International Journal of Research and Review
Vol.7; Issue: 9; September 2020
Website: www.ijrrjournal.com
Research Paper E-ISSN: 2349-9788; P-ISSN: 2454-2237

The Effect of Waste Material Based on Lean Construction on the Performance of the Retail Building Project

Rahmad Hidayat Saputra[1], Syafwandi[2]

[1]Students of the Masters Program in Construction Management at Mercu Buana University, Jakarta, Indonesia.
[2]Lecturer of the Masters Program in Construction Management at Mercu Buana University, Jakarta Indonesia.
[1,2]Master of Civil Engineering Program, Mercu Buana University, Jakarta 11650, Indonesia.

Corresponding Author: Rahmad Hidayat Saputra

ABSTRACT

This study aims to provide suggestions for project management using the Lean Construction concept that is applied to waste materials in order to increase the reliability of project planning. The IKEA - KBP (Kota Baru Parahyangan) building construction project is the construction of a home product sales service network originating from Sweden, the company was founded by Ingvar Kamprad since 1943. In the IKEA - KBP (Kota Baru Parahyangan) building construction project, a problem has been found. in the construction process, such as changes in project drawings, changes in specifications, inadequate storage areas, and other technical problems in the field that cause large waste material and can have an impact on project cost losses that exceed planned.
The main problem that will be studied is the effect of the lean construction concept on the factors causing the waste material to occur in the project. Project waste material will be a problem and cause project cost overruns if it is not immediately anticipated. Waste material in the project occurs due to various factors, such as many design changes, poor management of the project, natural and environmental factors, estimation error factors, labor factors and other factors.

Keywords: Lean Construction, Waste Material, Cost, Project management.

I. INTRODUCTION

A construction project, whether in the form of a building construction project, road, bridge or other construction, has a fairly long process. This long process often creates problems, especially in terms of supervision and control. The performance of a project will not run well if it is not carried out, and will result in cost overruns and delays in the process of completing a project. This of course will be detrimental to the construction company or the project owner or owner. Therefore a project control system is needed so that the project implementation process can run well, on time and on cost and in accordance with the planned technical specifications.

Construction project development involves many parties, various processes, different phases and stages of work and input from two sectors, namely the government and the private sector, with the main objective of project success. Construction projects are mostly unique in that they are customizable; no project is the same because each project adapts a workplace environment with a specific function, design or preference. Construction is a complex system because of the involvement of many parties from the pre-contract stage to the post-contract stage in the construction process; this will cause problems that will affect the performance of project completion.

According to Abushaban (2008), the failure of a construction project is closely related to problems and failures in performance. There are many construction projects that fail against cost performance, quality performance and time performance and against other performance indicators. The success of a construction project is highly dependent on the success of its performance. A project is considered successful if it is completed within the budget, on time and on the specified quality standards.

Project performance problems include the occurrence of excess costs, long delays from the planned schedule, serious problems in quality as well as an increase in the number of claims and litigation related to construction projects. Project condition factors in the form of factors causing cost overrun, time overrun, and quality failure that affect project performance have been identified in various countries and regions in Indonesia.

As mentioned above, the construction of a construction project also has the same target, namely the completion of the project in accordance with predetermined costs, time and specifications so that it can be accepted by the stakeholders involved in the project.

In the implementation of construction projects, there are many projects experiencing cost overruns and delays in time, even from previous researchers it was stated that eight out of ten projects experienced cost overrun. Time overrun, cost overrun and quality failure will cause losses both internally and externally. Therefore it is necessary to know the effect of project conditions on project performance in order to achieve the success of a construction project.

The IKEA - KBP (Kota Baru Parahyangan) building construction project is the construction of a home product sales service network originating from Sweden, the company was founded by Ingvar Kamprad since 1943. In the IKEA - KBP (Kota Baru Parahyangan) building construction project, many problems in the construction process, such as the amount of waste material that arises due to factors from frequent changes in drawings, changes in specifications, and other factors. Problems like this can have an impact on decreasing the resulting project performance so that it will cause losses in the form of increased costs and project implementation time which will be delayed than planned.

Here, the researcher will identify problems that result in the poor performance of a construction project so that there is a need for a method or concept for good construction project management so that the project performance can be achieved properly. The main problem that will be studied is the lean construction-based waste material on the project's performance. Project waste material will be a big problem and cause project cost overruns if it is not immediately anticipated.

II. LITERATURE REVIEW

2.1 Project Performance

Project performance is how the project works by comparing the actual work results with the estimated way of working on the work contract agreed upon by the owner and the implementing contractor. Soeharto gave an example where it could happen that in the report an activity in a project went ahead of schedule as expected. However, it turns out that the costs incurred exceed the budget. If control measures are not taken immediately, it may result in the project not being completed in its entirety due to lack of funds.

The definition of performance is often interpreted as a result or work performance. Performance has a broader meaning, not only as a result of work, but also how the work process takes place. Performance is about what to do and how to do it. Performance is the result of work that has a strong relationship with the organization's strategic goals, customer satisfaction, and contributes to the economy (Manlian, 2014).

Measurement of project performance can be seen from indicators regarding cost performance, quality performance, time performance and work safety performance by planning in a detailed, thorough, and integrated manner throughout the allocation of human resources, equipment resources, material resources and costs according to the needs. required. All of that is aligned with the aims and objectives of the project.

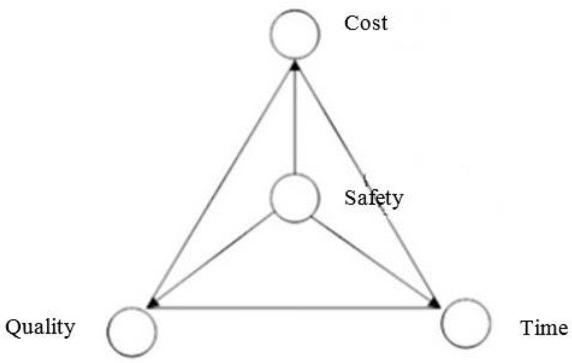

Figure 1. Benchmark of Project Performance

For optimal results, the project performance standards during the process must be set as detailed and accurate as possible to minimize deviation. Cost, quality, time and work safety as shown in the picture above is a measure of project performance in achieving project goals and objectives. The most important achievement optimization is work safety, because if this factor is ignored it can affect cost, quality and time performance, which can further result in material and life losses.

a. Cost Management

The entire sequence of project activities needs to have a project cost performance standard that is made accurately by creating a planning format as below:

1. The S curve, besides being able to know the time progress of the project, the S curve is also useful for controlling cost performance; this is shown from the weight of the cumulative expenditure of each activity which can be controlled by comparing it with the baseline for a certain period according to the actual progress of the project.
2. Cash Flow Diagram, a diagram that shows the planned flow of expenses and income during the project. This diagram is expected to control the overall project cost in detail so as not to disturb the project cash balance.
3. Earned Value curve which states the value of money that has been spent on a certain baseline in accordance with the actual progress of the project. If there are indications that the costs incurred exceed the plan, then the costs are corrected by rescheduling and predicting how much costs will have to be incurred until the end of the project due to these deviations.
4. Balance Sheet, which states the amount of financial assets and liabilities of the company during the period of one year with all the projects that have been carried out and the assets owned by the company.

These four things are made in the periodic report with the intention that from time to time it can be evaluated and controlled and become a reference in making decisions related to corrective actions in the event of deviations.

b. Quality management

Quality assurance can be obtained by carrying out a process based on predetermined material or work criteria until the final product standard is obtained, or by carrying out a work procedure process in the form of a quality system to obtain a quality system for the final product. Control of each process (quality control) is intended to ensure the quality of the material or work obtained in accordance with the goals and objectives set.

Getting a good quality performance standard can be done by adopting several quality planning and control systems as described below implementing the ISO 9000 Quality Management System by carrying out procedures as part of the entire system to get the final product as planned. The basic principles that are carried out are making and writing a plan (say what you do), implementing and controlling according to the plan (do what you say) and recording what has been done (record what you did). In this ISO 9000 quality management system, several quality system documents are also created, as described below:

1. Quality Manual, contains policies relating to the commitment to implementation, achievement and fulfillment of the requirements of the ISO 9000 quality system standard. Quality Procedure, a description of a work process which consists of a series of activities and involves many functions. Procedures can serve as guidelines for how to work and as a means to assess the effectiveness of the quality system that is made.
2. Work Instructions, describe the detailed steps of an activity contained in the procedure and involve one function only and usually include the forms of flowcharts, forms and reports.
3. ISO 9000 Quality Management System consists of 19 elements with groups of key elements such as: Role of Management, Control of Process, Verification, Relations with External Parties.

Each of the elements described in the quality system document as described above is adjusted to the description of activities that exist in the project. In order for the continuity of the quality system management program to run, an internal audit function is carried out by the company as well as an external audit by the certifying company which is carried out periodically. In construction projects, the application of a quality system using ISO 9001 is carried out by meeting the requirements and procedures for its elements, such as: Management Responsibility, Quality System, Contract Review, Design Control, Document and Data Control, Purchasing, Product Control, Product Identification and Traceability. , Process Control, Inspection and Testing, Control of Inspection Mat, Measure and Test, Inspection and Test Status, Control of Non-conforming Products, Correction and Prevention Measures, Handling, Storage, Packaging, Preservation and Delivery, Quality Record Control, Internal Quality Audit, Training, Service, Statistical Engineering.

1. Meanwhile, to complete the quality system requirements above in order to obtain the best quality against the final product standard, it is done by making detailed and accurate work drawings, then making general and technical specifications of the work and materials used.
2. For control during project implementation, the material delivery schedule must be on time, the material storage process is safe and protected, in addition to a standard operating procedure format that follows the specified specifications in the use of the material.
3. Complementing quality performance control can be done by making procedures and work instructions from total quality control (Integrated Quality Control), namely by carrying out planning activities (plan), implementation (do), inspection (check), corrective action (corrective action). Data and information used as references in making quality control decisions are as follows :

a. Examination format, containing data and results of the assessment.
b. Evaluation sheet format and deviation correction action.
c. A histogram diagram, which shows the frequency with which problems have occurred according to the corrective action taken.
d. Curves and control charts with predefined quality baselines, such as linear curves, pie charts, and so on.

2.2 Lean Construction

The lean concept itself is the result of lean thinking which was popularized by Toyota's Chief Engineer, Taiichi Ohno in the Toyota Production System. This concept itself was born after Ohno conducted a comparative study to review the production system applied at Ford. In contrast to Ford, which placed restrictions on product demand, Ohno carried out production activities when the order was available. In other words, striving for warehouse or storage locations to be empty and as a consequence, productivity performance must run effectively, so that the goods can be received by consumers on time. One of the main keys of the "Lean" principle as written in the "Toyota Production System" is the identification of activities into two groups, namely activities that provide added value and activities that are not necessary (wasteful). By identifying each activity involved, activities that benefit consumers can be increased, while activities that are waste can be reduced. Jobs that fall into this category of waste are then classified into two types, 'needs to be done but non-value adding or waste (must be done, but does not provide value or waste) and pure waste.

Howell (1999) [18] states that Lean Construction accepts Onho's production system design criteria as the standard of excellence. It is common opinion that the goal of lean is waste elimination. Many literature reviews do not show support for this as the “main goal”, but the problem of waste is an important aspect of the lean concept (Pettersen, 2008).

Lean construction, as defined by the Lean Construction Institute (LCI), is a production system whose management-based implementation emphasizes confidence and speed of value completion. The purpose of lean construction is to build projects as well as provide value, minimize waste and achieve excellence for the benefit of all stakeholders (Pinch, 2005). According to Koskela (1992), traditional managerial principles have considered conversion only, or all activities have been treated as if they were value added conversion. Due to traditional managerial principles, process flow is not controlled or improved on a regular basis. This has led to complex, uncertain and confused process flow, expansion of non-value added activities and reduction in output value.

According to Koskela (1992), production is the flow of material and / or information from raw materials to final products. In this flow, the material that is processed (converted), it is checked, it is waiting or moving. This activity is fundamentally different. Processing is an aspect of production conversion, checking, moving and waiting represents aspects of production flow. Process flow can be characterized by time, cost and value. Value refers to meeting customer needs. In most cases, processing activities are only value added activities. For material flow, processing activities change form or substance, assembly and disassembly (Koskela, 1992).

An analysis of the failure to the project plan shows that "normally only about 50% of the work on the weekly work plan is completed by the end of the planned week" and therefore, the contractor should be able to reduce these many problems. One way to do this is by using a variety of management activities, starting from project structure activities (temporary production systems) which are continued to improving performance and operations (Ballard and Howell, 2003).

Evidence from these studies and observations shows that a conceptual construction management model (work breakdown structure, critical path method and earned value management) has deficiencies in describing projects that are "on time, on budget and at the desired quality" (Abdelhamid, 2004). There is a deficiency in the theory of schedule compression in the form of crashing schedules and fast tracking and based on the bad experience in the project regarding the existence of a quality problem that is endemic and causes disputes, it is clear that the principles of construction management need to be reviewed (Mukhyi, 2008). .

In the end, all the consequences of sustainable construction will increase construction costs quite significantly from 5% to 10% (Smith, 2006). This of course will make the concept of sustainable construction unattractive to implement. On the other hand, in general, the construction industry is still struggling with the problem of inefficiency in the implementation of its construction process. There is still too much waste in the form of activities that use resources but do not produce the expected value (value). Based on data submitted by the Lean Construction Institute, waste in the construction industry is around 57% while activities that provide added value are only 10%. When compared with the manufacturing industry, the construction industry must learn a lot from the manufacturing industry in managing its production process, so that the amount of waste can be reduced while simultaneously increasing the value obtained (Koskela, 1992).

There are many activities that are not needed during the construction process, namely activities that require extra time and effort without added value for the project owner (Love, 1996). Since the early stages of a construction project, the construction manager should involve all the factors that may have a negative impact on the construction process, namely waste which includes delay, cost, quality, lack of construction safety, rework, unnecessary movements, long distances, management selection. wrong, inadequate methods or tools and constructability (Serpel et al, 1995; Koskela, 1992; Ishiwata, 1997; Alarcon, 1993). Meanwhile, according to data from the Construction Industry Board, waste includes technical or non-technical errors, working out of sequence, repetitive activities and movements, late or premature input and products or services that are not in accordance with the requirements of the project owner.

2.3 Material Waste Project

According to Franklin (1998), material waste in a construction project is material that is not used, as a result of the construction, repair, or change process. Waste in the form of this material is also defined as goods that appear as a result of production from a process or an accident that cannot be immediately reused without any further treatment. Another definition of waste in the form of material is a material resource that is in excess or has been used, including those that can be reused, can be recycled, can be returned to the supplier, or transferred to a place that can be reused by others.

According to Illingworth (1998), the residual construction material is defined as something that is in excess of what is required, either in the form of work or construction material that is left over, scattered, or damaged so that it cannot be used anymore according to its function. Material is one of the important components that has a fairly close influence on the cost of a project, so with a large amount of construction material left over, it can be ascertained that there will be swelling in the financing sector.

In its implementation, construction requires resources, including labor resources, materials, tools and money. The use of these resources needs to be managed in order to achieve high efficiency in order to achieve certain targets. The purpose of resource management is to reduce / control project costs, which in essence are controlling the productivity of equipment resources, manpower and controlling the level of waste for materials, as well as controlling the cost of money from money resources.

According to Asiyanto (2005), construction waste can occur due to various reasons, namely:

1. **Shrinkage of the quantity**

Shrinkage of the quantity can occur during transportation to the site and at the time of unloading the material to be placed in a warehouse or stockpile location. Shrinkage of quantity can also occur in the process of moving material from one place to another within the project site, especially for loose materials such as sand and gravel.

2. Quantity rejected

Inaccurate acceptance of material on-site may result in the rejection of some materials that do not meet quality, shape, color and other requirements.

3. Quantity broken

Poor material storage can cause damage, especially for materials that are heavily influenced by environmental conditions (temperature, humidity, pressure, etc.). Material damage can also occur due to improper picking, transporting, lifting and installation activities.

4. Missing quantity

Materials that are easily sold in the market or that are widely needed by the community (such as cement and others) are prone to loss due to theft. A weak security system with a weak control system will increase the possibility of losing these materials. Fictitious material (the quantity is there but the physical material is not there), is included in the missing quantity group.

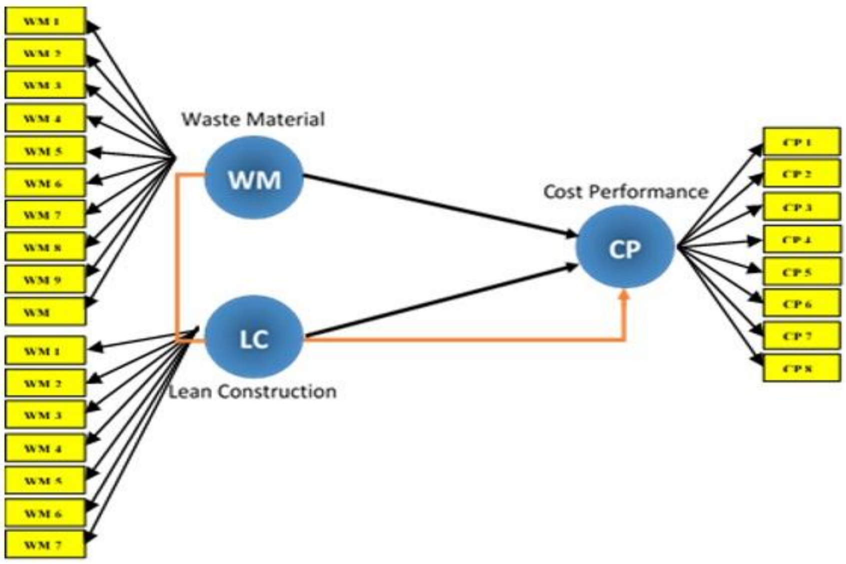

Figure 2. Model Of The Effect of Lean Construction-Based Waste Material On Project Cost Performance

5. Quantity due to overuse

This type of waste is usually carried out by executors who use the material directly, this waste can also be caused by over-method, over-quality or inaccuracy about size / dimensions, so that the dimensions of the work that occur are larger than the picture. The overuse of materials can also be caused by less efficient methods and also due to rework that occurs.

III. RESEARCH METHODOLOGY

3.1 Research Type

This research is included in explanative research (Esplanatory Research). Explanative research is research that is used to obtain data from a certain place, but the researcher performs treatment in data collection, for example distributing questionnaires, tests, interviews and so on. (Sugiyono, 2017). here procedure/technique of your research study.

3.2 Data Analysis Technique

This study uses the Partial Least Square (PLS) analysis technique with the SmartPLS 3.0 program. The following is a schematic of the PLS program model being tested:

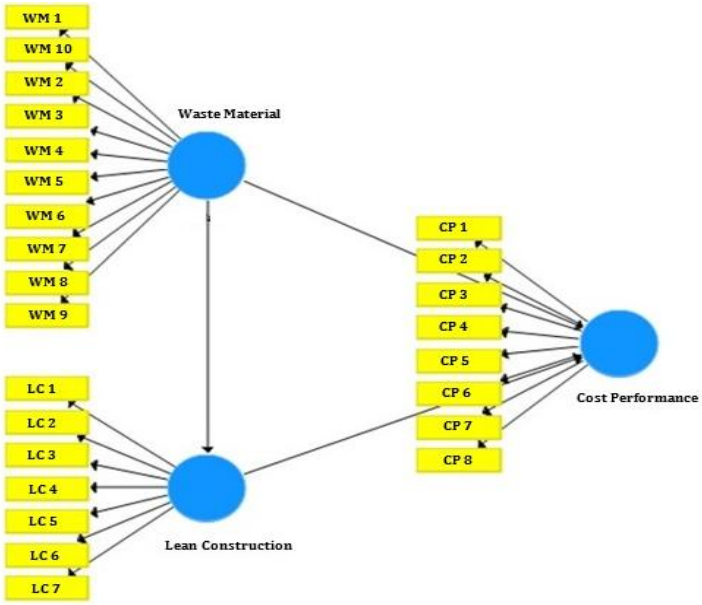

Figure 3. Theoretical Model of the Relationship Between the Effect of Lean Construction-Based Waste Material on Project Cost Performance

IV. RESULT & DISCUSSION

4.1 Evaluate the Outer Model

To test the convergent validity, the outer loading or loading factor value is used. An indicator is declared to meet the convergent validity in the good category if the outer loading value is > 0.7. The following is the outer loading value of each indicator in the research variable :

Table 1. Outter Loading

Indicator	Cost Performance	Lean Construction	Waste Material
CP1	0.849		
CP2	0.706		
CP3	0.833		
CP4	0.650		
CP5	0.773		
CP6	0.419		
CP7	0.837		
CP8	0.817		
LC1		0.769	
LC2		0.752	
LC3		0.817	
LC4		0.864	
LC5		0.835	
LC6		0.866	
LC7		0.872	
WM1			0.749
WM10			0.828
WM2			0.768
WM3			0.847
WM4			0.778
WM5			0.860
WM6			0.832
WM7			0.856
WM8			0.895
WM9			0.894

Based on the data presented in table above, it is known that each indicator of many research variables has an outer loading value of> 0.7. However, it appears that there are still several indicators that have outer loading values <0.7. According to Chin, as quoted by Imam Ghozali, the value of outer loading between 0.5 - 0.6 is considered sufficient to meet the convergent validity requirements.

4.2 Evaluate the Inner Model

This research will explain the results of the path coefficient test, the goodness of fit test.

4.3 Path Coefficient Test

Path coefficient evaluation is used to show how strong is the effect or influence of the independent variable on the dependent variable. Meanwhile, coefficient determination (R-Square) is used to measure how much the endogenous variable is influenced by other variables. Chin stated that the R2 result of 0.67 and above for endogenous latent variables in the structural model indicates that the effect of exogenous variables (which influence) on endogenous variables (which are influenced) is in the good category. Meanwhile, if the result is 0.33 - 0.67, it is in the medium category, and if the result is 0.19 - 0.33 it is in the weak category.

Table 2. Path Coefficient

Indicator	Cost Performance	Lean Construction	Waste Material
Cost Performance			
Lean Construction	0.647		
Waste Material	0.145	0.489	

Based on the inner model scheme that has been shown in table above, it can be explained that the largest path coefficient value is indicated by the effect of lean construction on cost performance of 0.647. Then the second biggest influence is the effect of waste material on lean construction of 0.489 and the smallest effect is the effect of waste material on cost performance of 0.145.

Based on the description of these results, it shows that all variables in this model have a path coefficient with a positive number. This shows that the greater the path coefficient value on one independent variable on the dependent variable, the stronger the influence between the independent variables on the dependent variable.

Model Goodness Test (Goodness of Fit), based on data processing that has been done using the SmartPLS 3.0 program, the R-Square value is obtained as follows :

Table. R-Square Value

Indicator	R Square	R Square Adjusted
Cost Performance	0.531	0.522
Lean Construction	0.239	0.232

Based on the data presented in the table above, it can be seen that the R-Square value for the lean construction variable is 0.239. The acquisition of this value explains that the percentage of the amount of lean construction can be explained by the waste material of 23.9%. Then for the R-Square value obtained by the cost performance variable is 0.531. This value explains that the cost performance can be explained by waste material and lean construction by 53.1%.

The goodness of fit assessment is known from the Q-Square value. The value of Q-Square has the same meaning as coefficient determination (R-Square) in regression analysis, where the higher the Q-Square, the model can be said to be better or more fit with the data. The results of the calculation of the Qsquare value are as follows :

Q-Square = 1 – [(1 – R21) x (1 – R22)]
= 1 – [(1 – 0,239) x (1 – 0,531)]
= 1 – (0,761 x 0,469)
= 1 – 0,357
= 0,643

Based on the results of the above calculations, the Q-Square value is 0.643. This shows the large diversity of research data that can be explained by the research model is 64.3%. While the remaining 35.7% is explained by other factors that are outside of this research model. Thus, from these results, this research model can be stated as having a good goodness of fit.

4.4 Hypothesis Testing

Based on the data processing that has been done, the results can be used to answer the hypothesis in this study. Hypothesis testing in this study was carried out by looking at the T-Statistics value and the P-Values value. The research hypothesis can be stated as accepted if the T-table value is 1.98 and the P-Values < 0.05. The following are the results of hypothesis testing obtained in this study through the inner model :

Table. T-Statistics and P-Values

Hypothesis	Influence	T Statistics (|O/STDEV|)	P Values	Result
H1	Waste Material → Cost Performance	2.216	0.027	Received
H2	Lean Construction → Cost Performance	9.558	0.000	Received
H3	Waste Material Based Lean Construction → Cost Performance	3.873	0.000	Received

Based on the data presented in table above, it can be seen that of the three hypotheses proposed in this study, all of them are acceptable because each of the effects shown has a P-Values value < 0.05. So that it can be stated that the independent variable to the dependent has a significant effect.

V. CONCLUSION & SUGGESTION

5.1 Conclusion

The results of this study provide an overview of the relationship between waste material control and the application of the lean construction concept to the cost performance of retail building projects. Based on the discussion in chapter 4, and answering the objectives of this study, the conclusions are as follows:

1. The effect of the waste material variable on the project cost performance is shown in table T-Statistics and P-Values, so there is a significant effect of waste material on cost performance. In other words, the higher the waste material control, the higher the project cost performance.
2. The influence of the lean construction variable on cost performance is shown in table T-Statistics and P-Values, so there is a significant effect of lean construction on cost performance. In other words, the higher the lean construction implementation, the higher the project cost performance.
3. The influence of the lean construction-based waste material variable on cost performance is shown in table T-Statistics and P-Values, so there is a significant effect of lean construction-based waste material on cost performance. In other words, the higher the lean construction-based waste material control, the higher the project cost performance.

From the research, it is found that the waste material based on lean construction has an effect on the cost performance of retail building projects

5.2 Suggestion

1. It is necessary to develop research by reviewing other factors that affect the cost performance of retail building projects, so that the contractor company is expected to be able to create an advantage in competition.
2. It is suggested for future researchers to look more broadly at project performance, namely cost performance, quality performance and time performance.
3. It is suggested that in future studies more for the selection of respondents whose presentation is more evenly distributed among contractors, consultants, and project owners in order to have multiple assessments of the construction project performance variables.

REFERENCES

1. Abduh, M., dan Roza, H.A. (2006). Indonesian Contractors' Readiness towards Lean Construction, Proceedings of the 14th Annual Conference of International Group for Lean Construction, Santiago, Chile.
2. Abduh, Muhamad. (2005). Makalah Konstruksi Ramping : Memaksimalkan Value dan Meminimalkan Waste. Fakultas Teknik Sipil dan Lingkungan, Institut Teknologi Bandung.
3. Alarcon, L.F. (1995). Training field personnel to identify waste and improvement opportunities in construction. In: L.F. Alarcon, ed. Lean Construction. Rotterdam: A.A. Balkema, 391-401.
4. Alwi, S., Hampson, K., Mohamed, S. (2002). Non Value-Adding Activities: A Comparative Study of Indonesian and Australian Construction Projects, Proceedings of the 10th annual conference of the IGLC, Gramado, Brazil.
5. Azwar, Saifuddin. (2006). Reliabilitas dan Validitas, Penerbit Pustaka Pelajar, Yogyakarta, hal.4, 5.
6. Ballard, G. (1999) Improving work flow reliability, Proc., IGLC-7, 7th Conf. Int.

Group for Lean Construction, Univ. California, Berkeley, CA., 275-286.
7. Ballard, G. H. (2000). The Last Planner System of Production Control, Ph.D. Thesis. Faculty of Engineering. School of Civil Engineering, The University of Birmingham.
8. Ballard, G., and Howell, G. (2003) An update on Last Planner, Proc., IGLC-11, 11th Conf. of Int. Group for Lean Construction, Blacksburg, VA
9. Bungin, Burhan. (2008). Metodologi Penelitian Kuantitatif : Komunikasi, Ekonomi, dan Kebijakan Publik serta Ilmu-ilmu Sosial Lainnya, Penerbit Kencana, Jakarta, hal.36, 168.
10. Cooke, B., Williams, P., 2004. Construction planning, programming & control. UK: Blackwell.
11. Dos Santos, A., Powell, J., Sharp, J., Formoso, C. (1998). Principle of transparency applied in construction, Proc. Of the Annual Conf. (IGLC-6) by C. Formoso (ed). 6th Conf. of Int. Group for Lean Construction, Guarujá, Brazil, 16-23.
12. Egan, J. (1998). Rethinking Construction: Report of the Construction Industry Task Force. London.
13. Gaspersz, V., & Fontana, A. (2011). Lean Six Sigma for Manufacturing and Service Industries Waste Elimination and Continous Cost Reduction, Bogor : Vinchristo Publication
14. Hirano, H. (1996). 5S for Operators: 5 Pillars of the Visual Workplace, Productivity Press, Portland, OR.
15. Howell, G. A., 1999. What is lean construction. IGLC (International Group of Lean Construction) 7th Theory 1.Idaho, USA, 26-28 July.
16. Howell, Gregory and Glenn Ballard (1994a). Lean Production Theory: Moving Beyond 'Can-Do', Proc. Conference on Lean Construction, Santiago, Chile. September, 1994.
17. Howell, Gregory and Glenn Ballard (1994b). Implementing Lean Construction: Reducing Inflow Variation, Proc. Conference on Lean Construction, Santiago, Chile. September, 1994.
18. Koskela, L. (1993). Lean Production in Construction. Proc. First Annual Conference of the International Group for Lean Construction (IGLC-1), Espoo, Finland, reprinted in Alarcon (1997).
19. Koskela, L. (1992). Application Of The New Production Philosophy To Construction. Stanford University, CIFE Technical Report # 72.
20. Koskela, L. and Leikas, J. (1994). Lean manufacturing of construction components, In: L.F. Alarcon, ed. Lean Construction. Rotterdam: A.A. Balkema, 263-271
21. Koskela, L., et al. (2002). The foundation of lean construction. In: Best, R., and Valence, G. D., eds. Design and Construction: Building in Value, Butterworth-Heinemann, 211-255
22. Latham, M. (1994). Constructing the team: Final report of the Government/Industry review of procurement and contractual arrangements in the UK construction industry. London: HMSO.
23. Moser, L., and Dos Santos, A. (2003). Exploring the role of visual controls on mobile cell manufacturing: a case study on drywall technology." Proc., IGLC-11, 11th Conf. of Int. Group for Lean Construction, Blacksburg, VA. 418-426.
24. Muhidin, Sambas Ali, & Maman Abdurahman. (2007). Analisis Korelasi, Regresi, dan Jalur dalam Penelitian, Pustaka Setia, Bandung.
25. Pham, D. T., Dimov, S. S. and Hagan, V. O., 2001. Advances in manufacturing technology XV. [online]. John Wiley and Sons. Terdapat di: http://books.google.com.my/books?id=RfW5rC9Rn84C&dq=Advances+n+manufacturing+technology+XV
26. Salem et al. (2005). ”Site Implementation and Assessment of Lean Construction Techniques”. Lean Construction Journal 2005
27. Santoso, Singgih. (2000). SPSS Mengolah Data Statistik Secara Profesional, Penerbit PT Elex Media Komputindo, Jakarta, hal.217, 223.

28. Schwaber, K. (2002). Agile Software Development with Scrum. Prentice Hall. Upper Saddle River, NJ.
29. Serpell, A., Venturi, A. and Contreras, J. (1995). Characterization of waste in building construction project. In: L.F. Alarcon, ed. Lean Construction. Rotterdam: A.A. Balkema, 67-77.
30. Spoore, T. (2003). Five S (5S): The key to Simplified Lean Manufacturing. The Manufacturing Resources Group of Companies (MRGC), The article was originally written for the Durham Region Manufactures Association (DRMA) Feb. 2003 newsletter.
31. Sugiyono dan Eri Wibowo. (2004). Statistika untuk Penelitian dan Aplikasinya dengan SPSS 10.0 for Windows. Cetakan Keempat: November. Bandung : ALFABETA
32. Sugiyono. (2004). Metode Penelitian Bisnis. Cetakan Ketujuh. Bandung : ALFABETA
33. Sugiyono. (2007). Metode Penelitian Kuantitatif Kualitatif dan R&D, Penerbit Alfabeta, Bandung, hal.83.

How to cite this article: Saputra RH, Syafwandi. The effect of waste material based on lean construction on the performance of the retail building project. International Journal of Research and Review. 2020; 7(9): 82-93.

******