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Development of Standard Operating Procedures (SOP) for Architectural Work of Subsidized Housing Based on Work Breakdown Structure (WBS) to Improve Quality Performance

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Abstract

This study addresses the critical issue of quality deficiencies in Indonesia's subsidized housing projects, where architectural defects and poor construction standards persist despite government initiatives to reduce housing backlogs. The research problem stems from persistent consumer complaints (3,241 cases from 2017-2024) regarding structural failures, substandard materials, and inadequate supervision. To tackle this, the study develops a Work Breakdown Structure (WBS)-based Standard Operating Procedure (SOP) for architectural work, aiming to systematically improve quality performance. The research objectives are threefold: (1) identifying architectural work components through WBS, (2) developing WBS-based SOPs, and (3) analyzing the SOP's impact on quality performance. Using a mixed-method approach, the study combines archival analysis of project documents, expert interviews (5 practitioners), and quantitative surveys (69 respondents from Jakarta's subsidized housing sector). Results demonstrate a comprehensive WBS framework with 19 work types, 46 work packages, and 333 activities. Statistical analysis confirms a significant positive relationship (R^2=0.834) between WBS-based SOP implementation and quality performance. The SOP enhances process standardization, accountability, and quality control across design, construction, and supervision phases. These findings offer practical implications for policymakers and construction firms: The structured SOP can reduce defects, improve compliance with minimum standards, and optimize resource allocation. Future studies should test this model in diverse geographical contexts and incorporate digital tools for real-time quality monitoring.
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Keywords: Subsidized Housing, Architectural Work, Quality Performance, Standard Operating Procedure, Work Breakdown structure

INTRODUCTION

The 1945 Constitution Article 28H Paragraph 1 states that: *Everyone has the right to live a prosperous life in birth and mind, to live, and to have a good and healthy living environment and to have the right to receive health services.* This article reflects the spirit that housing is a basic need for every human being and explicitly recognizes the right of the people to occupy a decent place to live as part of their physical and mental well-being (Cintuglu et al., 2017; Goppel, 2022; James, 2019; Lenard, 2015).

In order to support housing for low-income people and reduce the housing backlog, President Joko Widodo has established five main directions as a strategy for implementing the *Nawacita* vision and achieving Indonesia's Vision 2045. One of these directions is infrastructure development in the 2020–2024 *Rencana Pembangunan Jangka Menengah Nasional* (*RPJMN*) for the housing and settlements sector. It is stated that housing and settlements must be decent, safe, and affordable; groundwater and raw water should be sustainably safe; and both drinking water and sanitation must be suitable and accessible to the public. The 2020–2024 *RPJMN* targets that by 2024, 70% of households will occupy decent housing, all residences will have access to proper drinking water, and 90% of residences will have access to adequate sanitation. The housing development targets in the 2020–2024 *RPJMN* also include the management of household waste and wastewater in order to realize healthy settlements.

The plan for developing housing and settlement infrastructure in the 2020–2024 *RPJMN* aligns with the global agenda outlined in the Sustainable Development Goals (*SDGs*). The housing aspect in the *SDGs* is primarily addressed in Goal 11: *Making Cities and Settlements Inclusive, Safe, Resilient, and Sustainable.* More specifically, Target 11.1 aims to ensure access for all to adequate, safe, and affordable housing and basic services by 2030, as well as to upgrade slums. The housing aspect is also reflected in other *SDG* goals, including Goal 1, which concerns the fulfillment of basic needs for the poor, and Goal 6, which addresses access to water and sanitation. This illustrates that housing is interrelated with various aspects of life, including health and well-being.

Table 1. National Home Ownership Figures

	2018	2019	2020	2021	2022	2023
Number of households (Thousand Households)	61390,3	68700,7	68600,5	68900	70628,9	65504
Own homeownership (%)	80,02%	80,07%	80,10%	81,08%	83,99%	84,79%
Number of Households Owning Houses (Thousands)	49124,52	55008,65	55188,90	55864,12	59321,21	55540,84
Homeownership Backlog (Thousands)	12265,78	13692,05	13711,10	13035,88	11307,69	9963,16

Source : Central Statistics Agency 2018-2023 (Reprocessed)

According to data from the *Badan Pusat Statistik* (Central Statistics Agency) in 2023, there remains a housing backlog of 9,963.16. The housing development program under *Prabowo Gibran* aims to build 3 million houses during their administration, with details including 1 million houses each in urban, rural, and coastal areas. The Chairman of President-elect *Prabowo Subianto*'s Housing Task Force, *Hashim S.*, stated that the 3 million house program also seeks to alleviate Indonesia's housing backlog (*Kontan.co.id*, 2024). However, based on *BPKN* consumer complaint statistics, there were 3,241 complaints in the housing sector from 2017 to February 2, 2024, as depicted in figure 1.

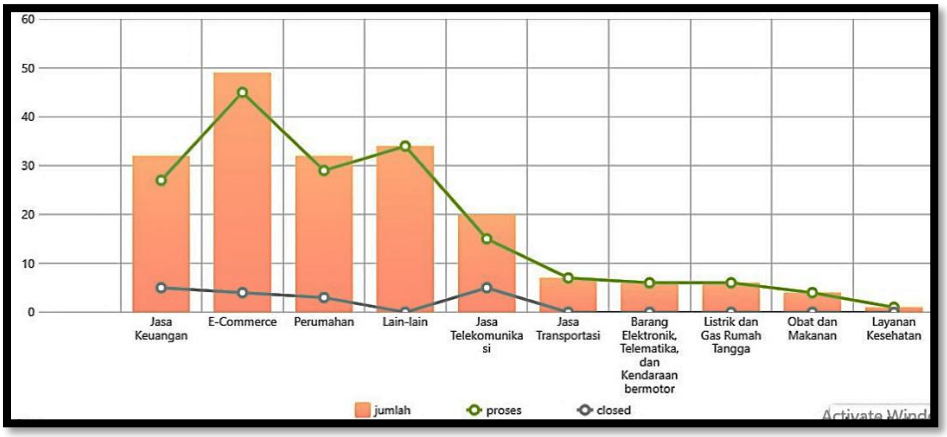

Figure 1. BPKN Consumer Complaint Statistics
Source: National Consumer Protection Agency

Although data from the *Badan Pusat Statistik* (Central Statistics Agency) indicates that the number of housing backlogs has decreased, statistical data on consumer complaints from *BPKN* (National

Consumer Protection Agency) show that there were 3,241 public complaints in the housing sector from 2017 to February 2, 2024. These complaints concerned issues such as payment, building quality, social facilities, and public infrastructure. A quality management system is indispensable to ensure that an organization can operate effectively and efficiently while also supporting its credibility within the community (Bashan & Kordova, 2021; Carvalho & Lima, 2022; Dyakonov et al., 2019; Gremyr et al., 2021; Montoya-Quintero et al., 2022). A quality management system refers to a set of documented procedures and practices used in system management that aim to ensure the appropriateness of processes and the quality of products (goods or services), aligned with specific requirements determined by customers and the organization (Colledani et al., 2014; del Pilar Arjona-Granados et al., 2022; Gejdoš et al., 2023; Hong et al., 2017; Knauer et al., 2020). The successful implementation of quality management for public housing in various countries demonstrates that such systems can significantly improve quality standards in public housing.

In line with the *BPKN* statistical data, which reported 3,241 public complaints in the housing sector between 2017 and February 2, 2024—particularly relating to payment, building quality, social facilities, and public infrastructure—*CNN Indonesia* reported that the *World Bank* has assessed government-subsidized housing for *Masyarakat Berpenghasilan Rendah* (*MBR* or Low-Income Communities) as uninhabitable. This assessment is based on factors such as location, accessibility, and building quality. In terms of quality, the *World Bank* stated that subsidized houses are generally uninhabitable. These findings were based on a sample analysis of 14,393 newly purchased housing units under the government's subsidy program. According to *World Bank* data, around 36% of the houses were unoccupied, with 44% due to poor basic infrastructure, 27% due to poor construction quality, and 17% due to the lack of electricity and clean water. According to the *Kementerian Pekerjaan Umum dan Perumahan Rakyat* (*PUPR* or Ministry of Public Works and Public Housing), 55.4% of subsidized units built by developers do not meet minimum construction standards and infrastructure requirements. One of the quality issues in subsidized housing is evident in the architectural elements that show damage within five years of construction. The following illustrates the documentation of architectural damage found in subsidized housing:

Figure 2. Occurrence of cracks and damage to the walls
Source: Personal Documentation

From the picture above, it can be seen that there is a tendency for damage to architectural work. Architectural damage that occurs includes cracks in walls, leaks in the roof, cracks in ceramics, and untidy tile installation. Architectural damage or defect is a failure or deficiency in the function, performance, law or requirements of the building user, which manifests itself in the form of structures, materials, services, or

other facilities of the affected building (*Watt*, 1999). Poor quality workmanship, low quality of materials, lack of supervision, and field monitoring are also the causes of defects during the construction process (*Rahman, Wang, Wood, and Khoo*, 2014).

In carrying out construction activities, a guideline is needed that regulates procedures and the person in charge of the work to avoid mistakes that cause construction damage. The importance of implementing *Standard Operating Procedures* (*SOPs*) for efficiency and effectiveness applies to all types of companies, one of which is in the construction sector (*Supriydi et al.*, 2020). *Standard Operating Procedure* (*SOP*) is a form of guideline or reference for carrying out work tasks in accordance with the functions and performance assessment tools of government agencies based on technical, administrative, and procedural indicators in accordance with work procedures and systems in the relevant work unit (*Atmoko*, 2011). Without *SOPs*, employees cannot carry out their duties properly because there are no clear guidelines in the implementation of these tasks (*Ajusta et al.*, 2021). The existence of *Standard Operating Procedures* (*SOPs*) on architectural work in subsidized housing is expected to avoid architectural damage to subsidized houses.

In this study, the creation of *SOPs* for architectural work is carried out based on the *Work Breakdown Structure* (*WBS*). *WBS* is a process of unraveling deliverables and project work in the form of individual components described in a hierarchical, top-down list (*Project Management Institute*, 2017). *WBS* is needed as a method of organizing projects into a hierarchical reporting structure so that it can be used to detail each work process (*Putritama*, 2022). *WBS* can facilitate the planning, creation, management, monitoring, and evaluation of the implementation of *SOPs*. The role of *WBS* in supporting the development of an *SOP* is as an organizing method so that it is comprehensive, measurable, and detailed. The formation of *SOPs* for architectural work can help accelerate processes, improve efficiency, minimize errors, and improve the quality performance of architectural work in the construction of subsidized houses.

Various studies that have been conducted previously on the implementation of subsidized housing quality management and public housing construction in various countries, factors that affect the quality of subsidized housing and public housing development, and public perceptions to improve the quality of subsidized housing have been taken from various literature, thesis journals, and others. From the results of these various studies, it can be concluded that the implementation of quality management can improve the quality of subsidized houses.

The evaluation of the activities of the planned stages that are researched will be useful for the writer and future readers, making the activities that are upgraded better than the previous ones. The novelty in this research is that the author wants to develop *Standard Operating Procedures* (*SOPs*) for the work of architects based on *Work Breakdown Structure* (*WBS*), which is expected to improve the quality performance of subsidized housing.

Based on the background of the problem that has been described above, the purpose of this study is: To find out what are the work packages (*WBS*) of architectural components in carrying out the construction of subsidized houses. Developing *SOPs* for architectural work in the implementation of subsidized housing construction. Analyzing the influence of *WBS*-based *SOP* development on architectural work on the quality performance of subsidized houses. There are direct and indirect benefits for the implementation of this research. The expected benefits of this research are as follows: The results of this research are expected to be a means of learning the implementation of good and correct *SOPs* for architectural work that can be applied in the construction of subsidized houses. The results of this study are expected to be used as a reference in compiling *SOPs* for architectural work in the construction of subsidized houses so that good

quality is achieved. The results of this study are also expected to add insight in developing the *SOP* process for architectural work as an effort to control the quality of subsidized housing products.

RESEARCH METHODS

To get relevant research results and in accordance with expectations, the right strategy is needed. Where, according to Siregar (2014) there are three factors that need to be considered in determining research strategies, namely:

1. Types of questions (Research questions) to be used in the research
2. The scope of control that the researcher has over the behavioral events to be studied
3. Focus on contemporary events as opposed to historical events.

In his research, Yin (2018) grouped research strategies as described in the following table:

Table 2. Research Strategy

Strategy	Question Types	Control of the Observed Event	Focus on Ongoing/Recently Resolved Events
Experiment	How, Why	Yes	Yes
Survey	Who, What, Where, How much, How big	Not	Yes
Archive Analysis	Who, What, Where, How much, How big	Not	Yes/No
History	How, Why	Not	Not
Case Studies	How, Why	Not	Yes

Source : Robert Yin, 1994

Furthermore, the research strategy used will be described based on each formulation of the problem/research question (RQ) which is explained in the table as follows:

Table 3. Research Strategies Used

Yes	Research Methods	Problem Formulation	Questions used	Data Collection Methods/Strategies
A	Research Methods Based on Type and Analysis			
1	Qualitative and Quantitative Research (*Mix Method)*	What are the components of the work package (WBS) of architectural components in the implementation of subsidized houses?	What	Archive Analysis, Survey
2		How is the development of WBS-based architectural work SOPs at the stage of implementing subsidized housing construction?	How	Archive Analysis, Literature Studies, Surveys
3		What is the model of the relationship between SOP of WBS-based architectural work in the quality performance of subsidized houses?	How	Survey

Source: Prepared Author

In accordance with the research strategy in the table above, the strategies and methods that will be used are as follows:

1. Archive Analysis: Archive analysis is a technique for gathering information from historical documents, or records from the past that provide access to historical people, organizations, and events (Baum, 2017). Archive analysis strategies/methods are used to find out the data and existing conditions of similar research objects.
2. Survey: Surveys are conducted to collect research-related data information from experts/experts through questionnaires and interviews with the aim of finding the relative occurrence, distribution, and relationships between variables of phenomena observed sociologically and psychologically (Sugiyono, 2013). The survey was conducted to the resource persons, both experts and other people who are competent in the material to be reviewed using questionnaires or interviews.

In this study, quantitative and qualitative research approaches (Mix method) were used. In the qualitative approach, this research uses interviews with experts and in the quantitative approach, this research uses statistical tests. The qualitative research aims to understand a phenomenon in social contact by prioritizing the process of in-depth interaction between the researcher and the phenomenon being studied (Herdiansyah Haris, 2010). Quantitative research is an approach to test theories by testing the relationships between variables. These variables can be measured with instruments so that numerical data can be analyzed using statistical procedures (Creswell, 2014).

RESULTS AND DISCUSSION

1. RQ-1 Findings and Discussion

In formulating WBS standards for architectural work for the construction of subsidized houses integrated with the design contract as the formulation of the first problem, an archive analysis process was carried out in the form of journals, theses, and project documents such as bills of quantity to compile the WBS before validation to experts. Then the validation process is carried out by conducting interviews with experts who have expertise in the field of architecture and expertise in the preparation of SOPs to be refined so as to produce the following hierarchy:

1) WBS Level 1 : Project Name

WBS Level 1 is the highest hierarchy in WBS and represents project goals/deliverables. Therefore, the name of the project is the first level of a WBS, in the context of this research is the Construction of Subsidized Houses.

2) WBS Level 2 : Job Cluster

The work cluster is a smaller element of the project, which when put together will form the construction of the project building (Rianty et al., 2018). In this study, there are four groups of jobs, namely Design Development, Architectural Work, and Miscellaneous Work.

3) WBS Level 3 : Type of Job

The type of work is a smaller detail of a group of jobs (Rianty et al., 2018). In this study, from the design development work group produced 7 types of jobs, from the architecture work group 6 types of work, and from other work groups produced 7 types of jobs.

4) WBS Level 4 : Job Package

A plan is defined as the lowest WBS level, for which the cost and duration can be estimated and managed. The final result of the work package must be in the form of a deliverable (Globerson et al., 2016). In this study, there are 55 work packages.

5) Alternative Design/ Methods

In this study, the example of using the design alternative category can provide complete information on design alternative choices in the WBS standard, stakeholders can find out the needs of the resources needed along with the differences in activities between one method and another.

6) WBS Level 5 : Activities

Activities are a description of the work package at WBS Level 4. According to Winn (2007), activities are details of steps to complete a work package. In this study, there were 360 activities.

7) WBS Level 6 : Resources

Resources are the lowest level in a WBS. Resources in a WBS are divided into 3 groups, namely labor, materials, and equipment.

Based on the results of the above hierarchy division, the validation of the WBS structure was carried out to experts with interviews and spreadsheet filling methods. Experts are asked to fill in the column with:

1) Correction or proposed change to the activity name
2) Adding/removing activities that are considered irrelevant
3) More realistic duration and resource estimates
4) Special notes related to work methods or conformity with subsidized housing project standards.

After filling out the spreadsheet, an interview session was conducted with the experts with the aim of:

a. Dive into the reasons behind the corrections or inputs provided in the spreadsheet.
b. Ask for the concrete experience of experts in similar projects.
c. Exploring expert perspectives related to the integration of WBS and SOPs.
d. Validate the WBS hierarchy and check the possibilities between activities.

The results of the experts' validation resulted in a number of important inputs, including:

1) In WBS Level 4 (work package) there is a "Building Permit" which is included in the WBS Level 3 (type of work) "Pre-Design" section, three experts suggested that there needs to be a detailed technical plan submitted in the IMB submission, so that the IMB process can only be carried out after the technical plan is completed. The IMB licensing process cannot be continued until the technical plan document is completed in a complete and structured manner. This detailed technical plan document includes, among others:
    a) Working Drawings
    b) Structural calculation and technical analysis
    c) Site plan
    d) Safety and environmental protection plan
    e) Cost budget plan and technical specifications of materials
2) In the initial structure of WBS Level 3, the researcher included the element of "Procurement Explanation and Evaluation" as one of the types of work that is considered to support the implementation of the project. However, after a validation process through interviews with five experts, three experts suggested that these elements do not need to be included in the WBS structure, with the following considerations:

a) Characteristics of design and build contracts

In the Design and Build contract system, the contractor is fully responsible for the design as well as the execution of the construction (build). This means that there is no separation of responsibilities between the planning consultant and the implementing contractor as happens in the conventional system.

Consequences:

a. The design details are prepared directly by the contractor.

b. The procurement of materials and services for the implementation of the project does not go through a vendor evaluation process as in government projects that use open tenders or selection.
c. The procurement evaluation process is internal and part of the project implementation strategy, not a separate work that can be broken down in the WBS.

b) Irrelevant as a deliverable component

According to PMBOK (Project Management Institute, 2017), elements in WBS must represent real and measurable deliverables. The "procurement details and procurement evaluation" type of work is more administrative and internal, and does not produce physical outputs that can be measured or inspected by the project owner. Therefore, according to experts, this type of work is not suitable as a WBS because it does not produce a stand-alone output, but is part of the contractor's managerial activities that are cross-packaged in scope.

c) Adjustments to the field practice of subsidized housing projects

The construction of subsidized houses generally uses a mass production approach and a short implementation time. The material procurement process is carried out directly by the contractor based on a unit price scheme or internal wholesale contract, so it does not require a formal procurement evaluation stage like in government projects.

In the initial structure of WBS Level 6 which contained the category of resources, one of the workforce positions listed was "Team Leader". However, after going through a validation process with five experts through filling out a spreadsheet and interviews, there was a significant difference in views on the accuracy of the use of the term in the context of subsidized housing construction projects. The results of expert input show:

a. Three out of five experts suggested that the term "Team Leader" be replaced with "Project Manager (PM)", because in the organizational structure of medium to large-scale construction projects, the strategic position in decision-making, supervision, and quality control is in the role of the PM, not in general terms such as "team leader" which is considered less specific and does not represent the formal structure of the project.
b. One expert suggested that the position be changed to a combination of "Team Leader and Expert", taking into account that in some small-medium scale projects, the technical leadership role in the field is still carried out by a team leader who doubles as an expert in a particular field (e.g. architecture, civil, or MEP).
c. Another expert did not suggest a change, but noted that the use of the term "team leader" needs to be explicitly explained in the context of his or her duties and responsibilities if it is still used.

In the process of validating the WBS structure carried out on five experts, it was found that there were differences of views regarding the feasibility of several work packages listed in WBS Level 4. One of the experts said that there are some details of work that are considered irrelevant to be included in the WBS structure. In more detail, the expert suggested that some of the work packages listed in WBS Level 4 be eliminated, with the following description:

d) In WBS Level 3: Pre-Designed Job Types, there is a job package at Level 4 which includes:

a. Licensing arrangements such as City Plan Stipulations (KRK) and Building and Environmental Plans (RTBL)
b. Preparation of initial cost estimates
c. Process for applying for a Building Permit (IMB)

According to the expert, these elements are administrative and not part of the physical deliverable, so they are more appropriately included in the project management plan document, rather than as a structured work package in the WBS.

e) In WBS Level 3: Design Development Job Types, two packages of work were found that were considered unnecessary to be included in Level 4, namely:

a. Assignment of working drawings: this process is an internal decision or part of design validation, rather than a standalone work that results in physical outputs in a field project.

b. Preparation of technical plan drawings: in a design and build system, technical drawings are generally integrated directly into the execution without explicit separation in the form of a stand-alone work package.

Based on these directions and considerations, I as a researcher accept and accommodate the input constructively. One of the concrete steps taken is to eliminate irrelevant work components. The purpose of this adjustment is to make the planning and execution of work effective and efficient, so that the WBS does not become too complex and remains focused on the components of the work that are truly relevant to the project. The following is an example of WBS level 2 – level 4 that has been compiled and refined based on theoretical and practical references from literature studies, real characteristics of subsidized housing projects as research objects, and validation inputs from five experts, arranged as follows:

Table 4. WBS Level 2 – 4 Subsidized House Construction

WBS Level 2 Work Package Group	WBS Level 3 Type of Work	Detail	Code	WBS Level 4 Work Package Detail
Design and Development	1.1.1	Design Planning	1.1.1.1	Planning Preparation
			1.1.1.2	Planning Execution
			1.1.1.3	Final Report Submission
	1.1.2	Preliminary Design	1.1.2.1	Site Planning
			1.1.2.2	Preliminary Spatial Planning
			1.1.2.3	Preliminary Mass and Form Design
			1.1.2.4	Licensing: KRK & RTBL
			1.1.2.5	Cost Estimation
			1.1.2.6	Planning Report
			1.1.2.7	Building Permit (IMB)
	1.1.3	Design and Working Drawing Development	1.1.3.1	Design Development
			1.1.3.2	Technical Specification Definition
			1.1.3.3	Volume and Area Determination
			1.1.3.4	Drawing Definition
			1.1.3.5	Component Cost Estimation
	1.1.4	Construction Implementation Documents	1.1.4.1	Technical Drawing Plan
			1.1.4.2	Detailed Construction Drawings
			1.1.4.3	Structural Calculation
			1.1.4.4	Work Plan and Requirements
			1.1.4.5	BOQ & Budget Plan
			1.1.4.6	Planning Report
	1.1.6	Periodic Supervision	1.1.6.1	Building Failure Assurance
			1.1.6.2	Implementation Compliance Inspection

WBS Level 2 Work Package Group	WBS Level 3 Type of Work	Detail	Code	WBS Level 4 Work Package Detail
			1.1.6.3	Drawing and Specification Adjustment
			1.1.6.4	Recommendations on Issues
			1.1.6.5	Recommendations on Materials
			1.1.6.6	Final Periodic Supervision Report
Insurance	1.1.7	Insurance	1.1.7.1	Construction All Risk (CAR), Third Party Liability (TPL), and Personal Insurance
			1.1.7.2	BPJS Employment Insurance
			1.1.7.3	Equipment/Material Insurance
Architectural Works	1.2.1	Ceiling Works	1.2.1.1	Ceiling
	1.2.2	Wall Works	1.2.2.1	Wall
	1.2.3	Floor Works	1.2.3.1	Floor
	1.2.4	Door and Window Works	1.2.4.1	Door
			1.2.4.2	Door Hardware
			1.2.4.3	Window
			1.2.4.4	Window Hardware
	1.2.5	Roofing Works Sanitary Works	1.2.5.1	Roof Insulation
			1.2.5.2	Roof Coating
			1.2.5.3	Gutter
			1.2.5.4	Secondary Skin
	1.2.6		1.2.6.1	Sanitary Toilet
			1.2.6.2	Sanitary Pantry
Other Works	1.3.1	Concrete Pavement for Carport	1.3.1.1	Concrete Pavement K-250
	1.3.2	Conwood Façade Works	1.3.2.1	Conwood Façade
	1.3.3	Skim Coat Finishing	1.3.3.1	Skim Cement MU200
	1.3.4	Reservoir	1.3.4.1	Reservoir
	1.3.5	Freon Piping Work	1.3.5.1	Freon Pipe
	1.3.6	AC Drain Pipe Work	1.3.6.1	Air Conditioner Drain Pipe
	1.3.7	Infiltration Well	1.3.7.1	Infiltration Well

Source: Author's Review, 2025

2. RQ-2 Findings and Discussion

1) Findings and Discussion of RQ 2 Phase 1

After the preparation stage of the Work Breakdown Structure (WBS) is completed as part of Research Question 1 (RQ1), the next step in the research is to develop a project organizational structure that represents the human resources involved in the implementation of the construction of subsidized housing architecture. The preparation of this organizational structure previously used project data. In the first organizational structure proposal submitted, a validation process was carried out with experts and practitioners. The preparation of this organizational structure was carried out by interviewing users (project implementers) to see field conditions and synchronization with the results of resource mapping in WBS, especially at level 6. There are a number of important inputs that are further used as the basis for the revision, including:

1. The organizational structure must be aligned with the resources listed in the WBS (RQ1): Each position in the organizational structure must be directly related to the activities and resources at WBS Level 5 and 6 so that there is no duplication or redundancy of positions that are not relevant to the scale of the project.
2. The term "Team Leader" was changed to "Project Manager", and "Administration" was changed to "Technical Admin": The use of the term "Team Leader" was deemed inappropriate so it was changed to "Project Manager", while the role of "Administration" which is directly related to technical in the field was changed to "Technical Admin".
3. Addition of Expert Positions to the Organizational Structure: Given the certain technical complexities still found in the architectural work of subsidized houses and to adjust resources at WBS level 6 it is recommended to add personnel as experts.
4. Types of Builders Described Specifically: This suggestion aims to make the role of the field more detailed and adjust resources at WBS level 6, such as masons, carpenters, painters, and blacksmiths. It also helps in the process of calculating labor needs as well as the flow of job reporting.
5. Eliminating "Commercial" and "Engineering" Positions: These two positions are considered irrelevant for medium-scale subsidized housing projects because commercial roles (e.g. related to investment or marketing licensing) are not directly part of the technical implementation. Meanwhile, "Engineering" as a term is considered too general and overlaps with other functions such as supervisors or experts.

Based on all these inputs, the organizational structure was revised to align with the existing hierarchy and resources in the WBS and avoid dual positions or less operational terms. This revision is important so that the organizational structure can be used directly as a reference in the SOPs for project implementation, including in the division of responsibilities, reporting flows, and quality control. The following is the organizational structure based on input from experts:

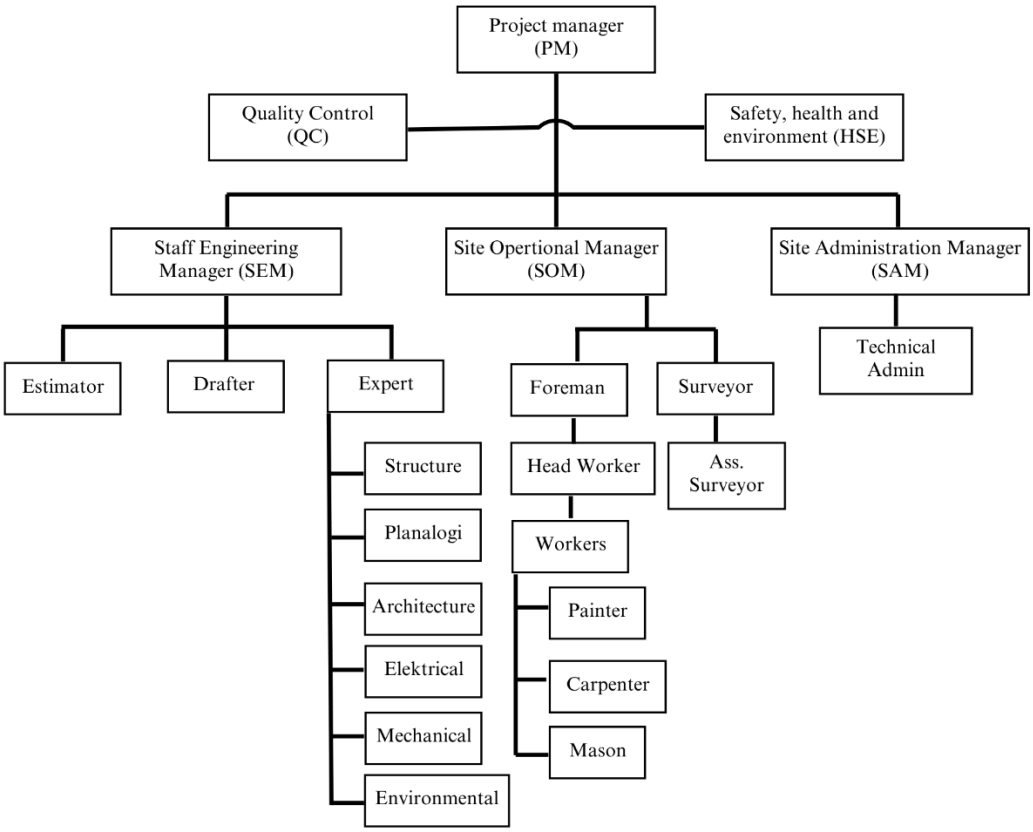

Figure 7. 1 Organizational Structure of Subsidized House Development
Source: Expert data, 2025

2) Findings and Discussion of RQ 2 Phase 2

After the validation process of the organizational structure is completed, the next step is to identify in detail the roles, duties, and responsibilities of each position contained in the structure. This identification is carried out to ensure that all elements of the organization have a clear function and are in accordance with the needs of the project. After the identification is completed, the results are then compiled in the form of a questionnaire instrument to obtain confirmation from experts. The experts involved in the validation have reviewed and approved the content and feasibility of the questionnaire instrument that was prepared, so that it can be used as a basis for collecting research data in a more systematic and targeted manner.

Tabel 5. WBS Level 4 – 6 Job description

Code	Position	Role	Duties & Responsibilities	Yes	No	Response	Source
X2.2	Project Manager (PM)	Project planning, coordination among teams, control and monitoring, quality and safety management, decision making, reporting and documentation,	– Plan the project by defining project scope, cost, and timeline				Project Data
			– Ensure the project runs according to the budget				
			– Manage resources (budget, materials, technology)				
			– Ensure project completion on time				

Code	Position	Role	Duties & Responsibilities	Yes	No	Response	Source
		project closure and evaluation	– Ensure project quality				
			– Execute and coordinate project implementation, allocate and monitor resources, and run the project as per the plan				
			– Perform supervision and control (tracking project progress, risk management, quality assurance, compliance to regulations)				
			– Communicate among teams and stakeholders				
			– Report project progress				
X2.3	Quality Control (QC)	Ensure project results meet specifications and quality standards, manage risk of failures, rework and client claims, and enhance client trust and company reputation	– Define quality standards and SOPs that outline technical specifications, work methods, and quality criteria				Project Data
			– Provide checklist for every project phase				
			– Maintain product/service quality				
			– Conduct inspections and testing				
			– Create and manage documents related to quality				
			– Develop corrective actions				
			– Inspect and test while reviewing process and final output in accordance with SOPs				
			– Use measurement and inspection methods to ensure quality				
			– Prevent defects or nonconforming products/services				
			– Temporarily stop work if nonconformance is detected				
			– Review documentation and results from all inspections and tests as part of quality assurance				
			– Conduct root cause analysis and provide resolution				

Code	Position	Role	Duties & Responsibilities	Yes	No	Response	Source
			– Recommend SOP revisions if any defects or weaknesses are found				
			– Improve continued quality, give feedback for SOP revisions				
			– Collaborate with related departments				
			– Calibrate quality testing tools				

Source: Author's analysis results based on project data and expert validation (2025)

3) Findings and Discussion of RQ 2 Stage 3

In this study, the researcher compiled a questionnaire to identify the inputs and outputs of each activity in the work procedure, including the estimated duration of the implementation of each activity. The questionnaire has been validated and all input items, outputs, and activity durations have been approved by the experts involved in the validation process. Input is all the resources needed to carry out an activity, either in the form of documents, information, or other supporting tools. Output, on the other hand, is the result or output obtained from the implementation of these activities, which can be in the form of documents, reports, work products, or certain decisions. In every activity, the presence of inputs and outputs is an important indicator in determining the sustainability and success of the work process.

However, one of the experts provided additional important input, namely the need for further elaboration related to certain input and output components. In particular, in technical administrative preparation activities and implementation preparations, it is recommended that inputs also include the Framework of Reference (KAK) document as the basis for planning activities. Meanwhile, in the activities of preparing the implementation team, outputs need to be added in the form of a list of personnel involved and an official assignment letter as proof of legality and responsibility for the implementation of duties.

4) Findings and Discussion of RQ 2 Stage 4

The problem formulation in this section specifically discusses the communication flow in the implementation of project activities, which is prepared with reference to the RACI (Responsible, Accountable, Consulted, Informed) matrix. This matrix is a managerial tool used to explain the roles and responsibilities of each stakeholder in a certain process or activity.

a. R (Responsible) refers to the party who is directly in charge of completing a certain activity or work.
b. A (Accountable) is the party who has the highest authority and is overall responsible for the final result of an activity.
c. C (Consulted) refers to individuals or organizations that need to be consulted or provide input before decisions are made or work is done.
d. I (Informed) is a party that must be informed regarding the development of activities, even though they are not directly involved in its implementation.

In the process of preparing a communication flow questionnaire, the researcher compiled an initial scheme based on an understanding of the organizational structure and project activities. However, based on the validation process with experts, there are changes in the organizational structure so that there are changes in the RACI category, namely the elimination of engineering, supervisor, monitoring, general

supervisor, supervisor, and commercial, then there is a change in the name of administration to technical admin.

After revision based on these inputs, the communication flow questionnaire was thoroughly approved by all experts involved. This validation ensures that each role in the RACI matrix has been appropriately distributed, according to the responsibilities, authority, and communication needs in the context of the project being studied.

3. RQ-3 Findings and Discussion

1) Findings and Discussion of RQ 3 Phase 1

The purpose of the research in RQ 3 Phase 1 was to determine the validation of the content used to identify indicators for the preparation of SOPs. At this stage, the researchers distributed questionnaires to five experts. After the questionnaire was distributed, from the results of the validation, all experts agreed on the variables and indicators of this researcher. The following is a validation of the content and construct for the indicators of variables x and y in this study as follows:

Table 6. RACI Communication Flow

Code	Indicator	Code	Indicator Description
X1	WBS	X1.1	WBS is explained in a complete and comprehensive manner
		X1.2	The scope of the WBS has been explained hierarchically
		X1.3	Level 5 components match project needs
X2	Organizational Structure	X2.1	The organizational structure reflects hierarchy, roles, and responsibilities
		X2.2	Conformity with Job Description
		X2.3	Organizational structure is easy to read
		X2.4	Organizational structure is consistent
X3	Roles, Duties, and Responsibilities	X3.1	Task descriptions are complete and comprehensive
		X3.2	Individual responsibilities are clearly defined
		X3.3	Measurable criteria are present
		X3.4	Roles and responsibilities are consistent
X4	Activities	X4.1	Activities are easy to understand
		X4.2	Activities follow applicable standards
		X4.3	Activity achievement is measurable
		X4.4	Activities are consistent
X5	Input and Output	X5.1	Input and output documents are complete
		X5.2	Input and output match the activity
X6	Duration	X6.1	Average process duration
		X6.2	Minimum and maximum process durations
		X6.3	Duration distinguished by complexity
		X6.4	Duration distinguished by activity types
X7	Communication Flow	X7.1	Communication flow is efficient
		X7.2	Communication flow is consistent
		X7.3	Communication flow complies with standards
		X7.4	Communication flow matches organizational needs
		X7.5	Communication flow matches customer needs
Y1	Performance Effectiveness & Efficiency	Y1.1	Customer Focus
		Y1.2	Leadership

Code	Indicator	Code	Indicator Description
		Y1.3	Personnel Involvement
		Y1.4	Process Approach
		Y1.5	System Approach to Management
		Y1.6	Continuous Improvement
		Y1.7	Factual Approach in Decision Making
		Y1.8	Factual Approach in Performance Assessment
		Y1.9	Mutually Beneficial Supplier Relationships

Source: Author, 2025

2) Findings and Discussion of RQ 3 Stage 2

Based on the findings for RQ 3, namely the relationship between SOP for Architectural Work and Quality Performance. Referring to the Minister of Public Works Regulation No. 4/PRT/M/2009 that quality performance must be able to show continuous improvement by actualizing 8 (eight) quality management principles in each activity process which includes:

a. Customer focus
b. Leadership
c. Personnel involvement
d. Process approach
e. Systems approach to management
f. Continuous improvement
g. Factual approach in decision-making
h. Mutually beneficial supplier relationships

In accordance with the purpose of this study, namely to find out the relationship between WBS-based SOP for Architectural Work in Subsidized House Construction on quality performance, the data collection and analysis process was carried out using a respondent questionnaire, where each respondent was asked to provide his or her perception of the influence of SOP on Architectural Work. Data collection was carried out by assessing indicators x and y using questionnaires that had been filled out by 69 respondents. The selection of 69 respondents was calculated using the slovin formula from the population of residential locations in Jakarta, which is 221 locations. Then the data processing process was carried out using various tests, namely homogeneity tests, data sufficiency tests, normality tests, validity tests, correlation tests, realism tests, and also linear regression tests. The following are the results of the data testing as follows:

1) Validity Test: A validity test to measure the accuracy of the instruments used in this study. To ensure that each item in the questionnaire actually measures what it is supposed to measure. The validity test based on the r table for 69 respondents r calculated > r table therefore all variables can be said to be valid.
2) Reliability Test: A Reliability Test to measure the consistency of an instrument in producing stable data, where the instrument is reliable and remains consistent if measurements are made repeatedly. To conduct a feasibility test, look at Cronbach's alpha value on the questionnaire if it is more than 0.80, it is considered reliable. Based on the results of the feasibility test for the total items tested, it has a Cronbach's alpha value of 0.890, so it can be concluded that all items in this questionnaire are reliable and can be continued with the next statistical test.
3) Normality Test: A normality test to find out if the data of the x and y variables are normally distributed. This uses hypotheses H1 and H0 with normal or abnormal data descriptions. However, for the sapphire

method, the data obtained was not normal. The test results of all the data are abnormal. Therefore, a non-parametric statistical analysis test was carried out, namely the Wallis Cross-Section.

4) Homogeneity Test: A homogeneity test to find out if the data comes from a population of the same variance, to find out whether the variables asked of the respondents are homogeneous or not. The homogeneity test was carried out based on the level of education, work experience, and position of each respondent. Based on the results of the homogeneity test, it was obtained that the majority of variables had an Asym value. Sig is more than 0.05 so that it can be concluded that H0 is accepted, that is, there is no difference in respondents' perceptions of both education level, work experience and position towards the questionnaire. Therefore, it can be concluded that the data obtained is homogeneous and can be continued in the next statistical test.
5) Data Adequacy Test: The data adequacy test was obtained by the slovin formula, from a population of 223 active subsidized housing locations in the DKI Jakarta area, a sample of 69 people was needed based on the data adequacy test.
6) Correlation Test: Based on the correlation test, there are 42 variables that have a strong and very strong correlation with quality performance. Variables that had low and moderate correlations were not included in the next stage of analysis.
7) Linear Regression Test: The results of the regression test can be analyzed from the R2 value of 0.834 and the adjusted square value of 0.815 (81.5%). The value is close to 1. Therefore, it can be concluded that the WBS-based SOP variable (Variable X) regarding the variable quality of subsidized housing (variable Y) has a significant impact on the performance of the quality of subsidized housing.

CONCLUSION

The *Work Breakdown Structure* (*WBS*) of subsidized housing architectural work consists of design and development work groups, architectural work groups, and other supporting work groups. There are a total of 19 types of work in *WBS* Level 3, 46 work packages in *WBS* Level 4, and 333 activities in *WBS* Level 5 of subsidized house construction architectural work. Four indicators are required in developing *Standard Operating Procedures* (*SOPs*) for subsidized house construction architectural work, namely: organizational structure, job descriptions, activities and their durations, and communication flows. The development of *WBS*-based *SOPs* is an efficient and effective procedure—it is informative and applicable to architectural work activities in subsidized housing projects. The relationship model between *WBS*-based *Standard Operating Procedures* (*SOPs*) and the quality performance of architectural work in subsidized house construction was examined through various tests, including data adequacy testing, homogeneity testing, normality testing, validity testing, correlation testing, feasibility testing, and linear regression analysis. All data were found to be adequate, normally distributed, homogeneous, reliable, correlated, and statistically significant.

In order for the implementation of the findings of this study to have an optimal impact, several follow-up steps are suggested. First, it is necessary to prepare more detailed technical implementation guidelines to facilitate the application of *SOPs* in the field. Second, it is important to conduct structured training for all project stakeholders to ensure a comprehensive understanding of the *WBS* system and related *SOPs*. Third, a periodic evaluation mechanism needs to be established to monitor the effectiveness of implementation and to continuously refine the existing *SOPs*. Finally, it is recommended to test the adaptability of this *WBS* model and *SOPs* on various other types of construction projects to expand the scope and benefits of the study's findings. By implementing these recommendations, it is hoped that better

and more sustainable quality standards can be achieved in the development of subsidized housing in Indonesia.

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