



Beyond the Model 3: Taiwan's Competence and Sustainability in the EV Industry

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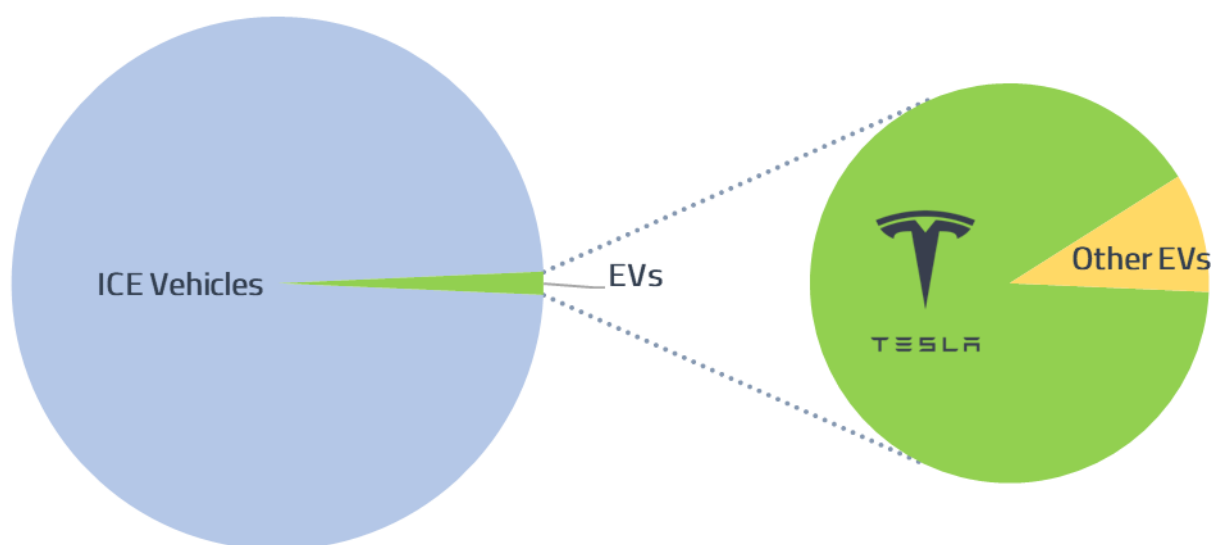
Since manufacturing giant Hon Hai Precision Industry Co. announced its MIH Alliance open electric vehicle (EV) development platform in October 2020, more than 1,000 companies have jumped aboard as of March 2021. They are expected to start supplying products to the platform by the end of April 2021, according to Hon Hai chairman Young Liu.

While the MIH platform is, in part, an attempt by Hon Hai to diversify its product portfolio to enhance its own profitability, it also underscored Taiwan's position as a linchpin of the global EV supply chain - one that is on par with its comprehensive role in computer and smartphone components.

This report will discuss Taiwan's advantages in the EV sector as well as challenges it faces, and make comparisons with other Asian economies where appropriate. We will use the lens of the Tesla's Model 3 to examine Taiwan's role as supplier as well as its increasing clout as a consumer. Finally, it will include profiles of the companies in Taiwan that are increasingly operating in the EV sector, with a special focus on investment opportunities from an environmental, social, and governance (ESG) perspective.

With evidence from its EV supply chain and relevant policies, this paper attempts to discuss Taiwan's advantages in the EV sector as well as challenges it faces, and make comparisons with other Asian economies where appropriate. This paper also takes a look at Taiwan's own market for EVs, which is growing from a small base. Given policy goals to reduce traditional internal-combustion-engine (ICE) cars over time, the domestic market will likely continue to expand, and may get further boosts if incentives are introduced, or tariffs lowered.

Figure 1 Taiwan's EV Sales in 2020



	Vehicles	EVs	Ratio	Tesla (Share in EVs)
2019	439,813	3,394	0.77%	3,136 (92.40%)
2020	457,411	6,360	1.39%	5,746 (90.35%)

Source: Directorate General of Highways, MOTC (Taiwan)

Global EV sales surpassed 3 million in 2020, a rise of 43% year-on-year, more than impressive in this stagnant economy. Taiwan, with 24 million people, is a relatively small EV market. Tesla accounted for more than 90.35% of the EV market with, 5,746 cars sold in the past year, up from 3,136 in 2019. And with more than 4,000 units in sales, the company's Model 3 topped the charts.

Despite low vehicle sales, Taiwan occupies an outsized position in the automotive parts sector. Sales of parts have brought in greater revenue than vehicles since 2006 (Hsu, 2016). The wave of smart cars in recent years has also brought business to many enterprises, both in the automobile and technology sector, with Tesla's suppliers featuring prominently. The recent report that Apple Car will be released in the third quarter of 2021 and mass-produced from 2024 has boosted Taiwan's stock market.

Figure 2 Twelve Taiwan-listed Tesla/EV Concept Stocks



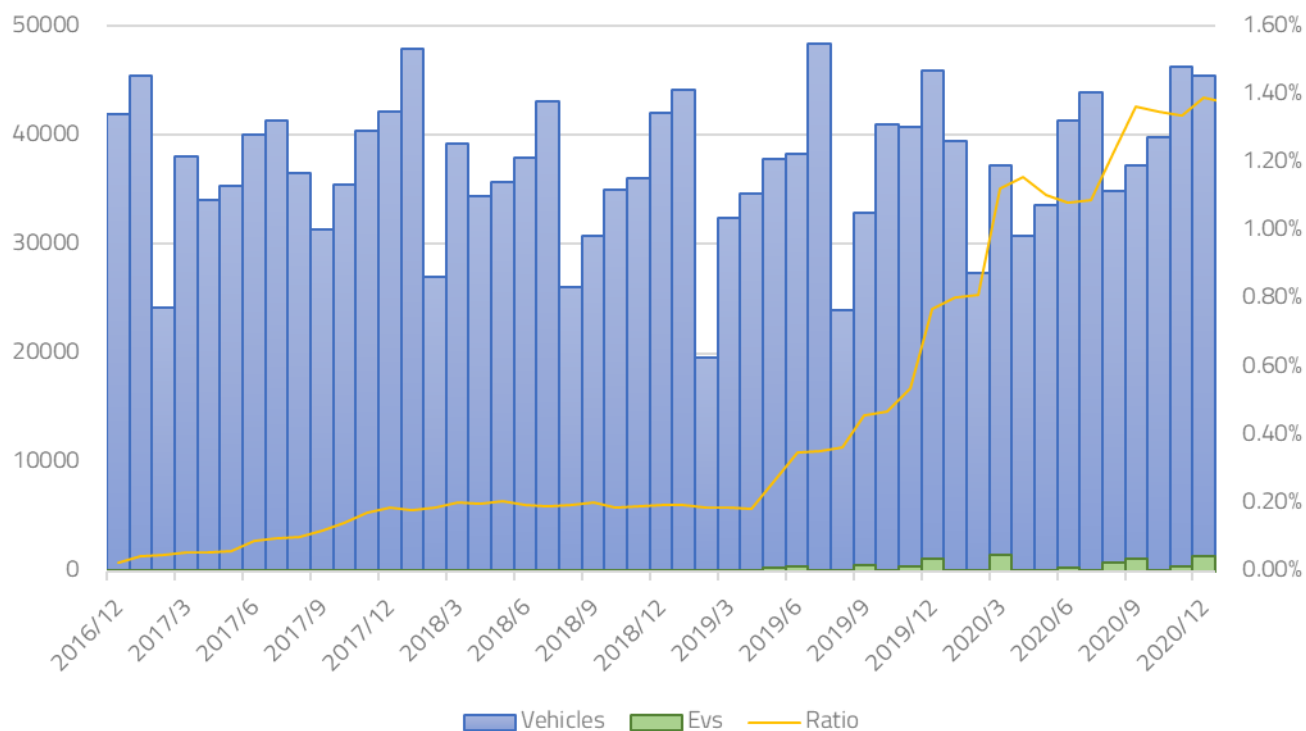
Source: Publicly available information; Share price information was retrieved from Yahoo Finance

Meanwhile, manufacturing EVs has been made increasingly easier, to the point that it is little different from manufacturing smartphones and PCs in Taiwan, a development underscored by Hon Hai's open platform. During the smartphone boom, many little-known brands designed their phones based on an 80%-finished original design manufacturer (ODM) model provided by foundries. MIH Alliance attempts to gather manufacturers to define a common standard adopted for their future 80%-finished EV model which smaller carmakers can use for their products. This mode will be profitable as long as MIH has enough clients to supply orders (Huang & Hou, 2021). What matters more is that once this mode is proved to work out, larger carmakers might also turn to the platform. Since the announcement, MIH has not only attracted many Taiwan-based enterprises but also EV industry titans such as CATL from China and Eaton from the US, among others.

Tesla Spurs Taiwan's EV Market

A total of 6,360 new EVs were registered in Taiwan, up 87% year on year, and EVs now account for more than 1% of new vehicles sold. Tesla's market share in EVs dropped slightly with the introduction of new models by Porsche and Audi but remained above 90%.

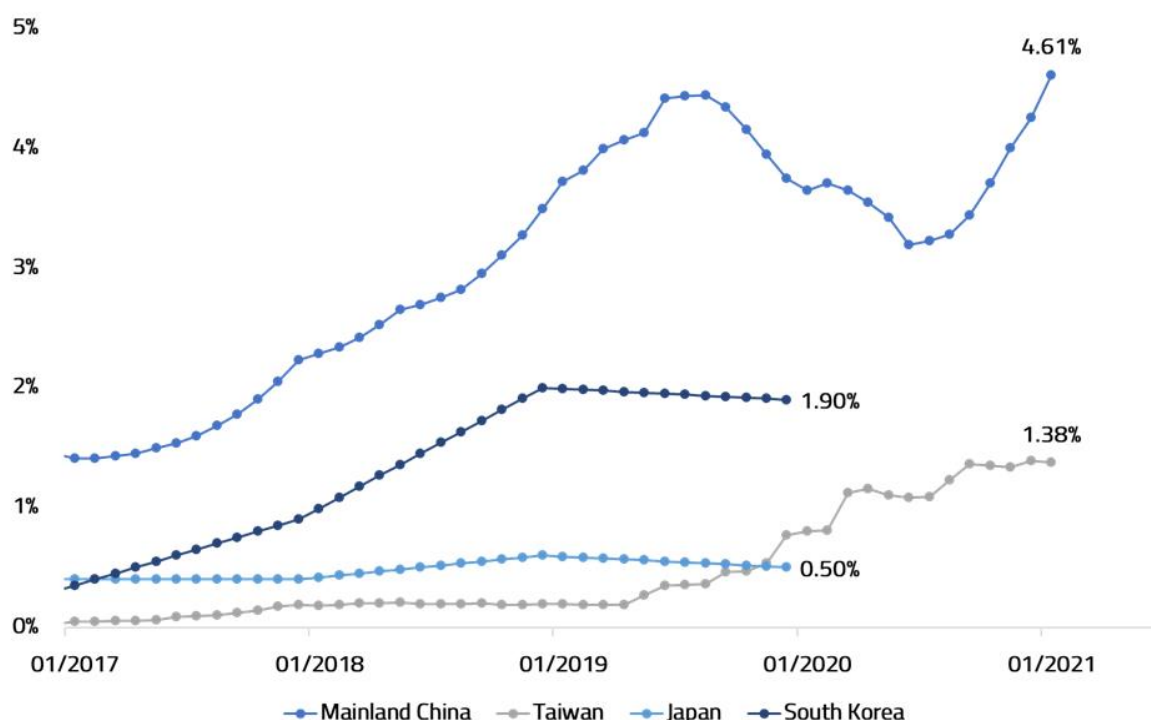
Figure 3 Taiwan EV Sales and Market Share Movements



Source: Directorate General of Highways, MOTC (Taiwan)

Taiwan outstripped Japan in terms of the level of EV market share in 2019, while it is still behind Mainland China and South Korea. A kind of “Tesla fever” – spurred by the introduction of the Model 3 – has contributed much of the progress. More than 1,000 Model 3s were sold in Taiwan just in December 2019, raising steeply the proportion of EVs sold from 0.5% to 0.8% of total vehicle sales, before that figure rose to 1.39% one year later.

Figure 4 EV Market Shares in Mainland China, Taiwan, Japan and South Korea

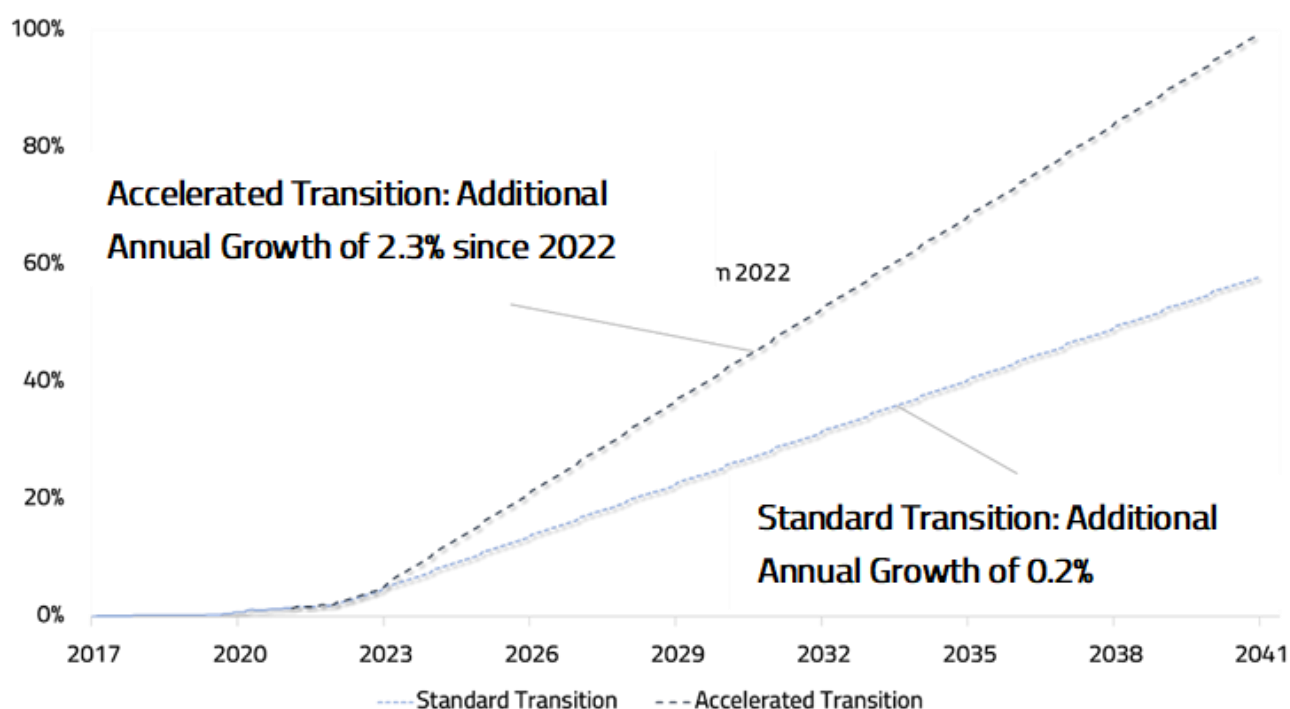


**Due to data availability, numbers for Japan and South Korea are displayed on a yearly basis for years till 2019. Numbers for Mainland China and Taiwan are exhibited as trailing-twelve-month calculations throughout.*

Source: Numbers for Taiwan are from Directorate General of Highways, MOTC (Taiwan); Numbers for Mainland China are from China Association of Automobile Manufacturers via CEIC Data; Numbers for Japan and South Korea are from International Energy Agency

Like many other jurisdictions, Taiwan has moved to curb fossil fuel consumption. Under the Air Pollution Control Act, enacted in 2017, Taiwan aims that fossil fuel cars would be phased out entirely by 2040, and under Taiwan's Sustainable Development Goals released in 2019, Taiwan further aimed that 35% of new motorbikes sales would be electric by 2035 (IC TPEX, 2020; Taiwan Sustainable Development Network, 2019). Since the market share of EVs is growing steadily in Taiwan, under current trends it would reach 57.2% if it should achieve additional growth of 0.2% every year. This is far from 100% penetration, which might require additional growth of 0.4% in 2022 and 2.3% every year thereafter. This transition will finally lead to full electrification of cars in Taiwan by 2040, but is likely to be realized with more aggressive incentives from the authorities.

Figure 5 Projection of EV Market Share in Taiwan



There are few incentives for EV purchasers in Taiwan as there are no subsidies provided but only tax exemptions, while subsidies are provided in Mainland China, Japan and South Korea as well as many European countries.

Table 1 Comparison of Incentives for BEV Purchase

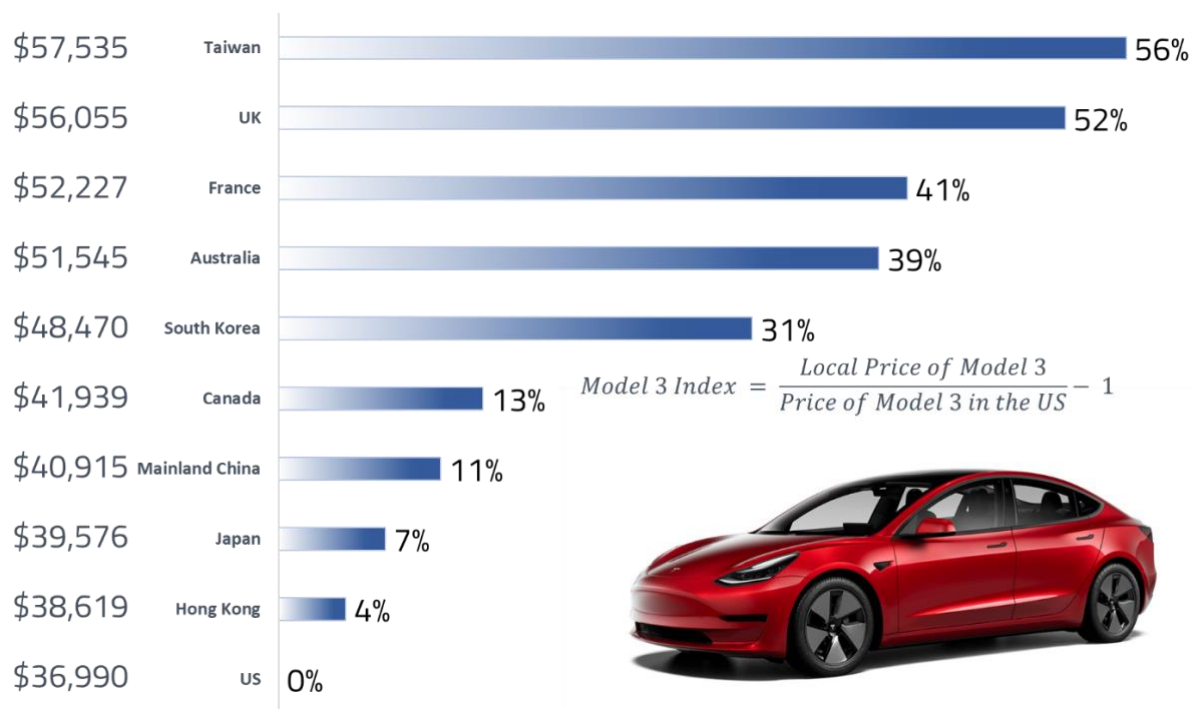
	Subsidies	Tax Exemptions
Taiwan	Not Available	BEVs exempted from vehicle license tax and fuel tax Up to NTD 50,000 reduction in commodity tax
Mainland China	Depending on electric range CNY 1,3000-1,8000 *Further adjustments will be made depending on battery density and energy efficiency	Exemption of purchase tax, and vehicle and vessel tax
Japan	Depending on electric range Up to JPY 400,000	Exemption of purchase and weight taxes
South Korea	KRW 8,000,000	Not Available
Australia	Not Available	Not Available
France	Depending on retail price EUR 6,000	Exemption of registration tax in many subnational regions
United Kingdom	Depending on retail price Up to GBP 3,000	Not Available

Source: International Energy Agency (2020) · Publicly available information

Applying “Latte Index” to Model 3 Pricing

Although the locally manufactured Toyota Corolla Altis and Ford Focus are both popular among consumers, most of the EVs marketed in Taiwan are imported. Tariffs mean they are sold at the highest price globally. Inspired by the Latte Index, a “Model 3 Index” illustrates the price difference of Model 3s between those sold in the US and elsewhere. For example, a Model 3 costs 56% more in Taiwan than in the US. The car is priced at NT\$1.6 million, equivalent to US\$57,535.

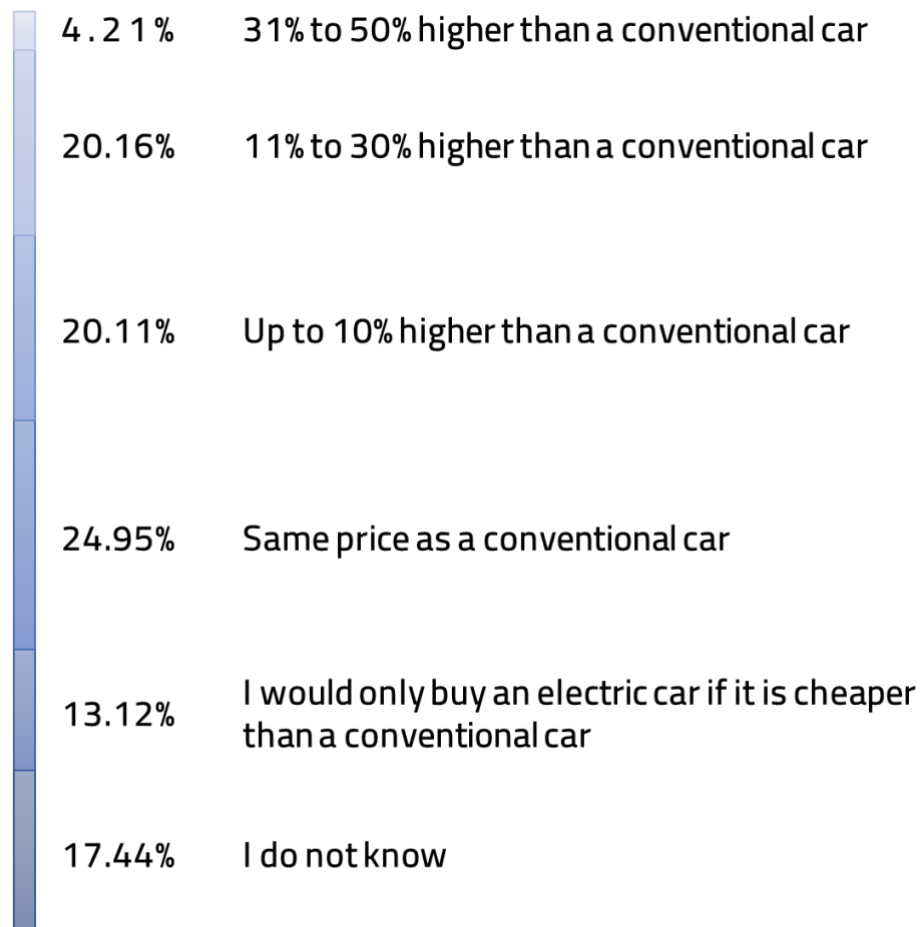
Figure 6 Global “Model 3 Index”



* The conclusion above was drawn under specific local prices of Model 3 (as displayed on Tesla official site), tariffs and exchange rates that were observed when data was being collected.

A consumer survey in Taiwan in 2019 reveals that 38% of the respondents would like to choose an EV over an internal combustion engine (ICE) vehicle if the EV is cheaper, while those who accept higher prices for EVs would not pay a premium greater than 30%. Currently, EVs are generally more expensive than ICE vehicles due to higher costs of production. The Toyota Corolla Altis, the second-best seller in Taiwan in 2020, is sold for about NT\$792,000 per unit, less than half the cost of a Model 3.

Figure 7 Acceptable Price Level for Purchasing an Electric Car in Taiwan

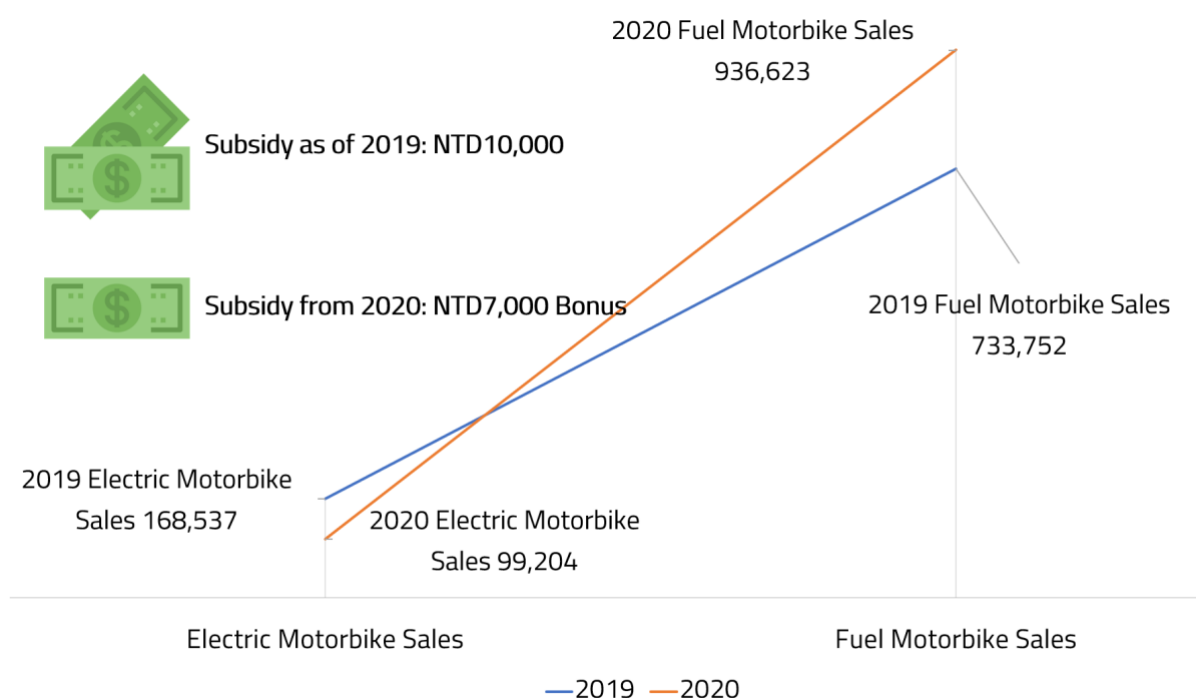


Source: Rakuten Insight (2019)

Motorbikes Have Lessons for EV Subsidies

Unlike its policy toward cars, Taiwan offers subsidies to those buying motorbikes, either gasoline- or electricity-powered, under a policy of phasing out older machines. Originally set at NT\$10,000 per vehicle, the subsidy has since been reduced to NT\$7,000. However, the reduction led to a drop in electric motorbike sales, while a sharp increase was seen in gasoline-powered motorbike sales.

Figure 8 Taiwan Scooter Sales in 2019 and 2020



Source: Directorate General of Highways, MOTC (Taiwan); Kang (2019)

Comparing the electric New Gogoro 3 and the gasoline-engine Kymco GP 125 ABS shows that electric motorbike buyers can gain an extra NT\$2,000 in subsidies from Taiwan's municipal governments.

Table 2 Prices of an Electric and Fuel-powered Motorbike (NTD)

	New Gogoro 3	Kymco GP 125 ABS
Retail Price	69,980	68,000
IDB Subsidy (2020 Rate)	7,000	7,000
IDB Subsidy (2019 Rate)	10,000	10,000
EPA Subsidy	3,000 (Old Vehicle Elimination)	3,000 (Fuel Vehicle Session Seven)
Retailer ABS Subsidy	4,000	4,000
Actual Price (2020)	55,980	54,000
Actual Price (2019)	52,980	51,000

Source: Publicly available information

Taiwan consumers show a preference for motorbikes priced below NT\$55,000. Electric motorbikes accounted for less than 10% of new motorbikes sold in 2020, down from nearly 20% in 2019, and industry stakeholders have expressed negative comments on subsidies on motorbikes (Sun, 2020). Offsetting the price gap between electric and gasoline-powered scooters requires an extra subsidy of about NT\$3,000 for electric models. However, to further encourage consumers to purchase electric scooters might require even higher subsidies than as consumers would have to tolerate lower performance and an underdeveloped electric motorbike support infrastructure.

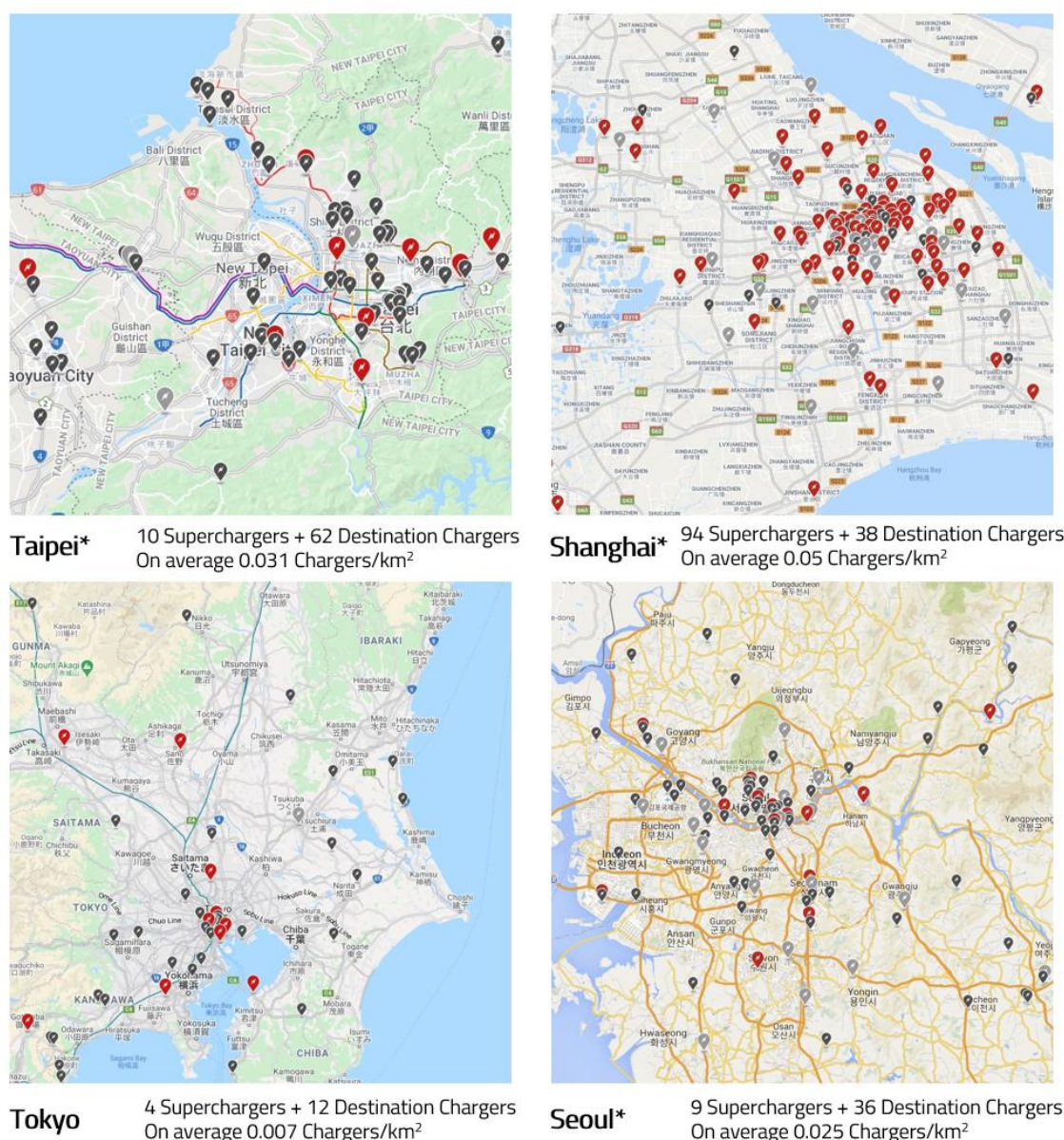
“Range Anxiety” Reveals Infrastructure Flaws

A UK survey in 2020 revealed that lack of suitable charging points, shorter ranges and higher prices are the top 3 disincentives to buying EVs (Wilde, 2020). These challenges are not compensated by the advantages of EVs, such as autonomous driving features.

Taiwan is home to about 40 Tesla supercharger stations. They, along with destination charger stations, provide over 1,000 Tesla charging units. Owners of other EVs such as Porsche can use the Yes Energy charging stations managed by Yulon, the second largest provider in Taiwan, with around about 700 charging units in 177 stations (Kao, 2020).

The Taipei metropolitan area has 0.031 Tesla charging stations per square kilometer, a denser coverage than Tokyo, which has less than 0.01 stations, and Seoul with 0.025 stations. The urban area of Shanghai has the densest coverage of the four, with 0.05 Tesla charging stations per square kilometer.

Figure 9 Density of Charging Infrastructure Coverage in Four Asian Metropolitan Areas



**To control for the variance of area and population density of different cities, geographical scales and total areas used in the calculations are as below*

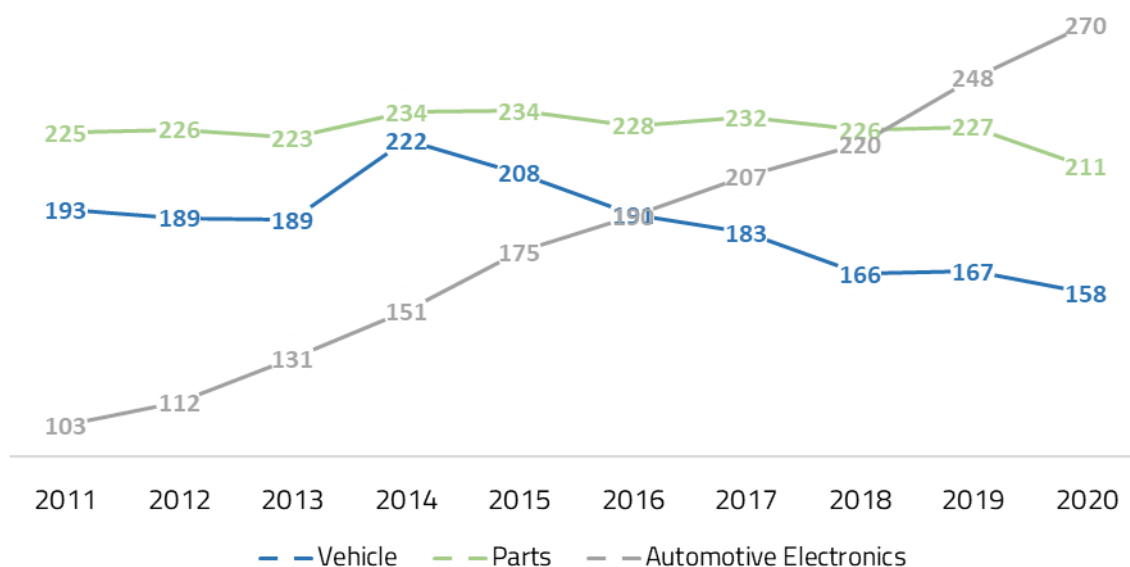
Taipei	Taipei and New Taipei City	2,325km²
Shanghai	Five less populated districts, Jinshan, Songjiang, Qingpu, Fengxian and Chongming, are not included.	2,606km ²
Seoul	Seoul Special City, Incheon Metropolitan City, and Suwon City, Gyeonggi Province	1,790km ²
Tokyo	Tokyo Metropolis	2,194km ²

Source: Tesla official site

Taiwan's Policies Supporting EVs

While Taiwan sells a small number of finished vehicles overseas – mainly to the Middle East – it is an export powerhouse for automotive parts. The automotive sector produced total revenue of NT\$452.2 billion in 2020, accounting for 2.46% of Taiwan's gross domestic product.

Figure 10 Value of Taiwan's Automobile Sector (NTD Billion)



**Numbers for 2018 and before, 2019, and 2020 were retrieved from different sources. Adjustments have been made to the numbers upon the variance of different statistical criteria being observed.*

Source: Wang (2019), Ministry of Economic Affairs (Taiwan) (2020), Hsiao, Hsieh, Tseng and Tsai (2021), Ku (2020)

Automotive parts and electronics would not have become such a significant part of Taiwan's economy without the preferential industry policies. Taiwan released its "Smart Electric Vehicle Development Strategy and Action Plan" Phase I in April 2010 and Phase II in May 2015, each with five key strategies.

Table 3 Comparison between the "Action Plan" in Phase I and Phase II

	Phase I	Phase II
	2010 to 2013	2014 to 2016
Policy	1. Setting environmental and energy standards	1. Collaborating to promote electric buses
Pilot	2. Promoting pilot implementation	2. Introducing more EV models to Taiwan
Purchase	3. Increasing incentives for EV purchasing	3. Increasing incentives for EV purchasing
Adoption	4. Improving adoption scenarios	4. Encouraging EV adoption among officials
Production	5. Guiding industrial development	5. Establishing an industrial value chain
	(1) Guiding 73 manufactures to improve	(1) Facilitating technical development
	(2) Promoting R&Ds of compact vehicles	(2) Promoting cooperation and enabling more production units to land in Taiwan

	(3) Promoting exports and entering Tesla's supply chain	(3) Introducing smart and safe mobility
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Source: Chen (2015)

In 2016, Taiwan issued its “Five Innovative Industrial Policies” in 2016 under which smart EVs were included in the “Promotion Program of Smart Machine Industry”. The program had the mission to make central Taiwan a global hub for the machinery industry (Lin, 2016). A contemporary document added that Taiwan-based enterprises should further collaborate to include more parts of the value chain and form an integrated solution to clients (Wu, 2016) °

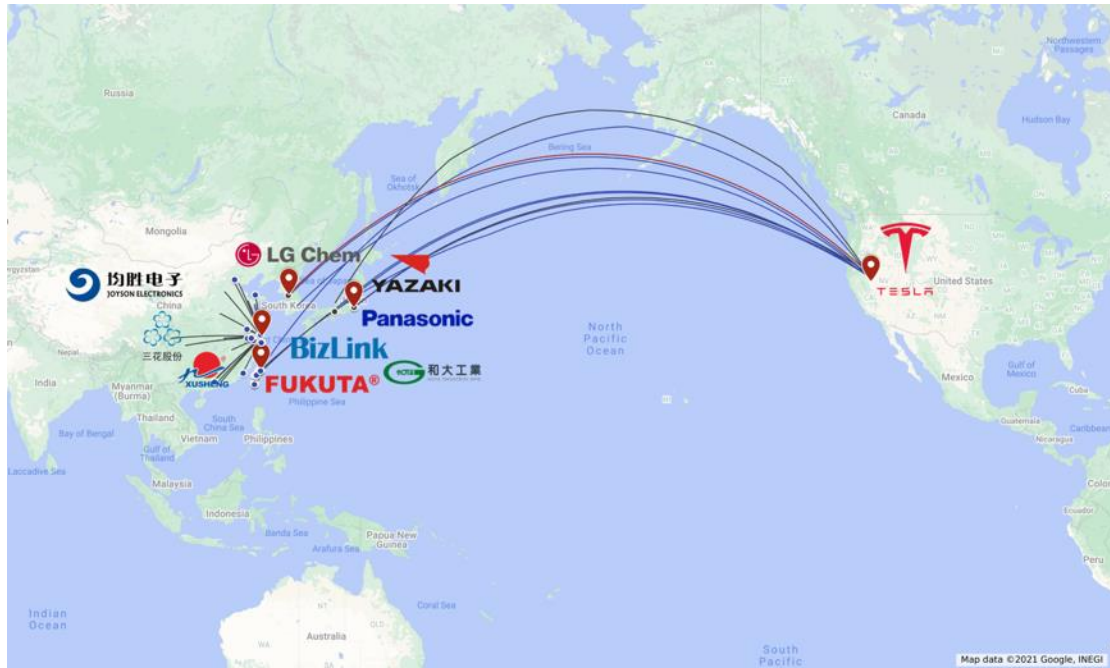
Table 4 Summary Table of Promotion Policies for Taiwan's Electric Vehicle Industry

Before 2010		
2009.04	Green Energy Industry Sunrise Solution	
2009.08	Electric Motorcycle Industry Development Promotion Plan	
2010 to 2015		
2010.04	Smart Electric Vehicle Development Strategy and Action Plan “Forming the Foundation”	
2014.05	Smart Electric Vehicle Development Strategy and Action Plan Phase II “Level Up”	
Since 2015		
2016.07	Promotion Program of Smart Machine Industry	Among “Five Innovative Industrial Policies”
2017.12	Air Pollution Prevention and Control Action Plan (APPCAP)	Full electrification of official vehicles and city buses by 2030
		Ban fuel-powered scooters by 2035 (already suspended) Ban fuel-powered cars by 2040
2019.09	Taiwan's Sustainable Development Goals	35% of new scooters sold being electric by 2030

Source: IC TPEX (2020), Taiwan Sustainable Development Network (2019)

The Growth of Taiwan's Model 3 Suppliers

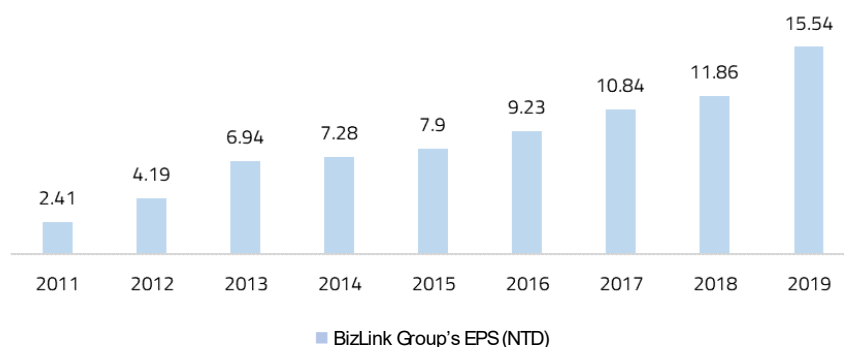
Figure 11 Tesla's Key Asian Suppliers



Source: Publicly available information · Google Maps

Asia's presence in Tesla's supply chain is ubiquitous, covering various sectors from batteries to body parts. The battery cells in the Model 3 were exclusively supplied by Panasonic before Shanghai Gigafactory included LG Chem and CATL as suppliers due to high volumes of car delivery (Tech Sina, 2020). CoreMax and Mechema are suppliers of cathode batteries in the Model 3. Chang Chung Group entered Tesla's supply chain by providing copper foils for Panasonic, LG Chem and CATL, despite not working directly with Tesla (Hsia, 2020). BizLink has seen rapid growth of revenue through being Tesla's exclusive supplier of battery harnesses.

Figure 12 Movements of BizLink Group's EPS (NTD)



Source: Annual reports of BizLink Group for years 2019, 2014 and 2011

As much as “Tesla concept stocks” and component firms have been on investors’ minds for several years, some firms had been in collaboration with Tesla when it released the Roadster, Tesla’s first-ever vehicle. Hota Industrials, quietly located in Dali District, Taichung, started working with Tesla in 2008 (Lu, 2020). Tesla contributed to 28.9% of Hota’s annual earnings in 2019 (Hota Industrial Mfg, 2020; Lin, 2020). Fukuta entered a development relationship with Tesla in 2006 and has supplied Tesla with more than 100,000 electric motors every year as of 2019 (Chang & Chen, 2019).

With the rise of smart mobility, chip manufacturers in Taiwan, such as TSMC, MediaTek and VIS, have distributed some of their resources to automotive electronics research and development (R&D), aside from working for tech firms (Shih & Wu, 2020). Tzu-Hsien Tung, chairman of Pegatron, announced in September 2020 that the company would be part of Tesla’s value chain for supplying control system solutions, after a long history of manufacturing smartphones and tablets. The announcement followed news that TSMC and Tesla would develop the carmaker’s autopilot chip, dubbed HW 4.0, aiming for mass production in the fourth quarter of 2021 (Lambert, 2020).

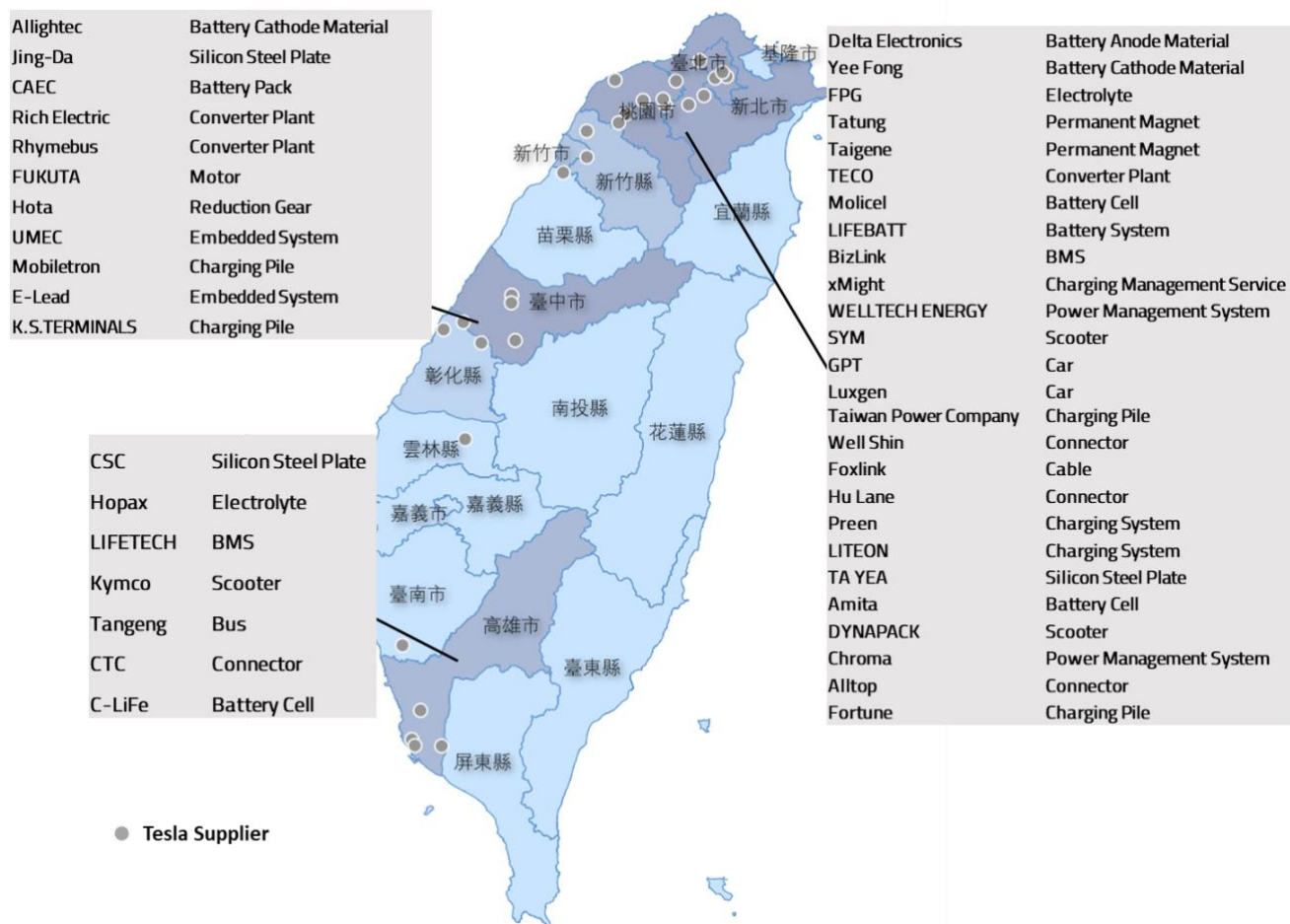
Figure 13 Tesla's Major Taiwan-based Suppliers

Supplier	Item(s)	Sector	Symbol
Pegatron	Control System	Electronic System	4938:TT
TSMC	Autopilot chip	Electronic System	TSM:US
Quanta	Autopilot Control Unit	Electronic System	2382:TT
	Charging Pile Electric Relay	Charging Infrastructure	
YAGEO	Passive Components	Electronic System	2327:TT
InnoLux	Touch Panel	Electronic System	3481:TT
TPK	Touch Panel	Electronic System	3673:TT
AU Optronics	Touch Panel	Electronic System	2409:TT
Delta Electronics	DC/DC Converter	Electronic System	2308:TT
ELAN	Image Transmission Chips	Electronic System	2458:TT
Asia Optical	Automotive Lens	Electronic System	3019:TT
Tong Hsing	Image Sensor Packaging	Electronic System	6271:TT
SUNON	Cooling Fans	Vehicle Body Parts	2421:TT
Yen Sun	Cooling Fans	Vehicle Body Parts	6275:TT
SuperAlloy	Forged Wheels	Vehicle Body Parts	1563:TT
EOI	LED Light	Vehicle Body Parts	6288:TT
SUMEEKO	Screws	Vehicle Body Parts	2066:TT
Boltun	Screws	Vehicle Body Parts	8349:TT
K.S. TERMINALS	Chaging Pile	Charging Infrastructure	3003:TT
CFTC	Relay Socket	Charging Infrastructure	1586:TT
	Battery Cassette	Batteries and Attachments	
xMight Inc	Charging Management	Charging Infrastructure	Not Applicable
Fortune Electric	Charging Pile	Charging Infrastructure	1519:TT
ESON	Battery Bonding	Batteries and Attachments	5243:TT
CoreMax	Battery Anode Material	Batteries and Attachments	4739:TT
MECHEMA	Battery Anode Material	Batteries and Attachments	4721:TT
Chang Chun Group	Copper Foil	Batteries and Attachments	Not Applicable
SDI	Lead Frame	Batteries and Attachments	2351:TT
BizLink	Harness	Batteries and Attachments	3665:TT
China Steel Corporation (CSC)	Electrical Steels	Powertrain	2002:TT
FUKUTA	Motor	Powertrain	Not Applicable
Hota	Reduction Gear	Powertrain	1536:TT
KIAN SHEN	Transmission Shaft	Powertrain	1525:TT
Global PMX	Transmission Parts	Powertrain	4551:TT

Source: Lu (2020), Mi, Lin and Cheng (2021)

There are many enterprises in Taiwan that produce parts and automotive electronics. Industrial clusters have formed as semiconductor companies emerged in northern Taiwan, precision machinery companies in central Taiwan, and vehicle body manufacturing companies in the south. Northern Taiwan has the largest concentration of such companies.

Figure 14 More Enterprises Have Located in the North



Source: Yu (2018), Wang (2019), Chang and Chen (2019)

Concept Stocks Reviewed for Sustainability

The global shortage of chips has caused carmakers to cut their production since the end of 2020. SAIC Motor revealed that its December 2020 production was down by 24% month-over-month, which posed a substantial retreat from its average production levels in the second half of the year (An, 2021). Although that is no more than another manifestation of the environmental, social and governance (ESG) risks associated with the automobile sector, the severity of this shortage has motivated carmakers to evaluate the nature and resilience of their supply chain management. Moreover, Tesla has been paying attention to sustainability since 2019, as pressured by shareholders and the public over quality issues. The carmaker invited Hiromichi Mizuno from UN Principles for Responsible Investment (UNPRI) to join its board as an independent director in April 2020. There is a high likelihood that Tesla's next step is to turn screws on the ESG performance of its suppliers, including those based in Taiwan. Apple has released its "Environmental Progress Report" annually since 2008 and its "Supplier Responsibility Progress Report" every year since 2007. Reviewed for sustainability, 29 Taiwan-based Tesla suppliers are at the extreme ends of the scale. As many as 20 of them are rated either between D and DDD or between A and AAA, according to MioTech ESG Ratings.

Figure 15 Visualized Distribution of ESG Ratings of 29 Taiwan-based Tesla Suppliers



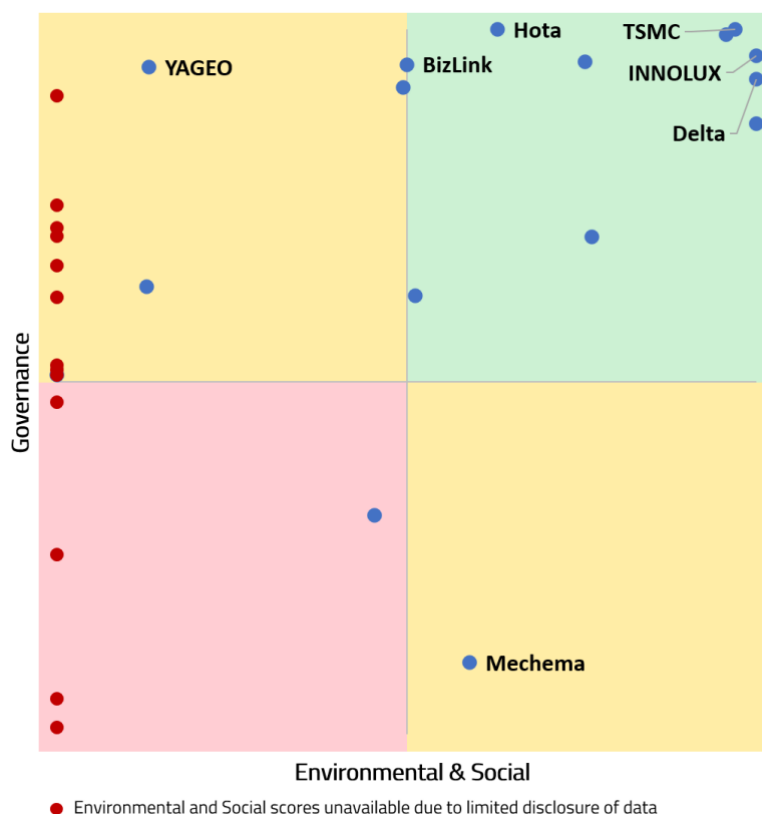
**ESG ratings, including those displayed above, are provided and updated on a cyclical basis by MioTech as per firms' disclosures and news coverage of firms detected and identified by MioTech. The exhibition only reflects the ratings of concerning firms when data was being collected. This also applies to the remainder of this section unless specially noted.*

Source: MioTech

While 14 enterprises are rated between D and DDD, their ratings reflect lack of disclosure rather than evidence of an unfavorable ESG performance. EOI, a firm in this group, has 33.33% of its directors on the board that are female, implying a better gender structure than many peers. Asia Optical is another example of lower ratings due to inadequate disclosure, even with the ratio of independent board directors as high as 42.86%. Poor data quality is recognized by institutions from the EU to stock exchanges to be a persistent issue in ESG. Although Taiwan Stock Exchange (TWSE) has not imposed compulsory obligations on companies' non-financial disclosures, 397 of about 1,000 companies listed

released corporate social responsibility (CSR) reports in 2019. Disclosures are more than fulfilling regulatory requirements as they provide investors with important information on how a firm has assisted with environment protection and social well-being. Firms with outstanding performance in ESG are likely to attract more investment from responsible investors.

Figure 16 Visualized Distribution of Environmental, Social and Governance Scores



Source: MioTech

Except for those with inadequate disclosures, Taiwan-based Tesla suppliers have decent ratings, with five rated between C and B and another 10 between BB and AAA. Top performers include Innolux, Delta and TSMC.

Table 5 Firms with Ratings from BB to AAA

Entity	ESG Rating	E	S	G		
Delta	AAA	100	100	93	✓Excellent Climate Change Mitigation	✗Less Disclosure on Governance
AAAs (5) Mean		99.1	97.9	95.1	-	-
CoreMax	BBB	67	86	70.6	✓Increased Employee Training	✗Higher Energy Intensity & More Pollutants Emitted
Hota	BBB	81	45	100	✓Higher Independent Directors Percentage	✗Inadequate Disclosure on Supplier Screening

BizLink	BB	21	79	95	✓More Balanced Employee Gender Structure	×Less Disclosure on Pollutants Emitted
BB to BBBs (4) Mean		68.1	58.9	89.4	-	-

Source: MioTech

Among concept stocks, CoreMax is rated BBB and BizLink is rated BB. The two companies have excellent social scores, especially in the employee engagement topic. CoreMax's employees received 35.69 hours of training on average in 2019, up from 21.18 hours in 2018. In 2019, the company additionally disclosed average training hours by gender, which showed that female employees had more training than male employees, but that may be partly explained by a much smaller number of female employees. BizLink, on the other hand, has a balanced gender structure of employees with men and women accounting for 45.22% and 54.78% of employees. Both companies need to work harder to improve their environmental score. BizLink has not disclosed its breakdown items of energy consumption as well as its volatile organic compound (VOC) emissions, but the bright side is that BizLink saw declines in both greenhouse gas (GHG) emissions and the intensity of GHG emissions. CoreMax made more open disclosures in terms of energy consumption, VOC emissions, and some key policies to mitigate climate change, but increased VOC emissions and higher intensity of energy consumption prevented a higher rating. CoreMax reduced its wastewater production by 22%. Unlike CoreMax, Hota, another BBB-rated company, discharged more wastewater in 2019, but the sharp decline in Scope 2 GHG emission has moved its GHG intensity to below the 2017 level. Hota has also optimized its corporate governance with a higher ratio of independent directors, but has not published its supplier screening policies and standards, despite information provided on evaluation of suppliers regarding CSR.

Table 6 Firms with Ratings from C to B

Entity	ESG Rating	E	S	G		
Mechema	CCC	58	60	10.2	×Increased Pollutants Emitted	×Insufficient Risk Management
YAGEO	CC	16	10.5	94.7	×Higher Intensity of GHG Emissions	×Lack of Disclosures on Community Impact
C to Bs (5) Mean		40.4	32.2	52.3	-	-

Source: MioTech

Mechema disclosures stating that in 2019 the company spent four times as much on environment protection as in 2018 is concerning, since water consumption and wastewater discharge rose by 5,000 and 1,000 tons respectively. The company has improved its energy consumption and GHG emissions. Mechema scored favorably in labor management and product responsibility, but its 2019 CSR report revealed that the company had appointed a remuneration committee but no audit committee. Mechema said in June 2020 that the company had set up an audit committee, and this could lead to a higher score. Yageo, a supplier of passive components and a CC-rated company, has a board with 33.33% independent directors, but all of its audit committee are accounting professionals, a higher level than some AAA-rated peers. Yageo's GHG intensity rose in 2019 over 2018, partly due to Yageo's headquarters being included in calculations. Higher GHG intensity of

Yageo's headquarters is a cause for concern. Furthermore, Yageo has not disclosed its efforts in broadening community impacts, because either the company or its stakeholders considered the issue of low materiality (Yageo Corporation, 2020).

Table 7 Intensity of GHGs Emitted by YAGEO

Year	GHG Emissions Intensity (t CO ₂ e/NTD Million)	Scale of Calculation
2017	5.78	Taiwan Nanzih Plant+Mainland China All Plants
2018	3.82	Taiwan All Plants+Mainland China All Plants
2019	7.13	Taiwan All Plants+Mainland China All Plants +HQ Office

Source: Corporate Social Responsibility Report of Yageo for 2019

Tesla's Taiwan-based suppliers generally have decent performance in terms of corporate governance, while environmental and social topics have led to their varying ESG ratings.

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Undefined Prospects

Decades of manufacturing PCs and smartphones has left Taiwan with abundant resources in the technology sector. Apple's supplier list 2019 revealed that 46 out of its 200 key suppliers were from Taiwan, followed by 41 from Mainland China and 38 from Japan (Apple Inc., 2019; Ting-Fang, Li, & Ihara, 2019). Notably, many include Tesla in their client list. However, the technology and automobile sector are ultimately not the same and require differing paths to success. Currently, Taiwan's automobile sector is still limited by sub-optimal vehicle manufacturing, absence of core suppliers and overreliance on exports, all of which are obstacles to overcome.

Figure 17 Shared Taiwan-based Suppliers of Apple and Tesla



Source: Sina VR(2019), Lu (2020)

Taiwan has rich experience in the production of car, scooter and bicycle components, and has been a part of the supply chain of carmakers like Toyota, Ford and Mercedes-Benz long before EVs appeared on the market. In consumer electronics, chip production and device assembly have given rise to giants like TSMC and Hon Hai.

Figure 18 Collaboration of Tech and Auto in Taiwan



Both the automobile and technology sectors will need new impetus for growth in the coming decade. In the years when even Apple has to face slower growth of phone sales, the consumer electronics field has few emerging markets to expand to and is not likely to duplicate the growth as seen in 2015. Working with carmakers and making products used in cars, scooters and even E-bikes can provide technology firms with another source of income and avoid the potential threats posed by a lack of diversification. Apple and Xiaomi's car making plans announced recently have confirmed the trend toward diversification. In the automobile sector, despite continuous orders, Taiwan does not have core market participants, or Tier 1 suppliers, like Bosch or Continental. Comparing the suppliers with Tesla's Nevada and Shanghai plants has demonstrated that all the rest are less replaceable than BizLink, FUKUTA, Hota and TPK. The Shanghai plant has turned to Mainland China, Japanese and US firms for powertrain and vehicle body parts supplies. Therefore, Taiwan's automobile sector should collaborate with its more globally competitive technology sector to stay on top of the future mobility trends.

Table 8 Tesla's Suppliers and Potential Suppliers

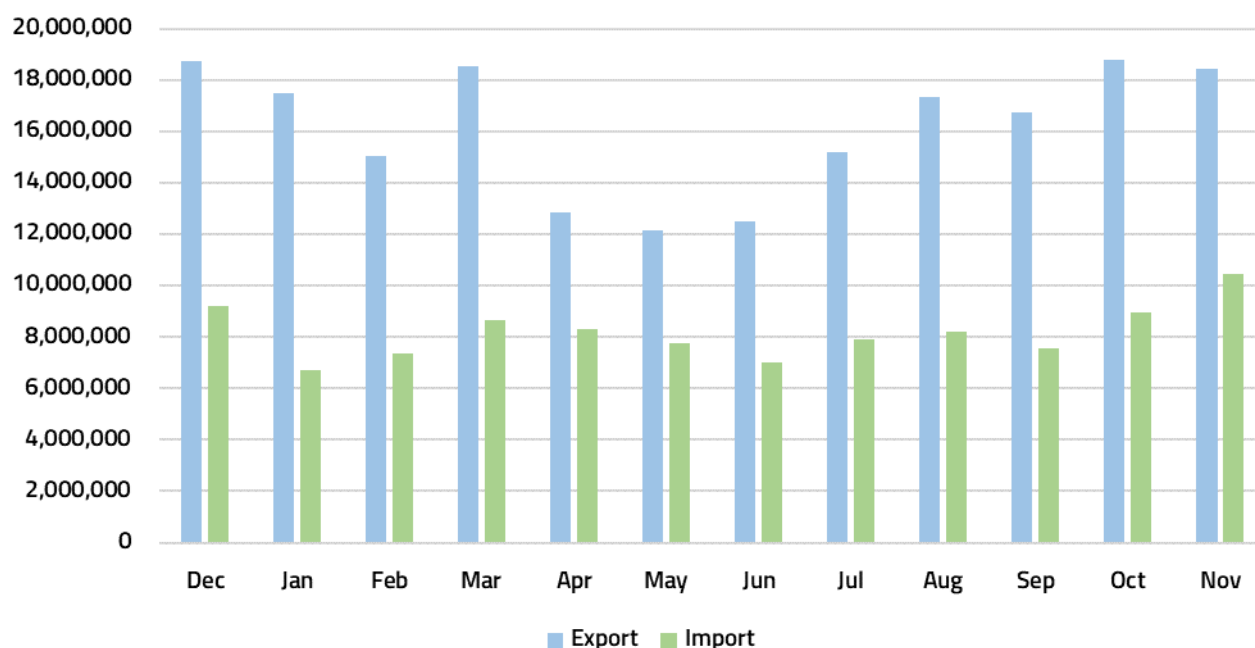
Item	Nevada Plant	Shanghai Plant	Potential Supplier
Charging Pile Electric Relay	Quanta	Hongfa	
Automotive Lens	Asia Optical	LianChuang Electronic, Delphi	Ofilm, Jingu Wheel, Sunny Optical
Touch Panel	TPK		
Cooling Fans	SUNON, Yen Sun	Dongshan Precision	
LED Light	EOI	Hella	Changzhou Xingyu
Battery Cassette	CFTC	Xusheng	Guangdong Hongtu, IKD Co, Ling Yun Industrial
Battery Anode Material	CoreMax, MECHEMA	Sumitomo Chemical	Easpring, Ningbo Shanshan
Harness	BizLink (YAZAKI was later introduced)		Deren Electronic
Motor	FUKUTA		HASCO
Reduction Gear	Hota		PPF, Shuanghuan Driveline
Transmission Shaft	KIAN SHEN	Changzhou NRB Corp	PPF

**The table above reflects only the comparison between the list of Taiwan-based Tesla suppliers provided by publicly available news reports and the list of Model 3 suppliers to Tesla's Shanghai plant provided by Sinolink Securities*

Source: Lu (2020), Miet al. (2021), Sinolink Securities

Less competitive capabilities and lack of Tier 1 suppliers are also underlying challenges for Taiwan in strengthening its role in the EV industry. Most of Taiwan's vehicle parts are exported. Each month from December 2019 to November 2020, exports by value amounted to between one and a half times and twice those of imports, with the US taking up 53.2%, followed by Mainland China, the UK and Mexico.

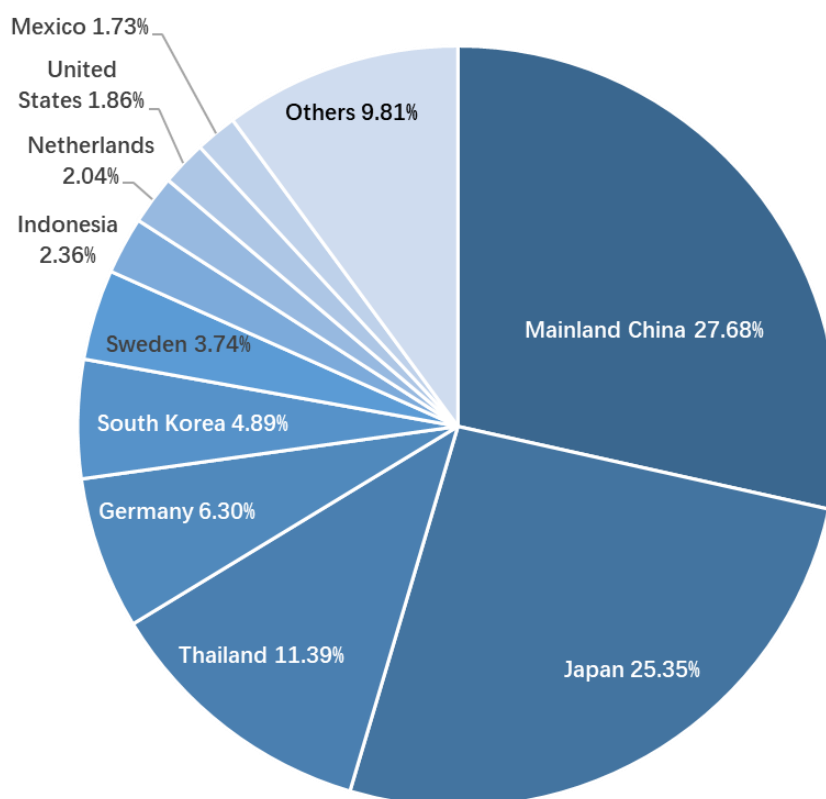
Figure 19 Imports and Exports of Taiwan's Vehicle Parts (NT\$'000)



Source: TTVMA (2021)

Taiwan's five largest sources of car parts are Mainland China, Japan, Thailand, Germany and South Korea. Mainland China has large companies such as the Warren Buffett-invested BYD, as well as EV start-ups like NIO, LI Auto and Xpeng. Japan's automobile sector is well-known for Toyota, Honda and Nissan. Mercedes-Benz, Volkswagen and Porsche, among Taiwan's top favorites, are from Germany. South Korea's Hyundai has been winning in the European market with its Kona EV.

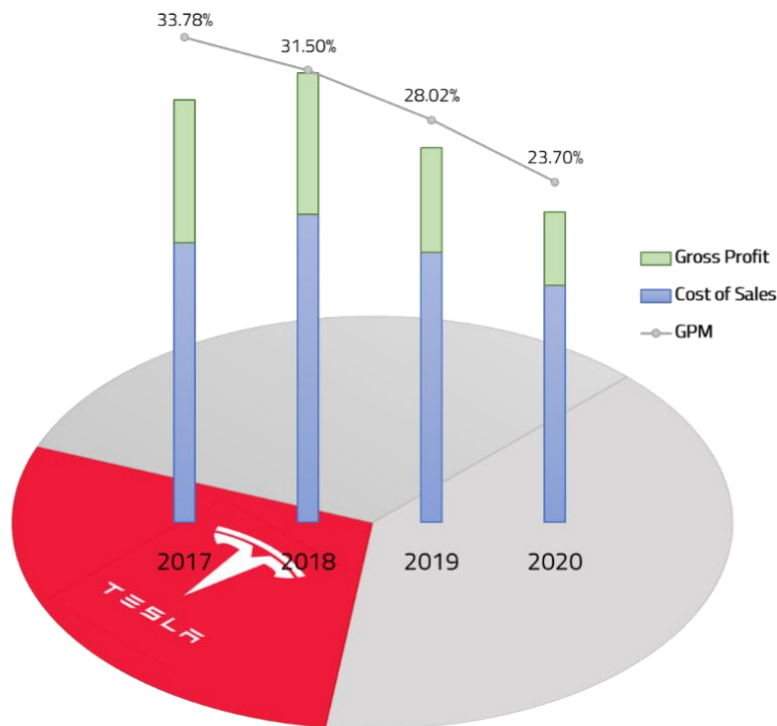
Figure 20 Taiwan's Import of Vehicle Parts by Economy as in 2020



Source: TTVMA (2021)

In comparison, Taiwan has far fewer carmakers and their cars have not made the charts even in Taiwan, which makes parts suppliers more dependent on export. Without Tier 1 suppliers, Taiwan-based Tier 2 or Tier 3 suppliers cannot enter carmakers' supply chains like those suppliers in Japan or Germany. Further than that, not being Tier1 suppliers makes these suppliers subject to multiple rounds of price negotiations, meaning that the result of price negotiations between Tier 1 suppliers and carmakers will have a cascade effect on them, in which they may have less autonomy as price is a part of their advantages. A news report in March 2021 shows that Tesla purchases batteries at US\$142 per kWh, lower than the industry average of US\$186, resulting from its ability to negotiate and take advantage of competition between Panasonic, LG Chem and CATL (TechWeb, 2021).

Figure 21 Hota Industrials' Profitability Over the Years (as of February 2021)



Source: Hota Industrial Mfg (2020), Lin (2020), Wang (2020), Yahoo Finance

The decline in Hota's profitability is estimated to be mainly a result of the closure of some US car factories and reductions in the prices of Tesla's products (Lin, 2020; Wang, 2020), causing investors' concern. The company is deemed as a significant beneficiary of supplying Tesla, with its share price rising from less than NT\$50 to more than NT\$100. However, its gross profit margin has fallen by over 10% since 2017 despite its share of its revenue from Tesla rising from 19.82% in 2017 to 29.94% in 2019 (Hota Industrial Mfg, 2020), which makes being Tesla supplier a bittersweet step forward for the company. More Taiwan-based manufacturers turn to smaller, light-asset carmakers such as Mainland China's Xpeng, whose smart cameras are from oToBrite, and NIO whose electronic control systems come from Wistron (Liu, 2020). MIH Alliance has also contracted with US start-up carmaker Fisker as its first EV client (Hou, 2021), although the American firm has courted controversy by announcing in 2020 it would go public via a controversial special purpose acquisition company, or SPAC. Xpeng and NIO, meanwhile, like other Chinese start-up carmakers have small market shares in EVs and lose money. The future of start-up carmakers and their Taiwan-based suppliers remain unknown in the current context.

Overall, Taiwan's EV industry, featuring its Tesla suppliers, has some lasting advantages as well as some longstanding weaknesses. Electrification is a key part of future mobility and Taiwan has the opportunity to change the game to its interest as electric vehicles have a different cost structure from ICE vehicles. Taiwan is expected for an enhanced role in the global automobile sector with its competitive technologies and pricing, but that has to be attained when weaknesses, like deficient car making, lack of core participants and pricing rights, are appropriately managed.

References

- AN, L. (2021). 芯片供应影响一季度汽车生产 分析师称约减产 5%.
- APPLE INC. (2019). SUPPLIER LIST. RETRIEVED FROM [HTTPS://WWW.APPLE.COM/SUPPLIER-RESPONSIBILITY/PDF/APPLE-SUPPLIER-LIST.PDF](https://www.apple.com/supplier-responsibility/pdf/apple-supplier-list.pdf)
- CHANG, N, -H, & CHEN, H, -C. (2019). 美國特斯拉營運變對我國廠商之影響. 經濟前瞻(181), 87-91.
- CHEN, H, -C. (2015). 台灣智慧電動車推動現況與政策方向. 車輛研測諮詢, 104, 19- 24.
- DIRECTORATE GENERAL OF HIGHWAYS, MOTC (TAIWAN). 新車領牌數 - 按廠牌分(汽車) (101 年 8 月起). 新車領牌數 - 按廠牌分(汽車).
- DIRECTORATE GENERAL OF HIGHWAYS, MOTC (TAIWAN).. 新車領牌數 - 按使用燃料別分. 新車領牌數 - 按使用燃料別分.
- TAIWAN MINISTRY OF ECONOMIC AFFAIRS. (2020). NEXT-GENERATION VEHICLE KEY INNOVATIVE INDUSTRIES IN TAIWAN. TAIPEI: TAIWAN MINISTRY OF ECONOMIC AFFAIRS.
- KAO, C, - Y. (2020). 吃下 3 成市占！台灣電動車充電設備霸主是它. RETRIEVED FROM [HTTPS://WWW.BNEXT.COM.TW/ARTICLE/57453/YES-ENERGY-STRATEGY](https://www.bnext.com.tw/article/57453/yes-energy-strategy)
- KU, C, - Y. (2020) 勤業眾信發布 2030 電動汽車趨勢展望. DELOITTE & TOUCHE, TAIPEI.
- YAGEO CORPORATION. (2020). 國巨 2019 企業社會責任報告書. NEW TAIPEI CITY: YAGEO CORPORATION.
- HOTA INDUSTRIAL MFG. (2020). 108 年度年報. TAICHUNG: HOTA INDUSTRIAL MFG.
- HOU, L, -J. (2021). 鴻海白牌電動車夢 竟靠沒交過車的新創軍團？. 商業周刊, 1738.
- HSU, C, -I. (2016). 台灣電動車與非電動車供應鏈的績效實證分析. (碩士), NATIONAL CHUNG CHENG UNIVERSITY, CHIAYI COUNTY.
- HUANG, C, -H, & HOU, L, -J. (2021). 鴻海 1.7 兆電動車豪賭 | 為何裕隆做 60 年沒成功 · 它卻有機會？. RETRIEVED FROM [HTTPS://WWW.BUSINESSWEEKLY.COM.TW/FOCUS/INDEP/6003759](https://www.businessweekly.com.tw/focus/indep/6003759)
- IC TPEX. (2020). 電動車輛產業相關產業政策.
- INTERNATIONAL ENERGY AGENCY. (2020). GLOBAL EV OUTLOOK 2020 (PP. 250). FRANCE: INTERNATIONAL ENERGY AGENCY.
- KANG, C, -J. (2019). 台灣電動機車產業進入快速發展期.
- LIN, C. (2016). 五大創新研發計畫 以創新驅動台灣下一世代產業成長動能. TAIPEI: TAIWAN EXECUTIVE YUAN.
- LIN W, -C. (2020). 解密 特斯拉概念股 系列 – 和大(1536) 拿下 特斯拉 全球獨家訂單.
- LIU, W, -T. (2020). 〈蔚來展望佳〉 Q3 出貨量將再創新高 緯創獨家供應受惠. RETRIEVED FROM [HTTPS://NEWS.CNYES.COM/NEWS/ID/4515299](https://news.cnyes.com/news/id/4515299)
- LAMBERT, F. (2020). TESLA IS WORKING ON HW 4.0 SELF-DRIVING CHIP WITH TSMC FOR MASS PRODUCTION IN Q4 2021, REPORT SAYS. RETRIEVED FROM [HTTPS://ELECTREK.CO/2020/08/18/TESLA-HW-4-0-SELF-DRIVING-CHIP-TSMC-FOR-MASS-PRODUCTION-Q4-2021-REPORT/](https://electrek.co/2020/08/18/tesla-hw-4-0-self-driving-chip-tsmc-for-mass-production-q4-2021-report/)
- LU, K, -C. (2020). 圖解特斯拉供應鏈 | 29 家代表台廠出列！3 優勢讓馬斯克離不開台灣. 天下雜誌, VOLUME 705.
- MI, C, -H, LIN, Y, -T, & CHENG, Y, -W. (2021). 蘋果加入電動車戰局 特斯拉密組台灣隊赴美設廠.
- PERKINS, R. (2021). EUROPE OVERTAKES CHINA IN EV SALES GROWTH IN 2020.
- RAKUTEN INSIGHT. (2019). WILLINGNESS TO PAY FOR AN ELECTRIC CAR IN TAIWAN 2019.
- ROBINHOOD SNACKS. (2021). TESLA, NIO, AND THE "YEAR OF THE EV".
- SHIH, Y, -H, & WU, C, -T. (2020). 臺灣自動駕駛產業發展與策略. 機械工業雜誌(445), 62-76.
- S, W, -L. (2020). 2020 電動機車銷量衰退三成 業者批：全球只剩台灣政府補助油車.
- TECHWEB. (2021). 松下计划摆脱对特斯拉依赖 与其他汽车制造商合作. RETRIEVED FROM [HTTP://WWW.TECHWEB.COM.CN/SMARTTRAVELING/2021-03-15/2830041.SHTML](http://www.techweb.com.cn/smarttraveling/2021-03-15/2830041.shtml)
- TING-FANG, C., LI, L., & IHARA, K. (2019). APPLE'S CHINESE SUPPLIERS OVERTAKE US FOR FIRST TIME. RETRIEVED FROM [HTTPS://ASIA.NIKKEI.COM/ECONOMY/TRADE-WAR/APPLE-S-CHINESE-SUPPLIERS-OVERTAKE-US-FOR-FIRST-TIME](https://asia.nikkei.com/Economy/Trade-war/Apple-s-Chinese-suppliers-overtake-us-for-first-time)
- TTVMA. (2021). 台灣汽車零組件出口統計(當月及累計)/台灣汽車零組件進口統計(當月及累計). RETRIEVED FROM: [HTTPS://WWW.TTVMA.ORG.TW/STATISTICS](https://www.ttvma.org.tw/statistics)
- TAIWAN SUSTAINABLE DEVELOPMENT NETWORK. (2019). 臺灣永續發展目標. TAIPEI: TAIWAN SUSTAINABLE DEVELOPMENT NETWORK.
- WANG, W, -N. (2020). 美疫情蔓延恐衝擊大客戶拉貨 和大股價創近 5 年低. RETRIEVED FROM [HTTPS://NEWS.CNYES.COM/NEWS/ID/4456716](https://news.cnyes.com/news/id/4456716)
- WANG, C, -C. (2019). 車輛產業(汽車電子、電動車與自駕車)發展契機與展望. 彰化: 財團法人車輛研究測試中心.
- WU, M, -C. (2016). 五大產業創新研發計畫 智慧機械產業推動方案 台灣行政院第 3507 次會議. TAIPEI: TAIWAN EXECUTIVE YUAN.
- HSIA, Y, -M. (2020). 前十厂商总份额超 85% · 2019 全球动力电池同比增长 16.6%. RETRIEVED FROM [HTTPS://M.GASGOO.COM/NEWS/70157555.HTML](https://m.gasgoo.com/news/70157555.html)
- HSIAO, J, -S, HSIEH, L, -L, TSENG, Y, -C, & TSAI, I, -C. (2021). 2020 年第四季及全年我國汽機車產業回顧與展望. TAIPEI: 工研院產科國際所 ITIS 研究團隊.
- SINA VR. (2019). 2019 苹果 200 家核心供应商名单曝光：中国 87 家 · 美、日各 38 家.
- TECH SINA. (2020). LG 化学将中国工厂产能提升一倍 以满足特斯拉需求.
- WILDE, D. (2020). TOP 10 REASONS UK DRIVERS ARE NOT CONSIDERING AN EV FOR THEIR NEXT VEHICLE. RETRIEVED FROM [HTTPS://UK.MOTOR1.COM/NEWS/448027/TOP-10-REASONS-DRIVERS-NOT-CONSIDERING-EV/](https://uk.motor1.com/news/448027/top-10-reasons-drivers-not-considering-ev/)
- YU, A. (2018). 影響臺灣電動車供應鏈廠商股票報酬之因子. (碩士), 國立臺北大學, 新北市. RETRIEVED FROM [HTTPS://HDL.HANDLE.NET/11296/9N87F8](https://hdl.handle.net/11296/9N87F8)

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