Technology transfer and economic partnerships between European and Chinese companies in the automotive industry – the case of Connected and Autonomous Electric Vehicles

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List of Abbreviations and Acronyms

ADAS - Advanced Driver Assistance Systems

BIS - Bureau of Industry and Security

BIT - Bilateral Investment Agreement

CAAM - China Association of Automobile Manufacturers

CAEV - Connected and Autonomous Electric Vehicle

CAI - Comprehensive Agreement on Investment

CAV - Connected and Autonomous Vehicle

CPTPP - Comprehensive and Progressive Agreement for Trans-Pacific Partnership

DRAC - Dongfeng Renault Automobile Company

ETSI - European Telecommunications Standards Institute

EV - Electric Vehicle

FCA - Fiat Chrysler Automobiles

FDI - Foreign Direct Investment

FTA - Free Trade Agreement

FTT - Forced Technology Transfer

GAC - Guangzhou Automobile Group Co.

GAC FCA - GAC FIAT CHRYSLER Automobiles Co., Ltd

GATS - General Agreement on Trade in Service

GWM - Great Wall Motor

IoV - Internet of Vehicles

ICE - Internal Combustion Engine

ICT - Information and Communications Technology

IPR - Intellectual Property Right

JAC - Jianghuai Automobile Co.

JMCG - Jiangling Motors Corporation Group

JV – Joint Venture

LiDar - Light Detection and Ranging

LCV - Light Commercial Vehicle

MIC 2025 - Made in China 2025

MIIT - Ministry of Industry and Information Technology

MoU - Memorandum of Understanding

NEV - New Energy Vehicle

OECD - Organisation for Economic Co-operation and Development

R&D – Research and Development

SEP - Standard Essential Patent

SMIC - Semiconductor Manufacturing International Corp

TRIPS - Agreement on Trade-Related Aspects of Intellectual Property Rights

TSMC - Taiwan Semiconductor Manufacturing Company

UNCTAD - United Nations Conference on Trade And Development

V2X - vehicle to anything

WIPO - World Intellectual Property Organization

WHO - World Health Organization

WTO - World Trade Organization

Introduction

The global automotive industry is currently experiencing a period of profound transformation. Following the emergence in the national agendas of developed and developing countries of the environmental pollution as a global issue and international commitments such as the Paris Agreement on climate change of 2016, leading automobile manufacturers are reducing their production of Internal Combustion Engine (ICE) vehicles and concentrating the efforts in developing New Energy Vehicles (NEVs), a category adopted in China that include pure electric vehicles, hybrid vehicles, fuel cell vehicles and solar electric vehicles[1]. Simultaneously, big steps have been made toward producing autonomous driving and driverless cars. According to Vaidya and Mouftah, a Connected and Autonomous Vehicle (CAV) has the technology to «communicate with nearby vehicles, infrastructure, as well as objects» and is «capable of driving itself without human intervention»[2]. Specifically, CAVs sense the environment using devices that include radars, Light Detection and Ranging (LiDar), image sensors and 3D camera. Furthermore, CAVs are connected to infrastructures and other vehicles (vehicle to anything or V2X) through the Internet[3]. SAE International, a global association of engineers based in the US, defines as standards six «Levels of Driving Automation»: level 0, no automation; level 1, either steering or brake/acceleration support are provided; level 2, both steering and brake/acceleration support provided; level 3 and 4, a set of features can autonomously drive the vehicles under limited conditions; level 5, the vehicle is fully automated[4].

Connected and Autonomous Electric Vehicles (CAEVs) are the frontiers of the automotive industry. These vehicles will not only promote more sustainable mobility by reducing gas emissions, but also enhance safety due to the elimination of accidents caused by human error and improve the traffic flows. This research aims to study and analyse cases of technology transfer between European and Chinese companies in these sectors. Therefore, the first chapter will give an overview of selected partnerships between European and Chinese actors, while the second and third chapters will explore relevant international agreements on technology transfer and propose a final assessment of the deals investigated.

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[1] T. ZHANG, C. MA, C. YONG, *Development Status and Trends of New Energy Vehicles in China*, 4th International Conference on Energy Science and Applied Technology, AIP Publishing, 2019. Retrieved from: https://aip.scitation.org/doi/pdf/10.1063/1.5089054.

[2] B. VAIDYA, H. T. MOUFTAH, *Connected Autonomous Electric Vehicles as Enablers for Low-Carbon Future*, IntechOpen, 2019, p.1. DOI: http://dx.doi.org/10.5772/intechopen.84287.

[3] *Ibidem*.

[4] *SAE International Releases Updated Visual Chart for Its "Levels of Driving Automation" Standard for Self-Driving Vehicles*, SAE International, 11 December 2018. Retrieved from: https://www.sae.org/news/press-room/2018/12/sae-international-releases-updated-visual-chart-for-its-%E2%80%9Clevels-of-driving-automation%E2%80%9D-standard-for-self-driving-vehicles.

I. Latest developments of European-Chinese economic partnerships in the automotive sector

In recent years, several economic partnerships have been established between European and Chinese automotive and automotive components producers. For instance, Shenzhen-based Huawei Technologies has recently signed an economic agreement of collaboration with the Franco-Italian STMicroelectronics. ST is a company specialised in semiconductor technologies and manufacturing microchips for the automotive sector, such as audio amplifiers, Advanced Driver Assistance Systems (ADAS) solutions[5], automotive infotainment, clocks, timers and sensors[6]. The firm has its headquarters in Geneve, Switzerland, and its main shareholder (27.5 per cent of the shares) is STMicroelectronics Holding B.V., a joint venture owned 50 per cent by the Ministero dell'Economia e delle Finanze of Italy and 50 per cent by Ft1Ci, a consortium composed by Bpi France and the French Atomic Energy Commission[7]. According to the magazine Nikkei Asian Review[8], the partnership between Huawei and STMicroelectronics will be focused both on the production of mobile and automotive processors.

For Huawei the rationale of this collaboration is twofold. On the one hand, the economic deal with STMicroelectronics represents an opportunity for the Chinese company to strengthen its credentials in the sector of automotive semiconductors, particularly in regard to autonomous driving. On the other hand, the partnership could shield Huawei and its chipmaker division HiSilicon from the restrictions that the US Commerce Department has implemented against the company[9]. Particularly, Huawei could obtain access to the software developed by Synopsys and Cadence Design Systems, two US software developers that were obliged by the US Department of Commerce to not to sell their products to the ICT firm.

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[5] ADAS is a technology that provides the vehicles with functions to assist the driver in dangerous situations. Retrieved from: https://www.mobileye.com/our-technology/adas/.

[6] Information retrieved from the official website of STMicroelectronics. Link: https://www.st.com/content/st_com/en.html.

[7] M. COLOMBO & G. CARETTO, *STMicroelectronics, cosi Italia e Francia lavoreranno con Huawei*, Start Magazine. Retrieved from: https://www.startmag.it/innovazione/stmicroelectronics-cosi-italia-e-francia-lavorano-con-huawei/.

[8] C. TING-FANG & L. LI, *Huawei strikes European chip tie-up as fears rise over US curbs*, Nikkei Asian Review, 28 April 2020. Retrieved from: https://asia.nikkei.com/Spotlight/Huawei-crackdown/Huawei-strikes-European-chip-tie-up-as-fears-rise-over-US-curbs.

[9] D. SHEPARDSON & K. FREIDFELD, *New U.S. restrictions on 33 Chinese firms and institutions take effect June 5*, Reuters, 3 June 2020. Retrieved from: https://www.reuters.com/article/us-usa-china-blacklist/new-us-restrictions-on-33-chinese-firms-and-institutions-take-effect-june-5idUSKBN23A2LG#:~:text=New%20U.S.%20restrictions%20on%2033%20Chinese%20firms%20and%20institutions%20take%20effect%20June%205,-David%20Shepardson%2C%20Karen&text=WASHINGTON%2FNEW%20YORK%20(Reuters),month%20will%20take%20effect%20Friday.

Apart from this case, a similar partnership has been established in April 2019 between the Dutch NXP Semiconductors N.V and the Chinese Hawkeye Technology Co. The two companies will jointly develop radars for the automotive market, specifically in the sector of the autonomous driving technologies in China[10]. Hawkeye is a start-up at the forefront of automotive sensors that has established a joint research center with Southeast University in Nanjing and developed a 77Ghz radar capable to detect crashes with an accuracy below the millimetre.

The cooperation agreements between European and Chinese Information and Communications Technology (ICT) enterprises for the production of the most advanced auto components available today should be inserted in the context of the rapid growth of CAEVs market. Indeed, according to a report of the International Energy Agency[11], the global stock of electric cars reached five million in 2018, an increase of 63 per cent compared to 2017. Around 2.3 million vehicles, the 45 per cent of the total, were sold in China, while Europe and the US accounted respectively for 24 and 22 per cent of the total. Moreover, the market is expected to grow sharply in the future, reaching 44 million electric vehicle sales per year for a total of 250 million EVs in circulation by 2030.

Consequently, this outlook opens up to a series of great opportunities and tremendous benefits both for European and Chinese markets and it is no surprise that important partnerships have been signed between the two sides today.

For instance, the Chinese state-owned automotive company FAW Group[12], together with the Chinese province of Jilin and Silk EV, an automotive engineering and design company, has announced to invest over one billion euros for designing, engineering and manufacturing electric luxury sports cars in the Region Emilia-Romagna in Italy. The investment, the first that FAW has promoted outside China, has been disclosed in May 2020 during a videoconference held by Manlio di Stefano, subsecretary of the Minister of Foreign Affairs of Italy, Vincenzo Colla, an officer of the region Emilia-Romagna, and Chinese authorities[13]. Previously, a joint venture between FAW and Silk EV had been established through a memorandum of understanding signed on 23 April 2020. FAW and Silk EV plan to build an Innovation, Research & Development Center and a Design Center in

[10] *NXP and Hawkeye Target Rapid Growth in Chinese Automotive Radar Market*, Nxp.com, 16 April 2019. Retrieved from: https://media.nxp.com/news-releases/news-release-details/nxp-and-hawkeye-target-rapid-growth-chinese-automotive-radar.

[11] International Energy Agency, *Global EV Outlook 2019*, May 2019. Retrieved from: https://www.iea.org/reports/global-ev-outlook-2019.

[12] FAW is the first automotive manufacturer in China with sales accounting for four million of vehicles sold in China and USD 90 billion of revenues. Retrieved from: https://www.regione.emilia-romagna.it/notizie/2020/maggio/sviluppo-i-cinesi-faw-e-silk-ev-insieme-in-emilia-romagna-per-lo-sviluppo-di-auto-elettriche-con-oltre-1-miliardo-di-euro-colla-la-motor-valley-pronta-ad-accogliere-importanti-investimenti-legati-allinnovazione-tecnologica-e-lo-sviluppo-sostenibile.

[13] S. CARRER, *Auto elettriche di alta gamma: il big cinese Faw investe un miliardo in Emilia in tandem con Silk Ev*, Il Sole 24 Ore, 12 May 2020. Retrieved from: https://www.ilsole24ore.com/art/i-cinesi-faw-investono-miliardo-emilia-AD7jELQ.

the Motor Valley, an industrial motor district located in the aforementioned Italian region[14]. Hiring is expected to start by the end of June 2020. The new FAW sports cars will be produced under the brand Hongqi and will implement 5G technology from Huawei[15].

Concerning the Chinese EV market, many Italian companies working in the automotive and automotive parts sectors have recently decided to invest in the production of CAEVs. In this regard, Fiat Chrysler Automobiles (FCA) has confirmed to be discussing with Hon Hai Precision Industry, the world's largest contract electronics manufacturer and parent of the Taiwanese Foxconn[16], the constitution of a joint venture for the development and production of EVs and the Internet of Vehicles (IoV) in China for the Chinese market[17]. The joint venture would be equally held 50 per cent by FCA and Hon Hai. Particularly, FCA would work together with Fit Hon Teng, an automotive components manufacturer, and Fih Mobile, a subsidy of Hon Hai specialised on software solutions for EVs[18].

If effectively reached, the economic deal would be very profitable for both sides. For Hon Hai the partnership would entail differentiating its business with the entrance in the growing sector of the EV and its components, considering also a decrease in the sales in the smartphone market (Hon Hai is an important supplier of Apple)[19]. Regarding FCA, the joint venture would strengthen its position in the EV market in China[20]. In this regard, on 4 March 2020 the company based in Turin, which is currently negotiating a merger with PSA Group in order to create the fourth largest automotive company in the world, has presented its first full-electric vehicle, the Fiat Nuova Cinquecento[21]. The upcoming car implements also the

[14] *FAW-Silk EV, jv investe 1 miliardo di euro in Emilia-Romagna*, Ansa, 13 May 2020. Retrieved from: https://www.ansa.it/canale_motori/notizie/industria/2020/05/13/faw-silk-ev-jv-investe-1-miliardo-di-euro-in-emilia-romagna_379a941d-7569-46a3-bd67-cc734d882c71.html.

[15] F. BECHIS, *Via della Seta, così l'Italia farà sfrecciare in Europa l'auto di Xi Jinping*, Formiche. Retrieved from: https://formiche.net/2020/05/faw-group-cina-emilia-auto-xi/.

[16] *Foxconn is technology firm particularly focused on Cloud Computing, Mobile Device, Internet of Things, Big Data, AI and Smart Networks*. Retrieved from: https://www.foxconn.com/en/GroupProfile.html.

[17] FCA, *FCA conferma le discussion con Foxconn*, 17 January 2020. Retrieved from: https://www.fcagroup.com/it-IT/media_center/fca_press_release/FiatDocuments/2020/january/FCA_conferma_le_discussioni_con_Foxconn.pdf.

[18] G. CARETTO, *Ecco cosa faranno Fca e la cinese Foxconn nelle auto elettriche*, Start Magazine. Retrieved from: https://www.startmag.it/smartcity/fca-foxconn/.

[19] C. TING-FANG & L. LI, *Foxconn to make electric cars in China with Fiat Chrysler*, Nikkei Asian Review, 17 January 2020. Retrieved from: https://asia.nikkei.com/Business/Technology/Foxconn-to-make-electric-cars-in-China-with-Fiat-Chrysler.

[20] K. HILLE, *Taiwan's Foxconn to tie up with FCA in electric vehicle push*, Financial Times, 17 January 2020. Retrieved from: https://www.ft.com/content/bb962204-38db-11ea-a6d3-9a26f8c3cba4.

[21] FCA, *Nasce la nuova 500*, 4 March 2020. Retrieved from: https://www.fcagroup.com/it-IT/media_center/insights/Pages/new_fiat_500_electric.aspx.

level 2 of the SAE framework for autonomous driving, which introduces some driverless functions[22].

FCA consolidated its presence in China since the last decade, when together with Guangzhou Automobile Group Co. (GAC)[23] founded the GAC FIAT CHRYSLER Automobiles Co., Ltd (GAC FCA). The equal joint venture has been established on 9 March 2010 and it is headquartered in the Changsha Economic and Technological Development Zone of Hunan[24]. In 2016, the GAC FCA Guangzhou plant started the production of Jeep Renegade, the second FCA SUV after the Jeep Cherokee to be commercialised in China[25]. In November 2019, GAC FCA has launched the Jeep Commander PHEV, the first Hybrid vehicle developed by the Joint Venture for the Chinese market with an operating range in electric mode of 70 km[26].

According to a Position Paper of the Automotive Working Group of the European Union Chamber of Commerce in China, in 2018 China's automotive market – the largest in the world – declined approximately 3 per cent compared to 2017, after 10 years of constant growth[27]. Specifically:

> The production and sales volumes of automobiles reached 27.81 million and 28.08 million units in 2018, down 4.16 per cent and 2.76 per cent year-on-year, respectively. For passenger cars, production and sales registered at 23.53 million and 23.71 million units, a drop of 5.15 per cent and 4.08 per cent respectively; and for commercial vehicles, the figures stood at 4.28 million and 4.37 million, up 1.69 per cent and 5.05 per cent respectively[28].

The reasons for the decline rely on a series of factors, including the end of policies to incentivise the purchase of cars and slowing economic growth. However, it is important to highlight that, at the same time, both the luxury cars and NEVs production and sales grew. Particularly, luxury cars reached 3,04 million in 2018, an increase of 11.6 per cent compared to the previous year. Concerning NEVs production and sales, in 2018 they both grew respectively 59.92 per cent (1,27 million vehicles) and 61.74 per cent (1,26 million) compared to

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[22] Apart from that, FCA is currently collaborating with Waymo (Google) to launch the first float of self-driving taxi (level 4 of SAE international framework) in the world through the sale of 62,000 Pacifica Hybrid vehicles. Retrieved from: https://www.fcagroup.com/it-IT/innovation/Pages/future_mobility.aspx.

[23] GAC is one of the six largest automobile groups in China and it is controlled by the Government. Retrieved from: http://en.gacfca.com/1.html.

[24] GAC FCA has an annual vehicle production capacity of 320,000 units and an annual engine production of 488,000 units. The joint venture has over 5,000 employees. Retrieved from: http://en.gacfca.com/1.html.

[25] FCA, *GAC FCA Celebrates Production Launch at New Jeep® Plant in Guangzhou, China*, 18 April 2016. Retrieved from: https://www.fcagroup.com/en-US/sustainability/fca_news/Pages/GAC_FCA_Celebrates_Production_Launch_at_New_Jeep_Plant_in_Guangzhou_China.aspx.

[26] G. GAVUZZO, *Jeep Commander PHEV: novità ibrida per la Cina*, Motorionline, 21 November 2019. Retrieved from: https://www.motorionline.com/2019/11/21/jeep-commander-phev-ibrida-cina/.

[27] European Union Chamber of Commerce in China, *Automotive Working Group Position Paper 2019/2020*, 2019.

[28] Ibidem, p. 171.

2017. Particularly, 984,000 units of EVs were sold, an increase of 50.8 per cent respect to 2017. At the same time, the auto components industry represented an important income for the Chinese economy as well, accounting for over USD 550 billion in May 2018[29]. For instance, due to the growth of NEVs production, in 2018 the EV battery business grew rapidly, increasing by 57 per cent respect to 2017.

Therefore, despite a decline in production and sales due to a cut of the Chinese government subsidies in the sector[30], in 2019 European and Chinese automotive and technology companies kept developing their cooperation to deliver innovative products. Unfortunately, in 2020 the Covid-19 outbreak has caused a significant drop in car demands and forced automakers to close their plants. In this regard, in April 2020 the China Association of Automobile Manufacturers (CAAM) stated that the sales of NEVs dropped over 50 per cent compared to a year earlier. Furthermore, according to the experts, the lockdown implemented due to the spread of the virus and the global economic recession that followed will probably delay investment, development and productions of NEVs[31]. To accelerate the recovery, national government and local authorities' policies to incentivise the industry will be necessary. Hence, it is partially positive the decision of the Chinese Finance ministry to extend the subsidies on NEVs to 2022, although reduced by 10 per cent compared to the previous years[32].

Notably, besides the cases illustrated above concerning FCA, German companies have been frontrunners in the race to develop partnerships with the Chinese automotive industry to produce NEVs. On 22 December 2017 Volkswagen, the largest foreign automaker in China with over four million vehicles sold in 2018, and the Chinese state-owned Jianghuai Automobile Co. (JAC) have formed the JAC Volkswagen Automotive Co. JAC Volkswagen is based in Anhui Province and it has been the first joint venture specifically dedicated to manufacturing NEVs, with a capital of RMB two billion[33]. On 10 July 2018, the Spanish SEAT, a subsidiary of the Volkswagen Group, signed a Memorandum of Understanding (MoU) and became a partner in JAC Volkswagen. According to the MoU, the three automotive companies are expected to build an R&D center in the city of Hefei, Anhui Province, focused on EVs and autonomous

[29] European Union Chamber of Commerce in China, *Auto Components Working Group Position Paper 2019/2020*, 2019.

[30] NEVs production and sales went down in overall respectively 3.4 per cent and 4 per cent respect of 2018. For further information, see: M. KRANE, *Chinese NEVs Market Slightly Declined in 2019: Full Report*, InsideEVs, 4 February 2020. Retrieved from: https://insideevs.com/news/396291/chinese-nevs-market-slightly-declined-2019/.

[31] *AUTOMOBILES. A look at business model transformation and decarbonization within the auto manufacturing sector*, Reuters, 19 May 2020. Retrieved from: https://graphics.reuters.com/DATA-ESG/AUTOS/ygdpzylllvw/.

[32] Y. SUN, B. GOTH, *China to cut new energy vehicle subsidies by 10% this year*, Reuters, 23 April 2020. Retrieved from: https://www.reuters.com/article/us-china-autos-electric-subsidies/china-to-cut-new-energy-vehicle-subsidies-by-10-this-year-idUSKCN225177.

[33] Volkswagen Group China, *JAC VOLKSWAGEN Automotive Co., Ltd*. Retrieved from: https://volkswagengroupchina.com.cn/en/partner/jacvolkswagen.

driving technologies within 2021[34]. In April 2019, Hefei authorities approved the JAC Volkswagen plan to invest USD 750 million in the construction of a new electric factory capable of producing 100,000 EVs per year[35]. Five months later, the joint venture launched its first model EV SOL E20X with a 4G wireless network connection[36]. In May 2020, Volkswagen has announced that plans to increase its share in JAC Volkswagen by investing around EUR one billion. The investment will allow the German company to increase its share in the joint venture by up to 75 per cent and take control of the management[37]. Aside from this joint venture, Volkswagen is planning to invest EUR one billion to become the largest shareholder with the 26 per cent of the stock of the Chinese battery manufacturer Gotion High-Tech[38].

Similar steps towards a full entrance in the Chinese market of the EVs have been taken by other important automakers. Indeed, in 2017 the Renault-Nissan Alliance (today Renault-Nissan-Mitsubishi Alliance) and Dongfeng Motor Group Co. formed the eGT New Energy Automotive, a joint venture specialised on developing and sell EVs in China[39]. eGT is held 25 per cent by Renault S.A., 25 per cent by Nissan and 50 per cent by Dongfeng. It is based in the city of Shiyan, Hubei Province. In Autumn 2019 Renault City K-ZE, the first EV model with an approximate range of 200 km developed and produced by the joint venture, debuted in China[40].

In July 2019, Renault S.A. invested EUR 128 million in JMEV, a subsidy to the Chinese state-owned Jiangling Motors Corporation Group (JMCG) focused on the production of EVs [41]. Hence, the subsidy has been today transformed into a joint venture owned 50 per cent by Renault, 37 per cent by JMCG and 13 per cent by the China Agricultural Development Construction Fund Corporation. On 14 April 2020, Renault has also announced its new strategy based on EVs and Light

[34] SEAT, *SEAT, il marchio leader del Gruppo Volkswagen in Cina*, Seat.ch, 10 July 2018. Retrieved from: https://www.seat.ch/it/azienda/news/company/china-jac-volkswagen-group.html.

[35] Y. SUN & N. SHIROUZU, *Volkswagen plans electric vehicle plant with JAC in China: local government*, Reuters, 25 April 2019. Retrieved from: https://www.reuters.com/article/us-vw-china/volkswagen-plans-electric-vehicle-plant-with-jac-in-china-local-government-idUSKCN1S114S.

[36] Hu, *JAC-Volkswagen Finally Launch SOL E20X, The 1st EV from the Joint Venture*, chinapev.com, 28 September 2019. Retrieved from: https://www.chinapev.com/jac/jac-volkswagen-finally-launch-sol-e20x-the-1st-ev-from-the-joint-venture/.

[37] C. RANDALL, *VW to take over majority stake in JAC joint venture*, electrive.com, 29 May 2020. Retrieved from: https://www.electrive.com/2020/05/29/vw-to-take-over-majority-stake-in-jac-jv/.

[38] *Ibidem*.

[39] *Renault-Nissan Alliance and Dongfeng Motor Group Co., Ltd. forge partnership to co-develop electric vehicles in China*, Nissan.com, 29 August 2017. Retrieved from: https://global.nissannews.com/en/releases/170829-01-e?source=nng.

[40] G. LYE, *Renault City K-ZE launched in China – 44 hp and 125 Nm; up to 271 km of range; priced from RM36,234*, paultan.org, 10 September 2019. Retrieved from: https://paultan.org/2019/09/10/renault-k-ze-launched-in-china/.

[41] P. GEORGIADIS, *Renault invests €128m into China electric vehicle joint venture*, Financial Times, 17 July 2019. Retrieved from: https://www.ft.com/content/cbd4b9e8-a85b-11e9-984c-fac8325aaa04.

Commercial Vehicles (LCV)[42]. In this sense, the French automaker has programmed to sell all of its shares in the Dongfeng Renault Automobile Company (DRAC), the joint venture Renault and Dongfeng have established in 2013 for the production of ICE vehicles.

In December 2019, the Dongfeng Peugeot Citroen Automobile, the equal joint venture between PSA Group and Dongfeng, announced that in 2020 three NEVs will be produced in China, the full-electric Peugeot 2008 and the hybrids cars Peugeot 4008 and Citroen C5 Aircross[43].

Furthermore, European automakers and Chinese ICT companies have started to cooperate for delivering innovative solutions in the field of autonomous driving. In recent years, China has launched strategies particularly aimed to further develop the sector of automated vehicles. In this regard, on 27 December 2018, China's Ministry of Industry and Information Technology (MIIT) launched the Internet of Vehicle (Intelligent Connected Vehicle) Industry Development Action Plan. Divided into two phases, before and after 2020, the Plan identifies five major focus areas to be developed for the successful emergence of an IoV industry. These are:

> Key technologies: Formulate ICV technology system that can support conditional automated driving (Level 3) and up and form software-hardware integration and application capabilities that are sure and trustworthy.
>
> Standardization system: Complete the formulation of key IoV/ICV standards, significantly increase effective supply of standards and perfect industrial standards system. Improve comprehensive testing and validation capabilities, perfect testing and evaluation system.
>
> Infrastructure: achieve LTE-V2X[44] coverage in parts of expressways and major urban roads, launch 5G-V2X pilot applications, set up narrow band IoT network, build vehicle-to-road coordinated environment.
>
> Application service: more than 30 percent in penetration of ICV users, more than 30 penetration rate in Level 2 ADAS on new vehicles and more than 60 per cent in onboard connected information service terminal on new vehicles.
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> Security assurance: Initial formation of industrial security administration system, implementation of security administration and protection system and mechanism, achieved phased developments in security technology and product R&D[45].

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[42] Groupe Renault, *GROUPE RENAULT SETS ITS NEW STRATEGY FOR CHINA*, 14 April 2020. Retrieved from: https://en.media.groupe.renault.com/news/groupe-renault-sets-its-new-strategy-for-china-2cc6-989c5.html.

[43] J. JIAN, *PSA accelerates China rollout of electrified vehicles*, Automotive News, 9 December 2019. Retrieved from: https://europe.autonews.com/automakers/psa-accelerates-china-rollout-electrified-vehicles#:~:text=PSA%20accelerates%20China%20rollout%20of%20electrified%20vehicles&text=PSA%20Group%2C%20pressured%20by%20local,main%20joint%20venture%20in%20China.

[44] V2X is an abbreviation of the term Vehicle-to-Everything, a technology that allow vehicles to communicate with other devices in the traffic. Retrieved from: https://www.investopedia.com/terms/v/v2x-vehicletovehicle-or-vehicletoinfrastructure.asp#:~:text=V2X%20is%20a%20vehicular%20technology,to%2Dinfrastructure%20(V2I).

[45] China Auto News CBU, *MIIT's ICV plan targeting 30% penetration rate of IoV by 2020*, sohu.com, 14 May 2019. Retrieved from https://www.sohu.com/a/313993187_352084.

Before the launch of the Plan, cooperation between Chinese and European firms in the autonomous driving sector had already begun. In August 2017, NXP Semiconductors announced to have signed a Strategic Cooperation Framework Agreement with the state-owned Chang'an Automobile, the second-largest domestic car manufacturer in China. Divided into two phases, while in the first one the partnership is set to be mostly focused on in-vehicle infotainment systems (display, touch screen, smartphone pairing), in the second the collaboration should be extended to the installation in Chang'an cars of NXP sensors and radars for autonomous driving[46].

In July 2018, Huawei and Audi signed a strategic partnership agreement which led to the launch in October 2018 of the «joint innovation program for L4 highly automated driving»[47]. The same month Huawei and Audi presented an Audi Q7 prototype that embedded Huawei's Mobile Data Center[48] (MDC) able to perform Level 4 of SAE International framework applications. According to Huawei, this prototype «shows a capacity of handling complex urban traffic environments while the driver can leave the steering wheel to the car. The car can drive through city traffic, identify pedestrians and traffic signals and can park itself»[49].

Similarly, in October 2018 Alliance Ventures, the strategic venture capital of the Renault-Nissan-Mitsubishi Alliance, has become an investor of WeRide.ai, a Chinese company focused on delivering Level 4 of SAE International framework autonomous vehicles[50]. Notably, We.Ride.ai is the first Chinese start-up to receive an investment from a non-Chinese automotive group[51]. The company uses 5G technology for the remote control of the vehicles.

Renault and Nissan have recently announced the Alliance Automotive Research and Development Ltd., a new R&D equal joint venture focused on CAEVs in Shanghai[52]. Its goal is to launch 12 EVs with different levels of autonomous features by 2022. Renault and Nissan, in a similar way to FCA, have

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[46] *NXP and Changan Automobile to Cooperate on Infotainment and Future Vehicle Technologies*, nxp.com, 30 August 2017. Retrieved from: https://media.nxp.com/news-releases/news-release-details/nxp-and-changan-automobile-cooperate-infotainment-and-future.

[47] S. METZ, *Audi and Huawei Explore New Driving Experience*, Huawei.com, 11 October 2018. Retrieved from: https://e.huawei.com/topic/leading-new-ict-en/audi-new-driving-case.html.

[48] Huawei MDC 600 is a computer capable of 352 trillion operations per second and to run 16 cameras, 6mmWave radars, 16 ultrasonic radars and 8 lidar sensors. Retrieved from: https://mybroadband.co.za/news/motoring/279437-huawei-launches-ai-computer-for-cars-to-enable-autonomous-driving.html.

[49] *Ibidem*.

[50] *Renault-Nissan-Mitsubishi becomes lead investor in China autonomous driving company WeRide.ai*, Green Car Congress, 31 October 2018. Retrieved from: https://www.greencarcongress.com/2018/10/20181031-weride.html.

[51] WeRide.ai has been established in 2017 and it is headquarted in Guangzhou. It is part of the joint venture WeRide RoboTaxi which has launched a robotaxi service in Guangzhou. Retrieved from: https://www.weride.ai/about.

[52] *Renault and Nissan partner on autonomous tech R&D hub in China*, Driverlessguru.com, 12 April 2019. Retrieved from: https://www.driverlessguru.com/latest-new-1/renault-and-nissan-partner-on-autonomous-tech-rd-hub-in-china.

also signed an agreement with the autonomous driving company Waymo (Google) to work together in the development of driverless mobility services in France and Japan.

In light of the partnerships described above, it is possible to assert that, despite the presence of serious challenges such as the global recession, the spread of the virus Covid-19 and the drop of the sales of cars, European and Chinese carmakers and automotive parts manufacturers are renovating their partnerships to deliver new advanced products. This is especially remarkable considering the economic decoupling and the tech/trade war currently undergoing between the United States and China. However, as mentioned before, the gradual reduction of state subsidies could be another factor susceptible to hamper in the future the growth of the automotive market. In this regard the Chinese government, while extending the durability of the subsidies for NEVs, has decided to reduce them by 10 per cent in 2020, 20 per cent by 2021 and 30 per cent by 2022[53].

Concerning technology transfer, these partnerships surely represent a great opportunity to exchange know-how and technologies between European and Chinese companies. According to the United Nations Conference on Trade And Development (UNCTAD) draft International Code on the Transfer of Technology, technology transfer is defined as: «the transfer of systematic knowledge for the manufacture of a product, for the application of a process or for the rendering of a service, which does not extend to the transactions involving the mere sale or mere lease of goods»[54]. The World Intellectual Property Organization (WIPO) defines technology transfer as «a series of processes for sharing ideas, knowledge, technology and skills with another individual or institution … and of acquisition by the other of such ideas, knowledge, technologies and skills»[55].

As it will be further explained in the next chapter, since the first joint ventures between European and Chinese automakers have been established in the 1980s, European foreign direct investments (FDIs) in the sector have represented a good instrument for Chinese firms to acquire technology and knowledge[56]. The exchange and hiring of engineers, technicians and experts between the JVs can represent another means to increase expertise as well. Furthermore, technology transfer can be also realized through the building of Research and Development centers in universities and research institutes.

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[53] Y. SUN, B. GOTH, *China to cut new energy vehicle subsidies by 10% this year*, Reuters, 23 April 2020. Retrieved from: https://www.reuters.com/article/us-china-autos-electric-subsidies/china-to-cut-new-energy-vehicle-subsidies-by-10-this-year-idUSKCN225177.

[54] *Transfer of Technology*, UNCTAD series on issues in international investment agreements, New York and Geneve, 2001, p. 5. Retrieved from: https://unctad.org/en/docs/psiteiitd28.en.pdf.

[55] N. CHAKROUN, *Patents for Development*, Edward Elgar, Cheltenham, 2016, p. 138. Retrieved from: https://books.google.it.

[56] X. QIU, *Technology transfer in Chinese automobile industry*, KTH Industrial Engineering and Management, Stockholm, 2013. Retrieved from: https://www.diva-portal.org/smash/get/diva2:633313/FULLTEXT01.pdf.

Specifically, UNCTAD states that:

> Firms in inferior sites that are seeking to pursue technological upgrading often seek technology transfer from locations with superior knowledge bases. This may be done through acquisitions of technologically strategic firms, licensing agreements that allow the use of particular technologies or flows of knowledge, through movements of human capital carrying experiential knowledge working in the superior knowledge bases (either in firms, universities or in R&D laboratories), and by knowledge circulation between employees in inferior and superior sites[57].

Transnational corporations such as the ones described above represent a fundamental source to transfer technology through FDI, both as M&A and JVs. Licensing of technology is another important tool to exchange technology and know-how.

Moreover, imports of machinery and equipment necessary for the production of the vehicles have been represented as a case of technology flow. In this regard, UNCTAD asserts that:

> Imports of machinery contain embodied knowledge and technology, and raise productivity in manufacturing directly when integrated into production locally. They can also contribute to the building of deeper levels of technological capabilities by local firms. Firms in these countries used imitation through reverse engineering of imported products to stimulate technological learning (as outlined clearly in Kim (1997)). Imitation has, for countries in the early stages of technological development, traditionally represented a key channel of "informal" technology transfer that is not mediated through market channels[58].

Therefore, it is possible to conclude by affirming that the economic partnerships analysed surely represent cases of technology transfer susceptible to bring a series of consistent benefits for both the Chinese and European partners. To better understand the category of the transfer of technology under the international law profile, the following chapter will give an overview of the most relevant international legislation on the matter.

[57] UNCTAD, *Studies in Technology Transfer, Selected cases from Argentina, China, South Africa and Taiwan Province of China*, UNCTAD current studies on science, technology and innovation Nº7, 2014, p. 3. Retrieved from: https://unctad.org/en/PublicationsLibrary/dtlstict2013d7_en.pdf.

[58] UNCTAD, ivi, ivi, ivi, p. 6.

II. Technology transfer under the International Economic Law

The first international norms concerning technology transfer have been included in the UNCTAD Draft International Code of Conduct on the Transfer of Technology. Specifically, in Chapter 2 of the 1985 version, paragraph Objectives, it is stated that:

> [the code aims] To establish general and equitable standards on which to base the relationships among parties to transfer of technology transactions and governments concerned, taking into consideration their legitimate interests, and giving due recognition to special needs of developing countries for the fulfilment of their economic and social development objectives ... To encourage transfer of technology transactions, particularly those involving developing countries, under conditions where bargaining positions of the parties to the transactions are balanced in such a way as to avoid abuses of a stronger position and thereby to achieve mutually satisfactory agreements … To increase the contributions of technology to the identification and solution of social and economic problems of all countries, particularly the developing countries, including the development of basic sectors of their national economies.[59]

Elaborated between 1976 and 1978 the Draft Code of Conduct of UNCTAD, which never entered into force because of the opposition of developed countries and divergencies among developing countries, has been «the first multilateral, albeit non-binding attempt at forging an agreement on broad principles on technology transfer»[60]. It was an initiative promoted by developing countries to regulate and promote the acquisition of foreign technology[61]. For instance, Chapter 4 of the Code lists a series of practises that parties should avoid when dealing with the transfer of technology transactions, such as: restrictions on sales regarding competing technologies; restrictions on R&D by the acquiring parties; obligation on the acquiring party to grant exclusive sales to the supplying party; patent pool agreements among technology suppliers which limit access to new technological developments or cause abusive domination of an industry or market, restricting the transfer of technology[62].

Moreover, in Chapter 5 of the code of conduct, titled «Responsibilities and Obligation of Parties», it is stated that:

> When negotiating and concluding a technology transfer agreement, the parties should, in accordance with this chapter, be responsive to the economic and social development objectives of the respective countries of the parties and particularly of the technology acquiring country … In being responsive to the economic and social development

[59] UNCTAD, *Compendium of International Arrangements on Transfer of Technology: Selected Instruments*, United Nations Publication, Draft International Code of Conduct on the Transfer of Technology, p. 264.

[60] M. WAIBEL, W. ALFORD, *Technology Transfer*, Max Planck Encyclopedias of International Law, Oxford Public International Law, 2014, p. 10.

[61] P. ROFFE, *Transfer of Technology: UNCTAD's Draft International Code of Conduct*, International Lawyer, p. 689 ss, p. 691.

[62] P. ROFFE, ivi, ivi, ivi, p. 699.

> objectives mentioned in this chapter each party should take into account the other's request to include in the agreements, to the extent technically and commercially practicable.[63]

Such requests, according to Chapter 5, might involve: the use of locally available resources such as local personnel that will be trained of skills by the potential technology supplier; the use of locally available materials, technologies and technical skills; the unpacking from the supplying party of information concerning the elements of the technology transferred[64].

Chapter 6, named «Special treatment for developing countries», acknowledging the economic and social problems of developing countries and least developed countries, asserts that governments of developed countries should take specific measures to encourage the building of scientific and technological capabilities of developing countries such as:

> give developing countries the freest and fullest possible access to technologies whose transfer is not subject to private decisions … facilitate access by developing countries, to the extent practicable, to technologies whose transfer is subject to private decisions … assist and co-operate with developing countries in the assessment and adaptation of existing technologies and in the development of national technologies by facilitating access, as far as possible, to available scientific and industrial research data … co-operate in the development of scientific and technological resources in developing countries, including the creation and growth of innovative capacities … assist developing countries in strengthening their technological capacity, especially in the basic sectors of their national economy, through creation of and support for laboratories, experimental facilities and institutes for training and research … co-operate in the establishment or strengthening of national, regional and/or international institutions, including technology transfer centres … encourage the training of personnel from developing countries[65].

Governments of developed countries should also promote the transfer of technologies to developing countries and least developed countries by considering the requests from developing countries to:

> contribute to the development of national technologies in developing countries by providing experts under development assistance and research exchange programmes; provide training for research, engineering, design and other personnel from developing countries engaged in the development of national technologies or in the adaptation and use of technologies transferred; grant credits on terms more favourable than the usual commercial terms for financing the acquisition of capital and intermediate goods in the context of approved development projects involving transfer of technology transactions.[66]

Finally, developed countries should incentivise enterprises and institution to collaborate with other enterprises or institutions in developing and least developed countries to:

> assist in the development of technological capabilities of the enterprises in developing countries, including special training as required by the recipients … undertake the development of technology appropriate to the needs of developing countries … undertake

[63] UNCTAD, ivi, ivi, ivi, p. 269.
[64] UNCTAD, ivi, ivi, ivi, pp. 269-270.
[65] UNCTAD, ivi, ivi, ivi, p. 273.
[66] UNCTAD, ivi, ivi, ivi, p. 274.

> R and D activity in developing countries of interest to such countries, as well as to improve co-operation between enterprises and scientific and technological institutions of developed and developing countries[67].

The logic underpinning the Draft Code of Conduct of 1985 was that developing countries should have had preferential treatment when dealing with technology transfer and that developed countries should have favoured the spread of new technologies and innovation. In contrast to this approach in 1994, at the end of the Uruguay Round, World Trade Organization (WTO) members concluded the negotiations of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). The international agreement aims to strengthen the Intellectual Property Rights (IPRs). According to Waibel and Alford, these are a fundamental institution for technology transfer, because «they grant rights in technology, and make technology excludable. They calibrate the trade-off between access and innovation»[68]. In this sense, the effects on IPRs are twofold: while they restrict access to technology by ensuring that the inventors receive adequate compensation, their commercialization could stimulate international technology flows[69].

Before analysing TRIPS, it is worth mentioning one of the first international property treaties ever established, the Paris Convention for the Protection of Industrial Property. Effective since 1884, the treaty was amended last time in 1979 and it is currently administrated by WIPO. The treaty has been adopted by 177 countries. Article 1 of the Paris Convention affirms that the protection of industrial property includes «patents, utility models, industrial designs, trademarks, service marks, trade names, indications of source or appellations of origin, and the repression of unfair competition»[70]. Article 4 requires that any applicant for a patent, the registration of a utility model, an industrial design or a trademark has a priority for a period that ranges from 6 to 12 months on other individuals that might apply later[71].

Concerning TRIPS, its Preamble affirms that its purpose is to «reduce distortions and impediments to international trade, and taking into account the need to promote effective and adequate protection of intellectual property rights, and to ensure that measures and procedures to enforce intellectual property rights do not themselves become barriers to legitimate trade»[72]. Articles 3 and 4 set the principles of the National Treatment and the Most Favoured Nation Treatment, respectively the principles, regarding the protection of international property, that each member should accord to the nationals of other members a treatment no less favourable than the one accorded to its nationals and that «any advantage, favour,

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[67] *Ibidem*.

[68] M. WAIBEL, W. ALFORD, ivi, ivi, ivi, ivi, pp. 4-5. perché usi questa buffa formula (ivi , ivi,…) e non ibidem?

[69] *Ibidem*.

[70] WIPO, *Paris Convention for the Protection of Industrial Property*, p. 2.

[71] WIPO, ivi, p. 3.

[72] UNCTAD, ivi, ivi, ivi, p. 61.

privilege or immunity granted by a Member to the nationals of any other country shall be accorded immediately and unconditionally to the nationals of all other Members»[73].

At the same time, article 7, named «Objectives», states that the protection of IPRs should contribute to promoting technological innovation and to the transfer of technology also to improve social and economic welfare. Article 8, titled «principles», affirms that:

> Members may, in formulating or amending their national laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of this Agreement. Appropriate measures … may be needed to prevent the abuse of intellectual property rights by right holders or the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology.[74]

The articles of TRIPS from 9 to 40 set the standards to protect IPRs. Article 14 protects performers and producers of sound recordings, as well as broadcasting organizations for acts undertaken without their authorization. Article 16 asserts that the owner of a registered trademark « shall have the exclusive right to prevent all third parties not having the owners consent from using in the course of trade identical or similar signs for goods or services which are identical or similar to those in respect of which the trademark is registered where such use would result in a likelihood of confusion»[75]. Article 22 on the protection of geographical indications affirms that the members should prevent that a good indicates it originates in a geographical area different from the true place of origin. Article 23 is specifically dedicated to the protection of geographical indications that identify wines and spirits, which is strengthened by special provisions that forbid expressions such as "style" or "imitation". Article 26 on Industrial designs states that the owner of a protected industrial design has the right to prevent third parties from producing copies without its consent. Article 28 asserts that the owners of patents have the exclusive rights to «prevent third parties not having the owner's consent from the acts of: making, using, offering for sale, selling, or importing for these purposes that product»[76].

Article 31, named «Other use without authorization of the Right Holder», include norms for allowing the utilization of a patent without the authorization of the right holder only under specific circumstances, for instance, if the user has tried to obtain authorization from the right holder on reasonable conditions without success. This requirement is not necessary in case of a national emergency, extreme urgency, public non-commercial use and anticompetitive practises. Anyways, such use should be limited in time, purpose and non-exclusive.

[73] UNCTAD, ivi, ivi, ivi, p. 63.
[74] UNCTAD, ivi, ivi, ivi, p. 64.
[75] UNCTAD, ivi, ivi, ivi, p. 67.
[76] UNCTAD, ivi, ivi, ivi, p. 72.

Moreover, the right holder shall be paid adequate remuneration according to the specific circumstances.

Article 40 affirms that members could adopt appropriate measures to prevent or control practises that may constitute an abuse of intellectual property rights and affect competition. In this regard:

> Each Member shall enter, upon request, into consultations with any other Member which has cause to believe that an intellectual property right owner that is a national or domiciliary of the Member to which the request for consultations has been addressed is undertaking practices in violation of the requesting Member's laws and regulations on the subject matter of this Section … The Member addressed shall accord full and sympathetic consideration to, and shall afford adequate opportunity for, consultations with the requesting Member, and shall co-operate through supply of publicly available non-confidential information of relevance to the matter in question and of other information available to the Member.[77]

Specific norms of TRIPS provide an exceptional regime for least developed countries. Article 66, for instance, contains measures to support technologic transfer on least developed countries. Particularly, least developed countries in view of their economic, financial and administrative limits are not required to apply TRIPS for 10 years. Furthermore, developed countries should incentivise enterprises and institutions in their territories to promote technology transfer to least developed countries.

Since this research aims to analyse technology transfer between European and Chinese firms regarding electric and autonomous connected vehicles, it is interesting to note that it is possible to find provisions regarding the subject in international treaties and declarations related to the environment protection. This is due to the cross-border nature of the field and its specific issues such as air pollution and climate change.

For instance, article 10 of the Paris Agreement on climate change of 2015 states that the parties «share a long-term vision on the importance of fully realizing technology development and transfer in order to improve resilience to climate change and to reduce greenhouse gas emission»[78] and that «noting the importance of technology for the implementation of mitigation and adaptation actions under this Agreement and recognizing existing technology deployment and dissemination efforts, shall strengthen cooperative action on technology development and transfer»[79]. In this regard, the Paris Agreement refers to the Technology Mechanism, a framework established in 2010 by the Convention on Climate Change to promote technology transfer to developing countries[80].

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[77] UNCTAD, ivi, ivi, ivi, p. 64.

[78] UNFCCC, *Paris Agreement*, p.9. Retrieved from: https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf.

[79] *Ibidem*.

[80] UNFCCC, *Technology Mechanism*, 2020. Retrieved from: https://unfccc.int/ttclear/support/technology-mechanism.html.

Today, the international debate on technology transfer has been characterized by the emergence of a new concern of the developed countries, the so-called forced technology transfer (FTT). Particularly, the Chinese government has been accused by the US, the European Union and Japan to conduct FTT, which can be defined as the «practice in which a domestic government forces foreign businesses to share their tech in exchange for market access»[81].

In a paper published by the Organisation for Economic Co-operation and Development (OECD), Andrenelli, Gourdon and Moïsé describe two circumstances in which FTT might occur, disclosure of sensitive proprietary information required by administrative processes and foreign restrictions. Regarding the first, the authors affirm that:

> Concerns have been raised about the use of potentially any registration, certification and approval procedure by government bodies to request, formally or informally, sensitive proprietary information which does not appear to be necessary for (or related to) the relevant administrative process. In this sense, regular administrative procedures such as various forms or licensing or approval, can become, under some circumstances, instruments for compelling ITT. This group also includes technology-related performance requirements that impose on investors local sourcing and local content requirements (including in the context of government procurement) or specific operations (regarding data localisation or disclosure of source code), with the potential to compel involuntary technology transfer.[82]

In relation with foreign restrictions:

> In addition, within this group there are also measures related to FDI restrictions which, in certain circumstances, can oblige foreign investors to have local partners in order to gain market access, with implications in terms of control of proprietary IP and know-how. This can include the requirement, in the context of FDI screening processes, to provide sensitive information or technology as a specific determinant of approval of the FDI by the relevant regulatory body.[83]

However, it is noteworthy to stress that FTT is surely a complex issue and, in a certain way, not something new. Indeed, performance requirements such as technology transfer are tools that have been widely used since the 1970s by developing countries to acquire technology in exchange for market access. Performance requirements can also include foreign exchange restrictions, local content requirements, as well as local equity requirements and local hiring targets, which oblige foreign companies that want to invest in developing countries to form

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[81] J. FRANKENFIELD, *Forced Technology Transfer (FTT)*, Investopedia, 21 May 2019. Retrieved from: https://www.investopedia.com/forced-technology-transfer-ftt-4687680#:~:text=Forced%20technology%20transfer%20(FTT)%20is,in%20exchange%20for%20market%20access.&text=When%20a%20company%20wants%20to,its%20technology%20with%20Chinese%20companies.

[82] A. ANDRENELLI, J. GOURDON, E. MOÏSÉ, *International Technology Transfer Policies*, OECD Trade Policy Papers No. 222, 2019, p. 8.

[83] *Ibidem*.

joint ventures with local ones[84]. Naturally, this open-up to several occasions of transfer of technology and, in certain cases, FTT.

In the case of China, despite the complaints of the US, the EU and Japan, performance requirements have already been formally prohibited in the Protocol of Accession of WTO of 2001. In this regard, Part IV of the Protocol, called Policies Affecting Trade in Goods, demands the «elimination and cessation of enforcement of trade and foreign exchange balancing requirements, local content and export performance offsets and technology transfer requirements made effective through laws, regulations or other measures»[85].

Neverthless, it is important to stress that ownership restrictions and compulsory joint ventures are not explicitly prohibited by international agreements. Few exceptions are the WTO General Agreement on Trade in Service (GATS) and specific norms included in international investment agreements. Concerning the first, Article XVI of GATS, titled «Market Access», affirms as a general rule that:

> In sectors where market-access commitments are undertaken, the measures which a Member shall not maintain or adopt either on the basis of a regional subdivision or on the basis of its entire territory, unless otherwise specified in its Schedule, are defined as … limitations on the number of service suppliers … on the total value of service transactions or assets … limitations on the total number of service operations … measures which restrict or require specific types of legal entity or joint venture through which a service supplier may supply a service; and limitations on the participation of foreign capital in terms of maximum percentage limit on foreign shareholding or the total value of individual or aggregate foreign investment[86].

Concerning international investment agreements, the category includes both bilateral investment agreements (BITs), which are treaties signed between two countries to establish the conditions for FDIs, as well as Free Trade Agreements (FTAs), treaties between two or more countries to promote imports and exports of goods and services among them by, for instance, cutting tariffs. In this regard, in deals such as the EU and Japan's Economic Partnership Agreement and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) it is possible to find provisions that «require the recipient country not to discriminate between foreign and domestic investors, not only with respect to their operations in the country once the investment has been established, but also as regards the conditions for establishing such investment»[87], as well as provisions that prohibit requirements that impose technology transfer. At the same time, they include norms that permit recipient countries to demand the establishment of R&D

[84] OECD, *Negotiating Group on the Multilateral Agreement on Investment (MAI)*, oecd.org, 15 January 1996. Retrieved from: https://www.oecd.org/daf/mai/pdf/ng/ng964e.pdf.

[85] WTO, *Accession of the People's Republic of China*, 23 November 2001, p. 16. Retrieved from: http://www.worldtradelaw.net/misc/ChinaAccessionProtocol.pdf.download.

[86] WTO, *General Agreement on Trade in Services*, p. 283 ss, p. 297. Retrieved from: https://www.wto.org/english/docs_e/legal_e/26-gats.pdf.

[87] A. ANDRENELLI, J. GOURDON, E. MOÏSÉ, ivi, ivi. ivi, ivi, p. 24.

centres in its territories and refer to article 31 of TRIPS concerning compulsory licensing[88].

To conclude, notwithstanding the complexity of the international debate on FTT, it is important to stress that the reasons why the US, the EU and Japan have pushed only in recent years China to reform the international norms on forced technology transfer are grounded on the rise of the Asian country as a world power economy and technology powerhouse. In this regard, according to the WIPO Global Innovation Index, in 2019 China ranked 14th in the world rankings higher than developed countries such as Japan, France, Canada and Italy and maintaining top ranks in patents, industrial designs, trademarks and high-tech exports[89]. Therefore it is clear that, while in previous decades performance requirements through administrative processes and compulsory joint ventures were viewed as more appropriate in exchange for market access, today this mechanism is no longer sustainable. To sum up, it is worthy to cite Professor Ya Qin's sentences on the special status of China:

> It is true that China's GDP per capita remains well below the average of OECD countries and that about 30 million Chinese still live below the poverty line. However, what matters most to the rest of the world is China's 'comprehensive national power,' a concept developed by the Chinese themselves. When considering the aggregate of a variety of factors, including economic power, science and technology, education, territory, natural resources, population, military force, and domestic governance, China is clearly a contemporary superpower. Consequently, there is little reason why China should not be treated as an equal of the OECD countries when it comes to the policy of technology transfer and market access. In this regard, it should be noted that the USA is challenging the practice of self-declared development status at the WTO, and the issue is poised to be a major item on the WTO-reform agenda.[90]

In light of the issues described above, the last chapter of this study will try to provide a final assessment of the economic partnerships between European and Chinese companies in the sector of the autonomous and electric vehicles by also inserting them in the context of a quickly mutating international economic order.

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[88] *Ibidem*.

[89] Cornell University, INSEAD, WIPO, *The Global Innovation Index 2019: Creating Healthy Lives—The Future of Medical Innovation*, Ithaca, Fontainebleau, and Geneva, 2019, p. XX. Retrieved from: https://www.wipo.int/publications/en/details.jsp?id=4434#:~:text=The%20Global%20Innovation%20Index%202019,education%2C%20infrastructure%20and%20business%20sophistication.

[90] J. YA QIN, *Forced Technology Transfer and the US–China Trade War: Implications for International Economic Law*, Journal of International Economic Law, 2019, p. 743 ss, p. 758. doi: 10.1093/jiel/jgz037.

III. European-Chinese economic partnerships at the outset of an increasing geopolitical economic order

Connected and Autonomous Electric Vehicles offer a number of advantages to highly improve urban mobility. Particularly, CAEVs might in the future:

- eliminate the accidents caused by human error, estimated to be at about 90 per cent of the total;

- improve the mobility for those who cannot drive such as the elderly and persons with a disability;

- reduce parking needs. Passengers can be dropped off at their destinations without parking the car. This advantage is also related to an overall increase of car-sharing services that adopt CAEVs fleets;

- relax the drivers who can now rest, work or entertain themselves instead of driving;

- reduce CO2 emissions, air pollution (40 per cent lower greenhouse emissions respect of internal combustion engines) and fuel consumption (in case of hybrid vehicles) thanks to smoother traffic flows and minimize braking.[91]

Regarding China, the country with the highest number of vehicles and electric vehicles (EVs) on the road in the world, implementing policies to incentivize the spread of EVs is due to both air pollution concerns in big cities such as Beijing, Shanghai and Guangzhou and a high dependency on oil imports, which reached 65 per cent in 2016[92]. According to the Ministry of Transport of China, key aspects of the development of EVs have been the development of charging infrastructure, the extension of EVs in the public service, the implementation of policy incentives from the central and local governments at all levels and the update of the technology features[93].

In reference to the latter, the Chinese Government set up specific policies which are expressively aimed to catch-up the technology levels of the Western countries in the next years. For instance, the initiative Made in China 2025 (MIC 2025) aims to realize «strategic manufacturing goals»[94] in order to create world leader champions in ten core industries: New Energy Automobiles, ICT, Digital Control Machine Tools and Robots, Aerospace and Aeronautic Equipment,

[91] B. VAIDYA, H. T. MOUFTAH, *Connected Autonomous Electric Vehicles as Enablers for Low-Carbon Future*, IntechOpen, 2019, pp. 3-5. DOI: http://dx.doi.org/10.5772/intechopen.84287.

[92] P. YU, J. ZHANG, D. YANG, X. LIN, T. XU, *The Evolution of China's New Energy Vehicle Industry from the Perspective of a Technology–Market–Policy Framework*, MDPI, 2019, p.1.

[93] P. YU, J. ZHANG, D. YANG, X. LIN, T. XU, ivi, ivi, ivi, p. 8.

[94] *Made in China 2025 中国制造 2025*, State Council, 2015, p.7. Retrieved from: http://www.cittadellascienza.it/cina/wp-content/uploads/2017/02/IoT-ONE-Made-in-China-2025.pdf.

Oceanographic Engineering Equipment and High-technology Shipping, Advanced Rail Transportation Equipment, Electric Power Equipment, Agricultural Machinery Equipment, New Materials and Bio-pharmaceuticals and High-performance Medical Equipment[95]. To reach these achievements, MIC 2025 recommends using a number of tools like setting new standards, creating innovation centers, investing in high-tech firms abroad and providing financial support by billions of dollars through subsidies, loans and funds[96].

For instance, in 2019 the Chinese Great Wall Motor (GWM) invested over 600 million dollars in R&D in EVs equipment, the Internet of Things, AI, 5G and autonomous driving, an increase of 7.31 per cent compared to 2018[97]. GWM has also established R&D centers in Japan, the United States, Germany, India, Austria and South Korea[98]. In 2017 Geely Auto, another Chinese car manufacturer, signed a Memorandum with the Swedish Volvo Cars to set up a joint venture to share vehicle architecture and engine technologies for the next generation of electrified cars[99]. Notably, both Volvo Cars and Geely Auto are controlled by Geely Holding, a Chinese car group based in Hangzhou that acquired the Swedish company in 2010.

Despite these efforts from the Chinese government and car manufacturers to catch-up the levels of their western counterparts, the Chinese automobile industry still needs to reach the technical levels of other foreign automakers and its core key technologies are still not at the international levels. In this regard, Tao Zhang, Chaoqun Ma and Chenghao Yong stated that:

> especially the product engineering capability needs to be strengthened. In addition, there is a big gap between the technical level of China's new energy vehicles and the advanced level of foreign countries in terms of vehicle common technologies such as vehicle design and development process, chassis development, engine and matching technology of transmission[100].

In particular:

> the lack of core technologies such as battery, motor and electric control results in a large performance gap between domestic key components and imported components, low efficiency of electric drive system, long battery charging time and short service life. In

[95] For further information, see the link: http://www.cittadellascienza.it/cina/wp content/uploads/2017/02/IoT-ONE-Made-in-China-2025.pdf.

[96] Institute for Security & Development Policy, *Made in China 2025*, 2018. Retrieved from https://isdp.eu/content/uploads/2018/06/Made-in-China-Backgrounder.pdf.

[97] GWM, *4.248 Billion Yuan in R&D Investment Enabled GWM to Increase Its Overseas Revenue by 66.61% in 2019*, GWM News, GWM-global.com, 2020. Retrieved from: https://www.gwm-global.com/news/17828.html.

[98] For further information, see the page 'Globalization Strategy' on the GWM website. Link: https://www.gwm-global.com/global.html.

[99] *Volvo Cars and Geely to deepen partnership and establish joint venture to boost synergies*, volvocars.com, 20 July 2017. Retrieved from: https://www.media.volvocars.com/global/en-gb/media/pressreleases/210908/volvo-cars-and-geely-to-deepen-partnership-and-establish-joint-venture-to-boost-synergies.

[100] T. ZHANG, C. MA, C. YONG, *Development Status and Trends of New Energy Vehicles in China*, AIP Conference Proceedings, 2019, p. 3. Retrieved from: https://doi.org/10.1063/1.5089054.

> addition, the vehicle control technology, motor drive system technology, battery system technology, power coupling technology, engine and transmission control technology, etc. have not achieved substantial breakthroughs in industrialization in China.[101]

The arguments listed above introduce the main findings of this paper. In particular, three positive aspects of the economic partnerships between European and Chinese companies analysed emerge from this study.

The first one is directly linked to the classic scheme of "technology for market access". By establishing joint ventures with European companies Chinese automakers such as GAC (partner with FCA), JAC (partner with Volkswagen and SEAT), Dongfeng (partner with the Renault-Nissan-Mitsubishi Alliance), Jiangling Motors (partner with Renault) can have access to cutting-edge technologies in the fields of vehicle design and development process, chassis development, engine and matching technology of transmission, battery technologic components and tacit knowledge[102] necessary to catch up the level of the Western countries in the next years. In exchange for that, the European companies can have access to high revenues by selling their products in the biggest car market in the world, gaining profits that will enable them to increase their investments in R&D and therefore maintain their leadership.

However, it would not be exhaustive to assess these partnerships only under the traditional scheme of "technology in exchange for market access" that is has been described in the second chapter of this work. Indeed, a second positive aspect emerged from this study is based on the fact that economic partnerships in the ICT sector such as the ones between STMicroelectronics and Huawei, NXP Semiconductors and Hawkeye, FCA and Hon Hai Precision Industry, or the investment of Volkswagen in the Chinese battery manufacturer Gotion High-tech, the investment of Alliance Ventures Renault-Nissan-Mitsubishi in WeRide.ai and the joint innovation program for L4 highly automated driving between Audi and Huawei represent projects that could advance the technology level of the European companies **by gaining the expertise and cutting-edge knowledge of the Chinese counterparts**.

In recent years Chinese companies have **become at the forefront of innovation and new technologies**. To better understand the emergence of China and other Asian countries like South Korea as new world innovators, it can be useful to look at a recent work of WIPO titled "The Geography of Innovation: Local Hotspots, Global Networks". The report describes how in the two latest decades a significant change has occurred in the distribution of global innovation hotspots and specialized niche clusters: while in the period that goes from 1970 to

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[101] *Ibidem*.

[102] Tacit knowledge or informal knowledge is defined as the unwritten, unspoken and hidden knowledge that an individual has and that it cannot be transmitted without pursuing joint or shared activities. In the automotive sectors, European experts have a certain level of tacit knowledge that can be assimilated by their Chinese counterparts only by collaborating together. Link to the definition: http://www.businessdictionary.com/definition/tacit-knowledge.html.

2000 only the US, Japan and Germany were accounting for two-thirds of all patent activity for the production of new technologies in the world, today their percentages have shrunk to nearly a half. Instead, Asia, Oceania and South America combined are now accounting for one-third of the total. China and South Korea have been mainly responsible for this shift, accounting in the period 2015-2017 respectively for nearly 14 and 8 per cent of all patents produced in the world[103]. Particularly, in 2018 China's R&D expenditure has surpassed the EU average, accounting for 2.141 per cent of its Gross Domestic Product (GDP) compared to 2.025 of the EU countries[104].

Furthermore, Beijing has already moved important steps towards becoming **a world leader in ICT, including AI and 5G**. In fact, according to Pérez:

- in recent years, a new generation of Chinese giant tech companies has emerged. To this generation belong the so-called BATs, an abbreviation of Baidu, Alibaba and Tencent, deemed to be direct competitors in the world respectively to Google, Amazon and Facebook, as well as ByteDance, owner of the worldwide successful app TikTok;

- these companies not only offer the same services of their American counterparts but often expand their features. WeChat, a multipurpose messaging app developed by Tencent[105] that can be considered the counterpart of WhatsApp, includes some additional elements compared to the American messaging app, like the possibility to transfer money and access to the e-commerce without exiting the app. Moreover, in China WeChat users can also order food, request medical appointments and make reservations for restaurants.

- the efforts put in innovation has made China the country with the biggest number of unicorns, a term used to refer to private start-ups with a value over one billion of dollars, amounting in 2019 to 206 against 203 of the US, as well as the country which benefits most from incorporating AI in the production processes (26.1 per cent of its total GDP). An example of a unicorn is Ant Financial, a start-up owned by Alibaba and specialized in Fintech, an innovative method of mobile banking very popular in South-East Asia, where a large number of the population do not have access to a bank account[106].

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[103] WIPO, *The Geography of Innovation: Local Hotspots, Global Networks*, Geneva, 2019, pp. 33-34. Retrieved from: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_944_2019.pdf.

[104] OECD, *Gross domestic spending on R&D*, OECD Data, oecd.org. Retrieved from: https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm.

[105] Tencent Holdings is a Chinese online game giant that on July 2020 overtook the role of Facebook as the world's most valuable social media network with a market capitalisation of USD 670 billion. Retrieved from: https://www.scmp.com/business/companies/article/3094961/tencent-overtakes-facebook-worlds-most-valuable-social-media.

[106] Á. P. PÉREZ, *La Ruta de la Seda Digital: la gran globalización china. Instituto Español de Estudios Estratégicos*, 2020. Retrieved from http://www.ieee.es/Galerias/fichero/docs_opinion/2020/DIEEEO38_2020AGUPAR_sedadigital.pdf.

Concerning 5G, in recent years the Shenzhen-based Huawei Technologies has emerged a leader in the next-generation of mobile wireless technology[107]: besides holding in the first half of 2019 the highest market share in the telecom equipment market (28 per cent of the total)[108], Huawei is a major holder of Standard Essential Patents (SEPs), the patents that define the standards to build the new technology[109]. While SEPs are not an exhaustive instrument to assess the actual leadership of a company in the telecommunications sector (patents are not equally valued and are declared by the companies themselves), it is nevertheless noteworthy that in January 2020 Huawei was holding the highest number of SEPs declared by the European Telecommunications Standards Institute (ETSI), 3,147, followed by Samsung (2,795), ZTE (2,561), LG (2,300), Nokia (2,149), Ericsson (1,494) and Qualcomm (1,293)[110].

AI, robotics and 5G have already started to reshape the automotive industry, particularly in reference to CAEVs. Advanced ICT knowledge that would not have been expected only a few years ago. In this regard, WIPO states that:

> Competencies required for the development of AVs have allowed players from the tech industry to enter the automotive sector, with the ultimate goal of creating fully autonomous vehicles that require no driver. The main ingredients for the realization of AVs are both the "V" and the "A." An AV unit is basically chassis and engine, plus an intelligence that brings full autonomy to the physical aspect. The incumbent automakers' core competency lies with the "V." Creating all the software (e.g., artificial intelligence) and hardware elements (e.g., sensors and cameras) required for autonomy – the "A" – is within the core competencies of the tech companies.
>
> The incumbent automakers' core competencies are mass manufacturing, mechanical engineering and jumping through the thousands of regulatory hoops that lead to the final car being on the road. They are the result of decades of accumulated tacit knowledge – knowledge that is not easily replicable – and knowhow. Mastering these competencies is not immediate and straightforward. New entrants' technological competencies are in hardware and software, especially the deep-learning and real-time control algorithms needed for vehicle autonomy. They are beyond the spectrum of expertise of most automakers and their suppliers, which have little prior knowledge of them.

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[107] 5G is considered to represent a major step forward in the development of wireless technology and to change the way we use the Internet significantly. While individuals will be able to enjoy download and upload speeds up to 100 times faster than 4G, allowing for example to download high-definition movies in a few seconds, it is in the industrial sectors where 5G will expediate most of its new applications and trigger a substantial advancement. Indeed, 5G represents the key to develop the Internet of Things (IoT) and Artificial Intelligence (AI), opening-up to new functions such as driverless automobiles, virtual and augmented reality, remote surgery, smart cities developments, as well as automated manufacturing.

[108] A. WEISSBERGER, *Dell'Oro: Worldwide Telecom Equipment market increases after 3 years of decline; VoLTE up 16% Y/Y*, Techblog.comsoc.org, 29 August 2019. Retrieved from https://techblog.comsoc.org/2019/08/29/delloro-worldwide-telecom-equipment-market-increases-after-3-years-of-decline-volte-up-16-y-y/.

[109] M. SPRINGBORG, *The New Tech War and the Geopolitics of 5G*, 2019. Retrieved from https://cworldwide.com/media/PDF/WP_2019_The_New_Tech_War_and_the_Geopolitics_of_5G.pdf.

[110] T. POHLMANN, K. BLIND, P. HEß, *Fact finding study on patents declared to the 5G standard*, IPlytics, 2020. Retrieved from https://www.iplytics.com/report/5g-patent-study-2020/#wpcf7-f3501-p3502-o1.

Core competencies of the automakers are more or less familiar to most people, but not so the technological waves that are transforming the industry.[111]

Therefore, it is of utmost importance that European automakers will partner with Chinese ICT firms to gain access to the cutting-edge technologies needed to keep up the latest developments of the automotive industry and succeed in this period of technology disruption.

Indeed, the main risk automakers are facing is to be outpaced by new outsiders that are better equipped with the know-how and AI technologies. The best example that goes to support this argument is American Tesla, Inc. On the first July 2020, the company founded in 2003 and specialised in electric and highly automated vehicles has overtaken Toyota as the world's most valuable carmaker with a market value of USD 209.37 billion. Toyota remains the largest car manufacturer by sales and revenues, gaining around USD 281 billion for the period from March 2019 to March 2020, dwarfing Tesla's sales of just USD 24,6 billion. However, becoming the most valuable automaker represents a signal from the investors of high expectations in the company in the next years[112].

Finally, the third positive aspect deriving from the cooperation between European and Chinese automakers is represented by their faculty to promote investments abroad. This is the case, described in the first chapter, of the one billion euros investment of FAW together with Silk EV in the Italian region Emilia-Romagna. If effectively implemented, the investment in an Innovation, Research & Development Center and a Design Center could strengthen the role of the industrial motor district as a top-level design and manufacturing hub.

However, over these partnerships and the future of the EU-China economic relationship loom the uncertainties of an international economic order that is currently undergoing a period of great transformation. Indeed, world powers have started to pursue a new approach towards globalization and international trade in which the economic benefits need to be constantly balanced by cybersecurity, national security and dependency of critical technologies concerns[113]. Particularly the US, in the face of the rise of China as a technology powerhouse able to exert a growing influence abroad, have engaged the Asian country in a tech-trade war that is causing economic decoupling between the two biggest economies in the world. According to Alessandro Aresu, scientific advisor of the Italian Journal Limes and official in the Italian government, both the US and China are practising the so-

[111] WIPO, *The Geography of Innovation: Local Hotspots, Global Networks*, Geneva, 2019, pp. 63. Retrieved from: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_944_2019.pdf.

[112] *Tesla overtakes Toyota to become world's most valuable carmaker*, bbc.com, 1 July 2020. Retrieved from: https://www.bbc.com/news/business 53257933#:~:text=Tesla%20has%20become%20the%20world's,%24209.47bn%20(%C2%A3165bn).

[113] A. ROBERTS, M. CHOER MORAES, V. FERGUSON, *Toward a Geoeconomic Order in International Trade and Investment*. Journal of International Economic Law, 22, 655-676. doi: 10.1093/jiel/jgz036.

called "political capitalism" (*capitalismo politico* in Italian), which is characterized by these features[114]:

- the presence in China of a Chinese Communist Party and the US of federal agencies with extraordinary powers;

- international trade and finance used for political purposes;

- technology and ICT firms used for political and geo-economic purposes;

- strategic industries are protected while rival foreign companies countered through extraordinary policies and regulations;

- a new mindset evaluates economic aspects based on concepts like national security and technology dependence from external actors.

In particular, concerning the ICT sector, on 15 May 2019 the US President Donald Trump signed the "Executive Order on Securing the Information and Communications Technology and Services Supply Chain". The order, which on May 2020 was extended for another year[115], defines foreign adversaries to communications networks, technology and services a threat at the level of national emergency[116]. The same day, the US Commerce Department added Huawei and 68 affiliates to an entity list that imposes US firms to do business with the Chinese company only with an export license released by the US Government[117].

In the following months, further actions from the US Government have been taken to remove the global industrial supply chains from China. In addition to that, the requests of who sustain the necessity to reshore or move away from China certain manufacturing businesses have been amplified by the emergency caused by the outbreak of the virus Covid-19. Indeed, the pandemic has highlighted the strategic position held by Chinese firms in supplying medical equipment and medicines to the rest of the world, like generic drugs and thermal cameras needed to test persons for fevers[118].

In light of this scenario, great importance is attached to the supply chain for microprocessors. On May 2020, following the announcement of the US Bureau of

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[114] A. ARESU, *Le potenze del capitalismo politico*, La Nave di Teseo, Milano, 2020, p. 8.

[115] C. GARTENBERG, *Donald Trump extends Huawei ban through May 2021, theverge.com*, 13 May 2020. Retrieved from: https://www.theverge.com/2020/5/13/21257675/trump-extends-huawei-ban-may-2021-china-us-android-google-telecom.

[116] C. REICHERT, S. KEANE, *Huawei says Trump's ban will hurt US 5G deployment*. Cnet.com, 16 May 2019. Retrieved from https://www.cnet.com/news/trump-effectively-bans-huawei-with-national-security-order/.

[117] R. BURKE, F. JALINOUS, K. MILDORF, K. SCHOMIG, S.J. SOWERBY, C. BRAYTON-LEWIS, S. JORGENSEN, M. SPICER, *US Designates Huawei to Entity List, Issues Temporary General License*, Whitecase.com, 23 May 2019. Retrieved from https://www.whitecase.com/publications/alert/us-designates-huawei-entity-list-issues-temporary-general-license.

[118] H. PAMUK, A. SHALAL, *Trump administration pushing to rip global supply chains from China: officials*, reuters.com, 4 May 2020. Retrieved from: https://www.reuters.com/article/us-health-coronavirus-usa-china/trump-administration-pushing-to-rip-global-supply-chains-from-china-officials-idUSKBN22G0BZ.

Industry and Security (BIS) to further restrict Huawei's acquisition of semiconductors[119], Taiwan Semiconductor Manufacturing Company (TSMC), the world's biggest and most technologically advanced microprocessors manufacturer, has stopped to accept new orders by Huawei and its affiliates[120]. Consequently HiSilicon, the fabless semiconductor company owned by Huawei, will need to find new chipmaker manufacturers to produce the processors it designs. However, by partnering with other chipmakers such as the Chinese Semiconductor Manufacturing International Corp (SMIC), HiSilicon will risk not being able to obtain the latest technologies in this sector necessary to achieve the ambitious plans of global leadership of the Shenzhen-based company[121].

Furthermore, the US has started a political campaign aimed to convince its allies to ban Huawei over the building of their future 5G infrastructure, sustaining that it could represent a mean at disposal of the Chinese authorities to spy entire countries[122]. The responses have been different. On the one hand, the members of the so-called Five Eyes, the intelligence alliance composed by Australia, Canada, New Zealand, the United Kingdom and the US, as well as Japan and South Korea, have all implemented measures to severely restrict the Chinese ICT company. The UK had initially taken a soft stance towards Huawei, allowing it to build with a cap of 35 per cent the periphery of the national 5G network. However, in July 2020 London reversed its decision by declaring to fully ban the Chinese company after 31 December 2020 and scheduling the removal of all its components by 2027[123].

On the other hand, the EU Member States took on different approaches to this issue, also according to their interests and relations with China. Hungary, for instance, has already clarified to be favourable to allow Huawei to implement 5G[124]. Others, instead, have not yet taken a clear stance. The German Government, for example, has been divided between proponents and opponents to allow Huawei to install 5G networks. German Chancellor Angela Merkel and her Minister for Economic Affairs Peter Altmaier have been trying to exclude the option of a ban to avoid any kind of retaliation on the thriving economic relationship with

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[119] US Department of Commerce, *Commerce Addresses Huawei's Efforts to Undermine Entity List, Restricts Products Designed and Produced with U.S. Technologies*, commerce.gov, 15 May 2020. Retrieved from: https://www.commerce.gov/news/press-releases/2020/05/commerce-addresses-huaweis-efforts-undermine-entity-list-restricts.

[120] *Taiwan chip maker TSMC stops new Huawei orders after US restrictions: Nikkei*, scmp.com, 18 May 2020. Retrieved from: https://www.scmp.com/tech/policy/article/3084840/tsmc-stops-new-huawei-orders-after-us-restrictions-nikkei.

[121] Y. MA, *In depth: Huawei's chip dreams in crosshairs of latest US assault*, Nikkei Asian Review, 3 June 2020. Retrieved from: https://asia.nikkei.com/Spotlight/Caixin/In-depth-Huawei-s-chip-dreams-in-crosshairs-of-latest-US-assault.

[122] S. DECKER, *Huawei Bets Big on European 5G Patents Despite Trump's Pressure*. Bloomberg.com, 12 March 2020. Retrieved from https://www.bloomberg.com/news/articles/2020-03-12/huawei-bets-big-on-european-5g-patents-despite-trump-s-pressure.

[123] L. KELION, *Huawei 5G kit must be removed from UK by 2027*, bbc.com, 14 July 2020. Retrieved from: https://www.bbc.com/news/technology-53403793?fbclid=IwAR03jrZgfvrv7jl1tCU6CPQmXhUeXvR9_vmy7qr4tW21Da0W9sD6NW9Pk3Q.

[124] Budapest Business Journal, *Hungary to partner with Huawei on 5G rollout*, 5 November 2019, Retrieved from https://bbj.hu/economy/hungary-to-partner-with-huawei-on-5g-rollout_173619.

China[125]. However, in November 2019, first the German Minister of Foreign Affairs Heiko Mass, followed by Minister of Defence Annegret Kramp-Karrenbauer, expressed their reticence about Huawei's participation in the development of 5G, referring to concerns over the ties of the company with the Chinese Government under the Chinese security laws. Taking an attitude similar to the German one, the Italian Government, which has the faculty to block economic deals on 5G technologies between Italian telcos and Huawei using the so-called "golden power", has not taken yet a final decision. However, in July 2020 Tim, one of the biggest telcos in Italy, has decided not to acquire Huawei 5G equipment for the core part of its network and choose instead the European Ericsson and Nokia[126]. Previously, Vodafone Italia had already implemented the same measures[127]. A total ban of Huawei seems so far unlikely to happen also in France. Nevertheless, the plan of the French cybersecurity agency chief Guillaume Poupard to release only temporary authorizations (for a period between three and eight years) for French telcos that want to purchase Huawei technologies has created uncertainty around the future presence of the Chinese company in France, wary that in the future may it be phased out[128]. Finally, a group of countries of Central and Eastern Europe that includes the Czech Republic, Poland, Romania and Denmark has already planned to implement strong restrictions for high-risk vendors like Huawei[129].

Apart from Europe and other US key allies, in South-East Asia in June 2020 Singapore's telecom operators Singapore Telecommunications and StraHub-M1 have declared that they will select Ericsson and Nokia for the city-state 5G network. A similar decision has been taken by Vietnam's Viettel that together with Nokia has developed its 5G equipment[130]. In South Asia, India is currently evaluating if to ban Huawei and ZTE from its future 5G network. The decision is also influenced by the border disputes between the Asian giants that occurred in June 2020[131].

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[125] N. BARKIN, *Europe's Backlash Against Huawei Has Arrived*, Foreignpolicy.com, 27 November 2019. Retrieved from https://foreignpolicy.com/2019/11/27/europe-huawei-backlash-merkel-germany-summit/.

[126] B. PAGLIARO, *Roma non ha deciso da che parte stare ma il golden power allontana Huawei*, La Repubblica, 13 July 2020.

[127] *Ibidem*.

[128] A. NUSSBAUM, H. FOUQUET, *France Says It's Not Banning Huawei Though Phase Out Started*, reuters.com, 24 July 2020. Retrieved from: https://www.bloomberg.com/news/articles/2020-07-24/france-says-it-s-not-banning-huawei-though-phase-out-is-underway.

[129] L. CERULUS, L, *Trump and friends: Where European countries come down on Huawei*, Politico.eu, 20 May 2020. Retrieved from https://www.politico.eu/article/trump-and-friends-where-europe-comes-down-on-huawei-5g/.

[130] K. IWAMOTO, *Huawei 5G dominance threatened in Southeast Asia*, Nikkei Asian Review, 20 July 2020. Retrieved from: https://asia.nikkei.com/Spotlight/Huawei-crackdown/Huawei-5G-dominance-threatened-in-Southeast-Asia.

[131] R. SHRIVASTAVA, *Endgame for Huawei? India likely to exclude Chinese firm from 5G roll-out, say govt sources*, indiatoday.in, 23 July 2020. Retrieved from: https://www.indiatoday.in/business/story/huawei-5g-ban-in-india-likely-govt-sources-1703692-2020-07-23.

The increasing geopolitical tensions that emerged in the last years have also hampered the correct functioning of international organizations. Once again, the main author of this shift has been the US. Particularly, in December 2019 Washington, in contrast with other countries, refused to renovate the Appellate Body, the WTO's dispute settlement system, arguing that its powers exceed its authority as conferred by its fundamental agreements[132]. Furthermore, on 6 July 2020, the US administration officially notified its intention to withdraw from the World Health Organization (WHO)[133]. In doing so, Washington accused the WHO to be under the influence of China during the pandemic caused by the virus Covid-19. The withdrawal will be effective in one year, precisely on 6 July 2021.

Against these disruptive effects, the EU and its members should pursue a twofold approach. They should develop a new comprehensive agenda that takes into account the geopolitical mindset emerged by the rising of the US-China tensions and the risks associated with its dependency from foreign powers concerning critical technologies and health products as highlighted by the outbreak of Covid-19. In this regard, an important step towards the right direction is represented by the new Industrial Strategy published by the European Commission in March 2020[134]. Assuming we live in an "ever-changing and ever more unpredictable world", the policy asserts the need to preserve "Europe's sovereignty". In this sense, new rules on merger control and state aid will be evaluated and approved by 2021 with the scope to create 'European champions'[135] able to compete with American and Chinese firms. In addition to this, the industrial strategy also mentions 'Europe's strategic autonomy', defining it as a concept to reduce the dependence on other countries of sectors like critical materials, technologies, food, infrastructure and security. In the digital sector, the policy renovates the EU commitment to strive to become a global leader, mentioning also 6G, the generation of wireless technology that will succeed 5G and which is expected to be deployed starting from 2030, calling for new investments in this field. At the same time, a framework to screen foreign investments will be effective from October 2020 to "safeguard Europe's interests on the grounds of security and public order".

Following this approach, in May 2020 France and Germany launched the project Gaia-X, a platform of cloud-hosting that will be located in Brussels. Albeit it will not directly substitute leading cloud services offered by companies like the

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[132] Greenberg Center for Geoeconomic Studies, *A Reset of the World Trade Organization's Appellate Body*, Council on Foreign Affairs, 14 January 2020. Retrieved from: https://www.cfr.org/report/reset-world-trade-organizations-appellate-body.

[133] L. O GOSTIN, H. H. KOH, M. WILLIAMS, M. HAMBURG, G. BENJAMIN, W. H. FOEGE, *US withdrawal from WHO is unlawful and threatens global and US health and security*, The Lancet, 9 July 2020. Retrieved from: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31527-0/fulltext.

[134] European Commission, *A New Industrial Strategy for Europe*, 10 March 2020. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/ip_20_416.

[135] B. SMITH-MEYER, C. OLIVER, *Europe vows to finally deliver on its unloved industrial strategy*, Politico.eu, 27 January 2020. Retrieved from https://www.politico.eu/article/europe-vows-to-finally-deliver-on-its-unloved-industrial-strategy-competition-china-united-states-commission/.

American Amazon Web Services and the Chinese Alibaba, Gaia-X will have nevertheless the merit to create a unified ecosystem of data of the European companies that will adhere to the project in a unique European platform under the world-leading European data processing rules[136].

At the same time, the EU countries should work to preserve a collaborative attitude towards other powers, working to deescalate the tensions that are currently shaking the international economic order. The economic partnerships between European and Chinese firms in the growing business of the CAEVs that have been analysed in this work **are clear examples of how international economic cooperation could bring tremendous benefits to the European industries**. In this regard, the EU should also collaborate with other powerhouses like the US and Japan to engage China in reforming forced technology transfer rules under the WTO. As it was showed in the second chapter, it is of utmost importance that China will acknowledge its new status of a technological powerhouse and address the concerns of European companies over the forced disclosure of sensitive proprietary information by administrative processes and FDI restrictions. Concerning the latter, China should also speed up the negotiations of a Comprehensive Agreement on Investment (CAI) with the EU which is expected to improve Chinese market access for European investors based on the principle of reciprocity between the two partners. Currently, at the 31st round, the negotiations have still not produced relevant signs of progress towards the conclusion of the agreement[137].

[136] O. HUGHES, *What is Gaia-X? A guide to Europe's cloud computing fight-back plan*, techrepublic.com, 10 June 2020. Retrieved from: https://www.techrepublic.com/article/what-is-gaia-x-a-guide-to-europes-cloud-computing-fight-back-plan/.

[137] European Commission, *Report of the 31st round of negotiations on the EU-China Comprehensive Agreement on Investment*, 28 July 2020. Retrieved from: https://trade.ec.europa.eu/doclib/docs/2020/july/tradoc_158905.pdf.

Conclusions

The main findings of this paper can be summarized into three points:

- economic partnerships between European and Chinese actors concerning CAEVs can bring benefits for both sides. By partnering with European automakers and European automotive components manufacturers, Chinese companies can have access to cutting-edge technologies and tacit knowledge essential to reach international levels. In exchange for that, according to the classical scheme of "technology for market access", European actors can gain profits by selling their products in the biggest car market in the world and increase their investments in R&D;

- AI, robotics and 5G have started to quickly reshape the automotive industry with the production of CAEVs. In order to succeed in this period of technology disruption, partnering with Chinese ICT companies could help European well-established automakers to preserve their leadership and not to be outpaced by outsiders that are better equipped with telecommunications and AI technologies;

- Chinese automakers and automotive parts manufacturers promote investments abroad. If effectively implemented, these investments could strengthen the position of European motor districts as top-level design and manufacturing hubs.

Despite the disruptive effects on the world economy and global supply chains of the US-China techno/trade war, as well as the slow progress on long-awaited reforms of the Chinese economy concerning market access, new opportunities exist for European actors to enter the Chinese automotive market. An example can be represented by the Chinese new infrastructure plan. Launched at the 2020 National People's Congress, compared to other previous infrastructure programmes this package is more reliant on private investments. In this regard, despite the maintenance of high market barriers in sectors such as the satellite communications and intercity rails, the autonomous vehicles sector is expected to be completely open to foreign investments and subject to tariff exemptions[138].

In the next years, finding the right balance between market openness and technology sovereignty concerns will be one of the most critical challenges of our times.

[138] D. WONG, *How Can Foreign Technology Investors Benefit from China's New Infrastructure Plan?*, china-briefing.com, 7 August 2020. Retrieved from: https://www.china-briefing.com/news/how-foreign-technology-investors-benefit-from-chinas-new-infrastructure-plan/.

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