

## LEAN CONSTRUCTION ENHANCEMENT AND EFFICIENT FLOW IN THE OPERATION OF MARINE FABRICATION USING SMART YARD SYSTEM: CASE STUDY ON SAPURA FABRICATION YARD, LUMUT, PERAK.

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### ABSTRACT

Today, the adoption of new technology and procedures has enabled dramatic advances in Industry. Organizations who fail to perceive the influence of various technologies and fail to adapt to changing circumstances have been pushed out of the mainstream of construction operations on a justifiable basis, In Sapura Fabrication Yard, Smart Yard System are use in their operation process as a Lean Construction method. The aim of this study was to study the efficiency of the Smart Yard system in the yard operating process. By using survey questionnaires, data from the operation staff has been collected and analysed. The questionnaire and interview collect staff' working information, Understanding on the system, experience in the system, and expectations from system. Using a survey questionnaire, data from operating personnel were collected and analysed. Questionnaires and interviews collected staff job information, service information, facilities and expectations from facility providers. This study aims to provide valuable insights to organizations operating Smart Yard Systems regarding efficiency flows in operations while using the system. A total of 105 questionnaires were collected and data were analysed using Statistical Package for the Social Science (SPSS) to investigate the status of the system's capabilities as a measure of lean construction that can eliminate all waste while improving efficiency in the operating process without compromising safety and quality to ensure customer satisfaction. Can be concluded, the use of this system can be an improvement for Lean Construction and improve flow efficiency.

**Keywords:** Lean Construction, Smart Yard, Fabrication Yard.

## 1. INTRODUCTION

In fabrication, effective project management requires a relentless pursuit of the most efficient use of personnel, materials, and equipment. Labour productivity improvement should be a primary and ongoing focus of those responsible for cost control of developed facilities. Material handling, which encompasses procurement, inventory management, shop fabrication, and field service, requires specific attention in order to maximise cost savings. In recent decades, the adoption of new technology and procedures has enabled dramatic advances in Industry. Organizations who fail to perceive the influence of various technologies and fail to adapt to changing circumstances have been pushed out of the mainstream of construction operations on a justifiable basis.

This study was conducted to investigate the current efficiency of the Smart Yard system in the yard operating process, Improvement can be made to the system and to evaluate the efficiency performance of the Smart Yard system in Sapura Fabrication Yard Lumut. In a fabrication's project process, a conventional process requires a period of time after one element of the fabrication phase is completed before the next step can begin. wastage of time on each activity due to various reasons such as overlooking the revised This amount of time wasted is very detrimental to an organization, is it good that this amount of time wasted is used for other activities productively. The construction industry, according to a number of studies, is suffering from a number of recurring issues such as cost and time overruns, low productivity, poor safety and quality, and a high rate of waste creation, all of which reduce the value delivered to the customer. The construction industry, according to a number of studies, is suffering from a number of recurring issues such as cost and time overruns, low productivity, poor safety and quality, and a high rate of waste creation, all of which reduce the value delivered to the customer [1].

This study will help Sapura Fabrication management, as they will be able to use the information to improve the existing system, ensure it is used smoothly and give a good impact to the project management in particular. In addition, this study can help other fabrication companies in the initial preparation to use this system in their organizations in the future.

### 1.1 Analysis of the previous works

Since the early 1990s, lean construction language has been used in the construction engineering and management fields. There are several essential ideas that have influenced the philosophy of lean construction over time. Lean construction has evolved as a result of the huge influence that lean manufacturing has had on the manufacturing industry. The Toyota Production System (TPS) is the source of the principles of lean manufacturing [2].

Lean construction has three primary qualities that distinguish it from standard construction management techniques[3]

- a. In order to reduce waste, such as inspection, transportation, waiting, and mobility throughout the building process, lean construction is implemented.
- b. The goal of lean construction is to reduce unpredictability and irregularity in order to maintain continuous material and information flows.
- c. Construction material should only be on site when essential, according to lean construction principles.

Currently, the world is talking about Industry 4.0, which has a greater impact on the industrial process and the future of employment than previously thought. The Shipbuilding 4.0 initiative will have a huge influence on the industry. In the past, the shipbuilding industry was always evolving, with new machinery, software, and newly applied organizational structure all contributing to its improvement [4].

Fast-paced technological progress requires businesses to adapt to this perpetual state of flux in their operations. In recent years, the industrial application of the Internet of Things (IoT) paradigm and the principles of Industry 4.0 have resulted in the introduction of the most up-to-date technologies for monitoring, controlling, and optimising processes, as well as the development of new products and services [5].

The shipbuilding industry must increase overall business collaboration, synchronization, and productivity, as well as lifecycle ship maintenance and support, all of which may be accomplished through optimization of the shipbuilding process. Several objectives must be completed throughout the design of the new vessel, including improving performance, lowering ownership costs, increasing fleet availability and dependability, improving quality, and ensuring compliance with the most recent maritime safety and regulatory standards. Building and repairing ships must be simplified, and ship building, service, and overall ownership costs must be reduced [4].

Over the past sixty years, construction labour productivity has been dropping, which has resulted in a decrease in total construction productivity. Historically, the conventional methods of managing construction projects and delivering them have grown into a process that is fundamentally wasteful and confrontational in nature. In order to enhance the way construction elements are produced and delivered to the job site, such as through the use of lean construction, there has always been a need to do so [6].

Construction productivity and the use of lean construction techniques have a statistically significant and meaningful association. During a building project, lean construction is a collaboration-based structure built on accountability and commitments that promotes efficiency. The stakeholders in the building industry must be able to put their faith in one another in this circumstance. Contractual relationships with design teams must be legitimate and dependable in order to be successful. In the majority of projects where lean construction concepts are utilised, teams come together using collaboration tools and work together to find methods to reduce waste in the building process [7].

Lean construction projects are characterised by the elimination of waste, the facilitation of cooperation, and the optimization of the structures of the value-added chain during the building process. The coordination of the many trades engaged in the building process, as well as the tracking of construction progress, continue to be significant issues in the industry [8]. The development and deployment of technology can help to sustain the productivity of the conventional shipbuilding sector [9]. Higher productivity and reduced costs throughout the manufacturing process are two significant factors that must be regarded as features of shipyards in order to remain competitive [10].

Using new technology at the shipyard has the potential to deliver significant savings in the shipbuilding industry. Nonetheless, the application of technology must be coordinated with the level of human resource capability available [11]. Technology, human resources (HR), shipyard management systems, capital, and materials can have an impact on productivity in the shipyard industry [12]. Other than that, Technologies may help shipyards retain their efficiency while also increasing their competitiveness; nevertheless, certain components of technology transfer projects are overlooked or neglected entirely. Prior to conducting the technology transfer, it is critical to determine which technologies need to be transferred and why adjustments are required in order to be successful. A shipyard's present competitiveness as well as the performance of the components of the shipyard's hardware and software technologies will be determined through this process [13].

The life cycle of a product is worthless unless it is associated with a value-added activity within the organisation. In order to minimise delays in product completion and to eliminate material waste, the shipbuilding industry is now incorporating lean manufacturing concepts into its manufacturing processes [14]. Lean production theory and techniques have been widely applied in the manufacturing and construction sectors to improve process efficiency by reducing the waste and increasing the value in the value streams [15]. The enhancement of shipbuilding processes is influenced by the need to maximise production efficiency while minimising total cost [16].

Modern shipyards rely heavily on the application of various integrated software solutions labelled conceptually as Product Lifecycle Management (PLM), Enterprise Resource Planning (ERP), Computer Integrated Manufacturing (CIM), and others, all of which are striving toward integration within even broader concepts such as Digital Twinning (DT) and the Internet of Things (IoT) [17].

When changes in sequence or process become necessary, the production will be completely integrated from planning to execution on the shop floor, and the production will be able to adapt quickly and effectively [18]. Smart Yard is one of the applications that exist in industry today for combine project information and procedures and apply solutions that minimise the overall cost of the project while increasing productivity. Improve the quality of the project by providing constant insight into programme performance, allowing to make informed decisions [19].

## **2. METHODOLOGY**

### **2.1 Introduction**

Research methodology is an outline of how a study is done. It outlines the strategies or processes used to find and analyse material on a given study topic, in this research, the research methodology is like the flow chart below:

### **2.2 Research Design**

Planning, organising, and strategizing a research inquiry in order to get answers to research questions or issues is known as research design (also known as research strategy). The plan consists of the entire strategy or programme of the research project in question.

### **2.3 Data Collection**

Archives, surveys, and interviews with Sapura's Staff and consultants involved in project management and smart yard system can all be used to gather information for this study. Respondents will be given broad questions on the differences in procedure between conventional methods and the use of smart yard technologies in the questionnaire. Researchers can analyse several key factors based on the information gathered from this questionnaire, including the level of efficiency in the process of operation in the yard, the level of confusion that arises or difficulties encountered when using this system, and the level of effectiveness in obtaining all project data from this system, among others.

### **2.4 Data Analysis**

The questionnaires were collected, and the responses were recorded by the researcher for further use in the research. To begin, researchers created a feedback database by collecting responses from respondents and entering them into a spreadsheet. The general findings of the questionnaire survey can be obtained by the researcher from the database. The results were transformed into a graphical aid, such as a clustered column bar chart, to assist the researcher in subsequently performing a rating comparison for each question.

### **2.5 Result, Discussion & Recommendation.**

After concluding his or her investigation, the researcher will determine whether the use of this Smart Yard System can increase productivity and reduce waste in the yard operation process. In addition, the researcher will recommend any improvements that should be made to ensure that this Smart Yard System is efficient as one of the methods of Lean Construction, and that it should be recommended for use by every yard in the industry.

### 3. ANALYSIS OF THE RESULTS

Upon analysis of the study's findings, the following conclusions were reached:

1. The system reduced processing time and slowed the process handover.
2. The system will reduce the reliance on multiple Excel documents, resulting in increased project efficiency overall.
3. The Process of Operation was Construction management optimization, management, and control are all aspects of the job.

### 4. CONCLUSION

Based on the results of the study that has been made, it is found that this Smart Yard System successfully reduces the time in the operating process and minimizes process delivery. In addition, the use of this technology is also seen to successfully reduce work dependence by using many Excel documents, thus it succeeds in producing improved project efficiency. Finally, the system successfully optimizes, manages and controls important activities, especially activities that are on a critical path that can disrupt the completion date in a project. In general, it can be said that using this system can improve the level of project operations management without denying the best level of safety and quality as well as succeed in getting customer satisfaction.

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