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The Impact of Total Quality Management on Corporate Environmental Performance: Organizational Innovation as Mediator

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Abstract

Purpose: This study examines the effect of Total Quality Management (TQM) on Corporate Green Performance (CGP) in automotive companies, with organizational innovation as a mediator. The background of this study is based on the need for automotive companies to improve their Corporate Green Performance amidst sustainability challenges. Although many previous studies have examined TQM and Corporate Green Performance separately, there is a lack of understanding of the role of organizational innovation as a bridge between the two.
Research Methodology: The research method used is path analysis with primary data collected through questionnaires from the managers and employees of automotive companies.
Results: The results show that TQM has a significant positive effect on Corporate Green Performance and organizational innovation. In addition, organizational innovation mediates the relationship between TQM and Corporate Green Performance.
Conclusions: This conclusion confirms that good TQM implementation improves Corporate Green Performance directly and indirectly through increased innovation.
Limitations: This study is limited by a small sample size and reliance on cross-sectional, self-reported data, which may affect generalizability.
Contributions: The implications of this study suggest that automotive companies should integrate TQM and innovation into their sustainability strategies and provide insights for stakeholders and policymakers to support environmentally friendly practices. This study enriches the literature on the relationship between TQM, innovation, and sustainability in the automotive sector

Keywords: *Automotive Industry, CGP, OI, TQM*

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1. Introduction

In an era of globalization marked by rapid growth and technological innovation, the automotive industry is facing increasingly complex challenges. One of the main challenges is the increasing demand for sustainable business practices. Public awareness of environmental issues has reached a critical point, prompting consumers and stakeholders to demand that companies become more responsible in their operations. In this context, the automotive industry, one of the largest contributors to carbon emissions,

must take proactive steps to reduce its environmental impact (Pattanayak et al., 2017; Severo et al., 2020; Sezen & Cankaya, 2013).

Many automotive companies still operate traditional business models that focus on production efficiency and short-term profitability, often ignoring sustainability aspects (Giampieri et al., 2020; Morioka et al., 2016). These practices not only lead to increased greenhouse gas emissions but also result in inefficient use of resources such as excessive use of energy and raw materials. The negative impacts of this approach are felt not only by the environment but also by the companies themselves, which can lose their competitiveness in a global market that now prioritizes sustainability.

With the increasing stringency of environmental regulations and increasing consumer preference for environmentally friendly products, understanding and implementing Total Quality Management (TQM) have become essential. TQM can serve as a framework that enables automotive companies to improve their Corporate Green Performance. This approach not only helps improve operational efficiency but also creates a more environmentally conscious corporate culture. Therefore, this study focuses on how TQM can be integrated into automotive companies to achieve better results in the context of sustainability, ensuring that they not only survive but also thrive in the changing industry landscape.

Several previous studies have shown a relationship between Total Quality Management (TQM) and Corporate Green Performance, confirming the importance of implementing quality principles in the context of sustainability. For example, a study by Khalil and Muneenam (2021) and Muliyati et al. (2023) found that companies implementing TQM tend to have better Corporate Green Performance, owing to increased operational efficiency and waste reduction. In addition, Dormer et al. (2013) and Tahir (2023) showed that TQM can contribute to reducing carbon emissions by improving more efficient production processes. However, although these results indicate a positive relationship, many existing studies are still limited in their explanations of the mechanisms underlying this relationship.

A major weakness in the existing literature is the lack of attention to the role of organizational innovation as a mediator in the relationship between TQM and Corporate Green Performance. Most previous studies, such as those conducted by Abu Salim et al. (2019) and Supardi (2023), have focused more on the technical aspects of TQM, such as quality control and process management, without considering how innovations in organizational structure and culture can facilitate the achievement of better Corporate Green Performance. This study suggests that organizational innovation, such as the development of green products and the adoption of new technologies, can be an important link between TQM to Corporate Green Performance (Abbas, 2020; Abdallah & Al-Ghwayeen, 2020; Yang et al., 2020).

Thus, there is an urgent need to investigate how TQM implementation can be facilitated by organizational innovation. This study will focus on the automotive industry, which is a sector that is highly affected by environmental issues, where TQM implementation and organizational innovation can make significant contributions to green performance. Unlike previous studies, which tend to separate TQM and innovation, this study integrates both aspects to provide a more comprehensive understanding of how automotive companies can achieve better Corporate Green Performance (Ghisellini et al., 2016; Nabilla & Soehaditama, 2023).

This study aims to analyze the effect of Total Quality Management (TQM) on Corporate Green Performance by considering the role of organizational innovation as a mediator. More specifically, this study aims to provide in-depth insights into how automotive companies can integrate TQM principles with innovative approaches to achieve better results in Corporate Green Performance. This study will also identify key factors that influence the relationship between TQM and Corporate Green Performance, and explore how organizational innovation can be optimized in this context (Ahmad et al., 2022; Chen et al., 2006). By focusing on the interaction between TQM and innovation, the results of this study

are expected to provide practical guidance for automotive companies in implementing sustainable and effective strategies.

This study argues that effective TQM implementation will significantly improve Corporate Green Performance, especially when integrated with organizational innovation. This hypothesis is based on the understanding that companies that adopt TQM principles not only tend to have better management systems and processes but are also able to drive innovation and operational efficiency needed in the context of sustainability. The expected outcome of this study is to show that organizational innovation is not only a tool for achieving better performance but also an important element in supporting environmental sustainability in the automotive industry. This research is important because it can provide a theoretical and practical basis for companies in facing future environmental challenges and offer new insights on how to integrate TQM and innovation to achieve higher Corporate Green Performance.

2. Literature Review & Hypothesis Development

2.1 Total Quality Management and Corporate Green Performance

Total Quality Management (TQM) is a comprehensive management approach that emphasizes continuous improvement, customer focus, and organizational involvement to enhance overall performance. In the context of sustainability, TQM plays a crucial role in improving Corporate Green Performance (CGP) by promoting efficient resource utilization, waste reduction, and environmentally responsible practice (Hussain, 2021; Jimoh et al., 2019). Companies that effectively implement TQM are more likely to integrate environmental considerations into their operational processes, leading to improved environmental outcomes (Hamdan & Alheet, 2021; Zairi, 2002).

2.2 Toxic Workplace Environment

TQM also contributes significantly to the development of organizational innovation. By fostering a culture of continuous improvement and encouraging employee participation, TQM creates an environment that supports creativity and the adoption of new ideas. Organizations that implement TQM practices tend to be more adaptive and open to innovation, particularly in developing new processes, technologies, and management systems that enhance both efficiency and sustainability (Basera et al., 2019; Moradi & Beigi, 2020).

2.3 Organizational Innovation and Corporate Green Performance

Organizational innovation is a key driver of Corporate Green Performance. Innovations in products, processes, and organizational practices enable companies to reduce environmental impacts while improving operational efficiency. The adoption of environmentally friendly technologies and sustainable production methods allows firms to minimize emissions, optimize resource use, and enhance their competitive advantage in environmentally conscious markets (Ahmadun et al., 2023).

2.4 The Mediating Role of Organizational Innovation

Organizational innovation plays a mediating role in the relationship between TQM and Corporate Green Performance. The implementation of TQM encourages the development of innovative practices, which in turn enhance environmental performance. This suggests that the impact of TQM on sustainability outcomes is not only direct but also indirect through its ability to stimulate innovation within the organization. Therefore, integrating TQM and innovation is essential for achieving optimal environmental performance and long-term sustainability (Albort-Morant et al., 2018; Shahzad et al., 2020; Song & Yu, 2018).

2.5 Hypothesis Development

The following research hypotheses were formulated based on this conceptual framework to be tested using the designed statistical methods.

H_1: The implementation of Total Quality Management (TQM) has a positively influences the Corporate Green Performance of automotive companies.

H_2: The implementation of Total Quality Management (TQM) has a positive on organizational innovation in automotive companies.

H_3: Organizational innovation (OI) has a positive effect on Corporate Green Performance (CGP) of automotive firms.

H_4: The implementation of Total Quality Management (TQM) has a positive effect on Corporate Green Performance (CGP) of automotive companies with the mediation of organizational innovation (OI).

3. Methodology

This methodology uses a quantitative approach with an explanatory design to analyze the effect of Total Quality Management (TQM) on Corporate Green Performance in automotive companies, with organizational innovation as a mediator (Abbas, 2020). The main focus of this study is automotive companies in Indonesia, which face challenges in sustainability and environmental impact management.

The research population comprised all automotive companies operating in Indonesia. From this population, 30 companies were selected as samples using purposive sampling techniques. The selection criteria included companies that had implemented TQM practices, demonstrated a commitment to sustainability, and had units that focused on organizational innovation. Primary data were collected through questionnaires distributed to managers and employees involved in environmental quality and sustainability. The questionnaire was designed to measure three main variables: TQM, organizational innovation, and Corporate Green Performance. TQM is measured based on principles such as continuous quality improvement and a customer focus. Organizational innovation is assessed through the level of innovation implementation in product and process development. Meanwhile, Corporate Green Performance is measured by indicators including emission reduction, energy efficiency, waste management, and the use of environmentally friendly raw materials.

The conceptual framework of this study describes the relationship between TQM, organizational innovation, and Corporate Green Performance. In this model, TQM is expected to drive organizational innovation, which, in turn, will improve Corporate Green Performance. TQM also has a direct influence on Corporate Green Performance, so organizational innovation serves as a mediator that strengthens this relationship between them. Thus, this study aims to provide more comprehensive insights into how automotive companies can integrate TQM and organizational innovation to achieve better Corporate Green Performance. The following conceptual framework was used as a reference in this study:

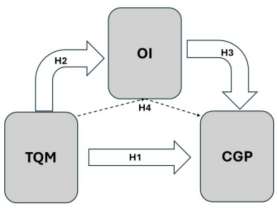

Figure 1. Conceptual Framework

The conceptual framework presented in this study explains the relationship between three main variables: Total Quality Management (TQM), organizational innovation (OI), and Corporate Green Performance (CGP). TQM, as an independent variable, plays an important role in improving company performance through the application of quality management principles, such as continuous improvement, employee involvement, and data-based decision-making. This relationship is assumed to affect CGP directly and indirectly through the mediating role of OI.

Green Manufacturing (GM) in this framework is positioned as a mediating variable that strengthens the influence of TQM on Corporate Green Performance (CGP). OI includes various environmentally friendly practices, such as energy efficiency, waste management, use of sustainable raw materials and pollution prevention. By utilizing GM principles, companies are expected to integrate quality management strategies into environmental sustainability efforts, which will ultimately improve EP.

This conceptual framework is based on the literature showing that TQM can drive GM implementation, and GM, in turn, can directly contribute to CGP improvement. Thus, this study not only tests the direct relationship between TQM and CGP but also examines the extent to which OI can mediate this relationship

4. Results and Discussion

Some After the data was collected through questionnaires distributed to respondents, analysis was carried out using statistical techniques such as descriptive, validity tests, reliability, and path analyses to test the proposed hypotheses. The following are the results of the data analysis for each hypothesis.

4.1 Descriptive Analysis

In the initial stage, a descriptive analysis was conducted to describe the characteristics of respondents and described the distribution of data for each variable studied. The following is the distribution of the respondents' characteristics and the average value of each variable studied:

Table 1. Distribution of Respondent

Variables	Average	Standard Deviation
TQM (Total Quality Management)	4.35	0.72
Organizational Innovation	4.12	0.68
Corporate Green Performance	4.20	0.74

This table shows that respondents tended to give positive assessments of TQM implementation, organizational innovation, and Corporate Green Performance of automotive companies.

4.2 Validity and Reliability Test

Before proceeding with the path analysis, validity and reliability tests were conducted to ensure that the instruments used in this study could measure the variables properly.

4.3 Validity Test

Shows that all items in the questionnaire have a loading factor value > 0.6, which means that the items are valid in measuring the intended construct (Sürücü & Maslacy, 2020).

4.4 Reliability Test

Cronbach's alpha produced a value above 0.7 for each variable, indicating that this research instrument is reliable (Hair et al., 2019).

4.5 Path Analysis

After conducting validity and reliability tests, path analysis was conducted to test the direct and indirect effects between Total Quality Management (TQM), organizational innovation, and Corporate Green Performance (CGP) in automotive companies. The path model tested includes four main relationships.

1. The direct influence of TQM on Corporate Green Performance.
2. The direct influence of TQM on Organizational Innovation.
3. The direct influence of Organizational Innovation on Corporate Green Performance.
4. The mediating influence of Organizational Innovation on the relationship between TQM and Corporate Green Performance.

4.6 Hypothesis Test Results

Hypothesis 1 (H1): The implementation of Total Quality Management (TQM) has a positively influences the Corporate Green Performance of automotive companies.

Variables	Coefficient	p-value	Result
TQM → CGP	0.43	0.001	Significant Positive

The hypothesis posits that the implementation of Total Quality Management (TQM) within an automotive company positively influences Corporate Green Performance (CGP) by driving improvements in operational efficiency and minimizing waste. TQM emphasizes structured practices, such as continuous improvement, quality control, and waste reduction, which collectively contribute to better environmental outcomes. By streamlining processes and optimizing resource utilization, TQM ensures that companies can reduce their ecological footprints while maintaining high-quality standards. This connection highlights TQM's pivotal role of TQM in achieving sustainability objectives, particularly in industries such as automotive, where environmental concerns are significant.

The results support this hypothesis, with a path coefficient value of 0.43 and a p-value of 0.001, indicating a statistically significant positive relationship between TQM and CGP in the healthcare sector. This finding demonstrates that companies experience notable improvements in environmental performance as they enhance their TQM practices. The significance of this relationship underscores the importance of integrating TQM into corporate strategies to achieve environmental goals. Effective TQM implementation not only boosts operational efficiency but also helps automotive companies align with increasing regulatory and sustainability requirements.

Hypothesis 2 (H2): The implementation of Total Quality Management (TQM) positively affects organizational innovation in automotive companies.

Variables	Coefficient	p-value	Result
TQM → OI	0.35	0.02	Significant Positive

The hypothesis suggests that Total Quality Management (TQM) principles, including continuous improvement and employee involvement, play a vital role in fostering organizational innovation. TQM creates a culture that encourages experimentation, collaboration, and problem solving, which are essential for driving innovative practices. By emphasizing employee engagement and collective participation, TQM enables organizations to explore and implement new processes, technologies, and ideas that en-

hance efficiency and sustainability. This alignment of quality management with innovation highlights the importance of TQM in helping firms adapt to dynamic market conditions and achieve competitive advantages.

The results validate this hypothesis, with a path coefficient of 0.35 and a p-value of 0.02, indicating a significant positive relationship between TQM and organizational innovation. These findings confirm that organizations implementing TQM effectively are more likely to cultivate an environment that is conducive to innovation. The emphasis on continuous improvement under TQM motivates firms to adopt creative solutions that optimize their operations and address sustainability challenges. Consequently, TQM serves as a framework for quality enhancement and a catalyst for organizational innovation, driving long-term growth and adaptability.

Hypothesis 3 (H3): Organizational innovation (OI) has a positive effect on Corporate Green Performance (CGP) of automotive firms.

Variables	Coefficient	p-value	Result
OI $\rightarrow$ CGP	0.30	0.03	Significant Positive

The hypothesis asserts that organizational innovation, including advancements such as environmentally friendly product designs and more efficient operational processes, significantly enhances Corporate Green Performance (CGP). Organizational innovations enable firms to optimize resource utilization, reduce emissions, and minimize waste, directly contributing to better environmental outcomes. By embracing innovative practices, companies not only align with sustainability goals but also position themselves competitively in markets where eco-consciousness is increasingly prioritized. This underscores the critical role of innovation in bridging operational excellence and environmental responsibility.

The results support this hypothesis, with a path coefficient of 0.30 and a p-value of 0.03, indicating a statistically significant positive relationship between organizational innovation and CGP. These findings demonstrate that companies implementing innovations effectively are better equipped to improve their green performance. This relationship highlights the importance of fostering a culture of innovation within organizations to drive sustainable efforts. For automotive Companies, particularly those investing in innovative practices and technologies, must meet environmental challenges and achieve long-term success in an eco-conscious market.

Hypothesis 4 (H4): The implementation of Total Quality Management (TQM) has a positive effect on Corporate Green Performance (CGP) in automotive companies, with the mediation of organizational innovation (OI).

Variables	Coefficient	p-value	Result
TQM $\rightarrow$ OI $\rightarrow$ CGP	0.12	0.01	Mediation

This hypothesis posits that the effective implementation of Total Quality Management (TQM) enhances organizational innovation, which subsequently contributes to improvements in Corporate Green Performance (CGP). TQM fosters a culture of continuous improvement and collaboration, encouraging the development of innovative practices and solutions. These innovations, such as adopting eco-friendly technologies and optimizing processes, directly impact CGP by reducing waste, improving efficiency, and minimizing environmental footprints of the production process. The mediation analysis using the

bootstrap method supports this hypothesis, revealing an indirect effect value of 0.12 with a p-value of 0.01, indicating that organizational innovation significantly mediates the relationship between TQM and CGP. This demonstrates that while TQM directly improves CGP, its impact is amplified when it is coupled with innovation-driven practices.

These findings underscore the synergistic relationship between TQM and organizational innovation in achieving environmental sustainability. TQM significantly and positively affects CGP, indicating that effective quality management practices lead to better environmental outcomes. Moreover, TQM positively influences organizational innovation, highlighting its role in fostering an environment that supports creativity and adaptation to change. Organizational innovation has a direct positive effect on CGP, emphasizing the importance of innovative practices in addressing sustainability challenges. As a mediator, organizational innovation strengthens the TQM-CGP relationship, illustrating that the integration of quality management and innovation is essential for automotive companies to achieve superior environmental performance and sustainability.

4.7 The Impact of TQM on Corporate Green Performance

The results of the analysis show that the implementation of TQM has a significant positive effect on the Corporate Green Performance of automotive companies. With a path coefficient value of 0.43 and p-value = 0.001, indicating that companies that implement TQM well tend to achieve better Corporate Green Performance. This is in line with the research by Abbas (2020), who found that companies that implement TQM have better Corporate Green Performance due to increased operational efficiency and waste reduction. However, this study also shows that although this positive relationship has been proven, several previous studies have not sufficiently explained the mechanisms underlying this relationship.

4.8 The Influence of TQM on Organizational Innovation

The findings also show that TQM has a positive effect on organizational innovation, with a path coefficient of 0.35 and a p-value of 0.02. This means that good TQM implementation can encourages companies to be more innovative. Previous studies, such as those conducted by Antunes et al. (2021), have focused more on the technical aspects of TQM and paid less attention to how innovation in organizational structure and culture can facilitate the achievement of better Corporate Green Performance. This study addresses these shortcomings by demonstrating that TQM fosters a culture that supports employee participation and process improvement, which is crucial for creating an environment conducive to innovation.

4.9 The Influence of Organizational Innovation on Corporate Green Performance

Organizational innovation is also proven to have a positive influence on Corporate Green Performance, with a path coefficient of 0.30 and a p-value of 0.03. This indicates that companies that adopt innovation, such as developing environmentally friendly products and efficient production processes, will improve their Corporate Green Performance. (Chen et al., 2006) also showed that innovation in the production process can contribute to reducing carbon emissions. The results of this study are in line with these findings and emphasize the importance of innovation in achieving environmental sustainability.

4.10 Mediation of Organizational Innovation in the Relationship between TQM and Corporate Green Performance

Mediation analysis shows that organizational innovation serves as a significant mediator in the relationship between TQM and Corporate Green Performance, with an indirect effect value of 0.12 and p-value = 0.01. This finding indicates that effective TQM implementation improves Corporate Green Performance directly and indirectly by increasing organizational innovation. This supports the arguments put forward by previous studies, but adds a new dimension by emphasizing the importance of organizational innovation as a bridge between TQM and Corporate Green Performance. Several previous studies have not highlighted

this aspect, so this This study makes a significant contribution to clarifying this relationship.

5. Conclusions

This study examines the influence of Total Quality Management (TQM) on Corporate Green Performance (CGP) within automotive companies, highlighting the mediating role of Organizational innovation. The path analysis revealed several critical relationships between these variables. First, TQM has a significant positive impact on CGP. Automotive companies that implement effective TQM principles benefit from enhanced operational efficiency and reduced waste, directly contributing to improved environmental performance. This underscores the importance of adopting a structured approach to quality management as a foundation for achieving sustainability goals.

Moreover, TQM fosters organizational innovation by creating a culture that emphasizes continuous improvement and employee engagement. Companies with robust TQM practices tend to encourage innovation in processes and products, thereby driving efficiency and adaptability. This relationship highlights TQM's role not only in improving quality standards but also in promoting a proactive organizational mindset toward innovation, which is increasingly vital in dynamic and sustainability-focused market environments.

Organizational innovation significantly impacts CGP. Companies that adopt innovative practices, such as developing environmentally friendly products and streamlining operational processes, demonstrate better environmental performance. This confirms innovation is a crucial driver of sustainability, enabling companies to align their operations with eco-friendly standards while maintaining competitiveness.

Importantly, organizational innovation mediates the relationship between TQM and CGP in this study. This indicates that while TQM directly enhances CGP, its influence is further amplified by the innovations it fosters within the organization. Thus, the integration of TQM and innovation provides a dual pathway for achieving superior environmental performance, emphasizing the synergistic effect of these practices in sustainability strategies.

This study has both practical and theoretical implications. For practitioners, these findings emphasize the need for automotive companies to integrate TQM and organizational innovation into their sustainability strategies. By fostering a culture of continuous improvement and innovation, companies can achieve operational excellence and environmental stewardship,bpositioning themselves competitively in markets that increasingly prioritize sustainability. For researchers, this study enriches the existing literature on the interplay between TQM, organizational innovation, and CGP, paving the way for further exploration of the factors influencing innovation within the TQM framework. Stakeholders, including regulators and consumers, can leverage these insights to advocate for the broader adoption of TQM and innovation as tools for achieving sustainability goals in the automotive industry. Finally, the findings offer valuable input for policymakers to develop regulations and incentives that encourage environmentally friendly innovations and quality management practices in the sector, contributing to national and global sustainability objectives.

5.1 Research Limitations

Several limitations must be considered in this research:

1. the sample size is limited to 30 automotive companies in Indonesia, which may restrict the generalizability of the findings to other industries or geographical contexts.
2. The study relies on cross-sectional data collected through questionnaires, which may not fully capture the dynamic nature of Total Quality Management (TQM), organizational innovation, and Corporate Green Performance (CGP) over time.

3. The measurement of variables is based on self-reported perceptions of respondents, which may introduce potential bias. Future studies are encouraged to incorporate longitudinal designs and objective performance data to enhance the robustness of findings.

5.2 Suggestions and Directions for Future Research

Future research is recommended to expand the scope of this study by including a larger and more diverse sample across different industries and countries to improve generalizability. In addition, longitudinal studies should be conducted to better understand the long-term impact of TQM on Corporate Green Performance through organizational innovation.

Further studies may also explore additional mediating or moderating variables such as corporate social responsibility, organizational culture, green supply chain management, and digital transformation to provide a more comprehensive model. Moreover, qualitative approaches or mixed-method research could be employed to gain deeper insights into how TQM practices are implemented and how they foster innovation in real organizational settings.

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Author Contributions

NR contributed to conceptualization, methodology, formal analysis, and data collection. DR contributed to investigation, writing—original draft preparation, writing—review and editing, and supervision. NR and DR contributed to validation.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this study. This research was conducted independently, and no financial or personal relationships influenced the results or interpretation of the findings.

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