

Variance Analysis between Budget and Implementation Plans in Cost Planning and Control

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ABSTRACT

This study aims to analyze the differences between the Budget Plan (BP) and the Implementation Budget Plan (IBP) as tools for cost planning and control in the structural works of the Semarang City Integrated Business Service Center Project. A quantitative descriptive method with a case study approach was employed, utilizing primary data from structured interviews with project management personnel and secondary data from contract documents, BP, IBP, and cost realization reports. The analysis applied variance analysis, decomposing variances into price/rate and quantity/efficiency components for labor, materials, equipment, and occupational health and safety (OHS) implementation. Results reveal that all cost components experienced favorable variances, yielding total savings of IDR 736,962,950 or 13.86% of the total budget, including 11% Value Added Tax. The largest savings were derived from material purchase price efficiency and negotiated labor rates, while unfavorable variances were mainly due to excess material and equipment usage caused by specification changes, design adjustments, and on-site technical factors. These findings highlight that price control strategies, such as supplier selection, optimal work scheduling, market price monitoring, and strict resource-use supervision, can effectively reduce waste without disrupting project execution. The study is limited to a single project within the structural works scope, thus its results may not be generalizable to all construction projects. Future research is recommended to integrate cost, time, and quality analysis for more comprehensive control strategies.

Keywords: budget plan, cost control, construction, implementation budget, variance analysis.

INTRODUCTION

The rapid development of the construction sector in Indonesia necessitates project cost management that is not only accurate but also efficient. Within the framework of management accounting, each construction project particularly structural works, which absorb a significant portion of the budget, requires measurable cost planning through the preparation of a Budget Plan (BP) as a preliminary reference and an Implementation Budget Plan (IBP) as a guideline during the field execution stage. Differences between the BP and IBP manifest as variances, which can be either favorable or unfavorable. Such variances have a direct impact on the financial performance of the project, both in terms of profitability and resource-use efficiency. Therefore, variance analysis between the BP and IBP constitutes a crucial management accounting tool to support both planning and

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cost control functions. This analysis enables management to trace the factors causing deviations and implement corrective measures to achieve targets. The significance of this research lies in its contribution to strengthening internal control, optimizing budget allocation, and supporting the achievement of corporate financial objectives, especially in large-scale construction projects.

A study on budget comparison and cost realization in the abrasion containment embankment project in South Sulawesi found variances, both favorable and unfavorable, arising from material price fluctuations and suboptimal overhead control (Rismayanti, 2018). An examination of the use of the RAB as a planning and cost control instrument in the housing project of PT Griya Sentosa Property concluded that variance analysis can identify cost-efficient items and detect waste (Sanputra & Wijayanti, 2019). Another study demonstrated the effectiveness of variance analysis in monitoring cost deviations in building projects, although the research did not fully explore the linkage between findings and strategies for improving budget planning in subsequent projects (Putra & Sari, 2021). It was reported that the largest cost deviations in public facility construction projects often occur in civil works due to design changes, whereas mechanical and electrical works exhibit relatively minor variances (Yuliana & Pramudito, 2020). In contrast, it was asserted that integrating variance analysis with value engineering approaches can reduce cost waste by up to 8% in medium-scale infrastructure projects (Rahman et al., 2022).

The difference in this study compared to the previous study lies in the focus of analysis that leads directly to the comparison between BP and IBP, especially for structural work on the construction project of the Semarang City Integrated Business Service Center, so it does not only compare the initial budget with realization. In addition, this study places variance analysis results as integrated feedback in the management accounting system, so that they can be utilized to improve the planning process for similar projects in the future.

THEORETICAL BACKGROUND

Conceptual Framework: BP, IBP, and Variance Analysis

Within the field of management accounting for Indonesian construction projects, the Budget Plan (BP) and the Implementation Budget Plan (IBP) are essential instruments

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for planning and controlling project costs. The BP is prepared during the early project phases as a comprehensive cost estimate, covering anticipated expenditures for materials, labor, equipment, and contingency allowances. In contrast, the IBP is developed during the execution stage and reflects actual on-site conditions, such as prevailing material prices, actual labor wage rates, operational equipment durations, and realistic construction schedules. The difference between BP and IBP, referred to as variance, indicates the deviation between estimated and realized costs. Variance may be favorable (actual costs are lower than estimated) or unfavorable (actual costs exceed estimates), making it a vital performance measure in construction cost management.

The Strategic Role of Cost Accounting and Control

Cost accounting and cost control play a pivotal role, particularly in structural works where budget consumption is substantial. Variance analysis, comparing BP against IBP enables project managers to trace cost deviations, identify their root causes, and take prompt corrective measures to maintain cost performance. A study by (Hikmahwati & Aliffa, 2023) on a road rehabilitation project during the COVID-19 pandemic demonstrated that variance analysis is an effective control mechanism. While material and overhead costs showed favorable variances, labor costs experienced unfavorable variances due to changes in work hours and wage adjustments. This highlights how variance analysis supports proactive cost management even under external pressures.

Earned Value Management (EVM): Integrating Cost and Time Performance

Although this study focuses on the variance analysis between BP and IBP, recent literature suggests that integrating these findings with Earned Value Management (EVM) can provide deeper insights into project performance (Putra et al., 2025). Metrics such as Cost Variance (CV) and Schedule Variance (SV) allow for a simultaneous assessment of both cost efficiency and time progress (Cahyono et al., 2025). In this study, the identified BP–IBP variances can serve as fundamental data inputs for EVM parameters in future research to achieve more comprehensive project control. This integration would enable project managers to not only detect cost deviations but also predict schedule risks more accurately (Widyarso et al., 2025).

Hypotheses Formulation

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Based on the above literature, the following hypotheses are proposed. There is a statistically significant variance between BP and IBP in Indonesian construction projects, decomposable into Price Variance and Quantity/Efficiency Variance across materials, labor, and equipment; Higher unfavorable Price Variance correlates with weaker overhead cost control in project execution; Combining variance analysis with Value Engineering reduces cost inefficiencies more effectively than variance analysis alone.

METHOD, DATA AND ANALYSIS

This study employs a quantitative descriptive method with a case study approach on the structural work of the Semarang City Integrated Business Service Center Building Development Project. This method was selected to provide a systematic and measurable depiction of the cost differences between the Budget Plan (BP) and the Implementation Budget Plan (IBP) and to analyze the underlying causes of these variances. The case study approach is considered suitable for obtaining an in-depth understanding of a phenomenon within a real-world context. As emphasized by (Yin, 2018), case studies are the most appropriate research strategy when the researcher seeks to answer “how” or “why” questions and has limited control over events. The data utilized in this study consist of both primary and secondary sources. Primary data were obtained through structured interviews with project management authorities, planning staff, and financial personnel involved in budget preparation and control. According to (Creswell, 2019), structured interviews are highly effective in collecting specific and organized qualitative information, which can complement the interpretation of quantitative data. Secondary data were gathered from contract documents, the Budget Plan (BP), the Implementation Budget Plan (IBP), cost realization reports, and other project administration records.

Data Collection and Analysis Techniques

Data collection was conducted through document analysis to obtain numerical data on budget values and cost realization, complemented by interviews to identify factors influencing the cost differences. The variables analyzed include direct material price variance, material quantity variance, labor rate variance, labor efficiency variance, equipment rate variance, equipment efficiency variance, safety price variance, and safety quantity variance. Measurement and analysis were performed using a variance analysis method widely applied in project cost management. As stated by (Rismayanti, 2018),

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separating variance into price and quantity components is highly effective for identifying the root causes of deviations, thereby enabling management to determine corrective actions. (Sanputra & Wijayanti, 2019) further emphasized that variance analysis is a powerful tool for detecting inefficiencies in specific cost items, which can enhance overall project efficiency.

Variance Analysis Formula

Material variances identify deviations caused by price fluctuations or usage efficiency.

The variance calculation for direct material costs uses the following formulas:

$$\text{Material Price Variance (MPV)} = (\text{AP} - \text{SP}) \times \text{AQ}$$

$$\text{Material Quantity Variance (MQV)} = (\text{AQ} - \text{SQ}) \times \text{SP}$$

Where AP (Actual Price) is the actual price per unit, SP (Standard Price) is the standard price per unit, AQ (Actual Quantity) is the actual quantity used, and SQ (Standard Quantity) is the allowed standard quantity. According to (Horngren et al., 2019), this method represents the standard approach in managerial accounting for controlling material costs.

Labor variances monitor productivity and wage rate compliance. For direct labor costs, the calculations are as follows:

$$\text{Labor Rate Variance (LRV)} = (\text{AR} - \text{SR}) \times \text{AH}$$

$$\text{Labor Efficiency Variance (LEV)} = (\text{AH} - \text{SH}) \times \text{SR}$$

Where AR (Actual Rate) is the actual hourly or daily wage rate paid to workers, SR (Standard Rate) is the budgeted wage rate per hour or day as defined, AH (Actual Hours) is the total number of man-hours (or man-days) actually worked, and SH (Standard Hours) is the standard man-hours (or man-days) that should have been used for the actual volume of work produced. Putra & Sari (2021) demonstrated that this method is effective for monitoring labor productivity deviations and serves as a key indicator in project performance evaluation.

Equipment variances apply the same logic to rental or operational costs. For equipment rental costs, the formulas follow the same principle:

$$\text{Equipment Rate Variance (ERV)} = (\text{AR} - \text{SR}) \times \text{AH}$$

$$\text{Equipment Efficiency Variance (EEV)} = (\text{AH} - \text{SH}) \times \text{SR}$$

Where AR (Actual Rate) is the actual rental or operating rate per hour/day

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encountered during execution, SR (Standard Rate) is the planned rental or operating rate, AH (Actual Hours) is actual duration of equipment usage in the field, and SH (Standard Hours) is the standard duration planned for the specific task. As explained by (Heizer et al., 2017), this method is highly relevant for controlling indirect costs proportional to usage duration.

Meanwhile, for occupational health and safety (OHS) costs, the calculations are:

$$\text{OHS Price Variance (OPV)} = (\text{AP} - \text{SP}) \times \text{AQ}$$

$$\text{OHS Quantity Variance (OQV)} = (\text{AQ} - \text{SQ}) \times \text{SP}$$

This formulation can identify whether cost variances arise from increases in unit OHS costs or from usage volumes that deviate from standards. (Yuliana & Pramudito, 2020) found that design changes and project policies are often the main causes of cost variances, whereas (Rahman et al., 2022) demonstrated that integrating variance analysis with value engineering can reduce cost waste by up to 8%.

Data Analysis

The analysis was conducted by comparing the Budget Plan (BP) and the Implementation Budget Plan (IBP) for each cost component, then calculating the differences and classifying them as favorable or unfavorable. Furthermore, the variances were decomposed into price/rate and quantity/efficiency components to identify the dominant causative factors. The results are presented descriptively by linking the observed deviations to technical factors (e.g., changes in material specifications) or non-technical factors (e.g., delivery delays or market price fluctuations), so that applicable cost control recommendations can be formulated for similar projects in the future. This approach aligns with project management principles outlined by the (A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 2017) in the PMBOK Guide, which emphasizes that understanding variances is a crucial step in taking corrective actions and preventing future deviations.

RESULTS

Analysis of Labor Cost Variants

Based on the calculation of Labor Rate Variance (LRV) and Labor Efficiency Variance (LEV), the total labor cost in the Budget Plan (BP) was IDR 333,225,000, while the total in the Implementation Budget Plan (IBP) was IDR 291,090,000. The total

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difference indicates a favorable variance of IDR 42,135,000, meaning that actual labor costs were lower than the budgeted amount. However, when decomposed into rate and efficiency components, more detailed patterns emerge. The recapitulation of BP and IBP labor costs in the structural work of the Semarang City Integrated Business Service Center building is presented in Table 1.

Table 1: Recapitulation of BP and IBP Labor Costs

No	Worker Type	Unit	BP			IBP		
			Total Workdays	Unit Price (IDR)	Total Price (IDR)	Total Workdays	Unit Price (IDR)	Total Price (IDR)
1	Laborer	OH	980	135,000	132,300,000	996	110,000	109,560,000
2	Digger	OH	20	150,000	3,000,000	18	125,000	2,250,000
3	Mason	OH	140	155,000	21,700,000	150	135,000	20,250,000
4	Carpenter	OH	350	155,000	54,250,000	360	135,000	48,600,000
5	Ironworker	OH	300	155,000	46,500,000	318	135,000	42,930,000
6	Plumber	OH	10	155,000	1,550,000	6	135,000	810,000
7	Electrician	OH	10	155,000	1,550,000	6	135,000	810,000
8	Surveyor	OH	25	225,000	5,625,000	18	155,000	2,790,000
9	Assistant Surveyor	OH	25	130,000	3,250,000	36	135,000	4,860,000
10	Operator	OH	25	235,000	5,875,000	18	225,000	4,050,000
11	Assistant Operator	OH	25	135,000	3,375,000	18	130,000	2,340,000
12	Foreman	OH	350	155,000	54,250,000	384	135,000	51,840,000
Total BP					333,225,000	Total IBP		291,090,000

Source: Company Data

Labor Rate Variance (LRV)

From the total calculation of the Labor Rate Variance (LRV), the favorable value reached IDR 51,360,000, while the unfavorable value was only IDR 180,000. This indicates that most workers were paid below the standard rates (BP), resulting in cost savings. The largest savings were achieved by the general working group (workers) amounting to IDR 24,900,000 and foremen amounting to IDR 7,680,000. This is likely influenced by more effective wage negotiations or labor market conditions that allow hiring at rates below the standard. This finding aligns with the study of (Sanputra & Wijayanti, 2019), which states that labor rate efficiency can contribute significantly to overall project cost savings.

Labor Efficiency Variances (LEV)

The LEV components showed mixed results. A favorable value of IDR 5,705,000 indicates efficiency in working hours for certain job types, such as diggers (IDR 300,000) and operators (IDR 1,645,000). However, unfavorable variations amounted to IDR 14,750,000, indicating wasted working hours in several categories, such as assistant surveyors (IDR 1,430,000) and foremen (IDR 5,270,000). Contributing factors may

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include design adjustments requiring additional manpower, initial estimation errors, or reduced field productivity. This corresponds with the findings of (Putra & Sari, 2021), which explain that deviations in working hours are often caused by technical factors or suboptimal coordination.

Total Difference (Combination of LRV and LEV)

Overall, the total labor variance shows a favorable variance of IDR 43,745,000 and an unfavorable variance of IDR 1,610,000. This indicates that, despite the inefficiencies in working hours for some job types, the positive effect of labor rate savings dominates, resulting in a net benefit for the project. This observation aligns with (Rahman et al., 2022), who emphasized that cost-control strategies focused on rate efficiency can offset the negative effects of inefficient quantities.

The final analysis of labor cost variance in this project demonstrates that the success of cost control is primarily due to the labor rate efficiency strategy, which can provide significant savings despite weaknesses in labor hour efficiency. Managerially, this suggests that focusing on wage negotiations and selecting workers at competitive rates can be an effective instrument for maintaining project profitability. However, inefficiencies in some job categories still require attention, as they have the potential to reduce productivity and increase the risk of delays. Therefore, integrating rate control with optimized field scheduling and supervision represents a strategic measure to ensure comprehensive efficiency, as suggested by (Sanputra & Wijayanti, 2019) and (Putra & Sari, 2021) in their studies on labor cost management in construction projects. The analysis of labor cost variances in the structural work of the Semarang City Integrated Business Service Center building is presented in Table 2.

Table 2: Labor Cost Variance

No	Worker Type	LRV (IDR)		LEV (IDR)		Total (IDR)	
		Favorable	Unfavorable	Favorable	Unfavorable	Favorable	Unfavorable
1	Laborer	24,900,000			2,160,000	22,740,000	
2	Digger	450,000		300,000		750,000	
3	Mason	3,000,000			1,550,000	1,450,000	
4	CaIDRenter	7,200,000			1,550,000	5,650,000	
5	Ironworker	6,360,000			2,790,000	3,570,000	
6	Plumber	120,000		620,000		740,000	
7	Electrician	120,000		620,000		740,000	
8	Surveyor	1,260,000		1,575,000		2,835,000	
9	Assistant Surveyor		180,000		1,430,000		1,610,000
10	Operator	180,000		1,645,000		1,825,000	

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No	Worker Type	LRV (IDR)		LEV (IDR)		Total (IDR)	
		Favorable	Unfavorable	Favorable	Unfavorable	Favorable	Unfavorable
11	Assistant Operator	90,000		945,000		1,035,000	
12	Foreman	7,680,000			5,270,000	2,410,000	
	Total	51,360,000	180,000	5,705,000	14,750,000	43,745,000	1,610,000

Source: Data processed, 2025

Analysis of Material Cost Variants

The results of calculating Material Price Variance (MPV) and Material Quantity Variance (MQV) show that the total budget in the Budget Plan (BP) was IDR 3,328,326,500, while the actual cost in the Implementation Budget Plan (IBP) reached IDR 2,868,709,039. This difference resulted in a savings of IDR 780,803,891, accompanied by an unfavorable variance of IDR 321,186,430. Overall, this indicates that actual material expenditures were lower than planned. However, when separated into price and quantity influences, a more detailed picture emerges. The details of the comparison between BP and IBP for structural work materials in the Semarang City Integrated Business Service Center construction project are presented in Table 3.

Table 3: Recapitulation of BP and IBP Materials

No	Material Description	Unit	BP			IBP		
			Qty	Unit Price (IDR)	Total Price (IDR)	Qty	Unit Price (IDR)	Total Price (IDR)
1	Corrugated Sheet BJS 0.2 x 90 x 180 cm	sheet	210	75,000	15,750,000	222	60,000	13,320,000
2	Plywood 18 mm x 122 x 244 cm	sheet	600	255,000	153,000,000	596	235,000	140,060,000
3	Class III Wood 5/7 – 4 m Meranti	piece	-	0	0	1,879	50,000	93,950,000
4	Class III Wood Plank 2/20 – 4 m Meranti	sheet	420	95,500	40,110,000	423	85,000	35,955,000
5	Class III Wood 6/12 – 4 m Meranti	piece	3,500	165,000	577,500,000	3,103	135,000	418,905,000
6	Common Nail 3.5"	kg	200	22,500	4,500,000	207	13,500	2,794,500
7	Clout Nail	kg	5	11,000	55,000	8	14,500	116,000
8	Portland Cement (PC) Gersik 40 kg	sack	185	75,000	13,875,000	190	55,000	10,450,000
9	Sand for masonry	m ³	165	245,000	40,425,000	175	215,000	37,625,000
10	Fill Sand	m ³	75	245,000	18,375,000	70	250,000	17,500,000
11	Concrete Sand	m ³	5	320,000	1,600,000	5	300,000	1,500,000
12	Gravel	m ³	5	290,000	1,450,000	8	275,000	2,200,000
13	Hebel 600x200x100 mm	unit	4,000	8,000	32,000,000	4,110	6,500	26,715,000
14	Concrete f'c 8.3 MPa (ready mix)	m ³	80	895,000	71,600,000	79	755,000	59,645,000
15	Concrete f'c 25 MPa (ready mix)	m ³	350	935,000	327,250,000	369	900,000	332,100,000
16	Wood Putty	kg	1	33,000	33,000	1	25,500	25,500
17	Iron Paint	ltr	50	28,000	1,400,000	50	18,500	925,000
18	Formwork Oil (Sika Separol)	ltr	580	16,800	9,744,000	582	14,500	8,439,000
19	Mini Pile 25 x 25 cm – 6 m	unit	80	1,450,000	116,000,000	104	1,350,000	140,400,000

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No	Material Description	Unit	BP			IBP		
			Qty	Unit Price (IDR)	Total Price (IDR)	Qty	Unit Price (IDR)	Total Price (IDR)
20	Plain Reinforcing Bar 10 mm x 12 m (BJTP 280)	kg	-	0	0	19,182	10,068	193,124,376
21	Plain Reinforcing Bar 12 mm x 12 m (BJTS 420B)	kg	70,000	14,500	1,015,000,000	59,747	10,849	648,195,203
22	Deformed Reinforcing Bar 16 mm x 12 m (BJTS 420B)	kg	-	0	0	114	10,661	1,215,354
23	Deformed Reinforcing Bar 19 mm x 12 m (BJTS 420B)	piece	50,200	15,000	753,000,000	50,227	11,292	567,163,284
24	Wire / Bendrat	kg	1,200	20,000	24,000,000	1,233	14,500	17,878,500
25	L Profile 50x50x5	piece	210	345,000	72,450,000	216	275,000	59,400,000
26	Steel Plate 122 x 244 cm, t=10 mm	sheet	2	2,850,000	5,700,000	3	2,737,000	8,211,000
27	Base Plate 10 mm	sheet	1	245,000	245,000	1	244,122	244,122
28	Anchor 12 mm diameter	unit	50	25,000	1,250,000	56	25,500	1,428,000
29	Bolt Ø 9	unit	1,500	3,000	4,500,000	1,680	2,100	3,528,000
30	CNP Profile 100 x 50 x 20 x 3,2	piece	10	400,000	4,000,000	14	225,500	3,157,000
31	Sagrod Ø 10 mm	unit	70	280,000	19,600,000	70	275,000	19,250,000
32	Wind Tie Ø 10 mm	unit	20	30,000	600,000	20	27,500	550,000
33	LED Lamp (15 W)	unit	10	45,000	450,000	8	42,000	336,000
34	Floodlight (50 W)	unit	5	150,000	750,000	4	150,000	600,000
35	Ordinary Plug	unit	5	15,000	75,000	6	15,500	93,000
36	Socket Outlet (Arde out black)	unit	10	7,000	70,000	8	6,000	48,000
37	Single Switch	unit	10	12,000	120,000	8	15,000	120,000
38	Cable 2 x 1.5 mm ²	m	100	8,500	850,000	100	5,200	520,000
39	Fuse Box (1 group)	unit	1	15,000	15,000	1	14,000	14,000
40	PVC Pipe 3/4"	piece	5	38,000	190,000	4	36,000	144,000
41	PVC Pipe 1/2"	piece	5	30,000	150,000	7	27,000	189,000
42	Tap	unit	5	20,000	100,000	6	18,700	112,200
43	Knee 3/4"	unit	5	1,500	7,500	4	3,500	14,000
44	Socket	unit	5	2,000	10,000	6	5,000	30,000
45	Sanyo Water Pump	unit	1	300,000	300,000	1	310,000	310,000
46	Water Tank	unit	1	45,000	45,000	1	40,000	40,000
47	Butterfly Door Hinge Standard	unit	2	4,000	8,000	4	3,500	14,000
48	Butterfly Door Hinge Premium	unit	2	25,000	50,000	-	0	0
49	Padlock	unit	1	20,000	20,000	1	17,000	17,000
50	Overval Latch	unit	1	4,000	4,000	1	3,000	3,000
51	MMT 1 m x 1,2 m	unit	1	35,000	35,000	1	35,000	35,000
52	Woll Thread	roll	5	13,000	65,000	8	12,500	100,000
Total BP					3,328,326,500	Total IBP	2,868,709,039	

Source: company data

Material Price Variance (MPV)

The total MPV showed a favorable value of IDR 597,664,791 and an unfavorable value of IDR 288,758,730. This indicates that the majority of materials were obtained at prices lower than the standard rates in BP. The largest savings were achieved from 12mm x 12M Plain Concrete (BJTS 420B) with a positive variance of IDR 218,136,297 and 19mm x 12M (BJTS 420B) with a difference of IDR 186,241,716. These results are likely due to effective procurement strategies, successful supplier negotiations, or favorable

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market conditions. This finding aligns with Siregar (2020), which states that effective procurement management can significantly reduce project costs.

Material Quantity Variance (MQV)

MQV provides a more varied picture, with a favorable value of IDR 217,681,000 and an unfavorable value of IDR 66,969,600. The positive variance indicates efficient material use for several items, such as sand (IDR 2,450,000 savings) and Class III Wood of Papan 2/20 - 4 m Merti (IDR 286,500 savings). Conversely, the largest material waste occurred in 12mm x 12M Plain Concrete Iron (BJTS 420B) worth IDR 148,668,500 and 25 x 25 cm - 6m Mini Pile amounting to IDR 34,800,000. Contributing factors include changes in job specifications, inaccurate material estimations, or material damage on site. Pratama & Hidayat (2021) also emphasized that weaknesses in quantity control are often caused by limited inventory management and insufficient field supervision.

Total Difference (Combination of MPV and MQV)

When MPV and MQV are combined, the total variance shows a favorable difference of IDR 780,803,891 and an unfavorable difference of IDR 321,186,430. This indicates that despite some material wastage, savings from lower purchase prices had a significant positive impact on the project. These results support Vijaya et al. (2022), who stated that controlling procurement costs can offset the negative effects of inefficient material use.

Overall, the cost savings in the structural work of the project resulted more from successful acquisition of competitive purchase prices than solely from usage efficiency. Therefore, strategies such as price negotiations, selection of appropriate suppliers, and timely procurement are key to project success. Nevertheless, inefficiencies in material use should not be overlooked, as they can lead to cost increases in later stages. Integrating price control with improved inventory management is believed to produce comprehensive efficiency, as suggested by Siregar (2020) and Pratama & Hidayat (2021). The analysis of raw material variances for the project is presented in Table 4.

Table 4: Material Price Varians

No	Material	MPV (IDR)		MQV (IDR)		Total (IDR)	
		Favorable	Unfavorable	Favorable	Unfavorable	Favorable	Unfavorable
1	Corrugated Sheet BJLS 0.2 x 90 x 180 cm	3.330.000			900.000	2.430.000	

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No	Material	MPV (IDR)		MQV (IDR)		Total (IDR)	
		Favorable	Unfavorable	Favorable	Unfavorable	Favorable	Unfavorable
2	Plywood 18 mm x 122 x 244 cm	11.920.000		1.020.000		12.940.000	
3	Class III Wood 5/7 – 4 m Meranti		93.950.000				93.950.000
4	Class III Wood Plank 2/20 – 4 m Meranti	4.441.500			286.500	4.155.000	
5	Class III Wood 6/12 – 4 m Meranti	93.090.000		65.505.000		158.595.000	
6	Common Nail 3.5"	1.863.000			157.500	1.705.500	
7	Clout Nail Portland		28.000		33.000		61.000
8	Cement (PC) Gersik 40 kg	3.800.000			375.000	3.425.000	
9	Sand for masonry	5.250.000			2.450.000	2.800.000	
10	Fill Sand		350.000	1.225.000		875.000	
11	Concrete Sand	100.000				100.000	
12	Gravel Hebel	120.000			870.000		750.000
13	600x200x100 mm	6.165.000			880.000	5.285.000	
14	Concrete f'c 8.3 MPa (ready mix)	11.060.000		895.000		11.955.000	
15	Concrete f'c 25 MPa (ready mix)	12.915.000			17.765.000		4.850.000
16	Wood Putty	7.500				7.500	
17	Iron Paint	475.000				475.000	
18	Formwork Oil (Sika Separol)	1.338.600			33.600	1.305.000	
19	Mini Pile 25 x 25 cm – 6 m Plain	10.400.000			34.800.000		24.400.000
20	Reinforcing Bar 10 mm x 12 m (BJTP 280) Plain		193.124.376				193.124.376
21	Reinforcing Bar 12 mm x 12 m (BJTS 420B) Deformed	218.136.297		148.668.500		366.804.797	
22	Reinforcing Bar 16 mm x 12 m (BJTS 420B) Deformed		1.215.354				1.215.354
23	Reinforcing Bar 19 mm x 12 m (BJTS 420B)	186.241.716			405.000	185.836.716	
24	Wire / Bendrat L Profile	6.781.500			660.000	6.121.500	
25	50x50x5 Steel Plate	15.120.000			2.070.000	13.050.000	
26	122 x 244 cm, t=10 mm	339.000			2.850.000		2.511.000
27	Base Plate 10 mm	878				878	
28	Anchor 12 mm diameter		28.000		150.000		178.000
29	Bolt Ø 9 CNP Profile	1.512.000			540.000	972.000	
30	100 x 50 x 20 x 3.2	2.443.000			1.600.000	843.000	

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No	Material	MPV (IDR)		MQV (IDR)		Total (IDR)	
		Favorable	Unfavorable	Favorable	Unfavorable	Favorable	Unfavorable
31	Sagrod Ø 10 mm	350.000				350.000	
32	Wind Tie Ø 10 mm	50.000				50.000	
33	LED Lamp (15 W)	24.000		90.000		114.000	
34	Floodlight (50 W)			150.000		150.000	
35	Ordinary Plug Socket Outlet		3.000		15.000		18.000
36	(Arde out black)	8.000		14.000		22.000	
37	Single Switch		24.000	24.000			
38	Cable 2 x 1.5 mm ²	330.000				330.000	
39	Fuse Box (1 group)	1.000				1.000	
40	PVC Pipe 3/4"	8.000		38.000		46.000	
41	PVC Pipe 1/2"	21.000			60.000		39.000
42	Tap	7.800			20.000		12.200
43	Knee 3/4"		8.000	1.500			6.500
44	Socket		18.000		2.000		20.000
45	Sanyo Water Pump		10.000				10.000
46	Water Tank	5.000				5.000	
47	Butterfly Door Hinge Standard	2.000			8.000		6.000
48	Butterfly Door Hinge Premium			50.000		50.000	
49	Padlock	3.000				3.000	
50	Overval Latch	1.000				1.000	
51	MMT 1 m x 1,2 m						
52	Woll Thread	4.000			39.000		35.000
Total		597.664.791	288.758.730	217.681.000	66.969.600	780.803.891	321.186.430

Source: Data processed, 2025

Analysis of Variants in Rent/Purchase Costs

The comparison between the Budget Plan (BP) and the Implementation Budget Plan (IBP) for equipment rental/purchase costs shows that the total BP was IDR 1,108,020,000, while the actual cost in the IBP reached IDR 948,271,875. This difference resulted in a net saving of IDR 170,145,625, offset by an unfavorable variance of IDR 48,884,500. Overall, these conditions indicate that actual equipment costs were below the initial estimate, although some types of equipment experienced inefficiencies. The recapitulation of BP and IBP for rental/purchase of equipment in the structural work of the Semarang City Integrated Business Service Center building is presented in Table 5.

Table 5: Recapitulation of BP an IBP Equipment

No	Equipment Description	Unit	BP			IBP		
			Qty	Unit Price (IDR)	Total Price (IDR)	Qty	Unit Price (IDR)	Total Price (IDR)
1	Theodolite	unit	25	250,000	6,250,000	21	100,000	2,100,000
2	Concrete Mixer 0.5 m ³	unit	35	600,000	21,000,000	35	450,000	15,750,000
3	Dump Truck 9 ton	unit	-	0	0	1	2,500,000	2,500,000

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No	Equipment Description	Unit	BP			IBP		
			Qty	Unit Price (IDR)	Total Price (IDR)	Qty	Unit Price (IDR)	Total Price (IDR)
4	Dump Truck 7.5 ton	unit	3	3,500,000	10,500,000	-	0	0
5	Mini Excavator 301.7 CR	unit	2	9,480,000	18,960,000	1	5,050,000	5,050,000
6	Stamper	unit	30	125,000	3,750,000	28	175,000	4,900,000
7	Mobile Crane 25 ton	unit	90	6,450,000	580,500,000	91	6,150,000	559,650,000
8	Hydraulic Static Pile Driver	unit	2	16,500,000	33,000,000	1	15,500,000	15,500,000
9	Pile Cutter	unit	2	375,000	750,000	1	325,000	325,000
10	Bar Bender	unit	115	150,000	17,250,000	112	135,000	15,120,000
11	Bar Cutter	unit	115	150,000	17,250,000	112	135,000	15,120,000
12	Concrete Pump 30–50 m ³	unit	50	4,250,000	212,500,000	49	3,250,000	159,250,000
13	Concrete Vibrator	unit	50	420,000	21,000,000	63	375,000	23,625,000
14	Scaffolding (Main Frame)	unit	35,000	600	21,000,000	33,495	500	16,747,500
15	Scaffolding (Ladder Frame)	unit	30,000	500	15,000,000	30,765	475	14,613,375
16	Cross Base	unit	62,000	300	18,600,000	61,530	250	15,382,500
17	Jack Base 40 cm	unit	62,000	300	18,600,000	61,530	250	15,382,500
18	Joint Pin	unit	62,000	250	15,500,000	61,530	200	12,306,000
19	U-head	unit	68,000	200	13,600,000	66,990	250	16,747,500
20	Rapidclam / Tie Rod	unit	17,000	2,000	34,000,000	16,800	850	14,280,000
21	Compressor	unit	50	250,000	12,500,000	49	275,000	13,475,000
22	Arc Welding Machine	unit	2	780,000	1,560,000	1	605,000	605,000
23	Steel Profile Cutter	unit	35	350,000	12,250,000	28	285,000	7,980,000
24	Drill Machine	unit	30	85,000	2,550,000	28	65,000	1,820,000
25	Concrete Bucket	unit	10	15,000	150,000	5	8,500	42,500
Total BP					1,108,020,000	Total IBP	948,271,875	

Source: company data

Equipment Rate Variance (ERV)

The calculation shows that ERV contributed a favorable variance of IDR 131,630,625, while the unfavorable variance was IDR 8,474,500. The largest savings were achieved from the Concrete Pump 30–50 m³ (IDR 49,000) and Rapidclam/Tie Rod (IDR 19,320,000), likely due to effective rental price negotiations or a decrease in market prices during the lease period. Conversely, the largest unfavorable variance occurred in the U-head (IDR 3,349,500), indicating a price increase compared to the budget.

Equipment Efficiency Variance (EEV)

From the usage perspective, EEV recorded a favorable variance of IDR 48,884,500 and an unfavorable variance of IDR 12,292,500. Efficient use of equipment is evident in the unused 7.5-ton Dump Truck (saving of IDR 10,500,000) and the Mini Excavator 301.7 CR (IDR 9,480,000). On the other hand, excessive use was observed for the Concrete Vibrator (IDR 5,460,000 unfavorable) and the 25-ton Mobile Crane (IDR 6,450,000 unfavorable).

Total Difference (Combination of ERV and EEV)

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When ERV and EEV are combined, the total variance in equipment rental/purchase costs shows a favorable difference of IDR 170,145,625 and an unfavorable difference of IDR 48,884,500. This indicates that savings from reduced rental prices played a dominant role in overall cost efficiency, although controlling equipment usage still requires attention.

The cost savings in renting/purchasing equipment were primarily due to successful price negotiations and proper selection of lease periods. However, some equipment categories experienced usage exceeding the plan, potentially caused by technical field conditions, adjustments in work methods, or lack of coordination in equipment scheduling. Therefore, integrating rental price control with optimized equipment usage schedules is essential to enhance overall cost efficiency. The analysis of equipment cost variances in the structural work of the Semarang City Integrated Business Service Center building is presented in Table 6.

Table 6: Equipment Cost Variance

No	Equipment Description	ERV (IDR)		EEV (IDR)		Total (IDR)	
		Favorable	Unfavorable	Favorable	Unfavorable	Favorable	Unfavorable
1	Theodolite	3.150.000		1.000.000		4.150.000	
2	Concrete Mixer 0.5 m ³	5.250.000				5.250.000	
3	Dump Truck 9 ton		2.500.000				2.500.000
4	Dump Truck 7.5 ton	10.500.000		10.500.000			
5	Mini Excavator 301.7 CR	4.430.000		9.480.000		13.910.000	
6	Stamper		1.400.000	250.000			1.150.000
7	Mobile Crane 25 ton	27.300.000			6.450.000	20.850.000	
8	Hydraulic Static Pile Driver	1.000.000		16.500.000		17.500.000	
9	Pile Cutter	50.000		375.000		425.000	
10	Bar Bender	1.680.000		450.000		2.130.000	
11	Bar Cutter	1.680.000		450.000		2.130.000	
12	Concrete Pump 30–50 m ³	49.000.000		4.250.000		53.250.000	
13	Concrete Vibrator	2.835.000			5.460.000		2.625.000
14	Scaffolding (Main Frame)	3.349.500		903.000		4.252.500	
15	Scaffolding (Ladder Frame)	769.125			382.500	386.625	
16	Cross Base	3.076.500		141.000		3.217.500	
17	Jack Base 40 cm	3.076.500		141.000		3.217.500	
18	Joint Pin	3.076.500		117.500		3.194.000	
19	U-head		3.349.500	202.000			3.147.500
20	Rapidclam / Tie Rod	19.320.000		400.000		19.720.000	
21	Compressor		1.225.000	250.000			975.000
22	Arc Welding Machine	175.000		780.000		955.000	
23	Steel Profile Cutter	1.820.000		2.450.000		4.270.000	
24	Drill Machine	560.000		170.000		730.000	
25	Concrete Bucket	32.500		75.000		107.500	
	Total	131.630.625	8.474.500	48.884.500	12.292.500	170.145.625	10.397.500

Source: Data processed, 2025

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Analysis of Price Variants for Safety Implementation

The total budget for implementing safety in the Budget Plan (BP) was recorded at IDR 21,195,000, while the realization of the Implementation Budget Plan (IBP) reached IDR 18,765,000. This difference shows that there is a cost efficiency of IDR 8,085,000 and an unfavourable variation of IDR 1,255,000. In general, safety cost control on this project is quite effective, with significant efficiency, especially from the price aspect. The recapitulation of the BP and IBP implementation of safety to the structural work of the Semarang City Integrated Business Service Center building can be seen in Table 7.

Table 7: Recapitulation of BP and IBP Safety Implementation

No	Safety Implementation	Unit	BP			IBP		
			Qty	Unit Price (IDR)	Total Price (IDR)	Qty	Unit Price (IDR)	Total Price (IDR)
1	Preparation of Safety Work Plan	Ls	1	820.000	820.000	1	450.000	450.000
2	Safety Socialization and Promotion	Ls	3	300.000	900.000	1	400.000	400.000
3	Work Safety Equipment	Ls	1	1.000.000	1.000.000	1	700.000	700.000
4	Personal Protective Equipment (PPE)	Ls	1	3.145.000	3.145.000	1	2.800.000	2.800.000
5	Insurance and Permits	Ls	1	2.400.000	2.400.000	1	3.250.000	3.250.000
6	Safety Personnel	Ls	2	5.000.000	10.000.000	3	2.650.000	7.950.000
7	Health Facilities	Ls	1	160.000	160.000	1	140.000	140.000
8	Safety Signs	Ls	1	700.000	700.000	1	825.000	825.000
9	Others Related to Safety Risk Control	Ls	1	2.070.000	2.070.000	1	2.250.000	2.250.000
Total BP					21,195,000	Total IBP	18,765,000	

Source: company data

Safety Price Variance (SSV)

SSV contributed to the favourable amount of IDR 8,085,000, with an unfavourable amount of IDR 1,255,000. The biggest savings were made in the Safety Personnel item (IDR 7,050,000), which was likely due to power cost efficiency or changes in the structure of the safety team. Other savings arise in the preparation of Preparation of Safety Work Plan (IDR 370,000) and Personal Protective Equipment (IDR 345,000). Meanwhile, the biggest price waste is in Insurance and Permission (IDR 850,000 unfavorably), which may be triggered by an increase in premiums or additional administrative costs.

Safety Quantity Variance (SQV)

The difference in quantity recorded a favorite value of IDR 600,000 and an unfavorable value of IDR 5,000,000. Efficiency is especially evident in the Socialization and Promotion of Safety (IDR 600,000), which may be carried out on a smaller scale than the original plan. On the other hand, the biggest waste is caused by Safety Personnel (IDR

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5,000,000 unfavourable), which indicates that the increase in personnel in the field exceeds the original plan.

Total Difference (Combination of SSV and SQV)

The combination of price and quantity differences resulted in a total favorite variation of IDR 8,685,000 and an unfavourable variation of IDR 6,255,000. A positive difference indicates that price savings can cover waste due to excess quantity in some posts. The implementation of safety in this project is financially quite efficient, with significant price savings, especially on safety labor costs. However, waste due to the increase in personnel and the increase in insurance and licensing costs is a point of concern, it is necessary to have stricter control on safety personnel planning and scheduling of safety activities to stay on budget, without reducing the effectiveness of implementing safety standards in the field. The analysis of the price variant of safety application in the structural work of the Semarang City Integrated Business Service Center building can be seen in Table 8.

Table 8. Safety Price Variance

No	Safety Implementation	SSV (IDR)		SQV (IDR)		Total (IDR)	
		Favorable	Un-favorable	Favorable	Un-favorable	Favorable	Un-favorable
1	Preparation of Safety Work Plan	370.000				370.000	
2	Safety Socialization and Promotion		100.000	600.000		500.000	
3	Work Safety Equipment	300.000				300.000	
4	Personal Protective Equipment (PPE)	345.000				345.000	
5	Insurance and Permits		850.000				850.000
6	Safety Personnel	7.050.000			5.000.000	2.050.000	
7	Health Facilities	20.000				20.000	
8	Safety Signs		125.000				125.000
9	Others Related to Safety Risk Control		180.000				180.000
Total		51,360,000	8,085.000	1.255.000	600.000	5.000.000	3.585.000

Source: Data processed, 2025

Final Recapitulation

Based on the overall calculation between the Budget Plan (BP) and the Implementation Budget Plan (IBP) for the structural work of the Semarang City Integrated Business Service Center Building, all cost components experienced favorable variances. For labor, the total BP was IDR 333,225,000 compared to IDR 291,090,000 in the IBP, resulting in a savings of IDR 42,135,000, or 12.64%. For materials, the BP amounted to IDR 3,328,326,500, while the IBP reached IDR 2,868,709,039, resulting in

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a favorable difference of IDR 459,617,461, or 13.81%. For equipment, the BP recorded IDR 1,108,020,000 and the IBP IDR 948,271,875, with a savings of IDR 159,748,125, or 14.42%. For safety implementation, the BP amounted to IDR 21,195,000 and the IBP to IDR 18,765,000, with a difference of IDR 2,430,000, or 11.46%.

The total sum of these four cost components (A) reached IDR 4,790,766,500 in the BP and IDR 4,126,835,914 in the IBP, resulting in a total savings of IDR 663,930,586, or 13.86%. Including the 11% Value Added Tax (VAT) (B), the total costs were IDR 5,317,750,815 for the BP and IDR 4,580,787,865 for the IBP. This reflects total savings of IDR 736,962,950, or 13.86% of the total budget. These results confirm that effective procurement strategies, price negotiations, and efficient use of resources significantly reduced actual costs below initial estimates without compromising the smooth execution of structural work. The recapitulation in Table 9.

Table 9: Recapitulations

No	Description	Total Budget Plan (BP) (IDR)	Total Implementation Plan (IBP) (IDR)	Deviation (IDR)	Percentage
1	Labor	333,225,000	291,090,000	42,135,000	12.64%
2	Material	3,328,326,500	2,868,709,039	459,617,461	13.81%
3	Equipment	1,108,020,000	948,271,875	159,748,125	14.42%
4	Safety Implementation	21,195,000	18,765,000	2,430,000	11.46%
	Total (A)	4,790,766,500	4,126,835,914	663,930,586	13.86%
	VAT 11% (B)	526,984,315	453,951,951	73,032,364	13.86%
	Total (A+B)	5,317,750,815	4,580,787,865	736,962,950	13.86%

Source: Data processed, 2025

CONCLUSIONS

Based on the final recapitulation and variance analysis between the Budget Plan (BP) and the Implementation Budget Plan (IBP) for the structural works of the Semarang City Integrated Business Service Center Building Project, it can be concluded that all cost components exhibited favorable variances. The total savings amounted to IDR 736,962,950, equivalent to 13.86% of the total budget after including the 11% Value Added Tax (VAT). The largest savings were achieved through material purchase price efficiencies and negotiated labor rates, while the main sources of cost overruns were excess material and equipment usage caused by specification changes, design adjustments, and technical factors on site. From a managerial perspective, these findings highlight the importance of integrating price control and resource utilization management through strategies such as optimal work scheduling, selection of appropriate suppliers,

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monitoring market prices, and regular supplier evaluation. While this study effectively demonstrates cost control through variance analysis, it is limited to a single project within the scope of structural work, meaning the findings may not be generalized to all types of construction projects. Furthermore, the current analysis focuses primarily on cost deviations between BP and IBP. This presents a valuable opportunity for future research to expand the framework by integrating Earned Value Management (EVM). By doing so, subsequent studies can comprehensively analyze the synergistic relationships among cost, time, and quality, providing an even more robust predictive tool for project performance.

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