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# NVA Waste Factors on Project Performance at The PT "XYZ" Warehouse Building, West Java, Indonesia

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**ABSTRACT:** NVA waste is a common activity in practically all construction projects and can affect the performance of those projects as a whole. In Cikarang, West Java, this also occurred in the PT "XYZ" Warehouse Building Project. The goal of this study was to ascertain how the performance of PT XYZ's warehouse construction project affected waste associated with Overproduction, Inventory, Defect, Motion, Transportation, Processing (Over processing), and Waiting. The study's findings indicate that there is a "medium correlation" between overproduction, inventory, defect, motion, transportation, processing (over processing), and waiting waste and project performance. The highest influence on total waste levels is exerted by transportation waste (0.653), waste defects (0.505), waste overproduction (0.436), waste inventory (0.335), waste waiting (0.223), waste over processing (0.175), and waste motion (0.054).

**KEY WORDS:** NVA Waste, Construction Performance, Correlation

## INTRODUCTION

Alwi et al. (2002) defined Non Value Adding Activities (NVA) as wasteful activities used to identify physical construction waste from other types of waste in the context of construction. According to their research, there are a number of non-value-adding activities carried out by construction firms in Australia and Indonesia. Design changes, a lack of trade skills, slow decision-making, poor coordination among project partners, ineffective planning and scheduling, delays in the delivery of materials to the project site, inappropriate construction techniques, poor design quality, poor site documentation, slow revisions and distribution of drawings, unclear site drawings, and vague specifications are a few examples of these NVA activities. In particular, NVA frequently happens in construction projects in Indonesia, including maintenance work, timetable delays, material waiting times, design revisions, insufficient worker skills, and delayed decision-making. It is crucial to remember that NVA does not add value but might negatively affect how well a building project performs.

Furthermore, according to Worcup (2016), just 10% of operations in the construction sector are value-added (VA), while 33% of activities are supporting activities (SA) and 57% are non-value-added (NVA). In comparison, the manufacturing sector shows a distinct mix, with roughly 62% of activities being value-added (VA), roughly 26% being non-value-adding (NVA), and roughly 12% being supporting activities (SA), as seen in Figure 1 below:

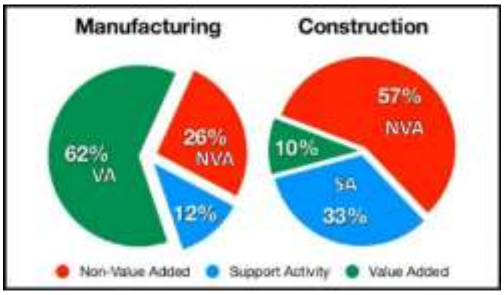


**Figure 1. Construction industry vs. Manufacturing industry (Worcup, 2016)**

Figure 2 above makes it clear how important it is to analyze Non Value Adding Activities (NVA) in the construction sector. Abdel Razek et al. (2007) and Hanna et al. (2005) both pointed out its detrimental effects on construction productivity as the reason for this. NVA activities, such as overtime work, are allotted nearly 49.6% of the construction execution time, which can negatively affect productivity and increase the risk of tiredness, incidents, and accidents, ultimately driving up project costs and delays (Horman and Kelley, 2005). According to Koskenvesa et al. (2010), ignoring NVA issues can negatively affect an organization's competitiveness as well as the productivity of the construction sector as a whole. As seen in PT "XYZ" Warehouse Building Project in West Java, Indonesia, these circumstances might impede the orderly progression of operations, adversely influencing the performance of building projects.

## NON VALUE ADDING (NVA) WASTE AND ITS IMPLICATIONS ON THE PT "XYZ" WAREHOUSE BUILDING PROJECT

Various forms of NVA waste and their accompanying examples were found in a prior study by Nurlaelah, titled "Analysis of NVA Waste in PT "XYZ" Warehouse Building Project, West Java, Indonesia," as shown in Table 1 below.

**Table 1. Types of NVA Waste in the PT "XYZ" Warehouse Building Project**

| No | NVA Waste | Examples of NVA Waste |
|---|---|---|
| 1 | Overproduction (Producing in larger and faster quantities than needed). | • Many wasted iron pieces for the construction of beams, poles/columns.<br>• Wasted cement, sand, and gravel mix for the foundation, poles, and beams. |
| 2 | Inventory (Excess testing, equipment, data storage, process inventory, and material and supplies more than needed). | • Accumulation of excavated soil in some corners, causing the project site to be untidy.<br>• Piling up construction materials in the warehouse without proper organization. |
| 3 | Defect (Products produced not according to specifications). | • Some parts of the building are damaged, such as cracked walls, peeling paint, and others.<br>• Cracked and lifted floor tiles in several locations.<br>• Wooden and aluminum doors and windows are dragging.<br>• Damaged door and window accessories. |
| 4 | Motion (Unnecessary movement of operators from one task to another, or from one place to another). | • Endless meetings by owner and contractor.<br>• Errors and delays in ordering materials from the supplier.<br>• Workers taking excessively long breaks.<br>• Workers Using mobile phones excessively during work. |
| 5 | Transportation (Unnecessary movement of materials or equipment). | • The transfer of excavated soil to another location is hindered due to insufficient equipment.<br>• The transfer of foundation and beam materials (blocks, cement, sand, gravel, iron) is hindered due to inadequate equipment and lack of logistics personnel managing the inflow and outflow of materials in the warehouse. |
| 6 | Processing (Non-value-added processing activities on the product). | • Slow progress of work.<br>• Incorrect or delayed exchange of information.<br>• Inaccurate measurements were made for constructing beams, poles/columns, resulting in numerous wasted iron or steel pieces.<br>• Design changes requested by the owner.<br>• Inaccurate measurements were taken for the casing and plywood used for temporary formwork.<br>• Rework in several parts of the building. |
| 7 | Waiting (Waiting due to weak management, planning, and monitoring of materials and workflow). | • Administrative issues originating from the owner.<br>• The foreman waiting for information from the contractor, and the contractor waiting for information from the owner.<br>• Workers waiting for work instructions from the foreman.<br>• Workers waiting for materials from the storage warehouse. |

**Source:** Nurlaelah (2023)

Seven of the previously listed NVA waste elements have the potential to have an impact on how well the PT "XYZ" warehouse building project performs. This is in line with the assertion stated by Ismail and Yusof (2016) that non-value-adding activities would directly impact the construction process and project but may be prevented by correctly carrying out work, close monitoring, regulating, and planning. Every person engaged in the construction process has the capacity to add to NVAAs and therefore influence the process. NVAAs can therefore be defined as activities that involve the expenditure of money, time, resources, labor, and space but bring no value to any of the parties involved in the process.

Non Value Adding Activities (NVAA) have negative consequences on building projects in a variety of ways, according to Imimole (2018). It is clear that the majority of the construction projects under investigation experience large cost overruns due to NVAA-related rework. This, in turn, may negatively influence an organization's ability to compete and, as a result, the industry's overall productivity. In the past, Hanna (2005) claimed that the NVAA has a detrimental impact on performance, increases fatigue and accidents, and ultimately raises project costs and schedules. As a measure of a project's success, construction performance is a significant factor to take into account.

Thanks to the efforts of researchers in the field of construction management, who sought to increase the efficacy and efficiency of projects, performance parameters in construction have evolved. According to Olawale (2010), a project is deemed successful if it is finished on schedule, on budget, and to the required level of quality. On the other hand, time, cost, the quality target, and participant satisfaction are the main metrics for gauging a construction project's overall success, according to Dissanayaka and Kumaraswamy (1999). According to Pitagorsky (1998), successful projects maintain and improve healthy relationships among project stakeholders while also satisfying their clients and sponsors by fulfilling their goals within the limits of time and budget. Consequently, (Egwunatum, 2017) There appears to be broad consensus in the subsequent literature reviewed above that of the three (3) criteria for evaluating project performance, time and cost seem to be a key indicator, while the other, quality, being a subjective parameter calls for a psychological evaluation. However, schedule and expense overruns are a direct result of poorly planned and executed building projects. Hereafter, a review of the industry's standard approach for contract awarding becomes necessary.

## RESEARCH METHOD

In order to investigate the effects of NVA waste on project performance, this research was carried out on the PT "XYZ" warehouse project in Cikarang, West Java, as described in the following research framework.

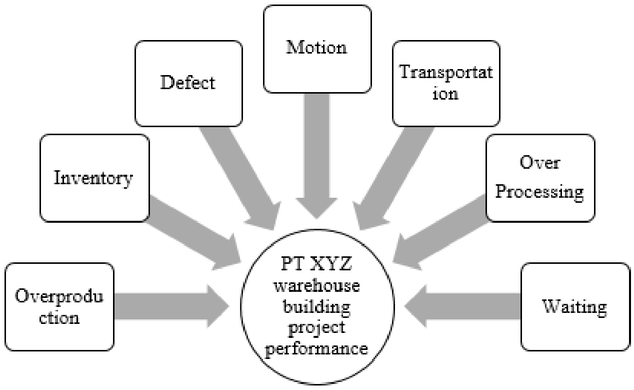


**Figure 2. Research Framework**

The research hypothesis proposed is:
Ho: The performance of the PT "XYZ" warehouse building project is not significantly impacted by waste overproduction, inventory, faults, motion, transportation, overprocessing, or waiting.
Ha: The performance of the PT "XYZ" warehouse building project is significantly influenced by waste overproduction, inventory, faults, motion, transportation, overprocessing, and waiting.

Meanwhile, for decisions taken, follow the rules:

- If the F Change sig value is > 0.05, it means it is correlated
- If the F Change sig value is <0.05, it means it is not correlated
- If the sig t value > 0.05, Ho is rejected, it means there is a significant influence between one independent variable and the dependent variable.
- If the sig t value < 0.05, Ho is accepted, meaning that there is no significant effect between one independent variable on the dependent variable.

To support this hypothesis, 33 research participants, including 4 contractors, 8 foremen, 6 field supervisors, 6 supervisory consultants, 7 planning consultants, and 2 owners, were distributed questionnaires as part of the study's methodology. Correlation analysis were performed as part of the analysis using SPSS statistical analysis tools. Variable X is used to represent the NVA variable, which includes elements like overproduction, inventory, defect, motion, transportation, over processing, and waiting. Variable Y, meanwhile, denotes PT "XYZ" warehouse building project performance.

## FINDINGS AND DISCUSSION

Based on the answers of 33 respondents and analyzed using SPSS statistics, the results are as shown in the following Figure 3.

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .510[a] | .260 | .053 | .76240 | .260 | 1.255 | 7 | 25 | .312 |

a. Predictors: (Constant), Waste Waiting, Waste Motion, Overprocessing, Waste Inventory, Waste Overproduction, Waste Defect, Waste Transportation

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 5.105 | 7 | .729 | 1.255 | .312[b] |
| | Residual | 14.531 | 25 | .581 | | |
| | Total | 19.636 | 32 | | | |

a. Dependent Variable: PT XYZ warehouse building project performance

b. Predictors: (Constant), Waste Waiting, Waste Motion, Overprocessing, Waste Inventory, Waste Overproduction, Waste Defect, Waste Transportation

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 16.711 | 3.649 | | 4.580 | .000 |
| | Waste Overproduction | -.243 | .307 | -.151 | -.791 | .436 |
| | Waste Inventory | -.306 | .311 | -.191 | -.983 | .335 |
| | Waste Defect | -.317 | .468 | -.134 | -.677 | .505 |
| | Waste Motion | -.408 | .201 | -.407 | -2.027 | .054 |
| | Waste Transportation | .113 | .248 | .096 | .455 | .653 |
| | Overprocessing | -.259 | .186 | -.248 | -1.396 | .175 |
| | Waste Waiting | -.433 | .347 | -.258 | -1.250 | .223 |

a. Dependent Variable: PT XYZ warehouse building project performance

**Figure 3. SPSS statistical analysis results**

The summary results show that there is a contemporaneous correlation between the performance of the PT "XYZ" warehouse building project and waste overproduction, inventory, defects, motion, transportation, processing (over processing), and waiting, with the sig F value being 0.312 > 0.05.

While being at the "Moderate Correlation" level, the R value was 0.512.

Each waste factor's significance value for the estimated t value varies, but generally speaking, it has a significance value > 0.05, indicating that it has an impact both separately and concurrently.

The most significant waste is transportation waste (0.653), followed by waste defects (0.505), waste overproduction (0.436), waste inventory (0.335), waste waiting (0.223), waste over processing (0.175), and waste motion (0.054).

Graphically (Fig 4), the ranking of waste that influences the performance of the PT "XYZ" warehouse building project is:

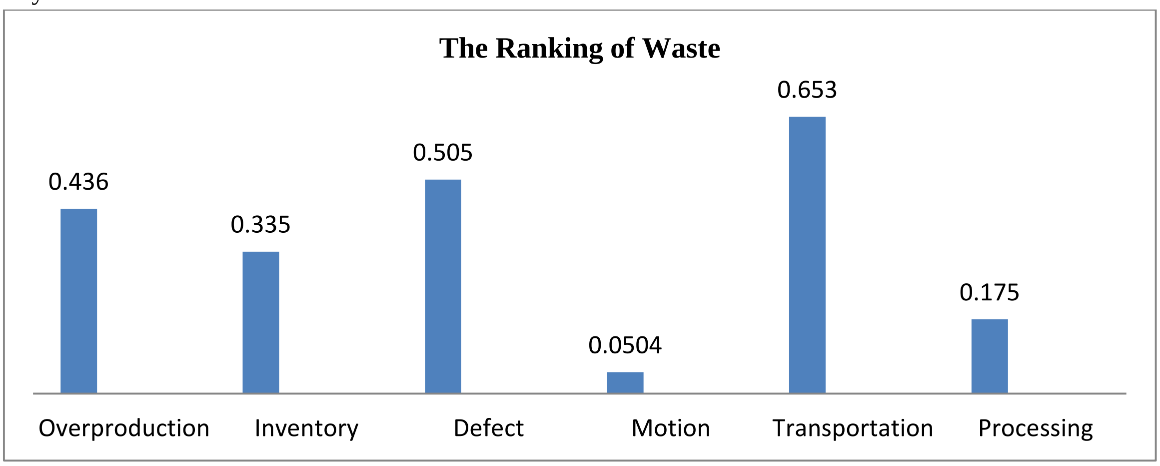


**Figure 4. The Ranking of Waste that Influences The Performance of The PT "XYZ" Warehouse Building Project**

According to the ranking above, waste motion comes in last and has the least impact on the performance of the PT "XYZ" warehouse building project. Next in line are waste defects, waste overproduction, waste inventory, waste processing (over processing), and waste motion. So that the first thing that must be repaired and evaluated by the contractor is the problem of waste transportation.

Even though the first rank is waste transportation, the parties involved in the construction process should not ignore this matter. All parties involved in its construction, including owners, consultants, and contractors, can make use of the level of waste ranking that influences the performance of PT XYZ's warehouse building project. Despite the fact that transportation waste ranks first among other types of waste, all sorts of waste are produced. Overall project performance may suffer as a result.

Performance deterioration in the construction sector is currently a significant issue, as highlighted in research by Robinson, et al. (2002). There was tangible and intangible building waste present, which contributed to this decline. Due to the fact that construction workers frequently do not comprehend waste, according to Alwi et al. (2010), this issue is widespread in the industry. Most waste-related activities, also known as activities, pertain to the two forms of trash. Non-value added activities, as defined by Senaratne and Wijesiri (2008), are frequently hidden from view, as emphasized by Tanskanen, et al (1997).

The majority of the time in the construction process is spent on ineffective tasks, according to a number of analysts, including Horman and Kenley (2005) and Mossman (2009). As a result, Alarcón (1997) suggested that we combine a strategy of detecting and decreasing waste with a strategy of generating added value. Furthermore, Formoso, et al. (2002) stressed the significance of waste measurement in the management of production systems, pointing out that it can be a useful tool for evaluating performance and locating areas that have the potential for improvement.

## CONCLUSION

However, it must be remembered that the study's findings pertain to waste that develops during PT XYZ's warehouse construction project in West Java, Indonesia. Each building project will produce waste at a different level, hence this will vary. This is because each project is unique in its nature and qualities, depending on the location of the construction project. In order to identify waste for each project and provide the best potential project performance, a thorough study is required.

## FURTHER RESEARCH

This research provides valuable information for the stakeholders involved in it, especially in warehouse building projects. However, a more in-depth study is needed for projects with certain classifications, such as housing projects, high-rise buildings, infrastructure, and others. So it can become valuable knowledge regarding waste that occurs in this construction project group.

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