



# NUS INVESTMENT SOCIETY

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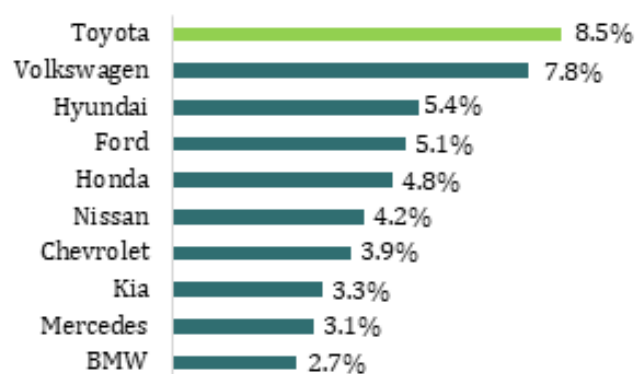
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## Section 1: Introduction

The automotive industry comprises a wide range of companies and organizations involved in the design, development, manufacturing, marketing and selling of motor vehicles and is one of the world's largest industries by revenue. The principal products of the automotive industry are passenger automobiles and light trucks, including pickups, vans, and sport utility vehicles. Secondary vehicles include commercial vehicles such as delivery trucks and large transport trucks, often called semis. In light of growing environmental awareness, automotive manufacturers are faced with a variety of new challenges. Market trends such as the shift to lighter materials, as well as the trend towards electric and autonomous vehicles are set to revolutionize the industry.

The leading automotive manufacturers are Toyota, Volkswagen, Hyundai, Ford and Honda. In 2020, Toyota had the largest market share of 8.5% (Figure 1), surpassing the 2019 incumbent, Volkswagen AG, as Toyota's global vehicle sales exceed Volkswagen's sales by 223,038 units. Between 2019 and 2020, global vehicle sales declined by 22% as a result of the economic downturn due to the COVID-19 pandemic. In 2021, Toyota's market share increased to 12.2%, remaining as the leader of the industry. In addition, US-based Tesla is noteworthy for being the pioneer in the Electric Vehicles (EV) market, selling slightly over 936,000 units in 2021.

Figure 1: Market Share of leading automakers



*Source: Statista 2021*

Global automotive sales grew to around 66.7 million automobiles in 2021, up from around 63.8 million units in 2020. Although global automotive sales fell just under 70 million units in 2021 due to the pandemic, the automotive industry is set to grow to 205 million units by 2028, with a forecasted 4.5% CAGR (2022-2030). The global automotive industry is projected to grow to just under USD 9tn by 2030, a 68% increase from 2017.

## Section 2: Japan Industry Overview

The automotive industry is a key pillar of Japan's economy, contributing around 89% of the country's manufacturing sector. It is also the third-largest automotive producing industry in the world, with 78 factories in 22 prefectures and a total employment workforce of over 5.5 million people. In spite of Japan's shrinking population over in recent years, the number of vehicles-in-use increased slightly over the last few years, from 81.85 million vehicles-in-use in 2020 to 82.08 million vehicles-in-use in 2022. This indicates a sustained demand for personal mobility. While large proportions of citizens of metropolitan areas such as Tokyo rely on the highly developed and advanced public transport network, rural prefectures have a high car ownership per household.

Figure 2: Top Competitors of Japan Automotive Market

Top Competitors	Market Cap (JPY)
Toyota Motor Corporation	28.2 tril
Honda Motor Company	5.7 tril
Nissan Motor Corporation	1.9 tril

Source: Statista 2021

In 2021, Toyota sold 1,424,000 vehicles, cementing its position as the leading automotive manufacturer in Japan. Despite a 2.1% decrease in sales volume as compared to the previous year, Toyota reported more than twice the number of vehicles sold as compared to its closest competitor, Suzuki, which only sold 608 thousand units in 2021. Key players of Japan's automotive market include Toyota Motor, Honda Motor and Nissan Motor, with market capitalization of JPY 28.2tn, JPY 5.7tn JPY, and JPY 1.9tn, respectively (Figure 2).

### a. Historical Developments

#### Global Semiconductor Chip Shortage

There has been an explosion in the use of semiconductors and digital technologies by automakers due to the rise of hybrid and fully electric vehicles, as well as autonomous driving and connected car functions. Hence, these innovations require even more computing power and are so novel and specialized that many carmakers have left it to big parts suppliers to manage the risks. Southeast Asian plants and suppliers are taking thorough quarantine and vaccination measures in response to the pandemic in Southeast Asia, making it difficult to maintain operations due to lockdowns at various locations and the unpredictability of the spread of COVID-19.

#### Introduction of Kei Cars

Originally introduced by the Japanese government to promote the growth of the car industry in 1949, the Kei Car is a light automobile that is now well-known for its affordability and ease of use. The Japanese government regulates the physical size, engine power, and engine displacement of Kei cars, such that its owners may enjoy both tax and insurance benefits.

Kei Cars have long been seen as a dominant form of daily transport in Japan, largely due to their affordability and energy efficiency, with the segment accounting for 35% of today's market. In 2021, Daihatsu sold over 532,700 Kei cars, thus remaining the leading mini car manufacturer in Japan.

### **Market leaders in the ASEAN Automotive Industry**

Japanese manufacturers' involvement in the countries of Southeast Asia dates back to 1962, when Nissan and Toyota established assembly plants in Thailand. The fact that the share of Japanese cars now makes up some 80% of the ASEAN market indicates that Japanese car manufacturers play a key role in this region. Throughout the 1970s and 1980s, their Asian operations focused on assembling knock-down kits from Japan. In recent years, however, they have begun initiating more strategically conceived involvement. This includes participation in a national car project, as well as programs centering on the expanded development of their host nations' domestic automotive industries.

Japanese manufacturers enthusiastically promote an ASEAN-initiated program, known as Brand-to-Brand Complementation (BBC), in which the flow of auto components between member nations is unrestricted, allowing economies of scale in the region as a whole. They are also making comprehensive efforts to boost regional economies and create jobs, transferring technological know-how through joint ventures, technical agreements and the training of local personnel, and extending support for peripheral industrial activity, such as in metals and electronics.

### **Promoting Industry-to-Industry Relations between the U.S. and Japan**

Japanese and U.S. manufacturers have an extensive history of capital and technical tie-ups since 1965, despite the trade issues that have arisen between them. Those ties have actually expanded over the years, and today Japanese and U.S. manufacturers have capital, production, import and sales ties, as well as cooperative development ties.

Since the dissolution of capital ties between Mitsubishi and Chrysler, companies directly participating in capital tie-ups at present are GM, Isuzu and Suzuki, as well as Ford and Mazda. Other types of tie-up arrangements (production, sales, product development, finished car supply, etc.) exist between Toyota and GM, Mazda and Ford, Nissan and Ford, Nissan and GM, Mitsubishi and Chrysler, and Honda and Chrysler.

These ties are contributing to investment in the United States and to the strength of the U.S. overseas export market, while exports from independently owned Japanese factories in the U.S. are also increasing each year.

Significant efforts have also been made at the private sector level to resolve automobile trade issues between Japan and the United States. One such effort was the 1987 launching of a series of general conferences and discussion meetings organized by the Japan Automobile Manufacturers Association (JAMA) and the (U.S.) Motor and Equipment Manufacturers Association (MEMA) to promote U.S. parts procurement by Japanese manufacturers. These meetings have led to the implementation of specific initiatives aimed at establishing closer business ties between Japanese manufacturers and U.S. parts suppliers, including joint committees, the publication of materials explaining the "design-in" process of Japanese manufacturers, the compilation of industry contact lists, and the organization of special events designed to enhance cooperation and mutual awareness.

Japanese manufacturers are also working hard to expand business ties with automobile industries in Canada, Europe, Asia and Australia. Some of their initiatives have been outlined in the JAMA Action Plan for International Cooperation released by the Japan Automobile Manufacturers Association in June 1995.

### **Local Production in the European Union and Ties with European Manufacturers**

Europe is the second largest automobile market after the United States, and Japanese manufacturers have been progressively establishing ties in various countries of the European Union over the past decade. Nissan was the first to establish its own independent operations in the United Kingdom in 1984, and other manufacturers quickly followed suit: Honda in 1985, Isuzu (in a joint venture) in 1987, and Toyota in 1989. Outside the U.K., operations include a Toyota-Volkswagen tie-up in Germany, a Nissan tie-up and a Suzuki tie-up in Spain, a Toyota joint venture and a Mitsubishi tie-up in Portugal, and a Mitsubishi joint venture in the Netherlands; Suzuki has also established a joint venture operation in Hungary.

In terms of local parts procurement, Japanese manufacturers are actively promoting industry-level cooperation. In March 1995, the Japan Automobile Manufacturers Association (JAMA) held a joint conference with the European Automotive Components and Equipment Industries Association (CLEPA) in Paris, where decision makers from 80 selected European suppliers met with representatives of the Japanese manufacturers to explore potential business opportunities.

### **b. Regulatory Implications**

#### **Tightening Regulations on Carbon Emissions**

In 2020, 464 of Japan's local governments (88% of Japan's population) announced their commitment to net-zero carbon emissions by 2050. Moreover, in 2021, Japan pledged to cut GHG emissions by 46% by 2030 compared with 2013 levels, foreshadowing tightening regulations surrounding carbon emissions. Countries around the world are actively reducing their carbon footprint in response to an increased perception of climate emergency. Growing social pressure on politics to tighten environmental regulations, exemplified by frequent climate protests in Japan garnering participation of more than 6 million people.

As a result, tightening environmental regulations all around will result in growing operating expenses and sustainability investments to meet regulatory requirements, hampering profitability across major automotive manufacturers.

#### **Automobile Recall System in Japan**

Recalls of automobiles are governed by the RTVA and are separate from the general rules of recall for other consumer products. Manufacturers and importers of vehicles with type approval must conduct recalls pursuant to an order of the MLIT or on a voluntary basis. In many cases, the manufacturers choose to conduct a voluntary recall rather than waiting to receive an administrative order.

Based on the Automobile Type Approval Guidelines and Guidelines for the Notification of Recalls (Ordinance No. 96 of 1994 of the Vehicle and Component Approvals Division, Engineering and Safety Division, Road Transport Bureau, the MLIT), manufacturers or importers are required (in principle) to specify the cause of a defect and the solution, as well as the scope of the targeted vehicles, in a report to the MLIT. They must also notify the MLIT, in the format provided by the MLIT, with an explanation of the defect, the solution, specifications, a photograph of the target vehicle and a recall summary in English. Also, manufacturers need to make the recall public by notifying users by mail or in person, and publish the fact in the gazette of the Japan Automobile Service Promotion Association. Information about a recall is also publicly available on the MLIT website.

Once a manufacturer makes a notification of a recall, it is required to immediately implement the recall work. A breach of these regulations may result in up to one year's imprisonment and a JPY 200mn fine.

### **Automobile Parts Recall System in Japan**

With regard to defective automobile parts, the defect should be dealt with by way of a recall of the entire vehicle by the car manufacturer, except for two categories of parts.

As exceptions, tyres and child safety seats are subject to an independent recall procedure pursuant to the Order for Enforcement Regulations for RTVA (Ordinance No. 185 of 1 June 1951) and parts manufacturers are to carry out the recall process rather than the car manufacturer.

Technically, car manufacturers can claim compensation for loss or damage incurred as a result of conducting a recall due to defective parts from a supplier. However, this type of litigation has historically been relatively rare in the keiretsu structure. Therefore, it was surprising to many in Japan when a Japanese car manufacturer sued one of its major tier 1 suppliers in 2014 claiming more than JPY15.6bn as compensation for damage incurred as a result of a recall caused by a defective power steering device produced by the parts manufacturer.

Since 1 October 2016, a new 'class action'-like regime has been introduced in Japan (Special Provisions for the Civil Procedure for Collective Recovery of Loss of Assets of Consumers (Act No. 96 of 2013)). This class action-like regime is two-tiered. At Tier 1, a qualified consumer organisation must prove that the relevant manufacturer owes common liability to a number of consumers. Then, at Tier 2, each consumer can have a consumer organisation file its claim with the summary court.

This class action-like regime does not cover strict product liability. Furthermore, it only entitles the recovery of actual losses and specific performance and does not extend to an indemnity for any consequential losses, loss of profits, injury or bodily harm. The action can only be made against a defendant who has direct privity of contract with consumers - not against third-party car manufacturers, importers or parts suppliers. Thus, this class action-like regime has limited application, and it does not significantly impact the automotive industry in Japan.

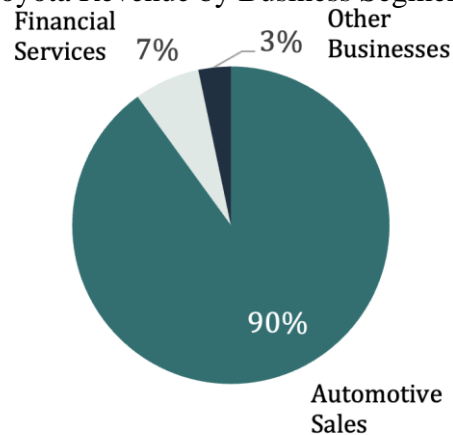
## Section 3: Key Players

### a. Toyota Motor Corporation

#### Company Overview

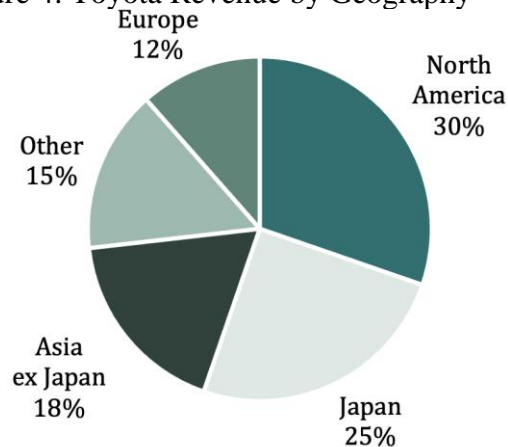
Toyota Motor Corporation (TMC) was established in 1937 by Kiichiro Toyoda to venture into automobile manufacturing in Aichi, Japan. Since then, TMC has been focused on automotive sales, developing and offering new financial products such as motor insurance and a wide variety of other business operations, which includes sale of marine engines and housing services.

Figure 3: Toyota Revenue by Business Segments



Source: Toyota 2021

Figure 4: Toyota Revenue by Geography



Source: Toyota 2021

TMC has 3 main revenue streams by segments, Automotive Sales, Financial Services and other Business Operations (Figure 3). In FY2021, TMC booked a total revenue of USD27.2tn. Toyota Motor Corporation manufactures vehicles and components in 27 countries and market its products in over 170 countries. TMC's main markets include Japan and North America, contributing 25% and 30% of total revenue respectively (Figure 4).



## Financial Analysis

Figure 5: Toyota Financial Ratios

	FY2017	FY2018	FY2019	FY2020	FY2021
<b>Profitability</b>					
ROA	3.8%	5.0%	3.7%	3.9%	3.9%
ROE	10.6%	13.7%	9.8%	10.5%	10.4%
Gross Margin	17.6%	18.7%	18.0%	18.1%	17.8%
EBITDA Margin	13.9%	14.9%	13.6%	14.0%	17.0%
Operating Margin	7.2%	8.2%	8.2%	8.2%	8.1%
Net Income Margin	6.6%	8.5%	6.2%	6.9%	8.3%
<b>Activity</b>					
Total asset turnover	0.6	0.6	0.6	0.6	0.5
Inventory turnover	8.1	8.3	8.1	7.5	6.7
Fixed asset turnover	2.8	2.9	2.9	2.8	2.4
Accounts receivable turnover	3.4	3.5	3.4	3.4	3.1
Accounts payable turnover	9.2	9.3	9.5	9.7	8.3
<b>Liquidity</b>					
Current ratio	1.0	1.0	1.0	1.0	1.1
Quick ratio	0.9	0.8	0.9	0.8	0.9
Cash ratio	0.2	0.2	0.2	0.3	0.3
<b>Financial leverage</b>					
Debt ratio	0.6	0.6	0.6	0.6	0.6
Debt-to-equity ratio	1.7	1.6	1.6	1.5	1.6
Interest coverage ratio	87.8	75.8	51.8	67.8	64.6

Source: Toyota 2021

TMC's 5-year historical gross profits and profit margins have remained relatively stable. Despite the substantial fall in revenues and operating income in FY2021, TMC was able to maintain or grow its gross and profit margins.

TMC's activity ratios remain relatively stable, with an increase in days payable signaling an increase in available cash to use for short term investments and working capital.

TMC healthy current and quick ratios indicate that the group has been building adequate short-term assets to fund short-term liabilities and daily functioning. We expect to see the upward trend of all three liquidity ratios continue in the foreseeable future, as the company rides on the worldwide recovery from the pandemic.

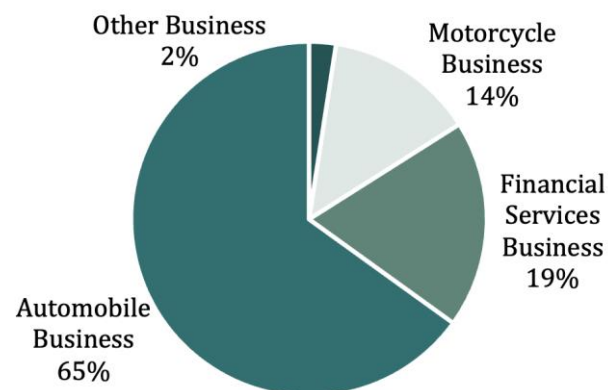
TMC's Debt ratio and DE ratio remain rather consistent, with TMC's capital structure remaining rather constant. TMC's slight decrease in interest coverage ratio may be attributed to its aggressive acquisitions and expansions strategies, and we expect it to remain at a comfortable level post-2021.

## b. Honda Motor Company

### Company Overview

Honda Motor Co., Ltd. (HMC) develops, manufactures, and distributes motorcycles, automobiles, and power products such as generators and farm machinery. HMC also operates a financial credit business. HMC has manufacturing facilities in the US, Canada, the UK, France, Italy, Spain, Brazil, Mexico, India, and Thailand.

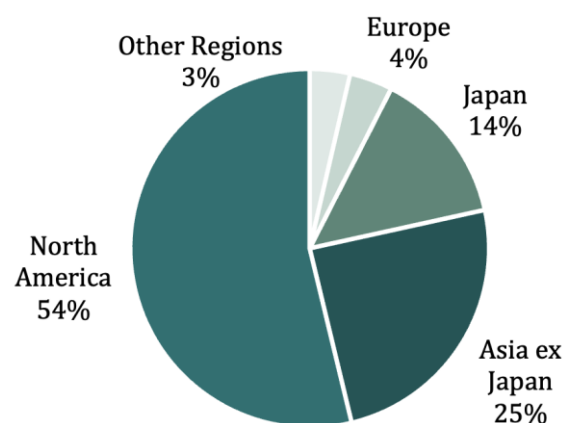
Figure 6: Honda Revenue by Business Segments



Source: Honda 2021

HMC has 4 main revenue streams by segments, Automobile business, Financial services business, Motorcycle business and other business (Figure 6). In FY2021, HMC booked a total revenue of JPY 13.2tn.

Figure 7: Honda Revenue by Geography



Source: Honda 2021

HMC's biggest market (by geography) is North America, which carries more than half of its total revenues (Figure 7). HMC's other major markets include Asia (ex Japan) and Japan, which comprise a total of almost 40% of its revenues when combined.

## Financial Analysis

Figure 8: Honda Financial Ratios

	FY2017	FY2018	FY2019	FY2020	FY2021
<b>Profitability</b>					
ROA	3.0%	6.0%	3.0%	2.0%	3.0%
ROE	9.0%	14.0%	8.0%	6.0%	8.0%
Gross Margin	22.0%	22.0%	21.0%	21.0%	21.0%
EBITDA Margin	12.1%	12.0%	10.8%	10.1%	11.8%
Operating Margin	6.0%	5.0%	5.0%	4.0%	5.0%
Net Income Margin	4.0%	7.0%	4.0%	3.0%	5.0%
<b>Activity</b>					
Total asset turnover	0.8	0.8	0.8	0.7	0.6
Fixed asset turnover	2.0	2.1	2.2	2.0	1.7
Accounts receivable turnover	17.6	19.6	19.9	20.9	18.4
Accounts payable turnover	9.4	10.0	10.4	11.1	10.2
<b>Liquidity</b>					
Current ratio	1.2	1.2	1.2	1.3	1.3
Quick ratio	0.9	0.9	0.9	0.9	1.0
Cash ratio	0.3	0.3	0.3	0.3	0.4
<b>Financial leverage</b>					
Debt ratio	0.6	0.6	0.6	0.6	0.6
Debt-to-equity ratio	1.5	1.3	1.4	1.5	1.3
Interest coverage ratio	67.4	64.3	55.0	25.7	47.6

Source: Honda 2021

HMC's gross and operating margins have remains rather consistent, with a slight overall decline in its ROA and ROE. Overall, HMC has displayed resilience in its profitability even amidst the pandemic, and improvements in supply chain operations post-pandemic should serve to bolster its ROA and ROE going forward.

HMC's asset turnover ratios have remained rather consistent, with a slight dip in 2021. HMC's accounts receivable and accounts payable turnovers have remained rather consistent with slight declines in 2021. It's worth noting that HMC's cash conversion cycle has hit a 5-year peak of 38.42, a 16.8% increase from 32.90 in 2020. This lengthening of its cash conversion cycle means that Honda is taking a longer time to generate cash, but much of it can probably be attributed to supply chain inefficiencies arising from the pandemic.

HMCs liquidity ratios remain rather consistent, with a slight increase across all three ratios in 2021. This shows that HMC has been managing its working capital well, with higher liquidity to offset increased operational costs that have arisen from supply chain issues during the pandemic.

HMC's debt and DE ratio remain rather consistent, showing that there is little change to its capital structure over the past 5 years. A slightly concerning detail would be its major dip in interest coverage ratio in 2020 (-53.3%), but a healthy rebound of 62.5% to 47.6 in 2021 is a reassuring sign the Toyota continues to have strong creditworthiness.

### c. Nissan Motor Corporation

#### Company Overview

Nissan Motor Co., Ltd. (NMC) is an automobile manufacturer headquartered in Yokohama-shi, Kanagawa-ku, Japan. The company offers automobiles under the brand names of Nissan, Infiniti, Datsun, Nissan Crossing, Nissan Heritage and Motorsports, among others. Nissan also provides credit card and leasing services, non-life insurance and auto financing services.

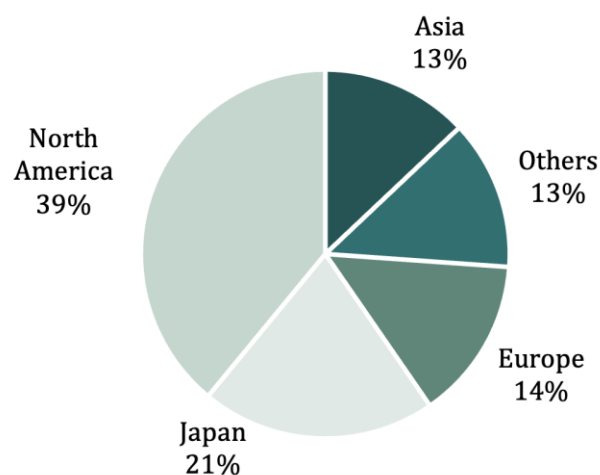
Figure 9: Nissan Revenue by Business Segments



Source: Nissan 2021

NMC has 2 main revenue streams by segments, Sales financing (52%) and Automobile business (48%) (Figure 9). In FY2021, NMC booked a total revenue of JPY 8.4tn, a 7.15% increase from its 2020 revenue of JPY 7.9tn.

Figure 10: Nissan Revenue by Geography



Source: Nissan 2021

NCM's biggest market (by geography) is North America, comprising 39% of its total revenues (Figure 10). NCM's second largest market is back in its home, Japan, comprising 21% of its total revenues. The rest of its revenue is distributed rather evenly between the remaining 3 geographic segments, between 13-14% for Asia, Europe and Others.

## Financial Analysis

Figure 11: Nissan Financial Ratios

	FY2017	FY2018	FY2019	FY2020	FY2021
<b>Profitability</b>					
ROA	4%	4%	2%	-4%	-3%
ROE	14%	15%	6%	-14%	-11%
Gross Margin	20%	18%	16%	15%	13%
EBITDA Margin	15%	13%	12%	3%	4%
Operating Margin	6%	5%	3%	0%	-2%
Net Income Margin	6%	6%	3%	-7%	-6%
<b>Activity</b>					
Total asset turnover	0.7	0.6	0.6	0.6	0.5
Fixed asset turnover	2.2	2.3	2.2	2.0	1.8
Accounts receivable turnover	14.2	15.4	18.5	22.8	18.0
Accounts payable turnover	6.2	6.1	6.0	5.7	4.8
<b>Liquidity</b>					
Current ratio	1.6	1.7	1.5	1.3	1.5
Quick ratio	1.3	1.4	1.2	1.1	1.3
Cash ratio	0.2	0.2	0.2	0.2	0.3
<b>Financial leverage</b>					
Debt ratio	0.7	0.7	0.7	0.7	0.7
Debt-to-equity ratio	2.6	2.3	2.4	2.8	2.8
Interest coverage ratio	69.3	57.1	36.4	-51.7	-8.3

Source: Nissan 2021

Despite its revenues increasing, NCM's profitability has taken a hit over the past three years, entering negative net income in 2020 and 2021. While NCM's gross margins have declined slightly, NCM's EBITDA margins have taken a 75% decline from 2019 to 2020, improving slightly from 3% to 4% in 2021. This implies a spike in its operational expenses, a possible result of supply chain disruptions during the pandemic.

A slight decline is evident in NCM's asset turnover ratios, implying a slight decline in efficiency – another possible byproduct of the pandemic.

NCM's liquidity ratios have improved slightly in the last year, despite a downward trend from 2017 to 2020, with management possibly putting greater emphasis on ensuring more liquidity. This allows NCM to confidently meet near term obligations amidst the cash flow uncertainties, with an increase in its working capital.

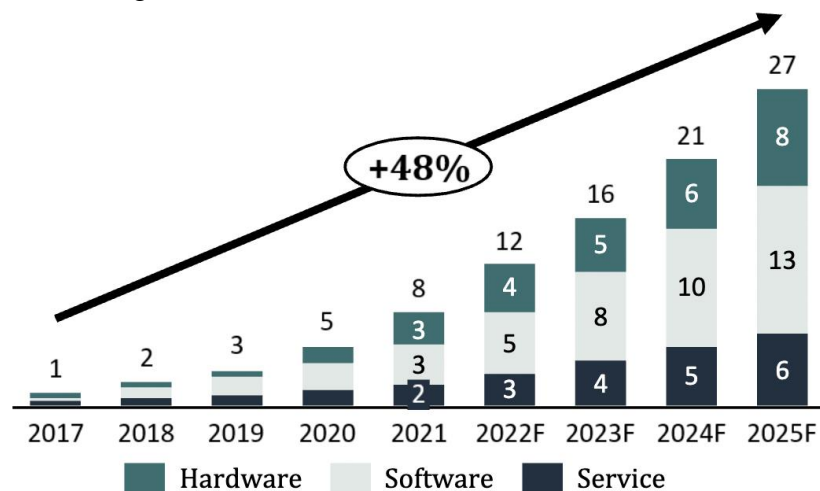
NCM's debt ratio and debt-to-equity ratios have remained largely constant, with NCM retaining a rather consistent capital structure. A decline in its earnings has led to negative interest coverage ratios in 2020 and 2021, however, the recovery from -51.7% to -8.3% in 2021 reflects swift action by management to improve its creditworthiness, and we should see improvements in its interest coverage ratios going forward.

## Section 4: Key Industry Trends

### Artificial Intelligence

Artificial Intelligence (AI) is increasingly being utilized in the automotive industry by many major automotive manufacturers. From the manufacturing process to transportation and service, AI has proven to be an essential component of modern automotive vehicles in recent years. For instance, in 2015, Toyota established the Toyota Research Institute to develop active vehicle safety and automated driving technologies, robotics, and other human amplification technology via Artificial Intelligence.

Figure 12: Automotive AI Market Size (USD bn)



Source: Deloitte

The automotive AI market has an estimated CAGR of 48% over the next few years, from USD 1bn in 2017 to USD 27bn by 2025 (Figure 12).

### Manufacturing

AI robots are used in the designing, part manufacturing and assembling processes of automotive vehicles. For instance, exoskeletons are used by workers to hold and lift heavy equipment up to an additional 44 pounds and can last for 6-8 hours. These exoskeletons are used along general assembly lines where manual labor is still heavily relied on. Another example is Nissan's inspection scanner, which utilizes machine learning to evaluate the quality of various car parts to an accuracy of 99.9%. This scanner has aided Nissan in achieving nearly 100% accuracy in its inspection process, ensuring advanced quality control and customer safety.

### Transportation

In addition to manufacturing, AI also plays a crucial role in the transportation sector. One example is the Predictive-Demand Taxi Dispatch Service, which is a service developed by Toyota, JapanTaxi, KDDI Corporation, and Accenture. The companies utilize artificial intelligence and machine learning to predict demand for taxi service while considering various inputs such as smartphone data, weather conditions, and the availability of public transport, optimizing the taxi dispatch system in Japan.

## Services

AI is also used to predict problems related to engine performance and battery performance that may occur in the future. For instance, Toyota utilizes Artificial Intelligence and deep machine learning to build its first advanced automated driving system, Teammate. Teammate offers the Advanced Drive function that allows drivers to navigate down the freeway hands-off, eyes-on-the-road, under certain conditions. Another example is Honda's driver assistance technology, which integrates AI to warn drivers of imminent traffic hazards and help them avoid accidents by checking the driver's movements and health using a monitoring camera and sensors.

## Rise of Electric Vehicles (EVs)

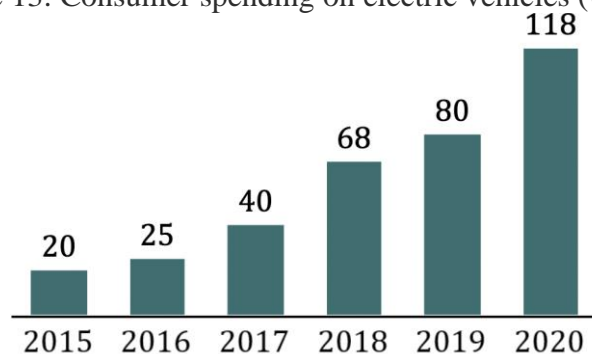
Electric vehicles have been on a steady rise over the years as consumers are paying increasingly more attention to the environment and automotive companies are aiming to capitalize on environmentally conscious consumers. The government of Japan endeavor to make all new car sales eco-friendly by 2035, and to become a zero-emissions society by 2050. Currently, automotive manufacturers in Japan are obliged to improve efficiency by 30% by the end of 2030. However, Japan's trade ministry still views hybrids as an important technology and has no intention of banning them.

The Global Electric Vehicle Market size is projected to grow from 4,093 thousand units in 2021 to 34,756 thousand units by 2030, at a CAGR of 26.8%. Several governments also provide fiscal incentives and grants on electric vehicles, encouraging consumers to spend more, boosting electric vehicle demand.

In addition, consumer spending on electric vehicles have grown from USD 20 billion in 2015 to USD 118bn in 2020, a 490% increase. In a global level, EV adoption is estimated to reach 45% under currently expected regulatory targets.

Regarding e-mobility, the Japanese government has raised subsidies for electric vehicles (EV), and aims to increase the number of EV charging stations to 150,000 by 2030. The major Original Equipment Manufacturers (OEMs) support e-Mobility Power, a joint venture established to construct, maintain and operate charging stations and related electrical infrastructure. Joint ventures and mergers among smaller suppliers are expected to increase in the coming years, in order to overcome technological shortcomings, and to raise more funding for R&D investment.

Figure 13: Consumer spending on electric vehicles (USD bn)



Source: IEA

## **In-Vehicle Digital Experiences**

The ability to integrate the vehicle to other aspects of a consumer's life gives automotive companies the opportunity to explore new business models in industries such as insurance, finance, and health. In collaboration with Oxford Economics, the IBV surveyed 140 automotive industry executives in Japan. Japan's executives believe that digital initiatives are expected to bring high value across the business functions of the organization, with those functions directly impacting the consumer rated the highest. Digitized products and services (78%) enable the brand to transition from functions to experiences while Digitized marketing and sales (73%) can allow multiple, seamless touchpoints with consumers during the use of the vehicle. New personalized products and services can be offered in both subscription and pay-as-you-use models. 60% of executives expect new business models to be enabled through digital initiatives.

By 2030, Japanese executives estimate revenue from platforms will be 14% of their total, a 75% increase over today's platform revenue. To accomplish this, industry executives expect to increase their annual investment budgets dedicated to industry platforms from 6% to 10% over the next ten years. Automotive executives are enthusiastic about the benefits of digital platforms. 80% say platforms enable greater innovation of products and services, while 86% say platforms enable greater personalization for the consumer. 79% say platforms contribute to lowering industry barriers of entry, and 74% say platforms facilitate greater value from data.

As we look to the future, we see the experience platform becoming much more relevant to the Japanese automobile industry. This supports the shift to a greater digital focus that creates more personalized, seamless experiences with consumers— and takes advantage of the huge amounts of data accessible to automotive companies. IBM estimates that an autonomous vehicle, driven at an average distance, generates up to 4,000 GB of data per day. In fact, 79% of executives expect customer experiences to be greatly enhanced by digital services. 87% of executives also say strategy innovation is critical to creating the agility to address rapid change and opportunities. Strategy innovation is critical as companies explore and pilot new business models for ownership, mobility services, and data.

From a global perspective, we see that consumers living in urban settings tend to be higher users of digital technologies than those residing in rural areas. But, in Japan, there doesn't seem to be a significant difference in many cases. 26% of urban consumers regularly use social media, compared to 28% of rural users. Also, 30% of urban consumers use multiple digital devices each day, as opposed to 25% of rural users. However, Japanese urban and rural consumers differ slightly in their attitudes toward sharing personal information in exchange for value. 27% of urban consumers are willing to share their medical information in an emergency, versus 30% of those who live in rural areas. 22% of urban users say they will share their mobility information in return for better products and services, compared to 19% of rural consumers. 17% of urban consumers indicate they would be willing to share financial information during e-commerce transactions from vehicles, versus 13% of rural users. The consumer's mobility digital expectation includes the vehicle's cognitive capabilities.

While most of the discussion is about the ability of the vehicle to drive itself, digital technologies, such as artificial intelligence (AI), Internet of Things (IoT), and cloud, can fuel many other features. Vehicles will be able to recognize occupants and personalize the content displayed to them. Vehicles will also continuously learn and offer new suggestions based on consumer interests. And most significant, vehicles will be able to engage their occupants in natural conversation.



## Section 5: Conclusion

In conclusion, the Japanese automobile industry is projected to undergoing revolutionary changes in the coming years, with Japanese automotive executives expected to spend over 276 billion yen to reskill their employees by 2030. The new and improved Autonomous, Connected, Electrified, and Shared (ACES) cars are forecasted to be the Japanese automobiles of the future. ACES are projected to offer a wide variety of functions such as recognizing owners based on their biometric information. ACES would be able to extract digital mobility profiles and information to provide a personalized in-vehicle digital experience during travel time.

The evolutionary possibilities of the Japanese automobile industry are limitless. If the leading automobile makers in Japan can successfully innovate and integrate the entire in-vehicle user experience, their existing customer base would not only grow exponentially on a local scale but perhaps on a global scale as well.

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