Analysis of Modular House Fabrication Technology Application in Subsidized Housing Construction Based on Project Planning

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Abstract. Technology in the construction industry is now rapidly developing. Construction technology, which synergies with good construction management, can increase cost efficiency, time, and project quality. In conventional construction methods, there is a high level of uncertainty. The high level of uncertainty impacts poor project control resulting in project delays, high overhead costs, and a decrease in project quality. Modular home fabrication technology was developed to reduce project costs and time and improve project quality. The increasing demand for proper housing is currently encouraging Indonesia's Government to create a Subsidized Housing Program. 'Y' subsidized housing is one of the subsidized housing in Indonesia. The 'Y' subsidized housing construction still uses conventional construction. How to compare the achievement of efficiency in cost and time plans as well as project quality between the application of modular home fabrication technology with traditional construction in 'Y' subsidized housing construction, with potential project cost savings of 5-15%, acceleration of project duration of 9 months from planning, and inspection the quality of the project is done in stages? The achievement of cost and time efficiency of the project and improving the quality of the project affect the choice of the construction method. Modular home fabrication technology can be implemented if the modular manufacturer meets the criteria. These criteria are: including being qualified in modernization, having a consistent level of productivity, having adequate mobilization, and commitment that is always maintained to see prospects.

1. Introduction

The community's need for proper housing continues to increase. The Indonesian government seeks to meet the housing needs. One of these is holding a subsidized housing program, the National Medium Term Development Plan (RPJMN) Target for 2020 to 2024. The subsidized housing program can meet the community's need for decent housing apart from being affordable, the housing program. Subsidies also make it easier for the community to apply for a KPR (Home Ownership Credit). Subsidized housing planning is generally typical. This kind of housing planning will affect the construction work method. The construction work method will undoubtedly affect the achievement of time efficiency, cost, and project quality. The modular home fabrication technology is one of the creative innovations in construction methods developed since 2010.

The modular house fabrication technology is an unconventional construction process that involves modern technology, which is carried out centrally and integrated into a workshop (factory). The
advantages of modular home fabrication technology are faster than conventional construction, include the duration of building wall construction, the number of workers is significantly reduced, the assurance of building quality control, systematic construction procedures, savings on material costs, minimizing construction waste, not polluting the environment, and project duration Overall faster [1]. The term instant house then emerged after the innovation of the PUSLITBANGPERKIM (Research and Development Center for Residential Housing), which created the RISHA (Healthy Simple Instant House), conceptualized as a knockdown house (can be assembled) as well as a home to grow. The primary material for RISHA is a prefabricated concrete structure consisting of 3 types of core components, each of which weighs less than 50Kg [2]. Integrated modular construction is an innovative off-site construction technique, changing the way of planning, designing, scheduling in the architectural, engineering, and construction industries [3]. The application of modular home fabrication technology in subsidized homes is the latest innovation. It combines construction technology with construction management to increase time efficiency, project costs and improve project quality. How to compare the achievement of efficiency in cost and time plans as well as project quality between the application of modular home fabrication technology with traditional construction in 'Y' subsidized housing construction, with potential project cost savings of 5-15%, acceleration of project duration of 9 months from planning, and inspection the quality of the project is done in stages?

2. Methodology

This research uses quantitative methodology with experimental approach in a case study [7][8][9]. Conduct analysis by comparing between traditional construction and fabrication construction. There are three aspects that influence construction work methods, including planning costs, time, and project quality. These three aspects will be compared to get the results. The research steps are shown in

![Figure 1. Research Methodology](image)

3. Result and Discussions

Y subsidized housing is a subsidized housing located in Bekasi City, West Java. The housing complex plans to build 270 subsidized housing units measuring 30x60 m² with typical plans. The estimated construction cost planned is Rp.80 million / house unit. With a project duration of approximately 22 months. The 'Y' subsidized housing uses conventional construction work methods (wet construction). In Figure 2, we can see the potential savings in the planned project time of 9 months in modular home fabrication technology compared to conventional construction on 'Y' subsidized housing. This comparison occurs because in the application of modular home fabrication technology, planning, and design activities can be faster due to typical subsidized house designs. On-site installation activities can be carried out simultaneously with modular fabrication activities in the workshop. For modular fabrication activities in the workshop, it can be 20-50% faster than on-site construction activities. This activity depends on the level of factory productivity in doing modules [4].
Table 1 shows the potential cost savings of up to 15% on modular homes' fabrication technology compared to conventional construction on 'Y' subsidized housing. These potential cost savings is caused by the application of modular home fabrication technology, equipment items, labor, and overhead costs are cut by 5-15%. In comparison, material costs have increased by up to 10%, based on the planned design. The modular house fabrication technology is more economical on cost because there is a reduction in molds' use, shortens construction time, and high labor productivity in the field. The efficiency of the price of conventional prefabricated concrete is approximately 26.84% [5].

| Cost          | Percentage | Potential Cost Saving |
|---------------|------------|-----------------------|
| Equipment     | 10%        | -5%                   |
| Materials     | 60%        | +10%                  |
| Labor         | 20%        | -15%                  |
| Overhead      | 10%        | -10%                  |

It can be seen in Figure 3, the project quality control scheme on the application of modular home fabrication technology. In this scheme, four stages of inspection are carried out: at the design stage, material preparation (raw material), modular fabrication, and on-site installation. Keeping the flow of activities smooth and stable, early detection of errors, and fast correction [6]. Meanwhile, the supervisory activities in 'Y' subsidized housing involve three internal supervisors at the time of project implementation. This supervisory will have an impact on the project cost budget plan.
4. Conclusion

The 'Y' subsidized housing with a typical 270 unit floor plan based on project cost has a potential savings of 5-15% in some sections, especially overhead costs. Meanwhile, there was an acceleration for the project time for nine months from the 22 months planned using conventional construction. Project quality improvement can be achieved with a project quality control scheme using modular home fabrication technology. This improvement because inspections are carried out in stages so that errors can be detected early and corrective action is quick. The achievement of cost and time efficiency of the project and improving the quality of the project affect the choice of the construction method. Modular home fabrication technology can be implemented if the modular manufacturer meets the criteria. These criteria are: including being qualified in modernization, having a consistent level of productivity, having adequate mobilization, and commitment that is always maintained to see prospects.

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