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Francis Thaise A. Cimene,  
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## REVIEWED BY

Matthew Fleenor,  
University of Mary Washington, United States  
Francesca Calamita,  
University of Virginia, United States

## \*CORRESPONDENCE

Angeles Dominguez  
✉ angeles.dominguez@tec.mx

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# Driving gender equality in the automotive industry: a review of educational strategies

Ana Zavala-Parrales<sup>1</sup>, Frank E. Meléndez-Anzures<sup>1</sup>,  
Sonia Perez-Suarez<sup>1</sup> and Angeles Dominguez<sup>1,2\*</sup>

<sup>1</sup>Tecnologico de Monterrey, Institute for the Future of Education, Monterrey, Mexico, <sup>2</sup>Universidad Andres Bello, School of Engineering, Santiago, Chile

The automotive industry has historically been characterized by male dominance, presenting significant challenges to achieving gender equality. Despite ongoing efforts to increase female participation, women continue to encounter systemic barriers, including entrenched gender stereotypes, unequal access to training, and a scarcity of female role models. This study systematically reviews educational strategies to advance women's inclusion in the automotive sector, focusing on their effectiveness in enhancing skills development, career progression, and leadership opportunities. Through the analysis from various regions and organizational contexts, key findings reveal that targeted interventions—such as vocational training programs, mentoring initiatives, leadership development workshops, and scholarship opportunities—have effectively improved women's technical competencies, professional confidence, and long-term retention in the industry. Additionally, the study highlights that these educational programs yield broader organizational and societal benefits, including increased workplace diversity, enhanced innovation, and improved productivity. Despite these positive outcomes, the research identifies persistent gaps that require further attention, such as the need for policy-driven frameworks to ensure sustained progress and the significance of cross-sector collaboration to amplify the impact of educational initiatives. This review offers evidence-based insights and practical recommendations for policymakers, industry leaders, and educators to support women's empowerment in the automotive workforce, underscoring the ongoing efforts necessary to achieve meaningful and sustainable gender equality in the sector.

## KEYWORDS

automotive sector, gender equality, empowering women, female leadership, mentoring, continuing education, higher education, educational innovation

## 1 Introduction

The automotive industry has historically been characterized by male dominance, with a pervasive perception of it being a male-dominated sector (Horak and Cui, 2017). This perception has been reinforced by the traditional association of the industry with physical labor and manufacturing, which has contributed to the underrepresentation of women in the workforce. The industry's historical focus on manufacturing and production roles has created a perception among women of high risk and danger associated with employment in the sector (Janis and Zulkipli, 2020). Furthermore, the leadership landscape in the automotive industry has been predominantly male, with accessing leadership roles remains a significant challenge for women in the industry (Eberl and Drews, 2022). This historical male dominance has also been reflected in the limited advice and support received by women from the automotive industry, as evidenced by the low percentage of women reporting advice from industry sources (Acar et al., 2017). The challenges women face in the automotive industry are further

compounded by barriers to entry and retention, as seen in the difficulties in recruiting and retaining women in related industries such as the construction sector (Akinsiku and Ajala, 2018). However, there is a growing recognition of the need to address these historical imbalances, focusing on improving the competency of vocational teachers in automotive engineering and promoting gender diversity in corporate boards within the industry. As the industry continues to evolve, there is an increasing emphasis on educational attainment and the development of effective apprenticeship models to enhance the participation of women in the automotive sector. These efforts reflect a broader recognition of the importance of inclusivity and diversity in driving the industry forward and addressing historical gender imbalances.

The primary aim of this study is to analyze and evaluate the effectiveness of educational strategies that foster gender equality within the automotive industry, particularly in the contexts of Mexico and Latin America. This review seeks to identify key interventions that have successfully enhanced women's participation in the sector, assess their impact on professional development, and offer actionable recommendations for stakeholders, including policymakers, educators, and industry leaders. By examining a variety of educational initiatives—such as vocational training programs, mentorship opportunities, leadership development workshops, and scholarship schemes—this study intends to contribute to the ongoing discourse on gender inclusivity and workforce diversification within the automotive sector.

To achieve this objective, the study systematically reviewed literature on gender equality in the automotive industry to identify relevant strategies, focusing on the selection of best practices that can be adapted and implemented within the regional context. This involved exploring previous studies, literature reviews, and relevant academic works that addressed the representation of women in the automotive industry and the educational strategies used to tackle this disparity. Inclusion criteria were established to determine which articles would be considered for the review. These criteria included the study's relevance to the topic of women's inclusion in the automotive industry, the study methodology, the geographic scope of the research, the study period, and the availability of robust empirical data. A search was conducted in academic databases and specialized repositories using keywords related to the topic, such as empowering women, gender equality, the automotive sector, continuing education, higher education, and educational innovation. The titles and abstracts of the studies found during the initial search were examined to determine their relevance and suitability according to the established inclusion criteria. Subsequently, a more detailed evaluation of the selected studies was conducted to assess their methodological quality and contribution to existing knowledge on the topic. The papers that best met the established inclusion criteria were selected based on relevance, quality, and methodological rigor. Empirical studies that presented successful cases in implementing educational strategies to increase the presence of women in the automotive industry were chosen. The selected papers were then analyzed to extract key findings and educational strategies highlighted in each case. Common patterns and significant differences were identified, and the effectiveness of educational initiatives in different geographical and business contexts was evaluated.

To foster a comprehensive understanding of gender disparities in the automotive industry, this study examines examples from various

countries that offer valuable insights into different methods for promoting women's empowerment and inclusivity. Their diverse socio-economic contexts guided the selection of countries, the maturity of their gender inclusion policies, and their relevance to the challenges faced by Mexico and Latin America. For instance, countries with well-established diversity programs, such as Canada and those in Europe, serve as benchmarks for evaluating the impact of long-term policies on women's participation in the workforce. Their experiences offer important lessons on effective strategies, including mentorship programs, flexible work policies, and leadership development initiatives, which have successfully enhanced female representation in the automotive sector.

In contrast, countries in Latin America encounter similar cultural and structural barriers as Mexico, such as deeply ingrained gender roles and limited access to STEM education and professional development opportunities. By comparing global best practices with regional realities, this study highlights adaptable strategies that can effectively address the unique challenges in the Mexican and Latin American contexts. This comparative approach enables a nuanced exploration of effective interventions, facilitating the creation of a tailored and actionable framework for promoting gender equality in the automotive industry. Ultimately, the chosen examples provide a balanced perspective, merging insights from global leaders in gender inclusion with regional experiences that reflect the socio-cultural dynamics of the study area.

## 2 Methodological framework

### 2.1 Systematic literature review protocol

To achieve a robust and methodical review of the body of literature in relation to gender equality in the automotive industry, this study applied the SPAR-4-SLR (Scientific Procedures and Rationales for Systematic Literature Reviews) protocol (Paul et al., 2021). This allowed a more systematic way of identifying, organizing, and reviewing relevant studies to strengthen the validity and replicability of the research process.

The systematic approach utilized in this study, grounded in the SPAR-4-SLR methodology, ensures a rigorous and transparent literature review analysis process. Nevertheless, it is crucial to recognize the potential biases and limitations that may have influenced the record selection and the interpretation of the findings. Acknowledging these factors contextualizes the results and provides a balanced understanding of the study's contributions.

The SPAR-4-SLR framework enhances the methodological rigor by establishing explicit inclusion and exclusion criteria and implementing a systematic approach to literature selection (Figure 1). The inclusion criteria were designed to prioritize studies relevant to gender equality in the automotive industry, ensuring a focus on methodological robustness, geographic diversity, and empirical rigor, with research from 2000 to 2024. Empirical rigor was evaluated through criteria such as peer-reviewed status, methodological transparency, and the strength of data collection methods, including mixed-methods, longitudinal, and experimental designs.

To ensure a comprehensive review, the exclusion criteria effectively remove non-peer-reviewed papers or records that were out of scope or lacked focus for this study. The literature search employed

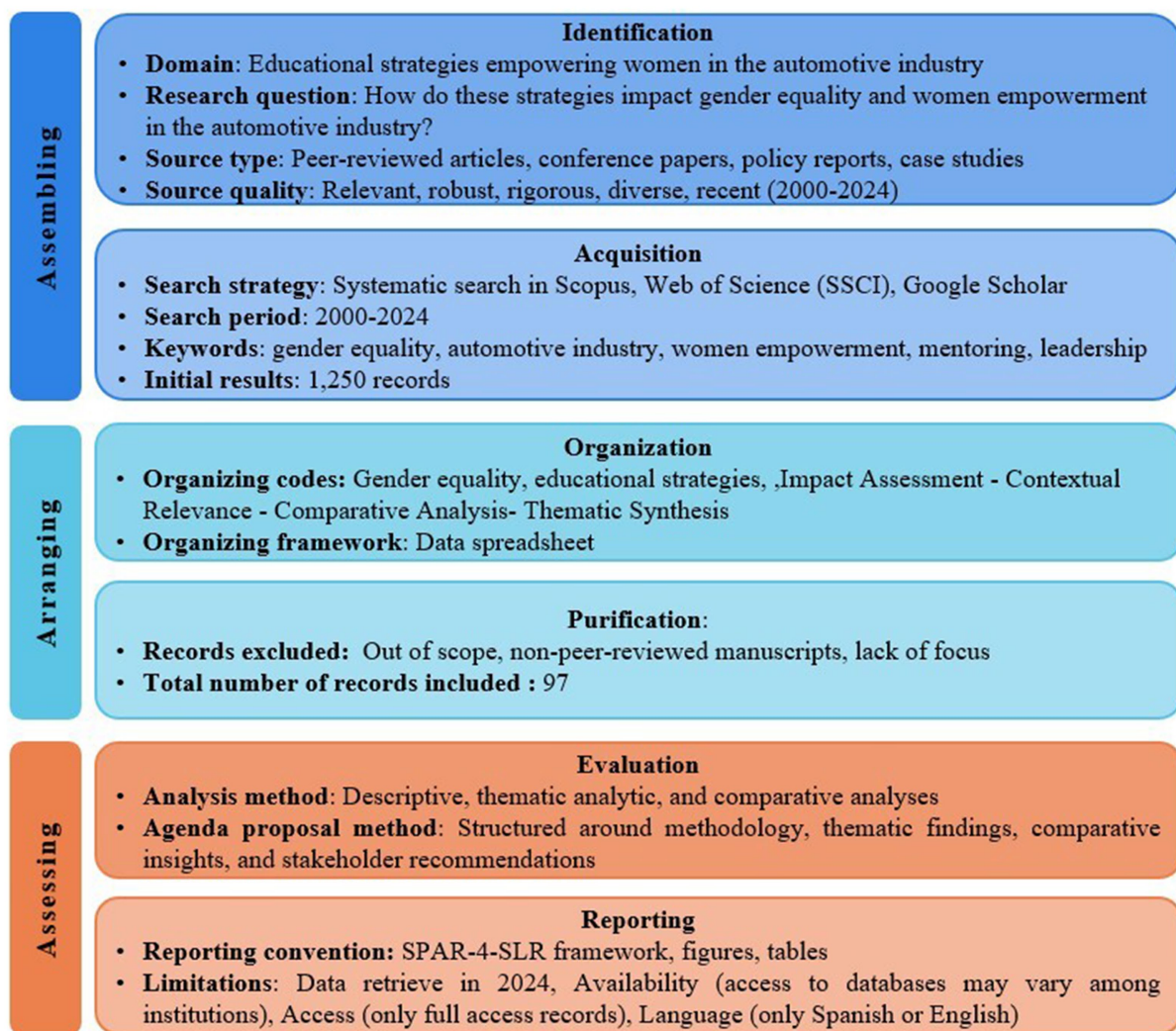


FIGURE 1  
SPAR-4 diagram detailing the systematic literature review process followed for this study.

a structured strategy in Scopus, Web of Science (SSCI), and Google Scholar. It used Boolean operators to refine the search using keywords such as gender equality, automotive industry, women's empowerment, mentoring, and leadership. The assembling, arranging, and assessing process resulted in a final dataset of 97 records from diverse regions and methodological approaches.

A flow diagram modeled after SPAR-4 SLR outlines the records selection process to enhance transparency and reproducibility, depicting the number of records identified, screened, assessed for eligibility, and ultimately analyzed for the review. In addressing potential biases, the study thoughtfully acknowledges factors such as publication bias (favoring English or Spanish language sources), limitations in data accessibility (commonly due to proprietary industry reports), and regional disparities in available research. Furthermore, methodological quality was assessed through a robust comparative framework centered on thematic synthesis, effectively triangulating key findings across the selected studies. Each record was analyzed by at least two researchers. Discrepancies were resolved together with a third researcher to ensure validity and consistency, as

well as to minimize subjective bias during the quality assessment process. Studies that did not meet the minimum quality threshold based were excluded from the final analysis, ensuring the robustness and reliability of our findings.

This paper presents data and case studies demonstrating the positive effects of these educational initiatives on women's skills, confidence, career prospects, and representation in the automotive sector. It also highlighted the roles of policy reforms, industry commitments, and international collaboration in supporting these initiatives. This work proposes perspectives on the ongoing efforts and strategies required to sustain and further advance women's empowerment in this sector, emphasizing the importance of continued research, policy support, and international cooperation.

## 2.2 Biases and limitations

This systematic literature review unearthed a variety of potential biases and limitations that could significantly shape both the selection

of articles and the interpretation of their findings. By recognizing these factors, the transparency and rigor of the review process are enhanced, while also illuminating opportunities for future advancements in research methodology.

- **Publication bias:** The selection method predominantly concentrated on peer-reviewed journal articles, conference papers, and policy reports sourced from prominent high-impact databases (Scopus or Web of Science), and from other indexes within the search engine Google Scholar. This focused approach on academic sources may have inadvertently marginalized gray literature, industry reports, and studies not included in those sources, all of which could offer valuable practical insights into gender equity in the automotive sector.
- **Language bias:** The literature search was conducted in English or in Spanish, published in other languages may have been overlooked. This is particularly true for research emerging from non-English-speaking regions facing considerable gender equity challenges in the automotive industry. This linguistic limitation indicates that the findings of this study cannot be generalizable.
- **Thematic bias:** The review emphasized educational strategies and leadership development initiatives as pivotal components driving gender equality within the automotive sector. Consequently, other essential themes—such as workplace policies, corporate governance, and socio-economic influences—might not have received adequate attention. These themes are important but fall out of the scope of this study.
- **Access and availability:** The databases used may vary from the date and institutional access. Also, in the case of non-open access records, retrieving the full-paper or document may depend on access from our institution. This implicates that some valuable documents may have not been included for not having access to the full record.

Despite these acknowledged limitations, the systematic and transparent implementation of the SPAR-4-SLR (Scientific Procedures and Rationales for Systematic Literature Reviews) methodology has provided a robust framework for identifying and critically analyzing relevant literature. This structured approach, coupled with clearly defined inclusion and exclusion criteria, has played a crucial role in mitigating potential biases and bolstering the reliability of the conclusions drawn in this study.

### 3 Implementing strategic initiatives to transform women's roles in the automotive industry

#### 3.1 Historical context and current challenges

The automotive industry has historically been male dominated, but in recent years, there has been a notable shift in how women perceive it. Recent studies indicate that women's positive views of the industry's attitudes have declined from 64% in 2015 to just 39%. In 2019, Bullock reported a study to investigate the reasons behind this change in perception. This study aimed to explore the complex identities and perceptions of women working in the automotive

industry, highlighting how their experiences are interconnected with the broader industrial mindset. The findings suggest that this decline in positive perception may be linked to these interconnections, underscoring the importance of recognizing the challenges women face in the automotive sector and the need to create a supportive and inclusive working environment to help address the existing disparities.

Leadership representation in the industry is particularly concerning. Surveys reveal that many women perceive a significant underrepresentation of minorities in leadership roles, while only 40% of their male counterparts share this belief. These findings correlate with the Role Congruity Theory by Eagly and Karau (2002), which posits that societal norms and stereotypes can hinder women's leadership potential, thereby contributing to minority underrepresentation. O'Brien et al. (2023) emphasize the importance of establishing career pathways, mentoring, activating networking support, and addressing unconscious bias, especially in male-dominated fields. These insights underline the necessity of dismantling biases and promoting diversity to create a more equitable leadership landscape in both academic and industrial contexts, which is vital (Deloitte, 2020).

Addressing these challenges requires a nuanced approach that considers both global best practices and the unique socio-cultural dynamics of Mexico and Latin America. While the structural barriers women face in Canada, such as underrepresentation in production roles and leadership positions, mirror those experienced in Latin America, factors like cultural perceptions, economic constraints, and educational access necessitate tailored strategies. For instance, mentorship programs and networking support have proven effective worldwide and can be adapted to the Latin American automotive sector to provide women with the resources and role models needed to navigate their careers successfully.

Moreover, successfully implementing diversity and inclusion programs in countries like Canada offers valuable insights into how similar initiatives can be structured in Latin America, with necessary adjustments to tackle region-specific challenges. By leveraging lessons learned from international experiences and customizing them to fit local realities, policymakers and industry leaders can develop a comprehensive approach that fosters a more inclusive and supportive environment for women in the automotive sector.

These efforts will help bridge the existing gender gap and empower women to assume leadership roles, ensuring that their contributions are recognized and valued at all levels of the industry.

#### 3.2 Educational strategies and their impact

In Canada's automotive industry, women have traditionally been underrepresented, comprising only 23% of assembly roles and 25% of parts production positions. This contrasts sharply with the nearly equal gender distribution in the broader national labor force, where women make up 48%, and aligns more closely with the overall manufacturing sector, where female participation stands at 28%. Despite this underrepresentation, Canada possesses a significant pool of qualified women with expertise in aerospace, machinery, and electrical equipment, as well as STEM education and trades certification. These skilled women represent an untapped resource with the potential to transition into automotive roles, enhancing the

sector's workforce diversity and innovation capabilities (FOCAL Initiative, 2020).

A similar challenge is observed in Mexico and other Latin American countries, where women's participation in technical and scientific sectors remains disproportionately low (Genin and Ocampo, 2019). Unlike Canada, where structured vocational training and industry partnerships have created pathways for female participation, Latin America faces additional socio-cultural barriers, such as entrenched gender roles, limited mentorship opportunities, and workplace cultures that are not always inclusive. Women in both regions often take on administrative, sales, and management roles rather than technical positions, and they frequently encounter lower wages and job insecurity compared to their male counterparts. Furthermore, the prevalence of part-time work and self-employment among women suggests that their full professional potential remains underutilized.

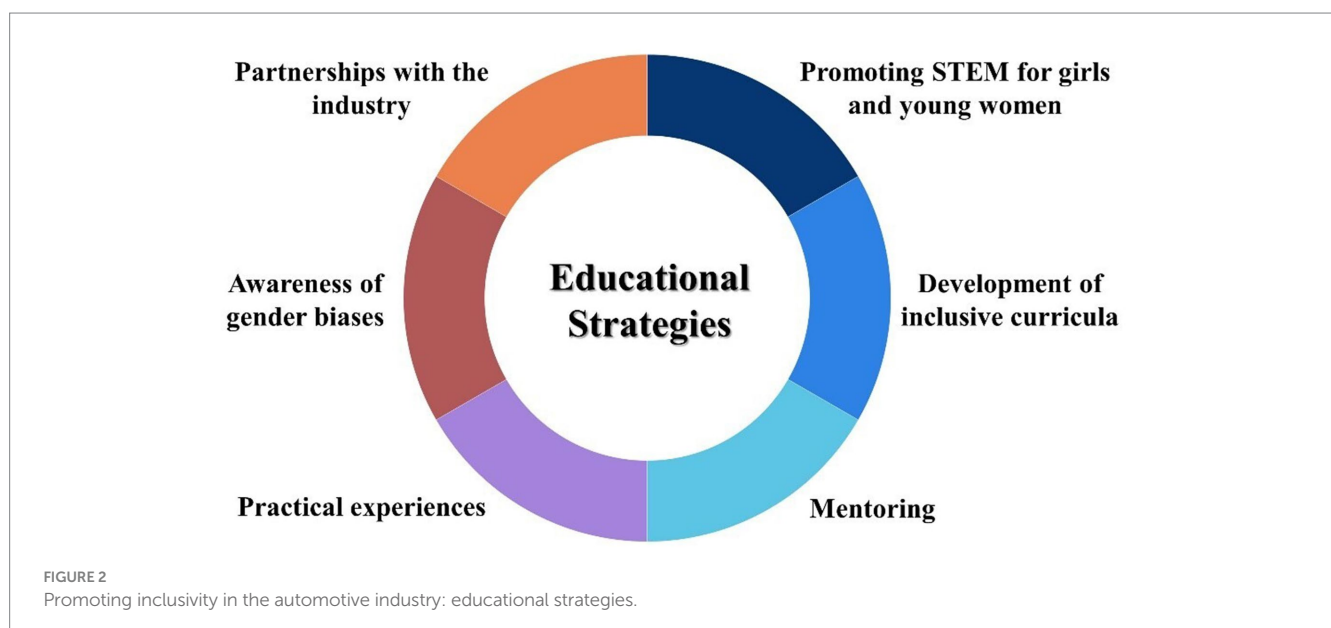
Addressing these disparities requires a multifaceted approach that combines successful international strategies with localized adaptations. Canada's experience highlights the importance of robust diversity and inclusion programs, flexible work policies, and clear career advancement pathways that provide women with the necessary support and visibility. Similarly, in Mexico and Latin America, tailored strategies must focus on dismantling cultural stereotypes, increasing female representation in STEM-related careers, and fostering industry-academia collaboration to create targeted training initiatives that meet the specific needs of the region. Implementing such strategies can help bridge the gender gap and ensure that women in the automotive sector in Latin America have greater opportunities for leadership, career progression, and job stability.

By learning from Canada's successes and adapting them to the Latin American context, policymakers and industry leaders can work together to build a more inclusive and equitable automotive sector that harnesses the full potential of its female workforce while addressing region-specific challenges (Figure 2).

As the foundation of our framework by identifying key educational strategies that promote gender inclusivity in the

automotive sector. It outlines critical interventions such as STEM promotion, inclusive curricula development, mentoring programs, practical experiences, and awareness of gender biases. These strategies provide a structured approach to equipping women with the necessary skills and support to thrive in the industry. Elaborating on the six educational strategies of Figure 2, we have the following.

- Promoting STEM for girls and young women. Partnerships with educational institutions can foster early interest in STEM among girls through specialized programs. This could include extracurricular activities, interactive workshops, and inspirational talks from successful women in the automotive field (Franz-Odendaal and Marchand, 2022).
- Development of inclusive curricula. Review and update curricula in educational institutions to ensure they are inclusive and reflect gender diversity in the automotive industry. This may involve integrating examples and case studies highlighting women's work in the industry and promoting female role models in academia (Mills and Ayre, 2003).
- Mentoring. Establish mentoring programs that connect students interested in automotive careers with female professionals. These mentors could guide, advise, and support young women as they explore their educational and professional options in the industrial sector (Sultana et al., 2013; Naik et al., 2019).
- Practical experiences. Facilitate practical experiences, such as internships and research projects, that allow students to apply their knowledge in a real automotive environment. This will give them a deeper understanding of the industry and help them develop relevant skills for future careers in this industry (Mehrtash and Centea, 2020).
- Awareness of gender biases. Integrate awareness of gender equity and eliminate gender biases in school and university curricula. This may include education on gender stereotypes, promoting respect and tolerance, and promoting equal opportunities for all students, regardless of gender (Kollmayer et al., 2020; Hinton-Smith et al., 2022).



- Partnership with industry. Collaborate closely with automotive companies to develop educational programs that meet the sector’s needs and prepare students, both men and women, for relevant roles in the industry. This may include creating specific training programs and employment opportunities for graduates (Morano-Okuno et al., 2019; Fieldhouse, 2008).

Focusing on these educational strategies aims to support women in preparing them to face the challenges and take advantage of opportunities in the automotive industry. These strategies have a twofold objective: to seek women’s empowerment (Figure 3) and to promote gender equity (Figure 4) in this industrial sector.

In global economic participation, women’s role has evolved considerably, underscored by initiatives across the G7, G20, and the United States. This movement toward economic inclusivity is not merely a social win; it’s an economic catalyst, evident in surges of GDP, health, social benefits, and poverty reduction. Thus, the evolving role of women in global economic participation teaches us the importance of recognition, equality, empowerment, collaboration, and long-term vision to promote more inclusive and sustainable economic development. However, the path to empowerment is strewn with systemic barriers—discriminatory practices, educational and infrastructural deficits, and a pervasive digital divide—that thwart women’s access to education, skill-building, and equitable work.

Based on the evolution of women’s role in global economic participation and the barriers they still face, combined with the educational strategies proposed in the literature, several initiatives can be proposed to promote women’s economic empowerment in Mexico and Latin America (Figure 3).

- Equitable access to education. Implementing policies and programs to ensure women have equitable access to quality education at all levels, from primary education to higher education and vocational training. This may include removing financial barriers, creating specific scholarships for women, and promoting inclusive and gender discrimination-free educational environments (Sriram et al., 2022; Siyez and Beycioglu, 2019).
- Development of relevant skills. Design training and capacity-building programs that develop technical, entrepreneurial, and leadership skills for women to participate fully in the economy. These programs should be tailored to the labor market’s needs and provide opportunities for practical learning and work experience (Bullough et al., 2015).
- Promotion of digital literacy. Encouraging digital literacy among women by providing access to resources and training in information and communication technologies (ICT). This will enable them to seize job and business opportunities in the digital economy and bridge the digital divide separating them from economic opportunities (Sujarwo et al., 2022; Sandys, 2005; Gurumurthy, 2006).
- Support of female entrepreneurs. Establishing specific support programs for female entrepreneurs, including counseling, mentoring, access to financing, and business support networks. These programs can help overcome women’s barriers when starting and growing their businesses (Iwu and Nxopo, 2015; Elliott et al., 2020).
- Financial education. Integrating financial education into educational programs for women provides them with the skills and knowledge needed to make informed financial decisions and manage their resources effectively. This may include budgeting,

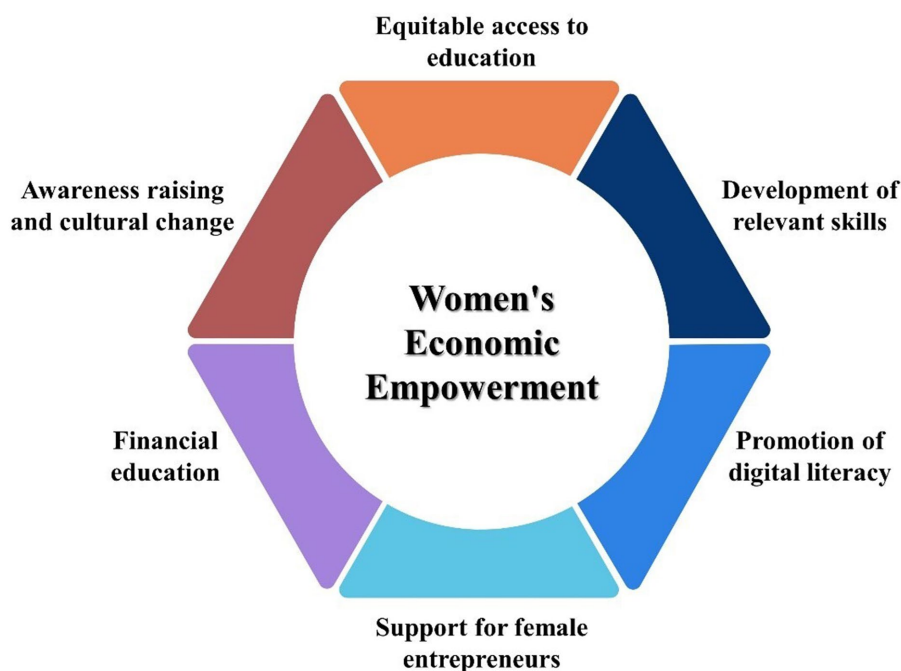


FIGURE 3 Empowering women in the automotive industry: initiatives for economic equality and success.

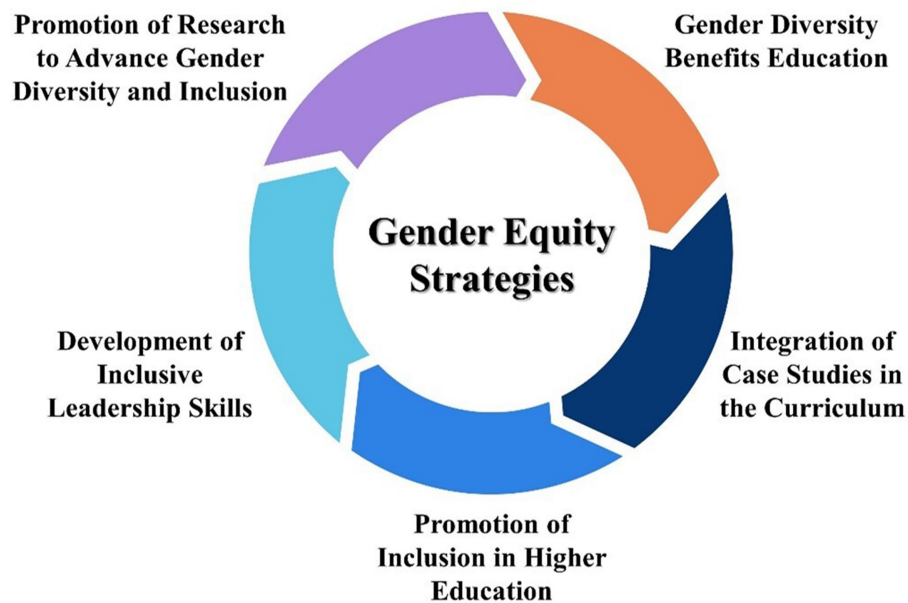


FIGURE 4  
Driving inclusion: educational strategies for automotive equity.

saving, investing, and credit management (Pérez-Roa et al., 2022; Jarecke et al., 2009).

- Awareness raising and cultural change. Conduct awareness campaigns and public education to promote gender equality in education, work, and society. This can contribute to changing attitudes and perceptions about women's economic role and overcoming cultural and social barriers they face (Ovseiko et al., 2017).

By implementing these educational strategies (Figure 3), we could contribute to overcoming the systemic barriers that hinder women's economic empowerment in Mexico and Latin America and move towards a more inclusive, equitable, and prosperous society for all, presenting initiatives aimed at achieving economic equality for women in the automotive industry. It highlights the need for equitable access to education, skills development, digital literacy, and entrepreneurial support. These elements strengthen women's economic participation and align educational efforts with broader economic empowerment goals.

A study pivoting on China's automotive industry from 2008 to 2011 provides empirical weight to the discourse, revealing that firms with gender-diversified boards flourish with higher asset and sales growth, lower debt ratios, and heightened R&D investment (Horak and Cui, 2017). This financial buoyancy, however, does not skew the return on equity, which remains consistent with firms lacking female board representation.

Statistical analysis—from t-tests comparing firms with and without women on boards to regression models controlling for size, industry, and temporal factors—corroborates these insights, suggesting that gender diversity is not just a token of social progress but a keystone of corporate robustness and industry competitiveness. These findings pivot towards the conclusion that policymakers and industry players have much to gain from championing gender diversity, not just as a token of progress but as a strategic imperative.

The data speaks; it's high time the economic power structures listened (Buse and Bilimoria, 2014).

Based on the study of the automotive industry in various countries and its correlation with gender diversity on the board of directors, we can derive the following educational strategies to promote gender equity in the automotive sector in Mexico and Latin America (Figure 4).

- Gender diversity benefits education. Develop educational programs for students, professionals, and industry leaders in the automotive sector, highlighting the tangible benefits of gender diversity in financial growth, innovation, and corporate competitiveness (Gurin et al., 2002; Velinov, 2023). Research has shown that gender diversity in the automotive industry is a social justice issue and a key driver of financial growth, innovation, and business competitiveness. Levin and Mattis (2006) highlight the need for gender diversity programs that address quality of life issues, training and development, and management accountability. Ain et al. (2021) further support this idea, highlighting the financial benefits of companies with greater gender diversity. Sethi et al. (2023) mention the importance of leadership development programs for women in engineering, which can help organizations fully leverage the benefits of gender diversity.
- Integration of case studies in the curriculum. Incorporating case studies in business, management, and economics education effectively enhances the learning experience and prepares students for real-world challenges (Davis et al., 2011). This approach can be particularly beneficial in the automotive industry, where the sector's history can provide rich illustrations of modern business concepts (Baker et al., 2008). These studies can give students concrete examples of how gender diversity impacts financial outcomes and corporate competitiveness.

- Promotion of inclusion in higher education. Foster the inclusion of women in higher education programs related to the automotive industry, such as mechanical, electrical, and industrial engineering. This can be achieved through awareness campaigns, specific scholarships, and mentorship programs encouraging more women to pursue careers in these fields (Yunus et al., 2023; Mohamed, 2015).
- Development of inclusive leadership skills. Offer training and specialized workshops in inclusive leadership skills for students, professionals, and business leaders in the automotive sector. These programs can focus on managing diverse teams, effective communication, and conflict resolution, among other vital skills (Cooney, 2017).
- Promotion of research to advance gender diversity and inclusion. Research in the automotive industry has highlighted women's challenges in leadership positions, including conflicting experiences and perceptions of identity (Bullock, 2019). These challenges are exacerbated by gender discrimination in promotion strategies, with women reporting slower progression and the need for flexible work schedules (Lloyd and Mey, 2007). To address these issues, companies must view gender diversity as a business issue with potential benefits for the company and its stakeholders (Levin and Mattis, 2006). However, there is a lack of academic literature on gender nonconformity in business education, which could hinder efforts to promote gender inclusion in industry (Graham and MacFarlane, 2021). Therefore, further research is needed to explore women's experiences in the automotive sector and promote gender diversity and inclusion.

Figure 4 offers a cohesive educational framework designed to promote gender equity within the automotive sector. It underscores the significance of leadership development, including women in higher education programs, and presenting case studies that exemplify best practices. These themes outline actionable steps to cultivate an inclusive environment that enhances women's career advancement and encourages greater organizational participation.

The selection of Canada, alongside other global examples, seeks to provide valuable insights into best practices that can be adapted to the distinct socio-economic and cultural contexts of Mexico and Latin America. Despite considerable regional variations, both contexts confront analogous challenges, including entrenched gender stereotypes, inadequate representation of women in technical roles, and barriers to professional advancement.

Canada's automotive industry exemplifies a case study characterized by its systematic implementation of diversity and inclusion programs. These initiatives may serve as a strategic framework for Latin American countries aiming to enhance female participation in this sector. By leveraging international experiences and adapting them to the specific needs of the Latin American market—such as addressing informal labor practices and prevailing cultural perceptions—this comparative approach enables the identification of transferable strategies.

This framework does not advocate for a one-size-fits-all solution; rather, it emphasizes the importance of utilizing global knowledge to inform local policies and industry initiatives. This ensures that the proposed educational and professional interventions are not only contextually relevant but also sustainable in the long term.

## 4 Driving new narratives: women-leader identities in the automotive industry

Through the lens of feminist standpoint theory and a communication theory of identity, women in the US automotive industry share compelling narratives that offer a window into their journeys (Bullock, 2019). These stories articulate the complex interplay of self-concept, relationships, and behaviors within a traditionally male-dominated sphere. Their testimonials describe a metamorphosis fueled by education and mentorship: knowledge and skill sets expanded, confidence surged, and resilience hardened against gender bias and social isolation. These women wear their triumphs as badges of honor, celebrating the pride and fulfillment gleaned from their roles while adeptly maneuvering through the sector's demanding corridors. Communication has been a cornerstone of their ascent—tone-setting, assertiveness, and a certain tenacity have become tools to command respect and carve out recognition. Yet, the camaraderie and the shared experiences with colleagues, both women and men, have fostered supportive networks and communities, fortifying their professional paths. And there lies the beacon of progress: the ascension to leadership roles, the tangible contributions to innovation and growth, and the blossoming optimism for the future. These women do not just occupy spaces in the automotive industry; they expand them, heralding an era where marketing, technology, and other fields beckon more opportunities for women's advancement. This is the transformative power of education and mentorship—a catalyst for personal and professional renaissance, a reason to be proud and hopeful for the future.

In the academic landscape of South Africa, a groundbreaking article posits the capabilities approach as a transformative framework to sculpt gender equality policies in higher education (Loots and Walker, 2015a). This piece transcends the conventional metrics of numerical parity, delving into the nuanced disparities that shadow women and men in academia and beyond. This article advocates for capabilities approach that honors the rich tapestry of lived experiences, intrinsic values, and individual agency. It identifies four foundational pillars essential for gender equality: bodily integrity, dignity, respect, voice, and knowledge and education. These core capabilities serve as the bedrock for higher education institutions to cultivate and strengthen, thus empowering their community and inspiring a new generation of leaders.

Case studies and testimonials reveal the profound impact of such initiatives. Once beneficiaries of these policies, women recount their metamorphosis: from burgeoning self-assurance to significant career leaps, embodying the essence of growth. They testify to the capabilities approach efficacy in fostering human development, equity, and greater social good.

The narrative is straightforward: the capabilities approach offers more than theoretical value—it is a lived experience, a beacon of progress that ignites personal transformation, underpinning a society's stride towards social justice and collective well-being.

The empowerment of women in the automotive industry, especially in the United States, and the implementation of the capabilities approach in South Africa leave us with essential strategies that could help drive gender equity in this sector and promote female leadership in Mexico and Latin America (Figure 5).



- Significance of education and mentorship. Women in the automotive industry have experienced personal and professional transformation through education and mentoring. [Dashper \(2018\)](#) cites the positive impact of mentoring on women's confidence, career planning, and professional networks. This highlights the importance of education and mentoring programs that expand women's knowledge and skills, increase their confidence, and prepare them to deal with gender bias and career challenges.
- Communication as an empowerment tool. Assertive communication and tenacity have become essential tools for women in the automotive industry to gain respect and recognition ([Lachira Estrada et al., 2020](#)). This is especially important in male-dominated environments, where women may have difficulty being heard and respected ([Mohd Jan, 2006](#)). [Grant and Taylor \(2014\)](#) further stress the importance of communication in developing leadership presence, suggesting that women can improve communication by changing how they talk about their accomplishments. This underscores the importance of developing practical communication skills in women that allow them to stand out in a male-dominated environment.
- Building support networks and communities. Shared experiences with colleagues, both women and men, have been instrumental in strengthening women's career paths in the automotive industry. [Bullock \(2019\)](#) highlights the importance of these factors in shaping women's identities and leadership experiences. [Davidson \(2018\)](#) further highlights the role of work relationships, particularly with female coworkers, in improving the quality of women's leadership experiences. These findings are supported by the work of [Cyr et al. \(2020\)](#), which suggests that team dynamics and friendship networks can positively impact the academic trajectories of women in STEM fields. This highlights the need to create and foster support networks and communities that offer a safe space to share experiences, advice, and resources between professionals in the sector.
- Capability approach for gender equality. Implementing the capabilities approach in South African higher education has the potential to address gender disparities as it recognizes the importance of experiences and autonomy in achieving gender equality ([Loots and Walker, 2015b](#)). This approach, which focuses on opportunities or activities considered meaningful to people in their daily lives, can guide the development of a gender equality policy in higher education institutions ([Loots and Walker, 2015a](#)). Understanding the capabilities approach involves recognizing the importance of individual experiences, autonomy, and opportunities to address social challenges, such as gender disparities, and design more effective and equitable interventions and policies.
- Transformative impact of inclusive policies. Case studies and testimonials reveal the profound impact of inclusive policies on empowering women, from increased confidence to significant career advancements. Various authors highlight the importance of addressing the root causes of gender inequality and the need for women's participation in policy formulation. These policies increase women's confidence and career advancements and contribute to social justice, human development, and inclusive growth ([Newman, 2017](#); [Wu, 2023](#)). The authors also highlight the need for specific policy recommendations to expand women's opportunities, address institutional constraints, and enhance their voice and agency. This highlights the importance of inclusive policies and programs promoting human development, equity, and social well-being.

Figure 5 analyzes the impact of organizational culture on the practical implementation of gender equity strategies. It links educational initiatives with workplace policies, emphasizing the necessity of nurturing an inclusive culture that appreciates diversity. By connecting educational interventions to workplace practices, these

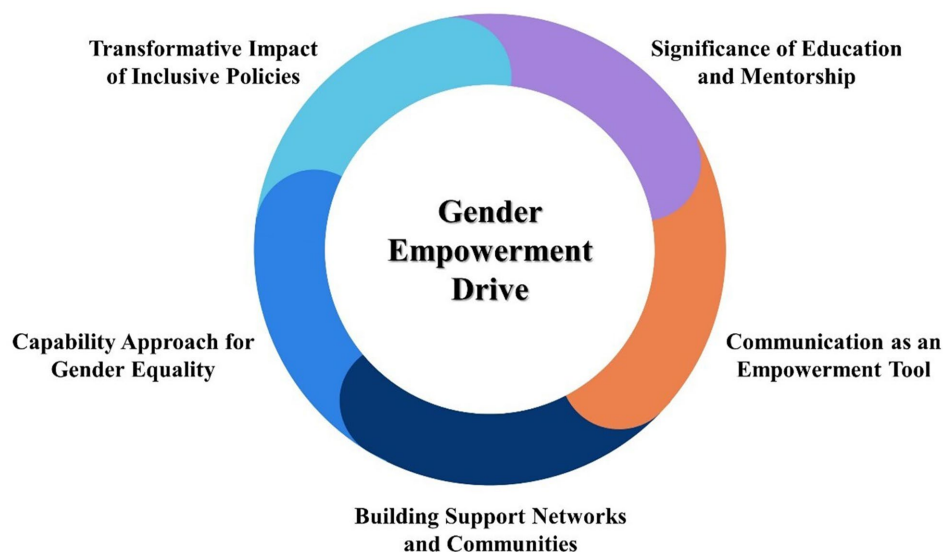


FIGURE 5  
Driving gender equity: lessons from women's empowerment in the automotive industry.

themes highlight the importance of adopting a holistic approach to achieving gender equity.

To drive gender equity and empower women in the automotive industry, investing in education, mentoring, developing communication skills, creating support networks, and inclusive policies based on capabilities approach that recognizes and strengthens the individual agency of women and men is crucial. These actions benefit women individually and contribute to social progress and social justice.

## 5 The impact of targeted educational strategies on women's empowerment in the automotive industry—a brief overview

Before the implementation of targeted educational strategies in the automotive industry, gender disparities were prevalent, with women's empowerment being limited. Studies such as [Van Engen et al. \(2001\)](#) highlighted the male-dominated nature of the industry and the hierarchical structures that favored men. However, with the introduction of educational strategies focusing on empowerment, there have been noticeable shifts. Research shows that these strategies have increased employee involvement, organizational commitment, and quality improvement ([Roslin et al., 2019](#); [Sharma and Bhati, 2017](#)). Emphasizing women's empowerment in various aspects of the industry, as indicated by [Alfaraidy \(2021\)](#), has played a significant role in closing the gender gap and promoting gender diversity in leadership positions, as suggested by [Horak and Cui \(2017\)](#). Overall, targeted educational strategies have positively impacted women's empowerment in the automotive industry, leading to improved gender

dynamics, increased participation, and a more inclusive work environment.

In addition to highlighting the positive impact of specific educational strategies on empowering women in the automotive industry, in [Figure 6](#) we emphasize some additional points of discussion supported by academic research in the field ([Naik et al., 2019](#); [Pološki Vokić et al., 2019](#); [Maier and Nair-Reichert, 2008](#)).

- Long-term sustainability. It is critical to analyze whether these changes are sustainable in the long term and if educational strategies are continuously being adapted and improved to address the changing needs of women in the automotive industry.
- Impact on organizational culture. Specific educational strategies can influence the organizational culture of automotive companies, promoting values of equity, inclusion, and diversity. It would be interesting to explore how these initiatives change the perception of women in the industry and how they are being received by employees, especially those in leadership positions.
- Remaining challenges and barriers. Despite the progress made through educational strategies, challenges and barriers exist to women's empowerment in the automotive industry. Examining what obstacles women still face regarding access to professional development opportunities, pay equality, and career advancement would be relevant.
- Results assessment. In addition to highlighting the positive aspects of women's empowerment, it is essential to conduct a comprehensive evaluation of the quantitative and qualitative outcomes of specific educational strategies. This could include measuring the increase in women's participation in leadership roles, the impact on organizational culture, and the company's perception by its employees and customers.

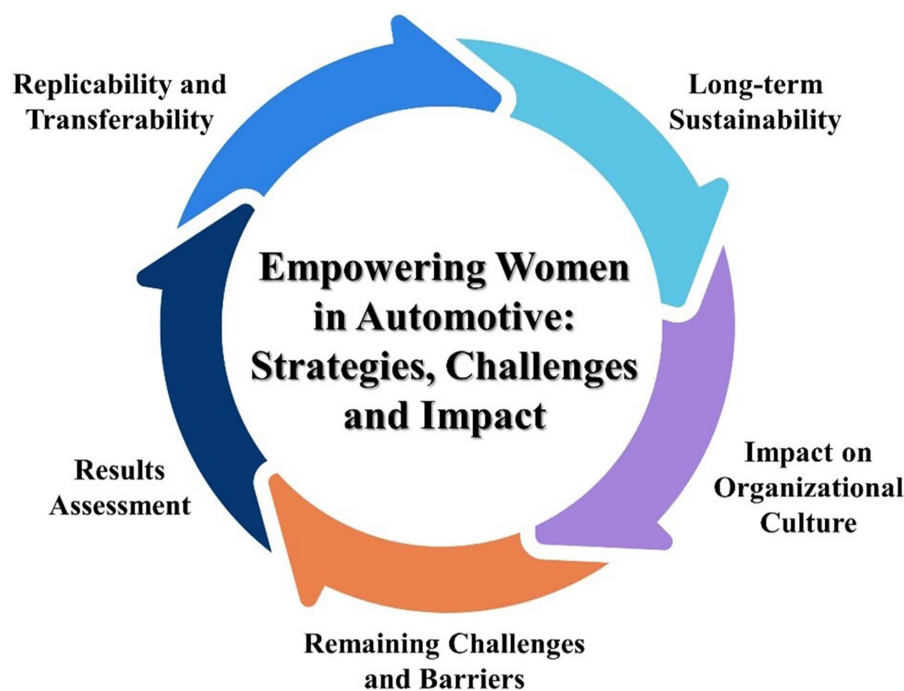


FIGURE 6  
Empowering women in automotive: educational strategies for sustainable change.

- Replicability and transferability. It is vital to consider whether successful educational strategies in a specific automotive industry context can be replicated and transferred to other sectors or regions. Identifying best practices and lessons learned could help inform future women's empowerment initiatives in different sectors and geographical locations.

Figure 6 offers a framework for evaluating the outcomes of educational strategies enacted within the automotive sector. It identifies key performance indicators, such as the representation of women in leadership roles, shifts in organizational culture, and employee satisfaction metrics, providing data-driven insights into the effectiveness of these strategies.

Implementing targeted educational strategies has significantly reduced gender disparities within the automotive industry by empowering women and increasing their representation in leadership positions. While global initiatives have offered valuable frameworks for addressing gender imbalances, successfully applying these strategies in regions like Mexico and Latin America requires careful adaptation to these areas' unique socio-cultural and economic contexts. Ensuring the long-term sustainability of these initiatives, their impact on organizational culture and their ability to tackle ongoing challenges—such as limited access to professional development and pay equity—are critical in achieving meaningful progress. Moreover, successfully replicating and transferring these strategies to different regions necessitates a comprehensive understanding of local workforce dynamics to enhance their effectiveness. By integrating global best practices with context-specific approaches and addressing these additional points of discussion, we can gain a more comprehensive understanding of the impact of educational strategies on women's empowerment in the automotive industry and work towards more significant and sustainable change in the future (Segovia-Pérez et al., 2019; Sukitsch et al., 2015; Liera and Desir, 2023) and we can foster a more inclusive and equitable automotive industry that promotes sustained gender diversity and workforce inclusivity.

## 6 Gender barriers in the automotive industry

Despite Volvo Cars' innovative project work, hailed for its creative flair reminiscent of a carnival, where standard hierarchies are momentarily upended, gender equality within this dynamic remains elusive (Styhre et al., 2005). The study in Volvo scrutinizes the gendered undercurrents of this spirited environment.

It acknowledges that, although project work is a hub for creativity and enthusiasm, it inadvertently perpetuates gender stereotypes. Women and men navigate an uneven playing field where technical and managerial roles are often divided along gender lines, echoing outdated stereotypes about aptitudes and preferences.

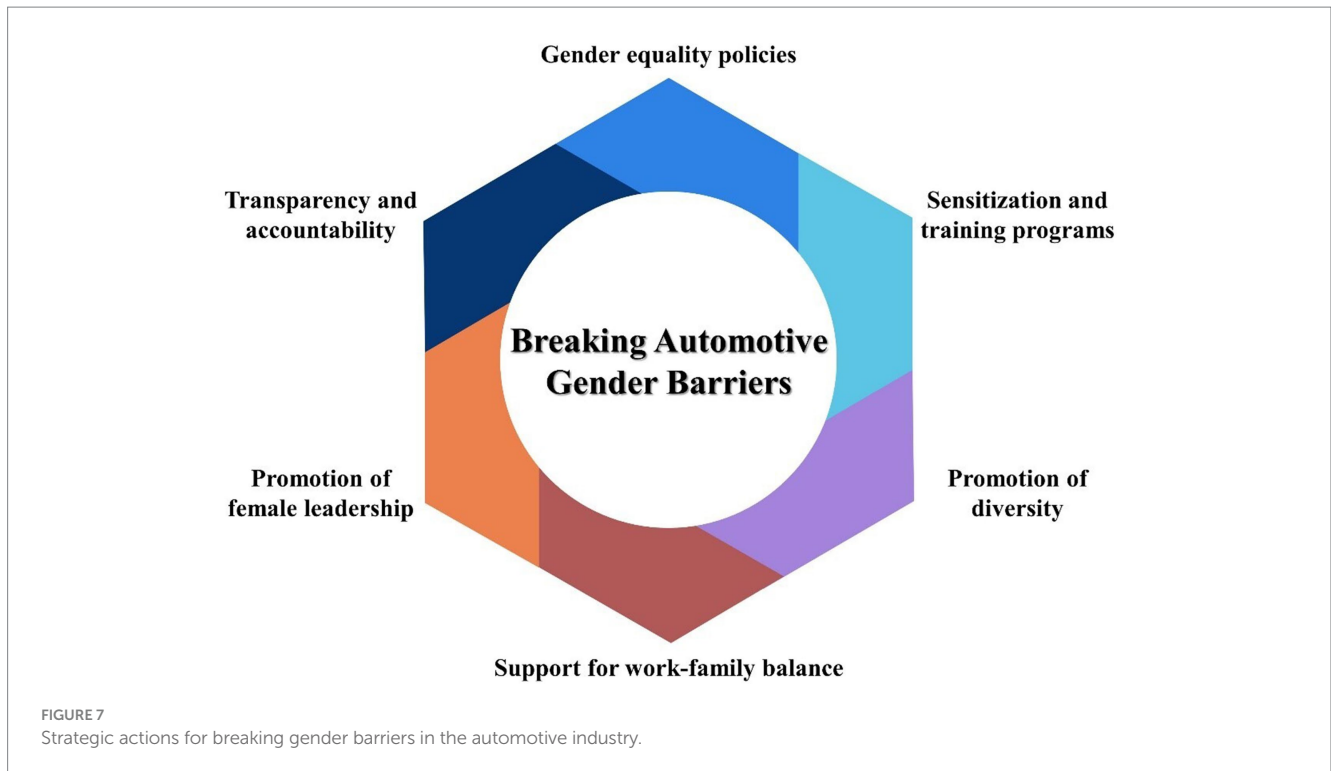
The carnival's spirit masks a deeper issue: the tenacious grip of masculine norms within the project's culture. Traits like risk-taking and competitiveness overshadow the value of collaboration and diversity, creating a workspace that inadvertently favors masculine attributes and overlooks the nuance of gender dynamics.

Furthermore, structural barriers loom large. The absence of solid institutional support for women's career trajectories, especially in senior roles, coupled with insufficient measures for work-life balance, poses significant obstacles. Despite their pivotal role in project success, women's contributions risk being marginalized or ignored, rendering their achievements invisible in the grand tapestry of corporate accomplishment.

This metaphorical carnival, while a site of temporary liberation from traditional constraints, inadvertently highlights the enduring challenges and limitations that still obstruct the path to full gender equality and inclusion.

Implementing a series of strategic actions is essential to reducing gender barriers in the automotive industry. Here are some key measures that can help address these barriers (Figure 7).

- Gender equality policies. Automotive companies must establish and adhere to solid gender equality policies that reduce discrimination and promote equal opportunity in all business areas. Sukalova and Ceniga (2021) highlight the competitive advantage of this type of policy, while Warth (2009) emphasizes the need for a combination of voluntary and legislative measures to address gender inequalities. Other studies highlight the corporate social responsibility to respect women's rights and call for a human gender perspective in the business and rights agenda (United Nations Human Rights Council, 2019; Wettstein, 2012; Ramasastry, 2015). These studies collectively support the establishment and adherence to gender equality policies that reduce discrimination and promote equal opportunity by integrating both sides to open the possibility of formulating a human rights agenda for corporations. This includes policies for fair hiring, merit-based promotions, and closing the gender pay gap.
- Sensitization and training programs. Implementing awareness and training programs for all employees, especially those in leadership and decision-making positions, is crucial. Latu et al. (2015) and Tan et al. (2020) highlight the need for leadership development programs that focus on understanding and counteracting unconscious gender biases. Bondarevskaya (2015) highlights the value of training programs in addressing gender stereotypes. Meanwhile, Lefringhausen et al. (2020) suggest that changing discriminatory behavior should be a cultural issue, not just a training issue. Together, these findings underscore the need for comprehensive and ongoing training programs that address gender stereotypes, unconscious biases, and discriminatory behaviors, thereby promoting a more inclusive and respectful organizational culture.
- Promotion of diversity. Automotive companies must actively promote gender diversity at all levels of the organization, including leadership and management positions. Azmat and Boring (2020) note that it is essential to consider the difficulties women face in advancing their careers due to barriers in the system. They also emphasize that policies, such as gender quotas, mentoring programs, and policies that support the family can help overcome these barriers. On the other hand, Garcia-Blandon et al. (2024) stated that companies must actively prioritize gender diversity, which must be led and supported by senior management. Furthermore, the article emphasizes the importance of creating an inclusive company culture that



encourages equal opportunities for all. [Velinov \(2023\)](#) highlights the importance of empowering women in the workplace through programs such as mentoring and training and organizational policies promoting gender equality. The findings indicate that a multifaceted approach is crucial to achieving gender diversity in leadership and management positions.

- Support for work-family balance. Policies and programs that support work-life balance, such as flexible schedules, paid maternity leave, on-site childcare, and remote work options ([Sabattini and Crosby, 2016](#); [Foster Thompson and Aspinwall, 2009](#); [Kossek et al., 2011](#); [Friedman, 2001](#)), are essential. Research consistently shows that these initiatives improve productivity and effectiveness, support cultural change, and create more inclusive workplaces ([Sabattini and Crosby, 2016](#)). This could help remove barriers women face due to family responsibilities and facilitate their participation and advancement in the automotive industry.
- Promotion of female leadership. Research consistently supports the importance of companies actively promoting female leadership development. Automotive companies should encourage this development through mentoring, training, and leadership skills training programs, which various studies have identified as effective strategies ([Russell et al., 2023](#); [Bonnywell, 2017](#); [Beeson and Valerio, 2012](#)). These programs can help women overcome the barriers they face in leadership roles and strengthen their skills. However, it is also essential that companies create specific opportunities for women to take on leadership roles and increase their visibility within the organization ([Beeson and Valerio, 2012](#)).
- Transparency and accountability. Companies must be transparent in their gender equality practices and accountable for results. Various research shows that transparency can lead to positive results. [Duchini et al. \(2020\)](#) and [Bennedsen et al. \(2022\)](#) found

that mandatory pay transparency can reduce the gender pay gap. This suggests that openness can lead to more equitable hiring practices. [Sharkey et al. \(2022\)](#) found that companies that reported pay parity experienced a short-term improvement in employee evaluations. [Conley and Torbus \(2018\)](#) emphasize the importance of transparency in addressing the gender pay gap, highlighting its role in raising awareness and driving action. These findings underscore the need for companies to be transparent in their gender equality practices and accountable for results.

[Figure 7](#) concentrates on identifying and addressing the barriers that inhibit women's full participation in the automotive industry. It classifies obstacles such as gender biases, limited mentorship opportunities, and challenges related to work-life balance, and proposes targeted interventions to alleviate these issues.

By taking concrete actions in these areas, automotive companies can significantly contribute to eliminating or reducing gender barriers in the industry, promoting a more equitable, inclusive, and diverse environment for all employees.

## 7 The intersection of gender differences and equality

Despite the improvements made through various initiatives, the literature review reveals enduring challenges and limitations in pursuing gender equality. The research probes into the intricate web of gender differences in basic skills and personality and how these differences align—or clash—with gender equality indicators.

The controversy at the heart of this dialogue is whether societies known for championing gender equality narrow or widen

gender disparities. This problem calls for an integrated analysis that scrutinizes a spectrum of theories—from social-role to evolutionary—that forecast diverging patterns of gender differences in egalitarian contexts. The empirical evidence drawn from the PISA and TIMSS assessments scrutinizes gender variations in academic prowess and personality constructs, such as the Big Five and HEXACO. Yet, this research has its hurdles: measurement issues, confounding variables, and the perennial specter of publication bias.

Moreover, the so-called “gender equality paradox”—the more egalitarian societies, the more pronounced gender differences persist—suggests a complex gene–environment–culture interplay. This paradox underscores the fact that societal attitudes, ingrained stereotypes, and systemic hurdles impede the path to full equality and inclusion. These factors reflect a nuanced reality where individualism, self-expression, and gendered preferences and choices remain entangled within the broader societal fabric.

Based on the importance of comprehensive analysis of various studies and empirical data to understand gender differences in academic abilities and personality constructs in contexts of gender equality, we propose several areas of focus for future studies (Figure 8).

Figure 8 illustrates how successful educational strategies can be scaled and tailored across various regions, including Mexico and Latin America. It emphasizes the importance of contextualizing global best practices to meet region-specific challenges, ensuring that interventions remain culturally and economically relevant.

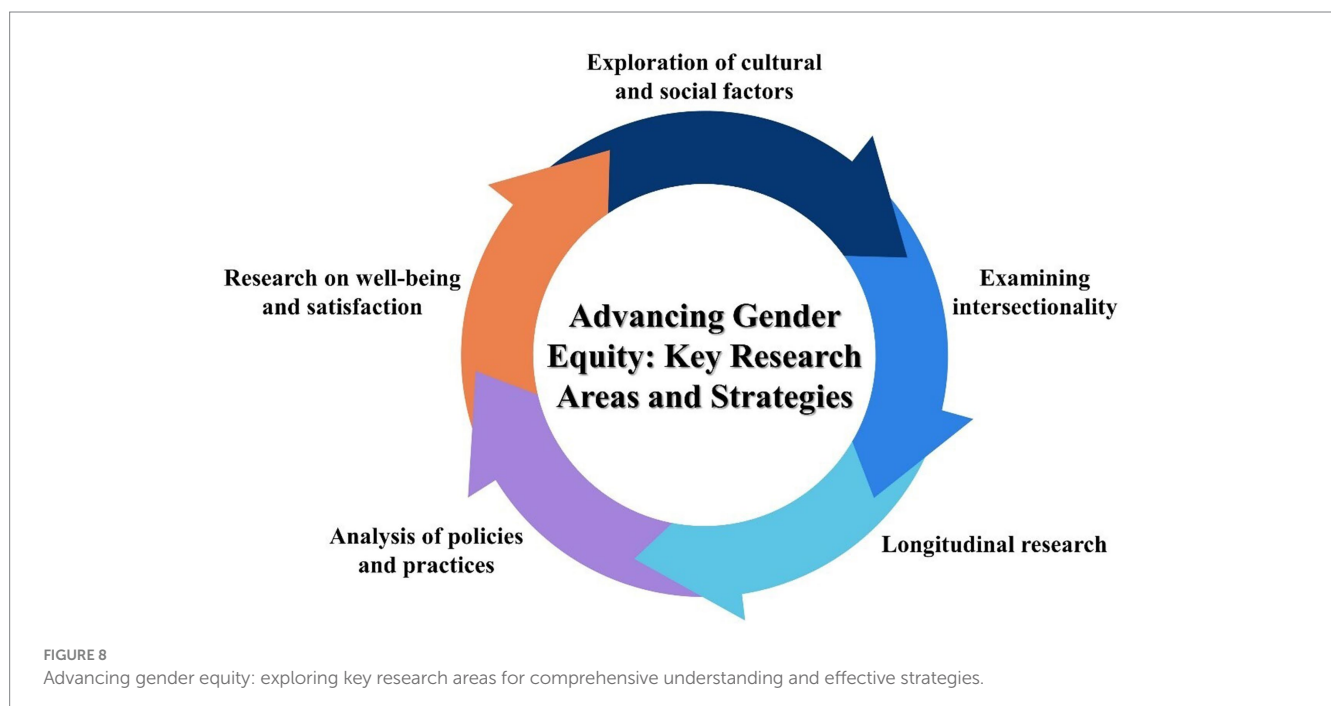
Elaborating on the key research areas and strategies for advancing gender equity, we have the following.

- Exploration of cultural and social factors. Investigating how cultural and social norms influence gender perception and

the educational and professional opportunities of men and women. This may include comparative studies across different cultures and societies to understand better differences and similarities in gender disparities (Andersen and Smith, 2022).

- Examining intersectionality. Investigating how other factors such as race, social class, sexual orientation, and gender identity interact with gender to influence individuals’ educational and occupational experiences. Understanding how these diverse identities intersect can provide a more comprehensive view of the inequalities faced by certain groups (Zimmermann and Seiler, 2019).
- Longitudinal research. Conducting long-term studies to examine how gender disparities in academic abilities and professional trajectories change over time and how policies and practices may affect these trends (Bedard et al., 2021; Huang et al., 2020).
- Analysis of policies and practices. Evaluating the impact of specific policies promoting gender equality in education and the workplace. This may include analyzing quota policies, mentoring programs, gender awareness initiatives, and measures to address gender bias in selection and promotion (Voorspoels and Bleijenbergh, 2019; Stromquist, 2013).
- Research on well-being and satisfaction. Exploring how gender differences in academic abilities and professional roles impact emotional well-being, job satisfaction, and quality of life for men and women. Understanding these dimensions can help inform policies and practices that promote a more equitable and healthier environment for all (Brown and Duan, 2007; Bilimoria et al., 2006; Machado-Taylor et al., 2014).

Addressing these research areas can help future studies gain a more comprehensive understanding of gender disparities and



develop effective strategies to promote gender equity in all areas of society.

## 8 Future directions and policy implications

Amid the advancements heralding gender equality in the automotive industry, we must acknowledge the multifaceted challenges that continue to regulate full inclusion and parity. Traditional gender roles and implicit biases form an invisible yet formidable roadblock, often dictating career trajectories and influencing workplace dynamics in subtle yet significant ways. Persistent stereotypes and double standards serve as additional speed bumps on the path to equality, questioning women's capabilities and leadership styles in a field dominated by men.

Despite strides toward bridging the gender pay gap, the chasm remains, fed by entrenched systemic issues like occupational segregation and negotiation disparities. The scarcity of women in leadership roles points to a glass ceiling that refuses to shatter completely, while work-life balance and unconscious bias present persistent detours. The road to success is further complicated for women who navigate multiple identities, where intersectionality reveals compounded layers of challenge and discrimination.

Legal frameworks and policies have not yet caught up with the need for robust protections against workplace discrimination and unequal pay. Enforcement is lackluster, leaving many cases of injustice in the shadows, unaddressed due to fear of retribution. Cultural shifts are imperative, requiring a change in mindset and the active engagement of men as allies to uproot harmful norms and practices.

The journey ahead calls for a comprehensive landscape mapping through gender-disaggregated data and intersectional metrics, ensuring no one is left behind in policy formulations. Future research should focus on identifying the choke points and accelerators of gender equality, while education strategies must be recalibrated to drive a cultural shift in perspectives. Policy actions should be laser-focused on closing gaps, enforcing legal protections, and facilitating international collaborations to turbocharge women's empowerment. The ignition of change in the automotive industry is underway. Still, it requires a continuous fueling of efforts, policy reform, and global cooperation to sustain momentum and drive forward the agenda of women's empowerment to its full potential.

Educational institutions play a fundamental role in promoting gender equity in the automotive industry. They can achieve this by developing inclusive academic programs that specifically address topics related to gender equality, female leadership, and diversity in the automotive industry. These programs may include specialized courses, workshops, and seminars that educate students about the importance of gender equity and provide them with the necessary skills to tackle challenges and seize opportunities in a diverse workplace. Additionally, as educational institutions, they can promote female role models in the automotive industry through events, conferences, and panel discussions. Inviting women leaders in prominent roles within the industry to share their experiences and advice can be incredibly motivating for students, showing them that they have a legitimate place in the industry and can reach similar heights. Encouraging female participation in fields related to science, technology, engineering, and mathematics from a young age is also

essential for increasing gender diversity in the automotive industry. This may involve creating extracurricular programs, summer camps, and educational activities specifically designed to engage girls and young women in STEM and demonstrate the exciting career opportunities available in the industry. Furthermore, establishing collaborations and partnerships with automotive companies to offer students practical opportunities, internships, and research projects can provide them with invaluable real-world experience and help them develop relevant industry skills. This can also open doors for future employment opportunities once students graduate. Finally, researching and analyzing gender barriers in the automotive industry can help identify areas where improvements are needed and propose practical solutions. By collaborating with industry experts, students, and other researchers, innovative ideas and policies to promote gender equality and inclusion in the automotive industry can be generated, laying the groundwork for significant and lasting change.

## 9 Conclusion

The automotive industry is at a crossroads, influenced by rapid technological innovations, environmental imperatives, and shifting consumer preferences. These developments necessitate a skilled and continuously evolving workforce, underlining the importance of education and training, particularly for women. Historically, women have encountered significant barriers in this sector, ranging from limited access to crucial roles to challenges climbing the professional ladder. Despite these obstacles, concerted education and training initiatives have begun to turn the tide, offering women better opportunities for involvement and advancement in the automotive industry.

The industry has witnessed a notable increase in women's participation and success by adopting targeted educational strategies, such as specialized training programs and mentorship initiatives. For instance, programs that enhance women's technical skills and leadership capabilities have shown promising results, with a gradual increase in the number of women holding key positions within the industry. This progress highlights the potential of focused educational efforts in Women's empowerment leads to improved workplace performance and inclusivity.

Based on the challenges and proposed solutions in other geographical regions to address the gender gap, promote equality in the workplace, and empower women in the automotive industry, we propose some guidelines, legal frameworks, and policies that could be implemented in Mexico and other regions of Latin America.

- Implement and strengthen laws and regulations reducing gender discrimination in the workplace and ensuring equal pay for equal work or work of equal value. This would include effectively enforcing existing laws and introducing new legislative provisions where necessary.
- Establish measures to promote salary transparency, such as mandatory disclosure of salary data by gender and position in all companies. This will allow for more effective identification and addressing of wage disparities.
- Implement policies that facilitate a better balance between work and personal life, such as equitable parental leave, flexible

schedules, and childcare facilities, which will help eliminate barriers women face in their careers.

- Develop training and awareness programs targeting both employers and employees, aiming to eliminate gender biases and promote an inclusive work culture that values and supports gender diversity at all organizational levels.
- Foster collaboration among government, businesses, civil society organizations, and academia to develop and implement effective policies and programs that promote gender equality and women's empowerment in the automotive industry.
- Invest in research and data collection disaggregated by gender to understand better the causes and consequences of gender disparities in the automotive industry. This will enable the development of more effective policies and the monitoring of their impact over time.

By implementing these guidelines and policies, Mexico and Latin America can move towards a more equitable and empowering work environment for women in the automotive industry, following the example of best practices and experiences from other geographical regions. In conclusion, the journey towards gender equality and inclusion in the automotive sector is ongoing. The need for continuous education and adaptive training remains paramount in empowering women to meet the challenges and seize the opportunities of this evolving sector. As we move forward, it is crucial to maintain momentum through research, supportive policies, and international collaboration, ensuring that the drive for women's empowerment in the automotive industry reaches its full potential, thereby enriching the sector and society.

## Author contributions

AZ-P: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft. FM-A: Formal analysis, Validation, Visualization, Writing – original

draft. SP-S: Conceptualization, Investigation, Methodology, Validation, Writing – review & editing. AD: Conceptualization, Funding acquisition, Project administration, Supervision, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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