CHAPTER III Research Methodology

III.1 Research Objects and Subjects

The primary focus of the research study is to examine how the implementation of the ISO 9001:2015 quality management system standard can have a notable impact on organizational efficiency in the construction industry, going beyond its mere function as a tool for obtaining certification. By going through various aspects of ISO 9001:2015 implementation and analyzing its effects on project delivery, customer satisfaction, process improvement, and overall business performance, this study seeks to shed light on the multifaceted benefits of adopting this standard in construction projects.

The primary objective of this research is to investigate and analyze how the ISO 9001:2015 standard operates as an effective and practical tool for establishing a Quality Management System (QMS) that can facilitate enhanced efficiency and productivity in construction logistics. The study will examine the key features of the ISO 9001:2015 standard, including its structure, principles, and requirements, as well as its practical applications for QMS implementation, performance improvement, and risk management.

The research will explore how the ISO 9001:2015 standard can support this particular construction project in achieving their goals and objectives by enhancing customer satisfaction, minimizing errors and defects, and fostering continuous improvement. By offering a comprehensive analysis of the benefits and limitations of ISO 9001:2015 as a QMS tool, this study aims to provide practical insights and recommendations for organizations seeking to optimize their operational and financial performance.

III.2 Research Design

This study employs qualitative research techniques, including observation and interviews. The researcher chose this qualitative approach because it allowed him to collect data directly from the field by speaking with the relevant informants and

seeing the real field circumstances to determine if they were consistent with the outcomes of the interviews or differed from them. The conditions of natural items were examined using this qualitative methodology. The information gathered may be from surveys, field notes, pictures, personal papers, or other sources (Moleong. 2005). It can learn how ISO 9001: 2015 is used to boost productivity in construction projects logistics by conducting these interviews, and it can also determine whether or not it has been implemented well. Consequently, detailed and direct observation is needed to obtain the outcomes of this investigation. The limiting variables will first be examined from previously read material prior to the start of the inquiry. The list of challenges identified will be utilised to create a series of questions that will be used to determine whether or not the project's use of ISO 9001:2015 as a tool that is suitable.

III.3 Research Stages

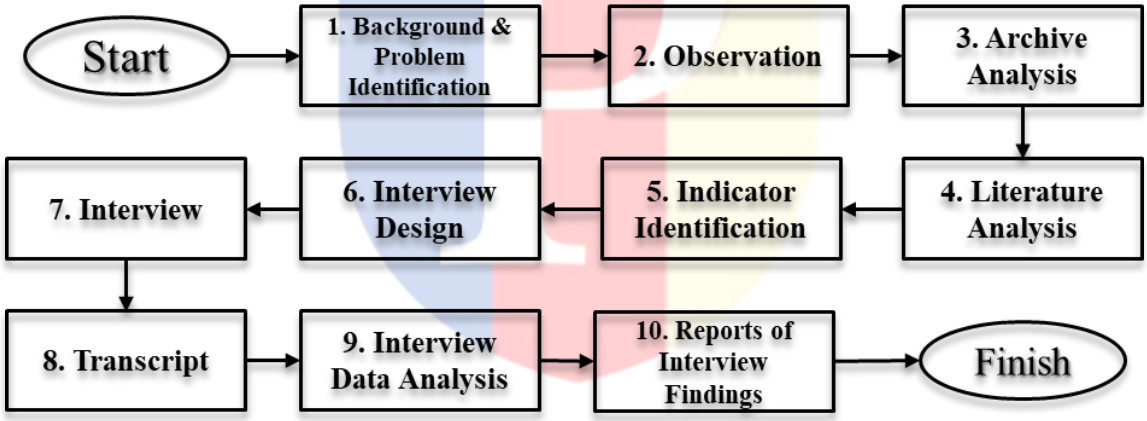

Figure III.1 Research stage

The following is an explanation of the flowchart from figure III.1

1. In order to determine why the formulation of the problem may be employed as scientific study, background and problem identification are carried out.
2. Making firsthand observations at the project's research location
3. Examining and evaluating historical records or data stored in archives
4. Literature analysis is carried out in order to learn about and understand the theory behind the forthcoming research.

5. Identify indications to discover elements that prevent the use of masks in construction projects
6. The interview questions are organised according to the information we wish to obtain from the source.
7. To make sure the interview questions are clear, specific, and relevant to the study issue, it is helpful to conduct interviews with representative informants.
8. The findings of interviews can be recorded or reviewed using transcripts.
9. Analysing the information gleaned from the interview to reach a conclusion
10. Pour out the results of the interview towards the final project

III.4 Data Type

The following list of data was utilised in this study:

1. Primary Data:

The information gathered for this study will be based on direct observation and interview findings, which will be utilized to gain a deeper understanding of the research subject. The direct observation process involves the careful and systematic collection of data through detailed documentation of events, behaviours, and activities, while the interviews will provide valuable insights from key stakeholders and participants. By combining these two methods, the research team will be able to generate a more comprehensive and multifaceted view of the subject under investigation.

2. Secondary Data:

As a crucial component of this research, a comprehensive review of relevant literature on construction logistics, ISO 9001, and the use of ISO 9001 for logistics in construction projects was conducted to serve as the secondary data source. This review encompassed a wide range of scholarly articles, books, and reports, and enabled the research team to identify key trends, best practices, and research gaps in the field. By synthesizing and integrating this secondary data with the primary data derived from direct observation and interviews, this study seeks to provide a more nuanced and in-depth understanding of the impact of ISO 9001 on

construction logistics, and to offer practical insights for organizations seeking to optimize their logistics processes and performance.

III.5 Data Gathering

III.5.1 Study of Literature

The previously studied literature will serve as the foundation for developing a theoretical framework for this study, in addition to serving as a guide to locating the objectives of this study. The prior journals that were read and had something to do with this research were the source of the literature review that was gathered. Construction Logistics, ISO 9001, and Implementation of ISO 9001 on Construction Logistics are some phrases or terms used to look for literature research. The words and or sentences utilised can be found in a number of publications that are relevant to this study topic.

III.5.2 Interview

One of the most often utilised techniques for gathering data in research is the interview. This approach is utilised for gathering information for the objectives of primary data collection from study subjects (respondents) in person. In order to achieve research goals, interviews are used to gather information on facts, beliefs, feelings, wants, and so forth. (Rosaliza 2015). Semi-structured interviews will be the style of interview used in this investigation. The semi-structured interview style asks the parties invited to the interview for their thoughts and ideas while allowing for a freer discussion of the topics at hand. The fundamental reason for using semi-structured interviews is that they provide the interviewer the option to delve further into the interviewees' comments to elicit additional information (Hansen 2022).

Out of the initial 20 variables considered for investigation, only 19 will be utilized and developed into interview questions. This decision is based on a significant finding regarding the variable "Control of customer supplied products" listed in table II.2 in chapter II above. Direct observations reveal that the owner or person in

charge of the project does not supply any products or materials, creating a discrepancy between the documented variable and the observed practices. To ensure a comprehensive and focused investigation that aligns with the observed context, the decision has been made to exclude this variable.

Table II.2 was transformed into a comprehensive set of interview questions for the research, aiming to gather relevant data and insights. These questions ensure consistency and comparability among participants, contributing to a thorough analysis. The development involved refining and tailoring the original information to align with the study's objectives and scope.

Below, the table III.1 is developed from Table II.2 to serve as interview questions for this thesis:

Table III.1 Interview Questions With Managers/Staff

No.	**Area**	**Question**
1	Control of a nonconforming product	How does your company deal with materials/goods or products that do not meet specifications?
1.1		Is there a procedure?
1.2		Who has the authority to make a decision whether the goods/material meets the specifications/not?
2	Process control	Has your company implemented ISO standards?
2.1		How to ensure that each process has reached the standard?
2.2		Any examples for the process?
3	Contract Review	Has your company ensured that the needs required by the owner have been stated in the contract?
3.1		And how does your company go about achieving this?
4	Control Of Quality Records	Does your company have a good documentation process?
4.1		Does the document play an important role in the internal or external audit process?
5		Is the equipment calibrated regularly?

5.1	Control of inspection measuring and test equipment	Is it well documented?
5.2		Is there any documentation for it?
6	Inspection and Testing	Does your company carry out QA processes on materials and equipment?
6.1		How was the QC process during the installation process?
7	Corrective and preventive action	Has your company implemented a corrective action system to address quality issues within the company?
7.1		What is the corrective action?
8	Internal Quality Audits	Is there an internal audit process in your company?
8.1		Has the internal auditor team been trained?
9	Inspection and Test Status	Does your company ensure that only inspected materials are used or further processed in your operations?
10	Handling, storage, packaging, preservation and delivery	Does your company have an SOP for material protection?
10.1		How do you ensure that these procedures are followed consistently at each stage of the work
11	Purchasing	Does your company have a purchasing procedure that contains supplier/sub-contractor specifications?
11.1		If so, what are the examples?
12	Design Control	Does your company have a system for anticipating design changes?
12.1		If so, what are some examples?
13	Document and data control	Is there an established process to maintain/change the quality of the documentation?

14	Product identification and traceability	Does your company have a method to track the whereabouts of materials from arrival to installation
14.1		If so, in what form? (Chart/Date/Code/FIFO etc)
15	Servicing	Is the maintenance period specified in the contract?
16	Quality System	Has your company created and controlled quality manuals and other related processes?
17	Training	Does your company have a training outcome document that is used to track and document HR competencies?
18	Management Responsibility	Does your company have provided a policy in terms of resource development
19	Statistical Techniques	Does your company evaluate work on a regular basis?
19.1		If so, what are the examples? (Graphics/Charts/Weekly reports/monthly reports/Charts board)

In the research article "An empirical study of applying ISO 9001 Elements in Large Size Indonesian Contractors," the researcher evaluated the implementation of variables related to the twenty QMS 9001 elements. The assessment of these variables was conducted using the mean or average of the collected data. However, for the purpose of this research, a percentage-based measurement will be employed to determine the level of implementation of these variables. The reference scale for this research is as follows: "Fully implemented" corresponds to a range of 88%-100%, "Partly implemented" corresponds to a range of 75%-88%, and "Minimally implemented" corresponds to values below 75% (Trigunarsyah et al 2011).

In this research, the assessment of ISO 9001 Quality Management System (QMS) implementation is conducted using a percentage-based approach rather than an average, as mentioned in the previous article. These numerical thresholds, which have been derived from the evaluation methodology used in the aforementioned article, have been transformed into percentages to align with the approach

employed in this study. It is important to note that this research is based on data collected from a single construction project, whereas the aforementioned article obtained data from 118 companies. The focus on a specific construction project allows for a more in-depth analysis of the implementation of ISO 9001 within that particular context. By utilizing a percentage-based evaluation, the research aims to provide a comprehensive understanding of the extent to which the QMS is implemented in the project, highlighting specific strengths and areas for improvement. This approach ensures a detailed assessment of the project's adherence to ISO 9001 standards, providing valuable insights for enhancing quality management practices in construction projects.

III.5.3 Observation

In order to get information from events that are taking place right in front of our eyes but are difficult to learn from the person who is the source of the information or who has been questioned, observation is a strategy used to gather data. Qualitative observation is used to understand background with different functions between objective, interpretive and interactive. Free qualitative observation examines the concepts and categories in each subsequent event to give meaning to the research subject or observation (Hasanah 2016).

III.6 Archive Analysis

Archive analysis is a valuable process that involves examining and evaluating historical records or data stored in archives. This methodical review and interpretation of past documents, records, or sources provide insights, extract relevant details, and draw informed conclusions. Archive analysis supports researchers, historians, and organizations in uncovering valuable information, identifying patterns, and making informed decisions based on historical data (Gossen 2017). In the context of the project, handling and working with various documents such as OK (Order Keperluan), PO (Purchase Order), BAPB (Procurment Letter), and MDS (Material Data Sheet) contributed to a comprehensive analysis and the insights derived from the archival data. Meticulous

archive analysis enabled well-informed decisions and supported the project's goals through the utilization of historical knowledge.

III.7 Data Analysis

If the data is in the form of a collection of words rather than a list of numbers, data analysis is done in qualitative research. The study's data were gathered through observation and interviews, thus they had to be processed before they could be utilised in the recording and editing processes. The language used in qualitative research is still words, not numbers. (Rijali 2018).

There are 3 types of commonly used analysis to analysed the results from the interview, Content Analysis, Coding Analysis, and Discourse Analysis. (Hansen 2020)

1. Content Analysis, a method for drawing reliable inferences from a document's content or information collected from quotations from sources.
2. Coding Analysis, putting emphasis on the coding element of current data to openly or indirectly find patterns or linkages. seeks to identify the key points of the informants' statements.
3. Discourse Analysis, thorough examination of each claim and viewpoint made often by the sources. The source is more psychologically seen as a human being when the focus is placed on the manner the informant provided a statement of each single phrase stated by the source.

CHAPTER IV Data Collection and Processing

IV.I Qualitative Data Collection Instrument

In this qualitative research, a range of tools and instruments are employed to collect data. The specific instruments used include:

1. The field-taken photos taken using a mobile phone camera are used as documentation to be included in the report. These pictures offer visual proof and support the research's general conclusions.
2. During interviews, a laptop running OBS studio (Visual and audio recording software) is utilized as a voice recorder to capture participant's comments. This enables the captured audio to be played again while doing data analysis and transcript writing are being done.

IV.2 Archive Analysis

During the road preservation project in South Kalimantan, extensive experience was gained in conducting archive analysis. This involved acquiring, managing, and working with various project-related documents and records. The significance of archival data in informing decision-making and ensuring project success was fully realized. Through careful examination and interpretation of these documents, valuable insights were extracted, patterns were identified, and informed recommendations were made. Proficiency in handling archive analysis played a crucial role in supporting the project's objectives and contributing to its overall effectiveness.

IV.3 Observation

During the period from 28th June 2022 to 26th November 2022, the researcher was located in Banjarmasin and Binuang, South Kalimantan. Throughout this time, the primary focus was on gathering information and gaining insight. Various documents were obtained, including Purchase Orders (PO), Berita Acara Pengadaan Barang (BAPB), Order Keperluan (OK), Material Data Sheet (MDS),

sub-contractor/supplier selection documents, and guidelines on grading the selected sub-contractor/supplier. Additionally, the researcher participated in the evaluation process of the selected sub-contractors/suppliers, as well as the final grading for them.

Alongside these activities, the real-time implementation of ISO 9001:2015 was observed, which was crucial for passing the external audit and obtaining certification for the road preservation project. The researcher was appointed by the project manager and internal auditor to assist the logistic division, primarily to help arranging, documenting and make new or missing documentation such as OK (can be found in appendix X, page XX), PO (can be found in appendix X, page XX), and BAPB (can be found in appendix X, page XX), since the logistic division was short handed at that moment. This involvement allowed for the acquisition of essential knowledge both before and after the interviews for this thesis. The methods employed to accomplish these tasks included conducting site visits during the proposal phase and requesting relevant documents from the respective departments.

IV.4 Interview

From 24th March 2023 until 10th April 2023, the researcher conducted interviews via WhatsApp calls. These calls were recorded with full consent from each respondent using a desktop recording software OBS Studio. The purpose of these interviews was to gather valuable insight and answers for the related study. The participants interviewed included the Project Manager, Engineering Manager, Logistic Coordinator, QHSE (who also serves as the internal auditor), and Quantity Surveyor. The interviews were conducted with an average duration of 30 minutes, and a prepared list of questions was utilized to guide the discussions. The interviews were a vital component of the research process, providing the researcher with valuable information and perspectives relevant to the study.

The research involved conducting interviews with five expert participants who possessed significant experience in construction projects (displayed on the table IV.1). These interviews were conducted via call, targeting managers and staff

members with substantial expertise in the field. The participants' profiles are as follows:

1. Respondent 1 (Project Manager): R1 is a highly experienced project manager with almost twenty years of diverse experience in various construction projects.
2. Respondent 2 (Engineering Manager): R2 serves as an Engineering Manager, working under the supervision of R1. With approximately twelve years of experience in construction projects and fieldwork, R2 brings valuable expertise to the study.
3. Respondent 3 (Quantity Surveyor): R3 works under the guidance of R2 and also fulfills the role of a bridge engineering manager. With four years of experience as a Quantity Surveyor, R3 contributes valuable insights to the research.
4. Respondent 4 (Logistics Coordinator): R4 serves as a logistics coordinator and provides support in warehouse management and administration. With around three years of experience in construction projects, R4 brings essential knowledge to the study.
5. Respondent 5 (QHSE): R5 serves as the Quality, Health, Safety, and Environment (QHSE) representative from the headquarters in Jakarta and also acts as an internal auditor. With more than 10 years of experience as a trained internal auditor and twenty years working in the construction industry, R5 offers valuable insights into the research topic.

The following table presents the profiles of the managers and staff members interviewed for this study:

Table IV.1 Manager and staff profile table

	Experience	Affiliation	Project
R1 (PM)	Almost 20 years	Contractors	Road Preservation Project, South Kalimantan
R2 (EM)	About 12 Years		
R3 (QS)	4 Years		
R4 (Logistic)	About 3 years		

Following the completion of the interviews, the responses provided by the managers and staff were analyzed and collated based on the given questions. The questions and corresponding answers from the managers and staff can be found in Appendices 110, 115, 119, 124, 128. These responses were then organized and compiled into a response matrix, capturing the collective insights shared by the participants. This matrix serves as a valuable resource for gaining a comprehensive understanding of the perspectives and experiences expressed by the managers and staff involved in the study. The results of the answers are summarized and used as a response matrix in table IV.2:

Table IV.2 Respondent Answer Matrix

NO	Question	R1 (PM)	R2 (EM)	R3 (QS)	R4 (Logistic)	R5 (QHSE)
1	How does your company deal with materials/goods or products that do not meet specifications?	Returned to supplier	Returned to supplier	Returned to supplier	Returned to the supplier if the lab test results do not match the specifications	Returned to the supplier included sanctions/penalty
1.1	Is there a procedure?	Yes, by doing a lab test	Yes	Yes	Yes	Yes
1.2	who has the authority to make a decision whether the materials meet the specifications/not?	supervising consultants	PM/Logistic	Logistic/QC/PM	PM/QC	QC/Logistic
2	Has your company implemented ISO standards?	Yes	Yes	Yes	Yes	Yes
2.1	How to ensure that each process has reached the standard?	Do a checklist that meets the standards	Completed job checklists	Follow the available SOP steps and orders	Follow and work on the SOP that has been given	Field implementation review, there is an internal audit for it too

NO	Question	R1 (PM)	R2 (EM)	R3 (QS)	R4 (Logistic)	R5 (QHSE)
2.2	Any examples for the process?	There is	There is	There is	There is	There is
3	Has your company ensured that the needs required by the owner have been stated in the contract?	Already, we have documents concerned with special specifications	Yes	PM or a higher party will ensure the matters of determining the contents of the contract	Yes	Yes
3.1	How to ensure its achievability?	Inspection and test. Following Quality plan	Follow the quality plan that has been made before	Work as stated	Follow work instructions according to the product	There is a signature from the PM of the project, including signatures from all parties involved

NO	Question	R1 (PM)	R2 (EM)	R3 (QS)	R4 (Logistic)	R5 (QHSE)
4	Does your company have a good documentation process?	Yes	Yes	Yes	Yes	Yes
4.1	Does the document play an important role in the audit process	Very important	Yes	Yes, Important	Very important	It is important to achieve the goal Quality Cost Time
5	Is equipment calibrated regularly?	According to the calibration period	It depends on the tool, some are once every 6 months, some are once a year	Depending on the tool, some are a year, some are 6 months	Once a year	Once a year
5.1	Is it well documented?	Yes	It's been well documented	Not really understand	Yes	Yes
5.2	Is there any documentation?	There is	There is	Unsure	There is	There is

NO	Question	R1 (PM)	R2 (EM)	R3 (QS)	R4 (Logistic)	R5 (QHSE)
6	Does your company carry out QA processes on materials and equipment?	Yes	Yes	Yes	Already, carried out by QC and supervised by a supervisory consultant	Yes, for materials at the beginning with the supervising consultant
6.1	How was the QC process during the installation process?	There is a checklist for it	By following the work SOP that has been provided	There is a checklist to be filled	Fulfillment of the checklist given according to the job	there is a checklist including the PM's signature
7	Has your company implemented a corrective action system to address quality issues within the company?	Yes	Yes	Yes	Yes	Yes
7.1	What is the corrective action?	Proof of consent included signature	There is approval from the owner and supervising consultant	There is evidence of Consent	Signed and stamped by the consultant	With proof of consent

NO	Question	R1 (PM)	R2 (EM)	R3 (QS)	R4 (Logistic)	R5 (QHSE)
8	Is there an internal audit process in your company?	Yes, there is	Yes, there is	Once every 6 months	Yes, there is	Once every 6 months
8.1	Has the internal auditor team been trained?	Yes	Yes	Yes	Yes	Already and certified
9	Does your company ensure that only inspected materials are used or further processed in your operations?	Yes, including the SOP	Yes, confirmed by logistics and QC	It's been confirmed	It's confirmed, from the lab results	Yes, according to the requirements and specs
10	Does your company have an SOP for material protection?	Yes, there is	There are some protections for materials, not all of them	No	There are for some materials and materials such as diesel and LPA/LPB/LPS	Nothing, there is only SOP for storage and retrieval
10.1	How do you ensure that these procedures are followed consistently at each stage of the work	There is a checklist for it	There are rules that are made and obeyed	There isn't any	Following the SOP that has been applied to the particular item	With warehouse personnel for material control

NO	Question	R1 (PM)	R2 (EM)	R3 (QS)	R4 (Logistic)	R5 (QHSE)
11	Does your company have a purchasing procedure that contains supplier/sub-contractor specifications?	Yes	Yes	Yes	Yes	Yes
11.1	If so, what are the examples?	Examples include OK, PO to BAPB	From OK to BAPB	OK, PO and BAPB	From OK, PO, BAPB to finally the selection and evaluation of sub-cons	There is a kind of PO/OK/BAPB
12	Does your company have a system for anticipating design changes?	It has been arranged in the contract with the owner	For changes, it is regulated by the consultant and project owner, the contractor only provides technical justification	Only owner and supervising consultant can make those changes	Design changes are handled by the owner, the contractor only does the work	There is none, the design is from the owner, the company only provides suggestions/input

NO	Question	R1 (PM)	R2 (EM)	R3 (QS)	R4 (Logistic)	R5 (QHSE)
12.1	If so, what are the examples?	General terms of the contract	New Addendum	Revision of technical drawings	Added new job/Addendum	None
13	Is there an established process to maintain/change the quality of the documentation?	Yes	Yes	Yes	Yes	Yes
14	Does your company have a method to track the whereabouts of materials from arrival to installation	Yes	Yes	There is, from PO to BAPB untill daily work reports	Yes, the purchase is from OK to BAPB and material spending with MDS	There is, PO to BAPB and field work reports
14.1	If so, in what form? (Chart/Date/Code/FIFO etc)	Documentation of proof of work, in the form of dates	Yes, in the form of date and codes	Daily report, MDS, OK, PO, BAPB	OK, PO, BAPB and MDS	Didn’t understand, because it's more related to field work

NO	Question	R1 (PM)	R2 (EM)	R3 (QS)	R4 (Logistic)	R5 (QHSE)
15	Is the maintenance period specified in the contract?	Yes	Yes	Yes	Yes	Yes, since or from the tender
16	Has your company created and controlled quality manuals and other related processes?	Created before the start of the project	The Quality Manual must have been made before the project started operation	Yes, before the project started	Yes	Quality manual has been maintained and made
17	Does your company have a training outcome document that is used to track and document HR competencies?	Yes	Yes	Yes	Yes	Yes

NO	Question	R1 (PM)	R2 (EM)	R3 (QS)	R4 (Logistic)	R5 (QHSE)
18	Does your company have provided a policy in terms of resource development	Yes	Yes	Yes	Yes	Yes, for example HSE works for the environment
19	Does your company evaluate work on a regular basis?	Yes, evaluation of the entire project	Yes	Yes, there is evaluation for it	Yes	Only from the owner in the form of numbers
19.1	If so, what are the examples? (Graphics/Charts/Weekly/monthly reports/Charts board)	In the form of reports, weekly reports to the realization curve	Weekly report up to S curve including realization and upcoming works	Weekly report	Weekly report	For example held by the project owner