The Impact of Covid-19 on the Global Automotive Industry - Future Challenges

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Abstract

The Automotive Industry (AI) constitutes one of the most vibrant industries contributing massively to the global GDP. The industry is affected by several factors such as (disruptive) innovation, SCM access to technology, and HR development. The legal framework constitutes a major element that drives AI operations, leading companies to focuson ensuring compliance. The Covid-19 pandemic has created a brand-new environment in which the AI is required to operate. The research has identified a major difference in the performance of the German and the Japanese brands.Additionally, the research has identified that luxury brands have been more resilient to the pandemic effects, in comparison to family and SUV brands. The current paper has examined the major AI brands as these are evaluated by Interbrand, as well as extensive updated literature review in order to identify the impact of the pandemic, and how the Brands can overcome the major obstacles.

Keywords:AI, innovation,legal framework, technology, brands, innovation, HRM

1. Introduction

The Automotive Industry (AI) as a major economic sector has been positively affected by internal factors such as the fourth industrial revolution, the rapid development of Information Technology (IT),as well as the impact of human capital which plays a key role in the overall growth, performance, and productivity of the industry. This has enabled all the industry sectors to expand to new markets, and most importantly, to provide innovative products to the existing markets (Pardi, 2019). In addition, the AI is highly impacted by several external factors, but primarily by political decisions of both countries and regions. Large single economies such as the United States and China, and regional organisations such as the European Union (EU) and the North American Free Trade Agreement (NAFTA) develop policies which greatly impactproduction and marketing processes within the industry (Miller & Sirgy, 2011). Recent developments in Supply Chain Management (SCM) have also reshaped the way that the AI is developing its operations, as more players from more countries have entered the game, with the role of China is at the frontline of the overall process (Clinton & Hecimovic, 2020). All these create a challenging framework in which the AI is required to operate, with the effect that the industry managers will be required to implement new strategies, with the digital transformation of the industry being a pivotal issue (Winkelhake, 2019).

2. Discussion

2.1. AI Contribution to the largest Economies

The AI has in recent decades contributed heavily towards the global Gross Domestic Product (GDP) and job creation, with the world's largest economies (USA, China, Japan, and Germany) enjoying the lion's share (ILO, 2020). For the USA, the AI industry contributes as much as $545.4 millionto the coutry's GDP, representing 2.7% of the country's GDP in 2019(US BEA, 2019). For developing economies, the impact of AI progress has led not only to economic growth but also to social cohesion, with the BRICS countries (Brazil, Russia, India, China, and South Africa) expriencing some of these benefits (Bharadwaj, 2015). All the above create a vibrant business environment which callsthe sector to identify the prospects that are visible not only in the USA, but also in the global market, which to a large extentare also applicableto the industry of heavy industrial products (Ghadimi et al., 2018).

China has long managed to champion the industry by developing both quantitalively and qualitatively, and offering a broad range of products and services. China's focus on the AI industry has contributed significantly to the growth of the economy. At the same time, the country has managed to experience massive growth in the international market by strategically cooperating with several global brands, providing parts, logistics, and SCM services (Techakanjanakit, 2012).

In China, vehicles' sales reached 25million units, with Battery Electric Vehicles (BEV) being sold three times more than plug-in hybrid electric vehicles (PHEV) (Wong, 2020). The Chinese brands have managed to win customers'preferences with a massive 39.2%, followed by the Japanese brands with 21.3%, with German, American, Korean, and French makers following in the 1.4 billion market (Figure 1) (MarkLines, 2020).

In addition, Figure 2 outlines global EV sales in 2018 (as a percentage of the overall vehicle sales), revealing the role of the Scandinavian region in the overall development of 'green products' (Routley, 2019).

In addition, the global market of Publicly Accessible Vehicles, for both slow and fast chargers, has experienced a healthy growth of 6%, with China enjoying a significant proportion, higher than its share in the global population (Figures 3 & 4) (IEA, 2020). This creates the appropriate infrastructure to enable the AI to produce the right number of vehicles, and to ensure that custoerswill have easy access to chargers outside their residence. Importantly, the Scandinavian countries are all placed among the best performing, with Norway, Iceland, and Sweden proudly holding the first three positions. This is a major signpostfor the AI to focus its strategic marketing approaches and create a positive business environment, as the Scandinavian regions constitute one of the most powerful ones across the globe (NCM, 2017).

The EUis movingin the same direction as the USand Chinese markets, as the overall AI contribution to the organisation's GDP reached 7% in 2019, with an estimated 14.6 million workers being involved both directly and indirectly in the process of manufacturing, marketing & sales, and after-sales services, helping the EU to achieve a massive trade surplus of €74 billion (EAMA, 2020). Germany remains the flagship of the EU's AI with total sales of €436.20 billion, with €153.45 billion being linked to the German internal market, and an additional €282.75 million being in the complex global market arena (Statista, 2020). Figure5 outlines Germany's AI sales between 2010 and 2019, revealing the country's impact on the global market, which has enabled the EU to overall enjoy a healthy economic growth.

The Americas and the Asia-Pacific regionsare also experiencing a massive growth not only in the production of cars, but most importantly, in the assembly procedures which take advantage of several elements such as low labour and transportation costs, leading to GDP growth and job creation. This creates an emerging business environment that can provide both opportunities and threats, which creates the need for deeper market analysis in order to reach the best possible marketing and supply chain strategic decisions (Simsek, 2019).

2.2. AI Key Trends& Drivers

The AI is highly sensitive due to the intense competition and the continuous structural changes that force companies to develop strategies that will enable them to take advantage of the opportunities provided in the global market, and ensure a sustainable competitive advantage (Vošta & Kocourek, 2017). The industry is affected by a number of key drivers such as disruptive innovation, battle for digital technology, developing a sustainable competitive advantage through effective supply chain management, securing access to raw materials, and unpredictability, all creating challenges for the next decade (Miller, 2017).

The changing preferences of consumers in relationg to several aspects such as the perceived quality, create further challenges for AI companies, leading them to become more creative and innovative, with the Value-Based Perceived Quality (VPQ) and Technical Perceived Quality (TPQ) being at the front line for the engineering departments (Stylidis et al., 2015). The 2010s have been the most important in terms of Innovation and Sustainability, which has had an impact on profitability, competition, the satisfaction of human needs, and ensuring the retention of the essential human capital (Vaz et al., 2019).

Open Innovation (OI) constitutes a real challenge and trend that drives the AI forward, and pushes companies to improve their overall development processes. Importantly, this can be visible in companies that are decentralized and have subsidiariesnot just in other countries, but in other regions, such as several French companies with departments in Brazil (Martins et al., 2019). The 4.0 industry which focuses on the exchange of data and the enhancement of manufacturing processes triggers the need for the AI to strategically focus on the transformation of its overall procedures that will help both the industry and individual companies to take advantage of the several opportunities provided. These mainly refer to cloud computing, R&D, Artificial Intelligence, and alternative fuels. Working with innovative start-ups can provide established manufacturers higher level of flexibility and access to more innovative approaches (Deloitte, 2020).

Additive Manufacturing (AM), best known as 3D Printing, adds to the available opportunities for the AI to promote innovation, competitiveness, and most importantly, to become a supply chain transformation driver. This requires companies within the AI to strategically focus on educating their workforce, as there is currently a substantial shortage of such trained staff in the particular field (Giffi et al., 2020).

The rapid 5G development has reshaped the ways that people operate in their daily lives, with an increasing number of cities across the world introducing 5G Technology into their facilities,which are vital for their citizens. This has an impact on transportation, hence, calling for the AI to focus on addressing the challenges and ensure that 5G technology will be compatible with the new cars for both personal/family and public usage (Guevara & Cheein, 2020).

Branding remains a challenge for the AI as this can provide itwith a more efficient market positioning. However, the AI will inevitably face challenges because of the sensitive marketplace and increasing consumers' demands, which are traditional branding strategic obstacles (Tafesse & Korneliussen, 2014). Companies such as Toyota, Tesla, and Volvo have in recent years come across brand-loyalty challenges, with brand-loyalty and emotional branding strategies being key in the overall procedure (Loureiro et al., 2017).

The emissions aspect creates several challenges for heavy industries as global warming calls for greener products, because of the fact that many geographical areas have experienced severe problems such as global warming. This has lead to calls on countries and industries to strategically focus on low-carbon emission products (IMF, 2020).

Finally, the AI is highly affected by the legal framework that has been developed across the world, which to a large extend determines the way that automakers will develop their products. Regulations such as Regulation 2018/858 of the European Parliamentcalls companies and member-states to harmonise their production activities and legal framework, respectively, in order to ensure the application of a uniform level of quality. Hence, this creates a legal challenge that needs to be taken into consideration by the AI in their future strategic planning.

2.3. TheAIin the Covid-19 era

The global economy has been highly affected by the Covid-19 pandemic, with the USA, the European Union, Japan, and China, experiencing a sharp decline in their economic growth, with both the short-term and long-term consequences to be yet clarified. The global trade, the financial and the commodity markets, are only some of the major industries that have been affected(World Bank, 2020). Income inequality and wealth distribution constitute some of the most important challenges for advanced economies, as these can form serious obstacles to transportation facilities, calling for the countries to focus on innovation, the introduction of the 5G technology, and improving inter-city transportation capabilities. This can potentially transform the pandemic crisis into a sustainable opportunity for both the countries and the individual industries to substantially improve their operations (Song & Zhou, 2020).

The AI has been one of the major pandemic victims, resulting in a large drop in sales, affecting over 40% of the jobs due to factory closures, mainly in China and other Asian markets (ILO, 2020). The pandemic and the intensive restriction measures that have been enfoced across the globe has had a substantial impact on industries directly linked to the AI, such as steel and supply chain, triggering a sustained domino effect, thus eventually affecting the industry's cost competitiveness (Deshmukh & Haleem, 2020).

The Chinese and German automotive sectors have experienced some of the most difficult problems onissues such as supply chain and access to electronics, as related companies and industries are facing serious problems, that can even threaten their survival (Guan et al., 2020). Responding to the current challenges is one of the major concerns for the AI, as this is unpredictable in terms of length and depth, thus creating concerns for several stakeholders such as shareholders, suppliers, the banking sector, governments, and regulators (Mishra, 2020).

3.Interbrand Evaluation

3.1. Introduction to Intrbrand Evaluation

Interbrand constitutes one of the most reputable Brand valuers, and the annual Brand evaluation is based on three basic steps: (i) current and future estimated profits, (ii) the Role of Brand Index (RBI) which includes primary and secondary data, and (iii) Brand Strength compared to the main competitors (Dorfleitner et al., 2019). All these create a positive environment in which the major AI brands can be analysed in terms of performance, and identify the impact of Covid-19. According to Interbrand (2020),there are 15 AI companies within the '100 Best Global Brands' with Toyota being the champion AI Brand, Mercedes-Benz coming in at second place, and BMW at third.

Figure6 outlines the results of the specific 15 Brands during 2018-2020, providing a clarified overview in terms of trends, and provides the ability to critically evaluate the Brands'performance before and after the Covid-19 pandemic, and hence the impact thereof.

Importantly, 13 out of the 15 companies have experienced a decline, with Hyundai being the only one that managed to increase its value, and Tesla being the only newcomer in the list. Figure7 outlines the change (%) by Brand between 2019 and 2020.

The fact that Tesla, an innovative Brand which focuses on providing 'green' vehicles with recent expansion on other relevant products, andwhich heavily invests billions of dollars in R&D and Design has entered the Interbrand list, indicates how these elements can lead to a substantial competitive advantage in the emerging green market (Perkins & Murmann, 2018). Products such as the Cypertruck not only have enabled Tesla to enhance its overall Brand image, but most importantly, has managed to finance the project simply by achieving as many as 200.000 preorders, with the prices of the three different models ranging from $39.000 to $69.000. Hence, the company has managed to attract at least $7.8 billion, contributing to its overall successful performance (Furr & Dyer, 2020).

3.2. Comparison of Brands by Country

Table 1 identifies the performance of the German and Japanese Brands under examination, as these constitutethe two most important players, and can provide useful information in indentifying possible performance problems in terms of innovation, marketing, and brand loyalty. The examination clarifies that the German Brands have managed to control the impact of Covid-19 as 5 out of the 6 Brands have experienced below-the-average negative performance, with only one Brand, MINI, which is owned by BMW, being below-the-average. Germany's performance is -4.5%, positively compared to the overall-6.29%. On the other hand, the Japanese Brands are in a much worse position, with all Brands experiencinga negativeimpact ranging between -8% to -11% with the country's average being at -9%, a massive 2.71% below the overall average (-6.29%) and exactly double of the German Brands.

Theluxury and the super luxury brands have experienced less decline from the family and SUVs brands(Table 2), indicating the role of strong brands, which can possibly lead AI companies to focus their attention on serving particular market segments. Importantly, most of the luxury and super luxury brands come from the German market, revealing the strength of the specific country in the global marketplace, and how this performance can have an impact on both the country's national economy and the EU economy. Tesla has not been included, as the company's rapid development which has enabled it to experience an unusual growth based on innovation and market diversification (Yoon, 2019) needs to be examined within a difference context. Market segmentation remains a challenge for the AI which to a great extent is influenced by quality in terms of materials and services (Casper &Sundin, 2018), calling for the companies to strategically focus on the emerging trends, something that Tesla has successfully managed to achieve.

4. Conclusions & Recommendations

Covid-19 has led the AI, just like the rest of the major global economy sectors, to a negative impact, creating several challenges for both the industries and national economies. These challenges are far from easy to overcome, leading to the need for collective market evaluation that will take the entire industry forward. The potential job loss creates further uncertainty for the industry and the workforce, as valuable human capital may be forced to move to other industries, causing further problems that need to be identified and confronted before the crisis escalates and becomes a serious disaster for the entire AI. However, this is a concern which is not limited to the industry only, but importantly, extends to governments,that need to provide the relevant support to the AI through a series of schemes, that will enable the companies to retain their human capital at the most difficult times. Innovation constitutes a major driver for Brand development, and this is clearly visible in the case of Tesla which has managed to enter the Interbrand scoresheet by focusing on providing vehicles that matchconsumers' requirements. The Cypertruck is evaluated as a fine example of an innovative product that lead the company to a sustainable competitive advantage, by amassing a massive200.000 preorders. Innovation can extend to several market segments, even niche segments, thus enabling the Brands to focus on their own unique skills and capabilities, leading them to product & services diversification.Supply Chain Management can provide the AI with several benefits, ranging from customer satisfaction to brand loyalty, and of course, to a substantial positive financial performance, much needed for the overall growth, especially in difficult time periods, such as the Covid-19. This of utmost importance, calling for the Brands to develop their SCM functions, and even, merge activities in order to achieve economies of scale. 5G constitutes a major challenge for the entire AI as its adaptation to new vehicles such as the Battery Electric Vehicles is evaluated as a necessity, rather than a need.

It is an obvious fact that the Japanese AIis indeed facing more challenges than the German AI, creating more concerns over their future strategic planning. Finally, the fact that super-luxury and luxury brands have incurred a lesser negative impact in comparison to family and SUV brands, constitutes an indicator that other brands should turn their production to such types of vehicles. This also comprises an indicator as to which social classes have been more severely affected by the pandemic. The focus on all the above-mentioned is necessary, as the changing market environment, and the global uncertainty due to the negative impact of Covid-19, can give rise to serious obstaclesfor the industry's sustainable development.

5. Limitations of the Study

The research was developed based on secondary data; hence, this may cause limitations in terms of data collection. However, attention has been paid in order to ensure that data is collected from trustworthy academic and professional sources. Given the continuation of the Covid-19 pandemic, the overall impact may change, thus, further research is required in order to enable the verification of the outcomes.

References

Bharadwaj, A. (2015). Technological and Socio-Economic Issues in the Global Automobile Industry. Transp. In Dev. Econ. 1, 33–39. https://doi.org/10.1007/s40890-015-0005-2

Casper, R., Sundin, E. (2018). Addressing Today's challenges in automotive remanufacturing. JnlRemanufactur, 8, 93–102. https://doi.org/10.1007/s13243-018-0047-9

Clinton, C. & Hecimovic, A. (2019). Global supply chains after COVID-19: the end of the road for neoliberal globalisation? Accounting, Auditing &

Accountability Journal, 33(8), 1-27. https://www.researchgate.net/publication/343880906_GLOBAL_SUPPLY_CHAINS_AFTER_COVID-19_THE_END_OF_THE_ROAD_FOR_NEOLIBERAL_GLOBALISATION

Deloitte (2020). Deloitte Insights: Industry 4.0 in automotive. https://www2.deloitte.com/content/dam/insights/us/articles/automotive-news_industry-4-0-in-automotive/DI_Automotive-News-Supplement.pdf

Deshmukh, S.G. & Haleem, A. (2020). Framework for Manufacturing in Post‑COVID‑19 World Order: An Indian Perspective, International Journal of Global Business and Competitiveness, 15, 49–60.

https://doi.org/10.1007/s42943-020-00009-1

Dorfleitner, G., Rößle, F., & Lesser, K. (2019). The financial performance of the most valuable brands: A global empirical investigation. Heliyon, 5(4), e01433. https://doi.org/10.1016/j.heliyon.2019.e01433

European Automobile Manufactures Association (2020). Facts about the Automobile Industry.https://www.acea.be/automobile-industry/facts-about-the-industry#:~:text=The%20turnover%20generated%20by%20the,an%20array%20of%20business%20services

European Parliament and Council (2018). Regulation (EU) 2018/858. Official Journal of the European Union L 151/1. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.151.01.0001.01.ENG

Furr, N. & Dyer, J. (2020). Lessons from Tesla's Approach to Innovation. Harvard Business Review, February 2020.https://hbr.org/2020/02/lessons-from-teslas-approach-to-innovation

Ghadimi, P, Wang, C & Lim, M (2018). Sustainable supply chain modeling and analysis: Past debate, present problems and future challenges. Resources, Conservation and Recycling, 40, 72-84. https://doi.org/10.1016/j.resconrec.2018.09.005

Giffi, C.A., Gangula, B. & Illinda, P. (2020). 3D opportunity in the automotive industry Additive manufacturing hits the road. Deloitte University Press. https://www2.deloitte.com/content/dam/insights/us/articles/additive-manufacturing-3d-opportunity-in-automotive/DUP_707-3D-Opportunity-Auto-Industry_MASTER.pdf

Guan, D., Wang, D., Hallegatte, S. et al. (2020). Global supply-chain effects of COVID-19 control measures. Nat Hum Behav 4, 577–587. https://doi.org/10.1038/s41562-020-0896-8

Guevara, L. & Cheein, F.A. (2020). The Role of 5G Technologies: Challenges in Smart Cities and Intelligent Transportation Systems. Sustainability,12(16),1-15. https://doi.org/10.3390/su12166469

Interbrand (2020). Best Global Brands. https://interbrand.com/best-global-brands

International Energy Agency (2020). Global EV Outlook 2020. https://www.iea.org/reports/global-ev-outlook-2020

International Labour Organisation (2020). The future of work in the automotive industry: The need to invest in people's capabilities and decent and sustainable work. Issues paper for the Technical Meeting on the Future of Workin the Automotive Industry. Retrieved from https://www.ilo.org/sector/Resources/publications/WCMS_741659/lang—en/index.htm

International Labour Organisation (2020). ILO Sectoral Brief: COVID-19 and the automotive industry. https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/briefingnote/wcms_741343.pdf

International Monetary Fund (2020). A Year like no other. IMF 2020 Annual Report. https://www.imf.org/external/pubs/ft/ar/2020/eng/downloads/imf-annual-report-2020.pdf

Martins, M.B., Kaminski, P.C. & Guo, J. (2019). Differences in open innovation practices between headquarters and subsidiaries in the automotive industry: The French case. Cogent Engineering, 6(1), 1-21. https://doi.org/10.1080/23311916.2019.1684806

Loureiro, S.M.C., Sarmento, E.M. & Le Bellego, G. (2017). The effect of corporate brand reputation on brand attachment and brand loyalty: Automobile sector, Cogent Business & Management, 4(1), 1-10. https://doi.org/10.1080/23311975.2017.1360031

MarkLines Data Center (2020). China – Flash report, Sales volume, 2019. https://www.marklines.com/en/statistics/flash_sales/salesfig_china_2019

Miller, R. (2017). The six trends driving change in the automotive industry. Ernst & Young. https://www.ey.com/en_gl/automotive-transportation/the-six-trends-driving-change-in-the-automotive-industry

Miller, C. & Sirgy, M.J. (2011). Impact of Globalization of the Automotive Industry on the Quality of Life of the US Southeast. The Economic Geography of Globalization. In book: The Economic Geography of Globalization. IntechOpen.

Mishra, R. (2020). COVID-19 impact on Indian automotive industry- Taking action in troubled times. ET Auto. https://auto.economictimes.indiatimes.com/news/industry/opinion-covid-19-impact-on-indian-automotive-industry-taking-action-in-troubled-times/74944847

Pardi, T. (2019). Fourth industrial revolution concepts in the automotive sector: performativity, work and employment. Journal of Industrial and Business Economics, 46(3),https://ideas.repec.org/a/spr/epolin/v46y2019i3d10.1007_s40812-019-00119-9.html

Perkins, G. & Murmann, J.P. (2018). What Does the Success of Tesla Mean for the Future Dynamics in the Global Automobile Sector? Management and Organization Review, 14(3), 471-480. https://doi.org/10.1017/mor.2018.31

Routley, N. (2019). Visualizing EV Sales Around the World. Visual Capitalist.
https://www.visualcapitalist.com/electric-vehicle-sales

Simsek, M.C. (2019). Regional Shift in the Global Automotive Sector. Advances in Economics and Business 7(5), 171-184. https://DOI:10.13189/aeb.2019.070501

Song, L., & Zhou, Y. (2020). COVID-19 Pandemic and Its Impact on the Global Economy: What Does It Take to Turn Crisis into Opportunity? China & World Economy,28(4), 1-25. https://doi.org/10.1111/cwe.12349

Statista (2020). Sales in the automobile industry in Germany from 2005 to 2019.

https://www.statista.com/statistics/657398/automobile-industry-germany-sales

Stende, T. (2017). Nordic Council of Ministers: Is the Nordic Region best in the world? https://norden.diva-portal.org/smash/get/diva2:1149463/FULLTEXT02.pdf

Stylidis, K., Wickman, C. & Söderberg, R. (2015). Defining perceived quality in the automotive industry: an engineering approach. Procedia CIRP 36(2015), 165-170. https://doi.org/10.1016/j.procir.2015.01.076

Tafesse, W. & Korneliussen, T. (2014). Branding Goals and Strategies at International Auto Shows. International Journal of Marketing Studies, 6(4), 23-34. https://DOI:10.5539/ijms.v6n4p23

Techakanjanakit, S. (2012). The Strategic Transformation of Automobile Industry in China. International Journal of Financial Research 3(3). https://doi.org/10.5430/ijfr.v3n3p8

U.S. Bureau of Economic Analysis (2020). GDP by Industry, Value Added by Industry.
https://apps.bea.gov/iTable/iTable.cfm?reqid=150&step=2&isuri=1&categories=gdpxind

Vaz, C.R., Rauen, T.R.C. & Lezana, A.G.R. (2017). Sustainability and Innovation in the Automotive Sector: A Structured Content Analysis. Sustainability, 9(6), 1-23. https://Doi:10.3390/su9060880

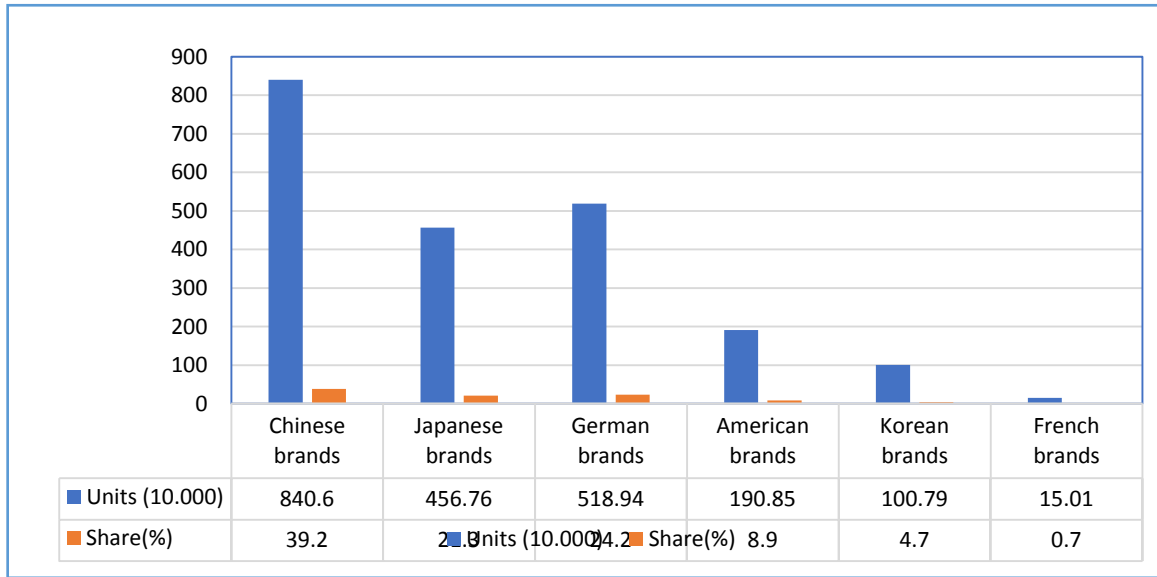Vošta, M. & Kocourek, A. (2017). Competitiveness of the European Automobile Industry in the Global Context, Politics in Central Europe 13(1), 1-8 https://DOI:10.1515/pce-2016-0023

Winkelhake, U. (2019). Challenges in the Digital Transformation of the Automotive Industry. ATZ Worldw 121, 36–43. https://www.springer.com/gp/book/9783319716091

Wong, S. (2020). Automotive sales industry in China – Statistics & Facts. Transportation & Logistics – Vehicles & Road Traffic. Statista. https://www.statista.com/topics/1100/automobile-sales-in-china

World Bank (2020). Global Economic Prospects. Washington, DC: © 2020 International Bank for Reconstruction and Development / The World Bank. https://www.worldbank.org/en/publication/global-economic-prospects

Yoon, E. (2019). Tesla's Strong Brand Gives It Unusual Expansion Potential. Harvard Business Review. May 2019 https://hbr.org/2019/05/teslas-strong-brand-gives-it-unusual-expansion-potential

Figure 1. China Car Sales by Country Brands [Source: MarkLines Data Center, 2020]

	Chinese brands	Japanese brands	German brands	American brands	Korean brands	French brands
■ Units (10.000)	840.6	456.76	518.94	190.85	100.79	15.01
■ Share(%)	39.2	21.3	24.2	8.9	4.7	0.7

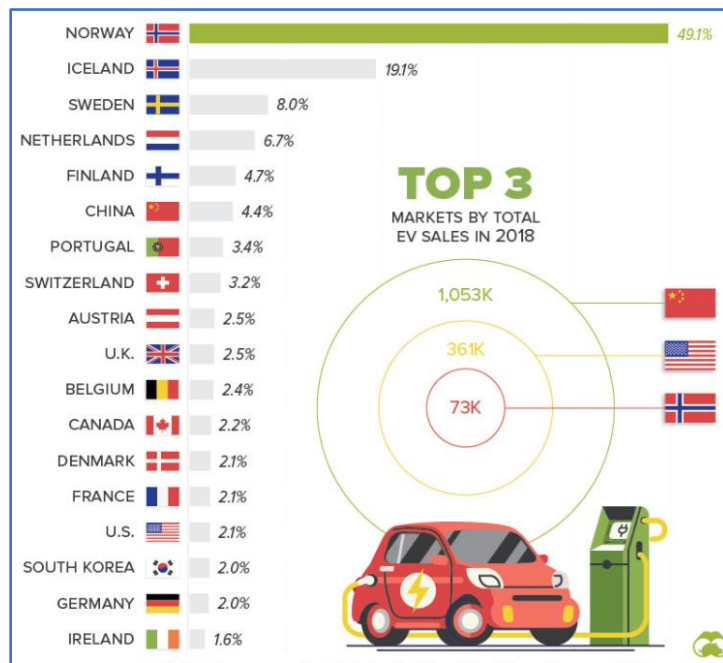Electric Vehicles 2018 [Source: Routley, 2019] *Figure 2.* Sales of

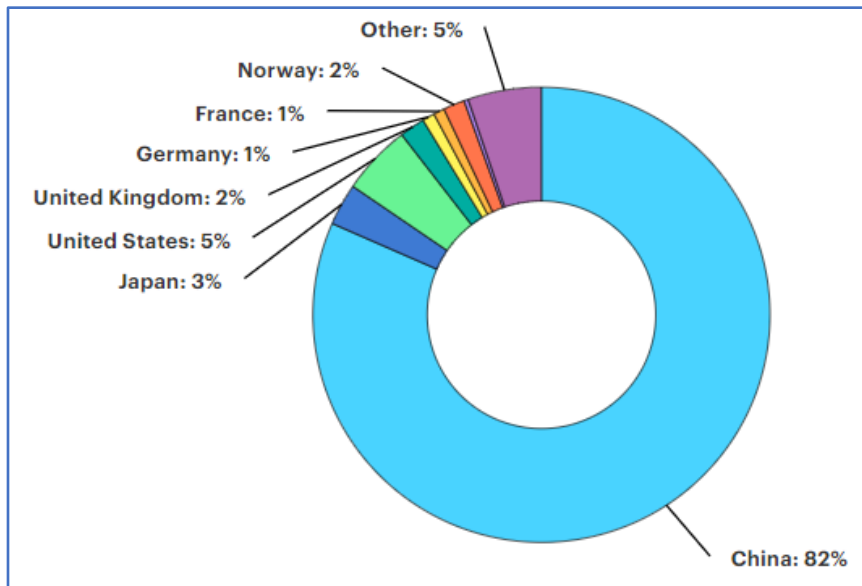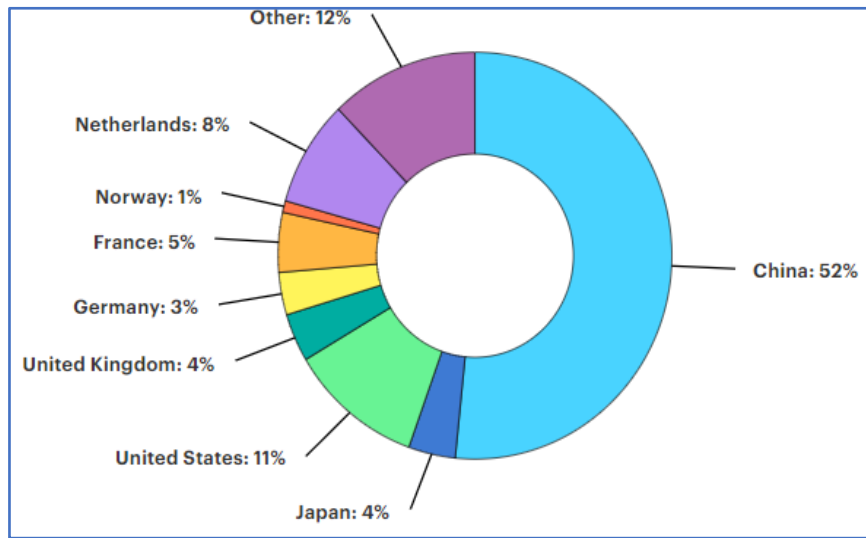Figure 3. Publicly

Accessible Slow Chargers [Source: IEA, 2020]

Figure 4. Publicly accessible Fast Chargers [Source: IEA, 2020]

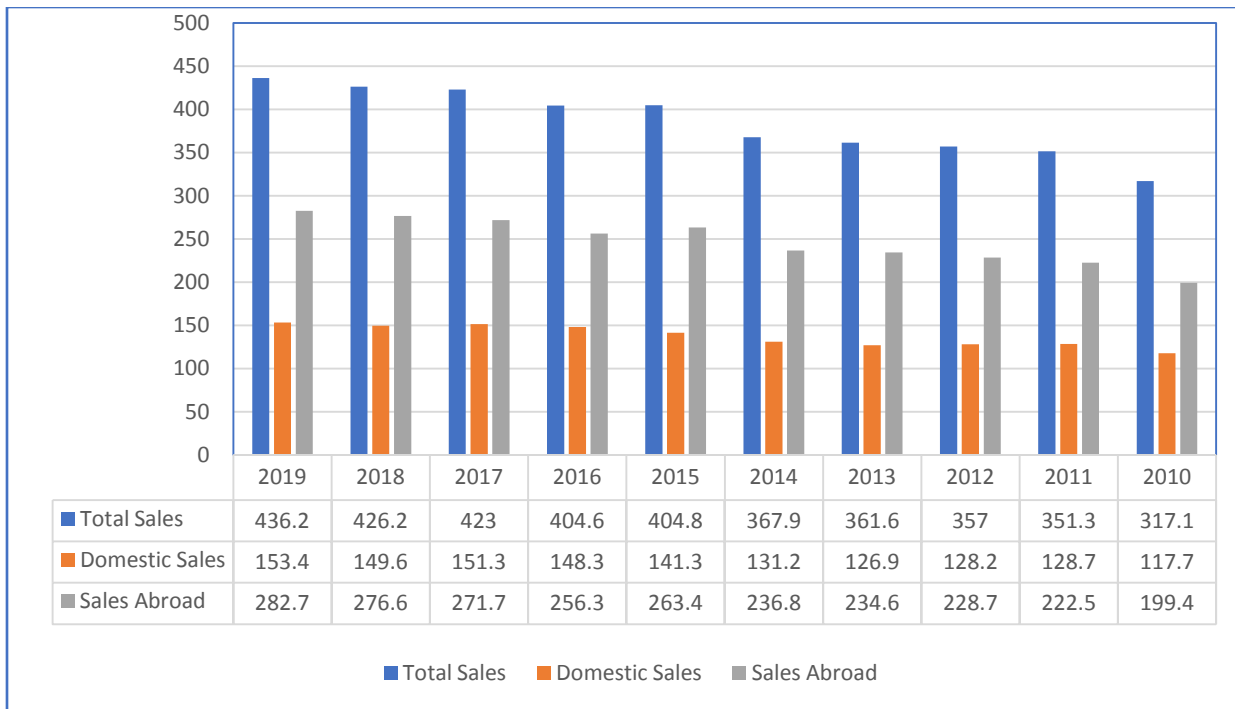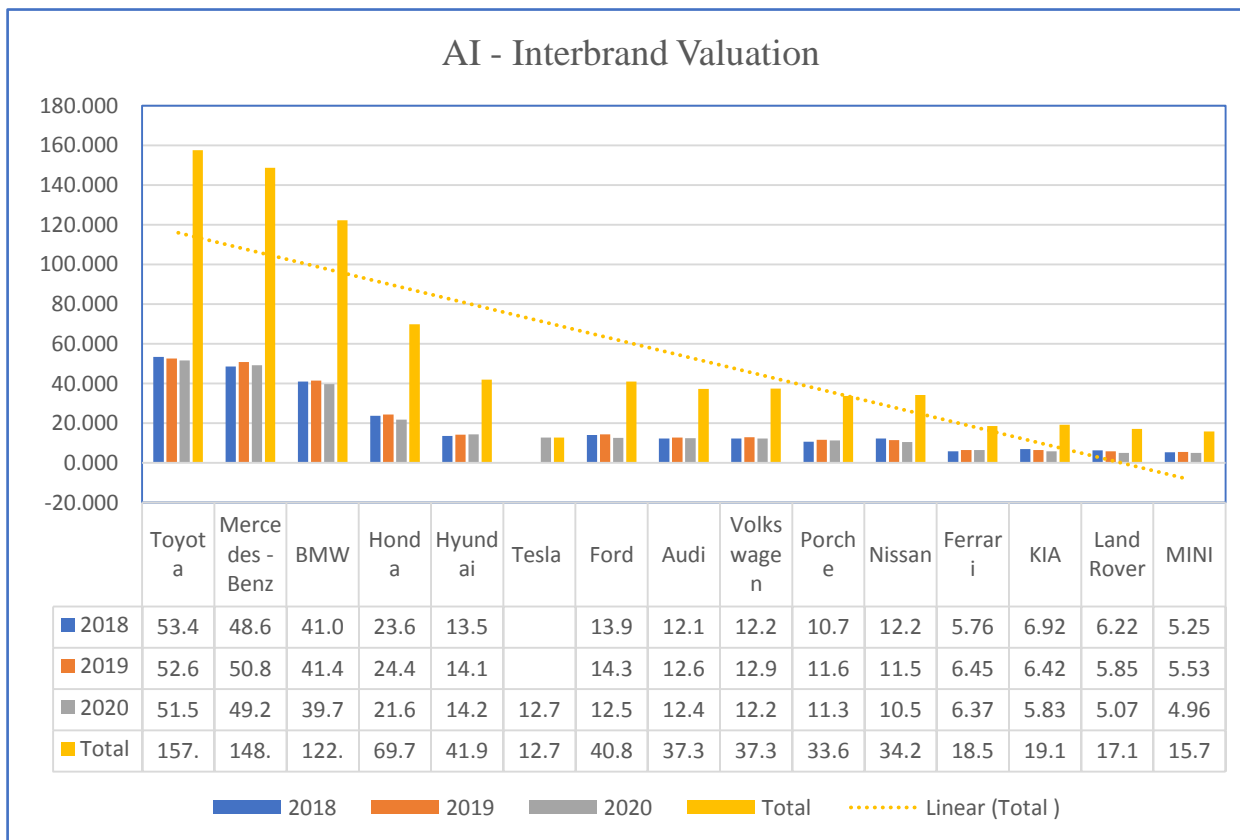|	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
Total Sales	436.2	426.2	423	404.6	404.8	367.9	361.6	357	351.3	317.1
Domestic Sales	153.4	149.6	151.3	148.3	141.3	131.2	126.9	128.2	128.7	117.7
Sales Abroad	282.7	276.6	271.7	256.3	263.4	236.8	234.6	228.7	222.5	199.4

Figure 5. Sales in the automobile industry in Germany from 2010 to 2019 [Source: Statista, 2020]

Figure 6. AI – Interbrand Valuation [Source: Interbrand, 2020]

	Toyota	Merce des - Benz	BMW	Honda	Hyundai	Tesla	Ford	Audi	Volks wagen	Porche	Nissan	Ferrari	KIA	Land Rover	MINI
2018	53.4	48.6	41.0	23.6	13.5		13.9	12.1	12.2	10.7	12.2	5.76	6.92	6.22	5.25
2019	52.6	50.8	41.4	24.4	14.1		14.3	12.6	12.9	11.6	11.5	6.45	6.42	5.85	5.53
2020	51.5	49.2	39.7	21.6	14.2	12.7	12.5	12.4	12.2	11.3	10.5	6.37	5.83	5.07	4.96
Total	157.	148.	122.	69.7	41.9	12.7	40.8	37.3	37.3	33.6	34.2	18.5	19.1	17.1	15.7
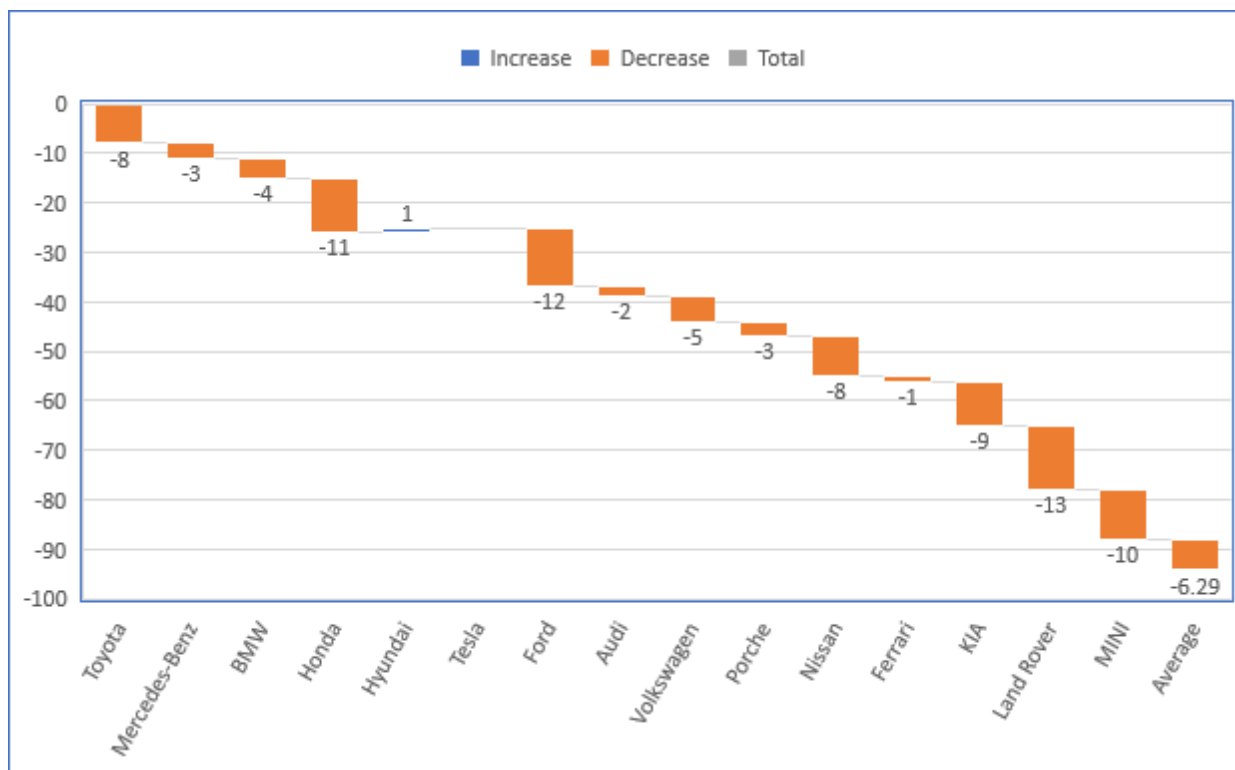
Table 1
Comparison of German and Japanese Brands

German Brands		Japanese Brands	
Brand	Change %	Brand	Change %
Mercedes-Benz	-3	Toyota	-8
BMW	-4	Honda	-11
Audi	-2	Nissan	-8
Volkswagen	-5		
Porche	-3		
MINI	-10		
Average	-4.5	Average	-9

Table 2

Comparison of Luxury & Super Luxury Brands vs Family & SUVs Brands

Luxury & Super Luxury Brands	Change %	Family & SUVs Brands	Change %
Mercedez-Benz	-3	Volkswagen	-5
BMW	-4	MINI	-10
Audi	-2	Toyota	-8
Porsche	-3	Honda	-11
Ferrari	-1	Nissan	-8
		Ford	-12
		Hyundai	1
		KIA	-9
		Land Rover	-13
Average	-2.6	Average	-8.33