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DRIVING THE FUTURE TOGETHER: A COMPARATIVE STUDY OF PAKISTAN-USA AUTOMOTIVE POLICIES, TRADE, ARTIFICIAL INTELLIGENCE, AND HUMAN CAPITAL DEVELOPMENT

Muhammad Tahir Saleem

MBA, University of Central Punjab, Lahore, Pakistan

tahrsaleem007@gmail.com

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Muhammad Tahir Saleem

Abstract

The automobile sector is critical globally due to its economic impact and position as a driver of industrial progress. In recent years, digital transformation, artificial intelligence, sustainable manufacturing, and the growing adoption of electric vehicles have significantly influenced the global automotive industry. This industry not only creates millions of direct and indirect jobs worldwide but also propels technological advancement and innovation. Automotive firms and their supply chain provide major contributions to many countries' GDPs, supporting investment and international trade. As a result, cooperation between developed and emerging economies has become increasingly important. According to certain industry estimates, the automotive industry is a critical component of the US economy, accounting for 4.8% of GDP and employing 10.1 million people in direct and indirect occupations. The industry has changed in the twenty-first century, thanks in part to new market entrants, more technologically advanced automobiles, advances in vehicle powertrain development, shifts in the labor force, and rising vehicle costs (Souweidane, 2026). Similarly, the automobile business is one of Pakistan's most important industries. The automotive industry is one of the most important private businesses in Pakistan. Pakistan is gradually expanding its automotive sector through industrial growth, a young, skilled workforce, competitive production costs, and government initiatives supporting industrial modernization.

This research deeply examines the potential for Pakistan-U.S. cooperation in the automobile sector, moving beyond the usual focus on trade volumes and tariffs. It also examines how closer cooperation between the two countries could boost industrial competitiveness, strengthen economic ties, and spur innovation in the automotive sector. This study focuses on the analysis, which we can expand to include areas that are driving the industry's future, such as import & export, regulatory alignment, human capital readiness, artificial intelligence integration, supply chain, research initiatives, and the transition to sustainable mobility solutions.

The data show that a long-term partnership between Pakistan & the USA could yield mutual economic and technological benefits. However, to achieve these findings, government policies and automotive industry partnerships in all aspects

should be stronger, and continuous investment in research & development and workforce training is necessary.

INTRODUCTION

The automotive industry is widely recognized as one of the most important sectors of the global economy. Beyond manufacturing vehicles, it contributes significantly to international trade, employment, technological advancement, industrial productivity, and economic growth. Over the past two decades, rapid developments in artificial intelligence, digital transformation, sustainable manufacturing, and electric vehicle technologies have reshaped the industry's direction (Munir, 2024). These developments have also increased the importance of collaboration between developed and developing economies, creating new opportunities for technology transfer, industrial investment, research partnerships, and workforce development (Porter, 1990; Sturgeon & Biesebroeck, 2011; World Bank, 2024)

United States has long been recognized as a global leader in automotive innovation, thanks to cutting-edge manufacturing technologies, strong regulatory frameworks, ongoing R&D investments, and a highly qualified workforce (Organisation for Economic Co-operation and Development, 2023) While Pakistan's automotive sector is still in its early stages, it has been steadily growing thanks to regulations that encourage industrial development and foreign investment, the expansion of local assembly activities, and the rise of the auto-parts business, and the execution of measures to encourage the growth of the industrial sector and the influx of capital from outside sources (Engineering Development Board, 2021). However, the industry is still unable to realize its full potential due to issues with infrastructure, staff development, regulatory consistency, and IT adoption. (Organization for Economic Co-operation and Development, 2023) Although Pakistan and the United States are at different stages of industrial development, they possess complementary strengths that create opportunities for mutually beneficial cooperation. Pakistan offers new young talent, skilled human capital, competitive manufacturing costs, and most importantly, a geographic location. USA, meanwhile, has maintained mastery in advanced manufacturing, quality assurance, innovation, and global supply chain management. This important collaboration between these two nations could grow and promote automotive trade. Greater cooperation between the two countries could promote automotive trade, strengthen human resource development, and spur industrial investment and knowledge sharing (Munir, 2025). This research identifies Pakistan's opportunities, offering useful insights for American companies interested in cost-efficient production and expansion into growing markets. By comparing automotive regulations, manufacturing capabilities, trade potential, artificial intelligence, and workforce development, it explores possibilities for cooperation between Pakistan and the USA. For Pakistan, the question is how Pakistan can benefit from US experience in automotive, research & development, and digital manufacturing.

The findings suggest that such collaboration has the capacity to power economic ties, improve industrial competitiveness, and support the development of the global automotive industry. There is a possibility that such long-term cooperation between Pakistan and the USA extends beyond imports and exports to include innovation, research partnerships, and sustainable industrial policies (Organization. Pakistan is struggling to transition to electric vehicles (EVs), whereas the United States aims for EVs to convert 50% of its vehicle sales by 2030. Pakistan can learn valuable lessons from the USA through this automotive trade.

2. Literature Review

The current findings examine the role of automation, workforce development, artificial intelligence, and environmental sustainability, whereas previous studies emphasized supply chain

management and production efficiency. (Van Biesebroeck, 2011) argued that maintaining international collaboration, technological advancement, and long-term competitiveness requires a highly integrated global production network. Over the past two decades, the automotive industry has been significantly influenced. Likewise, Porter (1990) maintained that pro-industrial policies, innovation, and a skilled workforce are as essential to a nation's competitive advantage as its natural resources. Organization for Economic Co-operation and Development, 2023). Artificial intelligence has emerged as one of the most important technologies shaping the future of automotive manufacturing. Artificial intelligence applications such as predictive maintenance, robotic automation, computer vision, digital twins, and machine learning have significantly improved production efficiency, product quality, and operational decision-making. According to (Kampoowale, 2026), AI technologies are now required for manufacturing, shipping, quality control, and customer support, in addition to autonomous driving. In a similar vein, Koricanac (2021) claimed that the use of AI enables manufacturers to reduce operating costs, enhance manufacturing precision, and boost overall industrial efficiency. To stay competitive in the global market, automakers have been compelled by these technological developments to make significant investments in digital transformation strategies. (World Economic Forum, 2025)

The creation of human capital has also been a significant problem in automotive research. Instead of relying on outdated, labor-intensive production methods, modern manufacturing increasingly depends on highly skilled engineers, technicians, software developers, and AI professionals. Two of the most important factors influencing industrial competitiveness in the Fourth Industrial Revolution are continuous labor reskilling and digital literacy, according to the . In support of this viewpoint, noted that by incorporating digital technology into workforce planning and learning systems, digitalization in human resource management improves employee engagement, talent development, and organizational performance. Strategic HR policies greatly enhance organizational adaptation in quickly evolving technological contexts, as their comparative study between Pakistan and the US shows. (Organization for Economic Co-operation and Development, 2023; Saleem et al., 2023; World Economic Forum, 2025)

Recent research strengthens the link between business leadership and AI adoption. Although artificial intelligence improves operational efficiency, company culture, leadership commitment, and employee acceptance are critical for its successful application. According to (Saleem et al. 2026), proactive human resource leadership, regular staff training, and open company communication can help lessen opposition to AI adoption. According to their findings, to maximize organizational performance, technology transformation should be combined with effective change management techniques. Similar findings were reported by (Brynjolfsson & McAfee 2014), who contend that investments in organizational capabilities and human capital are necessary for digital technologies to offer sustained competitive advantages.

Studies comparing developed and emerging economies show that industry cooperation and knowledge sharing can support manufacturing growth. By continuously investing in R&D, fostering connections between academia and industry, and enacting favorable industrial policies, the United States has retained its position as the world leader in automotive innovation. Pakistan, on the other hand, has made it a priority to expand its domestic assembly operations, draw in foreign investment, and develop its auto parts manufacturing industry. According to the Engineering Development Board (2021), while localization strategies have helped boost domestic manufacturing capacity, challenges related to research findings, quality standards, and technological expertise still remain. Moreover, Barwick et al. (2025) dispute that the government plays a significant role in the growth of industries, specifically in the technological transition towards electric and intelligent mobility. Instead of relying solely on the trade in finished vehicles, researchers increasingly emphasize collaboration across

manufacturing, research, digital technologies, human capital, and supply chains. Global trade continuously underlines the importance of partnership between developed and developing nations.

According to (Buckberg, 2026), if nations need to sustain efficiency in the automotive sector, they require flexible global supply chains, dynamic innovation ecosystems, and sustained cross-border industrial collaboration. Pakistan and the United States possess complementary strengths that can be leveraged through long-term industrial cooperation, and these findings support this view. (Organization for Economic Co-operation and Development, 2023)

Adoption of Artificial intelligence, human resource digitalization, innovation in the automotive industry, and industrial policy areas of research have been examined in previous analyses. However, the partnership between Pakistan and the United States has been given limited attention in bringing these together. To bridge this gap, the automotive industries of Pakistan and the United States are compared by examining regulatory frameworks, broader opportunities, and manufacturing capabilities to inform bilateral cooperation. Drawing on current scholarly literature and comparative policy research, the study provides practical references to support stronger collaboration between the two nations' automotive industries (Organization for Economic Co-operation and Development, 2023; Porter, 1990; Saleem et al., 2026).

3. Research Gap

Well, in the United States, they largely emphasize innovation in technology, Electric Vehicles, and advanced manufacturing practices. From multiple perspectives, previous studies have examined most of these themes, concentrating on specific areas such as manufacturing efficiency, artificial intelligence, human resource management, industry policies, and global trade. On the other hand, Pakistan's automotive sector has primarily focused on domestic production challenges, regulatory reforms, and market development. Even though these studies provide useful insights, they generally address these issues independently (Koricanac, 2021; Van Biesebroeck, 2011; Wan et al., 2020)

The growing influence of Artificial intelligence and digital transformation on human capital and organizational performance has also been explored in recent studies. (Khan et al., 2024; Organization for Economic Co-operation and Development, 2023; Saleem et al., 2026). How these factors relate to automotive collaboration between Pakistan and the United States. There are a few studies that provide a comparative assessment of the two countries by examining regulatory frameworks, manufacturing capabilities, two-way trade, and workforce development within a single analytical framework.

This current study highlights the opportunities for Pakistan and the United States to share knowledge, transfer technology, engage in cross-border investment, and strengthen industrial cooperation. The findings offer practical policy recommendations for governments, industry stakeholders, and researchers seeking to reinforce long-term collaboration between Pakistan and the United States in the automotive sector. (Khan et al., 2024; Organization for Economic Co-operation and Development, 2023; Porter, 1990; Saleem et al., 2026)

4. Comparative analysis of the automotive industry: Pakistan and the United States

4.1 Automotive manufacturing and Industrial Capacity

Pakistan and the United States both have active automobile industries; they have different industrial development, manufacturing efficiency, and technology. The automotive sector is always important to a country's economy, serving as a key indicator of its industrial capacity, technological advancement, and economic resilience. The United States has consistently invested in R&D, automation, innovation, and skilled human resources to create one of the most sophisticated automotive manufacturing ecosystems in the world. Top manufacturers such as General Motors, Ford, and Tesla have adopted robotics, AI-driven production systems, and smart manufacturing technologies to boost productivity, reduce manufacturing costs, and enhance product quality

(Organisation for Economic Co-operation and Development, 2023; Van Biesebroeck, 2011; Wan et al., 2020)Thanks to technical advancements, the automobile industry in the United States has been able to adapt to rapidly changing consumer needs and environmental standards while maintaining global competition.

In contrast, local car assembly, the growth of the auto-parts industry, and government policies encouraging both localization and international investment have all contributed to the slow growth of Pakistan's automotive sector over the past 20 years (Engineering Development Board, 2021). International manufacturers' engagement has increased consumer choice and market rivalry. However, the industry's ability to compete in the global automotive manufacturing market is constrained by its continuous reliance on imported machinery, high-value components, and technologies. Long-term industrial growth, however, is limited by factors such as unequal industrial policy, insufficient R&D spending, inadequate technology infrastructure, and a shortage of highly skilled technical people (Asian Development Bank (ADB), 2023; World Bank, 2024a)

Despite these disadvantages, Pakistan has some strategic advantages that can support future economic growth. The country boasts a youthful, developing labor force, competitive labor costs, and an expanding network of small and medium-sized enterprises (SMEs) that manufacture auto parts. These advantages make Pakistan an attractive manufacturing partner for international automakers seeking access to regional markets and low-cost production. According to workforce digitalization study (Saleem et al., 2026) improving employee skills, technical education, and AI readiness can significantly increase industrial efficiency and organizational performance. (World Bank, 2024)

Comparatively speaking, the US offers valuable insights on creative management, advanced manufacturing, quality control, and industry-academia collaboration. Pakistan, on the other hand, offers opportunities for regional connectivity, access to labor, and cost-effective manufacturing. Both nations should leverage their complementary capabilities through technology transfer, joint ventures, industrial investment, and coordinated research projects rather than viewing these differences as competitive disadvantages. In addition to strengthening bilateral economic relations, these partnerships will contribute to developing a more robust and internationally competitive automotive value chain.

4.2 Automotive trade and investment opportunities

The global automobile industry continues to expand mostly through trade and investment. Pakistan is gradually expanding its vehicle manufacturing base through localization legislation and greater foreign investment, despite the fact that the United States is one of the world's largest automakers and exporters. The two countries maintain bilateral commercial connections; however, there is still little automotive collaboration between them. This presents an opportunity to form stronger alliances that extend beyond traditional import and export operations to encompass joint ventures, technology transfer, and industrial collaboration (Barwick et al., 2025; World Bank, 2024a; World Trade Organization, 2023)

Wiring harnesses, batteries, tires, filters, seats, and some engineering components can all be produced by Pakistan's booming auto-parts industry. These products might become more competitive in international markets, including the US, with increased investment in quality control, international certifications, and new manufacturing technology. However, achieving this objective will require continuous investment in research and product development in addition to adherence to globally recognized quality, environmental, and safety standards (Engineering Development Board, 2021)

Pakistan's competitive labor rates, growing industrial workforce, and strategic location at the crossroads of South Asia, Central Asia, and the Middle East can all benefit the United States. These advantages make Pakistan an attractive location for some vehicle manufacturing activities, component production, and regional supply chain management. According to previous research,

multinational firms are gradually diversifying their supply chains by partnering with emerging countries that offer long-term production potential and cost-effectiveness (Buckberg, 2026; Van Biesebroeck, 2011)

Future cooperation should focus on workforce development, AI-powered production systems, engineering education, and technology exchange in addition to manufacturing. Higher levels of innovation and long-term competitiveness are produced by companies that combine digital technologies with strategic human resource strategies, according to a new study. Pakistan and the United States should think beyond imports and exports; they should emphasize knowledge sharing, industrial research, and investment opportunities, create good bilateral trade relations, and sustainable economic opportunities for both countries.

4.3 Artificial intelligence and smart manufacturing

Artificial intelligence (AI) is revolutionizing the global automotive industry transforming vehicles from mechanical to smart AI software. Automotive manufacturers are increasingly adopting AI-enabled technologies, because AI is brain behind modern safety systems, all these advanced driver assistance systems (ADAS) is because of artificial intelligence, including smart manufacturing, personal in cabined experienced, to increase production efficiency. (Kampoowale, 2026), noted that AI is no longer limited to autonomous driving but creating vehicle design throughout the automotive value chain, manufacturing to quality assurance and after-sales services. Similarly, (Koricanac, 2021) argued that AI enables manufactures levels of quality levels of smart technology and operational efficiency. (Khan et al., 2024; Saleem et al., 2026)

Artificial intelligence in all aspects especially in automotive industry the United States has established itself as a global leader. Through sustained investment in research and development (R&D) in automotive manufacturing, technological innovation in Tesla, Ford & General Motors world already seen it. Major manufactures, including Tesla, Ford, and General Motors , have use AI in their production planning, smart manufacturing, in their factories assembling by robotics, improving production efficiency and product reliability (Buckberg, 2026). These findings suggest that AI is evolving from start of the automotive industry till the end, from supporting technology into a strategic capabilities that is important for maintaining long term efficiency on global automotive market. (Khan et al., 2024; World Economic Forum, 2025)

On the other hand, Pakistan's automotive industry is still on the first step of AI adoption. Although the automotive manufactures have introduced automation and digital production systems, but still there is more work to do, they have limited resources, underdeveloped infrastructure, and shortage of AI skilled professionals. Even after all these challenges, Pakistan is still trying its best to move towards AI adoption, improve its automation industry, and compete with the world. I believe that Pakistan should build a stronger partnership with the United States, especially in automotive sector. With sustained investment in smart manufacturing and digital technologies, Pakistan has great potential, capable of competing with international markets.

To successful adopt artificial intelligence, it is not enough to rely only on technological capabilities. A skilled workforce that understands AI is equally important. Today. Organizations need employees who have a good understanding of artificial intelligence, strong digital competencies, analytical skills, and the ability to work effectively with intelligent technologies. These capabilities are essential for te successful adoption, and use of AI. (Saleem et al., 2023) reported that employee engagement and organizational agility can only be improved when digital transformation is integrated into human resource management. Likewise, (Saleem et al., 2026) successfully adopting AI depends largely on leadership. Organizations need effective leadership, proper employee traning, and well-planned strategies from management to make AI adoption successful. Collectively, these studies suggest that if country or organizations need sustainable industrial transformation, then only invest in technology is not enough, they need workforce

development, employees training, skills and capabilities (World Economic Forum, 2025)

Pakistan and the United States both have a good potential to collaborate in AI-driven automotive manufacturing. If both countries carry out joint research, share knowledge with each other, build partnerships between universities and industries, and work together on Stogner bilateral cooperation through joint research, knowledge exchange technology transfer, the automotive industry can adopt AI much faster. This kind of collaboration can not only improve industrial performance but also help both university-countries strengthen smart manufacturing and intelligent transportation systems. Both countries can support each other in thiss process, and both will benefit from this collaboration.

4.4 Human resource development and workforce skill

Human resource development plays a vital role in boosting productivity and competitiveness in the automobile sector. As automation, artificial intelligence, and digital technologies continue to evolve firms require individuals that have strong technical abilities, digital competences, and the capacity to adapt to new technologies. It is very important to keep putting money into technical education, training for the workers, and leadership growth. This will help improve the industry's long term performance and enable it to remain competitive in the market. (World Economic Forum, 2025)

These partnerships help make sure that grads learn the practical and technical skills they need for jobs in advanced manufacturing, robots, and production systems that use AI. In contrast, Pakistan still has trouble matching technical education to the changing needs of industry, even though its workforce is young and growing. Improving engineering education, vocational training, and partnerships between universities and businesses could greatly increase the country's manufacturing capacity and support the long-term development of its automotive sector. (Engineering Development Board, 2021)

(Saleem et al., 2023), if you want strengthens human resource management you should improve talent development and employee engagement. Likewise, (Saleem et al., 2026) highlighted that effective leadership, continuous workforce training, and well-planned management are very important technology alone is not enough, organizations also need to invest continuously in workforce development so they can achieve long term success

To build a stronger long term partnership between, Pakistan and the United States, both countries need greater collaboration in workforce training, joint research, and knowledge sharing. Expanding these initaitives will improve workforce capabilities, make it easier to adopt new technologies, and encourage innovation in the automotive sector. In the long run, this cooperation can create more job opportunities, strengthen industrial relations between both countries, and improve the global competitiveness of their automotive industries. This kind of cooperation is very important for both Pakistan and the United States.

4.5 Policy lessons and strategic recommendations

Pakistan and the United States may enhance their bilateral ties by addressing present deficiencies and benefiting from one another's strengths. Pakistan might benefit from the United States' experience in quality assurance, AI-powered manufacturing, automobile safety laws, research and development (R&D), and industry-university collaboration. Implementing these measures would increase global competitiveness, product quality, and industrial productivity (Kampoowale, 2026; Organisation for Economic Co-operation and Development, 2023; Saleem et al., 2026)

On the other hand, Pakistan's competitive labor costs, growing engineering workforce, growing auto-parts industry, and advantageous geographic location might be advantageous to the United States. These benefits facilitate cost-effective manufacturing partnerships, supply chain diversification, and joint ventures (Van Biesebroeck, 2011)

Furthermore, both governments must encourage private sector investment, collaborative research, workforce development programs, and technology transfer. According to current studies, merging AI

with effective HR strategies boosts organizational performance and innovation (Organisation for Economic Co-operation and Development, 2023; Saleem et al., 2026). Thus, a long-term connection based on innovation, competent human resources, and favorable industrial policy may promote vehicle commerce while also encouraging sustainable economic improvement in both countries.

5. Key Findings

This study draws many major findings on potential future cooperation in the car sector between Pakistan and the United States. First Pakistan's automotive sector can benefit substantially from the United States long-standing strengths in advanced manufacturing, artificial intelligence (AI), research and development (R&D), and vehicle strategy standards. These capabilities provide valuable opportunities for technology transfer and industrial learning. (Kampoowale, 2026; Organisation for Economic Co-operation and Development, 2023) Second, Pakistan offers several competitive advantages of its own, including a young workforce, cost-effective labor, and a rapidly expanding auto parts manufacturing industry. When all these efforts come together, they create a positive environment that attracts foreign investors. This also helps the country become more connected to the global supply chain (Van Biesebroeck, 2011)

"The results of this research also show that the role of artificial intelligence and digital transformation in the automotive sector is increasing day by day. They play an important role in improving production efficiency, enhancing product quality, and strengthening supply chain performance. However, focus and investing only on technology alone is not enough. As highlighted by (Saleem et al., 2023), if you need equally benefit of digital transformations you should also focus on continuous workforce development, proper training, and effective human resource management. For long term, stronger bond between Pakistan and the United States through technology transfer, joint ventures, collaborative research, and supportive industrial policies can promote innovation in the automotive sector, increase trade between the two countries, and boast economic growth for both nations."

6. Future research direction

I believe there is still gap which need more attention and more research, although this research compares Pakistan and USA automotive cooperation. They both countries should explores the exporting high value automotive parts and locally manufactured vehicles from Pakistan to US. They always have knowledge about what is happening in market competition, regulatory requirements, and what Pakistan need to maintain international quality standards. In addition, how AI based manufacturing, predictive maintenance, and intelligent supply chain systems can be examined? And can improve productivity and operational performance in Pakistan's automotive industry. (Kampoowale, 2026; Koricanac, 2021)

We should also focus on countries like China, Malaysia and Turkey to get broader understanding of the automotive industry, this future research can make this comparison stronger and more comprehensive. Future studies can also explore how Pakistan and the United States can work together in areas such as battery performance, electric vehicle production, and sustainable mobility projects. I also believe that in future focus on research includes automotive manufacturers, policymakers, and industry experts, it will provide deeper insights into the opportunities, challenges, and long-term future of cooperation between the two countries.

7. Conclusion

Automotive market is altering very swiftly around the globe. Mainly change in artificial intelligence, sustainable transportation and digital manufacturing. Pakistan has several important merits in automotive industry like human capital workforce or young talent, while the Unites States hold strong position in research & development in innovation, quality of standards, knowledge and experience and the adoption in AI. Through this findings \Pakistan and the United States can identify opportunities for future investment, collaboration in automotive industry, trade, technology, innovation.

According to this research, I believe that long term collaboration should not be only limited to automotive industry, it should also include knowledge sharing, advanced manufacturing, automotive courses in University with collaboration with USA universities especially in Artificial intelligence. Both countries should invest in Artificial intelligence, advanced education, build strong relation between industry and universities. Universities should provide advanced practical education and gear up universities attendees with the skills needed by the industry. From this productivity, strengthen industrial capabilities will grow and help both nations remain motivated in the long term. (Kampoowale, 2026; Saleem et al., 2023)

I believe better and better industrial policy, healthy participation of the private sector, and trade investment between Pakistan and the United States can create new chances for economic development. If both nations' appropriately use their respective strengths, I think they can jointly develop an automotive industry that is stronger, more innovative, and able to compete at the global level. Future research can also examine how joint ventures in electric vehicle manufacturing, AI-enabled supply chain management, and collaborative automotive projects can become successful and what their long-term economic impact may be.

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