies shape these complex interactions.

In their paper, Margherita Russo, Fabrizio Alboni, Giovanni Bonifati, Jorge Carreto-Sanginés, Pasquale Pavone and Annamaria Simonazzi provide a useful empirical tool to map these dynamic and fast evolving territories of technological innovation. By developing a multidimensional textual analysis of the news published on *eletrive.com* between 09/2018 and 08/2021, the paper proceeds to identify eight main clusters related to topics such as battery production, charging infrastructure or electric motor performance. In each cluster, the analysis shows which are the main actors involved – mainly business companies, but also professional associations, national research institutes, government organisations and institutions – and what type of artefacts they are connected to – electric vehicle models, specific battery technologies, new plants, etc. The paper brings forward at least two interesting complementary results: on the one hand, most of the companies represented in the sample belong to the traditional automotive industry highlighting the key role that electrification has taken in OEMs strategies; on the other hand, new actors, coming in particular from the information and technology sector, occupy a more central place in the factorial map of topics, suggesting a more active role in shaping these new technological domains.

Amongst the new actors linked with electrification, the most important ones for the time being appear to be the battery producers. Batteries represent on average 40% of the value of a battery electric vehicle and their production is assured by a limited number of already large and fast growing companies mostly located in China where 73% of the global lithium-ion battery production capacity was installed in 2019. In their paper, Xieshu Wang, Wei Zhao and Joël Ruet focus on this new and still relative unknown industry for the automotive sector. They try to understand why China has taken such a significant lead in its development. They identify two main driving forces. First, the long-term New Energy Vehicle Policy introduced by the Central Chinese Government in 2010 that has acted as a catalyser for the growth of both the domestic electric vehicle and battery industries. Second, the specific strategy of 'specialised vertical integration' developed by Chinese companies all along the lithium-ion battery value chain. This has consisted in developing vertical integration as a way to reinforce the dominant position of each company in their original sector of production (extraction, refining, cells production, etc.) by rapidly scaling up production capacity and developing new products and technologies. As a result of both these driving forces that have successfully combined market protection, regulatory pressure and fierce technological competition, the Chinese battery industry is now consolidating in each segment of the value chain around few major actors that have already acquired a global footprint and the strategic control of key resources and technologies.

The global dominant position achieved by the Chinese battery industry raises important questions for all the other global players, and in particular for the North American and European automotive industries that lag significantly behind as far

as battery production is concerned. These questions however do not only concern the battery sector, but more generally the capacity of these national industries and of their respective governments of successfully transforming the automotive sector in a carbon free industry while keeping their competitive positions.

As highlighted by Patrik Gažo, the winner of the 2021 Young Author Prize of Gerpisa, and by his co-authors Monika Martišková and Thomas S.J. Smith, the idea that the rapid transition from production of ICE vehicles to BEVs is a win-win solution for both industry and climate needs a reality check. The question here is not only to understand whether electrification represents a viable industrial future for all the countries involved in the production of cars, but also if electrification will be, from this perspective, enough to achieve carbon neutrality. The paper focuses on the case of Czechia and Slovakia where the automotive industry is one of the most important economic sectors and analyses how different stakeholders of the automotive industry consider these crucial questions. It identifies three important barriers of transformation to an ‘ecological mobility industry’. The first barrier concerns the role of public policies: while all the stakeholders agree that the state should play a central role in the transformation, they consider that the key regulations that are steering the greening of the industry are made in Brussels by the European Union, and what is left for the Czech and Slovak governments is how to deal with the consequences of these regulations, in particular in terms of retaining investments and jobs. The second barrier is related to the massive foreign control of the automotive industry in these countries, which means that all the strategic decisions concerning the ecological transformation of the sector are taken elsewhere and that local stakeholders have very little influence on them. Because of these two barriers, what could be still done at the national and regional level to seize the initiative and develop domestic strategies towards an ‘ecological mobility industry’ have failed so far to emerge, as actors do not consider these alternative strategies as political and economic viable. This lack of institutional and economic entrepreneurship constitutes therefore a third barrier that reinforces path dependency. In other terms, if the fast track to electrification driven by European regulations and pursued by transnational OEMs does not prove to be viable for semi-peripheral countries such as Czechia and Slovakia, there does not seem to be a Plan B rather than keep fighting for foreign investments on the basis of low labour and production costs.

In such a context, semi-peripheral countries appear to be trapped in the perpetual search for cost competitiveness. A remark that brings us to the second major transformation covered by this special number: the digitalisation of manufacturing. As electrification is spreading, OEMs are looking at ways of digesting the extra costs – estimated at around €10 k per vehicle – represented by BEVs and PHEVs by comparison with equivalent ICE vehicles. Can the Industry 4.0 concept lives up to the expectations and delivers the extra productivity gains required to make the electric vehicles accessible and profitable? And how the digitalisation of automotive manufacturing is impacting work, employment and the relative competitiveness of national industries and major car companies?

In their paper, António B. Moniz, Marta Candeias and Nuno Boavida provide a detailed overview of the ongoing digital transformation of the Portuguese automotive industry by combining the statistical analysis of macro-economic data with the qualitative inputs from case studies. They find evidence of a positive correlation between increasing investments in automation and artificial intelligence, productivity gains and the growth of

both production and employment in the Portuguese automotive sector. Yet, most of these investments appear to be linked to the shortage of workers willing to perform physically and/or repetitive tasks rather than to a digitally driven transformation of manufacturing activities. While these investments do not result in workers' substitution with machines, they do entail a process of skill re-composition highlighted by the fast growing proportion of higher educated and qualified workers in the employment structure of the Portuguese automotive sector. The paper also notes that despite the relatively significant effects of this process of digitalisation and automation on work organisation and skills composition, the Portuguese social partners have not developed yet any concrete proposals to deal with these transformations.

In the case of the Italian automotive industry analysed by Angelo Moro and Maria Enrica Virgillito, the role of trade unions appears to be more prominent in the negotiation of the introduction and deployment of digital manufacturing technologies. Nevertheless, corporate strategies and productive models still play here a structural role in defining the way in which digitalisation is implemented. Moro brings forward an interesting opposition between 'premium' factories in Emilia Romagna (Lamborghini and Ducati both owned by the Volkswagen Group) and the mass production factories of FCA (now Stellantis) in the North and Centre-South of Italy. In the former, digital technologies (MES software, collaborative robots, M2M communication, AGVs, etc.) have been introduced in a more systematic way with the main purpose of simplifying production processes and increasing quality control and flexibility. In the latter, they have been introduced in a much more scattered way and have been mainly focused on increasing labour productivity by making assembly work more intense. In both cases however, Moro does not find any trace of 'revolutionary' transformations, but rather a continuous historical trend of 'leanification' of production processes. In other terms, the effects of digitalisation on manufacturing appear to have much less to do with the technologies per se than with the social and organisational contexts in which they are introduced. A conclusion that contributes to a growing literature on these topics that both dismisses the 'Industry 4.0' narrative and highlights the central role that power relations and social and organisational dimensions play in this evolutionary process.

Within the Gerpisa network, this renewed research interest towards the transformation of work and employment driven by electrification and digitalisation has led to the creation of a working group that is now part of our new international programme. We have also created two other working groups that focus on 'value chains, emerging players and the global south' and on 'the battery industry and the electric vehicle value chain'. The goal of these three research groups is to build longer-term collaborations and to produce joint publications, including future special numbers of *IJATM* and you are all welcome to join in.<sup>1</sup>

We are also very happy to announce that our next international colloquium that will take place between the 14th and the 17th of June 2022 in Detroit will be organised in person. The 2020 and 2021 international colloquiums of Gerpisa were both 'virtual' due to the COVID pandemic. Virtual colloquiums have obvious drawbacks in particular for a research network as ours that relies on social connections and interactions to build collective research. They have though at least one advantage: if you have missed them, you can still watch all the recorded presentations and plenary sessions on our website, including those of the articles of this special number.<sup>2</sup> But we are of course all looking forward to meet again in person for what is going to be a very special colloquium as we are going to celebrate the thirty years of our international network at the time when the

study of the global automotive industry could not be more exciting and more important for the future of our societies.

## Notes

- 1 *The 8th International Programme of Research of Gerpisa – (R)Evolution. The Post-Covid Transformations of the Global Automotive Industry* [online] <https://gerpisa.org/en/node/6693>.
- 2 The 2020 Colloquium is available here: <https://gerpisa.org/en/node/6100>, and the 2021 here: <https://gerpisa.org/en/node/6479>.