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The Effect of Environmental Uncertainty, Budget Participation, Task Complexity on Managerial Performance Moderated by Management Accounting Information Systems

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ABSTRACT

The increasing complexity and uncertainty of the business environment require organisations to optimise managerial performance in order to remain competitive. In Indonesian manufacturing companies, managerial performance is often influenced by internal and external factors such as environmental uncertainty, involvement in budget formulation, and task complexity. Although Management Accounting Information Systems (MAIS) have been widely studied in the context of decision making, their role as a moderating variable in the relationship between environmental uncertainty, budget participation, and task complexity on managerial performance has not been extensively researched. This study uses a quantitative approach with a survey method distributed to from manufacturing companies in South Jakarta. The data analysis technique used is (*Moderated Regression Analysis*) MRA .The results of the study indicate that Environmental uncertainty and task complexity have a significant negative effect on managerial performance, while budget participation and MAIS have a significant positive effect. MAIS was also found to weaken the negative influence of environmental uncertainty and strengthen the positive influence of budget participation on managerial performance, but it did not moderate the relationship between task complexity and managerial performance. This study introduces MAIS as a moderating variable that provides new insights into managerial performance studies. These findings emphasise the importance of implementing robust information systems to support more effective managerial strategies and decision-making.

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Introduction

Understanding the system as a whole is an important part of management activities, as it allows making the right decisions to improve the overall results of the system within certain limits. Making the right decision is the first step for managers in dealing with problems and designing suitable alternative solutions. [1] Managerial performance is the result of various managerial activities carried out effectively, including planning, implementation, administration, reporting, coaching, and supervision. Performance reflects the success of individuals or groups in completing tasks in accordance with their responsibilities and authority, in order to achieve organisational goals legally and ethically. Meanwhile, [2] states that managerial performance is the result of the implementation of duties and responsibilities by individuals, which is reflected in real behaviour such as work results, attendance, compliance with rules, and quality of communication, with indicators including efficiency, discipline, initiative, and accuracy. Optimal company performance is highly dependent on managerial effectiveness, both at the top and bottom levels. Managers play a role in motivating the team to achieve company goals, especially in the midst of increasingly fierce competition. Therefore, companies need a strong management system to plan, organise, lead, and control all activities, as well as make maximum use of existing resources. [3] that good managerial performance is essential for creating competitive advantage, and this performance improvement can be achieved through managers' ability to recognise opportunities, identify problems, and select and implement adaptation strategies effectively. Thus, improving managerial performance will have a direct impact on improving organisational performance and strengthening the competitiveness of the company.

Several actual phenomena show how weak managerial performance can have a detrimental impact on the organisation. For example, one example of managerial performance violations that occurred in recent years is [4] the corruption case of the 4G Base Transceiver Station (BTS) tower infrastructure development project involving the former

Minister of Communication and Information of the Republic of Indonesia, Johnny G. Plate. This case surfaced to the public in 2023 after the Attorney General's Office named Johnny G. Plate as a suspect for alleged corruption in the BTS project managed by the Telecommunication and Information Accessibility Agency (BAKTI) of the Ministry of Communications and Information Technology. As a high-ranking state official, Johnny G. Plate is supposed to perform managerial functions professionally and responsibly, especially in managing national strategic projects. However, in practice, the project worth more than Rp 10 trillion was allegedly not implemented according to proper procedures. He is known to have received a number of gratuities in the form of monthly money, golf facilities, and accommodation abroad. In addition, the project was disbursed and paid for even though the work had not been completed according to the contract, resulting in state losses of approximately IDR 8.03 trillion. This case reflects the weak implementation of internal control systems, low managerial accountability, and inability to deal with project complexity amid environmental uncertainty. If management accounting information systems are adequately implemented, the potential for such irregularities should be minimised through accurate reporting, budget transparency and data-driven performance evaluation.

Another case experienced by PT Bank Rakyat Indonesia (BRI) in 2019 highlighted the failure of the supervisory system and managerial decision-making. In that case, there was an error in transferring funds worth IDR 3 trillion to an unauthorised party. When the funds were requested back by the bank, the recipient of the funds refused and finally this problem was taken to legal channels [5] [6]. This case reflects the lack of internal controls and weak supervision in the bank's management system. A similar situation was experienced by PT Kimia Farma, which suffered huge losses amid public expectations that the pharmaceutical sector would benefit during the COVID-19 pandemic. In fact, the company had to bear the burden of raw material procurement costs that swelled up to five times, and even worse, a subsidiary of Kimia Farma was involved in manipulating sales reports. The losses experienced were not only financial, but also reputational, even causing five of the company's ten factories to be closed due to high operational costs [7]. This shows the

weakness of the management evaluation and planning system, as well as the lack of leadership effectiveness which has a direct impact on reducing managerial performance [8]. [9] states that managerial performance can be assessed through several indicators, namely the achievement of work targets, accuracy and suitability of work processes, innovation, work reputation, efficiency, and compliance with applicable norms.

Internally, there were problems with budget participation as sales targets were often set unrealistically, coupled with limited stock and suboptimal promotions. On the external side, factors such as extreme weather, inflation, and political issues significantly reduce consumer purchasing power. This shows that environmental uncertainty and task complexity are two major challenges that managers have to face in their daily operations. These challenges demonstrate the importance of understanding the factors that influence managerial performance. Environmental uncertainties, such as changes in technology, regulation, or global economic conditions, make the decision-making process increasingly complex [10]. Budget participation is also an important factor, where involving managers in budgeting is believed to increase their sense of responsibility and understanding of organisational goals [11]. Task complexity, which includes the level of difficulty, variety of work, and limited resources, affects managers' ability to perform their functions efficiently [12]. In the midst of these conditions, management accounting information systems (MAIS) can be an important instrument that helps managers obtain relevant, accurate, and timely data in the process of decision making, planning, and controlling the organisation [13].

The urgency of this research lies in the need to explore more deeply how MAIS can strengthen or weaken the influence of environmental uncertainty, budget participation, and task complexity on managerial performance. Many previous studies have examined these variables separately, but very few have examined the role of MAIS as a moderating variable in a comprehensive model. This research is significant because it not only contributes theoretically to the development of management science, but also practically in helping companies form responsive and adaptive managerial strategies. The novelty in this study lies in the use of MAIS as a moderating variable that mediates the relationship between the independent variables and managerial performance. In the midst of business complexity and

increasing environmental pressure, MAIS can be an important tool in accelerating the organisational learning process and supporting more structured decision making. This research is based on the Organizational Learning Theory introduced by Chris Argyris and Donald Schön. This theory emphasises the importance of organisational learning in order to survive, adapt and thrive in an uncertain environment. Organisations that learn actively will be able to adjust strategies, optimise resources, and improve managerial capabilities on an ongoing basis.

A number of previous studies reinforce the importance of this research. [10] shows that environmental uncertainty significantly affects managerial performance. [14] also proved that MAIS is able to strengthen the positive influence of environmental uncertainty on performance. In the context of budget participation, studies [15] and [16] show that managers' involvement in budgeting has a positive impact on achieving organisational performance. Meanwhile, [17] revealed that although task complexity can be a burden, if managed properly, it can actually increase managerial capacity in overcoming more severe challenges. Departing from these various empirical and theoretical backgrounds, this study aims to thoroughly examine the effect of environmental uncertainty, budget participation, and task complexity on managerial performance, as well as the role of management accounting information systems as a variable that moderates the relationship. This research is expected to contribute in developing academic insights and practical strategies to improve management effectiveness in various organisational sectors that are facing rapidly changing environmental dynamics.

When organisations face environmental uncertainty, managers are driven to seek information and improve their ability to deal with change. This learning process makes managers more adaptive and able to make strategic decisions that improve organisational performance. However, if uncertainty is too high, it can lead to confusion and lower managerial performance. Research by [18], [19] ,[20] and [21] shows that environmental uncertainty has a positive and significant effect on managerial performance. Meanwhile, [22]

states that environmental uncertainty has no effect on managerial performance Thus, the proposed hypothesis is:

H1 : Environmental uncertainty has a positive effect on managerial performance.

[23] Budget participation is the involvement of subordinates in the process of preparing the organisation's budget. According to [24] this participation involves employee contributions in budget preparation, the success of which is used as a benchmark in evaluating the quality of managerial performance. Managers' participation in the budgeting process increases their sense of responsibility and understanding of organisational conditions. This triggers learning that strengthens managerial skills in planning and managing resources, resulting in improved managerial performance. However, excessive participation without proper management can lead to stress and confusion. Research from [25], [26] and [3]supports that budget participation has a positive and significant influence.

H2 : Budget participation has a positive effect on managerial performance.

According to [27], task complexity describes the level of complexity and difficulty of a job which can cause inconsistencies in task completion and reduce employee accountability. Meanwhile, [28] stated that task complexity is related to individual perceptions of the level of difficulty of the job, which is influenced by limited capacity, memory, and ability to make decisions and manage various problems in an integrated manner. Complex tasks encourage managers to learn and develop skills in overcoming complicated challenges, thereby improving decision-making ability and resource management efficiency. However, if complexity is too high and not managed properly, managers can feel stressed so that performance decreases. Research [17] found that task complexity improves managerial performance by enlarging managers' ability to handle problems. However, researchers argue that at very high levels of complexity, performance actually decreases.

H3 : Task complexity has a negative effect on managerial performance.

MAIS provides accurate and relevant information to support managerial decision-making in a timely and effective manner. It enables managers to understand the state of the organisation, respond quickly to change, and improve resource management, leading to

improved managerial performance. If MAIS implementation is poor or overly complex, it can reduce performance due to difficulty of use. Research [29] and [30] shows that MAIS has a positive and significant effect.

H4 : MAIS has a positive effect on managerial performance.

Environmental uncertainty can hinder managerial performance, but with effective MAIS, managers get more accurate and real-time information to better deal with these changes. Thus, MAIS is able to reduce the negative impact of environmental uncertainty on managerial performance. Although there is no recent research that specifically supports this hypothesis, researchers think MAIS is very important as a moderating variable.

H5: MAIS reduces the effect of environmental uncertainty on managerial performance.

Budget participation will be more effective in improving managerial performance if supported by adequate MAIS. MAIS provides timely access to budget information and performance results, so that managers can make better decisions and increase their involvement. Conversely, without good MAIS support, the effect of budget participation on performance will be limited. Although no recent studies have specifically tested this, the researcher argues that MAIS can strengthen the effect of budget participation on managerial performance.

H6 : MAIS enhances the effect of budget participation on managerial performance.

Task complexity can reduce managerial performance if not managed properly. However, this negative impact can be reduced if the organisation has an adequate Management Accounting Information System (MAIS). An effective MAIS provides relevant and timely information, thus assisting managers in managing complex tasks more efficiently and accurately. Conversely, without good MAIS support, managers may have difficulty in understanding and completing complex tasks, which may ultimately deteriorate managerial performance. Although no recent studies have specifically examined the moderating role of MAIS in this relationship, researchers argue that MAIS may reduce the negative effect of task complexity on managerial performance. In addition, managers' skills and experience in using MAIS also determine the effectiveness of the system in helping to manage complexity.

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H7 : MAIS reduces the effect of task complexity on managerial performance.

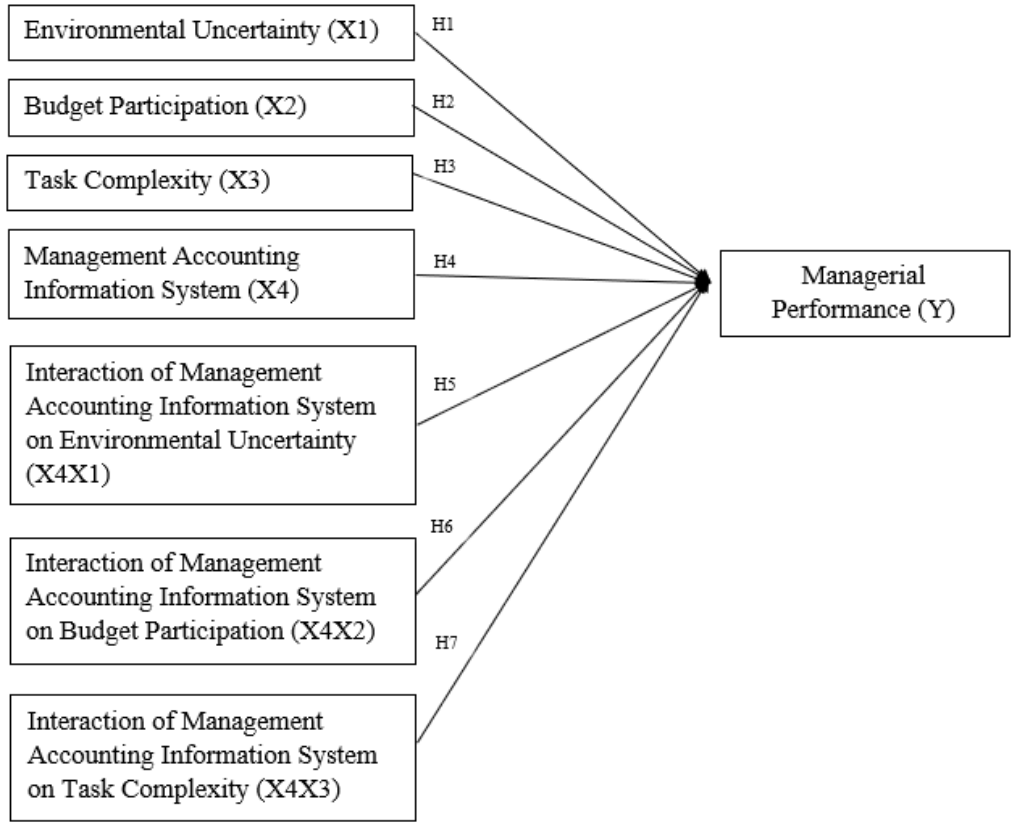

Figure 1. Thinking Framework

Method

This research is quantitative research with an explanatory approach. This approach is used to test the relationship between variables based on existing theory and measure the extent of the influence of the independent variable on the dependent variable. The data used in this study are primary data obtained directly through distributing questionnaires to respondents. The research population includes all units of analysis that have characteristics that are in accordance with the topic under study [31]. The population in this study cannot be known with certainty. The population in this study are managers who work in manufacturing companies operating in the South Jakarta area. This population includes managers at various levels, ranging from bottom-line managers, middle, to top-level

managers from various fields such as finance, marketing, operations, human resources, and information technology. Because the exact population size is unknown, sampling, the sample is part of the population that has similar characteristics [32]. conducted using probability sampling method of simple random sampling type. This technique allows all members of the population to have the same opportunity to be selected as respondents. The determination of the sample size was based on the Lemeshow formula with a confidence level of 90%, a margin of error of 10%, and a proportion of respondents of 0.5, so that a minimum sample of 68 respondents was obtained. However, in practice, the number of valid respondents analysed in this study was 99 people.

In this research is a questionnaire consisting of closed statements with a 6-point Likert scale. The scale includes options ranging from 'Strongly Disagree' to 'Strongly Agree'. The selection of an even scale aims to encourage respondents to provide a more explicit attitude towards each statement. The research instruments have been tested for validity and reliability. Validity was measured using Pearson Product Moment correlation technique, while reliability was tested using Cronbach's Alpha value with a minimum threshold of 0.60. The test results showed that all variable indicators met the validity and reliability requirements. The research stage began with the preparation of a questionnaire instrument based on indicators that had been adapted from previous research and adjusted to the organisational context. The questionnaire was then tested to assess its validity and reliability. After the instrument was declared feasible, questionnaires were distributed to respondents randomly selected from the target population. The collected data were analysed using statistical software IBM SPSS Statistics version 25. The analysis process began with a description of the variables, continued with the classical assumption test, and ended with multiple linear regression analysis and (MRA) to test the role of moderating variables.

Results and Discussion

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The data analysis method in this study used a quantitative approach, with the help of IBM SPSS Statistics software version 25. The analysis techniques used were tailored to the objectives and structure of the testing in the study, with the following results:

Validity Test

Table 1 presents the validity of the instruments for managerial performance variables, environmental uncertainty, budget participation, task complexity, and management accounting information systems as follows:

Tabel 1. Validity Test Result

Statement	R Value		R Table	Result
EU 1	0.632	>	0.1909	Valid
EU 2	0.741	>	0.1909	Valid
EU 3	0.692	>	0.1909	Valid
EU 4	0.691	>	0.1909	Valid
EU 5	0.700	>	0.1909	Valid
EU 6	0.733	>	0.1909	Valid
EU 7	0.722	>	0.1909	Valid
EU 8	0.744	>	0.1909	Valid
BP 1	0.939	>	0.1909	Valid
BP 2	0.948	>	0.1909	Valid
BP 3	0.936	>	0.1909	Valid
BP 4	0.949	>	0.1909	Valid
BP 5	0.940	>	0.1909	Valid
BP 6	0.903	>	0.1909	Valid
BP 7	0.882	>	0.1909	Valid
BP 8	0.882	>	0.1909	Valid
TC 1	0.511	>	0.1909	Valid
TC 2	0.502	>	0.1909	Valid
TC 3	0.598	>	0.1909	Valid
TC 4	0.554	>	0.1909	Valid
TC 5	0.708	>	0.1909	Valid
TC 6	0.414	>	0.1909	Valid
TC 8	0.506	>	0.1909	Valid
MAIS 1	0.623	>	0.1909	Valid

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MAIS 2	0.776	>	0.1909	Valid
MAIS 3	0.715	>	0.1909	Valid
MAIS 4	0.741	>	0.1909	Valid
MAIS 5	0.834	>	0.1909	Valid
MAIS 6	0.678	>	0.1909	Valid
MAIS 7	0.729	>	0.1909	Valid
MAIS 8	0.739	>	0.1909	Valid
MP 1	0.622	>	0.1909	Valid
MP 2	0.660	>	0.1909	Valid
MP 3	0.640	>	0.1909	Valid
MP 4	0.646	>	0.1909	Valid
MP 5	0.633	>	0.1909	Valid
MP 6	0.666	>	0.1909	Valid
MP 7	0.718	>	0.1909	Valid
MPBP 8	0.649	>	0.1909	Valid

Source: Data analysis, 2025

Based on the results of data processing, all indicators in this study were declared valid because the calculated R value of each indicator was greater than the R table of 0.1909. This shows that each statement in the questionnaire has a strong enough correlation with the variable construct it represents, so it is feasible to use in further analysis. For the Environmental Uncertainty (EU) variable, all indicators from EU1 to EU8 have a calculated R value between 0.632 to 0.744. Since all these values exceed the R table, the indicators are declared valid in measuring the level of uncertainty faced by the organisation. In the Budget Participation (BP) variable, indicators BP1 to BP8 show very high R values, ranging from 0.882 to 0.949. This reflects that each indicator is able to consistently represent the level of respondents' participation in the budgeting process. The Task Complexity (TC) variable has indicators TC1 to TC8, with calculated R values ranging from 0.414 to 0.708. Although there are some values that are relatively lower than other variables, all indicators still exceed the R table value, so they are declared valid and can be used to describe the level of manager task complexity. Meanwhile, the Management Accounting Information System (MAIS) variable shows the calculated R value between 0.623 to 0.834 for all MAIS1 to MAIS 8

indicators. This indicates that each indicator has a strong relationship with the measured construct, namely the effectiveness of the management accounting information system used. Finally, in the Managerial Performance (MP) variable, indicators MP1 to MP8 show calculated R values between 0.622 to 0.718. All of these values are also higher than the R table, which means that each indicator is valid in measuring respondents' managerial performance, especially in terms of work planning, implementation, and evaluation.

Thus, all indicators on each variable in this study have met the validity requirements based on the comparison between the calculated R value and the R table, and can be used in the next stage of analysis.

Reliabilty Test

Table 2 shows the results of the reliability test of the instruments for managerial performance variables, environmental uncertainty, budget participation, task complexity, and management accounting information systems as follows:

Tabel 2. Reliabilty Test Result

Variabels	Croncbach's Alpha	N of items
X1 (Environmental uncertainty)	0.856	8
X2 (Budget participation)	0.976	8
X3 (Task complexity)	0.798	7
X4 (Accounting and management information systems)	0.893	8
Y (Managerial performance)	0.807	8

Source: Data analysis, 2025

Based on the reliability test results, all variables used in this study showed Cronbach's Alpha values above 0.60, indicating that the measurement instruments met the reliability criteria and were suitable for further analysis. The Budget Participation variable obtained the highest reliability value, namely 0.976. This indicates that the items in this variable are very consistent and have a very high level of reliability. In other words, respondents provided

consistent answers to questions measuring budget participation, making this instrument highly representative in measuring this construct. The Management Accounting Information System (MAIS) and Environmental Uncertainty variables had Cronbach's Alpha values of 0.893 and 0.856, respectively, both of which are very good. This indicates that the items forming these two variables have adequate internal consistency and can be trusted to reflect the constructs being measured. Furthermore, the Managerial Performance variable has a reliability value of 0.807, which also indicates a good level of reliability, so that the data can be used to measure managerial performance with a high level of confidence. Although the Task Complexity variable has the lowest reliability value among the other variables, at 0.798, this value is still above the minimum recommended threshold, so the variable is still considered statistically reliable. This value indicates variations in respondents' perceptions of the level of task complexity, which can be considered in the discussion of the research results. Overall, with Cronbach's Alpha values above 0.70 for all constructs, it can be concluded that this research instrument has high internal consistency. This means that each item within a variable consistently measures the same concept, so the data obtained can be trusted for use in further statistical analyses such as regression and moderation tests.

Descriptive Variabels

Table 3 presents descriptive statistics for each variable, such as minimum value, maximum value, mean, and standard deviation, as well as normality and randomness tests (runs test).

Tabel 3. Descriptive statistic

Descriptive	Y	X1	X2	X3	X4
Minimum	34	8	12	27	31
Maximum	48	33	48	46	49
Median	40,00	16,00	39,00	35,15	40,10
Mean	41,32	15,66	36,42	35,18	40,12
Skweness	0,520	0,457	-1,280	0,503	-0,002
Kurtosis	-0,132	4,323	0,874	0,625	0,004

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Std. Devisiasi	3,152	3,712	8,823	3,459	3,926
Stats Uji Runs	1,333	-0,604	0,432	-3,333	-9,935
Sig. Uji Runs	0,183	0,546	0,666	0,001	0,000
Interprestasi Uji Runs	Random	Random	Random	Not Random	Not Random
Stats Uji KS-1	0,178	0,167	0,228	0,960	0,120
Sign. Uji KS-1	0,000	0,000	0,000	0,026	0,001
Interprestasi Uji KS-1	Abnormal	Abnormal	Abnormal	Abnormal	Abnormal
Eta Kuadrat	-	0,596	0,649	1	1
Interprestasi eta kuadrat	-	Strong	Strong	Very Strong	Very Strong

Source: Data analysis, 2025

Based on the results of descriptive analysis, the distribution of data from variables Y, X1, X2, X3, and X4 can be examined through skewness and kurtosis values. The skewness values for each variable are as follows: Y is 0.520; X1 is 0.457; X2 is -1.280; X3 is 0.503; and X4 is -0.002. Skewness is a measure of the skewness of the data distribution. A skewness value between -0.5 ≤ skewness value ≤ 0.5 indicates that the data distribution is symmetrical or close to a normal distribution. The kurtosis values for each variable are: Y is -0.132; X1 is 4.323; X2 is 0.874; X3 is 0.625; and X4 is 0.004. Kurtosis measures the peakedness of the data distribution. In the context of descriptive statistics, a mesokurtic or normal kurtosis value (Kurtosis = 3) is still acceptable as an indication that the data does not deviate significantly from the normal distribution. Most variables have a kurtosis close to zero, indicating a mesokurtic (normal) distribution. Although X1 has a kurtosis above 4, this condition is still within the tolerance limit and does not indicate a serious deviation from the distribution.

Simultaneous Effect Test

Test of Simultaneous Effect of Direct Relationship

Table 4 shows the results of the simultaneous effect test of direct relationships using multiple linear regression analysis to test the simultaneous effects of environmental uncertainty, budget participation, task complexity, and management accounting information systems on managerial performance as follows:

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Tabel 4. Result of Direct Relationship Model Structure

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.848[a]	0.72	0.708	1.704	0.72	60.323	4	94	0

Source: Data analysis, 2025

Based on Table 4, it can be seen that the R2 value is 0.720 or 72%, which means that the independent variables, namely environmental uncertainty, budget participation, task complexity, and management accounting information systems, are able to explain the dependent variable, namely managerial performance. Meanwhile, the remaining 28.0% is explained by other variables outside this research model. The calculated F value of 60.323 is greater than the table F value of 2.46 (with df1 = 4 and df2 = 94), and has a significance level of 0.000, which is smaller than $\alpha = 0.05$. This indicates that simultaneously, the variables of environmental uncertainty, budget participation, task complexity, and management accounting information systems significantly influence managerial performance. Thus, the proposed regression model can be considered valid and significant in explaining the relationships among variables in this study.

Classical Assumption Test

Since this study uses multiple linear regression with the help of SPSS, classical assumption tests were conducted to ensure that the regression model built meets the requirements of validity and reliability. These tests are important so that the regression estimation results are not biased and can be interpreted correctly. With these assumptions fulfilled, the analysis results are believed to reflect the actual relationship between the research variables.

Non-Multikolinearity

Tested using the Variance Inflation Factor (VIF) and tolerance values presented in Table 5 as follows:

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Table 5. Results of Non-Multicollinearity Test

Variabels	VIF	Eligibility Limits	Tolerance value	Eligibility Limits	Results
X1	1,729	<10	0,578	>0,10	Multicollinearity risk can be ignored.
X2	1,263	<10	0,792	>0,10	Multicollinearity risk can be ignored.
X3	2,003	<10	0,499	>0,10	Multicollinearity risk can be ignored.
X4	1,896	<10	0,527	>0,10	Multicollinearity risk can be ignored.

Source: Data analysis, 2025

There is no multicollinearity or relationship between independent variables in the model structure. This can be seen in each Variance Inflation Factor (VIF) value, where the environmental uncertainty variable (X1) is 1.729, budget participation (X2) is 1.263, task complexity (X3) is 2.003, and management accounting information system (X4) is 1.896, all of which are less than 10.

Non-AutoCorrelation

Tested using the Durbin-Watson test presented in Table 6 as follows::

Tabel 6. Result of Non-Autocorrelation Test

Model	Durbin-Watson
1	1.849

Source: Data analysis, 2025

Based on the results of the Durbin-Watson test in Table 10, it can be seen that the Durbin-Watson value is 1.849. With a sample size (n) of 99 and four independent variables (k), namely Management Accounting Information Systems, Budget Participation, Environmental Uncertainty, and Task Complexity, the lower bound (dL) is approximately 1.3779 and the upper bound (dU) is approximately 1.7214 (based on the Durbin-Watson table for n = 99 and k = 4). Since d > dU (1.849 > 1.7214), it can be concluded that there is no positive autocorrelation in this regression model.

Non-Heteroscedasticity

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Tested using the Glejser test presented in Table 7 as follows:

Table 7. Results of Non-Heteroscedasticity Test

Model		Sig.
1	Constant	0.932
	Environmental	0.238
	Budget Participation	0.843
	Task complexity	0.494
	Accounting and management information systems	0.268

Source: Data analysis, 2025

Based on the results in Table 7, there are no independent variable values that have a statistically significant effect on the dependent variable. This can be seen from the significance value > 0.05 or 5%. Therefore, it can be concluded that there is no heteroscedasticity, so the regression model can be used in testing.

Normality Residual Distribution

Tested using the Kolmogorov-Smirnov Test presented in Table 8 as follows:

Tabel 8. Results of Normality Test of Residual Distribution

One-Sample Kolmogorov-Smirnov Test	
Test Statistic	0.083
Asymp. Sig. (2-tailed)[c]	0.092

Source: Data analysis, 2025

Based on the normality test results, it can be seen that the Asymp. Sig value is 0.092 > 0.05. Therefore, it can be concluded that the data in this study is normally distributed.

Test of Simultaneous Effect of Moderation Relationship

Using Moderated Regression Analysis (MRA) to test whether management accounting information systems moderate the relationship between:

Environmental uncertainty on managerial performance

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Tabel 9. Results of the Structural Test of the Environmental Uncertainty Moderation Relationship Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.676[a]	0.457	0.446	2.346	0.457	40.477	2	96	0
2	.690[b]	0.476	0.459	2.318	0.018	3.267	1	95	0.074

Source: Data analysis, 2025

Based on Table 9 in Model 1, the R Square value is 0.457 or 45.7%, which means that the independent variables can explain 45.7% of the variation in the dependent variable. The remaining 54.3% is explained by other variables outside this research model. After incorporating the interaction variable (moderation), the R-Square value increased to 0.476 or 47.6%. Thus, there is an increase of 0.018 (1.8%) in the model's ability to explain the dependent variable. The calculated F value for the model change (F Change) is 3.267, which is greater than the table F value of 2.71 (with df1 = 1 and df2 = 95) at a significance level of 0.074. If using a significance level of 10% (α = 0.10), this value is less than 0.10, so it can be concluded that the addition of the moderating variable (environmental uncertainty) has a statistically significant effect on the model.

Budget participation on managerial performance

Tabel 10. Results of the Structural Test of the Moderating Relationship Model of Budget Participation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.478[a]	0.228	0.212	2.797	0.228	14.216	2	96	0
2	.502[b]	0.252	0.228	2.769	0.024	2.986	1	95	0.087

Source: Data analysis, 2025

Based on Table 10, it is known that in Model 1, the R Square value is 0.228 or 22.8%, which means that the independent variables can explain 22.8% of the variation in the dependent variable. The remaining 77.2% is explained by other variables outside this

research model. After incorporating the interaction variable (budget participation moderation) into Model 2, the R Square value increased to 0.252 or 25.2%. This indicates an increase of 0.024 (2.4%) in the model's ability to explain the dependent variable. The F Change value in Model 2 is 2.986, which is greater than the F table value of 2.71 (with df1 = 1 and df2 = 95) at a significance level of 0.087. The significance level is less than 10% (α = 0.10), so it can be concluded that the addition of the budget participation moderation variable has a significant effect. The increase in the R Square value is only 2.4%, which still indicates that budget participation plays a significant role as a moderating variable.

Task complexity on managerial performance

Table 11. Results of the Structural Test of the Task Complexity Moderation Relationship Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.479a	0.23	0.213	2.795	0.23	14.301	2	96	0
2	.484b	0.234	0.21	2.802	0.004	0.526	1	95	0.47

Source: Data analysis, 2025

Based on Table 11, it is known that in Model 1, the R Square value is 0.230 or 23.0%, which means that the independent variables in the model can explain 23.0% of the variation in the dependent variable. The remaining 77.0% is explained by other factors outside the research model. After introducing the interaction variable (task complexity moderation) in Model 2, the R Square value increased slightly to 0.234 or 23.4%. This indicates a very small increase of 0.004 (0.4%) in the model's ability to explain the dependent variable. The F Change value in Model 2 is 0.526, which is smaller than the F table value of 2.71 (with df1 = 1 and df2 = 95) at a significance level of 0.470. Since this value is far greater than the significance thresholds of 0.05 and 0.10, it can be concluded that the addition of the task complexity moderator variable does not have a significant effect on the model. The task

complexity variable does not act as a significant moderator in the relationship between the independent and dependent variables in this study.

Partial Effect Test

Test of Partial Effect of Direct Relationship

Table 12. Results of Partial Tests of Direct Relationships

Variabel	Koef.reg (Beta)	t	Sig t	Korelasi Partial
Costant	62,651	19,26	0,000	-
X1 (Environmental uncertainty)	-0,744	-12,206	0,000	-0,783
X2 (Budget participation)	0,075	3,424	0,001	0,333
X3 (Task complexity)	-0,627	-8,896	0,000	-0,676
X4 (Accounting and management information systems)	0,24	3,977	0,000	0,379

Source: Data analysis, 2025

Table 12 shows ; a) The constant regression coefficient value of 62.651 has a positive effect with a significance value of 0.000 < 0.05, meaning that it can be concluded that all independent variables (environmental uncertainty, budget participation, task complexity, and management accounting information systems) have a significant positive effect on the dependent variable of managerial performance. b) The environmental uncertainty variable has a regression coefficient value of -0.744 with a significance value of 0.000. The negative coefficient value indicates that environmental uncertainty has a negative effect on managerial performance, and the significance value of less than 0.05 indicates that the effect is significant. Thus, it can be concluded that environmental uncertainty has a significant negative effect on managerial performance. c) The budget participation variable has a regression coefficient value of 0.075 and a significance value of 0.001. The positive coefficient indicates that budget participation has a positive effect on managerial performance. Since the significance value is also below 0.05, this effect is significant. This means that budget participation has a significant positive effect on managerial performance. d) The task complexity variable has a regression coefficient value of -0.627 with a significance value of 0.000. The negative coefficient value indicates a negative effect on

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managerial performance, and since the significance value is also below 0.05, the effect is significant. Thus, task complexity has a significant negative effect on managerial performance. e) The accounting information system variable shows a regression coefficient value of 0.240 with a significance value of 0.000. This indicates that the accounting information system has a significant positive effect on managerial performance.

Test of Partial Effect of Moderation Relationship

Table 13. Results of Partial Test of the Moderating Relationship between Environmental Uncertainty and MAIS

	Model	Sig.
1	(constant)	0
	Environmental uncertainty	0
	Accounting and management information system	0.214
2	(Constant)	0
	Environmental uncertainty	0.032
	Accounting and management information system	0.038
	Accounting and management information system x Environmental uncertainty_N	0.074

a. Dependent Variabel: Managerial performance

Source: Data analysis, 2025

The regression results in Model 2 show that MAIS has a significant effect on Managerial Performance (MP) (p = 0.038), and the interaction between MAIS and EU is also significant (p = 0.074). This indicates that MAIS is a quasi-moderator in the relationship between Environmental Uncertainty (EU) and MP.

Table 14. Results of Partial Test of Moderating Relationship between Budget Participation and MAIS

	Model	Sig.
1	(constant)	0
	Budget participation	0.03
	Accounting and management information system	0.001
2	(constant)	0

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	Budget participation	0.674
	Accounting and management information system	0.273
	Accounting and management information system x Budget participation_N	0.087

a. Dependent Variabel: Managerial performance

Source: Data analysis, 2025

The significance value for the MAIS×BP interaction is 0.087 (8.7%), which is still below the 10% threshold, so it can be said to be significant. However, the main variable Budget Participation itself is not significant (sig. = 0.674), and MAIS is also not significant (sig. = 0.273), indicating that MAIS here only moderates, not acts as a direct predictor. Thus, MAIS acts as a pure moderator in the relationship between BP and MP.

Table 15. Results of Partial Test of the Moderating Relationship between Task Complexity and MAIS

	Model	Sig.
1	(constant)	0
	Task complexity	0.028
	Accounting and management information system	0
2	(constant)	0
	Task complexity	0.498
	Accounting and management information system	0
	Accounting and management information system x Task complexity _N	0.47

a. Dependent Variabel: Managerial performance

Source: Data analysis, 2025

The interaction between Task Complexity and Management Accounting Information System (MAIS×TC) has a significance value of 0.470 or 47%, which is well above the threshold of 10%. This means that the interaction is not significant, so MAIS cannot be considered a moderator in the relationship between Task Complexity and Managerial Performance. The significance value of Task Complexity in Model 2 is 0.498 (also not significant).

Discussion

The Effect of Environmental Uncertainty on Managerial Performance

The regression test results show that environmental uncertainty has a significant negative effect on managerial performance, with a regression coefficient value of -0.744 and a significance value of 0.000. This negative effect indicates that the higher the environmental uncertainty faced by an organisation, the more likely managerial performance will decline. Logically, this result is acceptable because in an uncertain environment, managers find it difficult to plan, organise, and control activities. When managers lack sufficient information to predict external situations, decision-making becomes more challenging, and the risk of errors increases, thereby reducing their performance. This finding is closely related to organisational learning theory, which states that in the context of environmental uncertainty, organisations should be able to adapt by learning from external changes. However, the results of this study show that such learning has not occurred effectively, so that uncertainty actually reduces performance. This indicates that the organisational learning process is not yet optimal in helping managers deal with environmental dynamics.

The Effect of Budget Participation on Managerial Performance

The regression analysis results show that budget participation has a significant positive effect on managerial performance, with a coefficient value of 0.075 and a significance of 0.001. This positive effect means that the higher the manager's participation in budget preparation, the higher the managerial performance achieved. This result is logical because participation provides managers with the opportunity to understand the financial and operational conditions of the organisation, as well as increasing their sense of responsibility for achieving targets. This involvement also increases motivation and commitment to the efficient implementation of the budget. These findings are consistent with previous research by [16] , [26], and [3], which concluded that budget participation improves managerial performance. This similarity occurs because budget participation is indeed one of the management approaches that has proven to be effective in various organisational contexts. From the perspective of organisational learning theory, budget participation encourages the learning process through active involvement in financial

planning. Managers do not only receive information but are also involved in the policy-making process.

The Effect of Task Complexity on Managerial Performance

The regression test results show that task complexity has a significant negative effect on managerial performance, with a regression coefficient value of -0.627 and a significance of 0.000. This means that the more complex the tasks faced by managers, the lower their managerial performance. This negative effect is logical, especially if complexity is not balanced with adequate resource support or training. Complex tasks can lead to fatigue, errors in decision-making, and delays in achieving work targets, ultimately reducing performance. In organisational learning theory, task complexity can be a source of learning if managers are able to evaluate experiences and respond to challenges adaptively. However, the results of this study indicate that complexity actually reduces performance. This can be interpreted as meaning that there has not been sufficient learning to cope with high workloads, so complexity becomes an obstacle rather than an opportunity for growth.

The Influence of Management Accounting Information Systems on Managerial Performance

Based on the regression results, management accounting information systems (MAIS) have a significant positive influence on managerial performance, with a coefficient value of 0.240 and significance of 0.000. This positive effect means that the better the implementation of MIS in an organisation, the higher the managerial performance. This is logical, as MIS provides accurate and timely information needed for effective and efficient decision-making. These results are consistent with previous studies, such as those by [29] and [30], which state that optimal implementation of MIS will improve efficiency, cost control, and decision-making. In line with organisational learning theory, management accounting information systems serve as a means to manage organisational knowledge and experience. MAIS helps managers learn from historical data and design actions based on accurate information. Thus, good MAIS implementation reflects organisational learning in managerial practice.

MAIS Moderation of the Influence of Environmental Uncertainty

The significance value of the interaction between MAIS and environmental uncertainty is 0.074, which is significant at the 10% level. This indicates that MAIS moderates the influence of environmental uncertainty on managerial performance. In this case, MAIS weakens the negative impact, meaning that MAIS helps managers to maintain performance even when faced with uncertainty. This is logical, as timely and relevant information helps managers to adjust their strategies quickly. These results support the notion that MAIS is a quasi-moderator, which serves to mitigate negative impacts. This relationship is also relevant to organisational learning theory, as MAIS helps organisations manage and understand information from the external environment more effectively. This suggests that through MAIS, organisations can learn from uncertainty, improve strategies, and maintain managerial performance stability.

MAIS's Moderation of the Influence of Budget Participation

The significance value of the MAIS × Budget Participation interaction is 0.087, indicating significant moderation. However, the main variable of budget participation becomes insignificant in the interaction model. This suggests that MAIS only moderates the relationship, not directly influencing it. This effect is logical because participation will be more effective when the information used in the budgeting process is supported by a good system. These results also support MAIS as a pure moderator. From an organisational learning perspective, MAIS's role in strengthening the relationship between budget participation and performance shows that information systems support collective learning processes among individuals in an organisation. This helps to achieve more participatory and informed decision-making.

MAIS's moderation of the influence of task complexity

The results show that the significance value of the MAIS × Task Complexity interaction is 0.470, meaning it is not significant. This indicates that MAIS is unable to

moderate the influence of task complexity on managerial performance. This can be explained by the fact that even though MAIS provides relevant information, if the task is highly complex and managers lack the ability to utilise it, then MAIS is insufficiently helpful. Therefore, not all relationships can be moderated by MAIS, especially if the complexity stems from non-informational factors. These results also indicate that the role of MAIS in organisational learning is not yet optimal in the context of highly complex tasks. Even if information is available, if it is not combined with managerial analytical and reflective skills, learning will not occur, and performance will not improve significantly.

Conclusion

This study aims to analyse the influence of environmental uncertainty, budget participation, and task complexity on managerial performance, as well as to evaluate the role of management accounting information systems as a moderating variable. Based on the results of data processing from 99 respondents working in manufacturing companies in South Jakarta, it can be concluded that environmental uncertainty has a negative effect on managerial performance, indicating that uncertain external conditions can hinder the effectiveness of managerial decision-making. Budget participation was found to have a positive effect, confirming that involving managers in the budgeting process can enhance a sense of responsibility and understanding of organisational objectives. Task complexity also has a negative effect on managerial performance, indicating that high workloads not managed with adequate support systems can disrupt managerial performance.

Additionally, management accounting information systems have a positive influence on managerial performance and act as an effective moderating variable. This system has been proven to strengthen the relationship between budget participation and managerial performance, as well as mitigate the negative impact of environmental uncertainty and task complexity. Thus, management accounting information systems not only function as data processing tools but also as strategic instruments in improving the accuracy and speed of managerial decision-making. In general, this study reinforces the importance of information systems in the framework of managerial decision-making amid the dynamics and complexity

of the organisational environment. The contribution of this study to the field of knowledge, particularly industrial engineering and accounting management, lies in the integration of information systems as a reinforcing element of organisational factors that influence performance. This research also expands the application of Organisational Learning Theory in a managerial context, emphasising that high-quality information systems promote continuous, adaptive, and responsive organisational learning.

Based on the research findings, it is recommended that company management, particularly in manufacturing companies, improve the quality and utilisation of management accounting information systems comprehensively. Companies need to provide regular training to managers so they can optimise the use of the system in decision-making. Additionally, budget participation should be positioned as an open collaborative process, so managers feel they have the space to express their strategic considerations. In facing environmental uncertainty, organisations need to build an integrated data-based monitoring and evaluation system, so decision-making can be done in a more adaptive and proactive manner. In response to task complexity, companies should evaluate workloads and redesign overly complex workflows with the assistance of information systems to support greater efficiency and control. In the future, similar research could be expanded by incorporating additional contextual variables, such as organisational culture or leadership structure, to provide a more comprehensive understanding of managerial performance.

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