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Industrial Clusters and Nearshoring in Mexico: A Strategic Framework for Economic Repositioning

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Abstract

The objective of this work is to make known the importance of clusters through nearshoring. In Mexico, it is part of several trade agreements, such as the T-MEC (Treaty between Mexico, the United States, and Canada), which facilitates international trade and provides tariff advantages. This may attract companies looking to benefit from these agreements. Mexico has a qualified and competitive workforce in terms of costs. Education and technical training are constantly growing, providing companies with trained human talent. Nearshoring can boost the creation and expansion of industrial clusters in different regions of Mexico. Clusters are geographic concentrations of companies and organizations related to the same sector. These clusters foster innovation and collaboration, increasing synergies and operational efficiency. Mexico has a diversified economy with key sectors such as manufacturing, automotive, technology, and aerospace. Nearshoring can encourage the growth of clusters in these sectors, promoting innovation and technological development. Mexico has shown economic stability and has policies to support industrial and technological development. The government has implemented

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programs to encourage foreign investment and infrastructure development, which can be attractive to companies seeking to establish themselves in the country. Establishing new businesses and expanding existing ones can create jobs and stimulate local economic growth. Clusters encourage collaboration and the exchange of ideas, which can lead to technological advances and greater competitiveness. Regional Development: The creation of clusters can help develop less urbanized regions, better distributing economic opportunities throughout the country.

Keywords: Nearshoring, Clusters, Development, Industries, Innovation, Mexico

INTRODUCTION

Nearshoring has been an increasingly popular strategy for foreign companies that want to establish operations closer to their main markets. In the context of Mexico, several companies from different industries have adopted this strategy, especially due to their proximity to the United States, their skilled workforce, and their commercial infrastructure.

Mexico has a historic opportunity to take the technology industry in its territory to the next level, which will lead the economy of the future. Through globalization and current business needs, the phenomenon of nearshoring in conjunction with digital transformation is gaining strength by demonstrating that it can drastically improve business operations with countries of geographical proximity.

Currently, foreign companies seeking to take advantage and innovate the quality of their work are finding great strategic and economic value in Mexico, due to its characteristics. One of them is the growing innovation that is born from human talent that is promoted internally, being the seed of the success of nearshoring and technological development in the country. This becomes more relevant when considering some specific data: according to the Global Business Council (CEG) (2023), nearshoring could generate up to 4 million jobs in Mexican territory by 2030, receiving between 30 and 50 billion dollars annually.

Likewise, UNESCO (2022) states that approximately 75% of jobs in the coming years will be related to STEM knowledge. The latter represents an important challenge in the region, since, according to OECD data, the percentage of graduates from STEM careers in Latin America is between 34% and 45% of all professionals. Fortunately, in Mexico, there is an

accelerated adoption of technological knowledge that will determine the path of the industries and the use of the new economy.

Now the democratization of skills and knowledge of technologies that will permeate every corner of life, such as artificial intelligence (AI) in Mexico, is a reality, through programs such as Intel AI for Youth, which promotes the talent of young technologists and the development of the industry in the country. Examples like these are increasingly common throughout the territory to link the social and labor success of future generations with the business and economic success of the country, which is undoubtedly extremely attractive for nearshoring strategies in the national territory.

This would launch an economic boom, since Mexico, through nearshoring, is expected to increase its gross domestic product (GDP) up to 2.5% in the next six years, in addition to reaching levels of foreign direct investment (FDI) of up to USD 50 billion (Ceeg, 2023). As a consequence, these social and economic factors will improve the adaptability of any industry and minimize the risks of supply chains by not depending on a single territory, such as the Asian continent. Business strategies must now have a global and local vision that allows a positive flow in any scenario within a changing and globalized world.

In the case of Mexico, this is a bilateral opportunity that extends inside and outside the country, since we have two great benefits: we are neighbors and the largest trading partner of the United States, the largest economy in the world, and a leader in technological innovation, and, we serve as a bridge between North America and the rest of the countries on the continent. This allows a faster and more flexible flow for North American companies and Latin economies, which are already aware of the added value of this geographic situation. This caused foreign direct investment to increase by 12% in 2022 compared to the previous year in Mexico, according to data from the Ministry of Economy, which portrays the reality of nearshoring. With this, there is no doubt that Mexico is a key player in taking advantage of this panorama and promoting a continental union that strengthens our economies. One of the most important steps to achieve this would be to relocate supply chains that are located on other continents, which would accelerate exports in Mexico by 30% in the coming years, according to Bank of America (2022).

Specifically, considering that North America is ideal for technology issues due to its optimal access to energy, resources, and talent, it is important to continue rebalancing the

semiconductor supply chain, which is the fundamental component of any industry and technology in the world. Favorably, Mexico already participates in five of the six major phases of the chip manufacturing process: Research and Development, design, validation, assembly, and semiconductor testing.

Nearshoring must be accompanied by the most innovative technologies that shape this historical moment. The business sector must be prepared to implement indispensable technologies such as ubiquitous computing, ubiquitous connectivity, cloud-to-edge infrastructure, and artificial intelligence, which will be crucial for the economy of the future.

Mexico has everything in its favor to become one of the leading countries thanks to its geographical, human, and economic advantages. Without a doubt, this historical moment requires great government, business, and social awareness to get the most out of nearshoring in conjunction with the technology industry and have a positive reach in every corner of the world that improves the lives of all living beings.

Mexico has a privileged geographic location, which facilitates nearshoring for companies in the US and Canada. This proximity reduces transportation costs and times, which is essential for efficient supply chains.

With projections of up to 4 million jobs by 2030 and the possibility of attracting between $30 and $50 billion in annual investment, nearshoring can be an important driver for Mexico's economic growth and development.

The trend towards nearshoring contributes to diversifying supply chains and minimizing risks by not depending solely on Asia. This can also reduce the carbon footprint and promote sustainable practices.

Since Mexico already participates in several phases of semiconductor production, the country has the opportunity to expand in this critical industry, benefiting the entire technological economy.

Mexico can be a bridge between North America and Latin America, promoting economic integration and technological collaboration between these regions. This can help create synergies and strengthen local economies.

The future of nearshoring and the technology industry in Mexico seems promising, but as you say, it is crucial to have government, business, and social support to maximize these

benefits. The key will be to continue strengthening human talent, improving technological infrastructure, and fostering a favorable ecosystem for innovation and investment.

Mexico has a historic opportunity to be a technological and economic leader. It will be interesting to see how these trends evolve and how Mexico can consolidate its position as a key hub for nearshoring and technology in the coming years. Below are some foreign companies that have arrived in Mexico through nearshoring.

Technology and Electronics Companies

Foxconn: These Taiwanese electronics manufacturing giant, known for producing devices for Apple and other large technology companies, has operations in Mexico. Nearshoring allows them to reduce shipping costs and times to key markets such as the United States.

Flextronics: Another leading electronic manufacturing company, Flextronics (now known as Flex) has expanded its operations in Mexico to manufacture electronic products for global customers.

Jabil: With multiple facilities in Mexico, these American electronics manufacturing company benefits from nearshoring to serve customers in North America efficiently.

Automotive Companies

BMW: The German automotive company established a plant in San Luis Potosí, as part of its strategy to take advantage of the production advantages in Mexico and the proximity to the United States.

Audi: Audi, another German automotive company, has a plant in Puebla, demonstrating the attractiveness of nearshoring for the European automotive industry.

Toyota: The Japanese automobile company has expanded its operations in Mexico to take advantage of the proximity to the US market and existing infrastructure.

Aerospace Companies

Bombardier: The Canadian aviation and transportation company has operations in Querétaro, an emerging center for the aerospace industry in Mexico.

Safran: The French aviation and defense conglomerate has a strong presence in Mexico, where it benefits from local talent and strategic location.

Appliances and Consumer Goods Companies

Whirlpool: This American appliance company has expanded its presence in Mexico to take advantage of nearshoring and serve the North American market more efficiently.

Honeywell: Although it also operates in the aerospace and technology sectors, Honeywell has facilities in Mexico focused on the production of household appliances and other consumer goods.

These companies represent just a sample of the many that have established or expanded their operations in Mexico through nearshoring. As global supply chains evolve and companies seek more efficient and resilient solutions, nearshoring is likely to continue growing in Mexico and attract more foreign companies in various industries (Gómez, J. 2023).

Hypothesis

1.-Geographic proximity between two entities increases the probability of interaction and collaboration between them. The physical proximity between two places, whether countries, regions, or even individuals, promotes communication, the exchange of resources, economic and cultural cooperation, as well as the creation of closer social ties.

Question 1 How can Mexico benefit from its proximity to the United States?

2.-Manufacturing in Mexico is driven by lower labor costs compared to developed countries, which makes it competitive for the production of consumer goods for both the domestic market and for export. Manufacturing in Mexico is increasingly adopting advanced technologies and automation processes to increase efficiency and maintain competitiveness in a constantly evolving global market.

Question 2. How capable are Mexican workers?

3 Given the growing awareness of climate change and the need to reduce carbon emissions, it is likely that Mexico is investing in the development of infrastructure for renewable

energy, as well as increasing urbanization and traffic congestion in Mexican cities, there could be significant investment in modernizing public transportation.

Question 3. How has nearshoring impacted infrastructure in Mexico?

4.-Mexico could make the signing of trade agreements with various countries or economic blocs have the potential to boost economic growth and strengthen Mexico's competitiveness in the global market. The country can benefit from greater access to foreign markets, thereby increasing exports and generating more employment opportunities and economic development. In addition, these agreements could encourage the transfer of technology and knowledge.

Question 4. How does Mexico benefit from trade agreements?

The Potential of nearshoring for the economic development of Mexico

Globalization has given rise to business relocation, known as "offshoring". It is essential to distinguish this concept from that of its concentration. While offshoring refers to the geographic relocation of specific business operations, outsourcing describes the practice of delegating services, tasks, and operations to third parties.

An offshore company is a multinational organization of a productive, financial, or investment fund type that chooses a place to locate its tax domicile without producing there and in which it benefits from asset protection, confidentiality, and tax advantages. Thus, there is an ad-hoc typology to contextualize relocation processes, giving rise to variants that are a function of aspects related to ownership, distance, and production processes, giving way to modalities such as the following:

- Ownership: it is related to the transfer by the company of productive factors (capital, labor, and business skills) to those regions where it intends to produce a good or service, the other modality related to this topic involves the subcontracting of a company external.
- Distance: this is shipping to distant territories (offshoring) where certain advantages can be taken advantage of in favor of the company, while the other modality is nearshoring which involves moving part of the production to regions not as far away as neighboring countries.

- Processes: services are presented abroad as a better way to approach customers, processes are sent to factories abroad; Sales are when external sales services are contracted to open new markets, and finally research and development, which is nothing more than the relocation of activities that add value to the service or product. (González, R., & Martínez, S. 2023).

The nearshoring tendency seeks to relocate production chains in nearby countries to strengthen global supply and production networks. Mexico, due to its geographical proximity and commercial alliances with the United States and Canada, has a great opportunity to attract foreign investment. However, although relocation has gained impulse in the last two years, there is still no clear method to evaluate its results (González, 2024).

The governor of Nuevo Leon Samuel Garcia, as well as some leaders in Mexico, are one of the defenders of the subcontracting of services provided from Mexico to the United States and Canada, this fact contributed partly that the direct foreign investment outside the order of $ 29 , 000 million USD, during the first half of the year 2023 (Treviño, 2024)

They seek to change electrical subsidies in Mexico from prices to amounts, inspired by technologies such as photovoltaic (PV Solar). They are expected to reallocate budgets for solar panels in homes, reducing market distortions and solving infrastructure investment problems, thus supporting a transition to a greener and sustainable economy (Duran *et al.,* 2024)

The commercial war between the US and China in 2018/19 caused a reorganization of global value chains (GVC), benefiting Mexico. Commercial data of 2015-2021 show that the greatest import protection of Chinese products in the US promoted the trade of Mexican companies, especially those of GVC in manufacturing industries. However, Chinese retaliation rates and American tariffs on Chinese supplies had negative effects. In general, the commercial policy remodeled the GVC, highlighting the role of Mexico in this new dynamic (Utar*, et al.,* 2023).

Industrial policy reform, nearshoring and a deeper Mexico–U.S. partnership could provide tailwinds for Mexican economic growth. Whether Mexico can harness the full potential of such transformative change is less clear (Cañas & Strackman, 2024).

Nearshoring is an economic phenomenon that represents a time change, driven by geopolitical motivations and the transition from a unipolar global economy to a multipolar. In this context, the United States restructures its hegemony against China, while Mexico is consolidated as a strategic option for the relocation of productive activities (Calvario & Silva, 2024).

Nearshoring has become a key economic phenomenon, driven by geopolitical motivations and the change of a unipolar global economy to a multipolar. This phenomenon reflects the restructuring of the hegemonic power of the United States against the growing influence of China, with Mexico emerging as a strategic actor in this new context (Falck-Reyes, 2023).

After the commercial war between the USA and China, the Nearshoring phenomenon has promoted companies from China, South Korea and Japan to increase its investments in Mexico. These investments are mainly concentrated in the manufacturing sector, especially in the manufacture of car and electronic components, taking advantage of the country's geographical and strategic advantages (Romero,2024).

In the first semester of 2023, the automotive sector concentrated the greatest demand for Nearshoring in Mexico, leading absorption in five of the main industrial markets in the northeast and low. While the demand of the electronic and appliances sector leads the activity in the West and Northwest region of the country (CBRE, 2023).

Investment in Nearshoring in Mexico is due to the growing salary difference between Mexico and China, which makes the Mexican market more attractive due to its lowest labor costs. In addition, China's loss of competitiveness in the US market favors the installation of plants in Mexico. Pandemia also increased nearshoring, since geographical proximity helped maintain the production times and delivery of US plants (Vazquez, 2024).

The expansion of the manufacturing sector in Mexico has revealed significant opportunities, but also a lack of educational tools for engineers, students and decision makers. So there is an innovative framework proposal that uses virtual reality (VR) and artificial intelligence (AI) to transform the teaching of advanced manufacturing systems. The frame includes three main components: (1) design and modeling of Robotic platforms in VR, (2) a virtual manufacturing company to understand problems and problem solving, and (3) product evaluation using VR to ensure functionality and satisfaction of the satisfaction of the customer. This approach combines theory and practice to improve the

understanding of modern manufacturing challenges and enhance the growth of the manufacturing sector in Mexico (Ponce *et al.,* 2024)

To take advantage of Nearshoring, Mexico proposes to promote the development of industrial parks, accelerate public security policies, offer tax incentives to attract direct foreign investments and improve port infrastructure, roads and airports (Santillan *et al.,* 2024)

Nearshoring represents a change of time, driven by geopolitical motivations in a transition context of a unipolar to multipolar global economy. The United States is restructuring its power against China, while Mexico, after an economic opening and a disarticulated internal market, now has the opportunity to take advantage of this phenomenon to strengthen its global connection and develop new market chains under a renewed approach to state planning (Hernández & Rojas 2024).

After Covid, companies are reconsidering outsourcing, leaning towards Mexico due to proximity and growth opportunities. This change is driven by the search for technological talent and digital transformation. Globalization presents new challenges and advantages, with economic integration models such as the Silk and BRICS route. An example is Bombardier-Aeroespacial in Querétaro, which shows how Mexico is strengthening subnational cooperation. By 2049, China is expected to expand its geopolitical influence beyond Taiwan, dominating new supply chains (Salas *et al.,* 2023)

The special report of the newspaper The economist analyzes the current and future investment of foreign companies that are relocating their production chains in Mexico, a phenomenon known as Nearshoring. This movement seeks to approach the final consumer in Latin America. The report highlights how companies are moving operations to Mexico to take strategic and geographical advantages, improving their proximity to Latin American markets and optimizing their supply chains (Morales *et al.,* 2024)

Toyota

Toyota's creation and application of high technology have had a significant impact on society globally. Here are some ways this technology has influenced the automotive industry and society in general:

It is known for its innovations in efficiency, especially with the launch of the Toyota Prius, the first mass-produced hybrid car. This pioneering technology has had a major impact on the industry, pushing other manufacturers to explore cleaner and more efficient technologies, such as hybrid and electric motors.

Toyota has been at the forefront of introducing safety technologies, such as the Toyota Safety Sense safety system, which includes features such as autonomous emergency braking, adaptive cruise control, and lane departure warning. This has contributed to an overall increase in vehicle safety, saving lives and reducing accidents.

The Toyota Production System (TPS) is a widely adopted model that emphasizes efficiency, quality, and waste elimination. This approach has influenced the manufacturing industry worldwide, generating more efficiency and better-quality products in various areas.

The expansion of Toyota's operations and the adoption of high technology have led to job creation and the development of specialized skills. The company has contributed to economic growth in many regions where it has factories and research centers.

Toyota has invested in technologies related to future mobility, such as autonomous vehicles and connectivity. These investments are paving the way for new forms of transportation, with the potential to make roads safer and more efficient and provide greater accessibility for people with disabilities or who cannot drive.

Social responsibility and environment: With a focus on sustainability, Toyota has promoted the use of green technologies and responsible practices. In addition to its hybrid vehicles, Toyota has also invested in the development of hydrogen cell technologies and implemented green practices in its manufacturing facilities, helping to reduce its carbon footprint. It has had a positive impact on many aspects of society, from improving safety and sustainability to encouraging innovation and efficiency in manufacturing. (Suzuki, T., & Yamamoto, H. 2021)

BMW

Development of Electric and Hybrid Vehicles BMW has been at the forefront of the transition from fossil fuel vehicles to electric and hybrid vehicles. With the BMW I line, which includes models such as the BMW i3 and BMW i8, the company has driven the adoption of electric vehicles and promoted sustainability in the automotive industry.

Autonomous and Assisted Driving Technologies BMW has invested in the development of autonomous driving technologies and advanced driver assistance systems (ADAS). This has contributed to increased safety on the road and laid the foundation for future advances in autonomous driving, which can have significant implications for road safety and urban mobility.

BMW has developed advanced connectivity technologies, such as the BMW iDrive system, which allows drivers to interact with their vehicles intuitively. This technology has improved the user experience and facilitated the integration of connected services, providing greater convenience and functionality to drivers.

Sustainable Materials and Manufacturing: BMW has been innovative in using lightweight, sustainable materials, such as reinforced carbon fiber, to reduce vehicle weight and improve efficiency. The brand has also adopted sustainable manufacturing practices, which have helped reduce its environmental impact and served as a model for other companies.

It is known for its focus on performance and driving dynamics. The brand has developed innovative technologies in engines, chassis, and suspension systems, creating a unique driving experience. This has raised consumer expectations of what a luxury car can offer.

BMW's technological advances have contributed to its position as a premium brand and have had a cultural impact, influencing the perception of luxury and sports cars. BMW models are associated with performance, innovation, and exclusivity, which has had a notable effect on lifestyle and automotive trends (López, M., & Sánchez, P. 2022).

AUDI

The creation of high-tech companies, such as Audi, has had a significant impact on society and the automotive industry in several ways. Audi, part of the Volkswagen Group, is known for its focus on innovation, high-quality design, and the integration of advanced technology into its vehicles. Some of Audi's key impacts on society are explored below:

Innovation in Automotive Technology:

Audi is a pioneer in the introduction of new technologies in the automotive industry. For example, it has been one of the first brands to adopt advanced lighting systems such as Matrix LED headlight technology and laser headlights, which improve visibility and safety.

The company has also innovated in driver assistance systems, such as Audi pre-sense, which helps avoid accidents.

Autonomous Driving and Intelligent Mobility:

Audi has worked on developing technology for autonomous driving and advanced driver assistance systems (ADAS). These advances can contribute to improving road safety and creating smarter mobility systems, changing the way people interact with cars and road infrastructure.

Focus on Sustainability and Electric Vehicles:

Audi is committed to sustainability, and the creation of electric and hybrid vehicles is part of this commitment. The Audi e-tron series, for example, marks the company's commitment to electric mobility, promoting the use of cleaner energy sources and helping to reduce greenhouse gas emissions.

User Experience and Connectivity:

Audi has innovated in creating advanced user experiences, such as the Audi Virtual Cockpit, which replaces traditional instruments with a configurable digital display. Connectivity is another area where Audi has excelled, allowing drivers to stay connected and have access to various applications and services.

Cultural Impact and Design:

Audi's distinctive design and focus on aesthetics and luxury have had a cultural impact. Audi vehicles are associated with modern design and sophistication, influencing automotive market trends and consumer expectations.

Contribution to the Economy and Employment:

High-tech companies like Audi also have a significant economic impact, creating jobs and stimulating the local economy in the regions where they have manufacturing facilities and offices. Furthermore, the development of advanced technology requires specialized talent, contributing to the development of skills and knowledge in the automotive sector.

The creation of high-tech companies like Audi has impacted society through innovation, sustainability, improving road safety, creating advanced user experiences, influential design, and contributing to the economy and employment. These aspects have helped transform

the automotive industry and change the way people perceive and use vehicles (García, A., & Martínez, R. 2023).

Foxconn

Foxconn, a contract manufacturing company and the world's largest electronics manufacturer has had a significant impact on society and the technology industry.

Foxconn is known for its ability to produce electronic devices in high volumes. It has been a crucial player for companies like Apple, Sony, Microsoft, Dell, and many others. This capability has allowed electronic devices to be produced on a massive scale, which in turn has contributed to greater accessibility and reduced costs for consumers.

Foxconn is a central part of the global technology supply chain. Their ability to manage a complex network of suppliers and produce high-quality devices has allowed large technology companies to focus more on design and innovation. However, it has also raised concerns about the concentration of manufacturing power in fewer hands, which may have implications for supply chain resilience.

With manufacturing facilities in several countries, Foxconn has created hundreds of thousands of jobs, especially in China, but also in other places such as India, Vietnam, Mexico, and Brazil. This has contributed to economic development in the regions where it operates, providing large-scale employment opportunities.

Foxconn has been at the center of debates over working conditions and workers' rights. Instances of long working hours, low wages, and health and safety issues have raised concerns about labor practices in the electronics industry.

The incidents at Foxconn factories have led to increased scrutiny of working conditions in the tech industry and prompted many companies to adopt more responsible practices and improve the treatment of their workers.

Foxconn's mass production model has also raised concerns about environmental impact. The large volume of production leads to high consumption of resources and the generation of electronic waste. Foxconn has begun to address these issues through investments in renewable energy and recycling programs, but environmental impact remains a challenge for the electronics industry.

Technological Innovation and Development of New Products:

As a strategic partner of many technology companies, Foxconn has contributed to the development and implementation of new technologies, such as augmented and virtual reality devices, robotics, artificial intelligence, and products for the Internet of Things (IoT). Its experience in manufacturing and assembly has been essential in bringing disruptive innovations to the market. (Gómez, J., & Pérez, L. 2023).

FLEXTRONICS

This company offers contract manufacturing services for a wide range of electronics and technology products, from consumer electronics to medical equipment and telecommunications.

By providing high-tech manufacturing services to other companies, Flex has facilitated the mass production and distribution of technology, allowing many companies to focus on innovation and product development with facilities in multiple countries, creating thousands of jobs globally., and contributing to the economic development of the regions where it operates.

This job creation has a positive effect on the local economy by driving industrial development and providing job opportunities in high-tech areas.

It collaborates with companies from various sectors, which encourages the development of technological ecosystems.

The company acts as a strategic partner for emerging and established companies, helping to bring their ideas to market and enabling greater innovation and diversity in the technology industry, it is an integral part of the global technology supply chain. Its ability to manage the production and assembly of high-tech products has allowed many companies to reduce manufacturing costs and time. However, this same concentration can create challenges in terms of supply chain resilience and dependence.

Flex has implemented sustainability and social responsibility practices in its operations, including efficient resource management and the use of renewable energy. The company has also emphasized improving the working conditions and safety of its employees, learning from past experiences, and adapting more ethical policies.

Flex has been a catalyst for innovation in various industries, including automotive, medical, telecommunications, and consumer electronics.

Its expertise in high-tech manufacturing and its ability to adapt to different sectors has allowed its member companies to launch innovative products and revolutionize the industry.

It contributed to the development and manufacturing of medical devices and healthcare equipment. Its experience in manufacturing and technology has helped bring high-quality devices to the market that contribute to people's health and well-being, especially in times of pandemic. (Gómez, J., & Pérez, L. 2023).

JABIL

Is one of the largest contract manufacturing and technology services companies in the world, offering design, manufacturing, and supply chain services for a wide range of industries. Its global presence and focus on advanced technology have had a significant impact on society.

It manufactures components and products for many of the world's largest brands, from consumer electronics to medical equipment, automotive, and telecommunications. Its ability to produce on a large scale and with high technology has facilitated the growth and mass distribution of technology, contributing to the proliferation of innovative products.

It has facilities in several countries and has created hundreds of thousands of jobs, positively impacting the economy of the regions where it operates.

Its extensive international presence offers employment opportunities and encourages the development of specialized skills in manufacturing and technology plays a critical role in the global supply chain.

Its ability to handle production, assembly, and logistics for various industries has enabled partner companies to reduce costs and improve efficiency. However, this heavy concentration on certain companies can create challenges if major supply chain disruptions occur. Has adapted to technological changes and has participated in a wide range of sectors, from consumer electronics to health and automotive.

This diversified approach has allowed the company to maintain relevance and promote innovation in different fields.

Emphasized sustainability and social responsibility in its operations. The company has implemented programs to reduce environmental impact, use renewable energy, and promote fair labor practices.

Commitment to sustainability is crucial to minimizing the negative impact of mass production on the environment.

It has also had a significant impact in the healthcare sector, manufacturing medical devices and related equipment. This approach has been especially important during situations like the COVID-19 pandemic, where the production of medical devices and personal protective equipment has been critical.

Works with a wide range of clients and fosters collaboration and the development of technological ecosystems. This collaboration allows companies to focus on innovation and design, while handling manufacturing and logistics, facilitating the development of high-tech products (López, M., & Pérez, A. 2023).

SAFRAN

It is a French multinational company specializing in the aerospace and defense industry. Safran and other high-tech companies in the aerospace sector drive innovation, developing more efficient and advanced engines and systems. This helps improve aircraft performance and safety, which is essential for commercial and military aviation.

The creation of this company generates highly specialized and well-paid jobs, promoting economic growth in the regions where they operate. It also stimulates a supply chain that benefits other companies and suppliers related to the aerospace industry.

International collaboration and technology transfer:

Safran collaborates with aviation manufacturers and companies around the world, promoting technology transfer and knowledge exchange. This international cooperation drives globalization and helps create higher standards for the aerospace industry.

Impact on transportation and mobility:

Safran's innovations have a direct impact on air transport, enabling safer, more efficient, and sustainable flights. This in turn facilitates global mobility, contributing to the connection between people and businesses around the world.

Sustainability and reduction of environmental impact:

Aerospace companies are increasingly focused on sustainability, working to reduce emissions and improve fuel efficiency. Safran, for example, has invested in technologies that reduce the environmental impact of aviation, contributing to a more sustainable future for air transport.

Defense technology development:

Safran also has a significant presence in the defense sector, which can have an impact on the security and military capabilities of the countries where it operates. While this may be beneficial for national defense, it also raises ethical questions and challenges related to militarization and the use of advanced technology for military purposes (González, R., & Martínez, S. 2023).

WHIRLPOOL

Whirlpool, by being a pioneer in the manufacture of smart appliances, has enabled homes to be more efficient and connected. Its products integrate technology to offer greater comfort and ease of use, from washing machines with Wi-Fi connectivity to refrigerators with touch screens.

Companies like Whirlpool have had a positive impact on sustainability by developing more energy-efficient appliances. This has helped reduce electricity and water consumption, contributing to the fight against climate change and the conservation of natural resources.

The creation of high-tech appliances has improved the quality of life by providing greater comfort and making household chores easier.

This allows people to spend more time on other activities, such as work, leisure, or family.

Companies like Whirlpool create jobs and contribute to economic growth. Furthermore, the adoption of advanced technologies in the manufacturing and distribution of home appliances creates new opportunities for specialization and training of professionals in technological fields.

With the introduction of high-tech products, Whirlpool and other similar companies have changed the way consumers purchase home appliances. The use of technologies such as e-

commerce and augmented reality allows customers to have more informed and personalized shopping experiences.

The introduction of smart home appliances has created greater awareness of technology in daily life. This has led people to seek to learn more about technology, developing digital skills that can be applied in other aspects of life.

The creation of companies like Whirlpool focused on high technology, has had a positive impact on society by promoting innovation, improving quality of life, promoting sustainability, and contributing to economic development.

However, like any technological transformation, it also poses challenges, such as the need to close the digital divide and ensure that everyone has access to these advances (García, A., & Martínez, R. 2023).

HONEYWELL

Honeywell is dedicated to innovation in areas such as automation, industrial control systems, aerospace technologies, security solutions, and healthcare technologies. This enables technological advances that drive efficiency and productivity in various sectors.

Honeywell is known for its industrial control systems and automation solutions. These technologies help companies improve safety and efficiency in industrial processes, which can have a positive effect on the economy and sustainability.

Honeywell has a significant presence in the aerospace sector, offering avionics systems, engines, and other key components. This has contributed to the development of more advanced technologies for aviation, improving the safety and efficiency of commercial and military flights.

Innovations in Security and Protection:

Honeywell provides security solutions for homes, businesses, and critical infrastructure. These technologies, such as alarm and access control systems, help improve security in society and protect valuable assets.

Environmental Impact and Sustainability:

Honeywell also focuses on technologies that promote energy efficiency and sustainability. Its products and solutions can help businesses and households reduce energy consumption and greenhouse gas emissions, contributing to a more sustainable future.

During the COVID-19 pandemic, Honeywell was involved in the production of personal protective equipment (PPE) and technologies for monitoring and controlling air quality, highlighting its ability to adapt and contribute in critical situations for society.

Society through its high-tech products and services is broad and multifaceted. From improving industrial efficiency and safety to contributing to sustainability and public health, Honeywell plays an important role in many aspects of modern life (López, M., & García, A. 2023).

Economic Advantages of Nearshoring for Mexico:

Job Growth: Nearshoring can lead to job creation, especially in sectors such as manufacturing, technology, and services. This can reduce unemployment and increase the income of Mexican families.

Attracting Foreign Direct Investment (FDI): Interest in nearshoring can lead to a significant increase in foreign investment. This not only benefits businesses but also generates tax revenue and encourages local economic growth.

Infrastructure Development: Demand for infrastructure, such as roads, ports, and telecommunications networks, can increase with nearshoring. This can create opportunities for local businesses and improve connectivity within the country.

Knowledge and Technology Transfer: With global companies establishing operations in Mexico, there are opportunities for the transfer of skills and technology to the local workforce, which can drive innovation and improve competitiveness.

Improved Competitiveness: Mexico can benefit from the diversification of production, reducing dependence on a single sector or region. This can make the economy more resilient to changes in the global environment.

Challenges and Considerations for Mexico. Political Stability and Security: To attract and retain foreign investment, Mexico must address challenges related to security and political stability.

Although Mexico has a skilled workforce, it must invest in education and training to meet the demands of growing industries. Increased industrial activity can have environmental impacts. Mexico must balance economic development with sustainability. The political and trade dynamics between the United States and Mexico may affect nearshoring opportunities. Mexico must maintain solid trade relations and avoid tariff barriers.

Nearshoring has the potential to play a fundamental role in Mexico's economic future. As global companies look to diversify and strengthen their supply chains to adapt to geopolitical shifts, global disruptions, and environmental concerns, Mexico is uniquely positioned to benefit. Below, some trends and possible scenarios related to nearshoring and the future of Mexico are explored.

The COVID-19 pandemic and geopolitical tensions have demonstrated the fragility of global supply chains.

Nearshoring allows companies to reduce risks by having operations closer to their key markets. The reconfiguration of trade relationships, such as trade tensions between the United States and China, is leading companies to reconsider where they locate their operations.

Mexico, with its proximity to the United States and its participation in trade agreements such as the United States-Mexico-Canada Agreement (USMCA), benefits from these trends.

Mexico is already an important player in sectors such as the automotive, electronics, aerospace, and manufacturing industries in general. With nearshoring, these industries could expand and diversify further, attracting investment and creating jobs.

Nearshoring can help reduce the carbon footprint by reducing the distance of transporting goods. Mexico could position itself as a leader in sustainable production if companies adopt environmentally responsible practices.

For nearshoring to thrive, Mexico needs to address issues of insecurity and violence. Companies seek stability and security to operate effectively.

Complex regulations and corruption can deter foreign investment. Mexico must work to simplify procedures and combat corruption to create a favorable business environment.

Although nearshoring can boost certain regions, it is essential that economic development is inclusive and benefits a broader spectrum of the Mexican population. Infrastructure and education development is crucial to maintaining long-term competitiveness. Mexico needs to invest in roads, ports, telecommunications, and training to meet the growing demand for nearshoring.

Nearshoring has the potential to boost the Mexican economy, creating jobs and attracting foreign investment. However, to maximize this potential, Mexico must address its structural challenges and create an enabling environment for sustainable economic development.

This involves not only attracting investment but also ensuring that growth is equitable, inclusive, and environmentally responsible. In the future, Mexico could become a key hub for nearshoring, serving as a bridge between North America and other regions.

To achieve this, the country must continue to develop its infrastructure, improve security and stability, and promote education and training to meet the changing needs of global industry.

The creation of nearshoring clusters for small businesses can be an effective strategy to boost regional economic development and strengthen the competitiveness of small and medium-sized businesses (SMEs) in Mexico.

Clusters are geographic groupings of related companies and institutions that share a common approach and benefit from collaboration and proximity. Here I offer you a detailed vision of the concept of nearshoring clusters for SMEs and their impact in Mexico.

Clusters encourage cooperation between companies, which can lead to the creation of synergies and collaboration on joint projects. SMEs can share resources, technologies, and knowledge, which improves their efficiency and competitiveness.

By grouping into clusters, SMEs can benefit from economies of scale and reduce operational costs, such as transportation and logistics. Furthermore, proximity between companies facilitates interaction and exchange of services.

Clusters typically develop in areas with adequate infrastructure, allowing SMEs to access shared services such as production facilities, storage, transportation, and IT services.

Clusters can organize training and skills development programs for SME employees and owners, helping to improve work quality and productivity.

Clusters can attract additional investment and customers due to the visibility and reputation they gain as centers of excellence in their sector. This can open new business opportunities for SMEs. Establishing a successful cluster requires a strong governance structure and effective coordination between participating companies and institutions.

Lack of leadership or cohesion can affect the development of the cluster. Clusters need quality infrastructure, including roads, ports, telecommunications networks, and basic services. If the infrastructure is poor, it can limit the growth of the cluster. SMEs may face challenges in obtaining financing and capital to invest in cluster development.

Governments and financial institutions must provide adequate support to overcome this obstacle. For clusters to be sustainable in the long term, they must balance regional development and consider environmental impact. Excessive concentration in certain areas can create inequalities and environmental pressures.

Nearshoring clusters for SMEs can play a crucial role in Mexico's economic development, especially in the context of the reconfiguration of global supply chains. To achieve success, it is essential to establish a clear vision, strong governance structures, and an environment that fosters collaboration and sustainable growth.

Local governments and institutions can play an important role in fostering these clusters, providing incentives, infrastructure, and support for training and business development. At the same time, it is essential to foster inclusion and equity to ensure that the resulting growth benefits a wide range of communities and does not cause environmental harm. (González, R., & Martínez, S. 2023).

Model in a Nearshoring Context

The Toyota Company in Mexico is based on several key pillars that have made it one of the most successful companies in the automotive industry in the country.

The company is famous for its Just-In-Time production system, which minimizes waste and maximizes efficiency by producing only what is needed when it is needed.

This approach has been implemented at its manufacturing plants in Mexico, allowing them to maintain low inventories and respond quickly to market demand. Toyota's philosophy

focuses on continuous improvement and the constant pursuit of excellence in all aspects of its operation.

At its Mexican plants, this is reflected in a rigorous focus on product quality and the implementation of robust quality control systems.

Toyota fosters a culture of employee participation and empowerment, where each team member's opinion is valued and employees are encouraged to contribute ideas for process improvement. In Mexico, this translates into staff training and development programs, as well as the implementation of autonomous work teams that assume specific responsibilities within the plant.

It has a close relationship with its suppliers, encouraging collaboration and cooperation to ensure quality and efficiency throughout the supply chain.

In Mexico, the company works with a network of local and international suppliers to ensure a constant flow of high-quality parts and components.

It is committed to being a good corporate citizen in the communities where it operates. In Mexico, the company participates in corporate social responsibility programs, such as education and the environment, contributing to the sustainable development of the region.

Toyota's business model in Mexico is based on principles of efficiency, quality, employee participation, and commitment to the community, which has allowed it to maintain a prominent position in the Mexican automotive market (Suzuki, T., & Yamamoto, H., 2021).

MATERIALS AND METHODS

Study Design

This study uses a case study approach to analyze how various multinational companies in the automotive and manufacturing industry have implemented and developed technological innovations, as well as the impact of these practices on sustainability, safety, and the economy. Six companies relevant to technological innovation in their respective industries were selected: Toyota, BMW, Audi, Foxconn, Flextronics, and Jabil. These companies were selected due to their leadership in the sector, their commitment to technological advancement, and their documented contributions in aspects of sustainability and social responsibility (Suzuki & Yamamoto, 2021; Gómez & Pérez, 2023; López & Sánchez, 2022).

Population and Sample

The sample consists of case studies of the six companies mentioned, obtained from annual reports, academic articles, research publications, and specialized databases. To ensure data relevance, only documents published between 2020 and 2024 were considered. Each case was analyzed to identify the technologies implemented, their social and environmental implications, and their influence on the economic development of the communities in which they operate.

Data Collection Instruments

Secondary data collection methods were used, such as scientific literature review, company sustainability reports, social and economic impact studies, and publications on advances in automotive and manufacturing technology. These documents provided qualitative data on advanced technology initiatives, as well as on the results of sustainable and corporate social responsibility (CSR) practices in each company. The selection and analysis of the documents was done using a purposive sampling technique, focusing on materials that highlighted the themes of innovation and sustainability (García & Martínez, 2023; López & Pérez, 2023).

Data Analysis Procedures

For data analysis, a qualitative thematic coding strategy was employed to identify key patterns and relationships between technological innovation practices and the observed social and economic impacts. The main categories analyzed included:

Efficiency and sustainability: Technologies aimed at reducing energy consumption, sustainable materials, and waste minimization.

Safety and social responsibility: Innovations in safety, both in products and in companies' work practices.

Economic impact and social development: Job creation, contribution to the local economy, and improvements in worker skills.

Each category was evaluated to identify how the implementation of specific technologies has impacted these aspects within each company (Suzuki & Yamamoto, 2021; Gómez & Pérez, 2023).

Validation of Results

To ensure the validity of the results, the data was compared to background studies in the automotive and manufacturing industry on the adoption of advanced technologies and sustainable practices. In addition, recent articles in academic databases such as Scopus and Google Scholar were reviewed to confirm the identified trends and strengthen interpretations on the impact of these companies on society and the environment (López & Sánchez, 2022; Gómez & Pérez, 2023).

Limitations of the Study

This study is limited to secondary data, which restricts access to detailed information on the internal implementation of each technology and its specific decision processes. Also, due to the qualitative nature of the analysis, the findings reflect general trends and cannot be generalized to the entire industry without further analysis.

RESULTS

In this study, multiple cases of multinational companies that have adopted advanced and sustainable technologies were analyzed to assess their impact on industry, the environment, and society. Below are the main results based on the themes of technological innovation, sustainability, economic impact, and social responsibility.

Technological Innovation

Toyota, BMW, and Audi have excelled in implementing advanced mobility technologies, such as electric, hybrid, and autonomous vehicles. Toyota, with its Prius model and the Toyota Safety Sense system, has set a precedent in fuel efficiency and vehicle safety (Suzuki & Yamamoto, 2021).

Similarly, BMW and Audi have developed electric vehicle lines, such as the BMW i3 and the Audi e-tron series, that seek to reduce dependence on fossil fuels and advance autonomous mobility (López & Sánchez, 2022; García & Martínez, 2023). In addition, these advances have laid the groundwork for future innovations in connectivity and user experience, such as BMW's iDrive system and the Audi Virtual Cockpit.

Foxconn, Flextronics, Jabil, and Safran have been essential in implementing new manufacturing technologies for electronic and aeronautical devices. Foxconn's collaboration with leading technology companies has facilitated the mass production of

high-demand electronic products, allowing for cost reduction and greater access to technology (Gómez & Pérez, 2023). In the aerospace sector, Safran has contributed to the development of advanced systems in aviation, such as efficient engines and lightweight materials, which improve aircraft safety and performance.

Sustainability and Environmental Practices

The companies studied have made significant efforts to reduce their environmental impact by adopting sustainable technologies. Toyota and Audi have implemented sustainability practices in their operations, focusing on the development of hybrid and electric vehicles, which reduce carbon emissions (Suzuki & Yamamoto, 2021; García & Martínez, 2023).

Audi has incorporated advanced lighting technologies, such as Matrix LED headlights, which not only improve safety, but also have lower energy consumption.

Flextronics and Jabil have adopted responsible and sustainable manufacturing practices in their facilities, implementing recycling programs and using renewable energy to minimize their environmental footprint (López & Pérez, 2023). In addition, these companies' focus on responsible resource management helps set an environmental standard in the manufacturing sector, especially in the production of consumer electronics and medical equipment.

Economic Impact and Job Creation

Toyota, BMW, Foxconn, and Flextronics were found to have contributed significantly to economic development in the regions where they operate. The expansion of their factories and research centers has generated direct and indirect employment opportunities, driving local economic growth and improving job specialization in the technology sector (López & Sánchez, 2022; Gómez & Pérez, 2023).

Foxconn and Flextronics have played a key role in job creation in countries such as China, India, Mexico, and Vietnam. Mass production in these countries has boosted the local manufacturing industry and fostered the transfer of technological knowledge, generating skilled labor in global technology supply chains.

Social Responsibility and Working Conditions

The analysis of labor and social responsibility practices revealed that Foxconn and Flextronics face challenges regarding working conditions and employee rights. At Foxconn, documented cases of long hours and workplace safety issues have drawn attention to the importance of working conditions in the electronics industry (Gómez & Pérez, 2023). These companies have responded with improvements in labor policies and the implementation of stricter safety standards.

On the other hand, companies such as Toyota, Audi, and BMW have also shown a commitment to social responsibility, not only through sustainability, but also through skills development programs for their employees. These efforts not only seek to improve working conditions, but also to foster a culture of inclusion and professional development within the automotive industry (Suzuki & Yamamoto, 2021; García & Martínez, 2023).

Collaboration and Impact on Society

The cultural impact of companies such as Audi and BMW has been evident in the public's perception of luxury vehicles and consumer expectations. The association of these brands with innovation, luxury, and sustainability has influenced consumer trends for high-end cars, reflecting a direct relationship between innovation and brand positioning (López & Sánchez, 2022).

For their part, Flextronics and Jabil have driven innovation across multiple sectors, from automotive to medical electronics, acting as strategic partners for technology startups and promoting the development of innovation ecosystems. This has allowed startups to focus on innovation, while these companies manage the manufacturing and logistics of advanced products (López & Pérez, 2023).

DISCUSSION

The results of this study highlight the essential role that multinational technology companies play in innovation, sustainability, economic development, and social responsibility. The comparison with recent studies allows to contextualize these findings and highlight the importance of adopting advanced and sustainable practices to face contemporary industry challenges.

Technological Innovation

The implementation of advanced technologies in companies such as Toyota, BMW, and Audi reaffirms the automotive sector's commitment to the transformation towards sustainable and autonomous mobility. This result coincides with what was pointed out by Kopp et al. (2021), who highlight that the transition to electric and autonomous vehicles not only responds to market demand, but also reflects a structural change in the industry towards sustainability and the reduction of carbon emissions.

Furthermore, the collaboration between Foxconn, Flextronics, Jabil and Safran and cutting-edge technology companies has accelerated the manufacturing of high-consumption devices and aerospace equipment, which is in line with the analysis of Brown and Green (2023), who claim that manufacturing outsourcing allows innovative companies to focus on the development of new technologies and optimize their production processes. The manufacturing of advanced electronic products and the development of more efficient engines in the aerospace sector are examples that reinforce this trend.

Sustainability and Environmental Practices

The sustainable practices of Toyota, Audi, Flextronics and Jabil, which include the use of renewable energy and recycling programs, reflect the commitment of these companies to reduce the environmental impact of their operations. These results are consistent with recent literature, which suggests that technology companies have a growing responsibility in mitigating their carbon footprint (Martínez & Pérez, 2022).

Furthermore, García and López (2023) identify that sustainability efforts, such as Toyota and Audi's hybrid and electric vehicles, are aligned with the goals of the UN Sustainable Development Goals (SDGs), specifically SDG 13, related to climate action.

This finding also reflects a transition towards more sustainable business models, which prioritize environmental management and eco-friendly products, as indicated by López and Sánchez (2022), who suggest that consumers are increasingly informed and demand business practices that minimize environmental damage. Audi's lighting innovation with its Matrix LED headlights is an example of how technological improvements can translate into more sustainable and energy-efficient products.

Economic Impact and Job Creation

The results also show that companies such as Toyota, BMW, Foxconn, and Flextronics have contributed to job creation and the economic development of the regions in which they operate. These results are in line with the studies of Silva et al. (2021), who claim that the presence of large multinationals in developing countries promotes the specialization of the workforce and the growth of local economies. The expansion of these companies allows the transfer of knowledge and skills to local economies, as noted by Gomez (2023), which encourages greater integration in the global supply chain.

On the other hand, the ability of Foxconn and Flextronics to generate employment in countries such as China, Mexico, and Vietnam demonstrates the role of these companies as drivers of growth in the global manufacturing sector. This aspect is highlighted by Thompson and Rivera (2020), who argue that technology multinationals have the power to transform the economic landscape in the countries where they operate, although these effects must be carefully managed to avoid economic inequalities and ensure fair working conditions.

Social Responsibility and Working Conditions

The commitment of some of the companies studied to social responsibility and improving working conditions is essential for their reputation and to maintaining consumer trust. However, the results also reveal significant challenges in this regard, particularly at Foxconn and Flextronics, where problems regarding safety and working conditions have been documented. According to the analysis by Torres and Campos (2022), these problems underline the importance of establishing and maintaining safety standards and fair working conditions in technology subcontracting companies.

Commitment to social responsibility is a growing priority in the automotive sector, where Toyota, Audi and BMW have implemented training and skills development programs for their employees, fostering a culture of inclusion and personal development. These results are in line with the findings of Aguilar and Ríos (2024), who highlight that employee well-being and professional development opportunities are key aspects of social responsibility strategies in the industry.

Collaboration and Impact on Society

Finally, the cultural and social influence of companies such as Audi and BMW on the public perception of luxury vehicles highlights the importance of branding and the alignment of technological innovation with consumer preferences. According to Sandoval and Martínez (2023), brand identity in the automotive sector has a direct effect on consumer demand, which is evident in the popularity of Audi and BMW's high-end vehicles, recognized not only for their luxury, but also for their commitment to sustainability.

Moreover, the collaboration of Flextronics and Jabil with technology startups has facilitated the development of innovation ecosystems, as stated by López (2023), allowing startups to take advantage of established manufacturing and logistics infrastructure. This collaboration is a critical factor for innovation and competitiveness in rapidly evolving markets, where the synergy between large companies and startups allows the implementation of new business models and technological solutions.

CONCLUSION

The potential of nearshoring-oriented production clusters in Mexico is significant and is in line with current global trends in the supply chain and production. Nearshoring, or moving production closer to end markets, offers Mexico a unique opportunity to become a key partner for companies seeking to diversify their manufacturing sources and reduce risks associated with globalization and long supply chains.

Mexico has important points for the development of productive clusters focused on nearshoring, such as:

1. Geographic proximity: Proximity to the United States, one of the largest markets in the world, is a key factor for companies seeking to reduce transportation costs and time.
2. Skilled workforce: Mexico has a highly trained workforce, with manufacturing experience and technical skills.
3. Infrastructure in development: The country has been investing in transportation, telecommunications, and energy infrastructure, which facilitates the development of productive clusters.

4. Trade agreements: Mexico is part of various trade agreements, such as the USMCA, that allow preferential access to several important markets.
5. Innovation and technology: The increasing adoption of advanced technologies and investment offer opportunities for the development of innovative and high-quality products.
6. Education and training: Ensure that the workforce continues to be updated with skills relevant to current and future demands.
7. Security and political stability: Maintaining a safe and stable environment is essential to attract foreign investment and foster business confidence.
8. Sustainability and social responsibility: Adopting sustainable and socially responsible practices can help companies meet growing expectations around corporate responsibility.

Nearshoring offers Mexico a strategic opportunity to strengthen its economy, attract investments, and promote the development of competitive productive clusters. With a proactive focus on addressing challenges and leveraging its advantages, Mexico is well-positioned to become a leader in the manufacturing industry and close-to-market production.

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