



ISSN: 2950-8835 © 2022 KODISA & JKR.
JKR website: <http://acomis.kisti.re.kr/jkr>
doi: <http://dx.doi.org/10.13106/jkr.2023.vol2.no1.1>.

The History of the Auto Industry in South Korea based on Double Helix Model

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Received: April 13, 2022. Revised: June 22, 2022. Accepted: June 29, 2022.

Abstract

The South Korean automotive industry has been the major producer for both domestic and international market. This rises of the South Korean automotive industry has resulted in combination various factors ranging from government policies and the foreign investment. The Double Helix model provides a comprehensive and useful framework to understand how these factors have interacted to shape the history of the auto industry of South Korea. This research aims to provide the history of the Auto Industry in Korea based on the Double Helix Model. To collect textual literature dataset, the present author tried to screen and select adequate prior studies in the past and current literature to achieve the purpose of the study. According to the literature analysis, the history of the automotive industry in South Korea is an interesting case in the successful implementation of the Double Helix model. The model emphasizes the collaboration between the government and the private sector in achieving common goals. This research founded the four historical events of the development of the South Korean automotive industry based on the Double Helix Models. In sum, the research concludes that the Double Helix Model is an essential tool for understanding the historical development of the auto industry in South Korea.

Keywords: Auto Industry, Korean Auto History, Double Helix Model, Qualitative Approach

Major classifications: Business History

1. Introduction

The automobile industry is one of the most significant sectors of the global economy while the South Korean automotive industry has emerged as one of the major dominants in the field. The South Korean automotive industry has been the major producer for both domestic and international market. This rises of the South Korean automotive industry has resulted in combination various factors ranging from government policies, the foreign investment and local entrepreneurship. The Double

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Helix model provides a comprehensive and useful framework to understand how these factors have interacted to shape the history of the auto industry of South Korea. The double Helix model is a theoretical framework used to describe the relationship between the government and the private sectors in the automotive industry of South Korea. The model focuses on the idea that the government and the private sector depend on each other and collaborate in achieving the same goals. The model stresses the importance of collaboration, cooperation and communication between the government and the private sector to promote growth and development.

The history of the automotive industry in South Korea can be traced back in the 1950 as the industry was initiated in August 1955 when a Korean businessman-Choi Mu-Seong and his brothers mounted a modified and localized jeep engine on the US military Jeep-model that was made from sheet metal (Green, 1992). The Korean government played a significant role in the development of these industry primarily through the establishment of the Automobile Industry Promotion Policy in 1962 and the Automobile Industry Protection Act to protect the infant industry (Ha, 2022). the government had realized the potential in that industry especially in boosting the country's economy and its capacity to provide job opportunities to many people in the country (Lee & Mah, 2017). Therefore, by initiating the above stated policies, the government supported the industry and encouraged foreign investment.

During the 1960s, the Korean government formulated the Korea Development Bank (KDB) which provided financial support to the automotive industry. The Korea Development Bank provided loans and other financial incentives to the local and foreign companies which had a significant impact to the growth of the industry (Ha, 2022). The government's support led to the development of various companies like the Kyeongseong Precision Industry in 1962, the Dongbang Automobiles and Saenara Automobile which was established through a collaboration with Nissan Motor Co. These companies were assemblers and they collected resources by collecting them from overseas partners. During the 1970s and 1980s, the South Korea's automotive industry continued to grow rapidly. Toyota's interest in maintaining its partnership with Shinjin Automobiles waned in the 1970s (Jacobs, 2021). Shinjin and General Motors created General Motors Korea in 1972 after Toyota's withdrawal, and the company was renamed Saehan Motors in 1976. Kia's Sohari Plant in Gwangmyeong, South Korea, became available to the public that year (Jacobs, 2021). The country's largest car manufacturer, Hyundai, was developed in 1975 and quickly became a major player in the industry.

In the 1990s, the Korean government implemented a series of reforms aimed at liberalizing the economy and promoting competition. These reforms led to increased foreign investment in the automotive industry and helped to further promote growth and development. However, the Asian financial crisis had an impact on the Korean economy and the automotive industry. despite the challenges, South Korea's automotive industry continued to grow and evolve in the 21st century. The industry has become more diversified with the Korean industry producing a wide range of vehicles including passenger cars, commercial vehicles, and electric vehicles. The country has also become a hub for research and development, with significant investment in advanced technologies such as autonomous driving and electric cars.

2. Theoretical Framework

The automobile industry has undergone a paradigm due to rapid technological growth since the mid- 1970s. According to the article by Kim and Mah (2018), Korea used technology licensing and foreign direct investment (FDI) to spur technological advancement. This article examines the evolution of technology acquisition in Korea's automobile industry and the critical role played by both universities and the government in this growth process. Technology acquisition is essential to create a competitive advantage and retain market share in the dynamic competitive global economy. This article, therefore, highlights the importance of collaborations among different actors within an innovative ecosystem. Besides, the paper provides essential insights into the innovation model in Korea and the strategies it employed in the automobile industry to attain and develop effective technology to inform discussions about the Double Helix Model. Furthermore, Ku (2015) elucidates the rapid growth of South Korea's automobile industry from humble technology beginning in the 1960s to developing into a giant actor in the global market.

According to this author, the evolution of this development is attributable to various factors, including the support of industrialization by the government, emphasis on better designs and quality, automation, and the role of chaebols in promoting innovation programs. Dos Santos and Paganotti (2019) also attribute the success of the automobile industry to the support from the government for innovative processes, the collaboration between companies and research institutions, and the presence of skilled labor to spur innovativeness. Although the article is not specific to South Korean innovation, it sheds light on vital insights into the factors critical to successful innovation in the automotive industry. This information can be helpful

in the development of South Korea's innovation model. Therefore, this study article explores and traces the history of South Korea's automobile industry essential in explaining the progress of the country on the Double Helix Model.

The double helix model has contributed significantly to South Korea's success. The secret of this model is the disaggregation of the traditional managerial tasks by splitting them into two parallel lines of accountability. These lines are equally powerful and fundamentally different, but they help managers create value and set priorities for the firm to create the customer experience. This model is like the DNA structure, where despite being fundamentally different, they are intertwined in leading teams. Therefore, this model emphasizes the importance of business leadership in creating value and overall success. The double helix model can be attributed to South Korea's technological advancement and influence on the global automotive industry. The country's leadership support, mainly the increasing focus on electric and autonomous vehicles. For instance, various firms like Hyundai and Kia have developed into global brands due to emphasis on quality, designs, and innovations. The insights from this article are essential in informing areas of improvement in the country's evolution of the automotive industry and reinforcing its position in the global innovation ecosystem.

According to Cho (2014), universities in South Korea have played a critical role in enhancing technological catch-up and creating innovation-based solid growth through the Corporate Helix Model. Universities as research institutions have created requisite human resource capacities and enhanced knowledge transfer mechanisms. Therefore, the Corporate Helix Model creates an essential framework to understand the correlation between the government, research institutions, and industry in stimulating innovation and economic growth (Saranga et al., 2019). The article's emphasis on the importance of universities in fostering innovation adds to the growing literature on the role of higher education institutions in driving economic development.

The previous study (Al-Shamsi, 2022) demonstrates how the Korean auto industry's innovations and imitation trends over decades have resulted in its current position among global technology leaders. Besides, the author elucidates the importance and the role of technological innovation and catch-up in Korea's successful economic development. The country's flexibility and innovative power have transformed the country from an agrarian to an industrial economy. Further, the article describes Korea's transition process, which began by assembling foreign cars to a world-class auto industry producing outstanding indigenous models. The study also emphasizes the importance of government through incentives and policies on the acquisition of technological know-how and capability development. Thus, South Korea government has played a critical role in the auto industry's growth to global standards.

The article "Impact of supply chain on the competitiveness of the automotive industry," by Rotjanakorn et al. (2020) examines the impacts of the supply chain on the company's competitiveness. Apart from creativity and innovativeness, without an effective supply chain, there would be no meaningful economic growth. The study explains how the Brazilian automotive industry leveraged its supply chain with innovation to create a competitive advantage. The insight from this study is vital to the reaction of more value to the South Korean value chain. Therefore, supply chain management is vital in creating a competitive edge in the rapidly growing industry. Besides, the Supply chain promotes customers' experiences by meeting their demands and enhances efficient production and delivery of goods and services to intended destinations. South Korea and other automotive industries can apply the study to develop vital collaborations and coordination with supply chain partners to improve their value and profit margins (Rotjanakorn et al., 2020). Furthermore, the study suggests that automotive industry firms have overhauled their supply chain management approach to create and maintain competitiveness.

Rotjanakorn et al. (2019) further explore the effects of the supply chain by analyzing the Brazilian and Japanese automotive industries to assess the competitiveness of their value chain. The study indicates that companies with effective management of their supply chains are likely to compete better in the global marketplaces. The insights from this study are essential to South Korea because it has emerged as a global giant in the automotive industry. Besides, the double helix model would promote efficiency through coordinated leadership to synchronize all the company's operations to maximize the innovative opportunities in the supply chain (Sakuramoto et al., 2019).

Wiktorsson et al. (2018) examine the aspect of intelligent factories by focusing on the automotive industry in South Korea and Sweden. The study demonstrates how intelligent technologies like Artificial Intelligence (AI) and the Internet of Things (IoT) can improve the company's operations by increasing quality control, effectiveness, and efficiency. Furthermore, the authors reinforce the importance of collaboration between different actors like the government, academia, and industry in promoting innovative capacities and exchanging knowledge. The findings of this study further suggest that the application of smart factories is fundamental to enhancing the competitiveness and quality of the automotive industry in the two countries; hence the technique can be utilized in other countries to improve productivity.

However, despite the rapid growth of the South Korean automotive industry, it has faced many challenges due to dynamics in global trends, including the shift towards electric and autonomous vehicles and stiff competition from emerging markets. The flexibility of the industry would determine its survival. Thus, the study emphasizes the essence of industries adapting to

rapid and diverse changes by investing in extensive research to promote innovation. Additionally, the authors explore the importance of trade unions in enhancing fair labor practices and workers' well-being. This study adds to the literature on the South Korean auto industry by applying a trade union view on the industry's transition.

Apart from the double helix model, South Korea has developed the Triple helix innovation system to increase inter-regional collaboration in technology. The study by Yoon and Park (2016) examines the triple helix impacts on South Korea's innovation system by analysis of network and inter-regional technological collaborations. The study demonstrates the importance of the triple helix model framework in the elaboration of the innovation system in South Korea. Like in the double helix model, healthy collaborations between industry, government, and academia are essential in establishing and sustaining inter-regional collaborations (Leydesdorff, 2021). Thus, the study emphasizes the importance of the government in developing and coordinating inter-regional collaborations while academia and industry enhance the development of advanced technologies and knowledge. Generally, this study provides vital information on the dynamics of the South Korea industry's innovation system and how the triple helix model enhances understanding.

The auto industry's history has a lot to do with the double helix model, which links different levels of leadership and frameworks to collaborate toward achieving intended goals. The coordination of different actors creates a conducive environment for innovative technologies and the creation of value chains. Therefore, the government should collaborate with academia and industry to create competitiveness, like in South Korea and Brazil.

Table 1: Summary of Prior Literature

Key Description	Supporting Resources
The Double Helix model provides a comprehensive and useful framework to understand how these factors have interacted to shape the history of the auto industry of South Korea. This research aims to provide the history of the Auto Industry in Korea based on the Double Helix Model.	Green (1992). Lee and Mah (2017, Ha (2022), Jacobs (2021), Kim and Mah (2018), Ku (2015), Dos Santos and Paganotti (2019), Cho (2014), Saranga et al. (2019), Al-Shamsi (2022), Rotjanakorn et al. (2020), Rotjanakorn et al. (2020), Rotjanakorn et al. (2019), Sakuramoto et al. (2019), Wiktorsson et al. (2018), Yoon and Park (2016), Leydesdorff (2021)

3. Research Findings

The history of the automotive industry in South Korea is an interesting case in the successful implementation of the Double Helix model. The model emphasizes the collaboration between the government and the private sector in achieving common goals. This section is a report of the four historical events of the development of the South Korean automotive industry based on the Double Helix Models.

3.1. The Embryonic Stage of the Korean Automotive Industry

The Under Japanese colonial control, Korea began manufacturing simple vehicle parts in the late 1950s. Korea learned car body manufacturing, molding, automotive component processing, and automotive maintenance. Since its liberation from Japan, Korea's expertise, technologies, and automotive employees have formed the early Korean automotive industry (Cho et al., 2014). Due to the operation in Korea, the U.S. military sold more automobiles while distributing late Japanese imperial oil reserves. Automotive components, gasoline, and U.S. military contraband items were readily accessible (Jacobs, 2021). Remodeling used cars boomed. Businesses included converting carbide automobiles or wood fuel vehicles into gasoline cars or rebuilding worn-out Japanese military vehicles by replacing their engines, transmissions, and axles with those from U.S. military vehicles.

The Korean automotive business is distinguished by its pre-liberation background in auto restoration and auto parts. The Korean War-era car restoration industry was crucial to developing automotive industry human resources and building an auto parts industry (Jacobs, 2021). Most countries that started in the auto sector had no experience creating car parts or assembling automobiles, therefore they allowed international automotive corporations from more industrialized countries to undertake knockdown manufacturing there.

In October 1955, Sibal Automotive Enterprises built a 4-cylinder engine and jeeps using it. Sebal, the first Korean-made car used native engines and car bodywork. The engine was based on the U.S military jeeps and utilized sibal enterprise-made cylinder blocks, heads, and crankshafts. The Sibal automobile body was hand-made due to a lack of press equipment. Since

steel plates were not produced or exported, Sibal Automotive Enterprises cut and unfolded steel drum cans to make car plates. The business manufactured 7 Sibal vehicles in 1955, 81 in 1956, and 459 in 1957 (Cho et al., 2014). However, the company's excessive investment and the rise of Saenara Motor Company, which assembled a knockdown version of Nissan's Bluebird, caused its bankruptcy in 1964.

3.2. Development of Knockdown (KD) Assembly in Korea

The Saenara Motor Company pioneered contemporary vehicle production with knockdown (KD) assembly and production. Since then, Korea has implemented extensive automotive industry promotion strategies and policies. Many consider this the beginning of the Korean car industry. KD assembly and manufacturing began in 1962, but the economic and materials crisis and the Saenara Motor Company's bankruptcy slowed production until 1966.

The Korean automotive industry introduced modernized vehicle assembly lines which was a departure from manual labor-based production. Additionally, in 1962 the Korean government developed the 'Automotive Industry 5-year plan which aimed to prevent the development of many automotive assembly plans. The plan also intended to develop a one diesel engine production plant with a capacity to produce about 3000 units of cars (Cho et al., 2014). The objective was to introduce KD parts for vehicle assembly from modern overseas firms, which provided foreign funding, and progressively create local sources to produce all automobile parts domestically within five years. The Korean government passed the 5-year-old Automotive Industry Protection Act to help push this agenda forward. This law restricted the number of car assembly plants that might legally open, safeguarded legitimate manufacturers from unfair competition, and forbade the import of completed vehicles.

The Saenara Motor Company Plant was built in October 1962 with help from the Korean government. Saenara Motor Corporation and Nissan have entered into technology collaboration and lending agreements. Despite facing many challenges, Saenara Motor Company accomplished a significant deal of significance by pioneering the modernized production system. The successes of Saenara Motor Company have been invaluable to Korea's increasingly sophisticated vehicle assembly and production processes. Technicians then drew out machine layouts, requirements for automotive tools, and tables detailing the machining process and machine selection.

In December of 1963, the Korean Ministry of Trade and Industry issued the Automotive Industry Integration Measure. By merging Saenara Motor Company, Sibal car Enterprise, eight temporary assembly facilities, and Asia Motor into Korea Machinery Enterprises Inc., the government hoped to boost domestic production of car parts (Dent, 2015). However, issues in revoking previously permitted assembly companies and incorporating them into the new system led to the measure's abandonment in October 1964. Hyundai Motor, Shinjin Automotive Corporation, and Asia Motor were the three automotive firms that emerged from the Korean automobile industry's reorganization. Asia Motor signed an agreement with the French firm SERI to import \$ 12.5 million in capital equipment and adopt cutting-edge technologies. The company bought 100 square kilometers of land and immediately started building car factories with an annual output of 8,000 vehicles. In 1968, Hyundai Motor and Ford formed a technology collaboration and assembly arrangement, and by November of that year, Hyundai Motor had created the 'Cortina' (Jacobs, 2021). The Korean auto industry benefited from the entry of foreign innovations, including assembly line expertise, automobile-related innovations, and qualified employees. Furthermore, the framework of competition among the main three firms facilitated constructive competition, which led to the sustained growth of the Korean automobile sector (Yoon & Park, 2020).

3.3. Development of a Fully Korean-made Vehicle

In 1974, the Korean government passed the Long-term Automotive Promotion Plan which was intended to develop a fully Korean-made car model so that the nation would improve the domestic production of automotive parts and boost the Korean Automotive Industry which had stagnated at the KD assembly into an export manufacturer faster. The Korean auto industry moved quickly to implement plans for large-scale manufacturing of a car designed and built entirely in the country. In 1975, Hyundai Motor unveiled the 'Pony,' the first Korean-developed vehicle, and finished building an extensive automobile plant capable of producing 50,000 vehicles annually (Cho et al., 2014). As a result, Korea's auto industry constructed the world's first batch production factory using homegrown technology. The 'Pony' model, which was designed in Korea, had exports of around 1,800 units in less than three years after its debut (Ku, 2015). This marked a pivotal moment in the transition away from a knockdown assembly-based model and toward exports for the Korean car industry (Jacobs, 2021). The success of Pony was hastened by the rising demand for automobiles in South Korea, which was fueled in part by the country's robust double-digit economic growth at the time. Two years after constructing the Yangsan Automobile Plant, Hyundai Motor

upgraded the auto facilities in 1977 and 1979 to create a system capable of producing 100,000 vehicles annually (Cho et al., 2014). The company's mass manufacturing ambitions were met in 1978, when it shipped out 18,317 units to 42 nations all over the world, including Europe.

3.4 Realization of Export-oriented Korean Automotive Industry

Encouraged by the improved production and export performance of the Korean Automotive Industry, the Korean government announced a production plan intended to produce 1 million units of cars by 1981 and 2 million units by 1986 (Cho et al., 2014). The government also halted production of preexisting mid- and full-size cars imported from abroad in 1982 and banned the import of locally accessible automotive parts. To keep carmakers and suppliers from going under, the Korean government has unveiled new regulations for the automotive sector (Shvetsova et al., 2021). The government took this action because there were too many automakers competing in the domestic market, and only a few were making good use of their available production capacity. Additionally, the international competitiveness of the Korean automotive industry was weak because annual production volumes fell short of 300,000 (Cho et al., 2014). To deal with these issues, the government created a regulation that mandated businesses to specialize in the manufacture of only one type of car.

In 1986, Hyundai Motors exported the Pony Excel to the United States, marking the beginning of the company's expansion into the North American market. Hyundai's intensive R&D paid off in the end, despite technical difficulties and delays in reaching the U.S (Jacobs, 2021). federal safety and emission criteria first. In its initial year on sale in the United States, the Pony Excel was the third best-selling vehicle, only behind the Nissan Sentra and the Honda Civic. The X Car Project and other innovations were developed specifically for the North American market in response to Hyundai's success in the United States. The success of Hyundai allowed other Korean automakers like Kia and Daewoo to break into the North American market. Globally, the full-scale entrance of the North American market by the Korean Automotive Industry was a watershed moment that threatened the hegemony of long-established Japanese and American automakers.

Automobile manufacturers in South Korea have been among the most innovative in their use of "smart factory" technologies in recent years. To maximize output and cut down on waste, "smart factories" implement systems like the Internet of Things (IoT), artificial intelligence (AI), and big data analytics (Shvetsova, 2019). Keeping up with the competition in the global car market has required companies like Hyundai and Kia to spend extensively in smart manufacturing technology.

Table 2: Research Finding

Key Content	Supporting Evidence
1. The Embryonic Stage of the Korean Automotive Industry	Sibal Automotive Enterprises cut and unfolded steel drum cans to make car plates. The business manufactured 7 Sibal vehicles in 1955, 81 in 1956, and 459 in 1957. However, the company's excessive investment and the rise of Saenara Motor Company, which assembled a knockdown version of Nissan's Bluebird, caused its bankruptcy in 1964.
2. Development of Knockdown (KD) Assembly in Korea	The Korean auto industry benefited from the entry of foreign innovations, including assembly line expertise, automobile-related innovations, and qualified employees. Furthermore, the framework of competition among the main three firms facilitated constructive competition, which led to the sustained growth of the Korean automobile sector.
3. Development of a Fully Korean-made Vehicle	Two years after constructing the Yangsan Automobile Plant, Hyundai Motor upgraded the auto facilities in 1977 and 1979 to create a system capable of producing 100,000 vehicles annually. The company's mass manufacturing ambitions were met in 1978, when it shipped out 18,317 units to 42 nations all over the world, including Europe.
4. Realization of Export-oriented Korean Automotive Industry	In 1986, Hyundai Motors exported the Pony Excel to the United States, marking the beginning of the company's expansion into the North American market. Hyundai's intensive R&D paid off in the end, despite technical difficulties and delays in reaching the U.S.

4. Implications and Conclusions

Insights about the power of public-private partnerships for growth and development can be gleaned from the case study of South Korea's auto sector, which is built on the Double Helix Model. Together, the public and private sectors collaborated to progress technology and the economy, as evidenced by the four historical events covered in the Results section. These results have substantial ramifications for car firms considering implementing similar tactics. To begin, the significance of early-stage government backing is demonstrated by the Korean automotive industry's embryonic stage. When the Korea Development Bank (KDB) was founded in 1954, it injected much-needed capital into the economy, helping both domestic and foreign businesses compete successfully on the international stage. This is useful for the auto industry since it encourages corporations to lobby for government money and incentives for R&D and factory construction.

Secondly, the development of the Knockdown (KD) Assembly in Korea shows how technology transfer can be facilitated through public-private partnerships. The KD Assembly process enabled Korean companies to learn from established players in the global market and to develop new technologies that could be used in their own operations. Auto companies can benefit from this by seeking out partnerships with established players within the industry and by focusing on technology transfer as a key strategy for growth and development. From the other finding, the development of the Fully Korean-Made vehicle highlights the importance of innovation and research, and development. Companies like Hyundai and Kia invested heavily in research and development, which enabled them to acquire and develop new technologies and compete with established players in the international market. Automotive companies have an advantage from this approach by investing in research and development and by focusing on innovation as a key strategy for growth and development. Lastly, the realization of the export-oriented Korean Automotive industry demonstrates how the public-private sector can promote growth and development in the international market. The government implemented a series of reforms that were aimed at liberalizing, equalizing the economy, and promoting competition which led to increased foreign investment in the automotive industry. Auto companies can benefit from these initiatives by seeking partnerships with foreign companies and by focusing on exporting their products to international markets as a key strategy for development.

Generally, the study's findings show that automotive industries would do well to incorporate private-public partnerships into strategic planning. The success of the Korean success of Korean automotive can be replicated by other automakers who seek government. Suppliers and distributors are examples of additional industry stakeholders that can help a company succeed by working together toward shared goals. Automakers may better position themselves to succeed in the global market and achieve long-term, sustainable growth, and development by working together. Additionally, the study's findings show the negative consequences of implementing the Double Helix Model. For instance, a collaboration between industry and academia can be difficult to achieve different priorities and objectives. Conversely, a collaboration between the companies and their supply chains and research institutions can be challenging as companies may be reluctant to share information or resources with competitors. Addressing such issues will lead to critical success in the implementation of the Double Helix Model in the auto industry and other industries.

To conclude, the Double Helix Model is an essential tool for understanding the historical development of the auto industry in South Korea. By determining the interactions and interdependence between the industry and its environment, there are for significant events that have been structured to the industry's trajectory. During the early stages of Korea's automotive industry, the government played a significant role in laying the groundwork for and encouraging the entry of foreign automakers into the Korean market. This initial stage established the necessary conditions for future growth and development in the industry. Increased localization of automotive production and the growth of a domestic supplier base was made possible by the advent of knockdown assembly in Korea. It was at this point that the industry began to transition from relying on the import of finished vehicles to becoming a major center of automotive production. For Korea's car industry, the creation of a car with no imported parts was a watershed moment. This success demonstrated the industry's ability to build up its own technological resources and become technologically independent in the manufacturing of automobiles. The realization of the export-related Korean automotive industry enabled the industry to become a major player in the global automotive industry by focusing on the quality and efficiency of the global market, which helped to further strengthen the industry and support its continued growth and development.

Ultimately, the history of the Korean automotive industry based on the Double Helix Model highlights the importance of government support, innovation, and collaboration between different actors who shaped the industry's growth. Through the industry's growth and development, it has become a significant contributor to the Korean economy and a major player in the international automotive market.

References

- Al-Shamsi, M. A. (2022). Review of Korean imitation and innovation in the last 60 years. *Sustainability*, 14(6), 3396.
- Cho, C., Kim, K., & Kim, M. (2014). Korea's automotive industry. *Knowledge Sharing Program: KSP Modularization*.
- Cho, M. H. (2014). Technological catch-up and the role of universities: South Korea's innovation-based growth explained through the Corporate Helix model. *Triple Helix*, 1(1), 1-20.
- Dent, C. M. (2015). South Korea's green growth strategy and East Asia's new developmentalism (pp. 45-64). *Oxford: Oxford University Press*.
- Dos Santos, I. C., & Paganotti, J. A. (2019). The innovative process in the automotive industry: An analysis of the great abc region automotive cluster. *Gestão & Regionalidade*, 35(105), 200-217.
- Green, A. E. (1992). South Korea's automobile industry: Development and prospects. *Asian Survey*, 32(5), 411-428.
- Ha, S. (2022). A study on the revitalization of the automobile tuning components industry. *Transaction of the Korean Society of Automotive Engineers*, 30(8), 609-617.
- Ha, Y. (2022). A study on factors affecting FDI in Korea-US automotive industry. *Korea Association for International Commerce and Information*, 24(1), 77-94.
- Jacobs, A. J. (2021). Hyundai Motor Part I: From Construction to Cars, Beginnings to 1987. In *The Korean Automotive Industry, Volume 1: Beginnings to 1996* (pp. 239-269). Cham: Springer International Publishing.
- Jacobs, A. J. (2021). Kia Motors, from Bikes to Cars: Beginnings to 1996. In *The Korean Automotive Industry, Volume 1: Beginnings to 1996* (pp. 201-237). Cham: Springer International Publishing.
- Jacobs, A. J., & Jacobs, A. J. (2022). Park's Engineering of a South Korean Auto Industry: Beginnings to 1979. *The Korean Automotive Industry, Volume 1: Beginnings to 1996*, 59-96.
- Jacobs, A. J. (2021). The Korean Auto Industry, 1962–1996: Summary, Conclusion, and Prelude to Volume 2. In *The Korean Automotive Industry, Volume 1: Beginnings to 1996* (pp. 369-408). Cham: Springer International Publishing.
- Jacobs, A. J., & Jacobs, A. J. (2022). The Korean Auto Industry's Post-Park Emergence Between Crises: 1980–1996. *The Korean Automotive Industry, Volume 1: Beginnings to 1996*, 97-143.
- Kim, G. H., & Mah, J. S. (2018). Technology acquisition in Korea's automobile industry. *Perspectives on Global Development and Technology*, 17(4), 408-428.
- Ku, S. (2015). The rise of South Korean (or Korean) automobile industry. *The Global Automotive Industry*, 95-108.
- Lee, J. I., & Mah, J. S. (2017). The role of the government in the development of the automobile industry in Korea. *Progress in Development Studies*, 17(3), 229-244.
- Leydesdorff, L. (2021). Evolutionary and institutional triple helix models. *Qualitative and Quantitative Analysis of Scientific and Scholarly Communication*, 89-113.
- Rotjanakorn, A., Sadangharn, P., & Na-Nan, K. (2020). Development of dynamic capabilities for automotive industry performance under disruptive innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(4), 97.
- Sakuramoto, C., Di Serio, L. C., & Bittar, A. D. (2019). Impact of supply chain on the competitiveness of the automotive industry. *RAUSP Management Journal*, 54(2), 205-225.
- Saranga, H., Schotter, A. P., & Mudambi, R. (2019). The double helix effect: Catch-up and local-foreign Co-evolution in the Indian and Chinese automotive industries. *International Business Review*, 28(5), 101495.
- Shvetsova, O. A. (2019). Technology learning in automobile industry: Comparative study between Thai and Korean companies. *The Open Transportation Journal*, 13(1), 236-249.
- Shvetsova, O. A., Tanubamrungsuk, P., & Lee, S. (2021). Organization leadership in the automobile industry: Knowledge management and intellectual capital. *The Open Transportation Journal*, 15(1), 16-30.
- Wiktorsson, M., Noh, S. D., Bellgran, M., & Hanson, L. (2018). Smart factories: South Korean and Swedish examples on manufacturing settings. *Procedia Manufacturing*, 25, 471-478.
- Yoon, J., & Park, H. W. (2016). Triple helix dynamics of South Korea's innovation system: A network analysis of inter-regional technological collaborations. *Quality & Quantity*, 51(3), 989-1007.
- Yoon, J., & Park, H. W. (2020). Pattern and trend of scientific knowledge production in North Korea by a semantic network analysis of papers in journal titled technological innovation. *Scientometrics*, 124(2), 1421-1438.