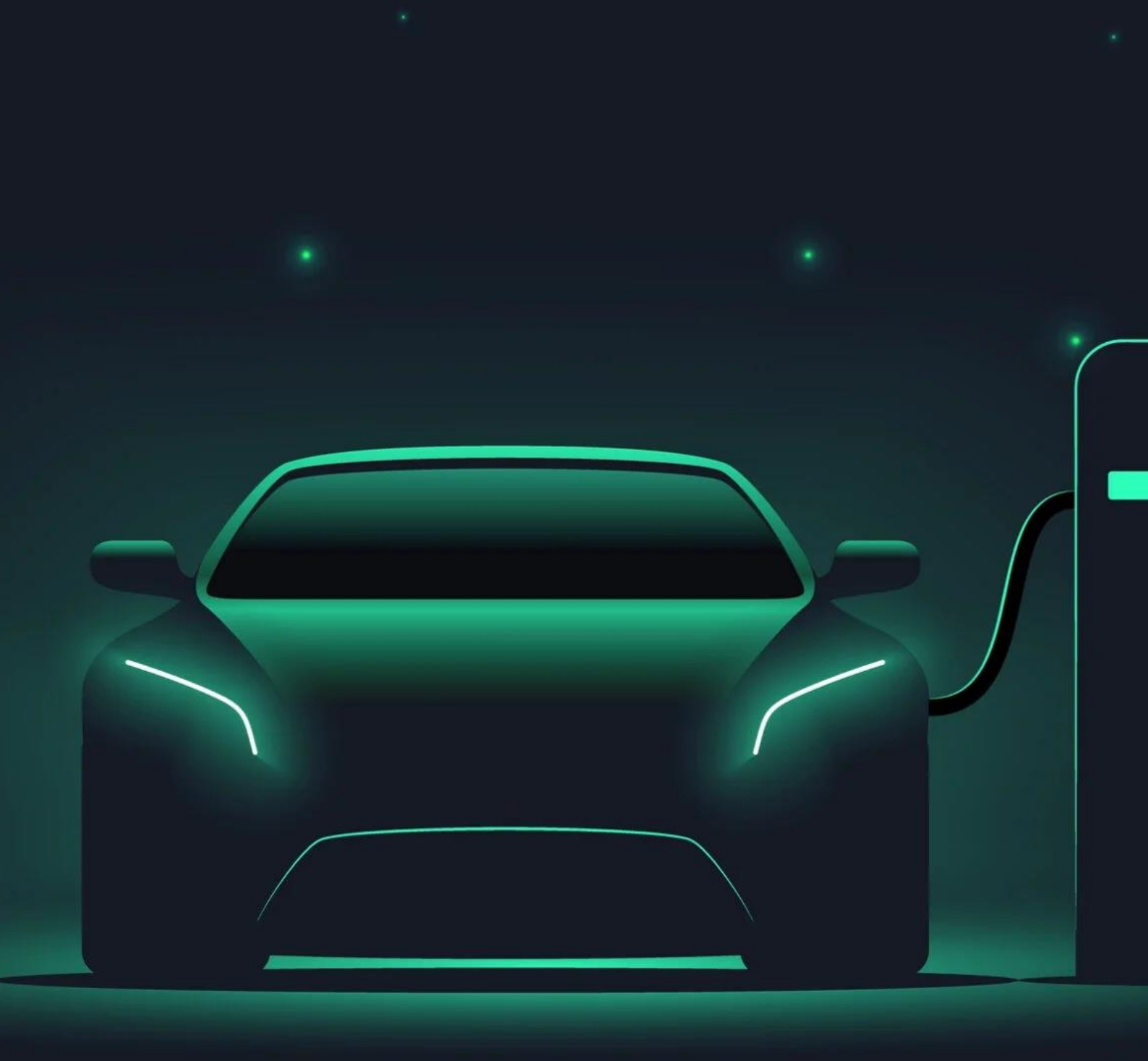
Why the Electrification of Vehicles holds a Large Threat for the Survival of Legacy Automotive Companies

January 2023



ME30197 BUSINESS PROCESSES

Candidate Number: 13171 Word Count: 1346

Introduction

A rapid increase in fuel price catalysed by the invasion of Ukraine, international agreement at COP26 on the ban of combustion engine sales by 2040[1], and a 97% reduction in battery cost in the last 3 decades[2] has propelled automotive companies into a technological race for survival.

With almost 20 million passenger Electric Vehicle (EV) sales[3], the electric powertrain has demonstrated that it is here to stay. Currently these vehicles only represent 1.5% of the global fleet; however, due to the combination of policy incentives and plummeting battery costs, consumer adoption is growing at an unforeseen rate. The legacy automotive companies must now make swift and aggressive actions towards electrification in order to compete for a share in the ever-engulfing slice over Internal Combustion Engines (ICE) vehicles.

This report will outline why EV adoption has occurred on a far shorter timeline than expected; why this technology shift results in added complexity and delays in the race towards electrification; and why lack of Vertical Integration and thus ability to scale fast, could be the final nail in the coffin for legacy automotive companies.

The Accelerated Transition to Electrification

To use renewables, reduce carbon emissions, and lessen our global reliance on oil, the mass adoption of electric vehicles has been inevitable for over a decade. However, few have been able to predict the unprecedented rate at which this transition is occurring. Recent strain and volatility on the oil and gas prices has incentivised western countries to detach their reliance on these commodities; and in March 2022, the cost per mile of an EV was 80% cheaper than ICE vehicles[4].

Electric vehicles are not only cheaper to run, but the battery cost, which currently accounts for a third of an EVs price tag[5], dropped by 89% from 2010 to 2020[6]. BloombergNEF estimates that the learning rate for batteries, defined as the percentage decrease in price for every doubling of output, is around 18%[7]. Interpolating this with the 90% YoY battery production in 2021[8], yields a yearly decline of 16% in battery cost.

Despite staggering drops in costs for both the EV consumer and manufacturer, legacy companies are still extremely reluctant to cut ICE vehicle production. In August 2021, Ford, GM, and Stellantis announced a joint goal that 40-50% of their sales will be electric or hybrid vehicles by 2030[9]. They have drastically underestimated the timeline of EV adoption, relying on the "Laggards", to purchase half of their vehicles, who by definition are not majority consumer. GM, acknowledging their flawed transition, are now aiming to compress their development schedules for 12 of their 30 planned EVs and halving the development timeline of GMC's Electric Pick-Up[10]. While these automakers may not be ready for 100% EV sales by 2030, the market will be.

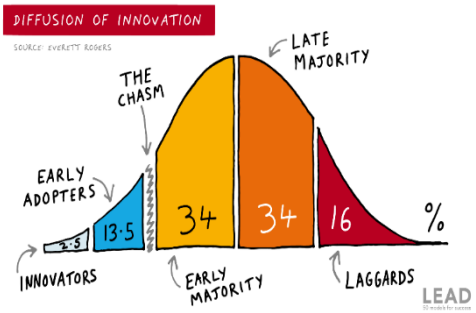


Figure 1 Popularised by Everett Rogers, the Diffusion of Innovation Graph [X]. Where a technological advancement leads to consumer adoption until the market share has saturated. For EVs, the question is not what the final market share over ICE vehicles will be, but over what timeline this occurs.

The Technology Race

"The electric powertrain cannot be bought off the shelf at a world-class standard, it is not a commodity. This is a technology race, and the market doesn't see it yet."

- Rawlinson, CEO of Lucid Motors [11]

Electrification has caused a large shift in technology, and legacy companies will have a difficult time to play catch up. The knowledgebase, or intellectual property, of legacy automotive companies has historically been the engine and the transmission, neither of which is relevant when producing EVs. Not only are these now obsolete, but the added complexities in power electronics and battery management from the powertrain will require significant development time, which is a scarce resource. Additionally, EVs rely heavily on software to control these systems and have catalysed disruptive innovation in the industry such as the push towards Autonomous, Connected, Electric and Shared (ACES) vehicles. The automotive software market is now set to increase by 17% YoY from 2022-2029[X]. These technology shifts will put extreme strain on legacy companies who have little inhouse expertise in software and power electronics.

Legacy companies are using their deep pockets to buy themselves time. GM are spending $27bn on electric vehicle R&D from 2020-2025, an increase of $7bn from initial plans 8 months earlier [7]. If they cannot achieve the inhouse capability needed for the transition, they have two further options: A. Acquire companies who have the technology expertise, buying needed time but requiring large financial investment. B: Outsource components to a greater degree, shortening the learning curve, but at the detriment of market leadership and margins.

For producing EVs in time for mass adoption, automakers must rapidly learn or acquire the technological knowledge to transition. The question is: will legacy companies be able to scale these newly developed EVs in time for mass adoption?

Why Vertical Integration Wins

Since the 20th Century where Iron Ore was fed directly into Ford's factory and Model Ts came out the other end, Vertically Integrated models have proven critical for large scale production and profitability in the automotive industry. Due to increasing complexity, modern cars are constructed with off-the-shelf components, coined by Ford CEO, Jim Farley, as "catalogue engineering"[Y]. Not only does this lead to lower margins and poor agility if a supply chain fails, but also leads to false complacency in a company where they believe their intellectual advantage cannot be replicated or displaced.

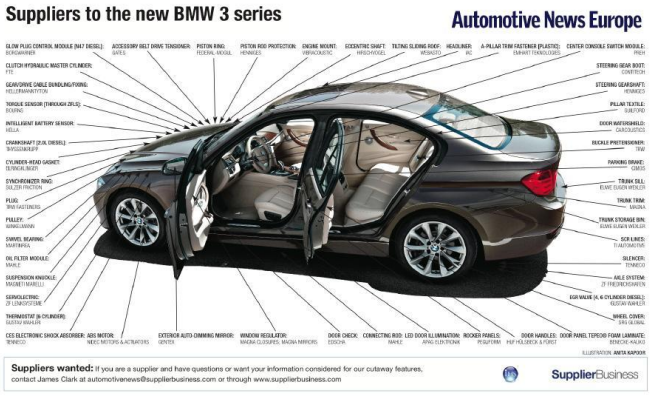


Figure 2 - The 2022 BMW 3 Series looks like an Ikea construction of off-the-shelf parts from hundreds of OEMs.

"Supply chains were already tight, and the combination of war in Ukraine and a substantial Covid-19 outbreak in China has exacerbated this situation."

- Scottish Mortgage Investment Trust PLC [13]

The fragility of supply chains has been highlighted recently by a number of events, from the global pandemic to recent geopolitical events.

Tesla is a perfect demonstrator of why Vertical Integration succeeds in the automotive industry. JB Straubel, former CTO, confirms 90-95% of the Model S is made by Tesla after OEMs consistently failed to deliver on time. In January 2018, Tesla shipped 2,400 cars in total, after promising investors more than 5,000 per week. Tesla is now producing 365,000 cars per quarter, a 54% increase YoY[14]. Tesla's insistence on vertical integration resulted in initially poor profitability but has since enabled immense scale whilst the rest of the industry has been in turmoil with the supply chain.

It is not just scalability, Tesla now have an operating margin of 18% which dwarfs Toyota and VW, the second and third largest companies by market cap, who achieved 7.5%[15] and 8.5%[16] respectively this quarter. This is also due to their software lead which legacy companies must embrace to prosper in the automotive market.

Legacy companies do not have the luxury of reducing their reliance on OEMs, since as Tesla demonstrates, vertical integration leads to inevitable production delays in early years, which they cannot afford. Supply chain turmoil is of poor timing for legacy companies, and they are likely to suffer during EV production.

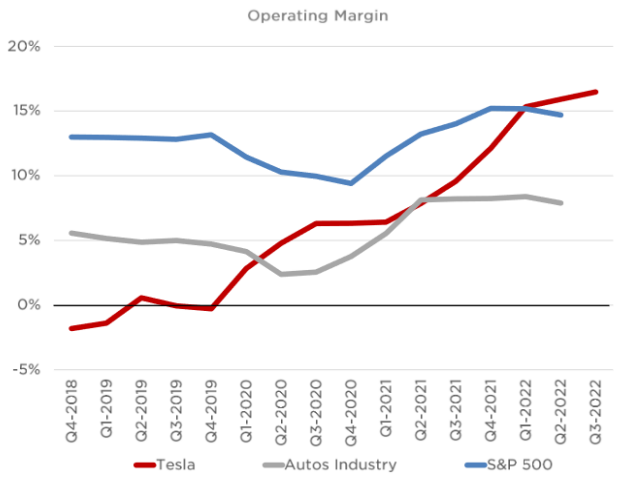


Figure 3 Operating Margins of the Automotive Industry vs Tesla. This figure was taken from Tesla's Q3 Earnings Report with calculations using audited and unaudited information in accordance with GAAP and non-GAAP basis.

Conclusion

This is the first time in history where a market of such size, has had a compulsory transition of technology, fuelled by economic, climate and geopolitical pressures. Despite consistent declines in battery costs year-over-year, legacy companies have been slow to react.

Electrification has introduced several disruptive technologies, which has moved the technology away from engines and power transmissions and towards electric powertrains, batteries, and software. Legacy companies' lack of inhouse expertise has caused them to heavily invest in R&D in an attempt to accelerate their development time and acquire technical knowledge during the transition. However, as Tesla have demonstrated, using inhouse expertise and vertically integrating inevitably causes production delays and only rewards in later years. Legacy companies will therefore have to increase their reliance on OEM suppliers in order to produce EVs in time for mass adoption. This will not only lower margins, but with reliance to the already strained supply chains, their ability to scale will suffer, leading to a reduction in market share. Electrification may serve as a grand reset for the automotive market.

Bibliography

Cover page image by Paul Craft on Shutterstock. https://www.shutterstock.com/image-vector/electric-car-charging-station-front-view-1864450102

[1] GOV.UK, "COP26 declaration on accelerating the transition to 100% zero emission cars and vans," GOV.UK, Dec. 06, 2021. https://www.gov.uk/government/publications/cop26-declaration-zero-emission-cars-and-vans/cop26-declaration-on-accelerating-the-transition-to-100-zero-emission-cars-and-vans

[2] "The price of batteries has declined by 97% in the last three decades," Our World in Data, Jun. 04, 2021. https://ourworldindata.org/battery-price-decline

[3] McKerracher, "Electric Vehicle Outlook 2018 | Bloomberg New Energy Finance," Bloomberg NEF, 2018. https://about.bnef.com/electric-vehicle-outlook/

[4] "Driving down the cost," New AutoMotive. https://newautomotive.org/research/driving-down-the-cost (accessed Dec. 05, 2022).

[5] "Here' s How Electric Cars Will Cause the Next Oil Crisis - Institute of Energy of South East Europe," www.iene.eu. https://www.iene.eu/heres-how-electric-cars-will-cause-the-next-oil-crisis-p3240.html

[6] V. Henze, "Battery Pack Prices Cited Below $100/kWh for the First Time in 2020, While Market Average Sits at $137/kWh," BloombergNEF, Dec. 16, 2020. https://about.bnef.com/blog/battery-pack-prices-cited-below-100-kwh-for-the-first-time-in-2020-while-market-average-sits-at-137-kwh/

[7] L. Goldie-Scot, "A Behind the Scenes Take on Lithium-ion Battery Prices | Bloomberg NEF," Bloomberg NEF, Mar. 05, 2019. https://about.bnef.com/blog/behind-scenes-take-lithium-ion-battery-prices/

[8] M. Xiao, "Lithium Ion Battery Market Is Moving Into Surge Mode," Interact Analysis, Apr. 2020. https://www.interactanalysis.com/lithium-ion-battery-market-is-moving-into-surge-mode/

[9] "Ford, GM and Stellantis Joint Statement on Electric Vehicle Annual Sales," news.gm.com, Aug. 2021. https://news.gm.com/newsroom.detail.html/Pages/news/us/en/2021/aug/0805-electric.html

[10] "GM Boosts Investment, Grows Electric Portfolio to Lead in EV Race," news.gm.com, Nov. 2020. https://news.gm.com/newsroom.detail.html/Pages/news/us/en/2020/nov/1119-electric-portfolio.html

[12] PWC, "Merge ahead: Electric vehicles and the impact on the automotive supply chain," PwC, 2019. https://www.pwc.com/us/en/industries/industrial-products/library/electric-vehicles-supply-chain.html

[12] Tesla, "Tesla Investor Relations Quaterly Reports," ir.tesla.com, 2022. https://ir.tesla.com/#quarterly-disclosure

[13] "Toyota Operating Margin 2010-2022," www.macrotrends.net, Sep. 2022. https://www.macrotrends.net/stocks/charts/TM/toyota/operating-margin

[14] "Volkswagen Group operating result increases and recovery in China accelerates," Volkswagen Newsroom, Oct. 2022. https://www.volkswagen-newsroom.com/en/press-releases/volkswagen-group-operating-result-increases-and-recovery-in-china-accelerates-15275 (accessed Dec. 05, 2022).

[69] https://rapidresponserevival.com/2021/09/07/cultural-change-requires-early-adopters/

https://news.gm.com/newsroom.detail.html/Pages/news/us/en/2020/nov/1119-electric-portfolio.html

[x] https://www.globenewswire.com/en/news-release/2022/09/07/2511938/0/en/Automotive-Software-Market-Is-Expected-to-Grasp-the-Value-of-USD-86-283-47-Million-by-2029-Industry-Share-Size-Industry-Analysis-Key-Growth-Drivers-Trends-and-Segments.html