

Increasing the Implementation of Environmental Management Systems Based ISO 14001 with the Six Sigma: Case Study Method in a Manufacturing Industry

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Abstract: Management systems are key in managing the company. With the implementation of a good management system, the company will get good results. The based Environmental Management System at ISO 14001 is one of the management systems that are widely used by companies. ISO 14001 focuses on environmental management so that pollution does not occur that can disrupt the company both from internal processes and external factors. This ISO 14001 application provides benefits not only to the environment but also to people and company profits. Six Sigma with the DMAIC step is often considered only a tool to make improvements to product quality but can actually be used to improve management systems. In the case of this research, the company is experiencing a decline in the application of ISO 14001 so that corrective action needs to be taken immediately, the system improvement method is chosen by the DMAIC Six Sigma method. Based on the causes of decline, steps are taken to increase employee competency, which in implementation requires a low cost but has a considerable effect. The improvements made show positive results, namely from the negative trend of implementation of 220% to a positive trend of implementation of 700%. The successful improvement of the application of ISO 14001 greatly helps companies to be more productive and competitive again in accordance with the objectives of implementing the ISO 14001 Environmental Management System.

Keywords: ISO 14001, Six Sigma, Competence.

1. Introduction

ISO 14001 has become the subject of extensive research. Studies generally focus on motivation to adopt standards. This motivation is often referred to as improving environmental performance, integrating pollution prevention programs, managing environmental risks, increasing employee environmental awareness, adapting to contract specifications, gaining market access and competitive advantage, strengthening environmental strategies, increasing operational efficiency, improving economic performance, improving relations with stakeholder groups, and build a strong image of corporate responsibility [1]. More and more companies are implementing Environmental Management Systems (EMS). Internal benefits for implementing and certifying the ISO 14001 standard have a significantly higher degree of influence on

benefits than external benefits, regardless of company size and sector of activity [2]. Benefits of the Environmental Management System emphasize four benefit groups: productivity benefits (optimization of resources, optimization of process flow, reduction in production costs, better employee motivation), financial benefits (opportunities to obtain investment funds from government organizations, access to credit with interest rate reduction, reduction in insurance premiums), market benefits (competitive advantage, positive effects on the market and with customers, opportunities to provide examples for suppliers) and social benefits (enhanced corporate image for society in general, reduced environmental responsibility, increased cooperation from authorities environment)[3].

The relationship of two different organizational adoption motives (i.e., internal and external) with the benefits of the triple bottom line (i.e., environmental, social, and market) on ISO 14001 adoption. External motives increase social and market position, while internal motives better provide environmental benefits. Practically, environmental benefits must be realized before companies can expect to obtain social and market benefits from the adoption of environmental management systems [4].

2. Literature study

ISO 14001 Environmental Management System is a part of the management system used to manage environmental aspects, fulfill compliance obligations, and handle risks and opportunities. An audit in ISO 14001 is a systematic, independent and documented process to obtain audit evidence and evaluate it objectively to determine the level of fulfillment of audit criteria or the level of success of implementing ISO [5]. The implementation of the Environmental Management System is beneficial internally within the organization, is the quality of management, quality of training, working conditions and safety, quality of environmental information, legal compliance, encouragement of innovation, improvement of procedures, strategic review of environmental responsibility; while the

benefits in finance are cost savings from reducing material, energy and waste; and benefits for people are increasing employee motivation, improving skills, a better corporate image among employees, a forum for dialogue between staff and management [6]. ISO 14001 researchers, see the benefits of increasing efficiency and profitability, increasing customer satisfaction, improving relations with staff and image [7]. Six Sigma is recognized as a problem solving method that uses statistical and quality tools to improve basic processes. Six Sigma is currently widely accepted as a high-performance strategy to reduce the failure of a company's quality system [8]. The DMAIC (Define-Measure-Analyze-Improve-Control) method in Six Sigma is often described as an approach to problem solving. Among the advantages of this method are powerful statistical techniques for finding facts and empirical idea verification, and the DMAIC stage model, which acts as a problem structuring device [9]. In the Define stage identification of potential projects is done, defining the role of the people involved in the Six Sigma project, identifying key quality characteristics that are directly related to the specific needs of the customer and setting goals. Stage Measure performs and develops a data collection plan that can be carried out at the process level, and / or output and Measures current performance (current performance) to be determined as a performance baseline at the start of Six Sigma projects. Stages of Analysis is a step to find a solution to solve a problem based on the Root Cause that has been identified. After obtaining the Root Problems and Solutions and validating them, the next step is to take corrective actions to those problems by conducting tests and experiments to be able to optimize the solution so that it is really useful to solve the problems we are experiencing. The purpose of the Control stage is to establish standardization and control and maintain the improved and improved process in the long term and prevent potential problems that will occur in the future or when there is a change in processes, labor or management changes [10]. Research shows that environmental strategies are positively related to the circulation process of environmental knowledge and company performance and the process of circulation of environmental knowledge is positively related to company performance. Companies that adopt a positive proactive strategy can improve the Circulation Process Environmental Knowledge and company performance, including environmental performance and financial performance. It can also help companies manage tacit and explicit environmental knowledge more effectively through environmental knowledge management. Therefore, companies with knowledge circulating processes that are efficient not only can consistently improve their green knowledge assets and international competitiveness, but also can create green business opportunities for sustainable development of the company and the environment [11].

3. Research methodology

To achieve the objectives of the research, the process of this

research will be carried out following the flow of DMAIC Six Sigma like this scheme:

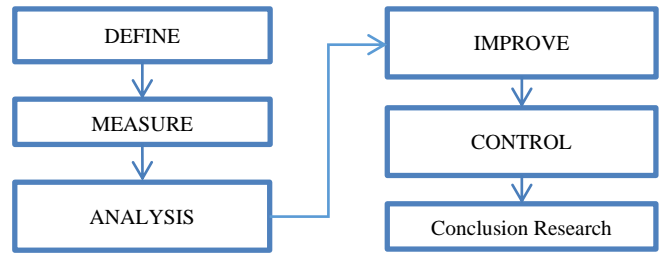


Fig. 1. Research Step

4. Analysis results

A. Define

An increase in audit findings as a sign of decreasing the level of implementation of the ISO 14001 Environmental Management System.

B. Measure

From the data from 2016 to 2017 there was a trend of an increase of 220% in each period as shown below. This downward trend can be assumed that the implementation of ISO 14001 experienced a very large decline. Management sees this problem as urgent action so that the trend can be restored so that all the benefits of implementing the ISO 14001 Environmental Management System can be achieved.

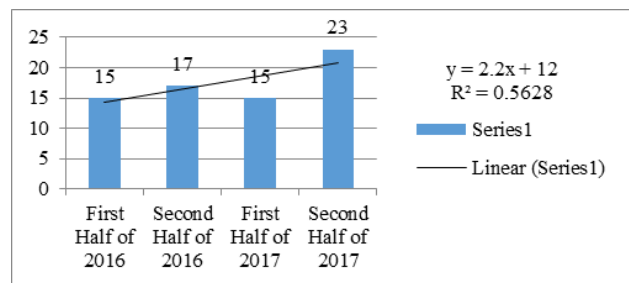


Fig. 2. Audit Findings Trend 2016 – 2017

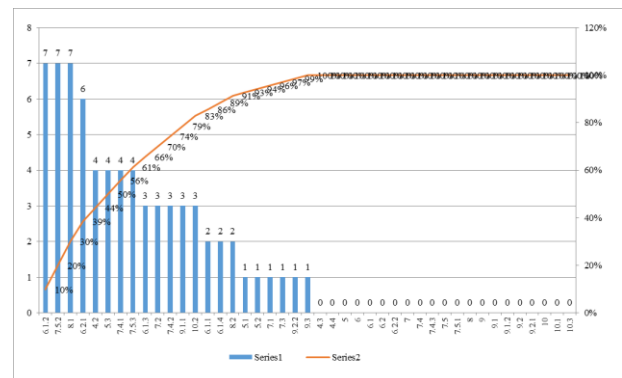


Fig. 3. Pareto Audit Findings

Detail findings per clause are shown in the Table 1. This data is taken from all the findings of the ISO audit conducted in a span of 2 years, namely 2016 and 2017.

Table 1
 Detail Audit Findings 2016 – 2017

Clause	Findings	Percentage	Total Percentage
6.1.2	7	10%	10%
7.5.2	7	10%	20%
8.1	7	10%	30%
6.2.1	6	9%	39%
4.2	4	6%	44%
5.3	4	6%	50%
7.4.1	4	6%	56%
7.5.3	4	6%	61%
6.1.3	3	4%	66%
7.2	3	4%	70%
7.4.2	3	4%	74%
9.1.1	3	4%	79%
10.2	3	4%	83%
6.1.1	2	3%	86%
6.1.4	2	3%	89%
8.2	2	3%	91%
5.1	1	1%	93%
5.2	1	1%	94%
7.1	1	1%	96%
7.3	1	1%	97%
9.2.2	1	1%	99%
9.3	1	1%	100%
4.3	0	0%	100%
4.4	0	0%	100%
5	0	0%	100%
6	0	0%	100%
6.1	0	0%	100%
6.2	0	0%	100%
6.2.2	0	0%	100%
7	0	0%	100%
7.4	0	0%	100%
7.4.3	0	0%	100%
7.5	0	0%	100%
7.5.1	0	0%	100%
8	0	0%	100%
9	0	0%	100%
9.1	0	0%	100%
9.1.2	0	0%	100%
9.2	0	0%	100%
9.2.1	0	0%	100%
10	0	0%	100%
10.1	0	0%	100%
10.3	0	0%	100%
Total	70	100%	

Pareto data shows the majority of findings occur in clause 6.1.2 & 7.5.2. Clause 6.1.2 is the determination of environmental aspects while clause 7.5.2 is the making & updating of documents. This clause 6.1.2 is very important because the core of the application of ISO 14001 is controlling the environmental aspects so that all potential pollution caused by the process can be anticipated and no environmental pollution occurs. Whereas clause 7.5.2 shows the management

of ISO 14001 documents, if management is bad then all actions taken will not be appropriate and potentially damage the application of ISO 14001 in the long term.

C. Analysis

The results of the analysis showed that 54.5% of the causes of the findings that occurred were factors caused by humans. This shows that there is a need for development in the HR field to reduce the potential number of findings due to human error. The HR development program carried out by the company refers to increasing employee competency. Improving employee competency is done by providing education & training.

D. Improve

The initial planning of competency training is scheduled for 1 year in 2018. Distribution is done so that operations can run normally and the production process can also be smooth. The initial focus of the implementation was carried out in January and February so that the positive effects of the training could be immediately felt on the implementation of ISO 14001.

The realization of the training has been carried out even though some implementation dates are adjusted to the trainer's schedule but are still implemented.

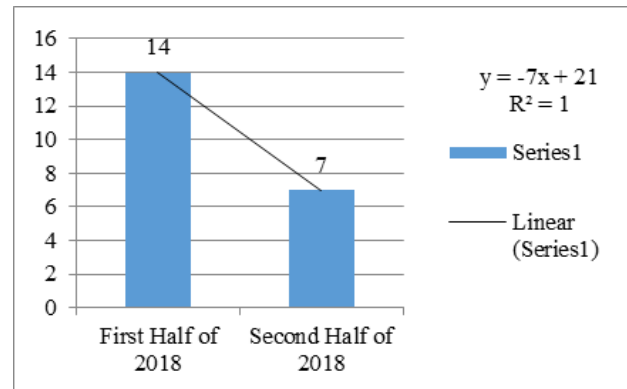


Fig. 4. Audit Findings Trend 2018

The results after increasing competence with training can be seen in the graph above. From the data of findings during the 2 times the audit shows a positive trend of a decrease in findings of 70%. This result is quite satisfactory for improving the performance of implementing the ISO 14001 Environmental Management System.

E. Control

In order for future competencies to not occur again, for each worker in the list of competencies must be supplemented with basic knowledge competencies ISO 14001 Environmental Management System. If new workers have not yet obtained this mandatory competence, then the system may not work normally according to their duties and responsibilities.

Table 2
 Root Cause Analysis

No.	Item	Man	Machine	Method	Material	Environment	Total
1	Percentage (%)	54.50	8.86	29.39	3.56	3.68	100.00

Table 3
 Competence Training Plan

Hard Skill	Topik	Awareness ISO 14001
January	Schedule	5,11,18,19,25,26
	Realisasi	5,11,18,19,25,26
February	Schedule	1,2,9
	Realisasi	1,2,9
Maret	Schedule	7
	Realisasi	7
April	Schedule	17
	Realisasi	17
Mei	Schedule	Ramadhan
	Realisasi	Ramadhan
Juni	Schedule	6
	Realisasi	6
Juli	Schedule	25
	Realisasi	25
Agustus	Schedule	9, 14
	Realisasi	14
September	Schedule	6,18
	Realisasi	6,18
Oktober	Schedule	10,23
	Realisasi	16,25
November	Schedule	7,21
	Realisasi	7,21
Desember	Schedule	6, 20
	Realisasi	12

5. Conclusion

The Six Sigma method with the DMAIC step is proven to be used in improving management systems not only to make improvements that are only product damage. From the application of the DMAIC step, the negative trend of implementing the ISO 14001 Environmental Management System can be transformed into a positive trend so that the initial hope of the benefits of implementing ISO 14001 for the company can be achieved. The steps to improve employee competency through training in basic knowledge of ISO 14001 Environmental Management System are good alternatives because it is proven that with sufficient competence the workers can carry out all their duties and responsibilities so that they can help companies be more productive and competitive. This training step was chosen because the implementation costs were quite cheap but had a considerable effect.

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