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Analysis of the application of quality management systems in the rubber industry based on ISO 9001:2015

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Abstract. Increasing competition in the global market and high consumer expectations for quality products, encourage companies to produce quality products of international standards. The rubber industry is part of an industry group that is prioritized in its development in Indonesia. Based on these conditions, companies are always required to develop quality management systems that exist in the production process. The purpose of this study is to analyze the application of the quality management system of the crumb rubber industry to the ISO 9001: 2015 certification standard. The analysis was carried out on case studies and discussions with leaders of crumb rubber companies in Padang City. The success of the implementation is affected by indicators that influencing in ISO 9001: 2015 certification standards. Based on the results of the case study it can be seen that PT B has implemented an integrated quality management system in the company's business processes. On the other hand, PT A still needs much improvement in implementing an integrated quality management system and integrated with the company's business processes. It can be concluded that a strong top management commitment is not supported by the application of a quality management system. The implementation of a quality management system has not been optimally demonstrated by the company's quality control documentation system is still incomplete and the company has not involved all aspects of the company in the implementation of quality management systems.

1. Introduction

Increasing competition in the global market and high consumer expectations for quality products, encourage companies to produce quality products of international standards. It also same for the manufacturing industry in Indonesia, especially the rubber industry. The rubber industry is part of an industry group that is prioritized in its development in Indonesia. The challenge of the rubber industry at this time is that it requires guidance on smallholder plantations to increase productivity. Also, it is also necessary to downstream 'crumb rubber' products and latex products to become downstream rubber products with high added value. Based on these conditions, companies are always required to develop quality management systems that exist in the production process. Rubber is a commodity used in many products and equipment around the world (industrial products to households). Rubber production in Indonesia focuses on the production of crumb rubber which is the raw material in the tire industry.



Product quality from crumb rubber is still low, as shown by data from the rubber industry in Padang, product quality is still below consumer expectations. Crumb rubber production in Indonesia is still in the quality control of the tire industry. Based on the results of discussions with the head of one of the crumb rubber industries in Padang Mr. H. Rinaldi Hadi, it is known that the quality management system used is only in accordance with the needs of customers. This is because the crumb rubber industry has not been able to build its quality management system. There are now a lot of terms used in product quality management in companies. Several attempts have been made to define and identify key terms such as quality management, total quality management and quality control [1].

Customer expectations of the quality of the crumb rubber are quite high. Therefore the company must pay attention to the quality standards used. Currently, the quality standard is undergoing a transition, namely the ISO 9001: 2008 certification standard to ISO 9001: 2015 certification standard. ISO 9001 is an International Standard of Quality Management System (QMS). This Standard describes the requirements for organizations to help them promote continual improvements and achieve customer satisfaction. ISO 9001 Quality Management System Standard is now transforming into a new brand with major changes from the earlier 2008 version, that was published in 2015 and known as ISO 9001:2015 [2]. There have been many previous studies conducted by previous researchers regarding the relationship between quality management and product quality performance. Brazilian automotive industry has implemented quality initiatives based on ISO 9001: 2015 certification standard. Organizations that understand the relative importance of each factor are likely to be successful in ISO 9001 implementation and in ensuring its internalization. The entire organization will not be motivated to contribute to the quality management process, which can result in the outcome being negative [3].

The other hand, The Kenya Bureau of Standards Certification Body (KEBS CB) is one of the leading Certification bodies in the East and Central African Region that implemented ISO 9001 in all aspect of the organization [4]. Besides that, quality management was associated with quality of production in Malaysia's manufacturing companies [5]. From the theoretical point of view, the variance of organizational performance would be largely explained through quality management practices since these were originally developed to achieve high-quality performance [5].

However, the main motivations for the ISO 9001 certification for Portuguese companies are the "improvement of quality", "corporate image", "commercial advantages"; globally, that the certification of Portuguese companies is due to internal factors (efficiency) and external factors (reaction, political reasons, and marketing) [6]. Prior research has focused on identification of factors critical to the success of the implementation, but not on their ranking/prioritization, which has importance to guiding managers in allocating resources appropriately during implementation and maintenance of ISO 9001: 2015 [3]. According to [7] implementation of the Quality Management System can support integrated development in small and medium industries in Romania, the impact of implementing a quality management system on the sustainable development of the organization. On the other hand, [8] the most important issue is to have a direct understanding of quality initiatives, the attributes of quality being used for day to day operations, and the sort of performance-driven indicators that are being developed to measure quality.

The purpose of this study is to analyze the application of the quality management system of the crumb rubber industry to the ISO 9001: 2015 certification standard. The analysis was carried out on case studies and discussions with leaders of crumb rubber companies in Padang City. The success of the implementation is affected by indicators that influencing in ISO 9001: 2015 certification standards. The results of the study are expected to be able to know the critical success factors that affect the application of quality management systems in the crumb rubber industry in Padang City to ISO 9001: 2015 certification standards.

2. Literature Review

Various studies are reported in recent times on a broad range of areas of quality management, including total quality management, quality awards, quality/business excellence, and relationships

among key elements/attributes [9]. Most of these studies have emphasized the importance of quality management, regarding its vital role in delivering quality products and services to customers and very importantly providing a competitive advantage with product differentiation under increasing competitive pressures at current times [10]. Therefore, an overview of various quality management concepts is presented as part of a broader literature review, these are:

2.1. *Quality Management*

Quality management systems are one of the most effective tools for companies to increase competitiveness. This issue has been studied for a long time since Dr. Edward Deming and Dr. Joseph Juran have started their studies and practical implementation of quality management and quality thinking [11]. The reasons to implement a quality management system based on standard ISO 9001 and benefits from it and that main reasons are these [11]:

- a. Well defined and documented procedures improve the consistency of output. That means that all processes in the company are described in a clear and easily understandable way for all employees, and that leads to the main idea of this standard do all things right at first time.
- b. Quality is constantly measured. That gives information to the top management whether all processes are running as it was defined and it also gives information about deviations from mean.
- c. Procedures ensure corrective action is taken whenever defects occur. As mentioned before, constantly measures give operative information about defects and the company can take all the necessary corrective actions and also by analyzing causes, define preventive actions.
- d. Defect rates decrease. If a company identifies and understands their problems and defines appropriate preventive actions, then it is a logical result from all these actions.
- e. Defects are caught earlier and are corrected at a lower cost. This is a very important benefit. If the procedure is well written, then it is possible to identify the problem at a very early stage. That is the whole idea of process management.
- f. Documented procedures are easier for new employees to follow. It is a very critical issue for companies with great labor turnover. And documented procedures assure that new employee will start to work effectively as soon as possible.
- g. Organizations retain or increase market share, increasing sales or revenues.
- h. Lower production costs because of fewer nonconforming products, less rework, lower rejection rates, streamlined processes, and fewer mistakes.

Quality management is a business philosophy; in this context, total quality management is a widely accepted core process of manufacturing and service organizations over many decades. TQM is identified as one critical building block of broader quality management [1]. The Quality Management System is a method used to manage, and optimize performance, which aims to offer services and lower costs [12]. According to [13], the company has implemented the QMS, so the company can demonstrate its ability to meet consumer needs and needs. Therefore, standards are needed for risk management, resource management, measurement and measurement, and improvement [13]. The purpose of implementing the Quality Management System is to improve the quality of defective products (rework) and rework (rework) [14]. According to [14], the Quality Management System is used to improve quality, commitment and proper management responsibilities, goals and responsibilities and their application in various aspects, service quality, quality control and quality improvement in quality systems, and more effort to improve [14].

2.2. *ISO 9001:2015*

ISO 9001 is an International Standard of Quality Management System (QMS). This Standard describes the requirements for organizations to help them promote continual improvements and achieve customer satisfaction. This Standard has been revised several times, the first version which was published in 1987 and known as ISO 9001:1987 was formulated based on the concept of quality assurance. It comprised three classifications, i.e. ISO 9001:1987 as a model for organizations with the creation of new products, ISO 9002:1987 for those without the creation of new products, and ISO 9003:1987 as a model for final inspection and testing purposes. The Standard was later developed into the second version, i.e. ISO 9001:1994 and was improved based on the concept of preventive action.

The third version, ISO 9001:2000, was formulated based on the concept of quality management to help organizations improve their business process. The fourth version was ISO 9001:2008 which underwent minor changes from the previous version [13].

ISO 9001 Quality Management System Standard is now transforming itself into a new brand with major changes from the earlier 2008 version. This new version was published in 2015 and known as ISO 9001:2015 [2]. The changes include more clauses and use a new concept and approach. If ISO 9001:2008 emphasizes continual improvement and customer satisfaction, ISO 9001:2015 puts more focus on risk-based thinking. Risk-based thinking, as the concept and approach added in the new version, requires organizations to identify and analyze potential risks that could arise both from inside and outside of the organizations. Thus, organizations can formulate strategies to prevent any impact of the risks, and they can be expectantly more resilient and sustainable by accommodating the risks [2]. Other changes in the new version are the consideration of the organizational stakeholders' needs, the importance of knowledge management and less emphasis on documentation. The new version of ISO 9001 has ten clauses, and a brief comparison of clauses between both versions is presented in Table 1.

Table 1. Difference between ISO 9001:2008 and ISO 9001:2015

| ISO 9001-2008 | ISO 9001:2015 |
|---|-------------------------------------|
| Clause 1: Scope | Clause 1: Scope |
| Clause 2: Normative References | Clause 2: Normative References |
| Clause 3: Terms and Definitions | Clause 3: Terms and Definitions |
| Clause 4: Quality Management System | Clause 4: Organizational Contextual |
| Clause 5: Management Responsibility | Clause 5: Leadership |
| Clause 6: Resource Management | Clause 6: Planning |
| Clause 7: Product Realizations | Clause 7: Support |
| Clause 8: Measurement, Analysis, and Improvements | Clause 8: Operation |
| | Clause 9: Performance Evaluation |
| | Clause 10: Improvement |

2.3. Critical Success Factors

CSFs are circumstances or practices, and requirements or things must go well. CSFs are crucial not only to the success of the QMS process or program but also to firm performance. To gain insight into the most important CSFs, the most recent literature reviews on QMSCSFs, and have been considered herein [15].

Critical success factors are defined as those critical areas of managerial planning and action that must be practiced to achieve effective quality management in a business unit [16]. One of the main difficulties in studying the critical factors of total quality management is how to define and measure them before they become critical [16]. According to [16] some organizations focus on specific areas such as quality management systems or statistical process control, whereas others take a holistic approach by implementing TQM program covering all the key areas [16].

Critical success factors are the behavioral aspects of management styles or the human factors which emphasized on organization's total quality management. Success factors to implementation TQM include Leadership, Customer focus, Quality culture, Teamwork, Training, Communication, Product design, etc. [17]. Moreover, the efficient utilization of critical success factors can increase quality improvement in each organization [17]. The application of a quality management system requires the attention of some "critical success factors" to be effective and efficient. Some of these factors are management responsibility, resource management, human resource management, quality in design and

process, measurement, analysis and feedback, supplier management, focus on consumer, technical quality and Jiritsuka quality [18].

3. Methodology

This research is a case study and discussion to the existing crumb rubber industry in the city of Padang, namely PT A and PT B. Case studies were carried out to determine the application of the quality management system currently implemented by the company. Case studies were carried out using semi-structured interview instruments so that the information obtained is more detailed. Based on the results of the case study will be formulated critical success factors that influence the implementation of quality management systems in the crumb rubber industry based on ISO 9001: 2015 certification standards. Semi-structured interviews are given to company leaders, with Mr. H. Rinaldi Hadi as quality management managers from PT A, Mrs. Rila as quality control heads from PT B, and Mr. Iko Pratama Razaki as production heads from PT B. The next section provides results from data analysis, including explanatory and confirmatory factor analysis. And the next section presents discussions, results, further research definitions, and research limitations. The final section concludes.

4. Results

Analysis of the results of the case study was obtained based on the results of semi-structured interviews in PT A and PT B using an open-ended question instrument. PT A and PT B have obtained ISO 9001 2008 certification since 2000 and are audited every five years. The analysis of the results of the case study aims to evaluate the implementation of the current integrated quality management system based on the techniques and tools of quality control used and the clauses and sub-clauses of the ISO 9001: 2015 Standard. Case studies are carried out from clause 4 to clause ten because clause 1 to clause 3 contains the scope of ISO 9001: 2015 and definitions. Based on the results of the case study can be known the condition of PT A and PT B, namely:

1. PT A and PT B understand and can explain the organizational context well as indicated by the quality system guidelines in the company. PT A and PT B have quality objectives as strategic objectives that must be achieved by the company. PT A and PT B use the standard SNI 06-1903-2006 (Standard Indonesian Rubber) and SNI 1903-2011 (Rubber Technical Specifications) and company quality guidelines as a guide to the company in the process of production and procurement of raw materials.
2. PT A has not been fully committed to the implementation of an integrated quality management system because the management representative holds full centralized control over all company process activities and only implements quality control in accordance with customer demand without involving employees and suppliers. On the other hand, PT B has supported the commitment and employee involvement of all company lines in controlling and improving the integrated quality management system and developing quality control to meet customer specifications that are accountable to the management representative.
3. PT A plans to plan process and change planning activities on the control of management representatives without involving employees and still using conventional approaches such as 7QC tools that are only understood by top management. On the other hand, PT B is planning an integrated planning process and process activities from all lines of the company involving factory heads and personnel using the SPC approach that is understood in an integrated manner, and the existing planning changes are discussed once in a monthly management review meeting and communicate it.
4. PT A and PT B provide support with the procurement of adequate human resources and infrastructure, but PT A has not been able to improve HR competencies by involving them in training held by customers and outside parties, while PT B has committed to improving HR competencies by involving employees in training organized by customers and outside parties.

5. PT A carries out operational production processes in accordance with guidelines or directives from the management representative under the guidance of the customer. Whereas PT B carries out a production process that is well integrated and appreciates the high performance of employees towards achieving the target.
6. PT A and PT B still need to develop an approach or method of quality control that is used in the implementation of an integrated quality management system to be able to achieve customer satisfaction targets.
7. PT A has the standard of every production process listed in the guidelines for quality standards in accordance with ISO 9001: 2008 by the management representative, while PT B has the standard of each process listed in the company's quality guidelines in accordance with ISO 9001: 2008 by the management representative and head of the department each division.
8. PT A controls the processes and products provided externally by using a special form controlled by the management representative, while PT B controls the processes and products provided externally by using a special form and supplier evaluation that is controlled by the purchasing department.
9. PT A controls the output mismatch by using the FMEA method which is evaluated by the management representative, while the PT B controls the output mismatch using the cross-check method using self-audits designed by customers and companies.
10. PT A evaluates employee performance based on the results of supervision and quality control using 7QC Tools and FMEA, but management representatives who carry out internal audits and periodic management review meetings. Meanwhile, PT B evaluates employee performance and process capabilities based on the results of management reviews and internal audits by the company's internal audit team on a regular basis which is communicated to all lines of the company and carries out continuous improvement from the results of the review which also involves all lines of the company.
11. PT A oversees product mismatches against customer specification requirements carried out by management representatives. On the other hand with PT B, the division heads of each division have the authority to supervise and regulate product nonconformities against customer specifications.
12. PT A and PT B strongly support continuous improvement by implementing quality control to achieve TQM in accordance with ISO 9001: 2015. PT A and PT B increase the quantity and quality of production by implementing just-in-time production systems, Kaizen philosophy, and TQM in business process activities that are evaluated in monthly meetings.

Based on the results of the case study it can be seen that PT B has implemented an integrated quality management system in the company's business processes. This is supported by research conducted by [13] that companies must implement an integrated quality management system in the company's business processes. Besides, [19] also stated that to be able to achieve TQM a commitment from top management is needed in providing resources, policies, and support in achieving TQM success following ISO 9001 standards. On the other hand, PT A still needs much improvement in implementing an integrated quality management system and integrated into the company's business processes. This is not in accordance with the results of research by [20] that to achieve quality management, companies must have a strong commitment in implementing quality management systems from all lines of the company.

PT B is required to remain consistent with the commitment to improve the implementation of an integrated quality management system by involving all lines of the company. PT B is also required to develop an integrated quality management system using the right quality control (QC T & T) approach in every business process activity. On the other hand, PT A has not involved all company lines in improving quality control that is only known by top management. This is not in accordance with the results of [21] that top management must have a strong commitment to involving all company lines in improving quality control.

The difference in the results of the case studies obtained showed differences in the size of the two companies such as the difference in the period of the two companies obtained ISO 9001. PT B

obtained an ISO 9001 certificate in 2000 while PT A obtained an ISO 9001 certificate in 2001. Also, the difference between the two companies was the size of production capacity; PT A has a production capacity of two times higher than that of PT B. PT A and rubber companies in the city of Padang can benchmark PT B from the results of the best practices the implementation of integrated quality management. As for Table 2 shows the best practices of the application of an integrated management system to the clauses and sub-clauses of ISO 9001: 2015 in rubber companies.

Table 2. Application of Quality Management System According to ISO 9001: 2015

| Indicators | Sub Indicator | Best Practices in Company |
|---|------------------------------------|---|
| Clause 4. Organizational Contextual | | |
| 1. Understanding the organizational context | | The company has quality guidelines that clearly explain the organizational context |
| 2. Needs and expectations of interested parties | | The company has produced quality targets based on product specifications from customers and SNI standards |
| 3. The scope of the quality management system | | The scope of the quality management system is outlined in the guidelines for the company's quality standards |
| 4. Quality management system and process | | 1. SNI 06-1903-2006 (Standard Indonesian Rubber) 2. SNI 1903-2011 (Rubber Technical Specifications) 3. ISO 9001:2015 Certificate 4. Product quality standards from customers |
| Clause 5. Leadership | | |
| 1. Leadership and Commitment | 1. Top management leadership | Each section head has authority over the application of the QMS in each part of which is accountable to the management representative |
| | 2. Top management commitment | Head of the section supported active participation in controlling the implementation of decisions, giving rewards for high employee performance, providing QC T & T training to employees, and communicating quality management systems |
| | 3. Customer focus | Each line knows customer needs from product specifications by implementing an integrated quality management system and evaluated with customer satisfaction |
| 2. Policy | 1. Determination of quality policy | Top management establishes policies & strategic objectives and all company lines carry out integrated improvements |
| | 2. Communication on quality policy | Conduct monthly meetings as internal communication such as 7 QC Tools, SPC, and quality control forms for all divisions |
| 3. Roles, responsibilities, and authority of the organization | | All lines of the company play a role and are responsible for risk-based thinking, namely corrective actions and preventive actions |
| Clause 6. Planning | | |
| 1. Actions against opportunities and risks | | Action plan for evaluating and improving risks from integrated inspection and direct audit findings by involving personnel throughout the production line |
| 2. Quality objectives and planning for achieving goals | | Implementation of quality control groups and the use of quality control methods in production planning and determination of product quality targets |
| 3. Changes in planning | | Reviewed in monthly meetings that are followed and communicated to all lines of the company |

Table 2. Application of quality management system according to ISO 9001: 2015

| Indicators | Sub Indicator | Best Practices in Company |
|--|--|---|
| Clause 7. Supports | | |
| 1. Resources | 1. People | Competent HR in implementation and improvement, but involved in improvement decisions and given training |
| | 2. Infrastructure | Providing infrastructure that supports the implementation of integrated SMM appropriately |
| | 3. The environment of process operation | A conducive work climate with increased teamwork in the implementation of integrated QMS |
| | 4. Monitoring and measuring resources (traceability) | Monitoring is discussed in monthly meetings by all divisions and applies traceability using quality control methods and internal quality audits |
| | 5. Organizational knowledge | Increased by attending seminars held by customers and outside parties that are followed by employees in turn and do benchmark with partner companies |
| 2. Competence | | Use quality professional staff and provide training on the use of 7QC Tools to employees |
| 3. Concern | | Implement the quality of built into products and quantitative-qualitative measurements of the effectiveness of team performance |
| 4. Communication | | Internal communication is in the form of monthly meetings and information data flow with each division's form while external communication is in the form of a certificate of agreement (COA) |
| 5. Documented information | 1. Making and Updating | Quality control documents in the form of special forms and process chart data controlled by PPD |
| | 2. Documented information control | Documented information is disseminated to all lines of the company and reported to PPD periodically |
| Clause 8. Operational | | |
| 1. Production Planning and Control | | Design quality guidelines, quality plans, quality manuals that are reviewed regularly with management reviews to improve work effectiveness |
| 2. Requirements for products | 1. Customer communication | Meetings and COAs as communication with customers are discussed in monthly meetings as feedback |
| | 2. Determination of requirements the product | Management review of evaluating product requirements reported to PPD |
| | 3. Review product requirements | Meeting with customers and using quality control methods |
| | 4. Changes in product requirements | The export section is supervised by the PPD and the head of the production and is informed to the supervisor |
| 3. Control of external product processes | 1. Type and range of control | The quality checklist method of raw materials supplied and the frequency of delivery |
| | 2. Information for external providers | Checksheet method for external provider information and traceability |
| 4. Process Production | 1. Control of product procurement | Set standards and criteria in company quality objectives and use quality control methods as an improvement effort |
| | 2. Identification and traceability | Using quality control methods for identification and traceability of the production output discussed in the monthly meeting |

Table 2. Application of quality management system according to ISO 9001: 2015

| Indicators | Sub Indicators | Best Practices in Company |
|--|--|---|
| 5. Releasing Product 6. Control of output non-conformance Clause 9. Performance Evaluation | 3. Property owned by customers or external providers | Property owned by customers or external providers is controlled in a special form |
| | 4. Preservation | Self-assessment to ensure the supply of production in accordance with customer requirements |
| | 5. Post-delivery activities | Provided product insurance by the distributor with approval at the distribution depot |
| | 6. Control of changes | Changes to the supply of products in the order statement contract (Shipping Instruction) |
| | | Cross-check by using a self-assessment audit to ensure the product meets specifications |
| | | Verification and identification of reject products and reprocessing processes |
| 1. Monitoring, measurement, analysis, and evaluation | 1. Customer Satisfaction | Measurement of customer satisfaction with a customer satisfaction questionnaire |
| 2. Internal Audit | 2. Evaluation and Analysis | Customer self-audit and external audit by YOQA |
| | | Internal quality audits are carried out regularly by using a self-assessment manual according to ISO 9001: 2015 |
| 3. Management Review | 1. Input Management Review | QC methods to be discussed in management reviews |
| | 2. Output Management Review | Improved results of management reviews with continuous improvement |
| Clause 10. Improvement | | |
| 1. Nonconformity and corrective action | | Discussed in monthly meetings and evaluation actions with continuous improvement |
| 2. Continuous improvement | | Implementation of TQM and ISO 9001: 2015 standards in all company lines |

5. Conclusions

Based on the results of the case study, it can be concluded that a strong top management commitment is not supported by the application of a quality management system. The implementation of the quality management system has not been optimally demonstrated by the company. This is evidenced by the control document in the company's quality control system that is incomplete in accordance with the requirements of ISO 9001: 2015. Also, the company has not involved all aspects of employees in implementing the company's quality management system. These conditions indicate that the key success factors for implementing a quality management system are not implemented in a balanced manner in achieving the goals of sustainable quality improvement, so it is not in accordance with the ISO 9001: 2015 standard QMS in clause 4-10, namely regarding the techniques and tools for controlling and monitoring products.

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