International Journal of Economic Literature (INJOLE) e-ISSN: 3026-0221
Vol. 2 No. 11 August 2025, page., 1826-1835

QUALITY CONTROL ANALYSIS OF LEATHER BAG PRODUCT USING SIX SIGMA METHOD AT CV CHIDEHAFU

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ABSTRACT

The increasing competitiveness in the manufacturing industry drives companies to continuously improve efficiency and product quality to meet customer needs and expectations. In the leather-based craft industry, product quality becomes a key benchmark that directly influences marketability and customer loyalty. CV Chidehafu Denpasar, a producer of leather bags, faces challenges in reducing product defects that could impact production costs and brand image. Based on production documentation from January 2024 to April 2025, the defect rate was found to exceed the company's tolerance threshold of 1%. This study employs the Six Sigma method using the DMAIC (Define, Measure, Analyze, Improve, Control) approach to design a more effective quality control plan. The analysis reveals that out of 4,800 total units produced, 717 were defective, resulting in a DPMO value of 29,880 or equivalent to a 3.3 sigma level. The most common defects include dirty leather, scratched surfaces, and loose stitching. Through Pareto and FMEA analysis, several improvement actions were proposed, focusing on raw material handling and operator skill enhancement. The implementation of Six Sigma-based quality control is expected to significantly reduce product defects and enhance the overall efficiency and quality of leather bag production at CV Chidehafu Denpasar.

Keyword: Six Sigma Quality Control, DMAIC, DPMO

INTRODUCTION

Quality is a crucial element in ensuring the sustainability and competitiveness of a company amid increasingly intense business rivalry. In the context of the manufacturing industry, quality is not only a parameter for customer satisfaction but also a reflection of process efficiency and the success of company strategies (Goetsch & Davis, 2016). Quality is defined as a dynamic condition related to products, services, people, processes, and environments that meet or exceed customer expectations and produce superior value (Goetsch, 2016:18). According to Heizer and Render (2016:244), quality can be viewed from three perspectives: user-based, manufacturing-based, and product-based. For customers, quality is synonymous with high performance and excellent features; while for producers, quality means conformity to standards and minimal variation in the production process.

In the era of globalization, systematic and data-driven approaches to quality control have become increasingly important. One widely used approach is Six Sigma, a method that emphasizes reducing process variation and continuous improvement to achieve near-zero defects (Pande et al., 2001). Six Sigma is a comprehensive, flexible system oriented towards understanding customer needs through data and statistical analysis, focusing on improving quality to a level of 3.4 defects per million opportunities (Gasperz, 2002:6). In its

implementation, Six Sigma uses the DMAIC stages (Define, Measure, Analyze, Improve, Control), allowing companies to identify and resolve quality issues comprehensively (Gygi et al., 2005:20). One tool used in the Measure and Analyze stages is the control chart, which enables companies to monitor process performance over time and detect unwanted variations (Heizer & Render, 2016:259).

CV Chidehafu Denpasar is a local company engaged in the production of leather bags, where quality is a key aspect in determining customer satisfaction and brand image. Based on production data from January 2024 to April 2025, a total of 717 defective units were found, indicating a need for systematic evaluation and quality control. Therefore, this study applies the Six Sigma approach to identify dominant types of defects, analyze root causes, and provide product quality improvement recommendations for CV Chidehafu Denpasar.

RESEARCH METHOD

This research is a descriptive quantitative study using a case study approach, aimed at identifying types of defects, the dominant causes of defects, and quality control solutions for leather bag products produced by CV Chidehafu Denpasar. The research design is applicative and problem-solving oriented, using the Six Sigma method with the stages of Define, Measure, Analyze, Improve, and Control (DMAIC). The study was conducted on the production line of CV Chidehafu, located at Jalan Pulau Moyo No.1A, Pedungan, South Denpasar, Denpasar City. This location was chosen because preliminary observations showed that the defect rate exceeded the company's tolerance limit of 1%.

The object of the study is the leather bag products manufactured by CV Chidehafu, while the subjects include the production department, quality control, and operational management. The types of defects analyzed include uneven stitching, stains on materials, peeled leather, stitch skips, and sizing errors. The primary data collected consists of the number of defective units from the total production output during the period from January 2024 to April 2025. The data sources used in this study include both primary and secondary data. Primary data was obtained through interviews with production staff and quality managers, as well as direct observation of the production process. Secondary data was collected from the company’s internal documents, such as production reports, quality inspection reports, and customer complaint records. Quantitative data, such as the number of defective products and total production units, were used to calculate DPMO and sigma values, while qualitative data was used to understand the root causes of failure.

Data collection methods included direct observation of the production process, documentation of quality inspection reports, and semi-structured interviews with relevant personnel involved in quality control. Observations were conducted to identify defect types and workflow stages with potential to cause defects, while interviews were used to gather more in-depth information about SOPs, technical challenges, and worker experiences in maintaining quality. Data analysis employed the Six Sigma approach through the stages of Define (identifying problems and CTQs), Measure (calculating defect proportion and DPMO), Analyze (Pareto analysis, fishbone diagram, and root cause identification), Improve (formulating improvement suggestions), and Control (developing a sustainable quality control plan). Analytical tools used included control charts (p-charts), Pareto diagrams, cause-and-effect (fishbone) diagrams, and the Failure Mode and Effect Analysis (FMEA) method to

prioritize quality issues. Through the Six Sigma approach, the company is expected to identify the main sources of defects, reduce process variation, and improve product quality continuously—ultimately reaching more competitive quality targets and
supporting the reputation of local products in international markets.

RESULT AND DISCUSSION

The initial stage in implementing Six Sigma at CV Chidehafu Denpasar began with the Define approach, which involves identifying the main problems and the most critical quality attributes for customers, known as Critical to Quality (CTQ). Based on the customer needs diagram, the attributes that most determine the quality of leather bags are leather surface, color, stitching, and accessories. From these attributes, CTQ elements were derived, such as non-peeling surfaces, cleanliness, even color, correct lining size, neat stitching, and properly attached accessories. Based on analysis of defective product data from January 2024 to April 2025, a total of 717 defective units were found out of 4,800 bags produced, consisting of various types of defects. The number of defective products is shown in Table 1, and the types of defects are presented in Table 2.

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Tabel 1.

Year	Month	Total		
		Production Quantity	Defective Product	Defect Percentage
2024	January	300	52	22%
	Februaryi	300	46	22%
	March	300	61	23%
	April	300	49	16%
	May	300	38	17%
	June	300	54	18%
	July	300	47	18%
	August	300	67	23%
	September	300	32	12%
	October	300	35	11%
	November	300	37	18%
	December	300	33	10%
2025	January	300	42	13%
	February	300	45	13%
	March	300	40	12%
	April	300	39	12%

Defective leather bag products 2024-2025 period

Table 2.
Number of Defective Products (2024-2025 Period)

Defective Leather Bags (2024-2025 Period)		
Defect Type	**Quantity**	**Percentage (%)**
Dirty Leather	114	16%
Loose stitching	105	15%
Scratched leather	93	13%
Peeling leather	91	13%
Untidy glue application	65	9%
Zipper difficult to close	52	7%
Detached zipper head	41	6%
Stitch hole marks	39	5%
Torn weaving	34	5%
Visible thread joints	27	4%
Detached studs	21	3%
Broken weaving	15	2%
Uneven lining size	8	1%
Dull paint color	7	1%

Sticker still attached	5	1%
Total	717	**100%**

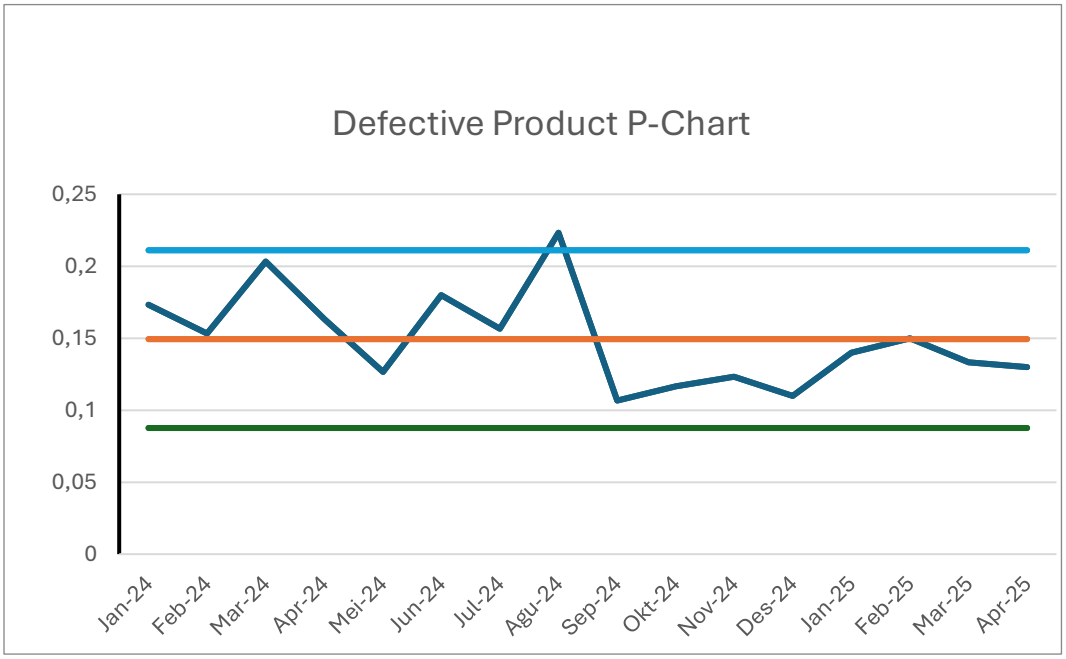
The types of defects were then analyzed using a Pareto Diagram, which showed that five main defect types contributed to over 66% of the total defects. The Pareto chart of defect types is shown in Figure 1.

Figure 1.
Pareto Chart of Defect Types

The next step involved conducting a statistical analysis of the production process using a proportion control chart or P-chart. The average defect proportion (CL) was calculated at

0.1494 or 14.94%. With a monthly sample size of 300 units, the upper control limit (UCL) was determined to be 0.2111 (21.11%) and the lower control limit (LCL) was 0.0876 (8.76%). The P-chart graph is shown in Figure 2.

Figure 2.



Defective Product P-Chart

The chart shows that there were two months, March and August 2024, that approached or exceeded the upper control limit, indicating instability in the production process during those periods.

In addition to the P-chart, calculations of Defect per Unit (DPU) and Defects per Million Opportunities (DPMO) were performed as metrics in the Measure stage. The DPU value of 0.1494 indicates that there was an average of about 0.15 defects per product unit. Assuming five potential defect opportunities per product (based on five main elements: leather material, stitching, zipper, lining size, and finishing), the DPMO was calculated to be 29,875. When converted to sigma level based on Gaspersz's standard conversion, this equates to a sigma level of 3.38. This indicates that although the production process has not reached the ideal Six Sigma standard (6 sigma), it is already at a moderate level that can be further improved.

In the Analyze stage, a Failure Mode and Effect Analysis (FMEA) was conducted to determine the defect types with the highest risk. Based on the Risk Priority Number (RPN) values, three types of defects categorized as CTQs were identified: loose stitching, peeling leather, and detached zipper heads. The main causes of these defects included non-standardized leather materials, inconsistent sewing procedures, and suboptimal zipper installation techniques. High detection scores on several defects indicated a weak inspection system at critical production points. Therefore, implementing a multi-point checking system and conducting raw material quality evaluations are crucial measures to be taken.

The Improve stage involved developing improvement recommendations for these three main defects. For loose stitching, it is recommended to standardize sewing techniques,

conduct employee training, and apply stitch quality control during the process. For peeling leather, recommendations include selecting materials that meet specifications, strict pre-production inspection, and training in proper finishing application. For detached zipper heads, it is advised to use high-quality components and provide installation technique training. The improvement plan is summarized in the following Figure 4.

Figure 4.
Improvement Plan

Defect Type	Root Cause	Suggested Improvement Action	Implementation Time	Evaluation Method
Loose stitching	Use of improper thread or sewing technique	Standardize sewing procedures, provide employee training, and implement stitching quality control	During sewing process	Stitch inspection and thread tension test

Peeling Leather	Leather material not meeting specifications or incorrect adhesive technique	Inspect leather quality before production, select qualified suppliers, use quality adhesives, and train finishing techniques	Before production & finishing	Raw material audit, adhesion test, visual inspection
Detached Zipper Head	Inappropriate zipper components and incorrect installation	Use high-quality zippers and provide training on proper installation techniques	Before and during installation	Zipper functionality test and daily inspection

CONCLUSION

Based on the research conducted at CV Chidehafu Denpasar using the Six Sigma method with the DMAIC (Define, Measure, Analyze, Improve, Control) approach, it can be concluded that the leather bag production process still has a relatively high defect rate. During the period from January 2024 to April 2025, out of a total production of 4,800 units, 717 defective units were found, resulting in a defect proportion of 14.94%. The P-chart analysis indicated that several months—particularly March and August 2024—had defect proportions that approached or exceeded the upper control limit, signaling that the process was not yet statistically stable.

The measurement results showed a Defect per Unit (DPU) value of 0.1494 and a Defect per Million Opportunities (DPMO) of 29,875, which corresponds to a sigma level of approximately 3.38. The FMEA analysis identified the most critical types of defects (CTQ) as loose stitching, peeling leather, and detached zipper heads. The main causes of these defects include unstandardized raw material quality, inconsistent work procedures, and weak detection systems at critical production points.

Recommendations from this study include: (1) the company should strengthen its quality control system, especially during raw material reception, the production process, and final inspection before packaging; (2) employee retraining and routine development of technical SOPs must be carried out periodically to maintain consistency in quality; (3) inspection checklists should be implemented at every stage of production to detect defects as early as possible; and (4) periodic evaluation of leather suppliers is needed to ensure consistent material quality. By consistently applying these recommendations, it is expected

that the company can reduce its defect rate toward the ideal standard of 1% or achieve zero defect.

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