Proceeding International Conference on Economic Business Management, and Accounting (ICOEMA) 2025
Program Studi Doktor Ilmu Ekonomi
Universitas 17 Agustus 1945 Surabaya

The Influence of Activity Complexity, Operational Efficiency, and Cost Structure on Cost Behavior : Study in PT Toyota Motor Manufacturing Indonesia 2022-2023

Dwi Yana Rahmawati [1] , Isnawiyah[2], Pristiya Maulaningrum[3], Aghnia Layalia[4], Maria Yovita R Pandin[5]
Magister of Manajement, Universitas 17 Agustus 1945, Indonesia
1262400051@surel.untag-sby.ac.id[1], 1262400053@surel.untag-sby.ac.id [2], 1262400055@surel.untag-sby.ac.id[3], 1262400056@surel.untag-sby.ac.id[4], yovita_87@untag-sby.ac.id[5]

Diterima: April 2025 ; Diterima:April 2025; Diterbitkan: June 2025
Tautan permanen/DOI:

Abstract

Cost behavior is a fundamental element in managerial accounting, because it affects decision making, planning, and cost control in an organization. This study aims to analyze the effect of activity complexity, operational efficiency, and cost structure on cost behavior in an organization at PT Toyota Motor Manufacturing Indonesia. Activity complexity indicates the diversity and interconnectedness of business processes that can increase indirect costs, while operational efficiency reflects the company's ability to manage resources optimally. The cost structure that describes the proportion between fixed costs and variable costs also determines the sensitivity of costs to changes in activity. With a theoretical approach from modern cost management literature and managerial accounting, this article concludes that these three variables play an important role in shaping cost behavior, both individually and in an integrated manner. Proper integration of the three can help companies design adaptive and sustainable cost control strategies, especially in facing a dynamic business environment. This study recommends the application of an activity-based approach and operational efficiency for PT Toyota Motor Manufacturing Indonesia to improve the accuracy of cost planning and decision making.

Keywords: *Complexity, Efficiency, Cost Structure*

INTRODUCTION

In the era of globalization and digital transformation that continues to develop rapidly, companies are faced with competition growing business strict, complex and demanding high adaptability to market dynamics. In order to survive and win competition, the company used not only its own superiority products and services, but also must be capable of managing source Power in a way efficient and

effective. One of the crucial aspects in management is deep understanding of cost behavior. Behavior cost is the base for taking decision managerial, planning budget, determining prices, and controlling strategies ongoing costs. Without accurate understanding about How cost changes along change activity operational, then the business strategy implemented tends not to be responsive and risks producing suboptimal decisions.

In general traditional behavior cost explained based on linear approach to changes in activity volume where costs are classified to in cost fixed, cost variable, and semi variable costs. However, in practice managerial contemporary, approach the the more considered No adequate For represent reality a business that is loaded will process diversity, dynamics technology, as well as pressure efficiency. Therefore, it appears necessary to expand perspective to other factors that also influence behavior cost in a way significant.

Three factor main thing that is believed own role important in to form behavior cost is complexity activity (activity complexity), efficiency operational efficiency, and structure cost structure. Complexity activity refers to the level diversity, interconnectedness, and difficulty activities carried out in a business process. High levels of complexity tend to increase cost No direct (overhead) because they need more Lots source Power in management, supervision, and coordination. On the other hand, efficiency is operational concerning how optimal the company utilizes input for producing output. An efficient company capable of press waste, minimize time cycle production, and reduce unit cost of the product. While that, structure cost reflects proportion between cost fixed and cost variable in total cost company. Structure This has its own implications direct to flexibility in the company in face change in activity volume and also condition economy.

In context management of modern cost, approaches like Activity-Based Costing (ABC) and Lean Management appear as responses to the limitations of traditional approaches. Both of them make an effort to give information more accurately with regard to activity as center analysis costs and focus on elimination activities that are not worth adding. Although this approach has been adopted, its implementation does not always succeed Because lack of understanding on

interaction between complexity activity, efficiency operational, and structure cost in influencing behavior cost .

PT. Toyota Motor Manufacturing Indonesia (TMMIN), a subsidiary of Toyota Motor Corporation headquartered in Japan, involves a complex manufacturing system for various vehicle models, including local and export assembly units. The company must manage complex logistics, multiple production variants, supplier coordination, and stringent quality standards. This high level of activity complexity increases indirect costs such as costs for supervision, interdepartmental communication, and process control. To address this, Toyota integrates Activity-Based Costing (ABC) with lean manufacturing practices to ensure accurate cost allocation, minimize waste, and maintain competitive efficiency across its operations.

This reality shows the existence gap necessary knowledge and practice bridged through comprehensive research. Therefore, research This done with objective For to study in a way deep How third factor said good in a way partial and also simultaneously contribute to behavior cost. With understand complex and interdependent relationships influence between variable this, manager expected can design management strategy more costs adaptive, accurate and appropriate with characteristics operational respective companies

LITERATURE REVIEW

a. Cost Behavior

Cost behavior refers to the pattern of how costs change in response to changes in activity within an organization. Costs are conventionally classified into three main categories: fixed costs, variable costs, and semi-variable costs (Garrison et al., 2012). Fixed costs do not change in the short run regardless of the volume of activity, while variable costs change proportionally to changes in volume. However, this linear approach is considered too simplistic to explain cost behavior in complex business environments. Anderson, Banker, and Janakiraman (2003) introduced the concept of cost stickiness, which is a condition where costs do not

fall as fast as they increase when activity decreases, suggesting that managerial decisions and organizational structure also affect cost behavior.

Cost behavior refers to the way costs change in response to variations in the level of activity within an organization (Horngren et al., 2015). Traditional cost behavior models typically classify costs as fixed, variable, or mixed costs. However, recent research emphasizes the role of cost stickiness—a phenomenon where costs increase more when activity increases than they decrease when activity decreases (Anderson, Banker, & Janakiraman, 2003). Understanding cost behavior is essential for strategic decision making, budgeting, and performance evaluation, especially in a manufacturing environment such as PT Toyota Motor Manufacturing Indonesia (TMMIN). Thus, understanding cost behavior must be done multidimensionally, considering various structural and operational determinants that affect costs, not just activity volume.

b. Activity Complexity

Activity complexity refers to the degree of diversity and interconnectedness between activities in a business process. This complexity contributes greatly to the formation of indirect costs (overhead), especially in organizations with multiple product lines, different technologies, and varied processes (Cooper & Kaplan, 1991). In the Activity-Based Costing (ABC) approach, activity complexity is the center of attention because it is considered the root cause of costs. The more complex the activities carried out, the greater the resources consumed, which has an impact on increasing operational costs. This variable can be measured through indicators such as the number of products, the number of activities, the level of automation, and the number of departments involved in the process. Organizations with a high level of complexity require a more careful cost management system in order to allocate overhead appropriately and avoid cost distortion.

Activity complexity is defined as the degree of intricacy and interdependence involved in operational processes (Cooper & Kaplan, 1992). In manufacturing, higher activity complexity—such as in assembling diverse models or managing a global supply chain—can lead to more indirect costs, making it more

difficult to predict cost behavior accurately (Kaplan & Anderson, 2007). For TMMIN, which adopts the Toyota Production System (TPS), managing complexity through lean practices is critical, but fluctuations in product variants and process requirements could still introduce cost behavior variability.

c. Operational Efficiency

Operational efficiency describes a company's ability to manage resources optimally to produce maximum output. In the strategic management framework, Porter (1985) stated that operational efficiency is one form of sustainable competitive advantage, especially in a low-cost strategy (cost leadership). According to Hansen and Mowen (2007), operational efficiency is not only related to cost savings, but also concerns the effectiveness in achieving organizational goals through lean processes and minimal waste. Efficiency evaluation can be done through indicators such as output/input ratio, cost per unit of product, cycle time, and production defect rate. Efficient companies generally have standardized production systems, integrated technology, and a culture of continuous improvement, all of which contribute to more flexible and controlled cost behavior.

Greater efficiency can stabilize cost behavior by reducing marginal costs per unit and optimizing resource use. Lean manufacturing principles, which are an integral part of TMMIN, aim to improve efficiency through waste elimination, standardization, and continuous improvement (kaizen) (Liker, 2004). Studies show that operational efficiency significantly moderates the relationship between activity volume and cost changes (Banker & Johnston, 2007), which is particularly relevant in automotive manufacturing.

d. Cost Structure

Cost structure is the relative proportion of fixed and variable costs in an organization (Noreen & Soderstrom, 1997). Cost structure determines the sensitivity of profits to changes in sales or activity volume, which is referred to as operating leverage. Cost structures that are mostly fixed costs tend to have high operating leverage, where small changes in sales volume can have a large impact on profits (Horngren et al., 2014). According to Garrison et al. (2012), the right cost

structure makes it easier for companies to develop pricing strategies, capacity planning, and evaluate project feasibility.

Cost structure also forms the basis for making make-or-buy decisions, outsourcing, and break-even analysis. In the context of cost management, an adaptive cost structure allows companies to remain flexible in the face of external fluctuations and maintain profitability in uncertain market conditions. A high fixed cost structure tends to indicate higher cost stickiness due to resource commitments and contractual rigidity. Conversely, a more flexible cost structure allows for faster cost adjustments. In the context of TMMIN, the use of automated machines, supplier contracts, and labor allocation policies can affect the stickiness of its cost structure. As Balakrishnan and Gruca (2008) note, cost structure is a major determinant of how responsive an organization is to changes in business volume.

e. Empirical Studies in Manufacturing Sector

Several empirical studies have examined the interplay between activity complexity, efficiency, and cost behavior in manufacturing contexts. Anderson et al. (2003) provided early evidence on cost stickiness, suggesting that managerial decisions and resource commitments play a central role. Subsequent studies by Banker et al. (2014) reinforced the idea that operational efficiency moderates cost behavior, particularly in firms with lean operations. Meanwhile, studies focusing on the automotive industry (e.g., Alcaraz & Sánchez, 2020) underscore that complexity in model variants, supply chain logistics, and production schedules heavily influence cost predictability.

f. Contextualizing the Study in PT Toyota Motor Manufacturing Indonesia

PT Toyota Motor Manufacturing Indonesia, as part of a global supply and production network, deals with varying degrees of activity complexity. The adoption of lean manufacturing and the Toyota Production System provides a robust framework for maintaining operational efficiency. However, the post-pandemic period (2022–2023) also posed challenges in supply chain stability, cost management, and demand volatility. These factors make TMMIN a relevant case for analyzing how internal operations (efficiency and complexity) and structural cost components affect the way costs behave in real-world settings.

g. Relationship Between Variables

Activity complexity, operational efficiency, and cost structure are three variables that are interrelated and contribute simultaneously to cost behavior. High activity complexity tends to increase indirect costs, but can be controlled if operational efficiency is high. Meanwhile, cost structure determines how much impact changes in activity have on overall costs. By analyzing the relationship between these three variables, companies can gain a more comprehensive understanding in managing cost behavior strategically. This supports data-based decision making and drives sustainable cost efficiency.

METHOD

1. Research Design

This study employs a **quantitative explanatory research design**, which is appropriate for investigating causal relationships between independent variables (activity complexity, operational efficiency, and cost structure) and the dependent variable (cost behavior). The goal is to quantify the impact of each independent variable on cost behavior both individually and simultaneously, using empirical data and statistical modeling.

The explanatory nature of the study allows for hypothesis testing based on theoretical frameworks from managerial accounting and cost management. This research design is selected because it enables the use of objective data and statistical analysis to produce generalizable results in a manufacturing context.

2. Research Object and Scope

The object of the research is **PT Toyota Motor Manufacturing Indonesia (TMMIN)**, a subsidiary of Toyota Motor Corporation, operating in Indonesia. The company produces various vehicle models for domestic and export markets and employs advanced manufacturing technologies and lean systems.

The **time scope** of the study covers **fiscal years 2022–2023**, a period characterized by post-pandemic recovery, raw material cost volatility, and increased demand complexity.

3. Data Types and Sources

The study utilizes **secondary data**, which include:

- **Toyota Sustainability Reports** (2022–2023),
- **Toyota Motor Corporation Annual Reports**,
- Internal cost and operational efficiency indicators (sourced from published summaries and investor materials),
- Managerial accounting literature, including textbooks and peer-reviewed journals.

The data were collected through **document analysis and literature review**, and all sources were selected based on credibility, relevance to the variables under study, and recency.

4. Data Measurement and Indicators

1. **Activity Complexity** is measured through:
    a. Number of product variants produced,
    b. Number of departments involved per product line,
    c. Frequency of production changeovers.
2. **Operational Efficiency** is assessed using:
    a. Overall Equipment Effectiveness (OEE),
    b. Cycle time (minutes per unit),
    c. Defect rate (units rejected per thousand),
    d. Lean maturity indicators (Toyota Production System application levels).
3. **Cost Structure** is derived from:
    a. Ratio of fixed to variable costs (extracted from financial reports),

b. Depreciation and automation ratios,
c. Outsourcing vs. in-house production cost allocation.

4. **Cost Behavior** is evaluated using:
   a. Elasticity coefficient: percentage change in cost over percentage change in activity volume,
   b. Overhead allocation patterns,
   c. Cost stickiness indices (based on the Anderson et al. model, 2003).

6. Data Analysis Technique

The analysis method applied in this study is **multiple linear regression**. This technique is used to examine the relationship between multiple independent variables and one dependent variable simultaneously. The general regression model used is:

$$Y=\alpha+\beta1X1+\beta2X2+\beta3X3+\epsilon Y$$

Where:

- Y = Cost Behavior,
- X1 = Activity Complexity,
- X2 = Operational Efficiency,
- X3 = Cost Structure,
- α = Constant,
- $\beta1,\beta2,\beta3$ = Regression Coefficients,
- ϵ = Error term.

Before conducting regression, **classical assumption tests** are performed to ensure model reliability:

- **Normality Test** (Kolmogorov-Smirnov),
- **Multicollinearity Test** (Variance Inflation Factor and Tolerance),
- **Heteroskedasticity Test** (Scatterplot analysis),

- **Autocorrelation Test** if needed (Durbin-Watson).

Statistical significance is set at $\alpha = 0.05$, and data analysis is carried out using software such as SPSS or STATA.

7. Hypotheses

Based on the theoretical framework and previous empirical findings, the hypotheses tested are:

- H_1: Activity complexity has a significant effect on cost behavior.
- H_2: Operational efficiency has a significant effect on cost behavior.
- H_3: Cost structure has a significant effect on cost behavior.
- H_4: Activity complexity, operational efficiency, and cost structure simultaneously influence cost behavior.

8. Validity and Reliability

To ensure **construct validity**, all variables are operationalized based on established frameworks in cost and management accounting literature. Data reliability is enhanced through the use of consistent sources (Toyota reports, peer-reviewed journals) and clear measurement methods.

Data triangulation is performed through comparison of internal financial data, industry standards, and empirical literature. Model reliability is further confirmed by evaluating the **coefficient of determination (R^2)** and **standard error of estimates**.

RESULTS AND DISCUSSION

Activity Complexity and its Effect on Cost Behavior

The complexity of activities in modern organizations is increasing along with the need to meet diverse customer demands, technological improvements, and product differentiation. Hansen and Mowen state that the more complex the operational activities, the higher the indirect costs generated, as more complex activities require more resources to manage. In traditional systems, costs are often allocated inaccurately because they do not consider the complexity of activities. Therefore, the Activity-Based Costing (ABC) approach becomes very relevant. Through ABC, costs are traced to the activities that actually consume resources, thus reflecting more accurate cost behavior. Activity complexity also adds a layer of nonlinearity in cost changes, as not all costs increase or decrease proportionally with production volume.

High activity complexity causes organizations to experience increased coordination, supervision, and documentation costs. Diverse activities make it difficult for managers to identify value-added and non-value-added activities. This results in inefficiency in allocating resources. Based on the findings of Laporte et al. (2008), multinational companies with high activity complexity show higher overhead cost levels than companies with simpler activities.

Table 1. Examples of Activity Complexity and Cost Implications

Activity Type	Complexity Level	Cost Implication
Standardized Production	Low	Lower indirect and overhead costs
Customized Production	High	Higher supervision and coordination costs
Multi-Product Line	High	Increased documentation and resource use

source : Laporte et al. (2008)

PT Toyota Motor Manufacturing Indonesia (TMMIN), a subsidiary of Toyota Motor Corporation headquartered in Japan. Toyota's operations in Indonesia involve complex manufacturing systems for various vehicle models, including both local assembly and export units. The company must manage intricate logistics, multiple production variants, supplier coordination, and stringent quality standards. This high level of activity complexity increases indirect costs such as those for supervision, interdepartmental communication, and process control. To address this, Toyota integrates Activity-Based Costing (ABC) with lean manufacturing practices to ensure accurate cost allocation, minimize waste, and maintain competitive efficiency across its operations.

Table 2. Study Results at PT Toyota Motor Manufacturing Indonesia 2022-2023

Aspect Studied	**Findings**	**Impact on Cost Behavior**	**Strategies Implemented**
Activity Complexity	Multiple product variants and production lines increase the need for coordination and documentation.	Higher overhead costs and more complex allocation of indirect costs.	Implementation of Activity-Based Costing (ABC) for accurate cost tracking.
Operational Efficiency	Lean manufacturing and Six Sigma implementation reduced defect rates and production cycle times.	Lower unit costs and improved contribution margins.	Strengthening of Continuous Improvement programs and process standardization.

Cost Structure	Large investments in technology and production facilities increased the proportion of fixed costs.	Higher operational leverage and risk during demand downturns.	Product diversification and production capacity optimization.

source : Toyota, 2022-2023

Operational Efficiency and its Relationship with Cost Behavior

Operational efficiency refers to an organization's ability to maximize output while minimizing the consumption of resources such as time, labor, and materials in the production or service process. It plays a pivotal role in shaping cost behavior and enhancing the overall financial performance of the company. According to Hansen and Mowen (2007), high operational efficiency is directly associated with the reduction of variable costs and an improvement in contribution margins. This is because efficient operations eliminate waste, reduce idle time, optimize labor use, and streamline production workflows.

Improving operational efficiency involves implementing strategic practices such as Total Quality Management (TQM), lean manufacturing, benchmarking, and continuous process improvement. These approaches aim to increase labor productivity, reduce cycle time, lower defect rates, and eliminate non-value-added activities. When such improvements are achieved, the cost per unit of output decreases, contributing to more favorable and predictable cost behavior.

In contrast, operational inefficiencies introduce complexities that distort cost structures. For example, a high defect rate results in rework and waste, while extended cycle times and poor scheduling can lead to underutilized capacity and inventory build-up. These inefficiencies do not increase costs linearly with output

but instead create semi-variable or even exponential cost behaviors, making cost prediction and control more challenging for managers.

Companies that succeed in achieving high levels of operational efficiency often adopt advanced methodologies such as Six Sigma, which emphasizes defect reduction and process control, and lean systems, which focus on value creation and waste elimination. These practices enhance not only operational performance but also organizational agility. Efficient firms can respond more quickly to shifts in customer demand, technological disruptions, or changes in input costs, thereby maintaining competitiveness in dynamic markets.

Moreover, operational efficiency enhances a company's ability to sustain performance under fluctuating conditions. Efficient operations contribute to a more flexible production system and a resilient supply chain. This adaptability is critical in industries with high volatility or demand uncertainty.

Hansen and Mowen (2007) further argue that companies adopting Activity-Based Management (ABM) in conjunction with ABC (Activity-Based Costing) can identify cost drivers more precisely and manage bottlenecks more effectively. This leads to more accurate cost estimations, greater transparency, and informed decision-making. As a result, companies with efficient operations and robust cost management frameworks tend to demonstrate more stable and predictive cost behaviors, which supports long-term strategic planning and investment. Example: A manufacturing firm that implements lean tools and Six Sigma may reduce its production cycle by 20% and defect rates by 50%. These improvements allow the firm to lower production costs, avoid penalties due to late deliveries, and enhance customer satisfaction—all of which contribute to improved profitability and more manageable cost behavior patterns.

Table 3. Toyota Operational Efficiency and Cost Behavior (2022–2023)

Category	FY 2022	FY 2023	Observations/Notes
Operating Profit	¥2,995.6 billion	¥3,054.6 billion	Increased due to marketing efforts and favorable currency exchange.
Operating Margin	9.5%	7.3%	Decreased, indicating pressure on operational efficiency.
Operating Expenses	$252.6 billion	$254.8 billion	Rose by 0.86%, showing cost containment amid external pressures.
Material Costs	¥640 billion	¥1.45 trillion	Sharp increase; Toyota absorbed costs and worked on cost-reduction strategies.
SG&A Expenses	$26.49 billion	$26.55 billion	Increased by only 0.25%, showing controlled administrative spending.
Cost Reduction Efforts	Ongoing with limited impact	Ongoing with supplier cooperation	Focus on materials substitution and usage efficiency.
Foreign Exchange Impact	+¥610.0 billion	Slight positive	Helped offset material cost increase.
Raw Material Cost Pressure	Moderate	High	Required strategic cost-sharing and supplier collaboration.

Overall Efficiency Trend	Improved	Under Pressure	Despite revenue growth, cost-side pressures reduced efficiency gains.

source : Toyota, 2022-2023

Cost Structure and its Impact on Cost Behavior

Cost structure describes the proportion of fixed costs and variable costs in the total cost of an organization. According to Hansen and Mowen, understanding cost structure is very important in analyzing the sensitivity of profit to changes in sales volume. Companies with a high proportion of fixed costs have high operating leverage, meaning that small changes in volume can lead to large changes in profits. In contrast, a more flexible cost structure-such as through outsourcing or the use of scalable automation technology-can reduce the burden of fixed costs and convert them into variable costs, thereby improving the company's ability to adapt to changes in demand. By understanding the cost structure, managers can develop more appropriate pricing strategies, product offerings, and investment and capacity policies.

Table 4. Comparison of Cost Structures

Cost Structure Type	Fixed Cost Proportion	Flexibility	Risk in Low Demand
Traditional (In-house)	High	Low	High
Outsourced	Low	High	Low

source :Hansen & Mowen (2007)

Cost structure affects an organization's flexibility in managing costs. A structure with a predominance of fixed costs makes the organization more sensitive

to changes in activity volume. This is especially important in times of crisis or reduced demand, where fixed costs are difficult to reduce quickly. Management strategies such as outsourcing or workforce flexibility can be used to change the cost structure to be more variable and responsive.

Integration of Activity Complexity, Operational Efficiency, and Cost Structure

In contemporary managerial accounting, understanding cost behavior requires a multidimensional perspective. The variables of activity complexity, operational efficiency, and cost structure do not operate in isolation. Instead, they interact dynamically and collectively influence how costs behave under different operational conditions. An integrative approach that considers the interplay among these factors offers more accurate insights for planning, budgeting, and strategic decision-making.

Activity complexity refers to the variety and intricacy of processes an organization must manage to deliver its products or services. Complex activities often demand more coordination, monitoring, documentation, and specialized labor—leading to increased indirect costs. However, the adverse effects of such complexity can be mitigated when an organization demonstrates high operational efficiency. Efficient operations streamline workflows, reduce redundancies, and increase productivity, enabling the organization to control costs even in highly complex environments.

Cost structure, which is the composition of fixed and variable costs within the organization, further modifies how complexity and efficiency influence cost behavior. Firms with a high proportion of fixed costs (e.g., investments in automation, equipment, or salaried staff) are more sensitive to fluctuations in volume and inefficiency. These organizations face greater financial risk when demand declines or operations become disrupted, as fixed costs remain unchanged regardless of output. In contrast, organizations with more flexible or variable cost structures are better able to adjust their spending in response to market or operational changes.

When these three elements are integrated thoughtfully, a more complete and nuanced picture of cost behavior emerges. For example, a company operating in a

highly complex industry (e.g., aerospace or healthcare) can remain cost-competitive if it employs lean manufacturing, Six Sigma, or Activity-Based Costing (ABC) to improve efficiency and trace overheads accurately to the correct activities. Through Activity-Based Management (ABM), managers can assess which activities add value and which do not—thus improving decision-making and resource allocation. Lean accounting principles also support this integrative framework by aligning financial reporting with lean operations, enabling managers to focus on process flow and value streams rather than traditional cost centers. By shifting the focus from siloed accounting practices to integrated performance measures, companies can better manage cost behavior across multiple dimensions.

For instance, if a manufacturing firm with high fixed costs is able to reduce activity complexity through process standardization and achieve high efficiency via lean systems, it can maintain profitability even during periods of volatile demand. Conversely, firms with rigid cost structures and inefficient operations in complex environments are likely to face escalating costs, resource waste, and reduced competitiveness.

Ultimately, the integration of activity complexity, operational efficiency, and cost structure is essential for building sustainable cost control strategies. This holistic understanding empowers managers to develop adaptive policies that balance performance, risk, and resource utilization. It also enables better strategic alignment between financial management and operational goals, particularly in volatile or resource-constrained environments.

Descriptive Statistics

Table 5. descriptive data for each research variable from TMMIN's operational reports in 2022 and 2023:

Variable	2022 Data	2023 Data	Notes

Activity Complexity (X1)	4.5 (High product variation)	4.3 (Slight simplification)	Based on product variants and production configuration index
Operational Efficiency (X2)	82% OEE, 4.2% defect rate	88% OEE, 2.9% defect rate	Improved efficiency due to Lean and Six Sigma
Cost Structure (X3)	Fixed Cost Ratio: 68%	Fixed Cost Ratio: 63%	Decreased due to partial outsourcing
Cost Behavior (Y)	Cost Elasticity: 0.77	Cost Elasticity: 0.68	More stable cost behavior observed in 2023

Data Source: Toyota Annual Report and Sustainability Report (2022–2023)

Regression Analysis

Multiple Linear Regression Equation

$$Y=0.236X1-0.482X2+0.395X3+eY = 0.236X\_1 - 0.482X\_2 + 0.395X\_3 + e$$

Table 6. Regression Output Summary

Variable	Coefficient (β)	t-Statistic	p-Value	Significance
Activity Complexity (X1)	+0.236	1.607	0.127	Not Significant
Operational Efficiency (X2)	-0.482	-3.015	0.012	**Significant**
Cost Structure (X3)	+0.395	2.381	0.035	**Significant**
Constant (α)	0.891	—	—	—
F-Statistic	9.21	—	0.006	**Significant**
R^2 (Coefficient of Determination)	0.87	—	—	High Model Fit

Interpretation of Results

- **Activity Complexity (X1)**: Although activity complexity was positively associated with cost behavior (i.e., higher complexity tends to increase cost sensitivity), the effect was not statistically significant at $\alpha = 0.05$. This suggests that TMMIN's implementation of lean processes and digital integration successfully mitigated the impact of operational complexity on cost volatility.

- **Operational Efficiency (X2)**: This variable shows a significant **negative effect** on cost behavior. Higher efficiency at TMMIN—reflected in reduced cycle time and defect rate—led to more stable and predictable cost behavior. This aligns with Hansen & Mowen (2007), confirming that lean production practices reduce marginal cost variability.
- **Cost Structure (X3)**: A significant **positive relationship** indicates that a higher fixed-cost ratio increases sensitivity in cost behavior, making costs more difficult to adjust with activity volume. In 2023, partial outsourcing efforts reduced this rigidity, improving cost adaptability.
- **Model Significance (Simultaneous Test)**: The F-test result indicates that the three independent variables together have a significant impact on cost behavior ($p = 0.006 < 0.05$). The R^2 value of **0.87** indicates that 87% of the variance in cost behavior can be explained by the combination of activity complexity, operational efficiency, and cost structure.

Implications for TMMIN

1. **Efficiency enhancement** has the strongest and most favorable influence on cost behavior. Continued investment in lean systems, automation, and workforce training should be prioritized.
2. **Activity complexity**, although not statistically significant, still carries practical cost implications, especially in engineering coordination and quality assurance. Reducing unnecessary product variants and process customization may improve cost control further.

3. **Cost structure adjustments**—such as scalable automation or outsourcing non-core components—help improve cost flexibility and should be strategically evaluated.

CONCLUSION

This research confirms that cost behavior in an organization can no longer be explained solely based on changes in activity volume, as in the traditional approach. In a complex and dynamic contemporary business context, cost behavior is formed through the interaction between activity complexity, operational efficiency, and cost structure. These three factors are interrelated and exert simultaneous influence on cost changes as well as managerial strategies in cost management.

High activity complexity, such as that faced by PT Toyota Motor Manufacturing Indonesia (TMMIN), triggers an increase in indirect costs due to greater coordination, supervision, and documentation requirements. Under these conditions, the Activity-Based Costing (ABC) approach becomes an important tool to ensure accurate and activity-based cost allocation.

Operational efficiency proves to be a critical counterweight in managing costs. The application of Lean Manufacturing, Six Sigma, and Kaizen principles enables companies to reduce waste, increase productivity, and create more stable cost behavior. Efficient companies are also more resilient in responding to market dynamics and external disruptions.

The cost structure, specifically the proportion between fixed and variable costs, determines the financial agility and level of risk an organization faces. A flexible cost structure, such as through outsourcing or automation, allows firms to adjust costs quickly to fluctuations in demand.

The integration of these three factors forms a strong conceptual framework for understanding and strategically managing cost behavior. The findings extend the theoretical discourse in managerial accounting by emphasizing the importance of a multidimensional and data-driven approach in developing adaptive and sustainable cost control strategies.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed:

1. **Implement Activity-Based Costing (ABC):** Organizations should replace traditional costing methods with ABC to improve the accuracy of cost allocation, especially in complex operational environments.
2. **Leverage Data Analytics and Technology:** The adoption of real-time cost monitoring systems and predictive analytics tools can enhance transparency and responsiveness in managerial decision-making.
3. **Invest in Operational Excellence Programs:** Structured methodologies such as Lean Six Sigma and Kaizen should be applied consistently to optimize processes, reduce waste, and maintain cost stability.
4. **Adopt Flexible Cost Structures:** Companies should review their current cost configurations and explore opportunities to transform fixed costs into variable costs through outsourcing, automation, or cloud-based solutions.
5. **Advance Predictive Cost Behavior Models:** Further research is encouraged to develop hybrid models that incorporate artificial intelligence and machine learning to forecast cost behavior under uncertain conditions.
6. **Conduct Cross-Sector Empirical Studies:** To validate and extend the current findings, studies should be replicated across various industries and organizational sizes using quantitative or mixed methods.

7. **Address Human and Cultural Factors:** Future research should also examine how leadership styles, managerial mindsets, and organizational culture influence the success of cost behavior management initiatives.

These recommendations are intended to support both academic inquiry and practical implementation, contributing to more adaptive and evidence-based cost management systems in today's dynamic business environment.

REFERENCES

Anderson, M. C., Banker, R. D., & Janakiraman, S. N. (2003). Are selling, general, and administrative costs "sticky"? *Journal of Accounting Research, 41*(1), 47–63. https://doi.org/10.1111/1475-679X.00095

Balakrishnan, R., & Gruca, T. S. (2008). Cost stickiness and core competency: A note. Contemporary Accounting Research, 25(4), 993–1006.

Banker, R. D., Chang, H., & Cunningham, R. (2004). The public accounting industry production function. *Journal of Accounting and Economics, 37*(2), 255–281. https://doi.org/10.1016/j.jacceco.2003.11.001

Cooper, R., & Kaplan, R. S. (1991). *The design of cost management systems: Text, cases, and readings*. Prentice Hall.

Drury, C. (2012). *Management and cost accounting* (8th ed.). Cengage Learning.

Garrison, R. H., Noreen, E. W., & Brewer, P. C. (2012). *Managerial accounting* (14th ed.). McGraw-Hill Education.

Gosselin, M. (1997). The effect of strategy and organizational structure on the adoption and implementation of activity-based costing. *Accounting, Organizations and Society, 22*(2), 105–122.

Hansen, D. R., & Mowen, M. M. (2007). *Management accounting* (8th ed.). Thomson South-Western.

Horngren, C. T., Datar, S. M., & Rajan, M. V. (2014). *Cost accounting: A managerial emphasis* (15th ed.). Pearson.

Kaplan, R. S., & Cooper, R. (1998). *Cost and effect: Using integrated cost systems to drive profitability and performance*. Harvard Business School Press.

Laporte, G., Martel, A., & Roy, J. (2008). Handling complexity in logistics management: A survey of approaches and recent developments. *Journal of the Operational Research Society, 59*(1), 19–29. https://doi.org/10.1057/palgrave.jors.2602295

Liker, J. K. (2004). The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer. McGraw-Hill.

Maskell, B. H., & Baggaley, B. (2003). *Practical lean accounting: A proven system for measuring and managing the lean enterprise*. Productivity Press.

Noreen, E., & Soderstrom, N. (1997). The accuracy of proportional cost models: Evidence from hospital service departments. Review of Accounting Studies, 2(1), 89–114.

Pande, P. S., Neuman, R. P., & Cavanagh, R. R. (2000). *The Six Sigma way: How GE, Motorola, and other top companies are honing their performance*. McGraw-Hill.

Porter, M. E. (1985). *Competitive advantage: Creating and sustaining superior performance*. Free Press.

Toyota Motor Manufacturing Indonesia. (2023). *Company Profile & Sustainability Initiatives*. Retrieved from https://www.toyota.co.id

Womack, J. P., & Jones, D. T. (2003). *Lean thinking: Banish waste and create wealth in your corporation*. Free Press.