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Case Study

The Differences in the Cost of Labor Wage Between the Contract Document and On-site Contractor Cost Analysis: A Case Study

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Highlights:

- The new calculated labor coefficients of daily productivity are lower for the contractor cost analysis based on-site investigation.
- The lower labor wages costs assessed by the contractor cost analysis in comparison to the unit price analysis following the Standar Nasional Indonesia for a block of two story in Banda Aceh, Indonesia.
- The general worker received higher labor wages of for three types of construction work (wall masonry, plastering, and tiling works) at calculated coefficients of daily productivity range between 0.235 to 0.626 man/day. Even though the daily unit price value for this group is the lowest (IDR 100,000,00) among other groups of labors (craftsman, head handyman, and foreman).

Abstract: The growth in the number of construction laborers has been complemented by the magnitude of the value of completed projects, especially in the field of civil construction. Therefore, the construction cost analysis is crucial to improve the efficiency and effectiveness of enhancement activities in this sector. This research paper presents a comparative analysis of labor wage cost between the Unit Price Analysis of Work (UPAW) in comparison to the on-site study of contractor cost calculation. This study analyzed the secondary data of UPAW based on Standar Nasional Indonesia in terms of daily labor productivity and wages of on-site masonry, plastering, and tiling works for a two-floor block school for a 6-day working period in Banda Aceh, Indonesia. The results showed that the yielded area was 1622.31 m2 for the particular block with new averaged labor coefficients ranging between 0.235 to 0.626 (general worker), 0.075 to 0.279 (craftsman), 0.01 (head handyman), and 0.015 (foreman) for on-site works. The calculated labor wage cost for the on-site study was then decreased in comparison to the value stated in the contract. The laborers received less wages (1.10% to 1.25%) for wall masonry, plastering, and tiling work. These cost discrepancies could lead to budget overruns, project delays, and financial losses, affecting the entire success of construction projects.

Keywords: Contractor cost analysis; labor coefficient; labor wages; unit price analysis of work

1. Introduction

Labors in construction are one of the main pillars of project execution [1]. The utilization of a large labor force causes the growth of the construction industry to increase annually. In 2008–2009, the total permanent workforce employed in the Indonesian construction sector showed an increase of 7% [2]. The upward trajectory of this statistic persists from 2018 to 2019, increasing from 1,287,225 to 1,344,571 [3]. Furthermore, this industry demonstrates a remarkable pattern of socio-economic progress by enhancing revenue streams and employment prospects while reducing unemployment. The construction sector utilized the economic infrastructures for industrial advancement and fundamental amenities, for example, residential and commercial units, dams, highways, stadiums and playing fields, ports, railways, airports, health maintenance units, power generators, and supplying stations, as well as communication facilities [4]. These are the foundation for other essential infrastructures in developing nations that contribute to life standards for the communities. For many years, this sector has contributed almost 10% annually to Indonesia's gross domestic product (GDP). It is the largest construction market in Southeast Asia and the fourth largest in Asia after China, Japan, and India. Indonesia is the primary rated country followed by China, particularly in terms of construction market growth in Asia. Jakarta is also ranked the top metropolitan region with the largest growing construction market in Asia and ranked second place after Singapore as the city with the most profitable construction market in Asia [5].

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The building budget design is used in Indonesia as a method to assess and plan the costs associated with constructing a building. The process is governed by a series of standards to ensure consistency, accuracy, and compliance with national regulations, hence minimizing errors in cost calculations. On the other hand, the Burgelijke Openbare Werken (BOW) 1921, which was a Dutch colonial regulation, is often utilized to establish unit price analysis methods for labor and materials in construction. Although it is an old standard for labor-intensive systems, its influence persists in modern Indonesian estimation practices, often referenced within contemporary guidelines such as those provided by [6]. The SNI is the revision of BOW 1921 issued by the Centre for Settlement Research and Development. This standard uses the basic principle of listing the construction materials with their specific material and labor wages coefficients in analyzing the unit price of a building work. One of the SNI written documents is the procedures for calculating labor wages in construction work [7]. It consists of factors such as job classification, skill levels, productivity levels, and regional differences in wage rates. It ensures that labor wages are calculated fairly and demonstrate the present market conditions. In 2022, the SNI was revised again and encapsulated in the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia [6].

There are three factors associated with construction project management, namely resource management, equipment management, and management system [4]. The accurate estimation and management of labor wages directly impact the cost, laborers' productivity and quality of construction projects. In Indonesia, labor wage costs are generally assessed based on standard rates and predefined assumptions, to form the contract document. The cost to execute the construction is calculated from the volume of work. It is based on the drawings and job specifications and the unit price of labor analysis. To secure accurate estimation results of labor wage, the price of the labor unit is adjusted to the specified specifications, both the drawings and on-site technical conditions. The projected expenses frequently vary between the labor remuneration costs evaluated in the contractual document and actual costs incurred on-site.

The discrepancies between SNI contract wages and on-site labor costs in Indonesian construction are influenced by a complex interplay of regional, economic, legal, and market factors. Addressing these discrepancies requires a nuanced understanding of local conditions, regular updates of wage standards, and effective enforcement of labor laws. A recent study by [8], mentioned that contract wages based on government regulation in 2016 gave higher value in comparison to contractor cost analysis, due to a higher labor coefficient. Additional research has investigated comparable cases, such as the study conducted by [9], which examined the various estimating methodologies used by contractors. This issue poses significant challenges to the building sector in this country. Due to estimates being made before construction begins, the total final contractor costs analysis is not the actual contract cost. Its accuracy mainly depends on the estimator's experience. The number of laborers is determined based on actual needs, and wages are normally issued using daily rates, lump-sum payments, building units, and similar methods. Furthermore, increased on-site labor costs might exert pressure on the management of cash flow, therefore directly affecting profit margins. Contractors may face a decrease in profitability if the actual salaries exceed the wages specified in the contract. Therefore, contractors must ensure they have the financial resources to handle the additional expenses. These discrepancies could lead to budget overruns, project delays, and financial losses, as well as the decrease in labor productivity. This, in turn, affects the entire success of construction projects. Based on the mentioned gaps, this study analyzed the new labor coefficient for a school project with measurement of on-site activities, as an indicator of labor productivity for contractor cost analysis.

Despite the critical nature of accurate wage estimation, there have been limited studies focusing on the causes and extent of these differences within the specific context of Indonesia. According to [6, 10], contractors in Indonesia typically submit the bid prices based on their previous experience of completing their projects and not specifically guided by BOW analysis, SNI, and Unit Price Analysis of Works (UPAW) 2021. [11] proposed that the calculation of construction expenses is more efficient when compared to SNI 2021 for estimating building costs. Although the labor coefficient of BOW can lead to cost overruns, [10] stated that this method is still commonly used in building construction due to its higher coefficients of materials and labor. [12] claimed that this can result in higher profits compared to the SNI method. The disparity between those values could be due to various factors, for example, the availability of skilled labor, labor productivity, organization management, market changes, and regional economic scenarios [13]. Thus, this study aims to conduct a comparative analysis of labor wage costs outlined in the contract document versus those observed through the on-site contractor cost analysis. The specific aim is to analyze wage costs using the SNI UPAW 2016 contract document and calculate actual wages using the new labor coefficients for three types of wall

masonry, tiling, and plastering works. This case study involves the construction of a two-story block of Islamic Junior High School (IJHS), according to [6], contract type lump sum and unit price.

2. Literature Review

2.1. Cost Estimation Method

A cost estimate aims to predict the magnitude of costs incurred to implement an activity in the future. Conceptual cost estimation is one of the most critical tasks in the early stages of a building project life cycle. Accurate estimation affects project management activities, including project bidding, project planning, risk control, quality and cost management, and resource allocation [14]. Each stage has a different method of estimation. This includes estimation detail, beginning with the preparation or grouping level of employment activity or Work Breakdown Structure. A complex project is made manageable by first breaking it into individual components in this hierarchical structure [15]. This is followed by the calculation of work quantity based on the drawings and specifications. Next, it is crucial to perform a unit pricing analysis. The estimate encompasses all the resources involved in the project, including wages for skilled labor, expenses for productivity equipment, costs of materials, expenses for subcontracting and other relevant charges to facilitate the execution of the operation. Throughout the implementation of a project, several unpredictable variables have a dynamic impact on the duration of activities and associated costs. The presence of various risks in multinational construction projects can be attributed to disparities in culture, economic conditions, specifications and standards, regulatory frameworks, and productivity levels [16].

Costs are part of the constraint on resources. It requires adequate management of work methods, and expenses cannot exceed the limit set [17]. Project costs are needed for each work item when executing a construction project. Project costs are categorized into two main sets, namely direct costs, and indirect costs. Direct costs are resources that are directly linked and incurred only to complete construction activities. The elements of direct costs are wage costs, construction material and equipment, and sub-contractor costs. Indirect costs are costs associated with employee salaries, employee mobilization and demobilization costs, employee leave costs, utility costs, transportation costs, incentive costs, socialization costs, and typical costs outside construction costs. These cost element indexes are compiled when the contract offer is submitted.

Unit Price Analysis is a calculation used in cost estimation. Unit price analysis is a method used to determine the construction cost. It involves multiplying the quantity of materials, tools, and labor required to accomplish the work with the price of each unit of these materials, which includes the cost of delivery [8]. To simplify the process of calculations, the number of materials, tools, and labor is represented by a number called a coefficient. This unit price will eventually be used to create a cost budget plan. Preparing a cost budget plan before carrying out a construction job is essential. The planning must be carried out carefully so that the control of construction cost control goes well. According to [13], the fixed unit price analysis assessed on-site takes into account various aspects related to labor productivity, the use of work supports, and building material procurement.

2.2. Labor Productivity

The success of a construction project is subject to time, quality, and cost. It depends on the implementation of an efficient project. The acquisition of repetitive work has an impact on labor productivity, but construction niche work is a dynamic activity that involves multiple workers, locations, and working conditions [18]. The construction labor is one of the inaccessible resources. The variation in the wage allocated is subjected to the skills related to the time, type of contract, site condition, labor market supply, and construction method.

Labor productivity is commonly dynamic, meaning it is not typically fixed [13]. The increase in productivity can be obtained by reducing all costs, including utilizing human resources and maximizing output. In this case, productivity is an indication of the overall effectiveness level of work. Labor productivity in construction project work is vital since its success or collapse depends on productivity. When considering labor productivity from the perspective of the laborers, the key criteria are skill, motivation, discipline, and education. However, from the employer's perspective, the determinants include the availability of materials at the correct time, the method of implementation, on-site management, and the working environment [18]. The study conducted by [19] emphasized that the productivity of foremen, chief builders, craftsmen, and workers in the

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ironworking industry, as measured by the SNI, is higher than that of the BOW. According to [20], the cost of mixed concrete work, formwork, and iron work based on BOW is higher than the cost based on SNI, and the cost analysis done by on-site contractors. [21] asserted that the efficiency of bricklayers decreases when they engage in overtime labor.

2.3. Labor Wages and Regional Economic Impact

The Indonesian construction subdivision makes a significant contribution to job opportunities, employing unskilled, semi-skill, and skilled laborers. Approximately, 8 million people work in this sector, and only approximately 9% possess working-skill qualifications. These professions are commonly classified as informal labor even if the laborers engage in a government project. The utilization of a vast number of laborers with low experience and competence is normal in conventional Indonesian employment. Even for large projects, the contractors use both modern and conventional management techniques. Their wages are typically paid on a daily basis. Although labor wages are a significant portion of the construction budget, around 30% [22], this component is inappropriately managed, particularly in developing nations, including Indonesia. Therefore, it is challenging for the contractor to accurately assess the magnitude of the labor cost for a project, drive the authors to conduct this study. [3] stated that while estimating the price of public procurement, the salaries of laborers are calculated based on competitive market wages, influenced by the supply and demand of labor. The construction company provides laborers' wages based on the prevailing market rate when participating in a bidding of a tender. Implementing this approach would enhance the accuracy of price estimation, hence fostering stronger competition among contractors.

The higher number of labors in a region may relate to a higher demand for buildings and more construction projects. Additionally, construction wages are different across contractors and regionals in Indonesia. In 2020, the average minimum wage from 34 regionals was IDR 2,664,186.56 per month. On average, the labor wage in Jakarta is the highest among other regionals at IDR 2,790,577.37 monthly. The average labor wages in the four regionals of Jawa Tengah, East Nusa Tenggara, Yogyakarta, and Aceh are still less than IDR 2,000,000 monthly. Additionally, [3] highlighted that for the labor demand variables, the magnitude of GDP and labor productivity in the region did not correlate to construction laborers' earnings. The standard deviation of the annual labor salaries in all regions is IDR 3,330,858.17, whereas the standard deviation of labor productivity is IDR 123,472,928.25. The disparity between workers' pay and labor productivity in wealthier regions such as Jakarta is directly linked to income inequality. [17] conducted a study to examine the percentage rise in construction expenses caused by the significant escalation in labor, materials, and construction equipment prices. [23] emphasized that the lack of official qualifications aligns with the informal practices surrounding the payment and hiring of construction workers. Minimum wage regulation fails to provide pay protection for construction workers who are employed in informal sectors. From an employment perspective, contractors do not establish formal contracts with workers and consistently classify them as part-time employees. Regarding payment, a contractor delegates this responsibility to a supervisor who serves as both a labor provider and a labor coordinator.

3. Methodology

3.1. Primary and Secondary Data of Case Study

Primary data was obtained from an on-site study for a construction project of Islamic Junior High School (IJHS), Banda Aceh, conducted between 1st November to 15 December 2021. The interviews were carried-out with a 51-year-old experienced head handyman to seek information on the work-break downs, dimension of the building, yielded volume, number of workers, labor unit price, working hours, and the laborers' specific tasks. Then, the assessed data were tabulated in the observation sheet.

The secondary data were referred to following the shop drawings and contract document. The construction of building tender code was 12833170, dated 18th June 2021. Labor Work Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia 28/PRT/M/2016 was used for assessing the SNI unit price of work for the fiscal year of 2021 (Governor of Aceh Regulation Aceh, 65, 2020). The summary of the secondary data for this case study is shown in Table 1.

Table 1. Detail of case study contract data

Contract Document Detail Construction of Islamic Junior High School, Banda Aceh	
Tender code	12833170
General plan of procurement (Package name)	Construction of new class IJHS
Contract type	Mixed lump sum and unit price
Rup code	29392960
Date of creation	8th June 2021
Source of fund	Regional Income and Expenditure Budget (Aceh Province)
Current tender status	Completed
Agency involved	Ministry of Religious Affairs
Work unit	Ministry of Religious Affairs, Banda Aceh
Category	Construction works
Fiscal year	2021
Package ceiling value	IDR 2,803,499,000.00
Package HPS value	IDR 2,803,396,792.73
Contractor	CV. Tri Jaya Family
Supervisory consultant	CV. Puga Redjaya Construction
Location	Jln. Sultan Malikul Saleh, Lhong Raya Village, Banda Raya District, Banda Aceh City

3.2. Labor Cost Analyses Based on the Contract Document and On-site Study

First, the unit price of labor and coefficient values of UPAW 2016 SNI (Table 2) were applied for this analysis. The standard stipulated labor costs for general labor, craftsman, head handyman, and foreman are IDR 100,000,000, 110,000,000, 135,000,00, and 120,000,00 man/day, respectively. This calculation compares the final labor cost wages of the contract and the on-site study of contractors' cost analysis. The values of labor coefficient were cited from SNI general guideline of appendices 4.4.1.7a, 4.4.2.2., and 4.4.3.35c for wall masonry, plastering, and tiling works, respectively. Next, the standard labor force price for wall masonry, plastering, and tiling works is calculated at IDR 44,150,00, 117,425,00, and 117,425,00 for a one-meter2 area, respectively.

Table 2. The standard labor cost according to the UPAW of the contract document

Labor	Wage cost (IDR)	Type of Works and Cost					
		Coef. value for wall masonry (m^2)	Cost (IDR)	Coef. value plastering (m^2)	Cost (IDR)	Coef. Value tiling (m^2)	Cost (IDR)
General labor	100,000,000	0.30	30,000,00	0.30	70,000,00	0.700	70,000,00
Craftsmen	110,000,00	0.10	11,500,00	0.10	38,500,00	0.35	38,500,00
Head handyman	135,000,00	0.01	1,350,00	0.015	4,725,00	0.035	4,725,00
Foreman	120,000,00	0.015	1,800,00	0.015	4,200,00	0.035	4,200,00
Sum			**44,150,00**		**117,425,00**		**117,425,00**

The second step was the calculation of cost according to the volume of work and dimensions of the building contract in the lump sum and unit price document. It gives the total labor wage cost of IDR 96,084,940.00 for wall masonry, plastering, and tiling works (Table 3).

Table 3. Analysis of labor wage costs according to building dimensions and type of work from the contract document

Type of works	Length (m, a)	Wide (m, b)	Height (m, c)	Volume (m^3, d)	UPAW per meter (e)	Total labor wage cost (IDR, f = d × e)
Wall masonry	101.16	-	4.5	455.25	44,150.00	20,009,287,50
Plastering	202.30	-	4.5	910.50	50,325.00	45,820,912,50
Tiling	28.533	9	-	256.80	117,425.00	30,254,740,00
					Sum	**96,084,940.00**

Next, the analysis was carried out by calculating the labor productivity for on-site contractor cost analysis. The calculation was based on six working days of the wall masonry, plastering, and tiling works of a two-floor block with 27 meter (length) × 9 meter (height) of IJHS, Banda Aceh. Equation 1 was applied to calculate the labor productivity cost.

$$Labor\ coefficient = \frac{Number\ of\ labor}{Productivity\ \left(\frac{unit}{day}\right)} \quad (1)$$

In the context of this study, the identified number of laborers and their productivity for the working period from 08.00 AM to 5.00 PM and rest time between 12.00 noon to 1.00 PM is depicted in Table 4. Table 5 shows the daily labor productivity and yielded area for six working days of 1622.31 m². Then, by considering the variable of labor productivity of the particular works, the new coefficient values of labor productivity were analyzed for on-site contractor cost analysis (Equation. 1). Table 6 shows the average of new coefficients of labor productivity for a 6-day working period. It illustrates the averaged labor coefficient values for general workers, craftsmen, head handyman, and foremen according to the type of works of wall masonry, plastering, and tiling.

Table 4. The daily productivity by yielded area for contractor cost analysis

Type of works	Daily productivity of yielded area (m2)						Total yielded area (m2)
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	
Wall masonry	75.6	78.525	78.3	67.95	77.85	76.95	455.18
Plastering	153.45	157.95	168.53	165.6	126.45	138.38	910.36
Tiling	45.9	39.87	40.5	45	40.5	45	256.77
						Sum	**1622.31**

Table 5. The identified number of labor on-site

Type of works	Number of labor on-site (working time from 08.00 AM to 5.00 PM, and rest time between 12.00 noon to 1.00 PM)			
	General labor	Craftsmen	Head handyman	Foreman
Wall masonry	3	1	1	4
Plastering	7	3	1	1
Tiling	5	2	1	1

Table 6. The average of new calculated coefficient of labor productivity

Type of works	Averaged values of calculated coefficient of labor for 6 days (Man/day)			
	General labor	Craftsmen	Head handyman	Foreman
Wall masonry	0.235	0.075	0.010	0.015
Plastering	0.236	0.107	0.010	0.015
Tiling	0.626	0.279	0.010	0.015

The cost analysis for the on-site contractor was determined by applying newly established coefficients of labor productivity associated with the duration of work and the area of the block, with the assumption number of labors were identical as of Table 5. These coefficients are presented in Table 7. Ultimately, this data was utilized for the final analysis of labor wage expenses, taking into account their daily productivity. Additionally, it was used to compare the UPAW calculation technique with the contractor cost analysis.

Table 7. Analysis of the labor wage costs from contractor cost analysis

Type of works	Length (m, a)	Wide (m, b)	Height (m, c)	Volume (m^3, d)	UPAW per meter (e)	Total Wage Cost (IDR, f = d × e)
Wall masonry	101.16	-	4.5	455.25	34,900.00	15,880,225.00
Plastering	202.30	-	4.5	910.50	45,405.00	41,341,252.50
Tiling	28.533	9.0	-	256.80	102,215.00	26,248,812.00

4. Result and Discussion

4.1. Labor Wage Costs Based on the Contract Document and On-site Study

The final cost of labor productivity for wall masonry, plastering, and tiling works is IDR 34,900,00, 45,405,00 and 102,215,00, respectively (Table 8). Based on the on-site cost analysis, the general labor received higher labor wages of IDR 113,600,00 for these three types of construction work.

Table 8. The labor wage costs from contractor cost analysis

Type of works								
Wall masonry			Plastering			Tiling		
Calc. Coef. (Man/ day)	Unit Price (IDR)	Wage (IDR)	Calc. coef. (Man/ day)	Unit Price (IDR)	Wage (IDR)	Calc. coef. (Man/ day)	Unit Price (IDR)	Wage (IDR)
	General labor							
0.235	100,000,00	23,500,00	0.236	100,000,00	27,500,00	0.626	100,000,00	62,600,00
	Craft man							
0.075	110,000,00	8,250,00	0.275	110,000,00	14,080,00	0.279	110,000,00	30,690,00
	Head handyman							
0.010	135,000,00	1,350,00	0.015	135,000,00	2,025,00	0.035	135,000,00	4,725,00
	Foreman							
0.015	120,000,00	1,800,00	0.015	120,000,00	1,800,00	0.035	120,000,00	4,200,00
Sum		**34,900,00**			**45,405,00**			**102,215,00**

This is due to the highest calculated coefficients of daily productivity, which range between 0.235 and 0.626 man/day. This is beside the fact that the group's daily unit price value is the lowest (IDR 100,000,00) among other groups (Table 8).

On the contrary, the craftsman received fewer wages of IDR 8,250,00 (wall masonry), IDR 14,080,00 (plastering), and IDR 30,690,00 (tiling) works for the six-working day period. Similarly, the head handyman and foreman received lower wages, between IDR 1,350,00 to 1,800,00 (wall masonry), IDR 1,800,00 to 2,025,00 (plastering), and IDR 4,200,00 to 4,725,00 (tiling) works. The daily analysis revealed productivity figures ranging from 0.235 to 0.626 man/day for general labor, 0.075 to 0.279 man/day for craftsmen, 0.010 to 0.035 man/day for head handymen, and 0.015 to 0.035 man/day for foremen. This finding is inconsistent with the study of [3], which mentioned that the worker's position determines the wages. The order of position from the lowest wages is helper, handyman, senior handyman, and supervisor.

Table 9 shows that the labor wages of the on-site study for contractor analysis are lower than those of the contract document. The difference in both costs was recorded for the wall masonry of IDR 4,121,062.50 (1.25%), plastering of IDR 4,479,660,00 (1.10%), and tiling works of IDR 3,905,928,00 (1.14%). This finding is inconsistent with a study by [13], as they highlighted that on-site prices paid to the laborers are more expensive in comparison to the unit price analysis of SNI 2013. However, this finding was supported by [10], as the researcher summarized lower prices for field study on the calculation of wages, materials, and equipment for soil excavation work, compared to SNI's standard.

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Table 9. Comparison of labor wage costs between the contract document and contractor cost analysis

Type of works	Labor cost (IDR)		
	Contract Documents (UPAW)	On-site study (Contractor Cost Analysis)	Percentage of difference (%)
Wall masonry	20,009,287,50	15,888,225,00	1.25
Plastering	45,820,912,50	41,341,252,50	1.10
Tiling	30,154,740,00	26,248,812,00	1.14

The discrepancies between labor wages stipulated in contracts and actual on-site construction costs were driven by a combination of market conditions, labor availability, and skill levels. Regarding market conditions, the contract rates may not always reflect the various regional differences in Indonesia, leading to discrepancies. Generally, regions that have a higher cost of living tend to provide higher wages to workers. According to [24], the average daily gross salary of temporary construction workers in the region of Aceh in 2022 was IDR 109,640. In comparison, the wage range in West Papua and Jakarta regions was between IDR 159,000 and 152,900. In regions where there is a surplus of construction labor, salaries tend to decline due to competition among workers to attract employers. This situation may result in the actual earnings received on-site being lower than the salaries specified in the contracts. In addition, workers are usually compensated depending on the time they spend working and their actual production level, which includes a fixed pay as specified in the contract.

To ensure productivity and quality, the main contractor conducted routine supervision. The primary contractor managed costs by setting consistent wages, which can be lower to account for potential inefficiencies and ensure project budget adherence. Moreover, for this case study, projects funded by local government may offer lower wages compared to those funded by private organizations. During periods of high construction activity, the demand for labor increases, leading to higher wages. On the contrary, wages might be closer to or even less than the contract rates in a low market. For the skill level, less complicated projects often require lower-skilled labor, which bids lesser wages [15]. The contracts might not fully prescribe the premium rates associated with specialized skills, leading to discrepancies. Similarly, the Region of Aceh may experience an increased proportion of individuals entering the labor market, resulting in lower salaries compared to the contract rates that are typically determined for highly skilled laborers.

The discrepancies between the labor wages stipulated in the contract document and actual on-site contractor costs can significantly impact various aspects of construction projects in Indonesia. These impacts can be broadly classified into project success, budget adherence, and financial management. In order to achieve project success, it is imperative to recognize that reducing salaries can have a detrimental impact on worker morale and productivity, ultimately hindering the overall success of the project. In the context of this country, maintaining constant and competitive wages may promote labor stability, reduce turnover rates, and assure continuous progress. Discrepancies lead to reduced salaries, which are associated with increased employee turnover and difficulties in hiring, resulting in disruptions to project schedules. If there is a discrepancy between the actual on-site pay and the wages specified in the contracts, it might result in unanticipated expenses and cost overruns. Project budgets based on contract rates may fall short, hence necessitating additional funding. The financial risks linked to disparities in worker wages encompass potential project delays, increased borrowing costs, and financial penalties for failure to meet contractual obligations. Consistent disparities may have a negative effect on the long-term financial health of a construction firm, especially smaller contractors that have minimal financial reserves.

5. Conclusion

In conclusion, the labor wages cost calculated via on-site study for contractor cost analysis gave low values to the laborers' wages. The total differences between both analyses (UPAW and contractor cost analysis) were recorded at 1.10% to 1.25% for wall masonry, plastering, and tiling works due to the differences in daily labor coefficients. In the context of Indonesia, regional economic variations, labor supply and demand dynamics, and differences in skill and experience levels contribute to these wage discrepancies. Additional concerns may include contractor practices, whereby subcontractors may remunerate their workers in a manner that deviates from the terms outlined in the contract.

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Employing informal labor in Indonesia can lead to wage disparities, as these workers may not get compensation in accordance with the SNI. Additionally, differences in how labor laws are enforced can lead to variations in wages. In regions with strict enforcement, contractors will pay higher wages to ensure compliance. Labor productivity is linked to the measurable and tangible production of goods or services, as well as the actual input. It may be enhanced by reducing unproductive working hours. Hence, the rise in labor earnings fosters the perception among the workers that they are being adequately compensated for their efforts. Furthermore, their confidence and allegiance towards the principal contractor or employer will also grow. The impact of the existing situation on worker salaries is likely to require improvement. It is recommended that an empirical or case study be conducted in the future to address the improvement aspects of (i) research variables such as project size, weather conditions, labor behavior, supporting facilities, and management type, (ii) extending the on-site investigation to obtain more accurate standard time measurements, and (iii) studying other types of work such as site clearing, earthwork, and superstructure to develop productivity analysis coefficients for projects in other regionals in Indonesia.

Author Contributions:

Conceptualization, A. Ayob; methodology, A. Ayob; software, M. Ilhamullah; validation, M. Ilhamullah and A. Ayob; formal analysis, M. Ilhamullah and A. Ayob; investigation, M. Ilhamullah; resources, A. Ayob; data curation, M. Ilhamullah; writing—original draft preparation, M. Ilhamullah; writing—review and editing, A. Ayob; visualization, Supriatna and A. Ayob; supervision, A. Ayob; project administration, Supriatna; funding acquisition, A. Ayob. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest:

The authors declare no conflicts of interest.

References

1. Alaloul, Wesam Salah, Muhammad Ali Musarat, M. S. Liew, Abdul Hannan Qureshi, and Ahsen Maqsoom. "Investigating the impact of inflation on labour wages in Construction Industry of Malaysia." Ain Shams Engineering Journal 12, no. 2 (2021). doi: https//doi.org./10.1016/j.asej.2020.08.036
2. Supriadi, Leni Sagita Riantini, Low Sui Pheng, Leni Sagita Riantini Supriadi, and Low Sui Pheng. "The Indonesian Construction Industry." Business Continuity Management in Construction (2018). doi: https//doi.10.1007/987-981-10-5487-7
3. Mutaqin, Muhammad Iqbal, and Choirul En Huda. "Minimum Wages and Construction Workers Earning in Indonesia." Jurnal Ekonomi dan Kebijakan Publik Indonesia 8.2 (2021): 111-137. doi: https://doi.org/10.24815/ekapi.v8i2.23670
4. Nor, Saffiah Mohd, Geetha Subramaniam, and Zahariah Sahudin. "The Effects of Foreign Labor on Labor Productivity in Construction Industries." Information Management and Business Review 15.2 (I) SI (2023). doi: https://doi.org/10.22610/imbr.v15i2(I)SI.3426
5. Hansen, Sen. "Formulating Standard Form of Construction Contract in Indonesia Context." The 1st International Joint Conference of Indonesia-Malaysia-Bangladesh-Ireland (2015). https://www.researchgate.net/publication/337240644
6. Standar Nasional Indonesia 1968 (2016). Analisa Harga Satuan. Penerbit Badan Standarisasi Nasional.
7. Pangestu, Renaldo Pudja, Edison H. Manurung, and Kerlima Hutagaol. "Analysis of the Budget Plan for the Construction of Freja House BSD Mass Buildings using the BOW, SNI 2008 & 2021 AHSP Methods." Indonesian Journal of Applied and Industrial Sciences (ESA) 2, no. 2 (2023). doi: https://doi.10.1007/978-981-10-5487-7-6

8. Putra, Andi Bayu, and Oki Setyandito. "Analysis on Construction Cost Estimation Ministry Regulation Year 2016 and Year 2022 for Construction Projects." SITEKIN: Jurnal Sains, Teknologi dan Industri (2022). doi: http://dx.doi.org/10.24014/sitekin.v20i2.21790
9. Piluto, Bambang. "Perbandingan Estimasi Anggaran Biaya Antara Metode BOW, SNI Dan Perhitungan Kontraktor." Jurnal Teknika 12, no. 2 (2020). doi: https://doi.org/10.30736/jt.v13i2.477
10. Gellu, Cornelius Agatho. "Comparative Study of Unit Price Analysis of Wages, Materials and Equipment on Excurement Work and Head Works Between SNI Method and Field." In ICSET: International Conference on Sustainable Engineering and Technology, vol. 1, no. 1, pp. 36-39. (2022). https://seminar.ustjogja.ac.id/index.php/ICSET/article/view/173
11. Suhermawan, Dwiky, and Hammam Rofiqi Agustapraja. "Evaluasi Perbandingan Anggaran Biaya Konstruksi Antara Metode SNI Dengan Metode Kontraktor." Jurnal Teknik 21, no. 1 (2023). doi: https://doi.org/10.37031/jt.v21i1.339
12. Abdullah, Taufik Safii, Suryo Handoyo, and Erni Mulyandari. "Comparative Analysis of Building Cost Budget Plans Using SNI and BOW Methods." Syntax Idea 6, no. 4 (2024). doi: https://doi.org/10.46799/syntax-idea.v6i4.3148
13. Prianto, Kusnul, and Mega Ayundya Widyastuti. "Analysis of Worker Productivity at Construction Projects in Highlands: A Case Study from the Development of Penanjakan Viewpoint at Bromo Tengger Semeru National Park in East Java." (2022). doi: https://doi.org/10.5220/000890440000481
14. Trost, Steven M., and Garold D. Oberlender. "Predicting accuracy of early cost estimates using factor analysis and multivariate regression." Journal of construction Engineering and Management 129, no. 2 (2003). doi: https://doi.org/10.1061/(ASCE)0733-9364(2003)129:2(198)
15. Rauzana, Anita, Abu Hassan Abu Bakar, and Mohamad Nizam Yusof. "The Influence of Uncertainty Variables on Cost Estimation Lesson Learned From Construction Industry in Indonesia." Australian Journal of Basic and Applied Sciences 9, no. 7 (2015). https://www.researchgate.net/publication/309320539
16. Dikmen, Irem, and M. Talat Birgonul. "A review of international construction research: Ranko Bon's contribution." Construction Management and Economics 24, no. 7 (2006). doi: https://doi.org/10.1080/01446190600601909
17. Santoso, Lalu Mulyadi, Tiong Iskandar, and Lies Kurniawati Wulandari. "Cost Escalation Analysis on The Western Indonesia National Road Improvement Project (WINRIP)." (2018). http://irjaes.com/wp-content/uploads/2022/04/irjaes-v7n2p128y22.pdf
18. Harianto, Feri, Mohamad FN Aulady, and Mila K. Wardani. "Productivity of Labor based on Labor Intensive Work for Small Group Contractors in Building Construction Projects in Surabaya, Indonesia." Indian Journal of Science and Technology 11 (2018). doi: https://doi.org/10.17485/ijst/2018/v11i40/131160
19. Basari, Khubab, Rendra Yoga Pradipta, Jati Utomo Dwi Hatmoko, and Arif Hidayat. "Analisa Koefisien Produktivitas Tenaga Kerja Pada Pekerjaan Pembesian." Jurnal Karya Teknik Sipil 3, no. 4 (2014). https://ejournal3.undip.ac.id/index.php/jkts/article/view/6427
20. Sukamto, Aulia Qur'anna, Saifoe El Unas, and M. Hamzah Hasyim. "Analisa perbandingan harga satuan pekerjaan beton bertulang berdasarkan SNI dan Software Ms Project." PhD diss., Brawijaya University (2014). https://media.neliti.com/media/publications/119128-ID-analisa-perbandingan-harga-satuan-pekerj.pdf
21. Sulistyawan, Abriyani. "Analisis kerja lembur dan produktivitas tukang batu pada proyek konstruksi." Jurnal Teknik Sipil, Fakultas Teknik Sipil–Universitas Diponerogo semarang 12, no. 3 (2007). https://www.scribd.com/doc/129396964/analisa-lembur
22. Lukmanasari, Srie Heruyani Stevia, and Biemo W. Soemardi. "Studi upah dan beban biaya pekerja konstruksi di Indonesia (Studi kasus: Pekerja konstruksi gedung di Pulau Jawa)." Media Komunikasi Teknik Sipil 22, no. 2 (2016). doi: https://doi.org/10.14710/mkts.v22i2.12876
23. Vamsidhar, K., D. A. Eshwarswaroop, K. Ayyappapreamkrishna, and R. Gopinath. "Study and rate analysis of escalation in construction industry." IOSR Journal of Mechanical and Civil Engineering 11, no. 2 (2014). doi: https://www.researchgate.net/publication/272712831
24. Badan Pusat Statistik Indonesia. Labor Force Situation in Indonesia (2024). Retrieved from https://www.bps.go.id/en/publication/2024/06/07/112a10c79b8cfa70eec9f6f3/labor-force-situation-in-indonesia-february-2024.html