CHAPTER V RESULT ANALYSIS

V.1 Interview

This chapter provides a comprehensive examination of the findings from interviews and observations carried out at a road preservation project in South Kalimantan. The data collected through interviews with managers and staff will be thoroughly analyzed to develop recommendations for implementing ISO 9001:2015 as a Quality Management System (QMS) in construction project logistics. The observation results will complement and support the interview findings, adding valuable evidence to the analysis. This exploration aims to generate valuable insights that contribute to enhancing logistics practices in construction projects.

V.2 Observation Result

Based on direct observations conducted, it has been determined that the implementation of ISO 9001 has been carried out in this road preservation project. These observational findings further support the interview results obtained and the subsequent creation of a flowchart as a visualization of the interview outcomes. The direct observations provide tangible evidence of the adherence to ISO 9001 standards within the project, reinforcing the credibility and reliability of the interview findings. The combination of interview data and observational evidence enhances the overall validity of the research and contributes to a comprehensive understanding of the project's adherence to quality management practices. This integration of multiple data sources strengthens the overall research methodology and ensures a robust assessment of ISO 9001 implementation in the road preservation project.

V.3 Results of Interviews

V.3.1 Results of InterviewsControl of a nonconforming product

Based on the conclusions drawn from the interviews, it is evident that there are difference in viewpoints among the respondents regarding the accountability for

determining compliance with specified requirements. Respondents 2 (EM), 3 (QS), 4 (Logistics), and 5 (QHSE) indicated that the Project Manager (PM), Quality Control (QC), and Logistics personnel hold the responsibility for making such determinations. However, Respondent 1 (PM) stated that the final decision ultimately rests with the supervising consultant and the owner. This discrepancy in responses highlights the influence of hierarchical roles on decision-making processes.

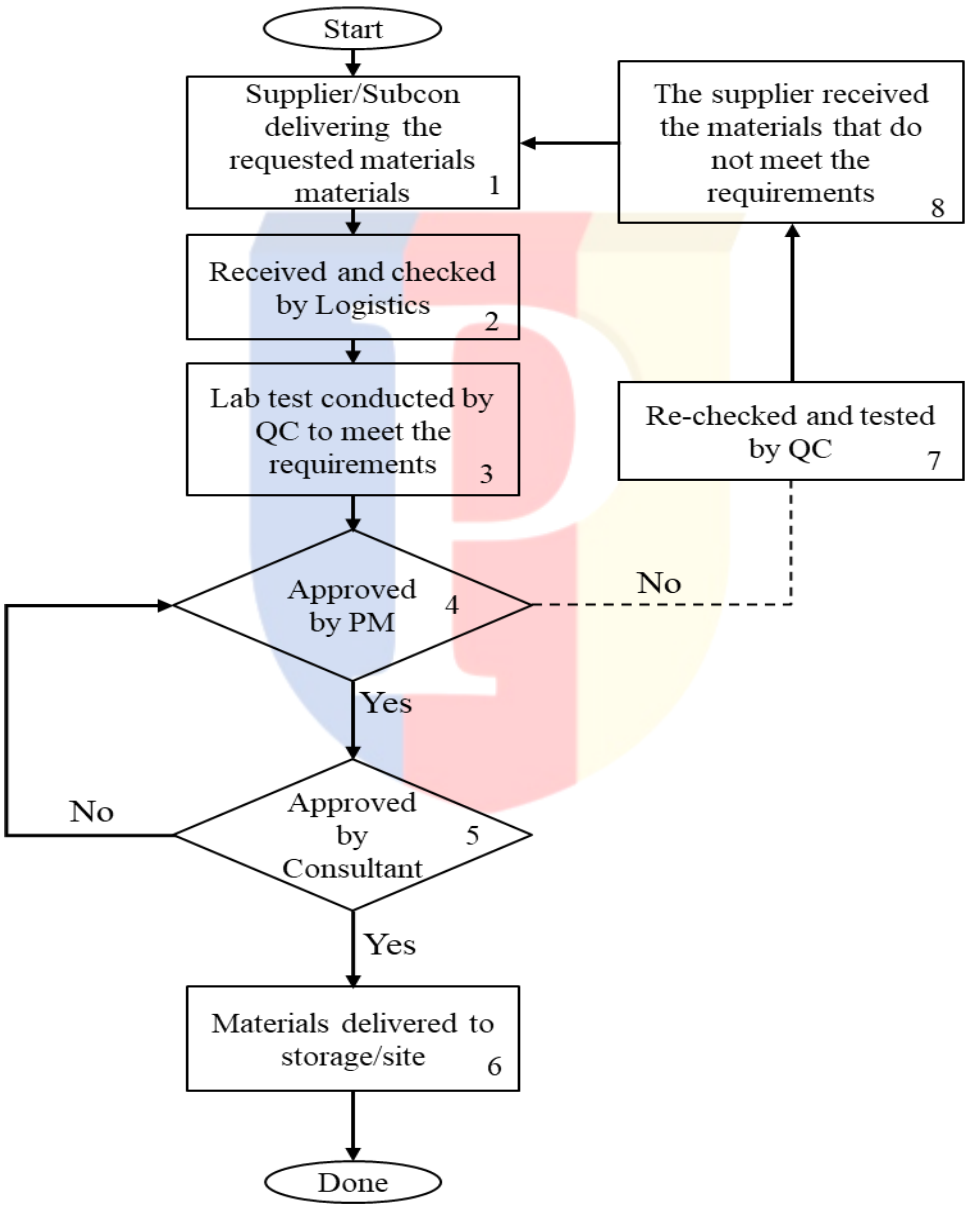

Figure V.1 Control of a nonconforming product flow chart

Indicator: Fully Implemented | Partly Implemented | Not Implemented

The flow chart provided above (Figure V.1) indicates the involvement of specific clauses from the ISO 9001 standard in various steps.

- Steps 1 through 7 are related to Clause 8.5 - Production and Service Provision.
- Step 3 corresponds to Clause 8.2.4 - Control of External Provision of Products and Services.
- Steps 4 and 5 pertain to Clause 5.3 - Organizational Roles.
- Steps 7 and 8 are associated with Clause 7.1.2 - Determination of Requirements for Products and Services and Clause 8.7 - Control of Nonconforming Outputs, respectively.

Regarding the level of implementation, the gathered data from interviews and direct observations indicate that Steps 1, 2, 3, 4, 5, and 7 have been fully implemented, while Step 6 has not been implemented. Overall, the findings reveal that 7 out of the 8 steps have been partly implemented, resulting in an implementation level of 87%. This falls within the range of 75% to 88%, indicating significant progress in adhering to the ISO 9001 elements.

In conclusion, this section highlights the importance of recognizing the differing perspectives among individuals in various hierarchical positions when it comes to decision-making processes. The identified clauses from the ISO 9001 standard provide a framework for evaluating the steps involved in the project. The achieved level of implementation, as measured by the percentage, signifies considerable advancements in incorporating the ISO 9001 elements into the organization's practices.

V.3.2 Process control

Based on the responses obtained during the interviews, it can be concluded that all five respondents confirmed the implementation of ISO standards within the company. They emphasized the significance of Standard Operating Procedures (SOPs) and job checklists as essential tools for ensuring the effective implementation of ISO standards. These measures serve as mechanisms to verify and validate adherence to ISO standards within the organization. Additionally, a

flowchart depicting the implementation of ISO 9001 for process control was presented.

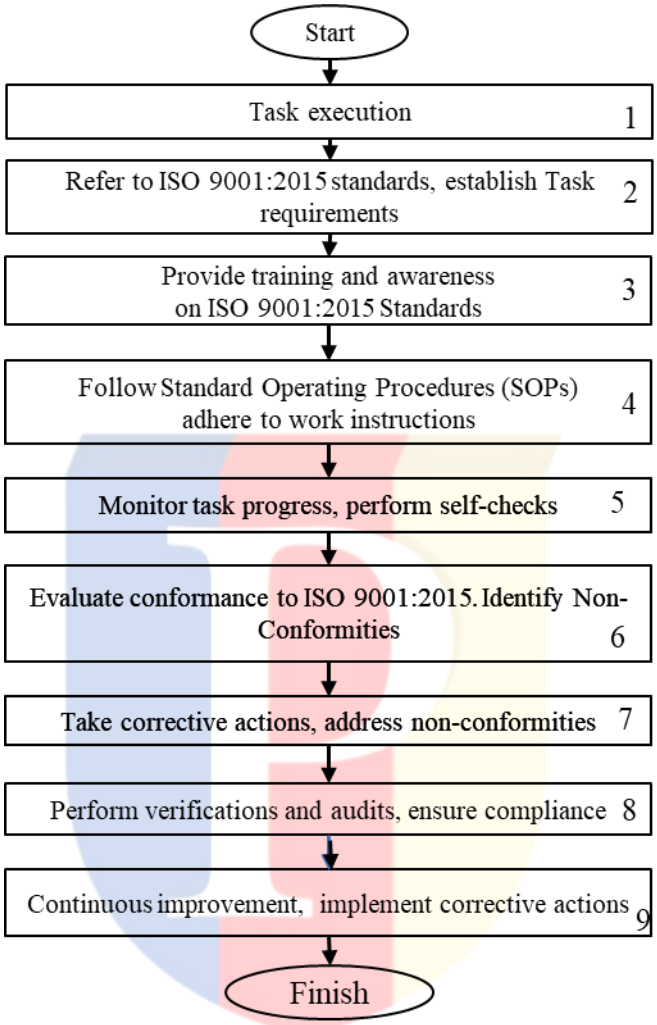

Figure V.2 Process control flow chart

The flowchart above (Figure V.2) outlines the involvement of specific clauses from the ISO 9001 standard in different steps of the process.

- Step 2 is associated with Clause 4.3 - Determining the Scope of the Quality Management System.
- Step 3 with Clause 7.2 – Competence.
- Step 4 with Clause 7.5 - Documented Information.
- Step 5 with Clause 9.1 - Monitoring, Measurement, Analysis, and Evaluation.

- Step 6 with Clause 10.2 - Nonconformity and Corrective Action.
- Step 8 with Clause 9.2 - Internal Audit.
- Step 9 with Clause 10.3 - Continual Improvement.

Regarding the level of implementation, all nine steps have been fully implemented, resulting in a comprehensive implementation of 100%. This indicates that the organization has successfully incorporated and executed the ISO 9001 elements across the entire process.

In conclusion, the responses from the interviews affirm the company's commitment to implementing ISO standards. The reliance on SOPs and job checklists as guiding mechanisms demonstrates the organization's dedication to ensuring compliance with ISO requirements. The flowchart provides a visual representation of the integration of ISO 9001 clauses into the various steps of the process. The complete implementation of all nine steps reflects the company's comprehensive adherence to ISO 9001, exemplifying its commitment to continual improvement and maintaining a robust quality management system.

V.3.3 Contract Review

Based on the responses obtained during the interviews, it can be concluded that the owner's requirements have been effectively incorporated into the contract. The respondents highlighted their adherence to the available quality plan and the provisions stated in the contract to fulfill these requirements. Furthermore, a flowchart illustrating the implementation of ISO 9001 for contract review is presented.

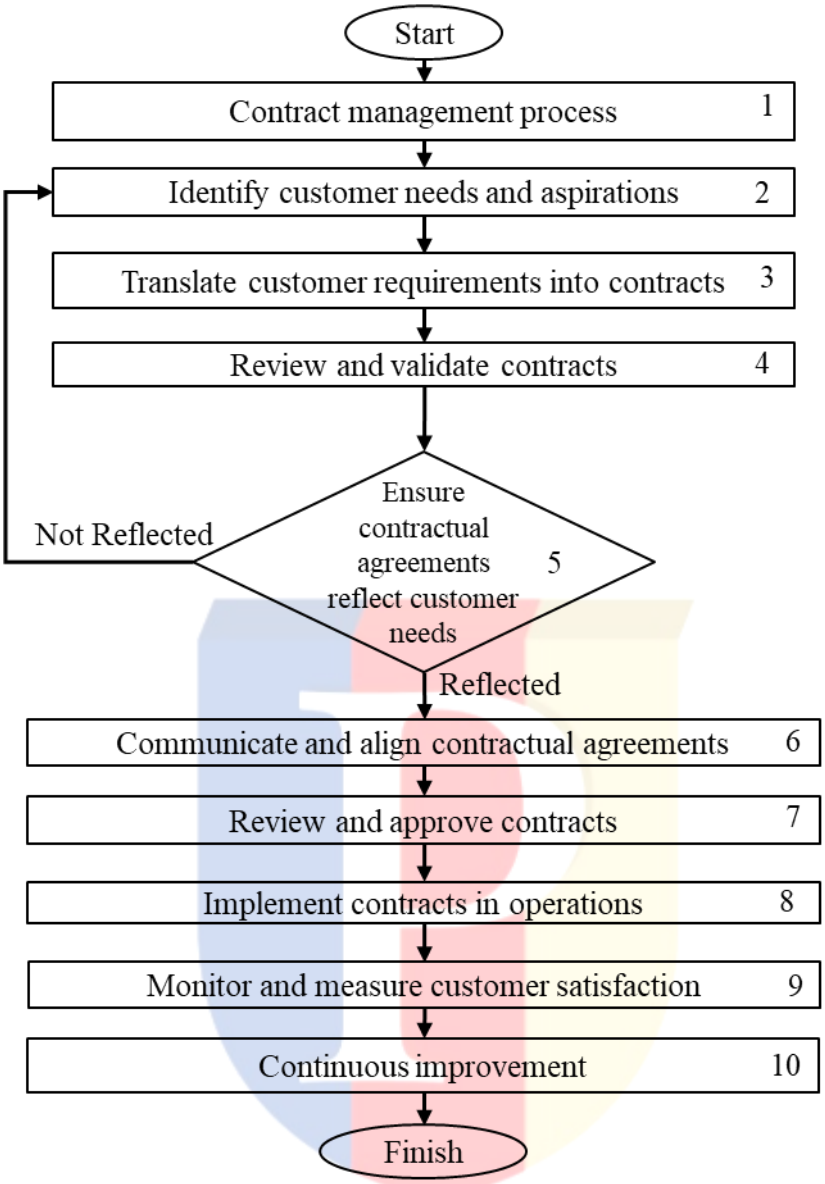

Figure V.3 Contract review flow chart

The flowchart above (Figure V.3) outlines the involvement of specific clauses from the ISO 9001 standard in different steps of the contract review process.

- Step 2 is associated with Clause 4.1 - Understanding the Organization and its Context and Clause 4.2 - Understanding the Needs and Expectations of Interested Parties.
- Step 3 involves Clause 8.2 - Requirements for Products and Services.
- Step 4 encompasses Clause 8.2 - Requirements for Products and Services and Clause 8.3 - Design and Development of Products and Services.
- Step 5 is associated with Clause 8.2 - Requirements for Products and Services.

- Step 6 involves Clause 7.4 – Communication and Clause 8.2 - Requirements for Products and Services.
- Step 7 focuses on Clause 8.2 - Requirements for Products and Services.
- Step 8 is identical to Step 7.
- Step 9 relates to Clause 9.1.2 - Customer Satisfaction.
- Step 10 involves Clause 10.3 - Continual Improvement.

Regarding the level of implementation, all ten steps have been fully implemented, resulting in a comprehensive implementation of 100%. This indicates that the organization has effectively incorporated the ISO 9001 elements into the contract review process, demonstrating their commitment to meeting customer requirements and ensuring continual improvement.

In conclusion, the interview responses affirm that the owner's requirements have been integrated into the contract, and the quality plan and contractual provisions are followed to fulfill these requirements. The flowchart provides a visual representation of the incorporation of ISO 9001 clauses into the various steps of the contract review process. The complete implementation of all ten steps indicates the organization's comprehensive adherence to ISO 9001, reflecting their commitment to customer satisfaction and continual improvement.

V.3.4 Control Of Quality Records

Based on the responses obtained during the interviews, it can be concluded that the company has a well-established documentation process for controlling quality records. The respondents emphasized the significance of documents in the audit process, highlighting their importance within the organization. A flowchart outlining the implementation of ISO 9001 for the control of quality records is presented.

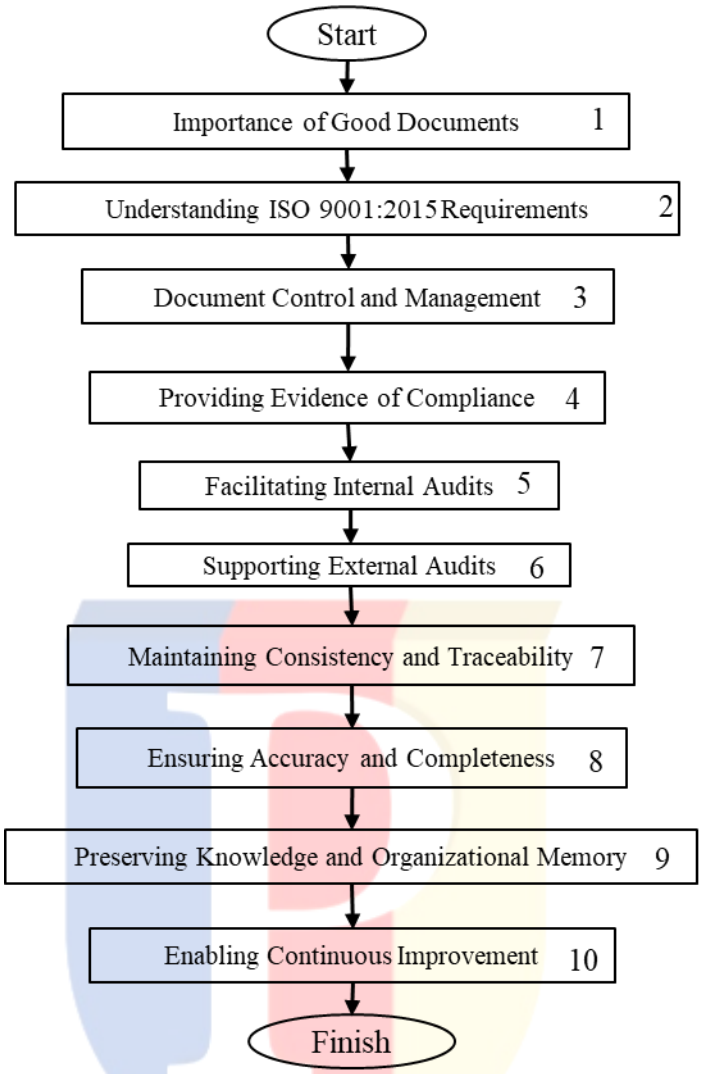

Figure V.4 Control of quality records flow charts

The flowchart above (Figure V.4) demonstrates the involvement of specific ISO 9001 clauses in different steps of the quality records control process.

- Step 2 is associated with Clause 4.3, which pertains to determining the scope of the Quality Management System.
- Step 3 involves Clause 7.5, which addresses documented information.
- Step 4 encompasses Clause 4.3, Clause 8.2, and Clause 9.1.1, relating to the scope determination, requirements for products and services, and monitoring, measurement, analysis, and evaluation, respectively.
- Step 5 is linked to Clause 9.2, focusing on internal audits.

- Step 6 involves both Clause 9.2 and Clause 10.2, pertaining to internal audits and nonconformity and corrective action, respectively.
- Step 7 is associated with Clause 4.2, Clause 8.1, and Clause 8.3, addressing the understanding of interested parties' needs and expectations, operational planning and control, and design and development of products and services.
- Step 8 encompasses Clause 7.5 and Clause 9.1, which relate to documented information and monitoring, measurement, analysis, and evaluation, respectively.
- Step 9 is linked to Clause 7.1.6, focusing on organizational knowledge. Finally,
- Step 10 involves Clause 10.3, which pertains to continual improvement.

Regarding the level of implementation, all ten steps have been fully implemented, resulting in a comprehensive implementation of 100%. This indicates that the organization has effectively incorporated the ISO 9001 elements into the control of quality records, demonstrating their commitment to proper documentation, monitoring, and continual improvement.

In conclusion, the respondents confirm the company's possession of a well-established documentation process for controlling quality records, with documents being regarded as highly important in the audit process. The flowchart provides a visual representation of the incorporation of ISO 9001 clauses into the various steps of the quality records control process. The complete implementation of all ten steps signifies the organization's comprehensive adherence to ISO 9001, reflecting their commitment to proper documentation, monitoring, and continual improvement.

V.3.5 Control of inspection measuring and test equipment

The interview results regarding the question on control of inspection, measuring, and test equipment indicate that the respondents confirmed the calibration of the equipment. The calibration frequency varies depending on the specific equipment, with some requiring calibration every six months and others once a year. The results of the calibration process are well-documented, demonstrating a strong

commitment to maintaining accurate and reliable measurement systems. Furthermore, a flowchart outlining the implementation of ISO 9001 for the control of quality records is presented.

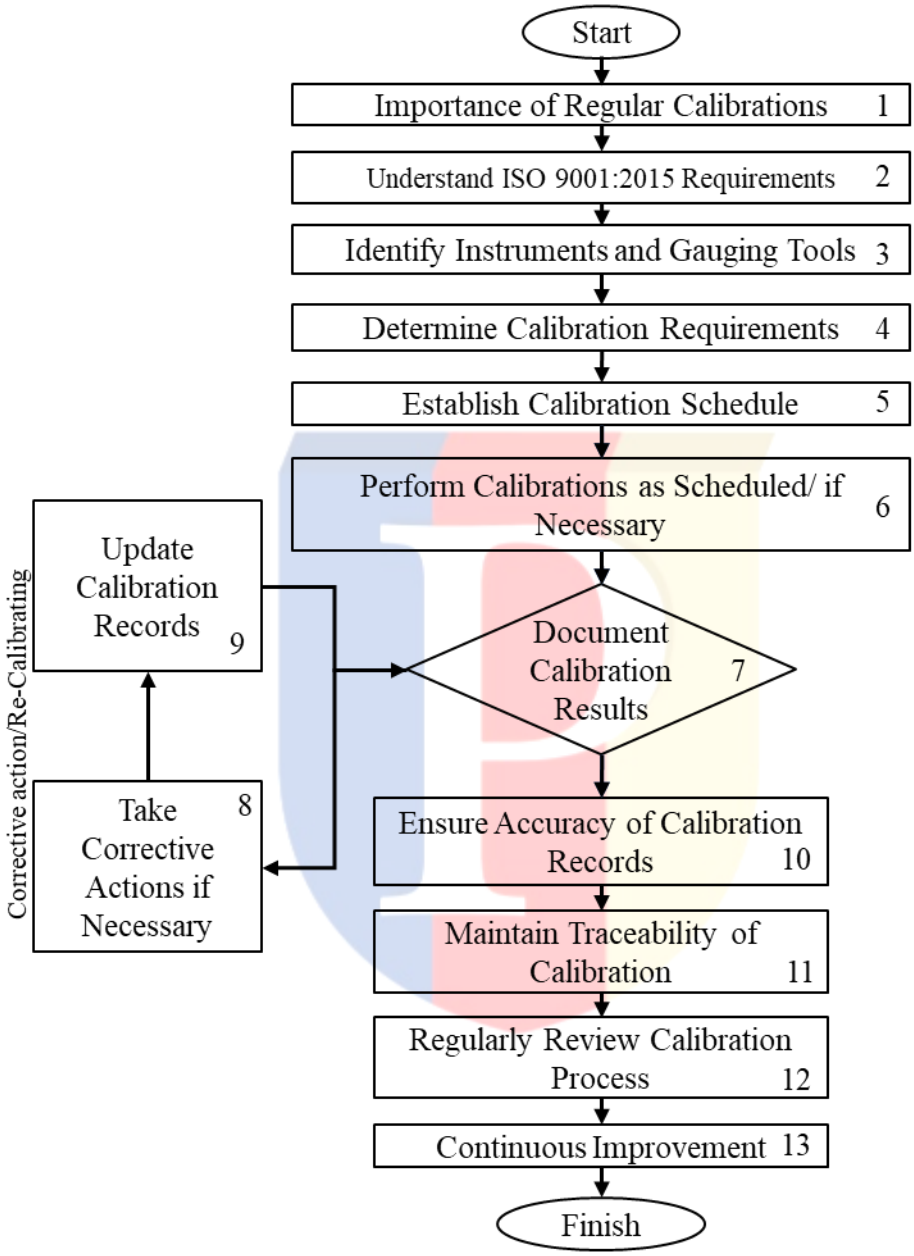

Figure V.5 Control of inspection, measuring, and test equipment flow chart

The flowchart above (Figure V.5) illustrates the involvement of specific clauses from the ISO 9001 standard in different steps of the quality records control process.

- Step 2 is associated with Clause 4.3 - Determining the Scope of the Quality Management System.
- Step 3 involves Clause 7.5 - Documented Information.

- Step 4 encompasses Clause 4.3 - Determining the Scope of the Quality Management System, Clause 8.2 - Requirements for Products and Services, and Clause 9.1.1 - Monitoring, Measurement, Analysis, and Evaluation.
- Step 5 relates to Clause 9.2 - Internal Audit.
- Step 6 involves Clause 9.2 - Internal Audit and Clause 10.2 - Nonconformity and Corrective Action.
- Step 7 focuses on Clause 4.2 - Understanding the Needs and Expectations of Interested Parties, Clause 8.1 - Operational Planning and Control, and Clause 8.3 - Design and Development of Products and Services.
- Step 8 is associated with Clause 7.5 - Documented Information and Clause 9.1 - Monitoring, Measurement, Analysis, and Evaluation.
- Step 9 relates to Clause 7.1.6 - Organizational Knowledge.
- Step 10 involves Clause 10.3 - Continual Improvement.

Regarding the level of implementation, all ten steps have been fully implemented, resulting in a comprehensive implementation of 100%. This indicates that the organization has effectively incorporated the ISO 9001 elements into the control of quality records, demonstrating their commitment to ensuring proper documentation and adherence to audit requirements.

In summary, the interview responses confirm the company's possession of a well-established documentation process for controlling quality records, with documents being regarded as highly important in the audit process. The flowchart provides a visual representation of the incorporation of ISO 9001 clauses into the various steps of the quality records control process. The complete implementation of all ten steps signifies the organization's comprehensive adherence to ISO 9001, reflecting their commitment to proper documentation, and monitoring.

V.3.6 Inspection and Testing

Based on the responses obtained during the interviews, it can be concluded that the company has implemented Quality Assurance (QA) practices for inspection and testing of materials and equipment. The respondents confirmed that the company

has established processes to ensure thorough inspections and testing, aiming to meet the required quality standards. A flowchart outlining the implementation of ISO 9001 for inspection and testing is presented.

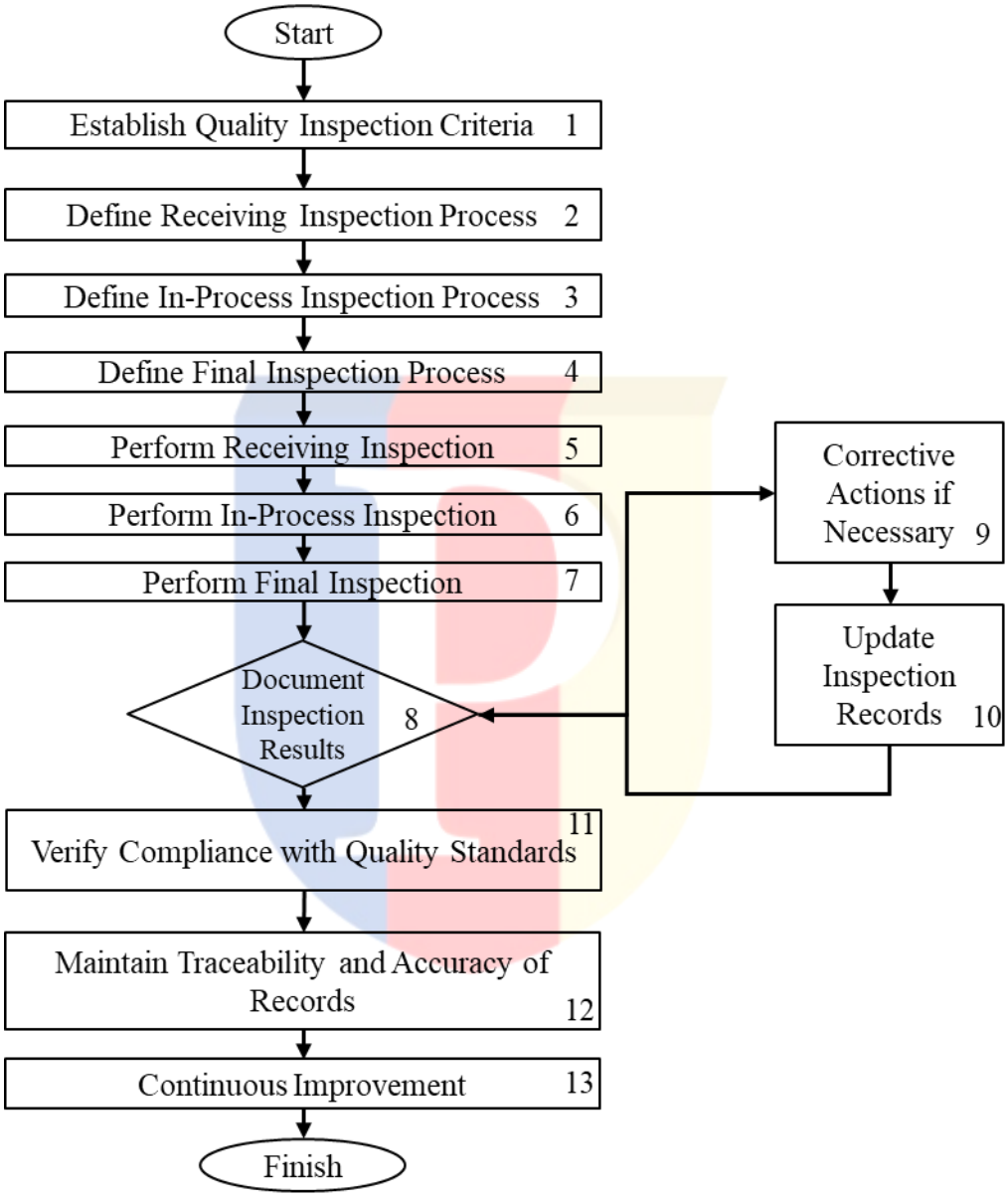

Figure V.6 Inspection and testing flowchart

The flowchart above (Figure V.6) depicts the involvement of specific ISO 9001 clauses in different steps of the inspection and testing process.

- Step 2 through 7 are associated with Clause 8.4, which pertains to the control of externally provided processes, products, and services.

- Step 8 involves Clause 7.5, which addresses documented information. Step 9 is linked to Clause 10.2, focusing on nonconformity and corrective action.
- Step 10 encompasses Clause 7.5, pertaining to documented information.
- Step 11 involves Clause 8.5 and Clause 9.1.1, addressing production and service provision, as well as monitoring, measurement, analysis, and evaluation.
- Step 12 is associated with Clause 7.5, relating to documented information.
- Step 13 involves Clause 10.3, which pertains to continual improvement.

Regarding the level of implementation, all thirteen steps have been fully implemented, resulting in a comprehensive implementation of 100%. This indicates that the organization has effectively incorporated ISO 9001 elements into the inspection and testing processes, demonstrating their commitment to ensuring the quality of materials and equipment through rigorous quality assurance practices.

In summary, the intervieew responses confirm that the company has implemented Quality Assurance practices for inspection and testing, ensuring that materials and equipment undergo thorough scrutiny to meet the required quality standards. The flowchart provides a visual representation of how ISO 9001 clauses are integrated into the various steps of the inspection and testing process. The complete implementation of all thirteen steps reflects the organization's commitment to adhering to ISO 9001 and underscores their dedication to maintain quality standards in their operations.

V.3.7 Corrective and preventive action

Based on the responses obtained during the interviews, it can be concluded that the company's control over design changes is limited, as stated by the respondents. The responsibility for design changes rests solely with the project owner or consultant, and the contractor's role is restricted to providing technical justifications and input/recommendations for any proposed changes. A flowchart outlining the implementation of ISO 9001 for corrective and preventive action is presented.

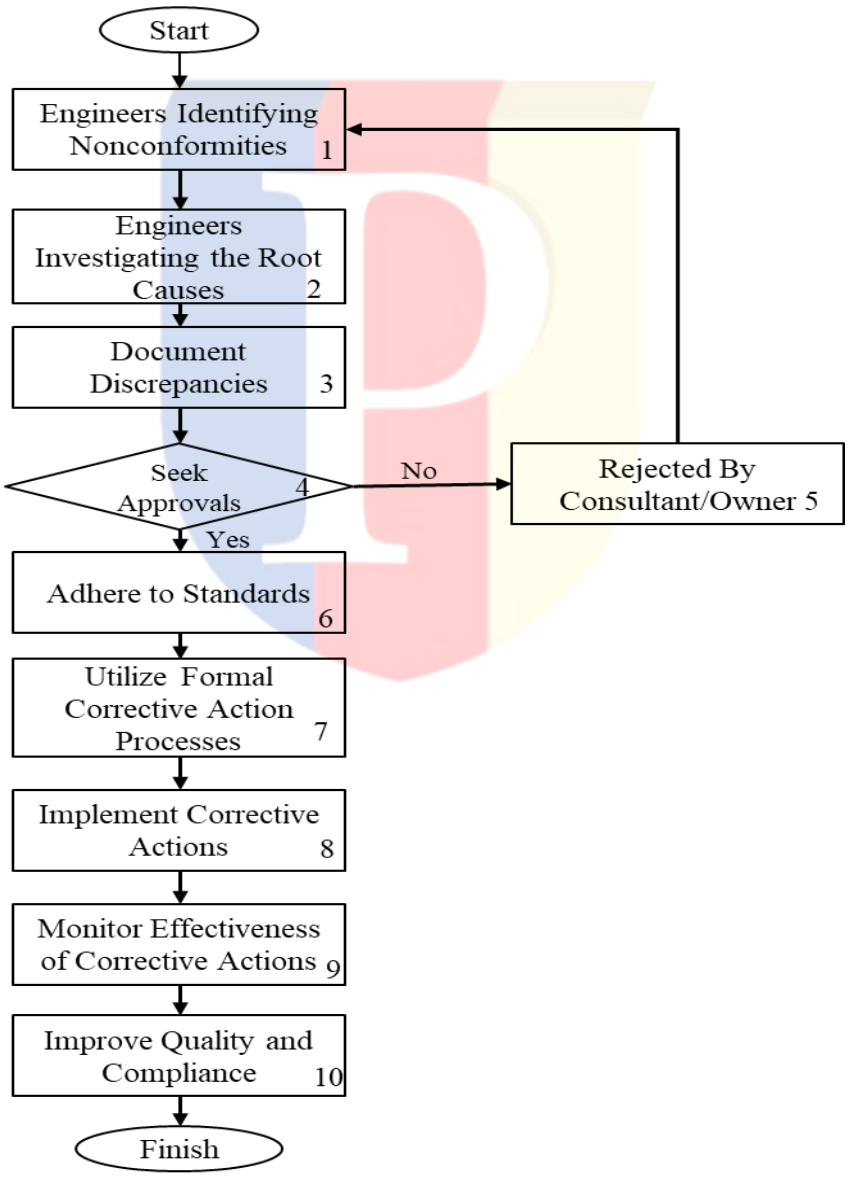

Figure V.7 corrective and preventive action flow chart

The flowchart above (Figure V.7) illustrates the involvement of specific ISO 9001 clauses in different steps of the corrective and preventive action process.

- Step 1 involves Clause 8.2, which pertains to requirements for products and services.
- Steps 1, 2, 4, 6, 7, 8, and 9 are associated with Clause 10.2, focusing on nonconformity and corrective action.
- Step 3 is linked to Clause 7.5, which addresses documented information.
- Step 6 involves Clause 8.5, pertaining to production and service provision.
- Step 7 is associated with Clause 10.2, relating to nonconformity and corrective action.
- Step 9 encompasses Clause 9.1.1, addressing monitoring, measurement, analysis, and evaluation.
- Step 10 involves Clause 10.3 and Clause 8.5, which pertain to continual improvement and production and service provision, respectively.

In terms of implementation, all ten steps have been fully implemented, resulting in a comprehensive implementation percentage ranging from 88% to 100%. This indicates that the organization has effectively incorporated ISO 9001 elements into the corrective and preventive action processes, demonstrating their commitment to addressing nonconformities and taking proactive measures to prevent their recurrence.

To summarize, the interview responses highlight that the company does not have control over design changes, which lies within the purview of the project owner or consultant. The flowchart provides a visual representation of how ISO 9001 clauses are integrated into the various steps of the corrective and preventive action process. The complete implementation of all ten steps reflects the organization's dedication to adhering to ISO 9001 and emphasizes their commitment to addressing nonconformities and continually improving their processes.

V.3.8 Internal Quality Audits

Based on the responses obtained during the interviews, it can be concluded that the company already has an internal audit process in place, which is conducted every six months. The respondents stated that the internal audit team is well-trained and certified, indicating their competence in performing the audits. A flowchart outlining the implementation of ISO 9001 for internal quality audits is presented.

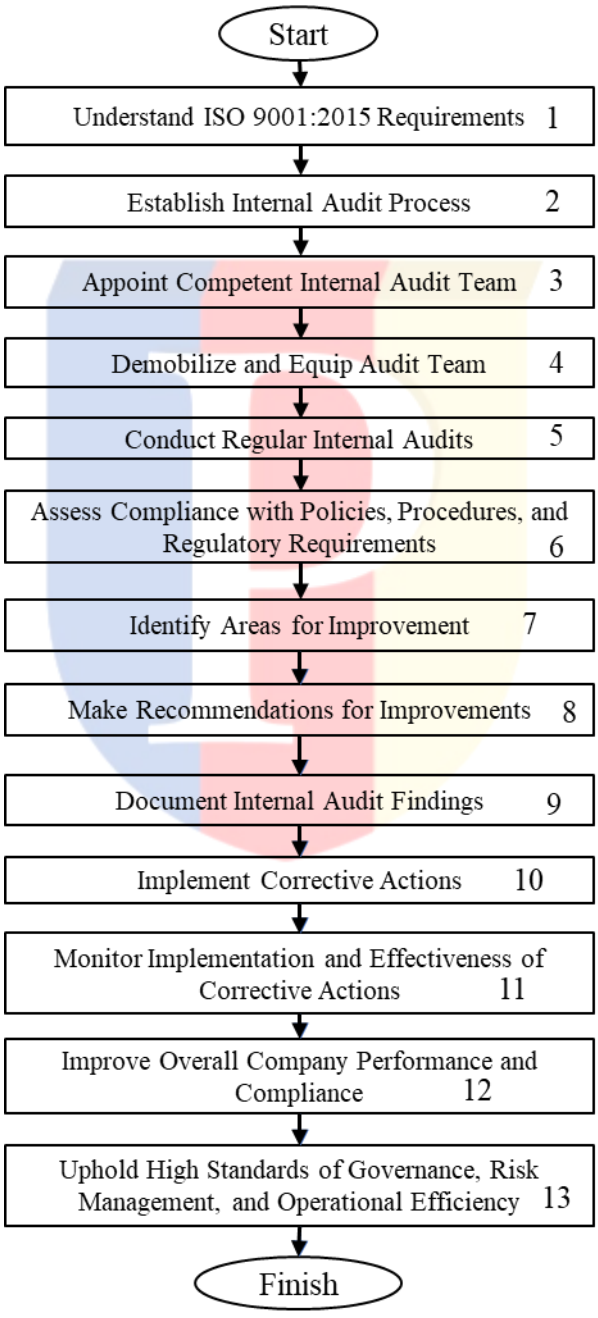

Figure V.8 internal quality audits flowchart

The flowchart above (Figure V.8) demonstrates the involvement of specific ISO 9001 clauses in different steps of the internal audit process.

- Step 1 encompasses Clause 4.1, Clause 9.2, and Clause 9.3, which relate to understanding the organization and its context, internal audit, and management review, respectively.
- Step 2 is associated with Clause 9.2, focusing on internal audit.
- Step 3 involves Clause 7.2 and Clause 9.2, pertaining to competence and internal audit, respectively.
- Step 5 is linked to Clause 9.2, addressing internal audit.
- Step 6 encompasses Clause 4.2, Clause 4.4, and Clause 8.2, which pertain to understanding the needs and expectations of interested parties, the quality management system and its processes, and requirements for products and services, respectively.
- Step 7 and Step 8 are both associated with Clause 9.2, relating to internal audit.
- Step 9 involves Clause 7.5, addressing documented information.
- Step 10 encompasses Clause 9.2 and Clause 9.3, focusing on internal audit and management review.
- Step 11 involves Clause 10.2 and Clause 9.1.1, pertaining to nonconformity and corrective action, and monitoring, measurement, analysis, and evaluation, respectively.
- Step 12 is linked to Clause 10.3, which addresses continual improvement.

In terms of implementation, all thirteen steps have been fully implemented, resulting in a comprehensive implementation percentage of 100%. This indicates that the organization has effectively incorporated ISO 9001 elements into the internal quality audit process, demonstrating their commitment to ensuring the effectiveness of their quality management system.

To summarize, the interview responses highlight that the company has a well-established internal audit process conducted every six months. The flowchart visually represents how ISO 9001 clauses are integrated into the different steps of the internal quality audit process. The complete implementation of all thirteen steps

reflects the organization's dedication to adhering to ISO 9001 and emphasizes their commitment to evaluating and improving their quality management system through regular internal audits.

V.3.9 Inspection and Test Status

Based on the information provided by the respondents, it can be concluded that the company places significant emphasis on inspecting materials and utilizing only those that meet predetermined specifications. The respondents highlighted the importance of adhering to established Standard Operating Procedures (SOPs) as reference points for quality control. By following these guidelines, the company ensures that substandard materials are not used in their operations. A flowchart outlining the implementation of ISO 9001 for inspection and test status is presented.

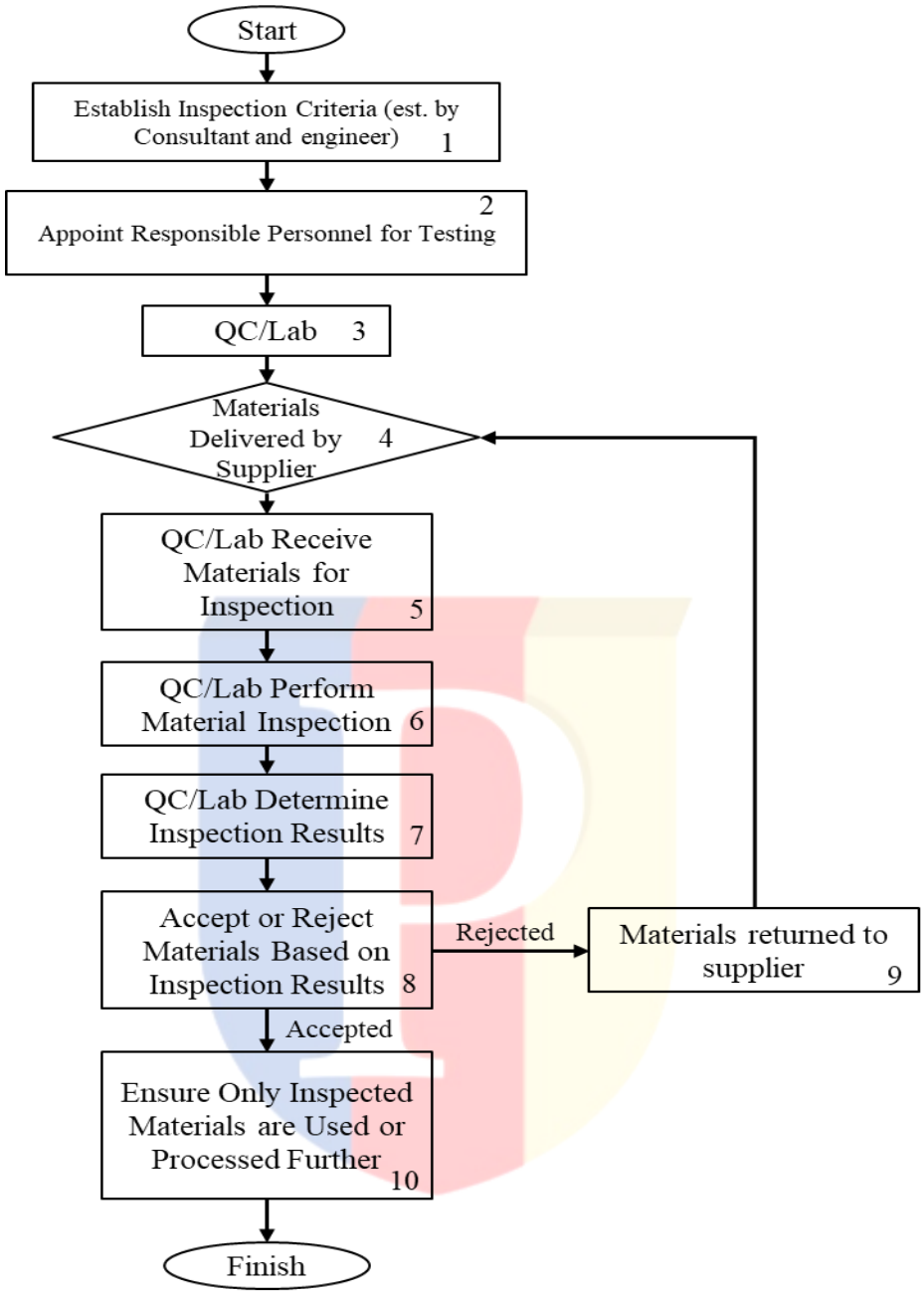

Figure V.9 inspection and test status flow chart

The flowchart above (Figure V.9) demonstrates the involvement of specific ISO 9001 clauses in different steps of the inspection and test status process.

- Step 1 encompasses Clause 8.4 and Clause 8.5.1, which relate to the control of external provision of products and services and the control of production and service provision.

- Steps 4 through 10 are all associated with Clause 8.4, focusing on the control of external provision of products and services.
- Step 5 is specifically linked to Clause 8.5.1, which addresses the control of production and service provision.

In terms of implementation, steps one through ten have been fully implemented, resulting in a comprehensive implementation percentage of 100%. This indicates that the company has effectively incorporated ISO 9001 elements into the inspection and test status process, ensuring the utilization of inspected materials and maintaining quality control standards.

In conclusion, the respondents emphasized the importance of inspecting materials and following predetermined specifications to maintain a high level of quality control. The flowchart visually represents how ISO 9001 clauses are integrated into the different steps of the inspection and test status process. The complete implementation of all nine steps reflects the organization's commitment to adhering to ISO 9001 and underscores their dedication to ensuring the utilization of only inspected materials. This approach helps mitigate the risk of using substandard materials and contributes to maintaining a robust quality management system.

V.3.10 Handling, storage, packaging, preservation and delivery

Based on the interview results concerning handling, storage, packaging, preservation, and delivery, it is evident that there are varying responses from the respondents. Respondent 1 (PM) indicated the presence of established procedures for these aspects. However, respondents 3 (QS) and 5 (QHSE) stated the absence of specific Standard Operating Procedures (SOPs) addressing material protection. Respondents 2 (EM) and 4 (Logistics) mentioned the existence of SOPs for certain materials, but not all materials were covered by these procedures. These divergent responses highlight the need for further evaluation and standardization in the organization's practices related to handling, storage, packaging, preservation, and delivery.

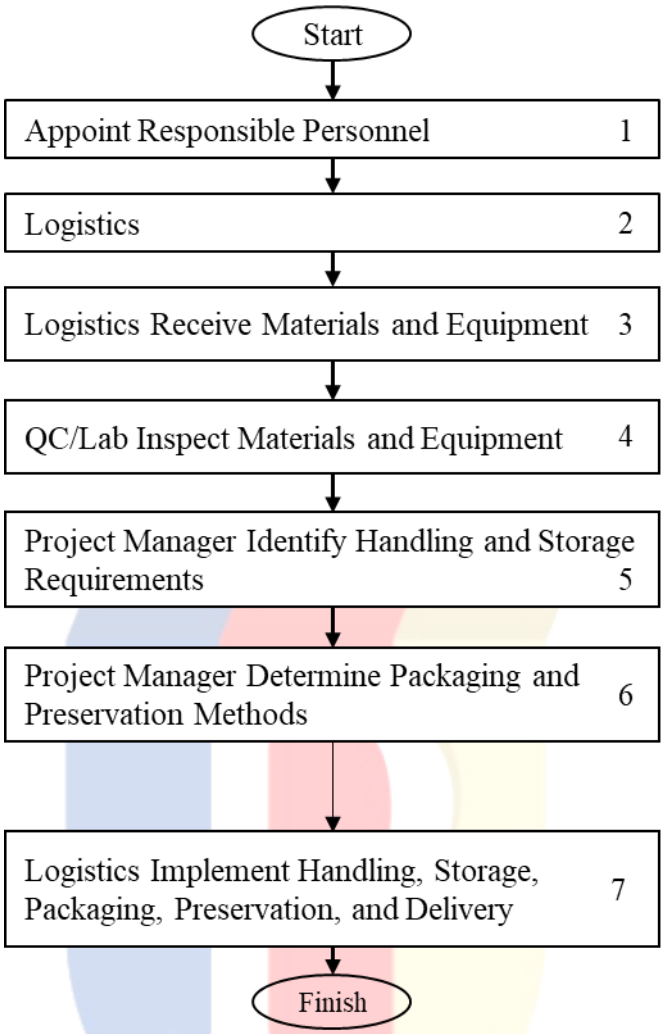

Figure V.10 Handling, storage, packaging, preservation, and delivery flow chart

Indicator: Fully Implemented | Partly Implemented | Not Implemented

In terms of implementation, steps 1, 2, 3, 4, 5, 6, and half of step 7 have been implemented, resulting in a partial implementation of 6 ½ steps out of 7. This indicates a level of implementation of 92.85%, falling within the range of 88% to 100% (still falls under fully implemented). Examining step 7, it becomes evident that the implementation has not been fully carried out. The interview findings indicate that only a subset of materials is currently being protected. This aligns with the author's observations during their presence on the road preservation project. Collectively, these findings suggest that the implementation of adequate material protection measures remains incomplete.

The flowchart provided corresponds to ISO 9001's Clause 8.4 - Control of External Provision of Products and Services. This clause is applicable from steps 3 to 7 and emphasizes the organization's responsibility to establish effective controls over externally provided processes, products, and services to ensure they meet specified requirements. It encompasses activities such as supplier selection, evaluation, and monitoring to ensure the consistent quality of externally sourced components and services.

To summarize, the responses from the interviewees revealed varying practices and procedures regarding handling, storage, packaging, preservation, and delivery. The flowchart indicates the involvement of Clause 8.4 in steps 3 to 7, emphasizing the organization's responsibility for effective controls over externally provided processes, products, and services. The implementation of these measures remains partially completed, indicating the need for further evaluation and standardization. The organization should strive to improve the implementation to ensure consistent material protection across all aspects of their operations.

V.3.11 Purchasing

Based on the interview responses, it was reported that there are established procedures for purchasing/procurement within the organization. The purchasing/procurement process involves several steps, starting with an OK (Order Keperluan), followed by a PO (Purchase Order), and concluding with a BAPB (Berita acara pengadaan barang/material) or Procurement Goods/Material Record. Subsequently, subcontractors undergo evaluation and selection, ultimately becoming the primary subcontractor for specific services or materials. These procedures ensure a systematic and controlled approach to procurement, facilitating the appropriate selection and engagement of subcontractors for specific services or materials.

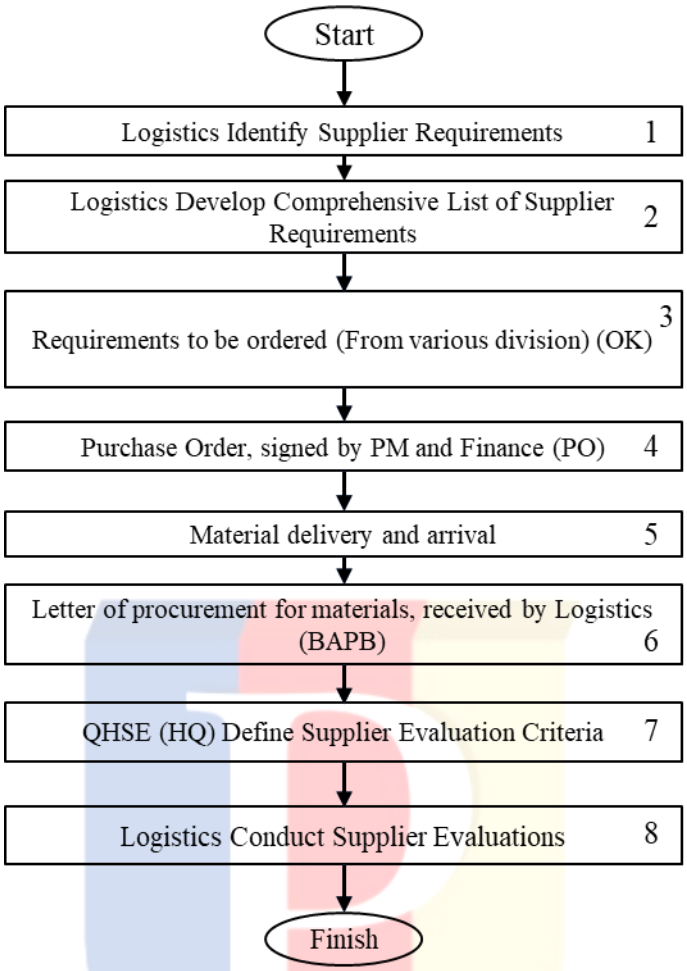

Figure V.11 Purchase/Procurement flow chart

The provided flowchart above (Figure V.11) corresponds to ISO 9001's Clause 8.4 - Control of External Provision of Products and Services, which is applicable from steps 1 to 8. This clause outlines the organization's responsibility for implementing effective controls over externally provided processes, products, and services. In steps 7 and 8, the specific clause relevant is Clause 8.4.1 - General.

Regarding implementation, steps one through eight have been fully implemented, resulting in a complete implementation of all 8 steps. This indicates a 100% implementation within the 88%-100% range (Fully implemented).

In summary, the interview responses confirmed the existence of established procedures for purchasing/procurement, ensuring a systematic and controlled

approach. The flowchart aligns with ISO 9001's Clause 8.4 and highlights the organization's responsibility for effective controls over externally provided processes, products, and services. The implementation of these procedures has been fully completed, demonstrating a comprehensive and consistent approach to purchasing/procurement practices.

V.3.12 Design Control

Based on the statements provided by the interview respondents, it was clarified that for design changes, only the Owner and the Consultant hold the authority to make modifications. The Contractor's role is limited to providing recommendations and technical justifications. An illustration of this can be observed in the procurement of a new work package, where the addition of a new addendum specifically addressing the associated tasks may be required. This clear division of responsibilities ensures that design changes are managed by the appropriate parties, while allowing the Contractor to contribute valuable input and technical expertise.

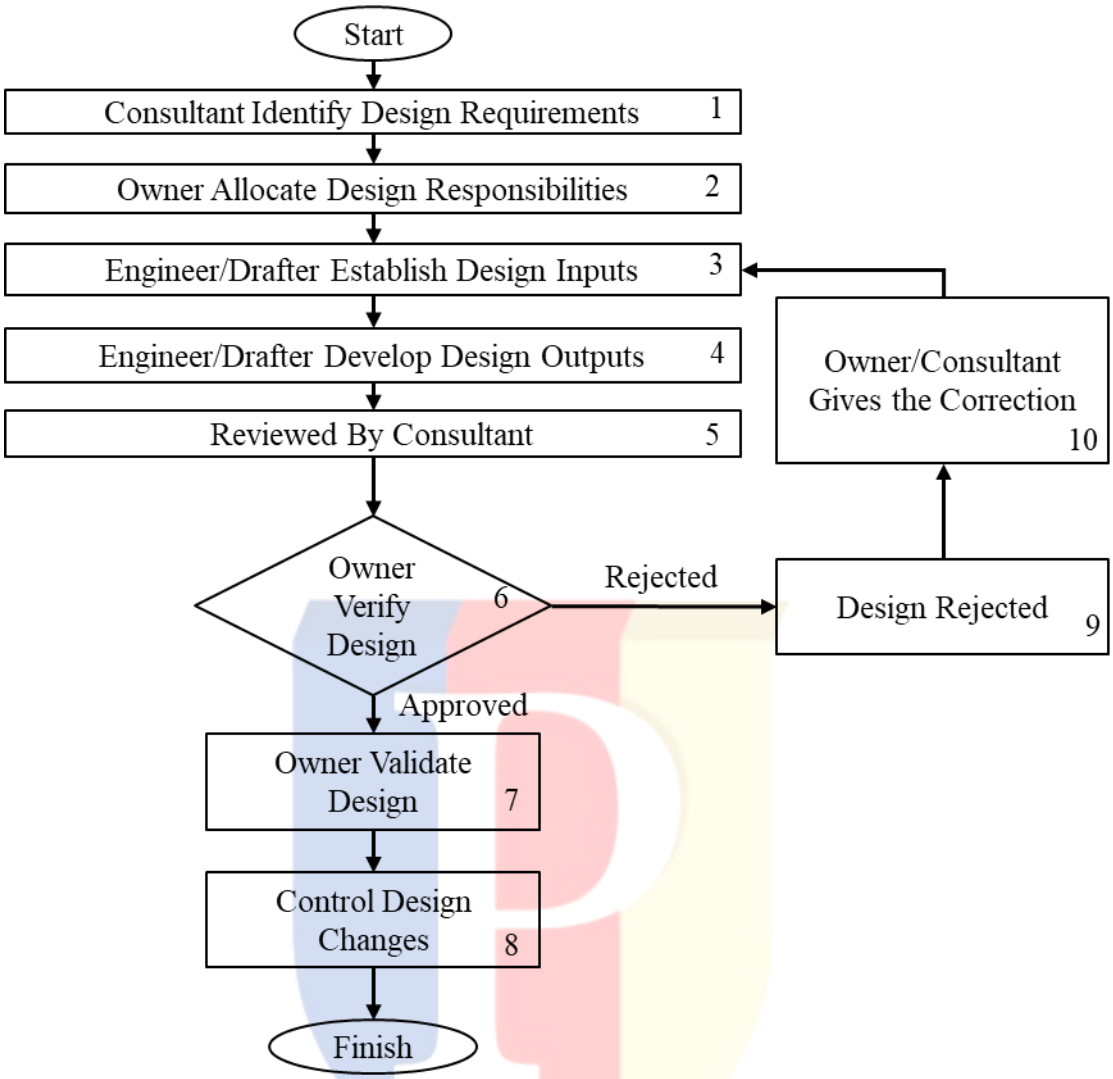

Figure V.12 Design control flowchart

The provided flowchart above (Figure V.12) outlines the implementation of ISO 9001 for design control. It encompasses several steps and clauses, as follows:

- Step 1 corresponds to Clause 8.3.2 - Requirements for Products and Services.
- Step 3 through 7 align with Clause 8.3.3 - Design and Development Inputs.
- Step 8 corresponds to Clause 8.3.6 - Design and Development Changes.
- Steps 9 and 10 relate to Clause 8.2 - Requirements for Products and Services.

Regarding implementation, steps one through ten have been fully implemented, indicating a complete execution of all 10 steps. This signifies a 100% full implementation within the 88%-100% range.

In summary, the interview responses affirm that design changes are managed by the Owner and the Consultant, with the Contractor's role limited to providing recommendations and technical justifications. The flowchart corresponds to ISO 9001's design control requirements, specifically focusing on clauses related to requirements, inputs, changes, and the overall design process. The implementation of these steps has been fully completed, demonstrating a comprehensive approach to design control practices.

V.3.13 Document and data control

Based on the statements provided by the interview respondents, it was indicated that there is an established process for determining and maintaining the quality of documentation within the organization. This process has been defined and implemented, ensuring that documents meet the required standards. The documentation quality control measures involve several steps and procedures to review, verify, and validate documentation, ensuring accuracy, completeness, and compliance with applicable guidelines or regulations. The implementation of these processes is crucial for preserving the integrity and reliability of the documented information, thereby contributing to the overall quality management system of the organization.

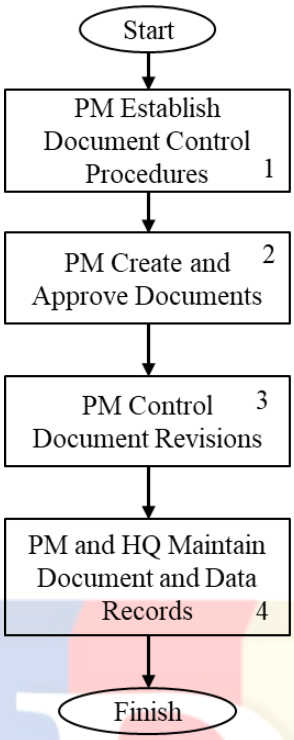

Figure V.13 Document and data control flow chart

The provided flowchart outlines the implementation of ISO 9001 for document and data control, specifically focusing on Clause 7.5 - Documented Information. The implementation involves steps 1 through 4, which correspond to the requirements and processes related to document control.

Regarding implementation, steps one through four have been fully executed, indicating the complete implementation of all four steps. This signifies a 100% full implementation within the 88%-100% range (Fully implemented).

In summary, the interview responses highlight the existence of an established process for determining and maintaining the quality of documentation within the organization. The flowchart aligns with ISO 9001's requirements for document and data control, specifically emphasizing Clause 7.5. The implementation of the steps in this process has been fully accomplished, ensuring the effective control and management of documented information.

V.3.14 Product identification and traceability

Based on the interview findings, it was revealed that the organization has established methods to track the whereabouts of materials from arrival to installation. These methods involve the use of documentation such as BAPB (Berita Acara Pengadaan Barang/Material) and MDS (Material Data Sheet). These documents serve as tools for monitoring and tracing the movement of materials within the project. The tracking process includes recording dates and utilizing unique codes or identifiers associated with the materials. By implementing these tracking methods, the organization can maintain effective control over the material flow, enhance traceability, and facilitate efficient project management.

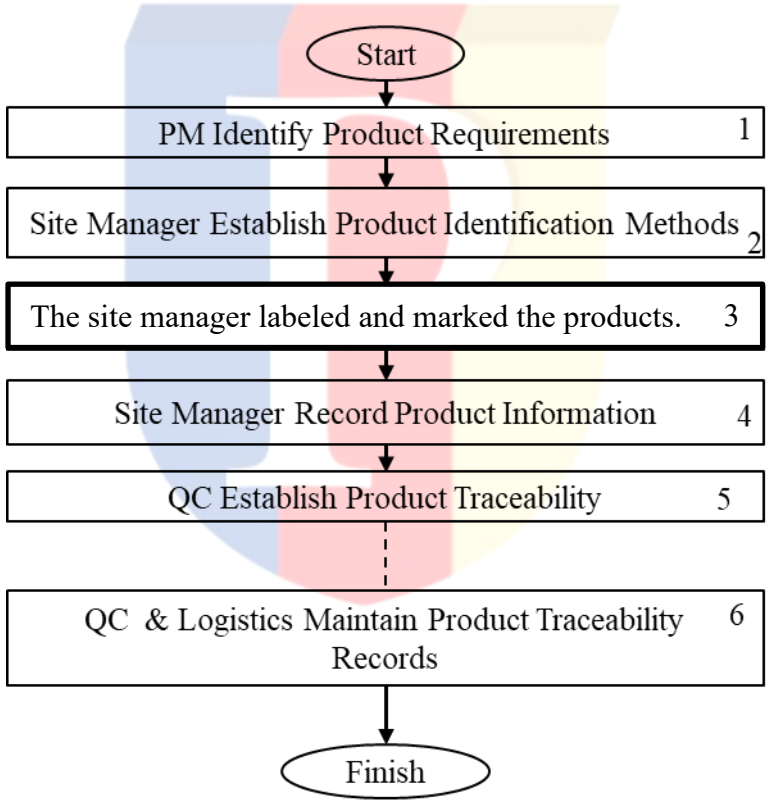

Figure V.14 Product identification and traceability flow chart

Indicator: Fully Implemented | Partly Implemented | Not Implemented

The provided flowchart above (Figure V.14) outlines the implementation of ISO 9001 for product identification and traceability. Steps one through four correspond to Clause 8.5.1 - Control of Production and Service Provision, which focuses on the control and management of production and service activities. Steps 5 and 6 align

with Clause 8.5.2 - Identification and Traceability, emphasizing the need for proper identification and traceability of products.

However, it is important to note that based on both the interview results and the author's observations, there are deficiencies in maintaining Product Traceability Records within the road preservation project. The observation findings indicate inadequate capturing and documentation of necessary information for ensuring proper traceability throughout the project lifecycle. The absence or insufficient implementation of robust traceability measures can lead to difficulties in addressing non-conformities, potential delays in resolving quality issues, and challenges in meeting regulatory or customer requirements. Therefore, it is crucial to address these deficiencies and implement appropriate measures to enhance the management of Product Traceability Records in the road preservation project.

Regarding implementation, steps 1, 2, 3, 4, and 5 have been partly implemented, indicating that five out of six steps have been addressed. This represents an 83.33% partial implementation within the 75%-88% range.

In summary, the interview responses highlight the organization's established methods for tracking materials, utilizing documentation such as BAPB and MDS. The provided flowchart aligns with ISO 9001's requirements for product identification and traceability, specifically emphasizing Clauses 8.5.1 and 8.5.2. However, deficiencies in maintaining adequate Product Traceability Records within the road preservation project need to be addressed. Enhancing traceability measures will contribute to improved quality management and project efficiency.

V.3.15 Servicing

Based on the interview results, it was revealed that the maintenance period is already specified in the contract, and this provision has been in place since the tender phase of the project. This indicates that the duration and scope of the maintenance activities were established and agreed upon from the early stages of project planning. By including the maintenance period in the contract, it ensures

clarity and accountability between the project stakeholders, including the owner, contractor, and other involved parties. The proactive inclusion of the maintenance period right from the tender phase demonstrates a comprehensive and structured approach to project management, highlighting the importance of maintaining the infrastructure's functionality, performance, and longevity. This contractual provision contributes to the overall success of the project by ensuring proper maintenance planning and execution throughout its lifecycle.

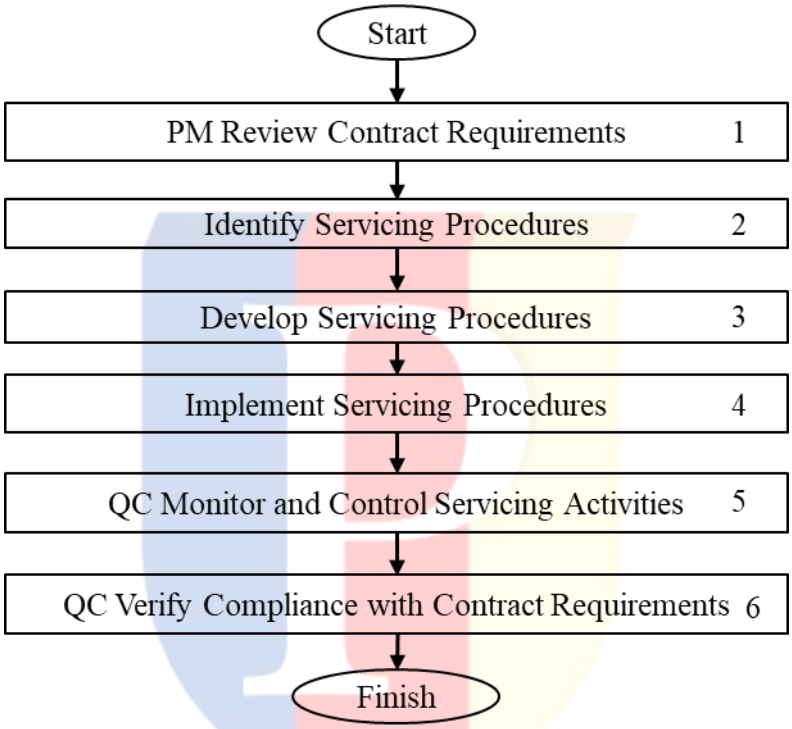

Figure V.15 servicing flow chart

The provided flowchart above (Figure V.15) outlines the implementation of ISO 9001 for servicing.

- Step 1 corresponds to Clause 8.2.3 - Review of Requirements Related to Products and Services, emphasizing the need to review requirements specific to servicing.
- Step 2 aligns with Clause 8.3 - Design and Development of Products and Services, indicating the importance of considering design and development aspects in servicing activities.
- Steps 3 through 5 also correspond to Clause 8.3, highlighting the continuous involvement of design and development considerations.

- Step 6 aligns with Clause 8.2.4 - Monitoring and Measuring Resources, emphasizing the monitoring and measurement aspects related to servicing activities.

Regarding implementation, steps one through six have been fully implemented, indicating that all six steps have been addressed. This represents a 100% implementation within the 100% range.

In summary, the interview responses highlight the inclusion of the maintenance period in the contract from the tender phase, demonstrating a comprehensive approach to project management. The provided flowchart aligns with ISO 9001's requirements for servicing, including clauses such as 8.2.3, 8.3, and 8.2.4. This proactive approach to maintenance planning and execution ensures the functionality, performance, and longevity of the infrastructure.

V.3.16 Quality System

Based on the interview findings, it was revealed that a quality manual has been prepared for the project, and this manual was developed prior to the commencement of project work. This proactive approach demonstrates the organization's commitment to establishing a structured framework for quality management right from the beginning. By creating the quality manual in advance, all stakeholders involved in the project can have a clear understanding of the quality objectives, procedures, and requirements to be followed throughout the project lifecycle. This early preparation of the quality manual sets a strong foundation for effective quality management practices, promotes consistency in work processes, and ensures adherence to the project's quality standards.

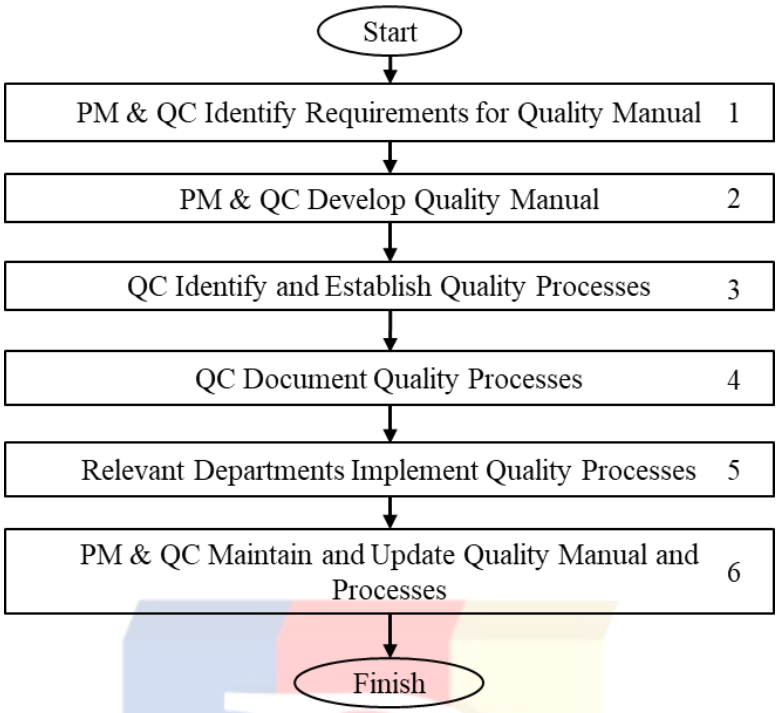

Figure V.16 quality system flowchart

The provided flowchart above (Figure V.16) outlines the implementation of ISO 9001 for the quality system.

- Step 1 corresponds to Clause 4.3 - Determining the Scope of the Quality Management System, emphasizing the need to define the scope of the quality management system.
- Step 2 aligns with Clause 4.2 - Quality Manual, indicating the importance of creating a quality manual.
- Steps 3, 5, and 6 are associated with Clause 4.4 - Quality Management System and its Processes, highlighting the need to establish and maintain the quality management system and its associated processes.
- Step 4 corresponds to Clause 7.5 - Documented Information, emphasizing the importance of documenting relevant information within the quality management system.

In terms of implementation, steps one through six have been fully implemented, indicating that all six steps have been addressed. This represents a 100% implementation within the 100% range.

In summary, the interview responses indicate the development of a quality manual for the project prior to the commencement of work. This proactive approach establishes a structured framework for quality management and ensures clarity and consistency among all stakeholders. The provided flowchart aligns with ISO 9001 clauses such as 4.3, 4.2, 4.4, and 7.5, emphasizing the importance of determining the quality management system's scope, creating a quality manual, and establishing and maintaining the quality management system and its associated processes.

V.3.17 Training

Based on the interview findings, it was revealed that the company has documented training outcomes to track the competencies of its employees. This practice demonstrates the organization's commitment to ensuring a competent workforce by systematically monitoring and documenting the skills and capabilities of its personnel. The availability of documented training outcomes enables the company to assess and verify the proficiency levels of its employees, ensuring that they possess the necessary skills to perform their roles effectively. By maintaining records of employee competencies, the organization can identify any gaps or areas for improvement, facilitate targeted training programs, and support ongoing professional development initiatives. This systematic approach to tracking employee competencies contributes to the overall success of the company by aligning skills with organizational objectives and enhancing the performance and productivity of its workforce.

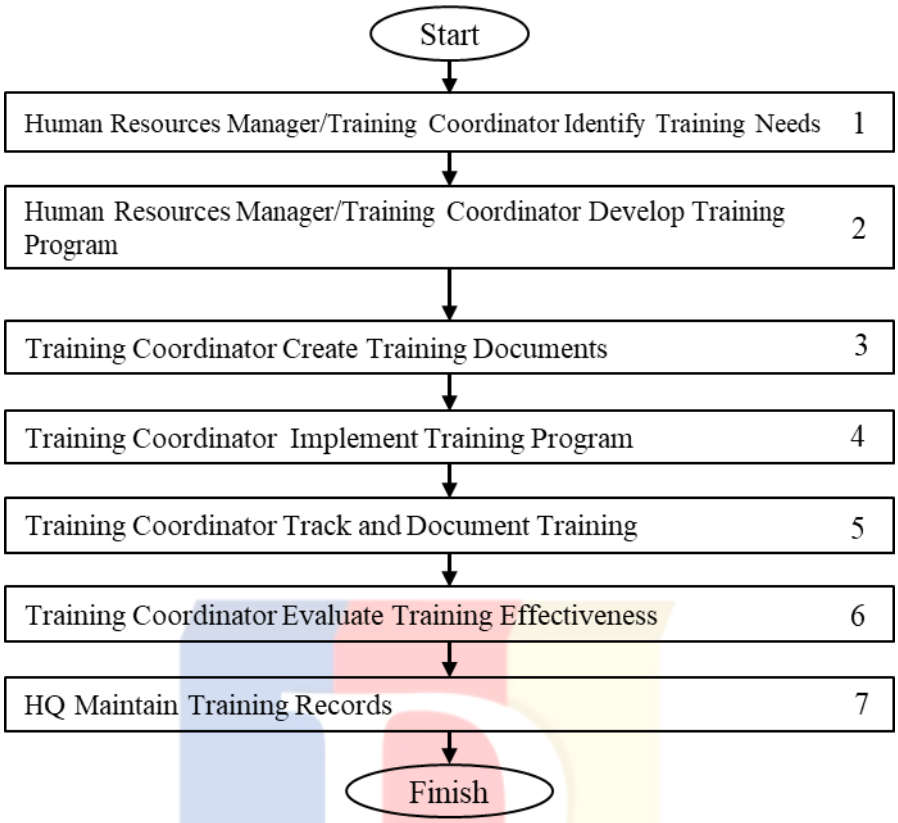

Figure V.17 Training flow chart

The provided flowchart above (Figure V.17) outlines the implementation of ISO 9001 for training.

- Steps 1 through 6 are associated with Clause 7.2 - Competence, emphasizing the need to determine the necessary competence for employees, provide training to meet those needs, and evaluate the effectiveness of the training.
- Step 7 corresponds to Clause 7.5 - Documented Information, highlighting the importance of documenting relevant information related to employee competence.

In terms of implementation, steps one through seven have been fully implemented, indicating that all seven steps have been addressed. This represents a 100% implementation within the 88%-100% range.

In summary, the interview responses indicate that the company has implemented a system to track employee competencies through documented training outcomes. This approach ensures a competent workforce and enables the organization to assess, verify, and address any skills gaps or development needs. The provided flowchart aligns with ISO 9001 clauses such as 7.2 and 7.5, emphasizing the importance of determining competence requirements, providing training, evaluating effectiveness, and documenting relevant information.

V.3.18 Management Responsibility

Based on the interview results, it was indicated by the respondents that the company has established policies regarding resource development. This demonstrates the organization's commitment to fostering the growth and enhancement of its resources, including human capital, technological capabilities, and other critical assets. By implementing resource development policies, the company takes a proactive approach to continuously improve its capacity and competitiveness.

These policies may encompass various strategies such as training programs, knowledge sharing initiatives, performance evaluation systems, and investment in advanced technologies or infrastructure. By prioritizing resource development, the organization can cultivate a culture of continuous learning, innovation, and adaptability, which are crucial elements for long-term success and sustainable growth.

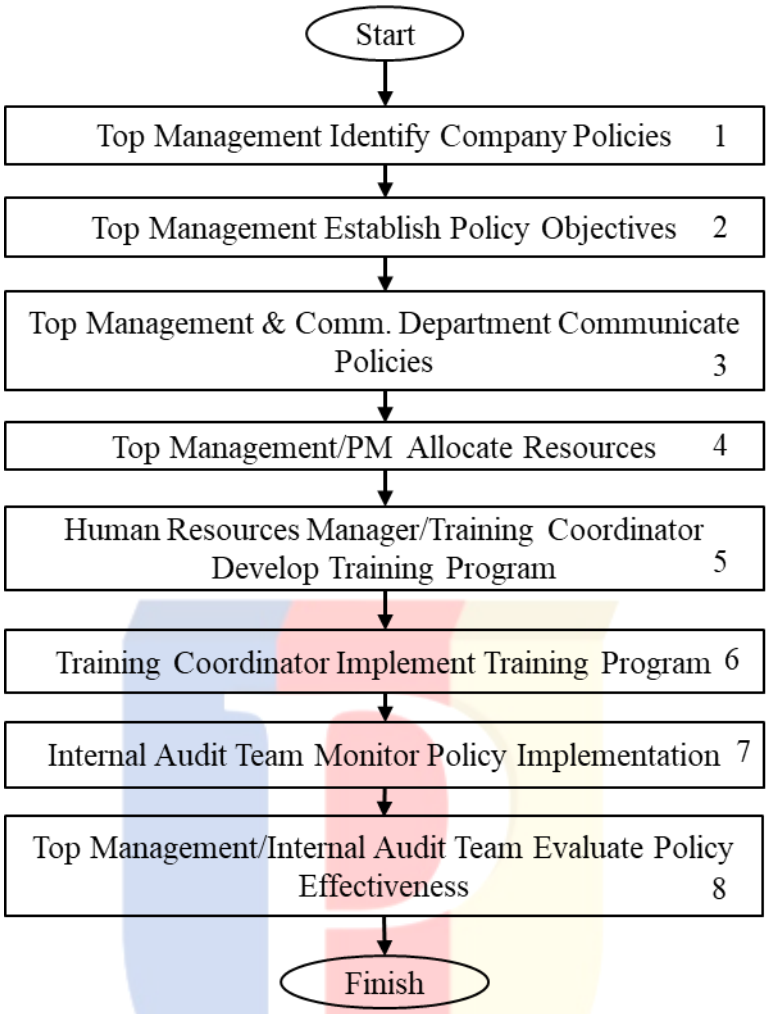

Figure V.18 Management responsibility flow chart

The provided flowchart above (Figure V.18) outlines the implementation of ISO 9001 for resource development.

- Steps 1 through 3 are associated with Clause 5.2 - Quality Policy, highlighting the importance of establishing a quality policy that aligns with the organization's objectives and provides a framework for resource development.
- Step 4 corresponds to Clause 7.1.2 - Resources, emphasizing the need to determine and provide the necessary resources for resource development activities.

- Steps 5 and 6 are related to Clause 7.2 - Competence, focusing on determining competence requirements and providing training to meet those needs.
- Step 7 corresponds to Clause 9.2 - Internal Audit, highlighting the importance of conducting internal audits to evaluate the effectiveness of resource development activities.
- Step 8 aligns with Clause 9.3 - Management Review, emphasizing the need for management review to assess the suitability and effectiveness of resource development initiatives.

In terms of implementation, steps one through seven have been fully implemented, indicating that all seven steps have been addressed. This represents a 100% implementation within the 88%-100% range.

In summary, the interview responses indicate that the company has implemented resource development policies to enhance its capabilities and competitiveness. These policies encompass various strategies and align with ISO 9001 clauses such as 5.2, 7.1.2, 7.2, 9.2, and 9.3. The flowchart provided illustrates the implementation steps involved in resource development.

V.3.19 Statistical Technique

Based on the interview findings, it was expressed by respondents 1 to 4 (Project manager, Engineering Manager, Quantity Surveyor, and Logistics) that regular evaluation is conducted for the entire project. However, respondent 5 (QHSE) highlighted that this evaluation is solely performed by the project owner, specifically through numerical assessments of the contractor's performance throughout the project duration. The evaluation reports take the form of weekly reports, which can be utilized to create an S-curve visualizing the completed or projected progress. According to respondent 5, the ownership and control of these reporting activities lie solely with the project owner.

This approach underscores the significance of the project owner's involvement in assessing the contractor's performance and tracking the project's progress. The

utilization of weekly reports and visual representation, such as the S-curve, aids in providing a comprehensive overview of the project's advancement and facilitates effective decision-making.

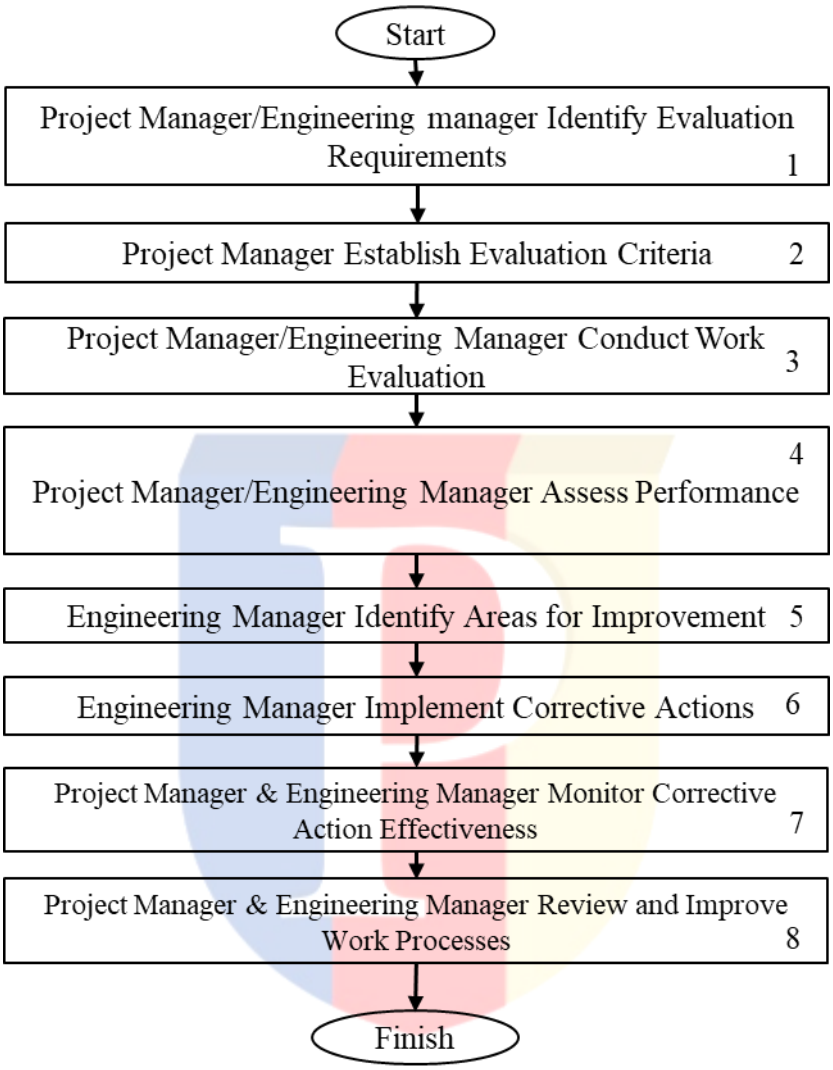

Figure V.19 Statistical technique flow chart

The provided flowchart above (Figure V.19) outlines the implementation of ISO 9001 for statistical techniques in project evaluation.

- Steps 1 and 2 are associated with Clause 9.1.1 - Monitoring, Measurement, Analysis, and Evaluation, highlighting the importance of establishing a systematic approach to monitoring and evaluating project performance.

- Step 4 corresponds to Clause 9.1.3 - Analysis and Evaluation, emphasizing the need to analyze and evaluate data to gain insights into project performance.
- Step 5 aligns with Clause 10.3 - Continual Improvement, emphasizing the role of evaluation in driving continual improvement.
- Steps 6 and 7 are related to Clause 10.2 - Nonconformity and Corrective Action, emphasizing the importance of addressing nonconformities identified during evaluation.
- Step 8 corresponds to Clause 10.3 - Continual Improvement, emphasizing the need to utilize evaluation results to drive ongoing improvement efforts.

In terms of implementation, steps one through eight have been fully implemented, indicating that all eight steps have been addressed. This represents a 100% implementation within the 100% range.

In summary, the interview responses indicate that regular project evaluation is conducted, with the project owner performing numerical assessments of the contractor's performance through weekly reports and utilizing visual representations like the S-curve. ISO 9001 clauses such as 9.1.1, 9.1.3, 10.2, and 10.3 are relevant to the implementation of statistical techniques in project evaluation. The flowchart provided outlines the steps involved in this implementation.

From the nineteen questions answered by the respondents, several findings have been identified. These include the identification of skipped work stages, adherence to ISO-standardized work procedures, and incomplete completion of a specific task stage. These results are further supported by direct observations made by the researcher. Presented below is a table summarizing the conclusions derived from the interviews and observations pertaining to each of the nineteen variables.

Table V.1 Summary of Findings: Interview and Observation Results for 19 Variables

No	Area	Fully Implemented	Partly Implemented	Minimally Implemented
1	Control of a nonconforming product		✓	
2	Process control	✓		
3	Contract Review	✓		
4	Control Of Quality Records	✓		
5	Control of inspection measuring and test equipment	✓		
6	Inspection and Testing	✓		
7	Corrective and preventive action	✓		
8	Internal Quality Audits	✓		
9	Inspection and Test Status	✓		
10	Handling, storage, packaging, preservation and delivery	✓		
11	Purchasing	✓		
12	Design Control	✓		
13	Document and data control	✓		
14	Product identification and traceability		✓	
15	Servicing	✓		
16	Quality System	✓		
17	Training	✓		

No	Area	Fully Implemented	Partly Implemented	Minimally Implemented
18	Management Responsibility	✓		
19	Statistical Technique	✓		

From the table V.1, it has been observed that certain data, specifically related to product/materials traceability records in logistics (as exemplified in V.3.14 Product identification and traceability), are not being adequately maintained. This issue needs to be addressed prior to undergoing the ISO certification audit process. Maintaining proper traceability records is of paramount importance as it serves as a reliable audit trail, allowing for the comprehensive tracking of products and materials throughout their lifecycle.

This particular concern is directly linked to two specific clauses within the ISO standards. Firstly, it aligns with Clause 7.5 - Documented Information, which emphasizes the importance of creating, updating, and maintaining appropriate documentation to ensure the effective functioning of the quality management system. In this context, the documentation related to product/materials traceability records plays a crucial role in complying with the requirements set forth in the ISO standard.

Furthermore, this issue also pertains to Clause 8.5.2 - Identification and Traceability, which outlines the need to establish and maintain processes for identifying and tracing products or materials, including the ability to identify their status with respect to monitoring and measurement requirements. By adhering to this clause, organizations can ensure that all relevant traceability information is accurately recorded and readily accessible for the purposes of audits and compliance verification.

Given the significance of maintaining proper documentation and traceability records, it is imperative that immediate action is taken to address the observed

shortcomings in data management. This will not only contribute to meeting the requirements of the ISO certification audit but will also enhance overall quality management practices and reinforce accountability throughout the organization.

V.4 Discussion

In this section, the research findings regarding the nineteen variables used as interview questions will be discussed. The results indicate that seventeen variables fall under the category of fully implemented, while two variables are classified as partly implemented. However, when specifically considering the Handling, Storage, Packaging, Preservation, and Delivery category, it is observed that only a few aspects of the storage component are being implemented. Nonetheless, due to obtaining a score of 92.85%, this variable still falls within the range of fully implemented (88%-100%).

V.4.1 Fully Implemented Variables

The research encompassed a comprehensive examination of 19 variables, aiming to assess their level of implementation within the organization. Out of these variables, it was found that 16 of them have achieved the status of fully implemented. This noteworthy accomplishment can be attributed to the unwavering commitment and compliance demonstrated by both the staff and management members involved in the organization's operations. Additionally, the successful implementation can be attributed to the utilization of standardized Standard Operating Procedures (SOPs) that have been provided by the central office (HQ).

The attainment of the fully implemented status by sixteen variables signifies the organization's dedication to adhering to industry best practices and quality standards. The staff and management have played a pivotal role in ensuring the effective execution of the identified variables, thus contributing to the overall success of the organization's quality management system.

As an example, three variables that have successfully fulfilled the required stages due to compliance with standardized SOPs will be selected. These variables exemplify the organization's adherence to established standards, ensuring their proper implementation and effectiveness. The following section provides a detailed examination of these variables as representative cases showcasing the organization's commitment to meeting and surpassing the necessary criteria.

Firstly, the implementation of established procedures for Purchasing highlights the importance of standardization and effective frameworks in optimizing a firm's performance. The ISO 9001 standard, which follows the PDCA cycle (Plan-Do-Check-Act cycle), provides a tested framework that enables organizations to improve their performance (Neyestani 2017). By adhering to ISO 9001's Clause 8.4, the organization ensures effective controls over externally provided processes, products, and services, leading to enhanced performance. The systematic and controlled approach to procurement, guided by the established procedures, reinforces the importance of standardized practices in improving organizational performance. These procedures enable the organization to comply with ISO 9001 requirements, select suitable subcontractors, and maintain quality standards throughout the procurement process. Thus, the combination of standardized procedures and ISO 9001 framework contributes to optimizing the organization's overall performance.

Secondly, Process Control, the research findings reveal that the organization has effectively implemented ISO standards, specifically in the area of process control, as affirmed by the responses obtained during the interviews. The participants highlighted the utmost importance of Standard Operating Procedures (SOPs) and job checklists as crucial tools in ensuring the successful implementation of ISO standards and maintaining effective process control. These measures serve as invaluable mechanisms for verifying and validating adherence to ISO standards, contributing significantly to the establishment of a robust and effective quality management system.

Obtaining ISO 9001 certification is not enough to realize its benefits. Service companies must implement an effective quality management system (QMS) aligned with ISO 9001 objectives. The organization's meticulous approach resulted in a comprehensive 100% implementation across all nine process steps, demonstrating their commitment to process control and ISO 9001 compliance. By prioritizing a well-designed QMS, companies unlock the full potential of ISO 9001, driving customer satisfaction, operational excellence, and long-term growth (Psomas et al. 2012)

The interviews provide concrete evidence of the company's unwavering dedication to implementing ISO standards, specifically in the area of process control, utilizing SOPs and job checklists as invaluable resources to guarantee compliance. The resolute completion of all nine steps exemplifies the organization's proactive stance towards continual improvement, effective process control, and their unyielding pursuit of maintaining a comprehensive and resilient quality management system.

Lastly, Inspection and Testing, regarding the level of implementation, all thirteen steps have been fully incorporated into the inspection and testing processes, resulting in a comprehensive implementation of 100%. This indicates the organization's effective integration of ISO 9001 elements, showcasing their commitment to ensuring the quality of materials and equipment through rigorous quality assurance practices. The implementation of established procedures is essential in improving organizational performance, as it provides a standardized framework for conducting thorough evaluations and tests (Roman et al. 2018).

In summary, the interview responses affirm that the company has implemented Quality Assurance practices for inspection and testing, ensuring that materials and equipment undergo meticulous scrutiny to meet the required quality standards. The comprehensive implementation of all sixteen steps reflects the organization's dedication to adhering to ISO 9001 and underscores their commitment to maintaining quality standards in their operations. By following these established

procedures, the company can enhance its performance, meet customer expectations, and continually improve its quality management system.

V.4.2 Partial Implementation and Recommendations for Improvement

Out of the initial set of twenty variables proposed by Trigunarsyah et al. (2011) to measure the level of ISO 9001 implementation, nineteen variables were chosen for investigation in this research, due to the owner of the project does not supply any products or materials (as listed in table II.2, number 19), creating a discrepancy between the documented variable and the observed practices.

Direct observations and interviews were conducted to gather data, revealing that sixteen indicators were fully implemented. However, three areas, specifically Control of a nonconforming product, Handling, storage, packaging, preservation and delivery, and Product identification and traceability, were found to be lacking full implementation. Additionally, during these observations, it was discovered that the variable "Control of customer supplied products" did not align with the observed practices, leading to its exclusion from the investigation to maintain a focused and contextually relevant study.

Firstly, the problem identified in the Control of Nonconforming Products relates to a deviation from the ISO 9001 implementation process. Specifically, the failure to follow the standard operating procedure (SOP) for rechecking nonconforming materials before returning them to the supplier poses risks to the overall quality management system. By bypassing this crucial step, the accuracy of the initial inspection is compromised, leading to potential inefficiencies in time management and future quality issues. The justification provided for not conducting reinspection after rejecting nonconforming materials was attributed to a lack of personnel in the Quality Control (QC) division. As a result, the Engineering Manager had to step in to assist with the inspection process. However, due to time constraints, a thorough reinspection could not be carried out, further exacerbating the nonconformity issue.

To handle this situation effectively, it is important to address the underlying issues and ensure compliance with ISO 9001 standards. Firstly, it is crucial to prioritize

the availability of personnel in the QC division who possess the necessary skills and knowledge to perform inspections and rechecking procedures diligently. This may involve training existing staff or recruiting new members with the required expertise. Secondly, sufficient time and resources should be allocated to allow for comprehensive reinspection of nonconforming materials. This step is essential in maintaining the integrity of the quality management system and preventing future quality-related complications.

Moreover, a thorough review and update of the SOP for the control of nonconforming products should be conducted to ensure its alignment with ISO 9001 requirements and the observed practices in the specific context. The SOP should clearly outline the procedures for rechecking and documenting nonconforming materials before their return to the supplier, leaving no room for ambiguity or misinterpretation.

According to Putri et al. (2021), it is crucial to emphasize the significance of diligently following all steps and procedures outlined in ISO 9001, including the control of nonconforming products. By doing so, the risks associated with nonconformities can be minimized, and the quality management system can be maintained effectively. Regular monitoring, audits, and continuous improvement efforts should be implemented to ensure ongoing compliance and adherence to ISO 9001 standards, ultimately leading to the desired results of enhanced quality and customer satisfaction.

Secondly, the problem identified in the Handling, Storage, Packaging, Preservation, and Delivery processes pertains to the selective storage practices observed for various materials. It was noted that only specific materials, such as CPHMA (Cold Paving Hot Mix Asbuton) and Fuel (specifically Solar), were stored and preserved in the designated storage area. The justification provided by the Project Manager for this selective approach was the extensive length of the project, spanning approximately 86 kilometers, which would incur additional costs for material mobilization if all materials were centralized in one storage location.

The selective storage strategy based on cost considerations raises concerns regarding the potential implications and risks involved. By limiting the range of stored and preserved materials, there is a risk of challenges in terms of availability, accessibility, and efficient handling of other critical resources required for the project. Moreover, unforeseen circumstances may arise that necessitate the urgent utilization of materials not stored in the designated area, potentially causing disruptions or delays in logistical operations.

According to Zimon (2017), organizations can effectively address various aspects of their quality management system (QMS), which includes evaluating alternative strategies to mitigate risks and ensure the availability of essential materials across the project site, while simultaneously maintaining compliance with ISO 9001 standards. For instance, optimizing storage configurations or implementing a decentralized storage approach could be considered. These strategies can help balance cost considerations while ensuring that all necessary materials are readily accessible as per project requirements.

By aligning these strategies with the principles and requirements of ISO 9001, organizations can enhance their logistic customer service and maintain a robust and comprehensive Quality Management System (QMS). Regular monitoring, audits, and continuous improvement efforts should be implemented to ensure the effectiveness of the implemented strategies and their alignment with ISO 9001 standards. This holistic approach will enable organizations to handle the selective storage challenge effectively, optimize logistical operations, and maintain high standards of quality and customer service throughout the project's duration.

Finally, the problem identified pertains to the incomplete implementation of the SOP for maintaining Product Traceability Records in the context of product identification and traceability. This issue hinders the organization's ability to effectively track and monitor the procurement and utilization of materials

throughout the project lifecycle, posing risks to supply chain transparency and compliance with ISO certification requirements.

The incomplete implementation of the SOP can be attributed to multiple factors, including the lack of personnel dedicated to logistics operations, with only one person assigned to the project. This limited availability of resources makes it challenging to execute the documentation process effectively and maintain comprehensive traceability practices.

To address this problem, proactive measures were taken by the organization. The Project Manager and the Quality, Health, Safety, and Environment (QHSE) personnel recognized the significance of rectifying the identified shortcomings. Following an internal audit, the organization assigned the researcher to collaborate directly with the logistics division to provide support in the preparation and completion of essential documents. This allocation of additional resources and expertise demonstrates a commitment to addressing the deficiencies in SOP implementation and reinforcing the organization's dedication to maintaining a robust traceability system.

In summary, the significance of effective traceability in supply chain operations cannot be overstated. Establishing a product identification and traceability measures is crucial for verifying authenticity, preventing counterfeiting, identifying fraudulent activity, and ensuring safe and sustainable supply chain operations (Gayialis et al. 2022). The identified gaps in implementing the SOP for maintaining Product Traceability Records underscore the need for proactive measures and allocation of resources to address these shortcomings, while the involvement of the researcher serves as a positive step towards enhancing documentation practices within the logistics division.

V.4.3 ISO 9001 Implementation in Road Preservation Project

It is important to highlight that despite these incomplete implementation stages, the road preservation project has obtained ISO certification. The justifications provided

by the Project Manager aimed to ensure effective project management within the given constraints.

In summary, this research has identified areas where the implementation of ISO 9001 Quality Management System could be further improved in the road preservation project. The areas that require attention include Control of a nonconforming product, Handling, storage, packaging, preservation and delivery, and Product identification and traceability. Recommendations include allocating more personnel to the Logistic and QC division, evaluating the feasibility of centralizing storage locations, and considering additional logistics support to facilitate documentation tasks. These suggestions aim to strengthen the project's adherence to ISO standards and enhance the overall effectiveness of the quality management system.