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Developing Quality Ownership for Consistent Process and Product Quality to Improve the Competitive Advantage: A Continuous Improvement Approach

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Abstract
Heeding operators' sense of belonging to the organization, especially at their work stations, is an effort to reduce waste in the manufacturing process. The sense of belonging will improve or develop a sense of maintaining the quality of their work, building the operators' quality ownership. This research employed the PDCA cycle (Plan, Do, Check and Act) in the continuous improvement approach and the A3 problem-solving method to observe how increasing the quality ownership can maintain a product's quality. Thus, the approach can reduce waste and maintain consistent product quality, improving the company's competitive advantage.

Keywords: Continuous Improvement**,** A3 Problem Solving**,** Quality Improvement**,** Competitive Advantage.

1. Introduction

Company X focuses on machine-made kretek cigarettes, Other Tobacco Products (OTP), and packaged pure-tobacco (for roll-your-own cigarettes), targetting the European market; OTP has added tobacco leaves and is rolled to resemble a cigar (Cigarillos). For the European market, product quality is crucial as the company expects to dominate the market [Porter, 2008; Schlie, 1996]. Accordingly, competitive advantage is essential to ensure the product's acceptability to the target market. Non-conforming products (products not conforming to quality) mean waste to the company [Widyantoro et al, 2016; Paula et al,2016]. Defective products remain unsold; they must be re-sorted and re-worked, causing an inefficient production process [Widyantoro et al, 2016, Handoko et al, 2018]. Even if the product reaches the consumers, they will surely make a complaint and the company will have to pay the penalty cost. Therefore, Company X uses a monitoring tool called the Visual Quality Index (VQI) to maintain its product quality performance; this quality control tool uses sampling from the production-process output and visually observes the product to identify any defects. Each defect has a weight factor affecting VQI's accumulated value. A high VQI value is an early warning signal indicating the product's non-conformity [Hidayat et al, 2017].

The high VQI value (an average of 200) implies that Company X has produced several non-conforming products, whereas the company's target is approximately an average of 190. From the company's perspective, it is due to its human resources' lack of quality ownership. According to Rubiyanto (2014) quality ownership is an employee's sense of belonging to the quality of work. The worker's responsibility is to ensure the conformity of each production process and product following standard operating procedures or predetermined product standards.

In developing quality ownership, the worker needs a sense of belonging; it is a psychological feeling affiliated to quality and will appear in every work behavior. A person with a sense of belonging will automatically have empathy and act independently to ensure that quality is essential. This research examined how increasing the quality ownership can maintain a

product's quality to reduce waste and maintain consistent product quality, improving the company's competitive advantage.

2. Research Methodology

In this study, the researchers employed the continuous improvement approach with PDCA cycle and A3 problem-solving method to examine how increasing the workers' quality ownership can lead to consistent product quality. Starting with a literature study, the researchers observed the workstation to identify the problems in the production process that caused non-conforming products to determine the corrective steps. The researchers applied the continuous improvement approach using the PDCA cycle integrated with the A3 problem-solving method to increase quality ownership indicated by decreased VQI value.

The continuous improvement approach with PDCA introduced by Deming is a part of total quality management; it is a continuous improvement involving all parties to achieve customer satisfaction [Hidayat et al, 2017; Besterfield et al, 2002; Handayani et al, 2016; Handoko et al, 2015; Waluyo et al, 2017]. A3 problem-solving method is a report about a problem in the field. The term derives from a paper size widely used in companies as a medium for writing reports. In general, the problems might not be prominent and lightly dealt with; it is also called 'first-order problem-solving. Most organizations do not address the root of the problem, leading to recurrence and inefficiency. Therefore, identifying the root of the problem is essential to resolve and minimize its recurrence. A3 thinking has two functions: as a tool and an improvement of the process. It consists of background, current conditions, goals, analysis, purpose-measure, plan, and follow-up [Shook, 2008; Sobek, 2008; Matthews, 2011]. The researchers processed the data obtained from the field using a continuous improvement integration approach with the A3 problem-solving and PDCA (Plan-Do-Check-Action) method.

The 'Plan' stage converted/integrated the A3 problem-solving method (clarifying the problem), including the background, problem breakdown, current conditions, and analysis. Then, the researchers conducted the root-cause analysis to determine the problem-solving target. In the 'Do' stage, the A3 problem-solving method was converted by creating a counter-measure of the root cause obtained from the analysis. The 'Check' stage involved converting the A3 problem-solving method: planning implementation and a monitoring schedule. The 'Action' stage converted the A3 problem-solving method by following up each counter-measure previously scheduled. Furthermore, the researchers compared the 'before and after' of the continuous improvement.

3. Results and Discussions

In the PDCA and A3 problem-solving integration, the 'Plan' stage involved converting the A3 problem-solving, viz. Background, Current Condition, Determining Target, and Analysis. The 'Background' was based on the Visual Quality Index (VQI). The quality assurance issued VQI after taking samples every 2 hours from the production process to determine the product's non-conformity level, each of which would have a score processed with software to generate the VQI number. In data retrieval during fieldwork, the VQI value was very high (200) and far from the predetermined target (190).

The result shows a low level of ownership quality; it was a warning signal that the company needs to immediately take corrective actions in production workers, machining techniques, and processes. The results of the VQI observation are presented in Table 1:

Table 1: The VQI Observation of Week 30-37.

Fieldwork Week	VQI Value
1	192
2	200
3	205
4	206
5	195
6	204
7	193

A more detailed observation of the 'current condition' in A3 problem-solving shows that performance measurement was only conducted in departmental units, not at the individual employee level. Thereby, not all employees were aware of the Feedback Tool for Operation (FTO) assessment results; almost 75% did not know the assessment methods and individual performance results. The employer's subjective assessment was more dominant than the objective assessment since it was only based on the department's performance, causing employees only knew how to increase the quantity and not maintain/improve quality. It affected employee motivation to continue maintaining their performance and quality, resulting in a lack of quality ownership (sense of belonging to quality).

In the production line, many products non-conformities were causing a high value of VQI, indicating that many defects were found in a product. The company could suppress the VQI value by paying attention to product quality; thus, motivation was needed to develop a sense of belonging to quality (quality ownership). The researchers had identified the root cause of the high VQI value. Next, the researchers determined targets/goals to overcome the current conditions. Some companies improve their human resources' capability through knowledge and technology transfer because they can accelerate the improvement [Handoko et al, 2017; Handoko et al, 2016; Handoko and Salmia, 2015; Handoko et al ,2017; Handoko et al, 2019; Hidayat et al, 2018] in advanced technology [Abdullah et al, 2018; Tjahjadi et al, 2017; Tjahjadi et al, 2017; Tjahjadi et al, 2017; Tjahjadi et al, 2019], safety management, quality management [Handoko et al, 2020; Prasetya et al, 2019; Cahyono et al, 2019], and green technology [Handoko et al, 2019; Wijayaningtyas et al 2020; Wijayaningtyas et al, 2019]. However, since The Company’s problem was related to quality ownership, the target/goal was to increase its employees' awareness of measuring individual performance to promote performance and quality awareness. The goal was also to create a more focused working atmosphere to improve quality ownership and decrease the VQI value.

The next stage was 'Analyzed'. In this stage, the researchers analyzed the production process, focusing on human resources. One of the root causes of a product failure was the lack of employee awareness of quality; to identify the root causes, employees needed to perform a control process inspection (CPI) to check whether the machine experiences problems in the middle of the production process. Without CPI, there would be a high chance of a product failure, as

shown by the high VQI value. The company expected the products to be in good condition by performing CPI.

Next, the researchers brainstormed with several operators crucial in the process. The activity focused on their work to find the root causes of product failure. One of which was their lack of quality ownership or awareness. The brainstorming resulted in several things needed to improve employees' quality awareness. The results show several problems decreasing employee performance and awareness of their work; in other words, there was a decrease in quality ownership, as presented in Table 2:

Table 2: Brainstorming Results Concerning the Problems.

No.	Problems
1	One Point Lesson (OPL) related to treatment / repair of a defect was unavailable
2	A routine job desk check for the helper was unavailable
3	Assessment at the individual level was unavailable
4	Weighted scoring for individual operators was unavailable
5	Monitoring sheets for machine downtime were unavailable
6	Monitoring tools for individual and machine performance were unavailable

3.1. The 'Do' stage in PDCA

3.1.1. Proposed Counter-measure

From the root-cause analysis results, the researchers created a countermeasure or the treatment for the root cause of a problem through brainstorming. The results are shown in Table 3:

Table 3: Counter-measure Brainstorming Results.

No.	Problem	Counter measure
1	One Point Lesson (OPL) related to treatment/repair of a defect was unavailable	Providing OPL to equalize perceptions among operators in handling a product defect
2	A routine job desk check for the helper was unavailable	Providing additional job desk routine checks for helpers and their outreach
3	Assessment at the individual level was unavailable	Providing detailed assessment of each employee based on working area.
4	Weighted scoring for individual operators was unavailable	Determining the weighted scale for each aspect
5	Monitoring sheets for machine downtime were unavailable	Providing a downtime monitoring sheet (knowledge management) used as a medium for inter-shift communication related to machine problems
6	Monitoring tools for individual and machine performance were unavailable	Providing monitoring tools for employee performance according to the process/machine area

As seen in Table 3, brainstorming was essential to consider the effort and the level of effectiveness of the countermeasures; it can be grouped by using the effect-effort matrix diagram as shown in Figure 1:

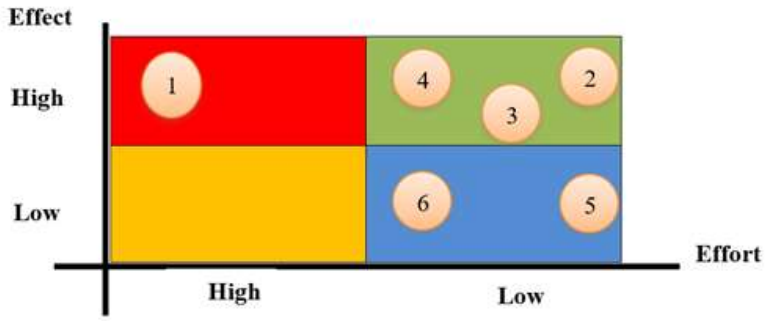

Fig. 1: The Matrix of Effect-Effort Diagram.

The Effect-Effort Matrix diagram is used to determine the priority of the proposed solution. The method makes it easier to identify the easiest effort having the most significant impact. From the diagram in Figure 1, the action plan is doing it from the easy effort having a significant effect; it is shown in the countermeasures number 2, 3, and 4.

The solutions are adding job desk routine checks for helper and socializing it, determining the weighted scale for each aspect, and making a detailed assessment of each employee based on working area. The next one is making a light effort with a light effect (number 5 and 6). The countermeasures are making performance monitoring tools for employees according to the process/machine area and providing downtime monitoring sheets used as inter-shift communication media related to updated machines (knowledge management). The last one is an action plan requiring a high effort with a high effect (number 1); the countermeasure is providing OPL to equalize perceptions among operators in handling a product defect. After all the effects and efforts are identified, it is necessary to schedule the process to improve and monitor the improvement effectiveness.

3.2. The 'Check' Stage of PDCA

In this stage, the researchers created a countermeasure-implementation schedule to evaluate whether it is according to the target, as in Table 4:

Table 4: The Countermeasure-implementation schedule for Week 40-47.

No.	Action Plan	Schedule time								Base VQI	Target VQI
		W 40	W 41	W 42	W 43	W 44	W 45	W 46	W 47		
1	Providing additional job desk routine checks for helpers and their outreach									200	193
2	Determining the weighted scale for each aspect									200	193
3	Providing detailed assessment of each employee based on working area									200	193
4	Providing monitoring tools for employee performance according to the process/machine area									200	193
5	Providing a downtime monitoring sheet (knowledge management) used as a medium for inter-shift communication related to machine problems									200	193
6	Providing OPL to equalize perceptions among operators in handling a product defect									200	193

3.3. The 'Action' Stage of PDCA

3.3.1. Follow-Up and Result

At this stage, the follow-up included a visualized weighted-scoring sheet written on a board so that each employee knows the assessment aspects to determine the value annually. Thus, it is clear that the quality of work affects the objectivity in determining the Feedback Tool for Operation (FTO) assessment; it is indicated by the VQI value and the work efficiency determined by the number of reject-product rates produced by the machine.

The company must disseminate employees' support and involvement in product awareness to make their best contribution to maintain product quality. Individual results from a year of work and coaching are assessed trimonthly, showing the level of achievement or temporary results to keep motivating performance and product-control improvement. One Point Lesson (OPL) is a tool used to align defect repairs from each operator; it is applied to see the OPL fix the defect when the same one occurs. OPL is made by the engineering department and printed according to the three major defects in the machine.

A general worker, also called a support operator, helps an operator. He has no special job desk; however, he must adapt and adjust his work in which they are placed. Wherever he works, he must participate in Control Process Inspection (CPI) of a product. After following up of root causes for continuous improvement, the researchers obtained the VQI values from observations from week 48 to week 51, as shown in Table 5. Table 5 shows that the average VQI value is 193, indicating a decrease in the average VQI value. It implies the company's success in increasing quality awareness; this shows improved quality ownership achieved through the continuous improvement approach using PDCA integrated with the A3 problem-solving.

Table 5: The VQI values of Week 48-51 Observations.

		Fieldwork: Week 48-51				Average
		1	2	3	4	
Machine 1	Cigarette	155	164	157	158	159
	Pack	35	31	32	31	32
Sub-total		190	195	189	189	191
Machine 2	Cigarette	135	163	161	162	155
	Pack	54	32	34	30	38
Sub-total		189	195	195	192	193
Machine 3	Cigarette	132	147	152	149	145
	Pack	60	50	45	45	50
Sub-total		192	197	197	194	195
Total average		190	196	194	192	193

4. Conclusions

Company X, a cigarette company with an international market, underwent some product quality problems. Its VQI figures show problems with its quality ownership of human resources. From the research results, the employer's subjective assessment caused a lack of individual quality awareness by only considering quantity without quality. Consequently, the operators lacked of quality ownership and did not perform CPI. In this study, the researchers employed the A3 problem solving method and converted/integrated into the Continuous Improvement (PDCA) approach to increase quality ownership. The process of integrating PDCA and A3 by heeding and following up on improvements to the problems gradually increased quality ownership; the VQI value, which was initially above 200, decreased nearly to the company's target (under 200) by dealing with the problems. The result shows that the improved quality control in achieving conformity in the production process and products is influenced by the increasing of human resources' quality ownership.

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