

SUSTAINABILITY BENEFITS OF ENVIRONMENTAL PRACTICES IN MSMEs: EVIDENCE FROM GUANAJUATO'S TEXTILE INDUSTRY

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Abstract: This study examines the implementation of environmental practices among micro, small, and medium-sized enterprises (MSMEs) in Guanajuato, Mexico, with a focus on the textile sector, and evaluates their contribution to business sustainability. The study addresses the growing demand for sustainable production models in regional industries that face environmental challenges. A quantitative, non-experimental, cross-sectional design was used, based on data collected through a survey of 244 MSME owners and managers. The Importance-Performance Map Analysis (IPMA) was applied to identify strategic improvement areas by comparing the relevance and execution of environmental practices. The results show an overall implementation level of 49.47%, indicating a significant potential for improvement. Key practices influencing sustainability include process design, energy management, and supplier selection, which positively impact employee motivation, reputation, profitability, and customer satisfaction. Although there is awareness of environmental issues among MSMEs in Guanajuato, the implementation remains limited. Strengthening these practices represents an opportunity to improve sustainability performance and competitiveness. The findings highlight the need for targeted policies and support mechanisms to accelerate the green transition of regional MSMEs.

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Introduction

Micro, small and medium-sized enterprises (MSMEs) play an important role in national economies due to their significant contribution to the generation, innovation, and local development of jobs (OECD, 2019). MSMEs represent more than 99% of all businesses in Mexico and generate approximately 70.6% of formal employment (INEGI, 2025a). Within this landscape, the textile industry holds particular socio-economic relevance, especially in states like Guanajuato, where it contributes significantly to local employment and production capacity. However, the sector is also associated with high environmental impacts from intensive resource use, chemical processes, and waste generation (Choudhury, 2017; Kant, 2012).

Although the INEGI 2024 economic census does not yet provide a detailed breakdown of formal employment in Guanajuato's textile sector, the state reported more than 1.1 million formal jobs as of June 2025 (INEGI, 2025b). MSMEs play a central role in this employment landscape, accounting for over 69% of formal jobs and 99.8% of all registered economic units. Additionally, the Guanajuato Ministry of Economy reports a continued strengthening of the economic base in 2024, with a notable increase in formal employment and business consolidation (Gobierno del Estado de Guanajuato, 2025).

Environmental sustainability has become a growing concern in industrial sectors worldwide, including textiles, due to the increasing pressure from regulatory frameworks, consumer expectations, and global climate commitments. This change has led to a heightened interest in how small businesses adopt and benefit from environmental practices. Existing research suggests that implementing such practices can improve environmental performance, operational efficiency, and competitiveness. However, MSMEs often encounter structural barriers, such as limited financial resources, technological gaps, and insufficient expertise, that restrict their ability to adopt sustainable strategies (Dangelico & Pujari, 2010; del Brío & Junquera, 2003). In Mexico, these challenges are compounded by weak institutional support and lax enforcement of environmental regulations (OECD, 2013).

In Guanajuato, a state with a long-standing textile manufacturing tradition, the environmental footprint of MSMEs is a growing concern. Although some companies have begun to adopt cleaner production methods and invest in waste management systems, the overall implementation of environmental practices remains fragmented and underresearched. This lack of comprehensive data hinders the ability of policymakers and industry leaders to design effective strategies for sustainable development.

The focus on Guanajuato as the study region is justified by several factors. Guanajuato is one of the Mexican states with the highest concentration of MSMEs in the textile sector, particularly in industrial clusters such as León, Moroleón, Uriangato, and San Francisco del Rincón, where textile activities play a central role in regional employment and economic output. At the same time, these clusters face significant

environmental challenges related to waste management, water consumption, and pollution, which makes sustainability a pressing issue. Unlike other states with consolidated textile industries, such as Puebla, Jalisco, Nuevo León, or Mexico City, Guanajuato has received relatively limited academic attention in terms of empirical studies on MSME environmental practices. Thus, this research contributes to filling that gap while also offering sociopolitical value insights, given the region's ongoing efforts to design and implement sustainability policies tailored to local industrial dynamics.

The objective of this study is to analyze both the implementation and perceived importance of environmental practices among MSMEs in Guanajuato's textile industry. Specifically, it seeks to identify the extent to which these companies adopt such practices and to evaluate their implications for advancing the goals of sustainable development in the region. In doing so, the study provides empirical evidence that can guide policymakers and industry leaders in promoting environmental responsibility while protecting the competitiveness of the sector.

Literature review

The growing concern about climate change, resource scarcity, and ecological degradation has increased pressure on businesses, particularly small and medium-sized enterprises (SMEs), to adopt environmentally sustainable practices. The Natural Resource-Based View (NRBV) (Hart, 1995) provides a strong theoretical foundation for this shift. NRBV posits that companies can achieve competitive advantage through strategic capabilities that facilitate environmentally sustainable practices, such as pollution prevention, product stewardship, and sustainable development. These capabilities allow companies to not only meet regulatory and societal expectations but also improve operational efficiency, drive innovation, and strengthen long-term viability (Hart & Dowell, 2011).

Several empirical studies support the proposition that environmental practices lead to sustainability-related benefits in SMEs. For example, Khoja et al. (2022), in their study of 49 SMEs in Houston, Texas, found that sustainable internal environmental strategies significantly improve operational, economic, and environmental performance. Their findings confirm that integrating sustainability into internal management processes, such as resource efficiency, waste reduction, and eco-conscious production, produces tangible performance outcomes across multiple dimensions.

Similarly, Yacob et al. (2019) investigated green initiatives in Malaysian manufacturing SMEs and found a positive impact on environmental sustainability. Notably, the intentions of owners or managers towards green practices served as a mediating factor, underscoring the role of individual leadership and vision in the implementation of sustainability efforts. However, the study also revealed that the adoption of green technology alone did not yield significant results, suggesting that technology must be accompanied by a behavioral and strategic alignment.

Consistent with these findings, Alraja et al. (2022) demonstrated that green human resource practices, such as green training programs and sustainability-focused performance evaluation systems, substantially enhance sustainable performance

in small and medium enterprises. This highlights the importance of embedding sustainability into organizational culture and systems, rather than treating it as a peripheral or compliance-driven issue. Furthermore, Omowole et al. (2024) emphasize that embracing green business practices, such as energy efficiency, waste minimization, and eco-design, reduces environmental footprints and enhances operational efficiency and competitiveness. These benefits are particularly important for SMEs, which often operate with limited resources and must find ways to innovate within constraints.

Expanding the strategic scope, Toromade and Chiekezie (2024) argue that innovative approaches, including circular economy principles, the adoption of renewable energy and digital technologies, are essential enablers of sustainability. These practices promote cost reduction and resource optimization and promote competitive advantage, particularly in dynamic markets. Lastly, the role of stakeholders cannot be overlooked. Journeault et al. (2021) identified five complementary roles that stakeholders can play in facilitating sustainability adoption in SMEs. These include acting as enablers, collaborators, monitors, resource providers, and legitimizers. Their study suggests that overcoming institutional and resource-based barriers requires multi-stakeholder engagement to improve both social and environmental performance outcomes.

This literature review also synthesizes recent findings that are particularly relevant to the textile sector, where environmental pressures are intensifying. The textile industry is increasingly scrutinized for its resource-intensive operations, and scholars have emphasized the need to transition toward circular economy principles to address its environmental footprint. For instance, Ferrulli et al. (2021) argue for systemic design approaches to support the adoption of a circular textile model, pointing out that while fashion items receive much of the focus, areas such as home textiles remain critically underexplored, revealing a significant gap in sustainable innovation. Furthermore, wastewater management is identified as a key factor in the sustainability transformation of sustainability of textile companies. Gomes et al. (2023) highlight the interdependence between water use, energy consumption, and environmental results, emphasizing the complexity of achieving sustainability in textile production systems. This reinforces the need for integrated environmental strategies, particularly for SMEs operating within the textile value chain.

Finally, circular supply chain management (CSCM) is emerging as a strategic framework capable of driving sustainable innovation in the textile sector. Ugrinov et al. (2024) analyze the barriers and enablers to CSCM adoption, stressing that the successful implementation of circular models requires coordinated efforts in design, logistics, stakeholder alignment, and capability development.

At the European level, empirical evidence highlights that commitment to resource efficiency actions among SMEs is strongly associated with progress in sustainability transitions, suggesting that targeted environmental practices can translate into measurable performance improvements (Chatzistamoulou & Tyllianakis, 2022). In textile-specific contexts, EU-level mapping reports emphasize both opportunities, such as eco-design, circular business models, and collaborative platforms, and persistent capability gaps that constrain smaller firms (European Commission, 2019). More recently,

Naranjo et al. (2025) documented how sustainability-oriented decision-making among European textile SMEs is becoming increasingly salient as companies seek to balance competitiveness with ecological responsibility.

Polish evidence mirrors these patterns. Large-sample studies of Polish manufacturing SMEs document a broadening portfolio of “green” initiatives and link them to operational outcomes, while also identifying persistent barriers such as financing, knowledge gaps, and technology adoption barriers (Wysocki, 2021). Leadership and organizational culture emerge as pivotal enablers of pro-environmental behavior, while pilot research on ESG implementation shows uneven awareness and readiness for sustainability reporting, with financial and informational constraints frequently cited (Piwowar-Sulej & Iqbal, 2025; Sakiewicz et al., 2024).

The reviewed studies consistently highlight that the adoption of environmental practices enables SMEs to improve operational efficiency, reduce ecological impacts, and build long-term competitiveness. In addition, evidence from different contexts, from manufacturing in Malaysia to textile production in Europe and Poland, indicates that integrating sustainability into internal processes, human resources, and supply chain strategies creates measurable environmental and performance outcomes. These findings are particularly relevant to the textile industry in Guanajuato, which faces growing pressure to reconcile economic viability with environmental stewardship. Based on the NRBV and the empirical evidence synthesized, it can be inferred that the implementation of environmental practices should improve the environmental performance of MSMEs operating in this sector.

H1: Environmental practices contribute to improved environmental performance in MSMEs.

Research methodology

This research applied a quantitative approach using a non-experimental, cross-sectional design. The analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM), a second-generation statistical technique suitable for complex models and small to medium-sized samples. Additionally, the Importance-Performance Map Analysis (IPMA) was used to explore strategic improvement priorities, using SmartPLS 4 software (Ringle et al., 2022) to conduct all analyses.

To estimate the measurement model, the PLS algorithm was utilized, ensuring internal consistency and construct validity. Furthermore, PLS predict was applied to evaluate the predictive power (Shmueli et al., 2019), while IPMA was specifically used to identify the gap between the importance and execution of environmental practices.

The sampling frame was based on data from the National Statistical Directory of Economic Units (DENUE) in Mexico. A sample size of 224 MSMEs (firms with 3 to 250 employees) was calculated in the Guanajuato textile manufacturing sector, assuming a 95% confidence level of 95% and a 5% margin of error, with $P = Q = 0.5$. Owners and managers of these companies were randomly selected to complete a structured questionnaire.

Measurement of variables

This study adopted a seven-item reflective scale adapted from Mengistu and Panizzolo (2021) to assess environmental practices. Items were rated on a five-point Likert scale, ranging from “not important” to “very important.” A five-item unidimensional scale adapted from Lima et al. (2023) and validated by Cuevas-Vargas et al. (2024) was used to measure sustainability benefits. This scale captures perceived improvements in employee motivation, competitive advantage, corporate image and reputation, profitability, and customer satisfaction, with responses measured on a five-point Likert-type scale from strongly disagree to strongly agree.

Common method bias

To address potential common method bias, full collinearity tests were conducted using the variance inflation factor (VIF) following Kock (2015). All VIF values were below the 3.3 threshold, indicating that common method variance is not a significant concern in this dataset (Table 1).

Table 1. Full collinearity test to evaluate common method bias

Variable	VIF value
Environmental practices	1.282
Sustainability benefits	1.282

Source: Own calculations based on PLS-SEM outcomes

Reliability and validity of the measurement variables

The reliability and convergent validity using the PLS-SEM algorithm. All item loadings exceeded the recommended threshold of 0.70 proposed by Hair et al. (2022), except for one item from the environmental practices construct, which had a loading of 0.696, still within an acceptable range to ensure indicator reliability. Model fit indices further supported the adequacy of the model, with a Standardized Root Mean Square Residual (SRMR) of 0.055 and a Normed Fit Index (NFI) of 0.898, indicating a satisfactory model fit. These results are consistent with the benchmarks suggested by Henseler and Sarstedt (2013), confirming the absence of significant misspecifications between the estimated and saturated models.

Regarding construct reliability, Cronbach’s Alpha values for all constructs surpassed the 0.70 threshold recommended by Nunnally and Bernstein (1994), confirming strong internal consistency. Furthermore, composite reliability (CR) also exceeded the 0.70 benchmark, further validating the consistency of the measurement scales (Hair et al., 2022). Additionally, the extracted average variance (AVE) was calculated to assess convergent validity. According to the criterion established by Fornell and Larcker (1981), an AVE value greater than 0.50 indicates adequate convergent validity. In this study, all constructs exceeded this threshold, confirming that the measurement scales used in the instrument demonstrate both reliability and convergent validity (Table 2).

Table 2. Reliability and convergence validity

Variable	Loading ranges	Cronbach's Alpha	CR	AVE
Environmental practices	0.696 to 0.866	0.915	0.932	0.663
Sustainability benefits	0.832 to 0.905	0.923	0.942	0.765

Source: Own calculations based on PLS-SEM results (Ringle et al., 2022)

However, discriminant validity was assessed using the Fornell and Larcker (1981) criterion, one of the most widely accepted methods for this purpose. This approach requires that the square root of the AVE for each construct (shown in bold along the diagonal of the correlation matrix) be greater than the correlations between that construct and any other. In this study, the highest correlation was 0.434, which is well below the corresponding diagonal values, providing strong evidence that each construct captures a distinct concept (Table 3).

Table 3. Discriminant validity based on the Fornell–Larcker criterion

Variable	Environmental practices	Sustainability benefits
Environmental practices	0.814	
Sustainability benefits	0.434	0.874

Source: Own calculations based on PLS-SEM results (Ringle et al., 2022)

Thus, based on the results of these psychometric assessments, there is sufficient evidence to confirm that the measurement scales included in the research instrument are both reliable and valid.

Results

First, to assess the predictive validity of the structural model, the cross-validated predictive ability test (CVPAT) was applied, comparing the model's PLS-SEM-based prediction errors with those from a naïve benchmark using the indicator average (IA) approach (Sharma et al., 2023). The evaluation focuses on whether the PLS model offers superior predictive accuracy relative to this baseline. As shown in Table 4, the endogenous variable yielded a PLS loss of 1.258, while the IA benchmark recorded a higher loss of 1.450, resulting in a negative average loss difference of -0.192. This negative value indicates that the PLS model outperforms the benchmark in terms of prediction accuracy (Liengard et al., 2021). The result is statistically significant, well below the conventional 0.05 threshold.

These findings provide strong empirical evidence that the structural model has robust out-of-sample predictive power for the outcome variable (Cuevas-Vargas & Fernández-Escobedo, 2025). Therefore, it can be concluded that the model not only fits the data well but also performs reliably in predicting sustainability benefits beyond the estimation sample (Hair et al., 2022).

Table 4. Predictive power through CVPAT – PLS-SEM vs indicator average

Endogenous variable	PLS loss	IA loss	Average loss difference	t-value	p-value
Sustainability benefits	1.258	1.450	-0.192	3.124	0.002

Source: Own calculations based on PLS-SEM results (Ringle et al., 2022)

To test the proposed hypothesis, the PLS-SEM bootstrapping procedure was conducted with 10,000 subsamples (Hair et al., 2022). The results yielded a path coefficient of 0.434, indicating a moderate and statistically significant effect of environmental practices on sustainability benefits. Thus, Hypothesis H1 is supported, providing empirical evidence that the adoption of environmental practices by MSMEs in the Guanajuato textile sector is positively associated with improved sustainability outcomes. These findings align with the predictions of the Natural Resource-Based View (NRBV) of the firm (Hart, 1995; Hart & Dowell, 2011), which posits that firms can gain a competitive advantage by developing capabilities that foster environmental sustainability. The observed results may include improvements in organizational reputation, employee motivation, customer satisfaction, and overall business performance (Table 5).

Table 5. Structural model results

Hypothesis	β	t-value	p-value	Decision
H1: Environmental practices → Sustainability benefits	0.434	8.038	0.000	Supported

Source: Own calculations based on PLS-SEM results (Ringle et al., 2022)

Furthermore, an importance-performance map analysis (IPMA) was performed to identify strategic areas for improvement by examining both the importance (total effect) and the performance (average latent variable scores) of the key constructs of the model (Hauff et al., 2024). The results indicate that environmental practices have an importance score of 0.434 in relation to sustainability benefits, signifying a strong influence on the outcome variable (Figure 1).

Regarding performance, environmental practices recorded a relatively low score of 49.472, while sustainability benefits achieved a higher performance level of 70.237. This gap suggests that, although environmental practices significantly influence sustainability results, their current level of implementation remains limited among MSMEs in Guanajuato's textile sector. Consequently, the IPMA highlights environmental practices as a high-priority area for strategic improvement. Enhancing the execution of these practices may lead to substantial gains in sustainability performance, underscoring the need for targeted support, training, and policy interventions aimed at strengthening environmental capabilities in regional MSMEs.

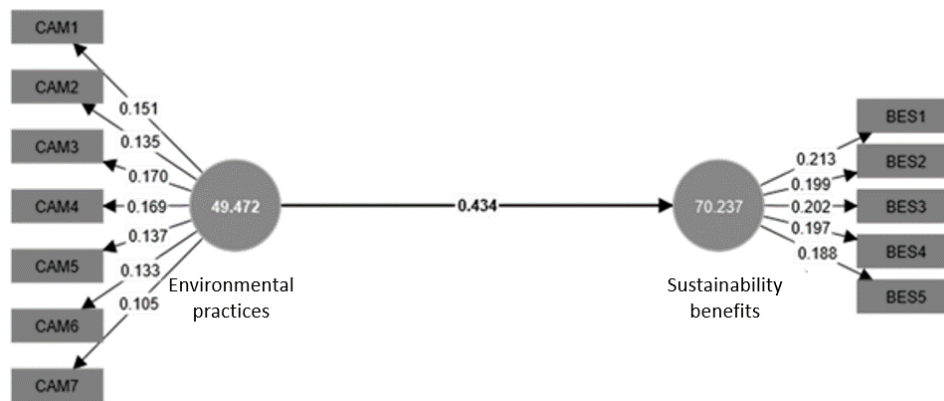


Figure 1. Importance-performance map analysis

Source: Own elaboration based on research results (Ringle et al., 2022)

Consistent with previous empirical studies (Alraja et al., 2022; Khoja et al., 2022; Yacob et al., 2019), the findings confirm that environmental practices, such as energy efficiency, responsible process design, and supplier selection, are associated with tangible improvements in organizational performance. These benefits, including improved reputation, employee motivation, and customer satisfaction, reinforce the multidimensional value of green practices, particularly in resource-constrained SME contexts. Furthermore, the relatively low performance score (49.472) for environmental practices, compared to the performance of sustainability benefits (70.237), indicates a significant implementation gap. This is in line with Omowole et al. (2024), who note that while SMEs increasingly recognize environmental concerns, actual practice often lags due to financial and organizational constraints.

Furthermore, the IPMA’s identification of environmental practices as both highly important and underperformed highlights a critical leverage point for improving sustainability outcomes. This aligns with Journeault et al. (2021), who stress the need for coordinated stakeholder engagement to address barriers and support the adoption of sustainable practices by SME. The findings also resonate with Toromade and Chiekezie (2024), who argue that innovation-enabling mechanisms, such as circular economy models and digital technologies, must fully complement environmental practices to realize performance gains.

In the context of the textile industry, these findings are particularly relevant. The sector is characterized by significant environmental impacts, especially related to water and energy consumption, as highlighted by Gomes et al. (2023). However, sustainable transformation remains uneven, particularly in traditional manufacturing regions such as Guanajuato. Studies by Ferrulli et al. (2021) and Ugrinov et al. (2024) emphasize the need for systemic and cross-functional approaches, such as circular supply chain management (CSCM), to achieve meaningful progress. This study supports this perspective, suggesting that isolated efforts in environmental management are insufficient; rather, integrated strategies supported by public policy and capacity building initiatives are essential to drive sustainable industrial transformation.

Conclusion

This study provides empirical evidence on the implementation of environmental practices among MSMEs in Guanajuato's textile sector and their contribution to business sustainability. The findings indicate that, while environmental awareness is present, the actual level of implementation remains limited. Practices related to process design, energy efficiency, and responsible supplier selection were found to have a significant positive effect on sustainability results, including enhanced reputation, employee motivation, profitability, and customer satisfaction.

From a managerial perspective, the results underscore the strategic importance of integrating environmental practices into core business operations. MSME owners and managers are encouraged to prioritize practices with the highest impact on sustainability performance, as identified through the Importance-Performance Map Analysis (IPMA). Addressing high-importance but low-performance areas represents a critical opportunity to increase competitiveness and ensure long-term viability in an increasingly sustainability-oriented market.

Regarding public policy, the study highlights the need for institutional support to enable the green transition of MSMEs. Policymakers should design targeted interventions, such as financial incentives, technical assistance, training programs, and supportive regulatory frameworks, that reduce adoption barriers and foster environmental innovation. Tailored support mechanisms for MSMEs in traditional manufacturing sectors, such as textiles, are essential to ensure inclusive and regionally balanced progress toward sustainable development goals.

Limitations and future research

This study is subject to certain limitations that should be acknowledged. First, the data were collected through self-reported questionnaires completed by company owners and managers, which may have introduced social desirability bias. As documented in research on corporate social responsibility (CSR) and sustainability, respondents may tend to present their businesses as more environmentally responsible than they actually are, potentially leading to an overestimation of the implementation of environmental practices. Future studies could address this limitation by triangulating data sources, for example, through environmental audits, on-site observations, or the use of secondary performance indicators, to provide a more objective assessment of the sustainability practices of MSMEs.

Second, this study is limited by its cross-sectional design and sector-specific focus, which may constrain the generalizability of the findings beyond the textile industry or the regional context of Guanajuato. Future research could employ longitudinal approaches to assess the evolution of environmental practices over time or expand the analysis to other sectors and regions. Additionally, incorporating variables such as digital capabilities, innovation intensity, or stakeholder pressure could further illuminate the drivers and barriers that influence sustainability adoption in MSMEs.

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KORZYŚCI DLA ZRÓWNOWAŻONEGO ROZWOJU WYNIKAJĄCE Z PRAKTYK ŚRODOWISKOWYCH W MŚP: DOWODY Z PRZEMYSŁU WŁÓKIENNICZEGO W GUANAJUATO

Streszczenie: Niniejsze badanie analizuje wdrażanie praktyk środowiskowych w mikro-, małych i średnich przedsiębiorstwach (MŚP) w stanie Guanajuato, w Meksyku, ze szczególnym uwzględnieniem sektora tekstylnego, oraz ocenia ich wkład w zrównoważony rozwój działalności gospodarczej. Praca odpowiada na rosnące zapotrzebowanie na zrównoważone modele produkcji w regionach przemysłowych zmagających się z wyzwaniami środowiskowymi. Zastosowano ilościowe, nieeksperymentalne badanie przekrojowe, oparte na danych zebranych wśród 244 właścicieli i menedżerów MŚP. Do identyfikacji strategicznych obszarów wymagających usprawnień wykorzystano analizę mapy ważności i efektywności (IPMA), porównując znaczenie i poziom realizacji praktyk środowiskowych. Wyniki wskazują na ogólny poziom wdrożenia na poziomie 49,47%, co świadczy o istotnym potencjale poprawy. Kluczowe praktyki wpływające na zrównoważony rozwój to: projektowanie procesów, zarządzanie energią oraz wybór dostawców – wszystkie mają pozytywny wpływ na motywację pracowników, reputację firmy, rentowność oraz satysfakcję klientów. Pomimo istnienia świadomości ekologicznej wśród MŚP w Guanajuato wdrażanie praktyk środowiskowych pozostaje ograniczone. Wzmocnienie tych działań stanowi szansę na poprawę wyników w zakresie zrównoważonego rozwoju i konkurencyjności. Uzyskane wyniki podkreślają potrzebę wdrożenia ukierunkowanych polityk publicznych i mechanizmów wsparcia przyspieszających zieloną transformację regionalnych MŚP.

Słowa kluczowe: praktyki środowiskowe, IPMA, MŚP, korzyści ze zrównoważonego rozwoju, przemysł tekstylny

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