Beyond the Roads: A Comprehensive Review of the Influencing Factors on the Effectiveness of Malaysia's Passenger Vehicle Industry within the Automotive Policy Framework

Ooi Shir May[1], Asmat Nizam Abdul Talib[1], Dr. Christopher Richardson[2], Dr Afifah Alwani Ramlee[3] and Farza Gadissa Fitri [1]

[1]School of International Studies Universiti Utara Malaysia, Kedah, Malaysia
[2]Graduate School of Business Universiti Sains Malaysia, Pulau Pinang, Malaysia
[3]Department of International Business, Marketing and Tourism University of Bedfordshire, UK

ABSTRACT

Within the framework of the National Automotive Policy 2020, the purpose of this study is to evaluate the elements that affect the effectiveness of the passenger vehicle sector. The main objective of this study is to assess the elements that affect the effectiveness of the passenger vehicle sector. In this study, a complete literature review and an analysis of empirical data are used to investigate several aspects of economic, including government regulations, market demand, and technological advancements, The findings contribute to a deeper knowledge of the effect that the National Automotive Policy has had on the passenger vehicle and provide policymakers, industry stakeholders, and researchers who are interested in enhancing its efficacy with suggestions for improvement. In addition, the findings contribute to a better comprehension of the effect that the National Automotive Policy has had on the passenger vehicle industry.

Keywords: National Automotive Policy, the passenger vehicle sector, government regulations, market demand, and technological advancements.

1. INTRODUCTION

The automotive industry plays a crucial role in fostering economic and social progress, both in the immediate and extended periods, and has consistently demonstrated its significance as a fundamental driver of prosperity in numerous nations, including Malaysia (Marin & Kaminski, 2018). The industry remains as an important and strategic part of the country's manufacturing sector, contributing 4% to Malaysia's GDP and continues to be the 3rd largest automotive market in ASEAN (MIDA, 2021). The passenger vehicle sector is an essential element of a nation's economy, since it significantly contributes to driving economic growth, creating employment opportunities, and promoting technological advancements. Kaitwade, (2020) asserts that the automotive industry has a substantial role in generating money for both emerging and established economies. The concept is commonly acknowledged as the fundamental basis for the calculation of the nation's gross domestic product (GDP).

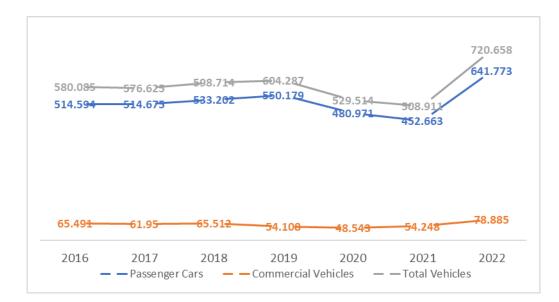*Corresponding Author: shirmay@uum.edu.my

Figure 1. Summary of New Passenger & Commercial Vehicles
Source: Malaysia Automotive Association (MAA)

From the figure above it's also implying how economic development of a nation is contingent upon the performance of the automotive sectors. The passenger vehicle industry plays a crucial role in strengthening a nation's economic well-being by facilitating job creation, fostering technological progress, and promoting general economic expansion. The transport sector, with a specific focus on passenger volume, exerts a substantial influence on the growth and development of the economy. Governments often enact rules and regulations to promote the growth and effectiveness of this business, acknowledging its importance. The National Automotive Policy 2020 serves as a policy framework that facilitates the growth and advancement of the passenger vehicle industry sector (Sahari, 2018).

To mitigate the significant impacts of the crisis, governments worldwide have implemented a growing array of policy approaches. The Malaysian government has implemented various measures to provide assistance to industries that have been significantly impacted. The effectiveness of the passenger vehicle sector is influenced by various elements under the overall policy framework of the National Automotive Policy 2020. The National Automotive Policy 2020 initiative is a strategy framework designed to enhance the expansion and competitiveness of the domestic passenger car sector, foster sustainable practices, and facilitate the incorporation of advanced technology within the industry.

The purpose of this study is to examine the numerous factors that influence the effectiveness of the passenger vehicle industry, with a particular emphasis on the National Automotive Policy 2020. By identifying and analyzing these factors, policymakers and industry stakeholders can gain insight into areas for development and make informed decisions for the industry's sustainable growth. Among the primary goals of a national automotive policy may be to encourage the local production of vehicles and components, provide incentives for investments in research and development, increase exports, and improve safety and environmental standards. These policies may also promote the use of alternative fuels and technologies and reduce reliance on imported vehicle components.

2. LITERATURE REVIEW

2.1 National Automotive Policy 2020

The advancement of automotive technology on a global scale has led to an increase in the adoption of Next Generation Vehicles (NxGV), the emergence of Mobility as a Service (MaaS), and the integration of Industrial Revolution 4.0. The National Automotive Policy 2020 aims to improve upon the previous National Automotive Policy by including technological advancements such as the Next Generation Vehicle (NxGV), Mobility as a Service (MaaS), and Industrial Revolution (IR4.0). Also, over the past few years, significant transformations have occurred within the automotive industry. The sales of fossil fuel vehicles are experiencing a more rapid decline than initially anticipated, mostly due to growing environmental and energy-related apprehensions. In light of the ongoing electric car revolution, the global automotive industry, which has been predominantly focused on the sale of fossil fuel vehicles for over a century, is now compelled to undergo a significant transformation. In the preceding decade, there has been a notable increase of 30 percent in the worldwide automobile industry. The automotive sector must adapt to the shifting consumer preferences that are increasingly favoring electric vehicles. According to (Oktav, 2017), it is apparent that in the forthcoming decade, the automotive industry worldwide leadership will be exclusively attained by manufacturers who demonstrate innovation in electric and autonomous car technologies.

These additions align with the ongoing progress in future technologies (MITI, 2020) which are:
Next Generation Vehicle (NxGV) - The discourse surrounding the Next Generation Vehicle (NxGV) has been deliberated within the framework of Malaysia's National Automotive Policy. The NxGV concept is a component of the National Automotive Policy 2020 attempts to facilitate the development of ecologically conscious and enduring automobiles. The term "NxGV" pertains to a category of automobiles that employ advanced technology and alternative power systems, such as electric or hybrid engines, in order to mitigate their environmental impact by reducing carbon emissions and enhancing energy efficiency. In light of the anticipated rapid integration of autonomous vehicles (AVs) in the forthcoming years, it is imperative for governmental entities and private enterprises to acknowledge the challenges associated with this transformative technology and effectively harness its potential to enhance societal well-being. Currently, Malaysia is targeting an EV contribution of 20% of the total vehicle sales by 2025 and 50% by 2035 (Azni & Khalid, 2021). Environmental concerns have become significant challenges for governments, societies, and corporate organisations. The Malaysian government has established a goal of achieving a minimum of 50 percent sales of Next Generation Vehicles (NxGV) in Malaysia by the year 2030, in alignment with the principles of the National Automotive Policy (MITI, 2020). In order to accomplish this goal, the government has implemented various strategies aimed at promoting the advancement and wider utilisation of NxGV. These measures encompass offering incentives to encourage the production and acquisition of NxGV, allocating resources towards the advancement of NxGV technologies through research and development, and establishing the essential infrastructure required to facilitate NxGV usage, such as electric vehicle recharge stations (Sears et al., 2014).

Mobility as a Service (MaaS) - The notion of mobility-as-a-service (MaaS) is a dynamic idea that involves individuals and businesses opting for transport services instead of owning vehicles. In this regard, Mobility as a Service (MaaS) involves the integration of diverse transport modes and the provision of on-demand mobility. This implies the consolidation of numerous transport services into centralised mobility services (MITI, 2020). An additional phase in the evolution of a service involves the facilitation of mobility, rather than only offering access to certain transportation products or services. According to (Smith & Hensher, 2020), a more comprehensive interpretation of Mobility as a Service (MaaS) encompasses various dimensions. These dimensions include the scale of implementation, which can range from large-scale and

global to small-scale and local. Additionally, MaaS can offer different payment models such as pay-as-you-go or subscription plans, with the option of customization. Furthermore, MaaS is capable of integrating various functionalities and types of services, and could be implemented by different actors or a combination of actors. Lastly, the establishment of MaaS can be done with or without an explicit intention to generate societal benefits.

Industrial Revolution 4.0 - Facilitates the transformation of the manufacturing environment into an advanced and intelligent sector 4.0 platform, thereby promoting the long-term viability of car sector enterprises. According to (Sahari, 2018), Malaysia's manufacturing sectors are positioned between the stages of Industry 2.0 and 3.0 in terms of the state of the industrial revolution. The deployment of Industry 4.0 is a step-by-step process. According to Rüßmann et al. (2015), the concept of Industry 4.0 can be actualized through the implementation of essential components such as big data and analytics, autonomous robots, simulation, horizontal and vertical system integration, the internet of things (IoT), cybersecurity, cloud computing, additive manufacturing, and augmented reality. Moreover, the integration of cyber-physical systems (CPS), machine-to-machine components, autonomous vehicles, nanotechnologies, biotechnologies, energy storage, and quantum technologies plays a pivotal role in facilitating a robust level of connectivity and communication throughout the progression of Industry 4.0 (UNIDO, 2016) (Stock & Seliger, 2016).

2.2 Factors that affect the passenger vehicle industry

The potential effects of a national automotive policy on the passenger vehicle industry can vary depending on the precise policies that are put into place. Generally, these policies aim to facilitate the expansion and advancement of the domestic vehicle sector, while concurrently considering the concerns of customers, the environment, and other relevant parties. In the context of the National Automotive Policy 2020, the effectiveness of the automotive sector can be influenced by the subsequent factors:

2.2.1 Economic Factors (GDP and Inflation Rates)

The International Monetary Fund posits that the Gross Domestic Product (GDP) serves as a metric for evaluating a nation's economic success. For instance, it can be defined as the comprehensive monetary worth of all ultimate goods and services generated within a specific timeframe as it's seen on the figure 2. The Malaysia National Automotive Policy is a strategic framework designed to support and develop the domestic automotive industry, enhance technological capabilities, encourage research and development, and promote sustainable growth. It may include specific measures to address economic challenges like fluctuations in GDP and inflation rates to maintain a conducive environment for the passenger vehicle industry.
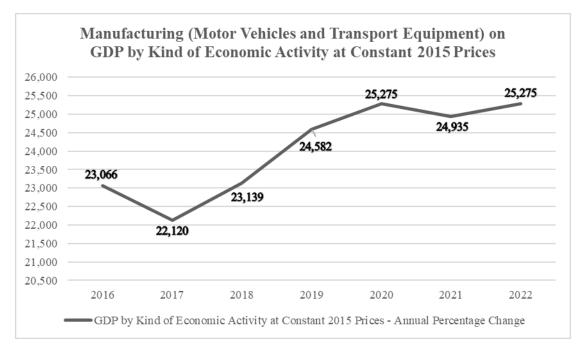
Figure 2. Manufacturing (Motor Vehicles and Transportation Equipment)
on Gross Domestic Product
Source: Department of Statistics Malaysia

The stimulation of production, employment, and investment in interconnected sectors can result in an augmentation of economic output, hence exerting a favourable impact on the rise of Gross Domestic Product (GDP). According to the findings of (Torok, 2022), there exists a strong positive association between the automobile industry and GDP growth in nations where the sector's contribution is significant and experiencing dynamic expansion. The steady growth of Malaysia's GDP has the potential to result in increased levels of disposable income for consumers, hence enhancing their affordability to purchase automobiles. Consequently, this development can yield favourable outcomes for the passenger vehicle industry. The Malaysia National Automotive Policy is a comprehensive and strategic framework aimed at providing assistance and fostering the growth of the local automotive industry. Its primary objectives include the enhancement of technological capabilities, the promotion of research and development activities, and the facilitation of sustainable growth within the sector. For instance, since EVs are in the early stages of adoption, their price is still considerably higher than the price of internal combustion engines vehicles (Lévay et al., 2017).

According to Yong & Park (2017), the effectiveness of financial policy incentives in promoting electric vehicle (EV) adoption is enhanced when they are implemented in conjunction with advantageous economic conditions. In further explication, the authors employ GDP per capita as a metric and ascertain that policy incentives exhibit greater efficacy in contexts characterised by higher GDP per capita. This underscores the significance of a country's economic circumstances in shaping the outcomes of policy interventions. The potential influence of the National Automotive Policy 2020 on inflation levels is contingent upon several factors, such as the effectiveness of the policy, the competitiveness of the domestic sector, the overall economic situation of the country, and other macroeconomic variables. The effects may not manifest instantly and may require a certain duration of time to become evident. It is necessary to employ effective implementation of specific strategies aimed at addressing economic challenges, such as fluctuations in GDP and inflation rates, in order to maintain a conducive environment for the passenger vehicle industry.

2.2.2 Government Factors

Government plays a bigger role such as on policy (Ali et al., 2017). The National Automotive Policy 2020 and its associated provisions and guidelines are projected to have a substantial influence on the passenger vehicle industry and emission standards. These effects encompass a range of factors, such as incentives for local manufacturing, taxation policies, restrictions at ports, and the establishment of environmental safety and emissions standards. According to (Zhang et al., 2019), institutional support refers to the provision of government assistance to companies with the aim of mitigating the negative impacts resulting from insufficient institutional government infrastructure. The government provides institutional support in the form of both material and intangible resources, including advantageous policies and programmes. The present study examines the correlation between the National Automotive Policy, innovation, and the success of vehicle manufacturers in Malaysia.

One of the objectives inside government policy is to enhance the interconnections among various actors within the system. The role of government policy is a significant determinant in the advancement of innovation and the augmentation of competitiveness. Institutional support is provided by the government in the form of material and intangible resources, including helpful policies and programmes. Because Government plays a bigger role such as on policy (Ali et al., 2017). One of the main aims of governmental policy is to enhance and fortify the interactions among various actors within the system. The role of government policy is of utmost importance in facilitating innovation and enhancing competitiveness. In order to optimise the efficacy of a policy, governmental entities depend on efficient coordination across pertinent government departments, regular assessment of policy outcomes, and prompt adaptations informed by feedback and evolving conditions.

For example, as shows on National Automotive Policy 2014 stated before National Automotive Policy focusing more Electric vehicles and to overcome the high initial capital cost, governments provide monetary incentives such as financial purchase incentives, tax exemptions and tax reductions. Financial purchase incentives provide an upfront reduction of the vehicle price, while tax exemptions and reductions are applied after an EV is purchased. Previous studies find that financial purchase incentives are the most effective incentive in stimulating individual adoption of EVs, because consumers prefer to have an instant reduction in the price to overcome the high initial purchasing price (Hardman et al., 2017); (Gong et al., 2020)) Furthermore, the implementation of the National Automotive Policy has the potential to contribute to the equilibrium of the trade balance by diminishing the dependence on imported automobiles and fostering the growth of locally manufactured vehicles for export purposes.

2.2.3 Market Factors (Demand and Consumer Preferences)

The passenger car sector is highly impacted by consumer preferences and market demands. The National Automotive Policy 2020 acknowledges the significance of harmonising industrial practices with evolving consumer expectations, environmental considerations, and energy efficiency mandates. The strategic consideration of these dynamic developments will play a crucial role in acquiring a larger portion of the market and guaranteeing the industry's sustainability in the long run.

The formulation of an effective National Automotive Policy 2020 requires the consideration of prevailing market demand and the discernible inclinations of consumers. In order to ensure the efficacy of the strategy, it is imperative to possess a comprehensive understanding of market dynamics and effectively address customer expectations. The demand for particular classifications of passenger vehicles, such as sedans, SUVs, and electric automobiles, is influenced by evolving consumer tastes, lifestyle patterns, and demographic changes. In their study,

(Banerjee, 2010) revealed that household income has a significant role in influencing the purchasing decisions of households in relation to the number and size of cars. Interestingly, the researchers discovered that family size does not have a significant impact on these decisions, as even bigger families tend to prefer smaller vehicles.

(Luniya & Verghese, 2013) determined that several elements, including price, resale value, mileage, financing options, comfort, safety, and automobile models, have a significant role in influencing consumer preferences when making a car purchase. When purchasing an automobile, clients are significantly influenced by characteristics such as mileage, availability of cheap financing, and the specific type of the car. (Gupta, 2013) demonstrated the significant impact of factors such as price, fuel efficiency, and engine power on consumer purchasing choices, as well as the noteworthy role of reference groups. In addition to friends, family, and relatives serving as primary influences, consumers also place trust in the information accessible on the internet. An important difference between individual and household consumers and business consumers, is that individual and household consumers are influenced by demographic factors such as personal income, gender, age, household size, and occupation levels (Biresselioglu et al., 2018). In contrast, firms are influenced by organisational factors such as: firm size, managerial structure, organisational resources, and their business strategy (e.g., CSR) (Mohammed et al., 2020).

Moreover, the primary factors influencing customer preference are price reductions within promotional offers and the fuel efficiency of passenger cars. The study further substantiated the correlation between the age of the respondents and the primary determinant of purchasing a passenger vehicle. Consumers expressed a preference for premium-level, fashionable, and powerful passenger cars, assuming that the price factor was disregarded. The augmentation of output and investment within the sector can yield the generation of employment opportunities and a subsequent rise in worker remuneration. This has the potential to yield a favourable influence on consumer spending and overall economic activity. If the policy is in accordance with evolving customer preferences, such as an increasing desire for electric vehicles or sustainable transportation options, it has the potential to foster the advancement and competitiveness of the business.

2.2.4 Technology Factors (New Product Development and Technology Transfer)

In an era of rapid technological advancements, staying at the forefront of innovation is crucial for the passenger vehicle industry's success. The National Automotive Policy 2020 prioritizes the integration and adoption of cutting-edge technologies, such as electric and hybrid vehicles, autonomous driving systems, and connectivity solutions. The effectiveness of the policy in promoting innovation will determine the industry's global competitiveness and sustainability. Continuous advancements in the technology sector positively influences innovations in the automotive industry. The cars of today have developed from a mainly mechanical means of transport to a provider of technological mobility and services (Chemendy, 2018).
New product development (NPD) is essential in the rapidly expanding global market of today as well for optimising national automotive policy, as it offers a competitive edge in response to the growing need for personalised and hybrid products (Aikhuele, 2017). In order to remain competitive in the global automotive sector, organisations must integrate sustainable product development practises with quality management practises as a component of their overall strategies (Ahmad et al., 2016). Therefore(Mohd Turan et al., 2017) have suggested a sustainability evaluation approach for product development. The emphasis on product design has emerged as a central concern within a fiercely competitive and rapidly expanding global marketplace (Mohd Turan et al., 2017).

The National Automotive Policy the capacity to enhance innovation and technical advancement within the transportation industry through its ability to attract global investments. In the long run, there exists the potential for this to enhance economic development and productivity. The significance of trust in technology is heightened in engagements with autonomous agents, wherein the delegation of decision-making authority from humans to technological agents occurs ((Glancy, 2012); (Tay et al., 2014); Tussyadiah et al., 2017).

In order to adequately confront the issue of accommodating late design changes requested by customers, it is crucial for suppliers to possess the capacity to anticipate consumer expectations and include them into the design process at an earlier phase (Fernando et al., 2018). The presence of advanced technological innovation capabilities has the potential to accelerate the process of NPD. In addition, (Taju Rahim & Zainuddin, 2017) have posited that businesses has the capacity to address worldwide carbon dioxide emissions by employing technological advancements. Automobile manufacturing businesses employ project risk analysis as a means to address uncertainties pertaining to supply and demand (Fernando et al., 2018). Furthermore, the implementation of this policy has the potential to enhance the competitiveness and foster economic growth within the domestic car sector through the facilitation of technology transfer agreements between domestic firms and their overseas counterparts.

3. CONCLUSION

This study has shed light on a multitude of crucial dynamics influencing the industry's performance. The findings emphasize the interconnectedness of economic, government frameworks, market demands, and technological advancements in shaping the industry's trajectory. This study has provided valuable insights that contribute to a deeper understanding of how the National Automotive Policy 2020 interacts with and impacts the passenger vehicles industry. The impact of a National Automotive Policy on the passenger vehicle industry will be contingent upon the extent to which these objectives are achieved. For example, if the policy offers significant incentives for local manufacturing and research and development (R&D), it has the potential to foster growth and innovation within the domestic economy. Consequently, this may lead to an upsurge in production and exports. Conversely, in the event that the policy exhibits an undue emphasis on protectionism and the restriction of imports, it has the potential to impede competition and hinder innovation. This might have adverse effects on consumers, as their choices would be limited and prices would be driven upwards, ultimately resulting in detrimental consequences for the economy. Furthermore, in the event that the policy does not sufficiently address environmental considerations or safety regulations, there is a potential for adverse externalities to arise, such as a rise in pollution levels or an escalation in traffic accidents. When formulating and executing policies, officials must conscientiously evaluate these aspects in order to assure the attainment of their desired objectives while mitigating any inadvertent repercussions. This study examines the difficulties and tactics discussed, as it offers valuable insights for future research and practical applications. The findings can be beneficial not only for guiding subsequent investigations, but also for assisting various entities, including small and medium-sized enterprises (SMEs), global investors, and other Malaysian companies, in effectively implementing these strategies to address the identified challenges. This literature review has examined the comprehensive problems and solutions associated with justifying the significance and relevance of further studying nine primary findings from the present study. This study will serve as a foundational framework for further research on the primary discoveries topics such as electric and electronic vehicles (EEV), end-of-life vehicles (ELV), and sustainability. This work has made a valuable contribution to scholars seeking to explore the latest and emerging trends in the automobile sector, with a particular focus on Malaysia. Based on the author's assessment, there remains a dearth of research pertaining to EEV, ELV and NPD particularly within the context of Malaysia. The prevailing emphasis appears to be on environmentally conscious subjects such as ELV as Malaysia is targeting an EV contribution of 20% of the total vehicle sales by 2025 and 50%

by 2035 (Azni & Khalid, 2021), EEV, and sustainability, despite the fact that NPD has been established as a means of attaining a competitive edge, as corroborated by (Fantazy & Salem, 2016). Hence, the researchers propose that future studies should prioritize the examination of electric vehicles within the automotive industry to provide statistically significant and favorable outcomes. The National Automotive Policy has established a favourable trajectory for the automotive ecosystem in Malaysia. By implementing appropriate governmental measures, it is possible to enhance both innovation and performance.

References

[1]   Ahmad, M. H., Md. Salleh, S., & Shaari, H. (2016). The mediating effect of brand satisfaction on the relationship between brand personality and brand loyalty: Evidence from Malaysia. Management Science Letters, 6, 87–98.

[2]   Aikhuele, D. O. (2017). Systematic model for lean product development implementation in an automotive related company. Management Science Letters, 337–350. https://doi.org/10.5267/j.msl.2017.4.003

[3]   Ali, N., Ghazilla, R. A. R., Abdul-Rashid, S. H., Sakundarini, N., Ahmad-Yazid, A., & Stephenie, L. (2017). A system dynamics approach to develop a recovery model in the Malaysian automotive industry. IOP Conference Series: Materials Science and Engineering, 210, 1–6.

[4]   Azni, M., & Khalid, R. M. (2021). Hydrogen Fuel Cell Legal Framework in the United States, Germany, and South Korea—A Model for a Regulation in Malaysia. Sustainability, 13, 2214.

[5]   Banerjee. (2010). New vehicle choice in India: household choice among motorized vehicle segments. 12th WCTR, Lisbon, Portugal 1.

[6]   Biresselioglu, M. E., Demirbag Kaplan, M., & Yilmaz, B. K. (2018). Electric mobility in Europe: A comprehensive review of motivators and barriers in decision making processes. Transportation Research Part A: Policy and Practice, 109, 1–13. https://doi.org/10.1016/j.tra.2018.01.017

[7]   Chemendy, N. (2018). An evaluation of demand and capacity planning processes – A qualitative case study on completely knocked-down vehicles at Mercedes-Benz Cars [Thesis]. Stellenbosch University.

[8]   Fantazy, K. A., & Salem, M. (2016). The value of strategy and flexibility in new product development. Journal of Enterprise Information Management, 29(4), 525–548. https://doi.org/10.1108/JEIM-10-2014-0102

[9]   Fernando, Y., Walters, T., Ismail, M. N., Seo, Y. W., & Kaimasu, M. (2018). Managing project success using project risk and green supply chain management: A survey of automotive industry. International Journal of Managing Projects in Business, 11(2), 332–365.

[10]   Glancy, D. J. (2012). Privacy in Autonomous Vehicles. Santa Clara Law Review , 52(4), 1171–1239.

[11]   Gong, S., Ardeshiri, A., & Hossein Rashidi, T. (2020). Impact of government incentives on the market penetration of electric vehicles in Australia. Transportation Research Part D: Transport and Environment, 83, 102353. https://doi.org/10.1016/j.trd.2020.102353

[12]   Gupta. (2013). A Study of Buying Decision Influencers for Passenger Car Segment in New Delhi. International Journal of Business and Management Invention, 2(12), 64–71.

[13]   Hardman, S., Chandan, A., Tal, G., & Turrentine, T. (2017). The effectiveness of financial purchase incentives for battery electric vehicles – A review of the evidence. Renewable and Sustainable Energy Reviews, 80, 1100–1111. https://doi.org/10.1016/j.rser.2017.05.255

[14]   Kaitwade, N. (2020). COVID-19 Shatters Global Automotive Industry: Sales of Metal Powder Take a Nosedive Amid Wavering Demand. Metal Powder Report, 76(3), 137–139.

[15]   Lévay, P. Z., Drossinos, Y., & Thiel, C. (2017). The effect of fiscal incentives on market penetration of electric vehicles: A pairwise comparison of total cost of ownership. Energy Policy, 105, 524–533. https://doi.org/10.1016/j.enpol.2017.02.054

[16]   Luniya, & Verghese. (2013). Consumers Purchase Preference and Its Determinants : An Empirical Study on 4-Wheelers in Chhattisgarh. The Pacific Business Review, 6(2), 48–52.

[17]   Marin, R. O., & Kaminski, P. C. (2018). Analysing open innovation integration to product development processes within the Brazilian automotive industry. International Design Conference, 1915–1924.

[18]   Mohammed, L., Niesten, E., & Gagliardi, D. (2020). Adoption of alternative fuel vehicle fleets – A theoretical framework of barriers and enablers. Transportation Research Part D: Transport and Environment, 88, 102558. https://doi.org/10.1016/j.trd.2020.102558

[19]   Mohd Turan, F., Johan, K., Muhd Nur, N. H., & Omar, B. (2017). Sustainability Assessment Model in Product Development. IOP Conf. Series: Materials Science and Engineering, 226, 1–9.

[20]   Oktav, A. (2017). New Trends and Recent Developments in Automotive Engineering. In H. Arapgirlioğlu, R. L. Elliott, E. Turgeon, & A. Atik (Eds.), Researches on Science and Art in 21st Century Turkey Chapter: 331 (pp. 2976–2987). Gece Kitaplığı.

[21]   Sahari, M. (2018). Government in the full force for Industry 4.0. Draft National Industry 4.0 Policy Framework – Public Review. P B12, New Straits Times. http://www.might.org.my/download/draft-national-industry-4-0- policy-framework-public-review/

[22]   Sears, J., Roberts, D., & Glitman, K. (2014). A comparison of electric vehicle Level 1 and Level 2 charging efficiency. 2014 IEEE Conference on Technologies for Sustainability (SusTech), 255–258. https://doi.org/10.1109/SusTech.2014.7046253

[23]   Smith, G., & Hensher, D. A. (2020). Towards a framework for Mobility-as-a-Service policies. Transport Policy, 89, 54–65.

[24]   Stock, T., & Seliger, G. (2016). Opportunities of sustainable manufacturing in Industry 4.0. In Procedia CIRP.

[25]   Taju Rahim, F., & Zainuddin, Y. (2017). Moderating effect of environmental turbulence on firm's technological innovation capabilities (TIC) and business performance in the automotive industry in Malaysia: A conceptual framework. In MATEC Web of Conferences, 90, 1–11.

[26]   Tay, B., Jung, Y., & Park, T. (2014). When Stereotypes Meet Robots: The Double-Edge Sword of Robot Gender and Personality in Human–Robot Interaction. Computers in Human Behavior, 38, 75–84.

[27]   Yong, T., & Park, C. (2017). A qualitative comparative analysis on factors affecting the deployment of electric vehicles. Energy Procedia, 128, 497–503. https://doi.org/10.1016/j.egypro.2017.09.066

[28]   Zhang, M., Qi, Y., Wang, Z., Zhao, X., & Pawar, K. S. (2019). Effects of business and political ties on product innovation performance: Evidence from China and India. Technovation, 80, 30–39.