

From Linear to Circular: Role of Business Strategy for Green Transition in Mexican Automotive Industry

Sandra Yesenia Pinzón-Castro, Gonzalo Maldonado-Guzmán[✉],
Rubén Michael Rodríguez-González*[✉]

Departamento de Mercadotecnia, Centro de Ciencias Económicas y Administrativas, Universidad Autónoma de Aguascalientes, Aguascalientes, Mexico

Email: *Michael_lamborgini@hotmail.com, Sandra.Pinzon@edu.uaa.mx, gonzalo.maldonado@edu.uaa.mx

How to cite this paper: Pinzón-Castro, S. Y., Maldonado-Guzmán, G., & Rodríguez-González, R. M. (2025). From Linear to Circular: Role of Business Strategy for Green Transition in Mexican Automotive Industry. *American Journal of Industrial and Business Management*, 15, 949-973.
<https://doi.org/10.4236/ajibm.2025.157045>

Received: May 13, 2025

Accepted: July 11, 2025

Published: July 14, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

The adoption of the circular economy is considered in literature as one of the essential strategies for improving both sustainable performance and green strategies. However, despite the importance and various benefits of adopting circular economy practices, both in manufacturing companies and in society in general, under this context, and to improve our understanding of the factors that facilitate the transition from a linear economy to a circular economy, this study aims to fill this gap in the literature and explore the effects of the circular economy on the adoption of green strategies from a sustainability perspective, for which a survey was distributed to a sample of 300 manufacturing companies in the automotive industry in Mexico, and the proposed research model was validated through the use of the PLS-SEM. The results obtained suggest that circular economic practices have a positive impact on sustainable performance, as well as green strategies. Likewise, green strategies have a positive impact on sustainable performance but also act as a vehicle in the relationship between the circular economy and sustainable performance.

Keywords

Circular Economy, Green Business Strategy, Green Transition, Sustainable Performance

1. Introduction

In the last two decades, the scientific and academic community, environmental defenders, specialists, businessmen and public administration have shown little concern about global environmental problems (Bhat et al., 2024) and, consequently,

most manufacturing firms around the world do not prioritize the development of goods that are beneficial for the environment and sustainability (Zhang et al., 2020; Ramzan et al., 2021). However, there is currently an effort by researchers, academics, consultants, environmental advocates, and entrepreneurs to try to identify the basic factors that contribute to environmental failure (Bhat et al., 2024), particularly those related to high water consumption, emission of pollutants into the air, the release of hazardous substances (Sadiq et al., 2022; Usman et al., 2022; Huang et al., 2022), and climate change (Bakos et al., 2020).

One of the strategies normally used by manufacturing firms to solve this problem is the recycling of urban solid waste and eliminating hazardous materials to reuse them in industrial production processes (Ezeudu et al., 2021; Bui et al., 2022). This strategy improves substantially when companies adopt circular economy (CE) practices, which converts industrial waste generated in a linear economy into valuable materials through regeneration, restoration and renewal (Barnabè & Nazir, 2022; Salesa et al., 2022), which implies a transition from a linear economy model that considers that available resources are abundant and can be eliminated after use (Nowicki et al., 2020; Roberts et al., 2022), to a CE model that increases the life cycle of products and identifies new opportunities and green business strategies (Wasserbauer et al., 2022; Pacheco et al., 2024).

As a consequence, the reconfiguration of the linear economy models that are applied in various manufacturing firms (based on take-make-use-eliminate) (Mendoza et al., 2022), towards CE models, could drive the creation of a green business model that takes advantage of business competitive advantages (e.g. reduction in the amount of materials used and industrial solid waste generated), and the significant reduction of risks (e.g. less dependence on natural resources) (Bocken et al., 2021), which could improve firm economic and sustainable performance (Han et al., 2020; Velenturf & Purnell, 2021). However, there are few studies published in the literature that relate CE and green business strategy (GBS), from a sustainability perspective (Pacheco et al., 2024), which is why researchers and academics need to guide their future studies in providing robust empirical evidence of this link (Bhat et al., 2024), particularly in developing countries (Pacheco et al., 2024).

Thus, the objective of this study is the analysis and discussion of the effects that CE exerts on both GBS and sustainable performance (SP) of manufacturing firms in the automotive industry. To achieve this objective, a study was carried out in manufacturing firms in Mexican automotive industry, using a sample of 300 companies and estimating the model by applying the statistical technique Partial Least Squares Structural Equation Modeling (PLS-SEM), with the use of SmartPLS 4.0 software (Ringle et al., 2024). Furthermore, it is important to establish that the analysis of manufacturing firms in the automotive industry is interesting, in one hand, generates 15% of the total cost of environmental depletion and degradation in Mexico (INEGI, 2021), and, in other hand, is also an economic base with an average annual increase of 10% in value-added over the past 5 years, making it the

most important economic sector in Mexico (INEGI, 2021).

The results obtained in this study provide robust empirical evidence that establishes a significant positive relationship between CE, both in SP and GBS, as well as the effects of GBS on the SP in manufacturing firms in the automotive industry. Additionally, this study contributes to filling the gap in the literature on the link between CE and GBS, from a sustainability perspective (Bhat et al., 2024), and by providing robust empirical evidence on the relationship existing between CE and GBS in manufacturing firms in the automotive industry of a developing country, as is the case of Mexico (Pacheco et al., 2024).

2. Literature Review

CE can be defined as an economic system that seeks to maintain the value of products, materials, and resources in the economy for as long as possible, minimizing waste generation and the extraction of natural resources (Nowicki et al., 2020). This approach is based on three fundamental principles: 1) Designing without waste or pollution from the beginning of the production process; 2) Keeping products and materials in use through closed cycles; 3) Regenerating natural systems, allowing resources to be restored rather than depleted (Roberts et al., 2022). This model focuses not only on waste management, but also on transforming the way we design, produce, and use goods, involving changes in business culture, technological innovation, and consumer habits.

2.1. Circular Economy and Sustainable Performance

CE model is totally opposite to the linear economy model that prevails in several manufacturing firms around the world (Pacheco et al., 2024), which considers that the availability of resources is abundant in all companies for their use in the production systems of goods, which can be eliminated after use (Prieto-Sandoval et al., 2018; Nowicki et al., 2020; Roberts et al., 2022). Assuming the existence of a linear economic model in all companies, the world economy could lose between 3 and 6 trillion dollars by 2030 due to the scarcity of natural resources, which would imply not only an interruption in the supply chain and the increase in raw material prices (Lacy & Rutqvist, 2015), but also a significant decrease in the level of SP (Nyambuu & Semmier, 2023; Zou et al., 2023).

In this context, CE is emerging in literature as one of the most important initiatives in the adoption of ecological solutions, to improve both the supply chain and SP of manufacturing firms (Sawe et al., 2021). However, for the implementation of the CE to have the expected results, it is essential that governments, policymakers, companies, researchers, and academics orient their studies towards the relationship of CE with SP, which is far from clear (Pacheco et al., 2024), which implies that all actors involved directly and indirectly with the CE now have to do so also with sustainability in order to take advantage of the potential of CE to address the problems of global society (Reike et al., 2018), and align the vision of the CE with GBS of manufacturing firms (Niero & Rivera, 2018).

Recently, some developing countries in Latin America have implemented some CE practices (Rovanto & Finne, 2022). Thus, for example, in 2016 in Chile, CE legislation was established to regulate the negative impacts of industrial activity and encourage companies to recycle their industrial solid waste (Chile, 2016). In 2010 in Brazil, the national solid waste law 2.305/010 was established, which minimized the generation of industrial solid waste (Brazil, 2010), while in Mexico in 2022, the Circular Economy Law was approved, which aims to reduce industrial solid waste (Senate of the Republic, 2022). However, despite these efforts, developing countries still have a long way to go in terms of the adoption and application of CE practices and their effects on SP (Pacheco et al., 2024).

In recent studies, Rodríguez-Espíndola et al. (2022) found that the application of CE practices in manufacturing firms in Mexico, like substituting non-recyclable materials with renewable or biodegradable inputs, significantly enhances economic performance; while Rodríguez-González et al. (2022) found that the adoption of CE generated an increase in the financial performance of manufacturing firms in Mexican automotive industry. Maldonado-Guzmán and Garza-Reyes (2023) provided empirical evidence of the link between CE and SP in Mexican manufacturing firms. Consequently, as highlighted by the literature that sustainable strategies in manufacturing firms can potentially benefit the CE solutions (Mishra et al., 2022). Thus, considering the information previously presented, it is possible to propose the following research hypothesis.

Even with all the proven benefits that CE provides to companies, there are difficulties and problems that must be mitigated for its implementation. Some of these problems include: high initial costs which can affect short-term profitability (Rovanto & Finne, 2022); complexity in redesigning processes and products; lack of common standards or certifications; an unprepared supply chain; a lack of suppliers that meet circular criteria; logistical challenges in recovering and reusing products or materials (Kaddoura & Nagel, 2019); resistance to change a traditional business culture focused on linear production; difficulty in changing internal and external mindsets (employees, consumers, investors); lack of infrastructure and collection systems; sort, reuse, or recycle used products; challenges in traceability and data management (Das & Bocken, 2024); and the need to control and track materials throughout the product lifecycle.

H1: The greater implementation of the circular economy, the greater sustainable performance.

2.2. Circular Economy and Green Business Strategy

In the last decade, the need for the scientific and academic community to contribute to mitigating climate change has increased (Das & Bocken, 2024), particularly because about 17% of the Amazon rainforest has been lost in the last 50 years due to deforestation and land use change (Barredo, 2021), and 69% of the wildlife population has been lost due to climate change and industrial pollution (WWF, 2022). These changes are causing an increasing deterioration of climate change globally

(Richardson et al., 2023), but even more so for the 1.4 billion people who live in highly vulnerable areas, and whose livelihoods and food are at risk (IPCC, 2022). The concept of CE is considered in the literature as a new and promising social perspective and business paradigm, which can help combat these problems (Das & Bocken, 2024).

From this perspective, more manufacturing firms have set the adoption of CE as their objective, and as it is implemented in industrial activities, the incorporation of GBS becomes necessary to comply with environmental regulations (Bocken & Konietzko, 2022, 2023), which will allow companies to save costs and resources (Ritala et al., 2018). However, a recent study found a global reduction in the circularity of resources, going from 9.1% in 2018 to 7.2% in 2023 derived from the increase in resource consumption, which suggests that the implementation of CE in manufacturing firms it should emphasize reductions, regeneration, and redistribution of resources (GBS), to counteract this negative trend that is observed globally (Circle Economy, 2024).

The business strategy of reducing the use of all resources is essential, which can be achieved through the implementation of CE through increasing the useful life of products (Kaddoura & Nagel, 2019; Bocken et al., 2022); while the business strategy of redistribution is necessary for the transition towards a long-term circular society, which is oriented on environmental and social prosperity, rather than economic prosperity (Bocken & Short, 2021; Jaeger-Erben et al., 2021). Finally, the business strategy of regeneration is essential given the damage that has been caused to the planet (Persson et al., 2022; Richardson et al., 2023). To achieve these strategies, the adoption of CE is necessary, since commonly the CE does not integrate elements of biodiversity regeneration, inclusive development of nature and social justice (Bosschaert, 2022), but it does have a positive effect in GBS (Vlasov, 2021; Muñoz & Branzei, 2021; Slawinski et al., 2021).

Recent studies have found a close relationship between CE and GBS focused on resource regeneration (e.g. Hahn & Tampe, 2021; Konietzko et al., 2023; Das & Bocken, 2024), they have also been published in literature some cases of companies that have applied regenerative GBS (e.g. Hahn & Tampe, 2021; Konietzko et al., 2023; Gualandris et al., 2024), including some examples of global firms (e.g. Ben & Jerry designating Patagonia as its main shareholder, and Timberland allocating a significant amount of resources to improve environmental management for the benefit of its workers) (Das & Bocken, 2024). However, more empirical evidence is needed in the literature on the relationship between CE and GBS, and the effects of this link on the net profits and SP (Hawken, 2021). Thus, considering the information previously presented, the following research hypothesis is proposed.

H2: The greater implementation of the circular economy, the greater implementation of the green business strategy.

2.3. Green Business Strategy as Mediating Variable

Global warming has already reached a level of 1.2°C and, according to recent pre-

dictions, an increase of between 2.7°C and 3.2°C is expected by the end of this century (IPCC Working Group III, 2022), this increase being higher to 1.5°C set by the Paris Agreement to try to keep humanity and the planet within a safe environment (Sohns et al., 2023). However, recent studies published in the literature recognize the importance of guiding research in the analysis of business sustainability, since this would improve global sustainable development (e.g., Belas et al., 2021; Sohns et al., 2023), and particularly in the analysis of GBS (González et al., 2019; Couckuyt & Van Looy, 2020), since this would significantly improve the level of SP of manufacturing firms (Huang et al., 2024).

However, even though various manufacturing firms have increasingly implemented green and sustainability strategies, global sustainability indicators have not improved significantly (United Nations, 2022), particularly because there is a total disconnect between business actions and environmental results (Dyllick & Muff, 2016), which is reflected in the low level of SP (Huang et al., 2024), therefore it is necessary that the government, companies, researchers, and academics direct their efforts in providing evidence of sustainability actions (Vásquez et al., 2021). Furthermore, not only should the sustainability strategies of large manufacturing firms be analyzed, but also the green strategies in small and medium-sized companies, even when individually large companies generate more pollutant emissions than small and medium-sized companies (Cantele & Zardini, 2019; Al-Hakimi et al., 2022).

Additionally, the adoption of GBS and the creation of innovative manufactured products not only mitigate the negative impact on the environment generated by manufacturing firms, but also increase social, financial benefits, and SP (Bhat et al., 2024). However, the exacerbated consumption of resources, such as electricity, drinking water, and virgin raw materials in the various industrial activities of manufacturing firms, is becoming a substantial priority for the generation of improvement initiatives by scientific, academic, and business communities (Maciel, 2017; González et al., 2019; Couckuyt & Van Looy, 2020). Thus, GBS allows manufacturing firms to properly manage their processes, adding sustainability to traditional measures of company performance (van der Aalst et al., 2023; Sohns et al., 2023).

Recent studies published in the literature have analyzed and discussed whether GBS can really increase SP (e.g. Wang et al., 2022; Huang et al., 2024), however, the results obtained continue to generate uncertainty and more research are required in this area that provides robust empirical evidence (Fiedler et al., 2021; Jona & Soderstrom, 2022; Chua et al., 2022; Lee et al., 2022). To provide robust empirical evidence, Ren et al. (2022) found that the adoption of GBS allowed a significant improvement in financial and SP, while Khanra et al. (2022) found that the implementation of GBS increases the competitive advantages and improves SP of manufacturing firms. Similar results were obtained by Huang et al. (2024) by finding that the application of GBS improved the SP of companies. Thus, considering the information presented in the previous paragraphs, it is possible to

propose the following research hypothesis.

H_B: The greater implementation of green business strategy, the greater sustainable performance.

The scientific and academic community commonly contributes to the evolution of knowledge through the exploration of various theoretical models, which allow improving the deterioration that the environment and global climate change are suffering (Bhat et al., 2024), among which stand out green human resources management practices (Singh et al., 2020), green supply chain initiatives (Wu & Kung, 2020), green innovation (Tolliver et al., 2020; Ke et al., 2022; Wan et al., 2022), green bonds (Singh et al., 2020), and GBS (Huang et al., 2024; Castillo-Esparza et al., 2024). If manufacturing firms considered environmental issues and their impact on climate change, it could generate a competitive advantage and financial performance (Bhat et al., 2024), particularly since it is global manufacturing firms that generate the greatest negative impact on the environment (Pacheco et al., 2024).

Additionally, manufacturing firms have a direct impact on the environment through air and water pollution, the depletion of natural resources, and climate change (Usman & Makhdum, 2021; Jahanger et al., 2022a; Ramzan et al., 2022). Furthermore, manufacturing firms generate various industrial waste that pollutes the air, water, and soil which poses a significant risk to ecosystems (Qader et al., 2021; Usman et al., 2021; Yang et al., 2021; Balsalobre-Lorente et al., 2022; Ke et al., 2022), therefore the adoption of both CE practices and GBS by manufacturing firms, it is becoming an essential need, not only to try to reverse these negative effects that have been generated to the environment (Rodríguez-González et al., 2022), but also to improve its level of SP (Castillo-Esparza et al., 2024).

In this sense, in the literature it has been shown that GBS not only reduce negative impacts on the environment (Das & Bocken, 2024), but also play a significant role when they act as a mediating variable that significantly improves the level of SP of manufacturing firms (Bhat et al., 2024), particularly when related to CE practices (Pacheco et al., 2024). Therefore, it is essential that manufacturing firms implement green strategies, since this, in addition to providing proportional economic incentives (Qiu et al., 2020), will also help them obtain sustainable benefits (Usman & Hammar, 2021; Yang et al., 2022), as well as to increase their level of SP (Huang et al., 2024), particularly when it acts as a mediating variable between EC and SP (Bhat et al., 2024).

Recently, the scientific, academic, and business community has been paying more attention to the analysis and discussion of the effects of the implementation of GBS and environmental policies by manufacturing firms (e.g., Zhou et al., 2019a, 2019b; Jahanger et al., 2022b; Usman & Balsalobre-Lorente, 2022), as well as its relationship with CE practices (Pacheco et al., 2024; Das & Bocken, 2024), and its mediating role between EC and SP (Bhat et al., 2024). However, the results currently found continue to raise doubts, which is why it is necessary for researchers and academics to adequately prioritize the analysis of the effects of GBS on SP

when it acts as a mediating variable (Bhat et al., 2024), especially in relation to CE practices in developing countries (Pacheco et al., 2024). Thus, considering the information presented in the previous paragraphs, it is possible to propose the following research hypothesis.

H4: The green business strategy plays a mediating role between circular economy and sustainable performance.

Figure 1, presented below, shows the formulation of the four hypotheses in the research model.

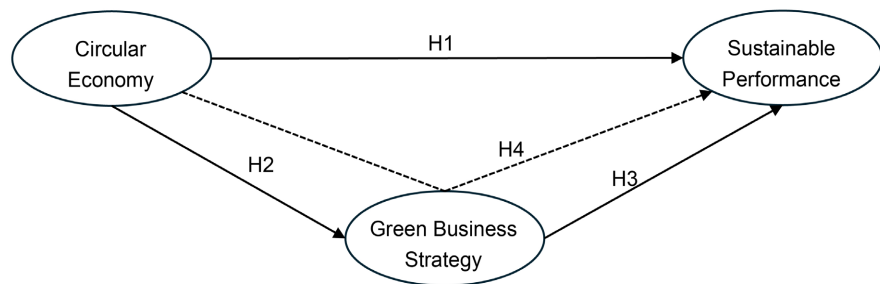


Figure 1. Research model.

3. Methodology

To validate the four hypotheses established in the research model, a study was carried out in manufacturing firms in the automotive industry in Mexico. Firstly, a “Business Panel” was held with the participation of 3 academics from the area of innovation, 2 public administration officials related to business financing, and 5 directors of companies in the automotive industry. The results obtained in this phase allowed us to design the survey used to collect the information, which was applied through a pilot test to 10 manufacturing firms in the automotive industry before its application to the total sample, making minor adjustments to the writing, appearance, and spelling. This method is essential to ensure validity when questionnaires are self-administered or contain self-developed scales (Hair et al., 2016).

3.1. Sample and Data Collection

The data was collected through the directory of manufacturing firms that were registered in the Mexican Association of the Automotive Industry, having a record of 916 companies in January 2021, belonging to different local, regional, national, and international business chambers, for which the study did not focus on a particular business association. The surveyed companies were selected through simple random sampling with a maximum error of $\pm 5\%$ and a reliability level of 95%, sending the survey to 600 companies, obtaining a total base of 300 surveys and a response rate of 50%. The application of the surveys was carried out during the months of January to June 2021, and was distributed to the company managers, who sent them to the corresponding departments to be completed. Managers identified people with the appropriate experience to answer the different groups

of questions in the survey delivered (Kuo & Chang, 2021).

Additionally, a procedure was implemented to avoid biased responses in the survey, which consisted of informing the managers of the anonymous treatment of their correct or incorrect answers, so they should answer each of the questions posed in the survey honestly (Podsakoff et al., 2003). This protocol aims to reduce as much as possible the possibility of obtaining lenient responses that were socialized among the companies that were surveyed. Therefore, the common method bias was analyzed considering Harman's single factor (Podsakoff & Organ, 1986), which states that the factor analysis should have a common factor that explains at least 40% of the total variance. In this sense, the relationships between the variables considered in the research model of this study did not occur due to common method variance.

3.2. Variables and Analysis

To identify the most appropriate scales for measuring CE, GBS, and SP an exhaustive review of the literature was carried out, considering the scale of Ormazabal et al. (2018) for the measurement of CE, who considered that CE can be measured through 8 items, and it is an appropriate scale for this study because it was used in the Spanish automotive industry. To measure GBS, the scale of Banerjee (2002) was used, which considered that GBS can be measured through 7 items. Finally, to measure SP, D'Amato et al. (2017) scale was used, which measured SP using 7 items. All items of the three scales were measured using a 5-point Likert-type scale with 1 = Strongly Disagree to 5 = Strongly Agree as limits.

Also, the PLS-SEM statistical technique was used since this study is based on a composite model (Sarstedt et al., 2016; Rigdon et al., 2017), using the SmartPLS 4.0 software (Ringle et al., 2024). Likewise, composite indicators were used that are essentially the operational definition of the emerging construct that mediates all its effects in the research model of this study (Henseler et al., 2015; Hair et al., 2021), particularly because these types of indicators do not have an error term, unlike what happens with models of causal formative indicators. In this sense, composite indicators generally share the same results even when they are not unidimensional and do not share a conceptual unit (Henseler, 2017), which is why composite indicators can represent different aspects related to the concept. Table 1 shows the results obtained from the application of PLS-SEM, and it is observed that the factor loadings of all the items of the three measurement scales are higher than the value of 0.6 recommended by Hair et al. (2019).

Table 1. Measurement model assessment.

Indicators	Constructs	Factor Loads (<i>p</i> -value)
	Circular Economy (CE)	
	Cronbach's Alpha: 0.949; Dijkstra-Henseler's rho (ρ_A): 0.950; CRI (ρ_c): 0.959; AVE: 0.740	
CE1	The firm regularly applies environmental criteria in the purchasing events and selection of suppliers.	0.898 (0.000)

Continued

CE2	The firm has established environmental criteria to reduce the consumption of raw materials, water or energy in the design and production of its products.	0.903 (0.000)
CE3	The firm regularly uses components or raw materials in the production of its products that are biodegradable.	0.901 (0.000)
CE4	Some of the components or raw materials used in the production of the products are reused, recycled or remanufactured.	0.879 (0.000)
CE5	The firm regularly uses renewable energy for the recovery and use of waste.	0.874 (0.000)
CE6	The firm regularly uses some treatments (filtration, etc.), to expand the use of industrial resources such as oils, acids, lubricants, etc.	0.824 (0.000)
CE7	The company regularly recovers the products that its customers no longer use	0.813 (0.000)
CE8	The company regularly sells waste and industrial materials that it no longer uses (chemicals, oils, packaging, plastics, etc.).	0.781 (0.000)
Green Business Strategy (GBS)		
Cronbach's Alpha: 0.965; Dijkstra-Henseler's rho (ρ_A): 0.966; CRI (ρ_C): 0.971; AVE: 0.828		
GBS1	It has recently incorporated environmental activities into its strategic planning processes.	0.899 (0.000)
GBS2	Quality control includes reducing the environmental impacts of your products and production processes.	0.920 (0.000)
GBS3	It strives to align its environmental objectives with the organization's other objectives.	0.899 (0.000)
GBS4	It has a firm social commitment to developing products and processes that minimize the impact on the environment.	0.917 (0.000)
GBS5	Environmental protection is one of the essential objectives that guide the organization's business strategy.	0.923 (0.000)
GBS6	Environmental activities are regularly considered when developing new products.	0.933 (0.000)
GBS7	It regularly develops products and processes that minimize the negative impact on the environment.	0.877 (0.000)
Sustainable Performance (SP)		
Cronbach's Alpha: 0.935; Dijkstra-Henseler's rho (ρ_A): 0.938; CRI (ρ_C): 0.947; AVE: 0.720		
SP1	The company's activities enable the transition to a low-carbon economy.	0.774 (0.000)
SP2	The company's activities protect and/or restore the environment by focusing on environmental quality aspects and improving resource efficiency.	0.829 (0.000)
SP3	The company's activities help maintain, protect, transform, and/or strengthen the economy.	0.845 (0.000)
SP4	The company's activities help to protect, transform, strengthen, and/or develop society, human well-being, and/or employment.	0.872 (0.000)
SP5	During the last 3 years, the company has invested in the integration of environmentally friendly technology to improve business activities.	0.904 (0.000)
SP6	The integration of sustainable policies in the company's activities has achieved a reduction in operating and/or production costs.	0.872 (0.000)
SP7	The integration of sustainable policies in the company's activities has had a positive effect on recorded profits.	0.838 (0.000)

4. Results

4.1. Reliability and Validity of Measurement Scales Measurement Model

The evaluation of the reliability and validity of CE, GBS, and SP scales was carried out through the most cited indicators in the literature: Cronbach's Alpha, Composite Reliability Index (CRI), Dijkstra-Henseler rho, and Average Variance Extracted (AVE) (Table 2 Panel A) (Hair et al., 2019), while discriminant validity was evaluated using the most cited indices in the literature: Fornell and Larcker criterion, and Heterotrait-Monotrait (HTMT) ratio (Table 2 Panel B) (Henseler et al., 2015; Hair et al., 2019). The results obtained from the application of PLS-SEM indicate, on one hand, that Cronbach's Alpha, CRI, and Dijkstra-Henseler rho have values higher than the recommended value of 0.7 (0.935 - 0.965; 0.947 - 0.971; 0.938 - 0.966, respectively), which indicates that the research model has an excellent fit to the data (Bagozzi & Yi, 1988; Hair et al., 2019) and, on other hand, the AVE values are higher than the recommended value of 0.5 (0.720 - 0.828) (Fornell & Larcker, 1981; Bagozzi & Yi, 1988).

Additionally, Table 2 shows the results of the discriminant validity analysis, which provides empirical evidence of the validity of the means and their ability to identify the different constructs. Thus, the Fornell and Larcker criterion is significant because the AVE values are higher than the square of the correlations between each pair of constructs, while the HTMT is also significant because the values are lower (0.282 - 0.442) than the 0.85 value recommended in literature (Henseler et al., 2015), which tells us that the values of these two criteria are indicative of the existence of discriminant validity. Table 1 shows these results more clearly.

Table 2. Measurement model: reliability, validity and discriminant validity.

Panel A. Reliability and Validity						
Variables	Cronbach's Alpha	CRI	Dijkstra-Henseler rho	AVE		
Circular Economy	0.949	0.958	0.950	0.740		
Green Business Strategy	0.965	0.971	0.966	0.828		
Sustainable Performance	0.935	0.947	0.938	0.720		
Panel B. Fornell-Larcker Criterion				Heterotrait-Monotrait ratio (HTMT)		
Variables	1	2	3	1	2	3
1. Circular Economy	0.860					
2. Green Business Strategy	0.424	0.910		0.442		
3. Sustainable Performance	0.267	0.439	0.849	0.282	0.460	

Note: PANEL B: Fornell-Larcker Criterion: Diagonal elements (bold) are the square root of the variance shared between the constructs and their measures (AVE). For discriminant validity, diagonal elements should be larger than off-diagonal elements.

4.2. Structural Model

The results obtained from the application of PLS-SEM show that the estimated data have acceptable statistical levels, obtaining an adjusted R^2 higher than the recommended value of 0.10 (Reinartz et al., 2009; Hair et al., 2011; Henseler et al., 2014; Hair et al., 2019), while SRMR, geodesic discrepancy (dG), and unweighted least discrepancy squares (dULS), had values lower than the values obtained in HI99, which indicates that the research model has an excellent fit to the data (Dijkstra & Henseler, 2015). Furthermore, the estimated data verify that CE has a significant positive effect on both SP (0.199; p -value 0.094), and GBS (0.427; p -value 0.000), these results showing evidence in favor of hypotheses H1 and H2, which indicates that the implementation of CE practices improved both the level of SP and GBS of manufacturing firms.

Additionally, the results obtained also show that GBS has a positive effect on SP of manufacturing firms (0.399; p -value 0.000), which provides evidence in favor of hypothesis H3, as well as that GBS can act as a mediating variable in the link between CE and SP (0.270; p -value 0.000), thereby providing evidence in favor of hypothesis H4. According to these results, it is possible to establish that the adoption of GBS by manufacturing firms improves their SP, but the SP increases significantly when GBS acts as a mediating variable between CE and SP, which contributes to improving the efficiency and flexibility of production processes, as well as the reduction of industrial waste through the incorporation of intelligent systems. Table 3 shows in greater detail the estimated data obtained from the hypotheses raised in the research model.

Table 3. Structural equation model.

Paths	Path (t-value; p -value)	95% Confidence Interval	f^2	Support
CE → SP (H1)	0.199 (2.582; 0.094)	[0.002 - 0.224]	0.230	Yes
CE → GBS (H2)	0.427 (8.156; 0.000)	[0.324 - 0.524]	0.064	Yes
GBS → SP (H3)	0.399 (6.626; 0.000)	[0.278 - 0.514]	0.171	Yes
Indirect Effects				
CE → GBS → SP	0.270 (5.111; 0.000)	[0.108 - 0.236]	0.116	Yes
Endogenous Variable	Adjusted R^2	Model Fit	Value	HI99
		SRMR	0.032	0.039
GBS	0.182	dULS	0.259	0.377
SP	0.204	dG	0.192	0.266

Note: CE: Circular Economy; GBS: Green Business Strategy; SP: Sustainable Performance. One-tailed t-values and p -values in parentheses; bootstrapping 95% confidence intervals (based on $n = 5000$ subsamples). SRMR: standardized root mean squared residual; dULS: unweighted least squares discrepancy; dG: geodesic discrepancy; HI99: bootstrap-based 99% percentiles.

5. Discussion

The results obtained in this study support our argument that CE has a significant positive effect on SP of manufacturing firms, these results being similar to those found by Rodríguez-González et al. (2022), Mishra et al. (2022) and Maldonado-Guzmán and Garza-Reyes (2023). The reasons that could explain this positive effect are, on one hand, that the managers of an important part of manufacturing firms in the automotive industry are clear about the benefits generated by the implementation of CE practices at the SP level and, on other hand, the adoption of CE practices helps manufacturing firms to comply with the environmental standards established by the public administration, which are increasingly strict, thereby reducing the strong social pressure that companies have for the development of friendly products with the environment.

The results obtained also support our argument that the adoption of CE has a significant positive effect on GBS of manufacturing firms, being in line with the results found by Vlasov (2021), Muñoz and Branzei (2021), and Slawinski et al. (2021), who established the need to provide more robust empirical evidence on the relationship between both concepts. The main reasons that could explain the positive effect of CE on GBS are, on one hand, that the recycling, scrap, and re-manufacturing of components and raw materials of vehicles that have ended their useful life, not only improves the GBS of manufacturing firms, but also generates a financial benefit and, on other hand, the adoption of GBS by companies in the automotive industry facilitates compliance with environmental standards.

However, the results of the implementation of CE practices at both SP and GBS could benefit much more if there were, on one hand, clarity in the various benefits that this relationship generates, since the studies published in the literature show a lack of clarity in the results obtained, which generates distrust among the managers of manufacturing firms in the automotive industry, policymakers, and industry professionals and, on other hand, the lack of fiscal incentives and government business support programs manufacturing firms, not only to minimize negative impacts on the environment and levels of environmental pollution, but also to adopt CE practices that improve SP.

Additionally, the results obtained in this study also support our argument that the adoption of GBS generates a significant positive effect at SP level, these results being similar to those found by Ren et al. (2022), Khanra et al. (2022), and Huang et al. (2024), who considered the need to provide more empirical evidence of the relationship between both concepts. The reasons that could explain the positive effect of GBS on SP are, on one hand, that the use of green strategies has been shown to substantially reduce negative impacts on the environment and improve SP in manufacturing firms in the automotive industry and, on other hand, that the costs associated with the implementation of GBS by manufacturing firms are lower than compared to the benefits that this generates.

Finally, the implementation of CE practices in manufacturing firms in the automotive industry facilitates the improvement of SP through the simultaneous

adoption of GBS, since it is practically through green strategies that manufacturing firms reduce emissions of industrial solid waste, by recycling and reusing the waste generated in the vehicle production process, these results coinciding with those found by Pacheco et al. (2024), Das and Bocken (2024), and Bhat et al. (2024). The fundamental reason that could explain these results is that GBS facilitates the flexibility of production processes and the reduction of industrial solid waste, which promotes the development of CE practices, as well as a significant improvement in the level of SP of manufacturing firms in the automotive industry.

5.1. Theoretical Implications

This paper has various theoretical implications for research in the CE transition and in the field of sustainability. Firstly, this study analyzed the level of CE adoption by manufacturing firms in Mexican automotive industry in a developing economy context, from a sustainability perspective. Most of the studies published in the literature have focused on the importance of CE practices and the barriers to CE adoption and their impact on operational performance, using qualitative studies. However, unlike the existing knowledge in literature, our study attempts to analyze the phenomena of the implementation of CE practices in automotive industry firms, and their effects on the GBS and SP of manufacturing firms, which has not been proposed in the existing literature (Pesce et al., 2020).

Additionally, this study has also aimed to address some existing methodological gaps in EC research, according to Sharma et al. (2021), and Barnabè and Nazir (2022), who considered the need to guide future CE research that adopts quantitative approaches, such as multi-criteria decision models to provide robust empirical evidence to support decisions about the CE transition and its consequences effects on SP. Therefore, the results obtained in our study contribute to the literature by strengthening the research agenda, particularly when CE is related to the adoption of GBS and SP in manufacturing firms.

Secondly, through a rigorous statistical analysis of the application of surveys to managers of manufacturing firms, our study expands the literature by concretely demonstrating how GBS are adopted in companies in the automotive industry, which allows us to establish the level of maturity that manufacturing firms have, in terms of being aware of the importance and benefits of sustainability practices, in accordance with what was suggested by Vásquez et al. (2021). Therefore, our study complements the limited knowledge existing in the literature, by providing robust empirical evidence that establishes that manufacturing firms in the automotive industry would improve their level of SP by adopting GBS, thereby generating a relatively high environmental awareness, as suggested by Shibamoto (2022).

Lastly, our study identified the factors that promote or hinder the adoption of GBS and SP in companies in the automotive industry, which allows us to complement existing knowledge by establishing how the transition to CE and towards

higher levels is being configured highest levels of SP. Therefore, by analyzing data collected by applying surveys to company managers, our study provides a broader understanding of the key success factors identified in the literature to improve the SP of manufacturing firms, in accordance with what was suggested by [Mitchell et al. \(2024\)](#). Thus, the ecosystem in which manufacturing firms in the automotive industry are located seems to be a determining factor for the EC transition and the adoption of GBS, from the perspective of sustainability.

5.2. Practical Implications

The data estimated in our study is relevant for executives, policymakers, business practitioners, and public administration. Firstly, the strong pressure that manufacturing firms in the automotive industry must improve the environment and sustainability is generating the adoption of CE practices and GBS in most organizations, since company managers not only have to make their production processes more efficient, but also manufacture more environmentally friendly products. In this sense, the positive effects of CE practices on GBS and the level of SP, advocate the transition to CE and the adoption of GBS that improve SP and, at the same time, decrease levels of industrial solid waste, which would benefit the environment in a highly polluting industry, such as the Mexican automotive industry.

Secondly, our study provides substantial support for the incorporation of CE practices in various areas, such as commercial, public, and environmental, since it places emphasis on the integration of CE in GBS and SP of manufacturing firms of the automotive industry. Currently, there is increasing attention from the scientific and academic community, policymakers, and organizational leaders on CE practices as one of the most effective means to investigate and improve the level of SP in developing countries, and this attention is specifically oriented towards the adoption of GBS that allow reducing emissions of CO₂ and other polluting gases into the atmosphere, using renewable energy and conserving water resources, as well as significantly reducing the levels of industrial solid waste, all with the aim of improving the environment and the sustainability of companies.

Thirdly, the adoption of CE and GBS practices is not a constant practice in all manufacturing firms in Mexican automotive industry, even less so in the companies that make up the supply chain, particularly because most of the green strategies that they are implemented in companies in the automotive industry, they are designed in developed countries where the parent plant is located, coupled with little or no government tax incentives that do not promote the adoption of CE and GBS, as well as the existence of policies environmental too lax. However, the results obtained in this study clearly indicate that CE practices positively affect both GBS and SP, which is why policymakers and public administration should develop policies and programs focused on the adoption of CE practices and GBS in all companies that make up the automotive industry.

Lastly, the findings of this study indicate that CE has a direct influence on SP and GBS, but the level of SP is significantly increased when GBS acts as a mediat-

ing variable in the link between CE and SP. Therefore, it is essential that managers of manufacturing firms in the automotive industry recognize the importance of moving from a linear economy to a CE, from a sustainability perspective, since an important body of research has shown that CE improves results of GBS and SP (e.g. Nyambuu & Semmier, 2023; Zou et al., 2023; Bocken & Konietzko, 2023; Circle Economy, 2024). In general, the implementation of CE practice and GBS should be a relevant issue for public administration, because it contributes to the development of sustainable and environmental activities of other companies (Sahbjamnia et al., 2018).

Lastly, in Latin America, several success stories demonstrate that CE is viable and generates benefits, both environmental and economic and social. Some notable examples include: 1) Huella Verde in Ecuador: This company revolutionized waste management in shopping centers, replacing disposable tableware with an industrial reusable tableware washing system, creating jobs and reducing environmental impact; 2) PetStar in Mexico: This company recycles PET bottles, implementing a “bottle-to-bottle” model, demonstrating the viability of recycling and creating value from plastic waste; and Grupo AlEn in Mexico: Through its Uumbal project, this company has restored lands and promoted forest conservation, demonstrating that the CE can be applied to agriculture and natural resource management. These success stories demonstrate that implementing CE is viable and efficient for practical applications.

6. Conclusions and Future Research Directions

The data obtained from our study allow us to establish the following essential conclusions. Firstly, given the importance of the application of CE and GBS to significantly improve the level of SP, the few studies published in the literature and the lack of clarity in the results obtained allow us to conclude, on the need to encourage the community scientific and academic in the analysis and discussion of the relationship between these concepts, both in other industries and in other developing countries, particularly in Latin America. Therefore, future research should be aimed at providing empirical evidence of the effects that CE practices have on GBS and SP, considering other measurement scales of the three concepts or, failing that, integrating GBS into the supply chain of manufacturing firms.

Secondly, our research contributes to the generation of knowledge by providing robust empirical evidence that demonstrates that CE practices have a positive impact both at SP and GBS levels, which allows us to conclude in general terms that the adoption of CE practices, together with the adoption of GBS at the same time, generates a higher level of SP in manufacturing firms that are implemented separately. Therefore, in future research, it would be important for researchers, academics, and industry professionals to consider these results as a future line of research, as well as the incorporation of other CE practices and other GBS, which can help improve the SP level of manufacturing firms in the automotive industry.

Thirdly, with respect to the methodology used in our research, it is possible to

conclude that there is a need to analyze successful cases of the adoption of CE and their effect on GBS and SP level, since not all manufacturing firms of the automotive industry have not had the same results, which would contribute to the literature in identifying the benefits of implementing CE and GBS at the same time. Lastly, in reference to the statistical technique used, it is possible to conclude that there is a need to use other different statistical techniques such as, for example, models based on covariance or neural networks which could have greater variability and efficiency in the analysis of the data than the PLS-SEM, as well as in the improvement of the results, since generally these statistical techniques consider both inter-temporal dynamics and individualities of the concepts.

Finally, a limitation of this article is that the surveys were self-administered and completed by those responsible for the business activities, which may lead to the following: 1) Respondents may answer in a way that makes them seem better or more socially acceptable, rather than being truthful; 2) People may not accurately remember past events, behaviors, or experiences; 3) The way questions are phrased or ordered can influence how people respond. Therefore, future research should explore other data collection methods to compare methodologies and minimize bias.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Al-Hakimi, M. A., Al-Swidi, A. K., Gelaidan, H. M., & Mohammed, A. (2022). The Influence of Green Manufacturing Practices on the Corporate Sustainable Performance of SMEs under the Effect of Green Organizational Culture: A Moderated Mediation Analysis. *Journal of Cleaner Production*, 376, Article ID: 134346. <https://doi.org/10.1016/j.jclepro.2022.134346>
- Bagozzi, R. P., & Yi, Y. (1988). On the Evaluation of Structural Equation Models. *Journal of the Academy of Marketing Science*, 16, 74-94. <https://doi.org/10.1177/009207038801600107>
- Bakos, J., Siu, M., Orenge, A., & Kasiri, N. (2020). An Analysis of Environmental Sustainability in Small & Medium-Sized Enterprises: Patterns and Trends. *Business Strategy and the Environment*, 29, 1285-1296. <https://doi.org/10.1002/bse.2433>
- Balsalobre-Lorente, D., Ibáñez-Luzón, L., Usman, M., & Shahbaz, M. (2022). The Environmental Kuznets Curve, Based on the Economic Complexity, and the Pollution Haven Hypothesis in PIIGS Countries. *Renewable Energy*, 185, 1441-1455. <https://doi.org/10.1016/j.renene.2021.10.059>
- Banerjee, S. B. (2002). Corporate Environmentalism: The Construct and Its Measurement. *Journal of Business Research*, 55, 177-191. [https://doi.org/10.1016/s0148-2963\(00\)00135-1](https://doi.org/10.1016/s0148-2963(00)00135-1)
- Barnabè, F., & Nazir, S. (2022). Conceptualizing and Enabling Circular Economy through Integrated Thinking. *Corporate Social Responsibility and Environmental Management*, 29, 448-468. <https://doi.org/10.1002/csr.2211>
- Barredo, L. (2021). *Science Panel for the Amazon: Presentation of Initial Findings*.

- <https://www.unsdsn.org/science-panel-for-the-amazon-presentation-of-initial-findings>
- Belas, J., Çera, G., Dvorský, J., & Čepel, M. (2021). Corporate Social Responsibility and Sustainability Issues of Small- and Medium-Sized Enterprises. *Corporate Social Responsibility and Environmental Management*, 28, 721-730. <https://doi.org/10.1002/csr.2083>
- Bhat, A. A., Mir, A. A., Allie, A. H., Ahmad Lone, M., Al-Adwan, A. S., Jamali, D. et al. (2024). Unlocking Corporate Social Responsibility and Environmental Performance: Mediating Role of Green Strategy, Innovation, and Leadership. *Innovation and Green Development*, 3, Article ID: 100112. <https://doi.org/10.1016/j.igd.2023.100112>
- Bocken, N. M. P., & Short, S. W. (2021). Unsustainable Business Models—Recognising and Resolving Institutionalised Social and Environmental Harm. *Journal of Cleaner Production*, 312, Article ID: 127828. <https://doi.org/10.1016/j.jclepro.2021.127828>
- Bocken, N. M. P., Niessen, L., & Short, S. W. (2022). The Sufficiency-Based Circular Economy—An Analysis of 150 Companies. *Frontiers in Sustainability*, 3, Article ID: 899289. <https://doi.org/10.3389/frsus.2022.899289>
- Bocken, N., & Konietzko, J. (2022). Circular Business Model Innovation in Consumer-Facing Corporations. *Technological Forecasting and Social Change*, 185, Article ID: 122076. <https://doi.org/10.1016/j.techfore.2022.122076>
- Bocken, N., & Konietzko, J. (2023). Experimentation Capability for a Circular Economy: A Practical Guide. *Journal of Business Strategy*, 44, 406-414. <https://doi.org/10.1108/jbs-02-2022-0039>
- Bocken, N., Stahel, W. R., Dobrauz, G., Koumbarakis, A., Obst, M., & Matzdorf, P. (2021). *Circularity as the New Normal-Future Fitting Swiss Business*. PricewaterhouseCoopers AG (PwC). <https://www.wwf.ch/sites/default/files/doc-2021-01/Circularity-as-the-new-normal-whitepaper-EN.pdf>
- Bosschaert, T. (2022). Circularity Is Not Sustainability: How Well-Intentioned Concepts Distract Us from Our True Goals, and How SiD Can Help Navigate That Challenge. In T. Bosschaert (Ed.), *The Impossibilities of the Circular Economy* (pp. 72-80). Routledge. <https://doi.org/10.4324/9781003244196-9>
- Brazil (2010). *Lei 12.305/2010—Política Nacional dos Resíduos Sólidos, Brasília, 2010*. https://www.planalto.gov.br/ccivil_03/ato2007-2010/2010/lei/l12305.htm
- Bui, T., Tseng, J., Tseng, M., & Lim, M. K. (2022). Opportunities and Challenges for Solid Waste Reuse and Recycling in Emerging Economies: A Hybrid Analysis. *Resources, Conservation and Recycling*, 177, Article ID: 105968. <https://doi.org/10.1016/j.resconrec.2021.105968>
- Cantele, S., & Zardini, A. (2019). What Drives Small and Medium Enterprises towards Sustainability? Role of Interactions between Pressures, Barriers, and Benefits. *Corporate Social Responsibility and Environmental Management*, 27, 126-136. <https://doi.org/10.1002/csr.1778>
- Castillo-Esparza, M. M. G. C., Maldonado-Guzmán, G., & Mejía-Trejo, J. (2024). Green Business Strategy and Its Effect on Financial Performance: The Mediating Role of Corporate Social Responsibility. *Tec Empresarial*, 18, 1-17. <https://doi.org/10.18845/te.v18i2.7134>
- Chile (2016). *Establece marco para la gestión de residuos, la responsabilidad extendida del productor y fomento al reciclaje*. <https://www.bcn.cl/leychile/navegar?idNorma=1090894>
- Chua, W. F., James, R., King, A., Lee, E., & Soderstrom, N. (2022). Task Force on Climate-related Financial Disclosures (TCFD) Implementation: An Overview and Insights from the Australian Accounting Standards Board Dialogue Series. *Australian Accounting Re-*

- view, 32, 396-405. <https://doi.org/10.1111/auar.12388>
- Circle Economy (2024). *The Circularity Gap Report 2024*. <https://www.circularitygap.world/2024>.
- Couckuyt, D., & Van Looy, A. (2020). A Systematic Review of Green Business Process Management. *Business Process Management Journal*, 26, 421-446. <https://doi.org/10.1108/bpmj-03-2019-0106>
- D'Amato, D., Droste, N., Allen, B., Kettunen, M., Lähtinen, K., Korhonen, J. et al. (2017). Green, Circular, Bio Economy: A Comparative Analysis of Sustainability Avenues. *Journal of Cleaner Production*, 168, 716-734. <https://doi.org/10.1016/j.jclepro.2017.09.053>
- Das, A., & Bocken, N. (2024). Regenerative Business Strategies: A Database and Typology to Inspire Business Experimentation Towards Sustainability. *Sustainable Production and Consumption*, 49, 529-544. <https://doi.org/10.1016/j.spc.2024.06.024>
- Dijkstra, T. K., & Henseler, J. (2015). Consistent Partial Least Squares Path Modeling. *MIS Quarterly*, 39, 297-316. <https://doi.org/10.25300/misq/2015/39.2.02>
- Dyllick, T., & Muff, K. (2016). Clarifying the Meaning of Sustainable Business: Introducing a Typology from Business-as-Usual to True Business Sustainability. *Organization & Environment*, 29, 156-174. <https://doi.org/10.1177/1086026615575176>
- Ezeudu, O. B., Ezeudu, T. S., Ugochukwu, U. C., Agunwamba, J. C., & Oraelosi, T. C. (2021). Enablers and Barriers to Implementation of Circular Economy in Solid Waste Valorization: The Case of Urban Markets in Anambra, Southeast Nigeria. *Environmental and Sustainability Indicators*, 12, Article ID: 100150. <https://doi.org/10.1016/j.indic.2021.100150>
- Fiedler, T., Pitman, A. J., Mackenzie, K., Wood, N., Jakob, C., & Perkins-Kirkpatrick, S. E. (2021). Business Risk and the Emergence of Climate Analytics. *Nature Climate Change*, 11, 87-94. <https://doi.org/10.1038/s41558-020-00984-6>
- Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18, 39-50. <https://doi.org/10.1177/002224378101800104>
- González, A. H., Calero, C., Pérez Parra, D., & Mancebo, J. (2019). Approaching Green BPM Characterisation. *Journal of Software: Evolution and Process*, 31, 1-26. <https://doi.org/10.1002/smr.2145>
- Gualandris, J., Branzei, O., Wilhelm, M., Lazzarini, S., Linnenluecke, M., Hamann, R. et al. (2024). Unchaining Supply Chains: Transformative Leaps toward Regenerating Social-Ecological Systems. *Journal of Supply Chain Management*, 60, 53-67. <https://doi.org/10.1111/jscm.12314>
- Hahn, T., & Tampe, M. (2021). Strategies for Regenerative Business. *Strategic Organization*, 19, 456-477. <https://doi.org/10.1177/1476127020979228>
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *Journal of Marketing Theory and Practice*, 19, 139-152. <https://doi.org/10.2753/mtp1069-6679190202>
- Hair, J., Hult, T., Ringle, C., Sarstedt, M., Castillo, J., Cepeda, G., & Roldan, J. (2019). *Manual de Partial Least Squares PLS-SEM*. OmniaScience.
- Hair, J.F., Celsi, M., Money, A., Samouel, P., & Page, M. (2016). *Essentials of Business Research Methods* (3rd ed.). Routledge.
- Hair, J.F., Sarstedt, M., Ringle, C.M., Gudergan, S.P., Castillo, J., Cepeda, G., & Roldan, J. (2021). *Manual Avanzado de Partial Least Squares Structural Equation Modeling (PLS-SEM)*. OmniaScience.
- Han, J., Heshmati, A., & Rashidghalam, M. (2020). Circular Economy Business Models

- with a Focus on Servitization. *Sustainability*, *12*, 8799. <https://doi.org/10.3390/su12218799>
- Hawken, P. (2021). *Regeneration: Ending the Climate Crisis in One Generation*. Penguin.
- Henseler, J. (2017). Bridging Design and Behavioral Research with Variance-Based Structural Equation Modeling. *Journal of Advertising*, *46*, 178-192. <https://doi.org/10.1080/00913367.2017.1281780>
- Henseler, J., Dijkstra, T. K., Sarstedt, M., Ringle, C. M., Diamantopoulos, A., Straub, D. W. et al. (2014). Common Beliefs and Reality about PLS. *Organizational Research Methods*, *17*, 182-209. <https://doi.org/10.1177/1094428114526928>
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A New Criterion for Assessing Discriminant Validity in Variance-Based Structural Equation Modeling. *Journal of the Academy of Marketing Science*, *43*, 115-135. <https://doi.org/10.1007/s11747-014-0403-8>
- Huang, Y., Haseeb, M., Usman, M., & Ozturk, I. (2022). Dynamic Association between ICT, Renewable Energy, Economic Complexity and Ecological Footprint: Is There Any Difference between E-7 (Developing) and G-7 (Developed) Countries? *Technology in Society*, *68*, Article ID: 101853. <https://doi.org/10.1016/j.techsoc.2021.101853>
- Huang, Z., Cao, J., & Pan, L. (2024). Greening Your Way to Profits: Green Strategies and Green Revenues. *Finance Research Letters*, *61*, Article ID: 105029. <https://doi.org/10.1016/j.frl.2024.105029>
- INEGI (2021). *Bank of Economic Information*. <https://www.inegi.org.mx/>
- IPCC Working Group III (2022). *Climate Change 2022. Mitigating Climate Change*. Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf
- Jaeger-Erben, M., Jensen, C., Hofmann, F., & Zwiers, J. (2021). There Is No Sustainable Circular Economy without a Circular Society. *Resources, Conservation and Recycling*, *168*, Article ID: 105476. <https://doi.org/10.1016/j.resconrec.2021.105476>
- Jahanger, A., Usman, M., & Balsalobre-Lorente, D. (2022a). Autocracy, Democracy, Globalization, and Environmental Pollution in Developing World: Fresh Evidence from STIRPAT Model. *Journal of Public Affairs*, *22*, e2753. <https://doi.org/10.1002/pa.2753>
- Jahanger, A., Usman, M., Murshed, M., Mahmood, H., & Balsalobre-Lorente, D. (2022b). The Linkages between Natural Resources, Human Capital, Globalization, Economic Growth, Financial Development, and Ecological Footprint: The Moderating Role of Technological Innovations. *Resources Policy*, *76*, Article ID: 102569. <https://doi.org/10.1016/j.resourpol.2022.102569>
- Jona, J., & Soderstrom, N. (2022). Evolution of Climate-Related Disclosure Guidance and Application of Climate Risk Measurement in Research. In C. Adams (Ed.), *Handbook of Accounting and Sustainability* (pp. 397-420). Edward Elgar Publishing. <https://doi.org/10.4337/9781800373518.00032>
- Kaddoura, I., & Nagel, K. (2019). Congestion Pricing in a Real-World Oriented Agent-Based Simulation Context. *Research in Transportation Economics*, *74*, 40-51. <https://doi.org/10.1016/j.retrec.2019.01.002>
- Ke, J., Jahanger, A., Yang, B., Usman, M., & Ren, F. (2022). Digitalization, Financial Development, Trade, and Carbon Emissions; Implication of Pollution Haven Hypothesis during Globalization Mode. *Frontiers in Environmental Science*, *10*, Article ID: 873880. <https://doi.org/10.3389/fenvs.2022.873880>
- Khanra, S., Kaur, P., Joseph, R. P., Malik, A., & Dhir, A. (2022). A Resource-Based View of Green Innovation as a Strategic Firm Resource: Present Status and Future Directions.

- Business Strategy and the Environment*, 31, 1395-1413. <https://doi.org/10.1002/bse.2961>
- Konietzko, J., Das, A., & Bocken, N. (2023). Towards Regenerative Business Models: A Necessary Shift? *Sustainable Production and Consumption*, 38, 372-388. <https://doi.org/10.1016/j.spc.2023.04.014>
- Kuo, L., & Chang, B. (2021). The Affecting Factors of Circular Economy Information and Its Impact on Corporate Economic Sustainability-Evidence from China. *Sustainable Production and Consumption*, 27, 986-997. <https://doi.org/10.1016/j.spc.2021.02.014>
- Lacy, P., & Rutqvist, J. (2015). *Waste to Wealth: The Circular Economy Advantage*. Palgrave Macmillan.
- Lee, C., Kuo, S., Hsu, H., Mo, T., Chang, E., & Huang, K. (2022). How Does the Research Community Contribute to Corporate Climate-Related Risk Disclosures? The Gap between Ideals and Reality. *Corporate Social Responsibility and Environmental Management*, 30, 927-940. <https://doi.org/10.1002/csr.2397>
- Maciel, J. C. (2017). The Core Capabilities of Green Business Process Management: A Literature Review. In *13th International Conference on Wirtschaftsinformatik* (pp. 1526-1537).
- Maldonado-Guzmán, G., & Garza-Reyes, J. A. (2023). Beyond Lean Manufacturing and Sustainable Performance: Are the Circular Economy Practices Worth Pursuing? *Management of Environmental Quality: An International Journal*, 34, 1332-1351. <https://doi.org/10.1108/meq-11-2022-0324>
- Mendoza, J. M. F., Gallego-Schmid, A., Velenturf, A. P. M., Jensen, P. D., & Ibarra, D. (2022). Circular Economy Business Models and Technology Management Strategies in the Wind Industry: Sustainability Potential, Industrial Challenges and Opportunities. *Renewable and Sustainable Energy Reviews*, 163, Article ID: 112523. <https://doi.org/10.1016/j.rser.2022.112523>
- Mishra, R., Singh, R. K., & Govindan, K. (2022). Barriers to the Adoption of Circular Economy Practices in Micro, Small and Medium Enterprises: Instrument Development, Measurement and Validation. *Journal of Cleaner Production*, 351, Article ID: 131389. <https://doi.org/10.1016/j.jclepro.2022.131389>
- Mitchell, R., Gu, J., & Boyle, B. (2024). Suspicion, Inclusive Leadership and Team Innovation: A Motivated Information Processing Approach. *Journal of Business Research*, 172, 114399. <https://doi.org/10.1016/j.jbusres.2023.114399>
- Muñoz, P., & Branzei, O. (2021). Regenerative Organizations: Introduction to the Special Issue. *Organization & Environment*, 34, 507-516. <https://doi.org/10.1177/10860266211055740>
- Niero, M., & Rivera, X. C. S. (2018). The Role of Life Cycle Sustainability Assessment in the Implementation of Circular Economy Principles in Organizations. *Procedia CIRP*, 69, 793-798. <https://doi.org/10.1016/j.procir.2017.11.022>
- Nowicki, P., Kafel, P., Balon, U., & Wojnarowska, M. (2020). Circular Economy's Standardized Management Systems. Choosing the Best Practice. Evidence from Poland. *International Journal for Quality Research*, 14, 1115-1128. <https://doi.org/10.24874/ijqr14.04-08>
- Nyambuu, U., & Semmler, W. (2023). Fossil Fuel Resource Depletion, Backstop Technology, and Renewable Energy. In U. Nyambuu, & W. Semmler (Eds.), *Sustainable Macroeconomics, Climate Risks and Energy Transitions: Dynamic Modeling, Empirics, and Policies* (pp. 71-85). Springer. https://doi.org/10.1007/978-3-031-27982-9_6
- Ormazabal, M., Prieto-Sandoval, V., Puga-Leal, R., & Jaca, C. (2018). Circular Economy in Spanish SMEs: Challenges and Opportunities. *Journal of Cleaner Production*, 185, 157-167. <https://doi.org/10.1016/j.jclepro.2018.03.031>

- Pacheco, D. A. d. J., Rampasso, I. S., Michels, G. S., Ali, S. M., & Hunt, J. D. (2024). From Linear to Circular Economy: The Role of BS 8001:2017 for Green Transition in Small Business in Developing Economies. *Journal of Cleaner Production*, 439, Article ID: 140787. <https://doi.org/10.1016/j.jclepro.2024.140787>
- Persson, L., Carney Almroth, B. M., Collins, C. D., Cornell, S., de Wit, C. A., Diamond, M. L. et al. (2022). Outside the Safe Operating Space of the Planetary Boundary for Novel Entities. *Environmental Science & Technology*, 56, 1510-1521. <https://doi.org/10.1021/acs.est.1c04158>
- Pesce, M., Tamai, I., Guo, D., Critto, A., Brombal, D., Wang, X. et al. (2020). Circular Economy in China: Translating Principles into Practice. *Sustainability*, 12, 832. <https://doi.org/10.3390/su12030832>
- Podsakoff, P. M., & Organ, D. W. (1986). Self-Reports in Organizational Research: Problems and Prospects. *Journal of Management*, 12, 531-544. <https://doi.org/10.1177/014920638601200408>
- Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2003). Sources of Method Bias in Social Science Research and Recommendations on How to Control It. *Annual Review of Psychology*, 63, 539-569. <https://doi.org/10.1146/annurev-psych-120710-100452>
- Prieto-Sandoval, V., Ormazabal, M., Jaca, C., & Viles, E. (2018). Key Elements in Assessing Circular Economy Implementation in Small and Medium-Sized Enterprises. *Business Strategy and the Environment*, 27, 1525-1534. <https://doi.org/10.1002/bse.2210>
- Qader, M. R., Khan, S., Kamal, M., Usman, M., & Haseeb, M. (2021). Forecasting Carbon Emissions Due to Electricity Power Generation in Bahrain. *Environmental Science & Pollution Research*, 29, 17346-17357. <https://doi.org/10.1007/s11356-021-16960-2>
- Qiu, L., Jie, X., Wang, Y., & Zhao, M. (2020). Green Product Innovation, Green Dynamic Capability, and Competitive Advantage: Evidence from Chinese Manufacturing Enterprises. *Corporate Social Responsibility and Environmental Management*, 27, 146-165. <https://doi.org/10.1002/csr.1780>
- Ramzan, M., Iqbal, H. A., Usman, M., & Ozturk, I. (2022). Environmental Pollution and Agricultural Productivity in Pakistan: New Insights from ARDL and Wavelet Coherence Approaches. *Environmental Science and Pollution Research*, 29, 28749-28768. <https://doi.org/10.1007/s11356-021-17850-3>
- Ramzan, M., Raza, S. A., Usman, M., Sharma, G. D., & Iqbal, H. A. (2021). Environmental Cost of Non-Renewable Energy and Economic Progress: Do ICT and Financial Development Mitigate Some Burden? *Journal of Cleaner Production*, 33, 1-11.
- Reike, D., Vermeulen, W. J. V., & Witjes, S. (2018). The Circular Economy: New or Refurbished as CE 3.0? Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options. *Resources, Conservation and Recycling*, 135, 246-264. <https://doi.org/10.1016/j.resconrec.2017.08.027>
- Reinartz, W., Haenlein, M., & Henseler, J. (2009). An Empirical Comparison of the Efficacy of Covariance-Based and Variance-Based Sem. *International Journal of Research in Marketing*, 26, 332-344. <https://doi.org/10.1016/j.ijresmar.2009.08.001>
- Ren, S., Yang, X., Hu, Y., & Chevallier, J. (2022). Emission Trading, Induced Innovation and Firm Performance. *Energy Economics*, 112, Article ID: 106157. <https://doi.org/10.1016/j.eneco.2022.106157>
- Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F. et al. (2023). Earth beyond Six of Nine Planetary Boundaries. *Science Advances*, 9, eadh2458. <https://doi.org/10.1126/sciadv.adh2458>
- Rigdon, E. E., Sarstedt, M., & Ringle, C. M. (2017). On Comparing Results from CB-SEM

- and PLS-SEM: Five Perspectives and Five Recommendations. *Marketing ZFP*, 39, 4-16. <https://doi.org/10.15358/0344-1369-2017-3-4>
- Ringle, C. M., Wende, S., & Becker, J. M. (2024). *SmartPLS 4 (Computer Software)*. <http://www.smartpls.com>
- Ritala, P., Huotari, P., Bocken, N., Albareda, L., & Puumalainen, K. (2018). Sustainable Business Model Adoption among S&P 500 Firms: A Longitudinal Content Analysis Study. *Journal of Cleaner Production*, 170, 216-226. <https://doi.org/10.1016/j.jclepro.2017.09.159>
- Roberts, L., Georgiou, N., & Hassan, A. M. (2022). Investigating Biodiversity and Circular Economy Disclosure Practices: Insights from Global Firms. *Corporate Social Responsibility and Environmental Management*, 30, 1053-1069. <https://doi.org/10.1002/csr.2402>
- Rodríguez-Espíndola, O., Cuevas-Romo, A., Chowdhury, S., Díaz-Acevedo, N., Albores, P., Despoudi, S. et al. (2022). The Role of Circular Economy Principles and Sustainable-Oriented Innovation to Enhance Social, Economic and Environmental Performance: Evidence from Mexican SMEs. *International Journal of Production Economics*, 248, Article ID: 108495. <https://doi.org/10.1016/j.ijpe.2022.108495>
- Rodríguez-González, R. M., Maldonado-Guzmán, G., Madrid-Guijarro, A., & Garza-Reyes, J. A. (2022). Does Circular Economy Affect Financial Performance? The Mediating Role of Sustainable Supply Chain Management in the Automotive Industry. *Journal of Cleaner Production*, 379, Article ID: 134670. <https://doi.org/10.1016/j.jclepro.2022.134670>
- Rovanto, S., & Finne, M. (2022). What Motivates Entrepreneurs into Circular Economy Action? Evidence from Japan and Finland. *Journal of Business Ethics*, 184, 71-91. <https://doi.org/10.1007/s10551-022-05122-0>
- Sadiq, M., Shinwari, R., Usman, M., Ozturk, I., & Maghyreh, A. I. (2022). Linking Nuclear Energy, Human Development and Carbon Emission in BRICS Region: Do External Debt and Financial Globalization Protect the Environment? *Nuclear Engineering and Technology*, 54, 3299-3309. <https://doi.org/10.1016/j.net.2022.03.024>
- Sahebjamnia, N., Torabi, S. A., & Mansouri, S. A. (2018). Building Organizational Resilience in the Face of Multiple Disruptions. *International Journal of Production Economics*, 197, 63-83. <https://doi.org/10.1016/j.ijpe.2017.12.009>
- Salesa, A., León, R., & Moneva, J. M. (2022). Airlines Practices to Incorporate Circular Economy Principles into the Waste Management System. *Corporate Social Responsibility and Environmental Management*, 30, 443-458. <https://doi.org/10.1002/csr.2365>
- Sarstedt, M., Hair, J. F., Ringle, C. M., Thiele, K. O., & Gudergan, S. P. (2016). Estimation Issues with PLS and CBSEM: Where the Bias Lies! *Journal of Business Research*, 69, 3998-4010. <https://doi.org/10.1016/j.jbusres.2016.06.007>
- Sawe, F. B., Kumar, A., Garza-Reyes, J. A., & Agrawal, R. (2021). Assessing People-Driven Factors for Circular Economy Practices in Small and Medium-Sized Enterprise Supply Chains: Business Strategies and Environmental Perspectives. *Business Strategy and the Environment*, 30, 2951-2965. <https://doi.org/10.1002/bse.2781>
- Sharma, N. K., Govindan, K., Lai, K. K., Chen, W. K., & Kumar, V. (2021). The Transition from Linear Economy to Circular Economy for Sustainability among SMEs: A Study on Prospects, Impediments, and Prerequisites. *Business Strategy and the Environment*, 30, 1803-1822. <https://doi.org/10.1002/bse.2717>
- Shibamoto, M. (2022). Cyclical Activity and Inflation under Secular Stagnation: Empirical Evidence Using Data on Japan's Lost Decades. Discussion Paper Series DP2022-32, Research Institute for Economics & Business Administration, Kobe University.
- Singh, S. K., Giudice, M. D., Chierici, R., & Graziano, D. (2020). Green Innovation and Environmental Performance: The Role of Green Transformational Leadership and Green

- Human Resource Management. *Technological Forecasting and Social Change*, 150, Article ID: 119762. <https://doi.org/10.1016/j.techfore.2019.119762>
- Slawinski, N., Winsor, B., Mazutis, D., Schouten, J. W., & Smith, W. K. (2021). Managing the Paradoxes of Place to Foster Regeneration. *Organization & Environment*, 34, 595-618. <https://doi.org/10.1177/1086026619837131>
- Sohns, T. M., Aysolmaz, B., Figge, L., & Joshi, A. (2023). Green Business Process Management for Business Sustainability: A Case Study of Manufacturing Small and Medium-Sized Enterprises (SMEs) from Germany. *Journal of Cleaner Production*, 401, Article ID: 136667. <https://doi.org/10.1016/j.jclepro.2023.136667>
- Tolliver, C., Keeley, A. R., & Managi, S. (2020). Policy Targets behind Green Bonds for Renewable Energy: Do Climate Commitments Matter? *Technological Forecasting and Social Change*, 157, Article ID: 120051. <https://doi.org/10.1016/j.techfore.2020.120051>
- United Nations (2022). *The Sustainable Development Goals Report 2022*. United Nations. <https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>
- Usman, M., & Balsalobre-Lorente, D. (2022). Environmental Concern in the Era of Industrialization: Can Financial Development, Renewable Energy and Natural Resources Alleviate Some Load? *Energy Policy*, 162, Article ID: 112780. <https://doi.org/10.1016/j.enpol.2022.112780>
- Usman, M., & Hammar, N. (2021). Dynamic Relationship between Technological Innovations, Financial Development, Renewable Energy, and Ecological Footprint: Fresh Insights Based on the STIRPAT Model for Asia Pacific Economic Cooperation Countries. *Environmental Science and Pollution Research*, 28, 15519-15536. <https://doi.org/10.1007/s11356-020-11640-z>
- Usman, M., & Makhdam, M. S. A. (2021). What Abates Ecological Footprint in BRICS-T Region? Exploring the Influence of Renewable Energy, Non-Renewable Energy, Agriculture, Forest Area and Financial Development. *Renewable Energy*, 179, 12-28. <https://doi.org/10.1016/j.renene.2021.07.014>
- Usman, M., Jahanger, A., Makhdam, M. S. A., Balsalobre-Lorente, D., & Bashir, A. (2022). How Do Financial Development, Energy Consumption, Natural Resources, and Globalization Affect Arctic Countries' Economic Growth and Environmental Quality? An Advanced Panel Data Simulation. *Energy*, 241, Article ID: 122515. <https://doi.org/10.1016/j.energy.2021.122515>
- Usman, M., Khalid, K., & Mehdi, M. A. (2021). What Determines Environmental Deficit in Asia? Embossing the Role of Renewable and Non-Renewable Energy Utilization. *Renewable Energy*, 168, 1165-1176. <https://doi.org/10.1016/j.renene.2021.01.012>
- van der Aalst, W. M. P., Hinz, O., & Weinhardt, C. (2023). Sustainable Systems Engineering: Opportunities and Challenges. *Business & Information Systems Engineering*, 65, 1-6. <https://doi.org/10.1007/s12599-022-00784-6>
- Vásquez, J., Aguirre, S., Puertas, E., Bruno, G., Priarone, P. C., & Settineri, L. (2021). A Sustainability Maturity Model for Micro, Small and Medium-Sized Enterprises (MSMEs) Based on a Data Analytics Evaluation Approach. *Journal of Cleaner Production*, 311, Article ID: 127692. <https://doi.org/10.1016/j.jclepro.2021.127692>
- Velenturf, A. P. M., & Purnell, P. (2021). Principles for a Sustainable Circular Economy. *Sustainable Production and Consumption*, 27, 1437-1457. <https://doi.org/10.1016/j.spc.2021.02.018>
- Vlasov, M. (2021). In Transition toward the Ecocentric Entrepreneurship Nexus: How Nature Helps Entrepreneurs Make Ventures More Regenerative over Time. *Organization & Environment*, 34, 559-580. <https://doi.org/10.1177/1086026619831448>

- Wan, X., Jahanger, A., Usman, M., Radulescu, M., Balsalobre-Lorente, D., & Yu, Y. (2022). Exploring the Effects of Economic Complexity and the Transition to a Clean Energy Pattern on Ecological Footprint from the Indian Perspective. *Frontiers in Environmental Science*, 9, Article ID: 816519. <https://doi.org/10.3389/fenvs.2021.816519>
- Wang, Q., Wang, H., & Chang, C. (2022). Environmental Performance, Green Finance and Green Innovation: What's the Long-Run Relationships among Variables? *Energy Economics*, 110, Article ID: 106004. <https://doi.org/10.1016/j.eneco.2022.106004>
- Wasserbaur, R., Sakao, T., & Milios, L. (2022). Interactions of Governmental Policies and Business Models for a Circular Economy: A Systematic Literature Review. *Journal of Cleaner Production*, 337, Article ID: 130329. <https://doi.org/10.1016/j.jclepro.2021.130329>
- Wu, T., & Kung, C. (2020). Carbon Emissions, Technology Upgradation and Financing Risk of the Green Supply Chain Competition. *Technological Forecasting and Social Change*, 152, Article ID: 119884. <https://doi.org/10.1016/j.techfore.2019.119884>
- WWF (2022). *Living Planet Report 2022—Building a Nature-Positive Society*. WWF. <https://livingplanet.panda.org/en-US/>
- Yang, B., Jahanger, A., Usman, M., & Khan, M. A. (2021). The Dynamic Linkage between Globalization, Financial Development, Energy Utilization, and Environmental Sustainability in GCC Countries. *Environmental Science and Pollution Research*, 28, 16568-16588. <https://doi.org/10.1007/s11356-020-11576-4>
- Yang, Q., Huo, J., Saqib, N., & Mahmood, H. (2022). Modelling the Effect of Renewable Energy and Public-Private Partnership in Testing EKC Hypothesis: Evidence from Methods Moment of Quantile Regression. *Renewable Energy*, 192, 485-494. <https://doi.org/10.1016/j.renene.2022.03.123>
- Zhang, J., Liang, G., Feng, T., Yuan, C., & Jiang, W. (2020). Green Innovation to Respond to Environmental Regulation: How External Knowledge Adoption and Green Absorptive Capacity Matter? *Business Strategy and the Environment*, 29, 39-53. <https://doi.org/10.1002/bse.2349>
- Zhou, G., Zhang, L., & Zhang, L. (2019a). Corporate Social Responsibility, the Atmospheric Environment, and Technological Innovation Investment. *Sustainability*, 11, Article No. 481. <https://doi.org/10.3390/su11020481>
- Zhou, Y., Shu, C., Jiang, W., & Gao, S. (2019b). Green Management, Firm Innovations, and Environmental Turbulence. *Business Strategy and the Environment*, 28, 567-581. <https://doi.org/10.1002/bse.2265>
- Zou, Z., Zhang, Y., Liu, X., Li, X., & Wang, M. (2023). Dynamic Nexus between Non-Renewable Energy Consumption, Economic Growth and CO₂ Emission: A Comparison Analysis between Major Emitters. *Energy & Environment*, 35, 4339-4360. <https://doi.org/10.1177/0958305x231180700>