

Evaluation of Project Budget Due to Price Fluctuations Based on Digital Technology in Factory Construction Projects

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ABSTRACT

The development of industrial construction requires adequate resources to avoid the failure and risk of the project. The resources required are materials (building materials), human resources (human resources), machines (equipment), capital (money), methods (methods of implementation), timing, and information on the implementation of the construction. According to data from the Central Statistical Agency (BPS), wages of labor in Indonesia of Rs. 2.89 million increased by 1.12% by 2022. In addition, the price of construction materials has also increased, such as steel, steel bones, concrete, and other construction materials. Especially steel price increases, starting in the second year of the pandemic, have risen about 30%–40%. Generally, the construction of factory buildings uses more steel profiles for the construction of warehouses—storage of raw materials or warehousing of production sites. This has a huge impact on the project budget that has been estimated prior to material price fluctuations. Therefore, the re-evaluation of the project budget in PT. XYZ, which has been estimated by the company at Rp. 219.5 billion, has a total budget change to Rp. 276.1 billion.

Keywords: Construction Projects, Project Budgets, Factory Buildings.

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INTRODUCTION

The government continues to increase its efforts to improve the competitiveness of industry globally. Therefore, investors doing business in Indonesia are given guidelines to facilitate them. Industrial activities have a major influence on the pace of the national economy, including the increase in the added value of domestic raw materials, the use of local labor, and the acquisition of export currency. The development of industrial construction projects is not independent of the need for resources such as material needs (building materials), human resources (human resources), machines (equipment), capital (money), methods (methods of implementation), time, and information.

Currently, PT. XYZ will increase food production at the processing plant in Padang, West Sumatra. The association estimates an investment of around Rs. 465 billion for the construction of a plant with a factory area of about 7 hectares and a construction period of about 2.5 years.

However, given the current conditions, the construction of industrial buildings is not cheap. The price of building materials has been on the rise since 2021. The BPS data showed that the Construction Major Trade Price Index (IHPB) rose from 2.2% year on year (YoY) in January 2021 to 6.4% YoY in August 2022.

In addition to the increase in the price of construction materials, the Biro Pusat Statistik (BPS) Indonesia, estimates that the wages of labor in Indonesia amounted to Rp. 2.89 million in February 2022. The amount increased by 1.12% compared to the previous year's Rp. 2,86 million.

Table 1. Wholesale Trade Price Index of Construction Materials 2022

Jenis Bangunan IHPB	Indeks Harga Perdagangan Besar Bahan Bangunan Konstruksi Tahun 2022												
	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agu	Sep	Okt	Nov	Des	Tahunan
Bangunan Tempat Tinggal dan Bukan Tempat Tinggal	110.95	111.29	111.79	112.44	113.07	113.52	113.91	114.24	114.81	115.29	115.10	115.19	113.47
Bangunan Pekerjaan Umum untuk Pertanian	107.25	107.30	107.74	108.33	108.81	108.98	109.42	110.18	112.09	113.35	113.39	114.06	110.07
Pekerjaan Umum untuk Jalan, Jembatan dan Pelabuhan	109.88	110.19	110.94	111.80	112.51	113.59	114.80	116.32	118.59	119.45	119.66	120.36	114.84
Bangunan dan Instalasi Listrik, Gas, Air Minum dan Komunikasi	113.48	114.04	114.61	115.40	115.89	116.64	117.24	117.89	118.72	119.07	119.05	119.16	116.77
Bangunan Lainnya	109.16	109.61	110.18	110.90	111.46	111.76	112.23	112.69	113.70	114.25	114.25	114.66	112.07
Konstruksi Indonesia	110.03	110.35	110.95	111.68	112.31	112.95	113.68	114.54	115.99	116.71	116.74	117.17	113.59

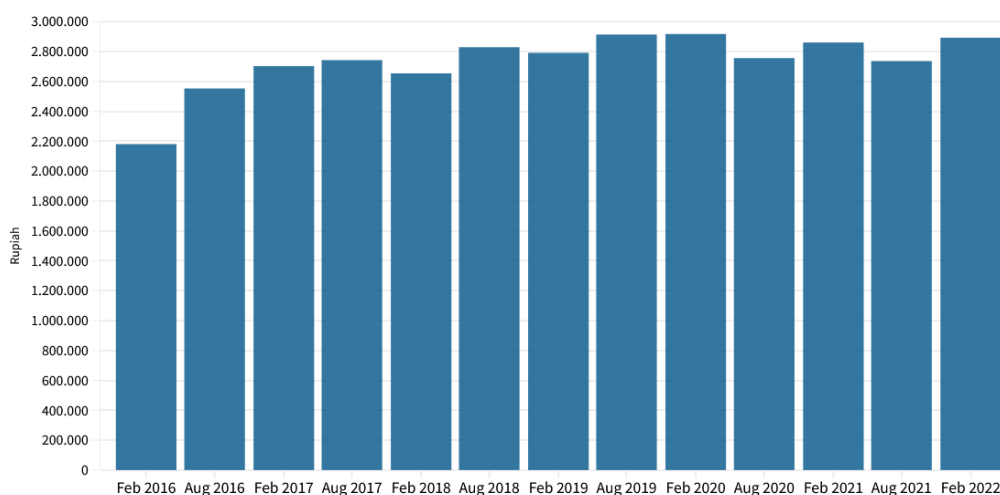


Figure 1. Average Indonesian Labor Wage

In addition to the rising cost of construction materials and labor, the cost of equipment that must be provided will also increase. This can be affected by the limited availability of tools in the area, so it has to ship or rent from outside, resulting in the cost of the mobilization of tools.

The change in the price of materials, especially steel, has a great influence, especially on the construction of factory buildings, because steel is much needed or used for the building of warehouses for storing raw materials or storage for the production site. This has a huge impact on the project budget that has been estimated.

Therefore, it is necessary to re-evaluate the project budget that the company has estimated in order to avoid the failure or risk of the project. The case study for this study was taken on the construction project of the PT. XYZ plant in Padang. In the analysis of this research data, the author performed an evaluation with the creation of digital technology and Java programming

for budgeting, which achieved accurate results and stored data well when needed later in the day.

MATERIALS AND METHODS

The research method used is descriptive-quantitative. The purpose of this research is to evaluate the project budget due to price fluctuations. The results of the data analysis are then presented in the form of descriptions or numerical tabulations to describe the actual state of the project. The data used for this research are project budget data created before the fluctuation of the price, tender documents or work of contract, and the project execution schedule.

This research is planned through several stages, namely:

- a. Problem formulation based on background studies and why this research is conducted.
- b. A review of the library contains definitions related to the topic of this research.
- c. The data collected are budget documents or project cost estimates, bidding documents, and work of contact (SPK) as support for data validation.
- d. Application design model for project budget evaluation with digital Java programming technology
- e. Running Application. A project budget analysis is carried out by reviewing and recapitulating the items of work covered in the budget before price fluctuations, then performing an advanced analysis by inserting the magnitude of price fluctuations that occurred.
- f. Discussions: This section reviews the budget evaluation results of a factory building construction project with digital Java programming technology.
- g. Conclusions and suggestions, containing the conclusions of the research and the suggestions for further research.

The case study discussed this time is a type of factory building with the following criteria:

- a. Project name: Factory Construction Project PT. XYZ
- b. Location: West Sumatra Field Building: Factory/Industry
- c. Area: 7 hectares
- d. Time Implementation: 2.5 years
- e. Budget Total Project: Civil Construction Budget = Rp 219.5 billion
- f. The scope of work on the project includes: structure and architecture; and other work included in civil work.

The modeling of the project budget evaluation application can be seen in the following image:

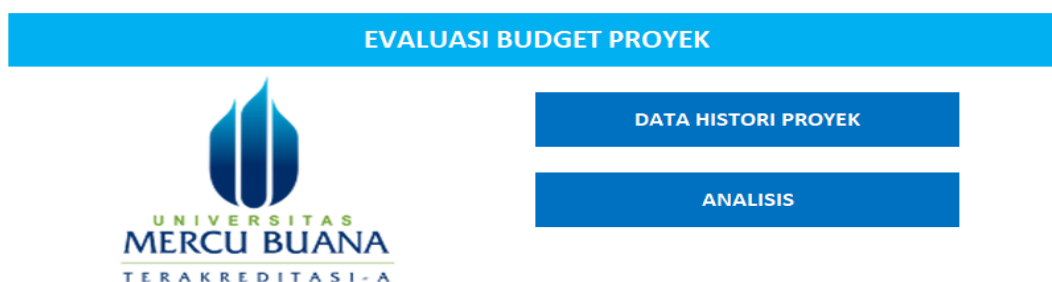


Figure 3. Interface 1 Project Budget

ANALISIS

PROJECT = PEMBANGUNAN PABRIK *Input
 ALAMAT = JL.: *Input
 ESTIMASI FLUKTUASI HARGA = UPAH 10% *Input
 MATERIAL 25% *Input
 ALAT 15% *Input
 CONTINGENCY COST = % *Input
 PPN = % *Input

Wajib diisi
 Wajib diisi
 Wajib diisi
 Wajib diisi
 Wajib diisi
 Wajib diisi
 Wajib diisi

Buttons: Analisis, Batal

CATATAN:
 Jika Analisis Langsung ke output
 Jika batal kembali ke tampilan awal

OUTPUT

PROJECT :
 JL : :

NO	SECTION	ITEM	QUANTITY	SATUAN	UNIT PRICE	TOTAL PRICE	DURASI (Hari)	KETERANGAN
TOTAL						Rp	-	

Buttons: CETAK

Footer: Created By: Zel Citra, Peki Dwiyanto, Yuste Malinda, Anom Wibisono 2023

Figure 4. Interface 2 Project Budget Analysis

RESULTS AND DISCUSSION

The results of the analysis of the budget of the project indicate quite significant changes due to the fluctuation of the price of materials, which also influences the rise in the price of wages or construction work implementation services. On the development project Feedmill PT. CPI in Padang, there was a change in the project budget from the previous budget that increased from Rp. 219.5 billion to Rp. 276.1 billion, an increase of Rp. 56.57 billion, or 25.8%.

Details of the results of the comparison of the initial budget with the changes in the budget as the impact of price fluctuations on the construction of the factory obtained an increase in the project budget for the development of the feedmill in the following fields:

Table 2. Changes in Project Budget

Section	Item	BUDGET		CHANGE BUDGET
		Quantity	Total Price Rp. 1000	Total price
I. General	1 Consultant Fee	1	ls	1.200.000
	2 Landfill	70.000	m3	5.250.000
	3 Pavement	20.000	m2	8.000.000
				17.000.000

	4	Fence & Retaining Wall	1.200	m1	2.400.000	3.600.000
	5	Drainage	1.200	m1	1.020.000	1.440.000
	6	Access Bridge	18	m3	90.000	875.000
	7	Main gate	18	m1	63.000	63.000
	8	Guard house	72	m2	324.000	324.000
		Total General Item			18.347.000	29.752.000
II. Truck Scale	1	Truck scale 60 T, 16 m	2	unit	650.000	650.000
	2	Foundation	90	m3	405.000	450.000
	3	Canopy	192	m2	480.000	480.000
	4	Office / Controll Room	96	m2	432.000	432.000
		Total Truck Scale			1.967.000	2.012.000
III. Main Office	1	Concrete pile	1.800	m1	450.000	945.478
	2	Office Building	576	m2	2.880.000	6.739.200
	3	Office Furniture & Partition	576	m2	864.000	864.000
		Total Main Office			4.194.000	8.548.678
IV. Finished Goods Godown & Lab	1	Concrete pile	2.820	m1	705.000	1.009.560
		Concret pile lantai	-	m1	-	2.975.696
	2	Godown	6.000	m2	13.800.000	16.500.000
	3	Production Office	216	m2	756.000	972.000
	4	Lab	216	m2	756.000	972.000
	5	Lab Equipment	1	ls	3.955.000	3.955.000
	6	Loading Area	2.160	m2	3.780.000	4.752.000
		Total Finish Goods			23.752.000	31.136.256
V. Feedmill	1	Tower Crane	12	mo nth	1.440.000	960.000
	2	Foundation Landfill	839	m3	167.731	186.950
	3	Concrete pile	4.200	m1	3.360.000	3.150.000

	4	Concrete Foundation, Intake	646	m3	3.231.000	3.230.000
	5	Concrete floor	120	m3	299.520	333.840
	6	Steel Construction	1.198.080	kg	23.961.600	35.604.855
	7	Bin	360.000	kg	9.000.000	11.988.732
	8	Service Lift		unit	-	-
	9	Hand add Lift	1	unit	200.000	200.000
	10	Stainless steel roof	11.261	kg	900.915	563.072
	11	Galvalume wall/roof	5.200	m2	1.300.000	1.040.000
		Total Feedmill			43.860.766	57.257.449
VI. RM Godown	1	Concrete pile	2.475	m1	618.750	886.050
		Concrete pile lantai	-	m1	-	2.837.160
	2	Open Godown	7.556	m2	13.223.000	16.623.200
	3	Bag Godown	5.400	m2	11.880.000	14.850.000
	4	Chain Pit	77	m3	384.000	384.000
		Total RM Godown			26.105.750	35.580.410
VII. Bulk Godown	1	Concrete pile	17.856	m1	4.464.000	6.660.948
	2	Bulk Godown	4.320	m2	19.440.000	21.600.000
	3	Receiving Area	768	m2	1.920.000	1.920.000
	4	Intake pit	86	m3	432.000	432.000
	5	MCC/Control Room	48	m2	216.000	216.000
	6	Chain pit	576	m3	2.880.000	2.880.000
		Total Bulk Godown			29.352.000	33.708.948
VIII. Silo : Corn Silo	1	Concrete pile	19.440	m1	14.580.000	14.580.000
	2	Foundation	2.280	m3	10.260.000	13.680.000
	3	Silo 6500 Tons	6	unit	11.076.000	12.183.600

	4	Erection	6	unit	1.650.000	1.650.000
	5	Steel structure	98.248	kg	1.964.960	2.259.704
		Total Silo			39.530.960	44.353.304
IX. Wetcorn/Vertical Storage	1	Concrete pile	1.080,0	m1	810.000	810.000
	2	Foundation	96	m3	432.000	480.000
	3	Erection	2	unit	180.000	180.000
	4	Hopper Tank 750 T	2	unit	1.022.400	1.124.640
	5	Steel structure	160.000	kg	3.200.000	3.680.000
			Total Wetcorn Tank			5.644.400
X. Receiving Area	1	Receiving Area	832	m2	2.496.000	2.496.000
	2	Intake pit	173	m3	864.000	864.000
	3	Tilting Platform	2	unit	3.400.000	3.400.000
	4	Control Room/MCC Room	240	m2	1.080.000	1.080.000
	5	Drum Precleaner	18.000	kg	360.000	414.000
	6	Steel structure	16.000	kg	320.000	368.000
			Total Receiving Area			8.520.000
XI. Coal Dryer	1	Concrete pile 40x40	180	m1	135.000	135.000
	2	Concrete pile 25x25	750	m1	187.500	268.500
	3	Concrete Foundation	400	m3	1.800.000	1.800.000
	4	Burner Godown & Coal Storage	600	m2	1.650.000	1.650.000
	5	Steel structure	5.000	kg	100.000	115.000
			Total Coal Dryer			3.872.500
XII. Coal Boiler	1	Boiler warehouse & foundation	749	m2	2.620.800	2.620.800
	2	Control Room	24	m2	60.000	60.000
			Total Coal Boiler			2.680.800
XIII. Utility	1	Transformer /	288	m2		

		LVMDB Room			1.152.000	1.152.000
2		Cubicle PLN	48	m2	216.000	216.000
3		Genset Room	96	m2	432.000	432.000
4		Koperasi / Canteen		m2	-	337.500
5		Musholla	80	m2	360.000	360.000
6		Dormitory		m2	-	-
7		Locker/KM/WC	120	m2	540.000	540.000
8		Rest Area	64	m2	224.000	224.000
9		Workshop	360	m2	720.000	720.000
10		Store Room	288	m2	576.000	576.000
11		Water Tank 100 m3	2	ls	1.000.000	1.000.000
12		Fuel tank	2	unit	180.000	180.000
13		CPO Tank 500T	2	unit	2.500.000	2.500.000
14		Molases Tank 200 T	0	unit	-	-
15		Alimet, Fish Oil, CC (@25Ton)	3	unit	450.000	450.000
16		Compressor room	48	m2	96.000	96.000
17		Bag storage	281	m2	702.000	702.000
18		Cool Room	281	m2	842.400	842.400
19		Biosecurity	64	m2	160.000	192.000
20		Sampling shelter	275	m2	550.000	687.500
21		QC Lab	144	m2	648.000	648.000
22		Motorcycle Parking	600	m2	360.000	360.000
		Total Utility Building			11.708.400	12.215.400

From table 2 above, it can be seen that each item of work has experienced a fairly significant increase in the project budget. Starting from the General, Truckscale, Main Office, Finish Good Godown, Feedmill, RM Godowns, Bulk Godows, Silo, Wetcorn Tanks, Receiving Areas, Coal Dryers, Coal Boilers, and Utilities Also visible on the following chart:

- General Δ 62%.
- Truckscale Δ 2%

- c. Main office Δ 104%
- d. Finish Good Godown Δ 31%
- e. Feedmill Δ 31%
- f. RM Godown Δ 36%
- g. Bulk Godown Δ 15%
- h. Silo Δ 12%
- i. Wetcorn Tank Δ 11%
- j. Receiving Area Δ 1%
- k. Coal Dryer Δ 2%
- l. Coal Boiler Δ 0%
- m. Utility Δ 4%

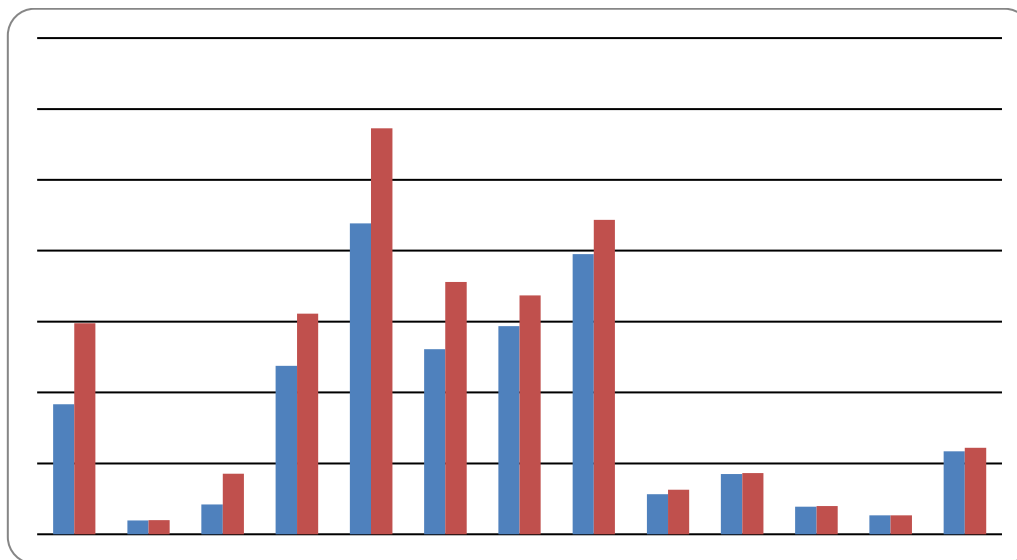


Figure 5. Interface 2 Project Budget Analysis

CONCLUSION

The results of the above data analysis can be seen: there was a change in the budget of the general job item by 62%, truckscale by 2%, main office by 104%, finish good godown by 31%, feedmill by 31%, and RM godown by 36%. Bulk Godown from 15%, Silo by 12%, Wetcorn Tank by 11%, Receiving Area by 1%, Coal Dryer by 2%, Coal Boiler by 0%, and Utility by 4%. The budget of the construction project Feedmill PT. XYZ in Padang has changed from the previous budget of Rp. 219.5 to Rs. 276.1, increasing by Rp. 56,57, or by 25.8%.

REFERENCE

- [1] Callahan, K. R dkk (2007). "Project Management Accounting: Budgeting, Tracking and Reporting Costs and Profitability". John Wiley & Sons, Inc., New Jersey.
- [2] Chandra, dkk. 2003. "Perkiraan Biaya Konstruksi". Jurnal Universitas Atmajaya.
- [3] Darmanto, B., Widjayakusuma, J., & Simanjuntak, M. R. A. (2020). "Identifikasi Faktor-Faktor yang Menyebabkan Cost Overrun pada Konstruksi Gedung Bertingkat." Tantangan dan Inovasi Teknologi dalam Menghadapi Kegagalan Konstruksi dan Struktur Bangunan. Proceedings of Seminar Nasional Teknik Sipil 2020, Surakarta,

Indonesia, June 10, 334-342.

- [4] Dimiyati, Hamdan dkk. 2014. "Manajemen Proyek". CV Pustaka Setia.
- [5] Ervianto, Wulfram I. 2002. "Manajemen Proyek Konstruksi". CV Andi Offset. Yogyakarta.
- [6] <https://dataindonesia.id/sektor-riil/detail/ratarata-upah-buruh-sebesar-rp289-juta-pada-februari-2022>
- [7] Kamaruddeen, A. M dkk. 2020. "A Study on Factors Causing Cost Overrun of Construction Projects in Sarawak, Malaysia." Civil Engineering and Architecture. Vol. 8, No. 3, 191-199.
- [8] Project Management Institute. 2017. "A Guide To The Project Management Body Of Knowledge (PMBOK Guide) (6rd ed.).
- [9] Remi, F. F. 2017. "Kajian Faktor Penyebab Cost Overrun pada Proyek Konstruksi Gedung". Jurnal Teknik Mesin. Vol 6, 33-39.
- [10] Rosenfeld, Y. 2014. "Root-Cause Analysis of Construction-Cost Overruns." Journal of Construction Engineering and Management. Vol. 140, No.1, 1-10.
- [11] Setiawan, T. H. dkk. 2017. "Analisis Frekuensi dan Besarnya Pengaruh Faktor-Faktor Penyebab Pembengkakan Biaya Pelaksanaan Proyek Gedung di Kota Bandung." Manajemen Aset dan Infrastruktur Berkelanjutan. Proceedings of Simposium II, UNIID, Palembang, Indonesia, September 19 - September 20, 212-218.
- [12] Soeharto, Iman. 1995. "Manajemen Proyek Dari Konseptual Sampai Operasional". Erlangga. Jakarta.
- [13] Subagyo, Drs. Pangestu. 2000. "Manajemen Operasi". Edisi pertama. Yogyakarta: BPFE-Yogyakarta.