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THE IMPACT OF CARBON EMISSION REDUCTION ON FINANCIAL PERFORMANCE: A CASE STUDY OF TOYOTA MOTORS

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ABSTRACT

This study investigates the impact of carbon emission reduction on the financial performance of Toyota Motors through a quantitative research approach. Using Return on Assets (ROA) as a proxy for financial performance and Toyota's carbon emission data from 2005 to 2020, the research employs a single-case study design focused on the North American region. Statistical analysis, including regression modeling, reveals a significant positive relationship between carbon emission reduction and ROA. The findings suggest that Toyota's efforts in reducing carbon emissions positively influence its financial performance, highlighting the strategic importance of sustainability initiatives in enhancing corporate profitability and resilience amidst global regulatory pressures. This study contributes to both environmental management and corporate finance literature by demonstrating the financial benefits of carbon efficiency in the automotive industry.

Keyword: Carbon Emission Reduction, Carbon Reduction Policy, Financial Performance, Toyota Motors

INTRODUCTION

Toyota Motor Japan

Toyota Jidosha Kabushiki-gaisha (Toyota Motor Corporation), headquartered in Toyota City, Japan, is the global automotive giant leading the Toyota Group. Founded in 1933 by Kiichiro Toyoda, building upon his father's company, Toyota Motor Corporation has grown into a behemoth encompassing nearly 1,000 subsidiaries and affiliates (Wada, 2020).

Toyota's roots trace back to the Toyoda Automatic Loom Works, Ltd., established in 1918. Leveraging this foundation, Kiichiro Toyoda forayed into automobile production, with the inaugural Model AA sedan rolling off the assembly line in 1936. The company subsequently witnessed significant milestones, including the 1940s establishment of Toyota Machine Works and Toyota Auto Body, and the 1982 merger with Toyota Motor Sales Company. Notably, 1984 marked Toyota's entry into the U.S. market through the joint venture, New United Motor Manufacturing, Inc. (NUMMI), with General Motors (Kikkawa, 2023).

Toyota's reach extends beyond automobile manufacturing. The corporation operates industrial and delivery services worldwide, while its subsidiaries venture into diverse fields such as vulcanized rubber production, resource extraction, steel manufacturing, and real estate. This diversification reflects Toyota's commitment to a comprehensive industrial presence (Wang, 2021).

Aligned with the growing global focus on environmental responsibility, Toyota unveiled the Toyota Environmental Challenge 2050 in 2015, coinciding with the Paris Agreement. This long-term initiative underscores Toyota's commitment to sustainability. Recognizing the interconnected challenges of climate change and the Sustainable Development Goals (SDGs), Toyota envisions

continuous transformation beyond 2030. The corporation's environmental efforts are driven by the belief that addressing these issues fosters a better future (Hulme, 2023).

Toyota has consistently spearheaded groundbreaking initiatives in the automotive industry. Notably, they were the first to establish a specialized automobile recycling program, operate a waste-free manufacturing plant, and achieve mass production of hybrid vehicles and hydrogen fuel cell sedans. These innovations exemplify Toyota's commitment to environmental consciousness and technological advancement.

Toyota Motor Carbon Reduction Policy

Toyota Tsusho's Materiality framework prioritizes the reduction of CO2 emissions across the automotive, industrial, and plant construction sectors. This commitment aligns with the company's goal of contributing to a carbon-neutral society. The strategy emphasizes the utilization of clean energy and innovative technologies to achieve this objective. This suggests a multi-pronged approach that leverages both established and emerging solutions for decarbonization. Renewable energy constitutes a cornerstone of Toyota Tsusho's business strategy, highlighting its commitment to environmentally friendly practices. This focus area aligns with the growing global shift towards renewable energy sources.

The company emphasizes a balanced approach, seeking innovative solutions that serve both environmental and commercial objectives. This indicates a strategic direction that promotes sustainability while maintaining business growth. Renewable Energy Sector suggests an active role in developing and promoting renewable energy sources critical for a low-carbon future. Toyota Tsusho recognizes the importance of lithium, a key material for electric vehicles, and aims to ensure a reliable supply chain. The emphasis on "Reduce, Reuse, Recycle" principles signifies a commitment to resource efficiency and a circular economy within the automotive sector.
[1].

Business problem

Tightening global regulations aimed at carbon emission reduction present both challenges and opportunities for corporations. Increased carbon dioxide production can lead to cost inefficiencies for manufacturers who exceed established emission thresholds. To assess carbon efficiency among companies with similar production processes, a productive efficiency model is employed. This model, as outlined by Trinks et al. (2020), quantifies CO2 efficiency by analyzing overall factor throughput and industry-specific performance metrics. This study specifically investigates the relationship between Toyota's carbon reduction practices and their financial performance. A core element of Toyota's strategy is a focus on renewable energy. The company pursues a multi-pronged approach to sustainability and growth, encompassing involvement in the renewable energy sector, securing a stable lithium supply chain (critical for electric vehicles), and implementing a "3Rs" (Reduce, Reuse, Recycle) principle for batteries within the transportation industry.

Research Question

Q1: Is there a relationship between environmental practice of the Toyota company and financial performance of the company?

Q2: Does decreasing the carbon footprints improve financial performance of Toyota company?

Q3: Is there impact of carbon emission on the financial performance of the Toyota company?

Literature Review

CSR theory and environmental concept

The core objective of most businesses lies in maximizing profit and shareholder value. This raises a critical question: to what extent can we expect companies to prioritize environmental concerns and proactively address climate change?

Scholars hold diverse perspectives on corporate social responsibility (CSR) initiatives related to the environment. Wood (1988) expresses skepticism, arguing that capitalism inherently leads to environmental degradation and is incompatible with ecological sustainability. Similarly, Windsor (2014) employs critical analysis to suggest that market

[1] https://www.toyota-tsusho.com/english/csr/environment/climate-change.html

mechanisms, such as carbon pricing programs, are ultimately inadequate in mitigating the catastrophic consequences of climate change. Banerjee and Duflo (2007) further this critique by highlighting the limitations of “win-win" assumptions in CSR. They argue that a company's profit-maximizing structure inherently restricts its capacity to achieve broader societal benefits. However, the urgency of the climate crisis cannot be ignored. Scientific evidence, as outlined by Stern (2006), suggests that unabated climate change carries significant risks. The potential for average temperature increases exceeding 5°C, coupled with the relatively modest cost of mitigation (around 1% of global GDP per year), underscores the need for action.

Governments worldwide are implementing regulations and restrictions to address climate change. This shift in the global business environment necessitates a change in corporate behavior. The traditional "business as usual" approach is no longer viable. Companies must consider the impact of climate change on their operations and long-term success. Without a well-defined carbon reduction strategy, businesses risk financial instability and potential market failure. From a purely financial standpoint, proactive carbon management represents a sound corporate strategy. Even for companies prioritizing environmental responsibility, effective communication is essential. Demonstrating how business practices contribute to reducing global warming allows them to address stakeholder concerns and enhance long-term profitability. In today's world, a strong climate change policy is increasingly becoming a key factor in ensuring a company's financial success.

Legitimacy theory

Legitimacy theory, as explored by scholars like Cormier and Gordon (2001), emphasizes the importance of a company's ability to fulfill its societal obligations in order to maintain credibility. Lindblom (1994) further defines legitimacy as a state of congruence between an organization's value system and the broader societal norms. A perceived or actual discrepancy between these values can threaten an organization's standing. Suchman (2013) offers a broader perspective, defining legitimacy as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms." Social contracts play a crucial role in legitimacy theory. Businesses and organizations operate within a social framework, and their legitimacy hinges on public perception of their adherence to societal expectations and values. As Cotter, Lokman, and Najah (2011) highlight, maintaining legitimacy requires organizations to continuously seek societal acceptance of the implicit social contract between them. When an organization's legitimacy is threatened, various strategies are employed to restore it. Social and environmental disclosure is a common tactic used to manage societal expectations and demands. By disclosing information on their social and environmental impact, companies aim to demonstrate their commitment to these aspects and convince stakeholders of their legitimacy (Cotter et al., 2011). In essence, legitimacy theory underscores the importance of aligning corporate behaviour with societal expectations for long-term organizational success.

Stakeholder theory

Stakeholder theory offers a comprehensive framework for understanding the relationships between organizations and the various groups they interact with. As defined by Freeman and Reed (1983), stakeholders are "any identified group or person who may impact the attainment of an organization's goals, or is affected by the success of an organization's objectives." This broad definition encompasses a diverse range of entities, including shareholders, creditors, government agencies, media outlets, and employees. Clarkson (1995) further differentiates between primary and secondary stakeholders. Primary stakeholders are considered essential for the organization's ongoing viability, while secondary stakeholders have an impact on, and are impacted by, the organization but are not directly involved in its core transactions. Stakeholder theory emphasizes the right of all stakeholders, regardless of their classification, to be informed about how their interests are affected by organizational decisions. This aligns with a broader ethical perspective that recognizes the inherent rights of stakeholders, both primary and secondary. Stakeholder theory can be viewed through two distinct lenses: the ethical/normative and the positive. The ethical perspective, as explored by Yap et al. (2018), emphasizes the fair treatment of all stakeholders by organizations. It argues that power dynamics are irrelevant, and an organization's responsibility

towards a stakeholder should be based on the impact it has on their lives, not just their financial influence. Hasnas (1998) exemplifies this ethical approach by suggesting that even in the absence of a direct financial benefit, stakeholder management is an ethical imperative, requiring managers to prioritize the well-being of all stakeholders, not just shareholders. The normative branch of stakeholder theory, on the other hand, emphasizes the balancing act required when managing the interests of multiple stakeholders. It posits that management has an obligation to consider the needs of all stakeholders and strive to achieve an optimal balance in situations where these needs conflict. In essence, the normative perspective underscores an organization's moral responsibility towards society as a whole.

Voluntary disclosure theory

Voluntary disclosure theory, as described by Gomes (2012), focuses on management's decision to share accounting and other relevant information beyond mandated requirements. This voluntary disclosure aims to reduce information asymmetry and improve communication between managers and stakeholders, particularly investors, by providing a clearer picture of the organization's long-term viability (Boesso & Kumar, 2007). In the context of environmental performance, Clarkson et al. (2008) propose that companies with superior environmental practices are more likely to engage in voluntary disclosure. This transparency allows them to distinguish themselves from those with weaker environmental performance. To achieve this differentiation, high performers will strive to provide verifiable and credible information about their environmental efforts, making it difficult for competitors to replicate such disclosures. Conversely, companies with poor environmental performance may choose to remain silent. As Verrecchia (1990) suggests, stakeholders may be unable to discern whether such non-disclosure stems from poor environmental practices or simply high proprietary information costs.

Signaling theory

Signaling theory, as explored by Cotter et al. (2011), delves into the motivations behind information disclosure by firms. A core concept in this theory is information asymmetry, which refers to the unequal distribution of information between stakeholders and the company. Signaling theory proposes that the party with more information can mitigate this asymmetry by transmitting it to others. In the corporate context, companies utilize voluntary disclosures, financial reports, and other means to signal their quality or worth to investors. By voluntarily sharing additional information, managers can help investors make more informed investment decisions. Companies with strong performance are generally more willing to disclose information to demonstrate their quality and differentiate themselves from competitors.

Originally applied to information asymmetry in the labor market, signaling theory has been extended to explain corporate disclosures (Maclean et al., 2014). The theory posits that information asymmetry can occur in any social context, and it explores how parties with more knowledge can communicate with others to address this imbalance. Companies, therefore, can use voluntary environmental disclosures to signal their superiority to competitors in the market, attracting investments and building a positive reputation. This behavior is driven by the information asymmetry inherent in the market (Verrecchia, 1983).

Both signaling theory and voluntary disclosure theory predict a positive relationship between environmental performance and environmental disclosure. High carbon performers are incentivized to distinguish themselves from poor performers by making verifiable and rigorous disclosures that signal their strong environmental practices to various stakeholders.

Institution theory

Institutional theory focuses on how social contexts shape corporate social behavior through established models, standards, values, norms, and schemas. This theory explores how these elements develop, spread, and evolve over time, as well as how they lose influence when no longer relevant (Scott, 2004). Despite its emphasis on maintaining order and stability, institutional theory acknowledges that corporate management inevitably navigates conflict and change within social contexts. Individual and organizational factors shape action scenarios by influencing interests, aspirations, and available options.

These forces can lead to the adoption or modification of specific behaviors, highlighting the impact of the social environment on individuals. "Regulatory, normative, and cognitive structures and activities" are identified as key components that provide

stability and purpose to organizational behavior. Regulatory structures encompass rules, laws, and other forms of formal regulations, while normative structures pertain to social and professional norms. Cognitive frameworks, on the other hand, are heavily influenced by cultural and ethical considerations. Chan and Zhou (2013) emphasize that pressures from external stakeholders for green practices can signal a shift in expectations for firms. Institutional theory is considered a recursive and self-reinforcing process, meaning it is both shaped by and shapes the individuals and technologies involved. Certain human behaviors reinforce established norms, while others challenge them. Technology, while inherently versatile, can be repurposed for various goals, highlighting the importance of human agency and decision-making in this process. As Suchman (1998) states, "institutional theory is therefore concerned with regulatory, social, and cultural variables that support an organization's survival and legitimacy rather than concentrating exclusively on efficiency-seeking behavior." Reaching high levels of corporate greening requires a fundamental shift in mentality. The growing global integration of green practices underscores the need for such initiatives to become institutionalized over time (Ulvila & Salminen, 1999). In essence, institutional theory provides a valuable lens for understanding how social contexts influence corporate social responsibility and the pressures that drive organizations to adopt or resist sustainable practices.

Empirical Review of Study

A growing body of research explores the complex relationship between corporate carbon emissions reduction strategies, financial performance, and disclosure practices (Delmas et al., 2015). Studies suggest that emission reduction efforts can negatively impact short-term financial performance (Delmas et al., 2015). Investments in mitigation strategies and potential disadvantages from competitors who do not incur similar costs can create temporary financial strain (Misani & Pogutz, 2015). Additionally, stakeholders may take time to recognize the benefits associated with a company's sustainability leadership (Delmas & Montiel, 2009). Similarly, cost reductions linked to improved carbon performance may take time to outweigh initial compliance expenses and upfront investments (Delmas & Montiel, 2009).

The focus of research appears to be shifting from a binary question of "does it pay to be green?" to a more nuanced exploration of "when and how" environmental practices translate into financial benefits (Eleftheriadis & Anagnostopoulou, 2017). The key question is not just whether environmental practices provide a competitive edge, but rather how cost-effective they are for businesses (Russo & Mintz, 2012). Delmas et al. (2015) propose an inverse U-shaped relationship between carbon emissions and financial performance. This theory suggests that companies might experience initial financial drawbacks associated with emission reduction efforts, but these costs eventually level off and are followed by long-term financial gains. However, a lack of conclusive evidence necessitates further research (Delmas et al., 2015).

A significant study by Clarkson et al. (2008) investigated the relationship between environmental performance and the extent of voluntary environmental disclosures. Their findings suggest that high performers are more likely to engage in comprehensive and verifiable disclosures, potentially aligning with economic-based voluntary disclosure theories. This contradicts socio-political theories that predicted a negative correlation between performance and disclosure (Clarkson et al., 2008). However, the inconclusive nature of these findings underscores the need for further exploration. A growing body of research explores the complex and multifaceted relationship between corporate carbon footprint (CFP), carbon emission reduction efforts (CER), and corporate financial performance (CFP) (Jiménez-Parra et al., 2018). Regulatory pressures and stakeholder expectations are key drivers for emission reduction (Jiménez-Parra et al., 2018). Stringent regulations, such as cap-and-trade schemes and carbon pricing, incentivize companies to reduce emissions or purchase allowances (Jiménez-Parra et al., 2018; Brouwers et al., 2018).

The link between voluntary environmental disclosures (VEDs), like greenhouse gas (GHG) disclosures, and environmental performance is also intricate and contested (Zhu & Zhang, 2012). While some studies suggest high performers disclose more (Clarkson et al., 2008), others report inconclusive or contradictory findings (Ennis et al., 2012). The relationship between CFP and CEP is further complicated by the potential economic implications. The resource-based view (RBV) posits that CER can be detrimental to competitiveness due to associated

costs (Yuriev et al., 2018). However, others argue that emission reduction enhances competitiveness and long-term advantage (Yuriev et al., 2018). Studies examining this link have yielded mixed results, with some finding a positive association between CER and financial performance (Ngwakwe & Msweli, 2013; Gallego-Álvarez et al., 2015), while others report no significant impact (Ennis et al., 2012). Environmental management (EM) practices can also have a significant financial impact (Brouwers et al., 2014). While some studies suggest increased production costs due to EM programs (Brouwers et al., 2014), others report potential profitability improvements (Brouwers et al., 2014). Additionally, strong EM has been linked to increased investor confidence and stock market value (Brouwers et al., 2014).

Research Methodology.

Research design

This study will employ a quantitative research design. Quantitative research involves collecting and analyzing numerical data to identify patterns, averages, and causal relationships (Creswell & Creswell, 2018). It allows researchers to reveal trends in carbon emissions and financial performance over time. Statistical models can be used to predict future financial performance based on carbon reduction efforts. Statistical techniques can help assess whether carbon reduction practices directly influence financial performance. By using a representative sample, findings can be generalized to a broader population of companies. This approach is particularly valuable for businesses seeking to make data-driven decisions regarding resource allocation and sustainability initiatives. By understanding the potential financial implications of carbon reduction, Toyota can optimize its strategies for long-term success.

Unit of analysis

The unit of analysis for this study will be Toyota Motor Corporation (TMC). A single-case study design will be used, focusing on TMC's internal data on carbon emissions and financial performance. Secondary data will be collected from reliable sources such as TMC's annual reports, sustainability reports, and industry databases.

Hypothesis of the study

Based on the literature review, the following research hypotheses will be tested:

H0 (Null Hypothesis): There is no statistically significant relationship between Toyota's carbon emission reduction practices and its financial performance.

H1 (Alternative Hypothesis): Toyota's carbon emission reduction practices have a positive impact on its financial performance.

Limitation of the study

While a quantitative approach offers numerous advantages, some limitations exist.

Limited Scope: A single-case study may not capture the complexities of the relationship between carbon reduction and financial performance across the entire automotive industry.

Data Availability: The availability and accuracy of secondary data can influence the study's findings.

Data Analysis

Measurement of the variables for the study

Dependent variable

This study will employ Return on Assets (ROA) as a proxy for measuring Toyota's financial performance. ROA is a common metric used in financial analysis to assess a company's profitability relative to its total assets (Alvarez, 2012; Ngwakwe & Msweli, 2013). It indicates how much profit a company generates for each dollar of assets it owns.

Formula:

ROA = Net Income / Total Assets

Net income and total asset data will be collected from Toyota's annual reports or financial databases for the chosen study period. ROA is a well-established and standardized metric, allowing for comparison with industry benchmarks and past performance. It measures how effectively Toyota utilizes its assets to generate profits. The research question centers on the impact of carbon reduction practices on financial performance. Since these practices may affect asset utilization (e.g., investments in clean technologies), ROA is a suitable measure.

Measurement of the independent variable for the study

Independent variable

This study will measure the independent variable, carbon emission reduction practices, by focusing on Toyota's yearly carbon emission data. However, to

gain a more comprehensive understanding, it might be beneficial to consider additional metrics alongside total annual emissions. Primary Measure is the Annual Carbon Emissions

Yearly carbon emission data will be collected from Toyota's sustainability reports, environmental disclosures, or reputable industry databases. This aligns with previous research (Delmas et al., 2015) and provides a direct measure of Toyota's overall emission reduction efforts.

Data collection and source of the data collection

The data for both variables were collected from the annual reports of Toyota. Specifically, carbon emission data were obtained from the company's annual sustainability reports, while the Return on Assets (ROA) was calculated from the annual reports using extracted data for net income and total assets. This study focused on a 15-year period from 2005 to 2020, as Toyota commenced its sustainability reporting, particularly on carbon emissions, in 2005. Data were collected annually, but only for the North American region, ensuring that both carbon emission and performance data were region-specific.

Descriptive analysis

Table 1

Summary statistic of the ROA

summary statistic	ROA	**Carbon emission**
Mean	0.05218	9.00810612
Standard Error	0.00593292	1.94452718
Median	0.0498	7.593736501
Mode	0.0513	#N/A
Standard Deviation	0.022978101	7.531121385
Sample Variance	0.000527993	56.71778931
Kurtosis	2.517895871	-1.26639122
Skewness	1.396029535	0.467357606
Range	0.0874	21.31
Minimum	0.0262	0.89
Maximum	0.1136	22.2
Sum	0.7827	135.1215918
Count	15	15

Figure 1

ROA graph of the study

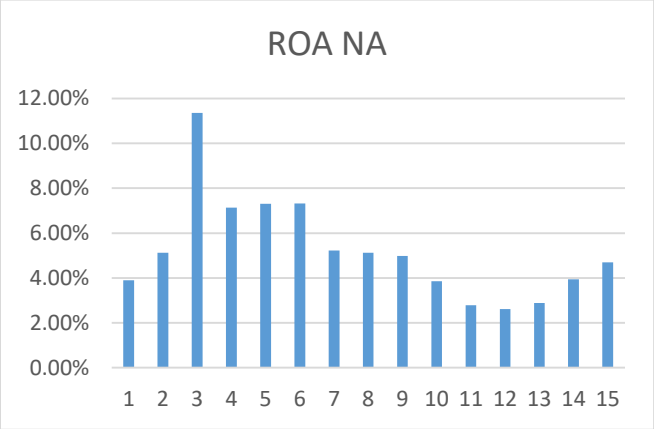
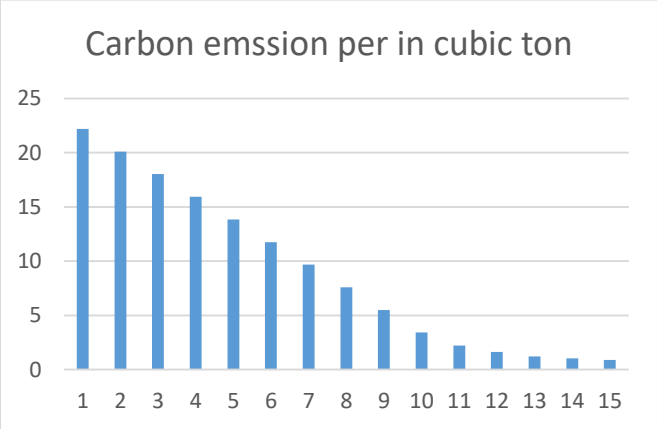


Figure 2

Carbon emission graph



The mean ROA for Toyota's North American region over the 15-year period is 5%, indicating that the average return over this timeframe is 5%. The highest ROA recorded is 11%, while the lowest is 2%. Similarly, the mean value of carbon emissions over the same period is 9, with a maximum value of 22.2 and a minimum value of 0.89. The data reveals a decreasing trend in carbon emissions from Toyota's North American region. To establish a relationship between ROA and carbon emissions, further analysis using a regression model is required.

Regression summary and interpretation

Table 2
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.591[a]	.349	.299	.01924

a. Predictors: (Constant), Carbon emission

Table 3
ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.003	1	.003	6.976	.020[b]
	Residual	.005	13	.000		
	Total	.007	14			

a. Dependent Variable: ROA
b. Predictors: (Constant), Carbon emission

Table 4
Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1(Constant)	.036	.008		4.546	.001
Carbon emission	.002	.001	.591	2.641	.020

a. Dependent Variable: ROA

The regression summary (Table 2) indicates a constant value of 0.036, which represents the average ROA of Toyota when the effect of carbon emissions is zero. The coefficient for carbon emissions is 0.002, implying that a reduction in carbon emissions by one unit increases the company's ROA by 0.002 units. This positive coefficient suggests a direct relationship between carbon emission reduction and ROA. The model's R square value is 0.349, indicating that approximately 34.9% of the variability in ROA can be explained by carbon emissions. The adjusted R square value of 0.299 adjusts for the number of predictors in the model, confirming the model's explanatory power.

The ANOVA table (Table 3) reveals that the model is statistically significant, with an F statistic of 6.976 and a p-value of 0.020, which is less than the 0.05 threshold. This signifies that the regression model provides a better fit than a model with no predictors. The significance of the individual predictor, carbon emissions, is further supported by the t-value of 2.641 and a p-value of 0.020, indicating that carbon emissions are a significant predictor of ROA.

The regression analysis demonstrates a statistically significant positive relationship between carbon emissions and ROA, as illustrated by the coefficients table (Table 4). The model explains a substantial portion of the variance in ROA and underscores the importance of carbon emissions in predicting financial performance.

Conclusion and Recommendation

The primary objective of this study was to investigate the relationship between carbon emission reduction and the financial performance of Toyota Motors. Global legislative initiatives aimed at reducing

carbon emissions present significant risks and opportunities for firms. High-emission manufacturing processes are particularly vulnerable to inefficiencies due to the uncertain costs associated with producing carbon dioxide. To compare the carbon emissions of companies with similar production systems, we employed a productive efficiency model. This model measures carbon efficiency, quantifying and ranking companies' relative dependency on carbon in the manufacturing process by accounting for total factor productivity and sector-related performance factors (Trinks et al., 2020).

Toyota has implemented various measures to reduce carbon emissions from their vehicles and operations. This study reviewed relevant theoretical concepts and empirical studies in the literature, forming the basis for constructing the study's hypotheses. After analyzing secondary data, we conclude that there is a positive relationship between carbon emission reduction and the financial performance of Toyota Motors. Our findings align with previous research, indicating that firms face significant risks and opportunities due to international efforts to limit carbon emissions. High-emission manufacturing processes are disproportionately affected by the unknown costs of carbon dioxide generation. Using a productive efficiency model, we quantified and ranked companies' carbon dependency, considering total factor productivity and sector-related performance factors. Our study examined the influence of carbon efficiency on financial performance outcomes and the role of general resource efficiency in explaining these effects.

For instance, a global sample of 1,572 companies from 2009 to 2017 found that carbon-efficient organizations exhibited greater financial performance. Specifically, a 0.1 percent increase in carbon efficiency was associated with a 1.0 percent increase in profitability and a 0.6 percent decrease in systemic risk. Carbon efficiency is strongly linked to resource efficiency and provides specific financial performance benefits, such as reducing systemic risk, which is a major advantage (Trinks et al., 2020). Our findings suggest that carbon-efficient manufacturing can be beneficial for both operational and risk management purposes.

Conversely, another study presents contradicting results. The lack of data has made it challenging to draw firm conclusions on how carbon emissions affect financial performance in African corporations. A study of 63 South African CDP firms examined the financial performance (ROE, ROI, and ROS) affected by carbon emissions (Scope 1, Scope 2, and Scope 1 and 2) for the 2015 fiscal year. Using multiple regression methodologies, the study found that carbon emissions negatively impact a company's financial performance. The findings suggest that organizations implementing green investment programs to reduce carbon emissions can effectively manage their financial outcomes. These insights demonstrate how firms can optimize their resources and capabilities to improve both environmental and financial performance (Ganda, 2018).

Future Direction for Researcher

This research focused solely on the impact of carbon emissions reduction on firm performance. Future research could expand on this by examining the impact of carbon performance on both carbon emissions reduction and firm profitability. Longitudinal studies employing panel data would be particularly valuable for understanding the significant correlations among these variables over time. Additionally, future studies should analyze and compare the long-term effects of green investments on business financial conditions across various contexts, including developing, emerging, and established countries. This study was limited to a single company; thus, future researchers are encouraged to include multiple companies operating in diverse environments to provide a more comprehensive understanding of the relationship between carbon emissions and firm performance.

Reference

Alvarez, I. G. (2012). Impact of CO 2 Emission Variation on Firm Performance. *Business Strategy and the Environment*, *21*(7), 435–454. https://doi.org/10.1002/bse.1729

Banerjee, A. V, & Duflo, E. (2007). *The Economic Lives of the Poor*. *21*(1), 141–167.

Boesso, G., & Kumar, K. (2007). Drivers of corporate voluntary disclosure: A framework and empirical evidence from Italy and the United States. In *Accounting, Auditing and Accountability Journal* (Vol. 20). https://doi.org/10.1108/09513570710741028

Brouwers, R., Schoubben, F., & Van Hulle, C. (2018). The influence of carbon cost pass through on the link between carbon emission and corporate financial performance in the context of the European Union Emission Trading Scheme. *Business Strategy and*

the Environment, *27*(8), 1422–1436. https://doi.org/10.1002/bse.2193

Brouwers, R., Schoubben, F., Van Hulle, C., & Van Uytbergen, S. (2014). The link between corporate environmental performance and corporate value: A literature review. *Review of Business and Economic Literature*, *58*(4), 343–374.

Chan, H.S.; Li, H.; Zhang, F. Firm competitiveness and the European Union emissions trading scheme. Energy Policy 2013, 63, 1056–1064. [CrossRef]

Clarkson, M. B. E. (1995). A Stakeholder Framework for Analyzing and Evaluating Corporate Social Performance Published by : Academy of Management Linked references are available on JSTOR for this article : A STAKEHOLDER FRAMEWORK FOR ANALYZING AND EVALUATING CORPORATE SOCIAL PERFOR. *Academy of Management Review*, *20*(1), 92–117.

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society*, *33*(4–5), 303–327. https://doi.org/10.1016/j.aos.2007.05.003

Columbia, B., Cormier, D., & Gordon, I. M. (2001). *An examination of social and environmental reporting strategies*. *14*(5), 587–616.

Cotter, J., Lokman, N., & Najah, M. M. (2011). *Voluntary Disclosure Research : Which Theory Is Relevant ? Voluntary disclosure research : Which theory is relevant ? Julie Cotter *, Norziana Lokman and Muftah M . Najah*. (January). https://doi.org/10.2139/ssrn.3470466

Delmas, M. A., Nairn-Birch, N., & Lim, J. (2015). Dynamics of Environmental and Financial Performance: The Case of Greenhouse Gas Emissions. *Organization and Environment*, *28*(4), 374–393. https://doi.org/10.1177/1086026615620238

Eleftheriadis, I., & Anagnostopoulou, E. (2017). Measuring the level of corporate commitment regarding climate change strategies. *International Journal of Climate Change Strategies and Management*, *9*(5), 626–644. https://doi.org/10.1108/IJCCSM-09-2016-0145

Freeman, R. E., & Reed, D. (1983). G ' Stockholders and. *California Management Review*, *35*(3).

Gallego-Álvarez, I., Segura, L., & Martínez-Ferrero, J. (2015). Carbon emission reduction: The impact on the financial and operational performance of international companies. *Journal of Cleaner Production*, *103*(August 2020), 149–159. https://doi.org/10.1016/j.jclepro.2014.08.047

Ganda, F. (2018). The effect of carbon performance on corporate financial performance in a growing economy. *Social Responsibility Journal*, *14*(4), 895–916. https://doi.org/10.1108/SRJ-12-2016-0212

Gomes, P. (2012). Tékhne — Review of Applied Management Studies. *Tékhne*, *10*(1), 1–2. https://doi.org/10.1016/s1645-9911(12)70001-4

Hulme, C. (2023). The Train Has Left the Station: Automotive and Energy-Intensive Industries. In: Corporate Climate Action, Transnational Politics, and World Order. Environmental Politics and Theory. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-031-34115-1_3

Jacobs, B. W., Singhal, V. R., & Subramanian, R. (2010). An empirical investigation of environmental performance and the market value of the firm. *Journal of Operations Management*, *28*(5), 430–441. https://doi.org/10.1016/j.jom.2010.01.001

Jiménez-Parra, B., Alonso-Martínez, D., & Godos-Díez, J. L. (2018). The influence of corporate social responsibility on air pollution: Analysis of environmental regulation and eco-innovation effects. *Corporate Social Responsibility and Environmental Management*, *25*(6), 1363–1375. https://doi.org/10.1002/csr.1645

Kikkawa, T. (2023). *History of innovative entrepreneurs in Japan*. https://doi.org/10.1007/978-981-19-9454-8

Maclean, I. M. D., Inger, R., Benson, D., Booth, C. G., Embling, C. B., Grecian, W. J., … Bearhop, S. (2014). Resolving issues with environmental impact assessment of marine renewable energy installations. *Frontiers in Marine Science*, *1*(DEC), 1–5. https://doi.org/10.3389/fmars.2014.00075

Ngwakwe, C., & Msweli, P. (2013). On Carbon Emission Reduction and Firm Performance: Example from 3M Company. *Environmental Economics*, *4*(2), 54–61.

Reverte, C. (2009). Determinants of corporate social responsibility disclosure ratings by Spanish listed firms. *Journal of Business Ethics*, *88*(2), 351–366. https://doi.org/10.1007/s10551-008-9968-9

Suchman, M. C. (2013). *AND STRATEGIC MANAGING LEGITIMACY : APPROACHES*. *20*(3), 571–610.

Scott, W.R. Institutional theory. In Encyclopedia of Social Theory; Sage: Thousand Oaks, CA, USA, 2004; pp. 408–414.

Trinks, A., Mulder, M., & Scholtens, B. (2020). An Efficiency Perspective on Carbon Emissions and Financial Performance. *Ecological Economics*, *175*(July 2019), 106632. https://doi.org/10.1016/j.ecolecon.2020.106632

Ulvila, J.W.; Snider, W.D. Negotiation of international oil tanker standards: An application of multiattribute value theory. Oper. Res. 1980, 28, 81–96. [CrossRef]

Verrecchia, R. E. (1990). Information quality and discretionary disclosure. *Journal of Accounting and Economics*, *12*(4), 365–380. https://doi.org/10.1016/0165-4101(90)90021-U

Wada, K. (2020). The foundation of the Japanese automobile manufacturing industry: attempts to adopt Ford's production system. In Studies in economic history (pp. 37–69). https://doi.org/10.1007/978-981-15-4928-1_3

Wang, Z. (2021). Exploring The Potential Of Lean Philosophy To Spread The Value Of Sustainability In The Japanese Automobile Industry: The Case Of Toyota Motor Corporation. *Upravlìnnâ Rozvitkom Skladnih Sistem*, *45*, 176–181. https://doi.org/10.32347/2412-9933.2021.45.176-181

Windsor, C. (2014). *Can the financialised atmosphere be effectively regulated and accounted for ?* (May). https://doi.org/10.1108/09613671111184760

Wood, F. B. (1988). *The Need for Systems Research on Global Climate Change*. *5*(3).

Yap, J. B. H., & Ng, X. H. (2018). (2018). 기사 (Article) 와 안내문 (Information) [. *The Eletronic Library*, *34*(1), 1–5.

Yuriev, A., Boiral, O., Francoeur, V., & Paillé, P. (2018). Overcoming the barriers to pro-environmental behaviors in the workplace: A systematic review. *Journal of Cleaner tion*, *2*, 379–394. https://doi.org/10.1016/j.jclepro.2018.02.041