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APPLICATION OF QUALITY TOOLS IN MANAGING CUSTOMER COMPLAINTS RELATED TO NON-CONFORMING PRODUCTS: CASE STUDY

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Abstract

In the context of increased consumer awareness, implementing a structured problem-solving approach using quality tools helped maintain and improve product and service quality while reducing customer complaints. This paper aimed to establish a problem-solving process within the National Paint Company (ENAP) in Algeria. The study utilized quality tools to identify and analyze the root causes of customer complaints and proposed solutions to enhance the company's practices. A descriptive and analytical approach was followed, employing semi-structured interviews, observation, and document analysis. The analysis highlighted a high occurrence of customer complaints related to product non-conformity. After applying quality tools and implementing the recommended action plan, the final dashboards results indicated a significant reduction in complaints, improved quality and a noticeable increase in customer satisfaction and loyalty. In conclusion, the approach adopted effectively addressed the identified issue, reinforcing quality management within ENAP.

Keywords: *Quality management; Problem-solving process; Quality tools; Customer complaints; Product non-conformity.*
JEL Codes: L15, M31

Introduction

The success and growth of any business are intrinsically linked to its clientele, making customer satisfaction and loyalty essential priorities. Customer satisfaction

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corresponds to the user's perception that influences their intention to evaluate and use a service (Dimitrieska et al., 2022). Companies strive to meet customers' needs by offering high-quality products and services. Based on the customer experience, clients may be satisfied, leading to long-term relationships, or dissatisfied, prompting the company to investigate the root causes of dissatisfaction to address potential issues (Sabadie et al., 2006).

Customer complaints are invaluable for identifying potential issues in products or services, serving as a critical signal for the company. While complaint management may be relatively straightforward in some sectors, it demands a rigorous approach in manufacturing companies to address quality or design-related concerns. Effective complaint management is essential for maintaining the company's reputation and longevity and is a core element of quality management. Quality management tools facilitate the systematic identification and resolution of issues, preventing recurrence and ensuring sustainable solutions (Bertoluci et al., 2001; Gillet-Goinard & Seno, 2016).

From this perspective, this article focused on implementing a systematic problem-solving approach to manage customer complaints effectively. This reflection builds on the previous research works of Pandey and Raut (2017); Thangaiah et al. (2018); Hidayat et al. (2021); Teplická et al. (2023). The main objective was to implement an effective problem-solving approach to reduce customer complaints, particularly those related to non-compliant products. From this primary objective, we defined three secondary objectives:

- Improve the current complaint management process of the ENAP company by analyzing the issues encountered;
- Identify and select the most significant and recurring problem by describing the current complaint handling strategy at ENAP;
- Use various quality tools to develop tailored solutions to the identified problems.

The research question was formulated as follows: "***How to implement a problem-solving approach to handle customer complaints?***" We adopted a qualitative descriptive and analytical approach to address this research question. Initially, we examined ENAP's activities and its complaint management by identifying the most frequent problem through interviews, observations, and document analysis. We then adopted an analytical approach to understand the underlying causes of the identified problem and propose suitable solutions, aiming to improve the current situation of the company.

Literature Review

It is increasingly difficult for businesses today to remain competitive in the face of increasingly demanding customers (Dimitrakaki, 2015), highlighting the importance of effective complaint management. According to Détrie (2001) a customer complaint is described as "*the explicit expression of dissatisfaction with the company, requiring attention to this dissatisfaction.*" Sabadie et al. (2006) for their part, describe a customer complaint as "*a request for information, clarification, or compensation directed to the company, following an experience deemed unsatisfactory by the customer and considered the organization's responsibility*." These two definitions highlight the importance of customer perception and the company's responsibility in complaint management.

Complaint management, according to Ray & Sabadie (2016), is characterized by a coordinated orchestration of strategies and resources implemented by companies. This approach aims to proactively address, learn from their failures, and convert customer dissatisfaction into satisfaction. The primary objective is to restore consumer trust in the organization. A previous analysis explored complaint management issues in various contexts. Sun (2020) examined complaints in the context of Industry 4.0, revealing that product quality issues (65%) and service issues (30%) are the leading causes. Proposed solutions, such as improving quality and training staff, have reduced complaints and enhanced customer loyalty, resulting in a 30% increase in loyalty rates and a 20% growth in market share for companies with effective complaint management systems. Ang & Buttle (2012) analyzed compliance with ISO 10002 standards for complaint management, discovering that well-defined processes improve customer satisfaction. Their study identified five key factors in complaint management, highlighting their positive impact on marketing-related outcomes, such as customer satisfaction and loyalty.

The problem-solving approach is a structured method aimed at identifying and analyzing problems, related to complaints, researching their causes, proposing and implementing practical solutions, and monitoring the results obtained to ensure their sustainability. It is based on using of quality tools and analytical methods to optimize decision-making and improve the overall performance of an organization. Several authors have proposed various tools for problem-solving. Among them, Marguerand & Gillet-Goinard (2006) presented the CARREDAS method (Context, Analysis, Realization, Resolution, Evaluation, Durability, Improvement, Set up monitoring) as a practical problem-solving approach.

Table no. 1. Steps of the Problem-Solving Approach

Step	Tool
Choose the problem	Pareto Diagram
Analyze the problem	QQOQCCP Questioning
Identify the causes	Brainstorming, 5M, 5 Whys
Find solutions	Brainstorming
Test the solutions	Indicator
Decide on the solution	Decision Matrix
Implement the solution	Action Plan
Monitor the solution	Indicators

Source: Marguerand & Gillet-Goinard. (2006).

According to Gillet (2021) finding a practical solution requires first identifying the source of the issue and implementing appropriate measures to ensure a lasting resolution and prevent the recurrence of the problem. Consequently, quality tools are essential for resolving various issues and ensuring the implementation of sustainable solutions. Recent studies on production process management have revealed various strategies and challenges related to optimizing operations and reducing waste, Jaqin et al. (2023) demonstrated that the applying Lean principles, notably Value Stream Mapping (VSM) and the 5 Whys, helps reduce time waste and significantly increases production. Moreover, Silambi & Indiyanto (2024) applied Lean Manufacturing and other quality tools to reduce waste in fish production, noting a significant reduction in production time. However, Kleszcz et al. (2019) highlighted that despite using of Lean tools in the ceramic industry, obstacles such as lack of training and resistance to change hindered effective implementation. Then, while Lean tools offer significant benefits, their success depends on overcoming organizational barriers and fostering a culture of continuous improvement.

Several approaches to solving quality problems and reducing customer complaints have been explored. A study was conducted on quality control tools at Skanem Interlabels in India, aiming to reduce customer complaints by 50% through root cause analysis and corrective actions (Pandey & Raut, 2017). A study examined quality issues in automotive components, using tools such as Pareto analysis and the Ishikawa diagram to address problems related to vehicle door locks (Teplická et al, 2023). Lean production methods were applied in Indonesia to reduce complaint processing time, showing significant improvements through the DMAIC approach (Hidayat et al., 2021). The analysis focused on how customer feedback and the QFD (Quality Function Deployment) method could enhance operational processes and product quality (Thangaiah et al., 2018).

All these studies highlighted the effectiveness of problem-solving tools in managing customer complaints, successfully resolved several complaints using root cause analysis and Ishikawa diagrams, Pandey & Raut (2017), Teplická et al. (2023) demonstrated that quality management tools could improve the quality of components and reduce defects**,** showed that Lean methods and DMAIC (Define, Measure, Analyze, Improve, Control) could streamline complaint management (Hidayat et al., 2021), and Thangaiah et al. (2018) emphasized the importance of customer feedback in improving product quality and operational processes.

These studies converge to underscore the effectiveness of problem-solving tools in handling complaints, forming the basis of our study at ENAP for proactive and effective complaint management aimed to improve customer satisfaction.

Research Context and Scope of the Study

Our case study was conducted within the National Paints Company (ENAP), which specializes in the production of organic coatings, such as paints, varnishes, resins, emulsions, driers, and adhesives. With over 30 years of experience and an annual production capacity of 150,000 tons for paint and varnish products, as well as 50,000 tons for semi-finished products, ENAP aims to strengthen its position in the national market, diversify its product range, develop exports, and establish industrial partnerships. The production unit in Cheraga, covering 44,410 m² with 4,452.5 m² built, plays a key role by specializing in manufacturing of building paints and varnishes while benefiting from a favorable logistical location.

The study focused on the Cheraga unit due to its strategic importance and the complexity of its operations. As a major player in the organic coatings sector, ENAP provides an ideal framework for analyzing the management of non-conforming products. The study examined the interactions between the sales, production, and laboratory departments to assess their coordination in handling complaints and recycling defective products. The analysis aimed to improve quality management practices, optimize production processes, and enhance customer satisfaction and loyalty.

This article examined the process of managing non-conforming products requiring recycling within the Cheraga production unit, highlighting the interactions between the three departments:

- The sales department is responsible for collecting returns of non-conforming products and transmitting them to production for evaluation;
- The production department, consisting of 55 people, oversaw manufacturing while adhering to formulas and quality standards, all while optimizing costs;

- The laboratory department, integrated into the production process, is responsible for quality control, anomaly analysis, and the development of recycling formulas. The laboratory plays a crucial role by closely collaborating with the sales and production departments to ensure the rapid and effective handling of defective products, which is essential for maintaining high-quality standards and ensuring customer satisfaction;

Close coordination between these departments is essential for effectively addressing complaints, improving production and recycling processes, and increasing customer satisfaction and loyalty.

Methodology

A qualitative approach was adopted, based on a constructivist epistemological paradigm, which extended the interpretivist paradigm. This paradigm, according to Gavard-Perret et al., (2012), rested on the idea that reality is not perceived as an objective fact but is constructed by individuals who observe and interpret it through their experiences, beliefs, and social contexts. In other words, knowledge developed from the interaction between the researcher and the subject of study, allowing shared meanings to emerge. To clarify further, this paradigm asserted that "*An object is considered to exist when we can construct it, present a concrete example of it, or calculate it explicitly*" (Largeault, 1993). Thus, constructivism emphasizes the importance of individual perceptions and interpretative processes in making sense of observed phenomena. It aimed to understand social reality by considering the subjectivity of both the observer and the concerned actors.

In this qualitative analysis, several tools were employed to enrich the understanding of the studied phenomena. Semi-structured interviews allowed for the collection of in-depth accounts by giving participants the freedom to express their perceptions while keeping the discussion focused on the research themes. Furthermore, observation facilitated immersion in the real context of the participants, enabling the identification of behaviors and interactions in their everyday environment. In addition, a document analysis was conducted to explore written data and provide a broader context to the information collected. By combining multiple sources and diverse perspectives, these methods offered a comprehensive and nuanced view of the studied reality.

Data Collection Methods

Document Analysis

This study involved a systematic review of relevant literature on quality management and customer complaint resolution to position our findings within the context of existing knowledge. In addition to the literature, we reviewed several internal company documents, including the company's presentation, organizational chart, and past records. A customer complaint file include: a complaint form, a return slip for recycling, a non-conformity report, a letter to the production department specifying the required corrections, and problem-solving practice guides. We also examined process reviews from the sales department, including key performance indicators like the number of complaints, processing times, satisfaction levels, sales figures, and revenue from new industrial clients. We also reviewed indirect monitoring documents related to non-conformity management and the customer complaint log, which tracks the dates and details of complaints.

Interview

An interview is a "*scientific investigation method that utilizes verbal communication to gather information related to a specific objective*" (Grawitz, 2000). In this study, we opted for semi-structured interviews, which encourage interaction in a dialogue format, offering flexibility in responses while maintaining focus on the main topic (Azioun & Mehdi, 2018). We interviewed three department heads (sales, laboratory, production) due to their specialized expertise and critical roles in problem-solving. An interview guide was created based on the international standard ISO 10002: 2018, entitled "Quality Management — Customer Satisfaction — Guidelines for Complaints Handling in Organizations," along with insights from the literature review and ENAP's internal documents. This guide aims to explore specific procedures, challenges in complaint management, and the complaint resolution process, and to identify problem causes and potential solutions. Each interview lasted approximately one hour on average.

Table no. 2. Details from interviews

Manager	Position	Department	Date	Duration	Location
R. S	Head of Sales Department	Commercial	06/03/2024	1 hour	Personal Office
A	Head of Laboratory Department	Operations	10/03/2024	50 minutes	Laboratory
A. S	Head of Production Department	Operations	13/03/2024	45 minutes	Department Office

Source: Developed by the authors

The table provides details about the individuals interviewed for the study. It listed the relevant managers, their roles, the departments to which they belonged, and the dates, durations, and locations of the interviews.

Observation

In this study, we used a general observation approach to analyze the non-conforming products reported by customers. It followed a flexible process without a predetermined framework, emphasizing detailed note-taking and a holistic understanding of the processes involved. On-site, we investigated the different stages of complaint handling, starting from the production of paints and varnishes to the equipment used for mixing, manufacturing, and recycling. We also observed the raw materials storage areas and the analysis laboratory, where testing and quality evaluation procedures are performed. These observations helped to gain a deeper understanding of the mechanisms established to identify the causes of non-conformity and to ensure product quality, all aimed at enhancing customer satisfaction.

Data Analysis Methods

Following the interviews with conducted with the relevant departments relevant to our research issue, we performed a comprehensive and detailed transcription of all verbal exchanges. This transcription served as the foundation for our content analysis, in which we examined the company's practices and identified the current challenges within the three departments involved. To enhance our analysis with the collected data, interview results, document analysis, and observations, we applied various quality tools to structure our approach, as outlined by Marguerand & Gillet-Goinard (2006). Initially, we used the Pareto tool to identify the nature of the problems related to customer complaints. Then, we employed the QQOCCP method to define and describe problematic situations accurately. The causes were analyzed through brainstorming sessions and the Ishikawa diagram, along with a weighted voting process to select the most relevant causes. Finally, to propose solutions, we conducted another round of brainstorming sessions, the Ishikawa diagram once more, while formulating solutions using a decision matrix inspired by the CARREDAS approach and weighted voting.

Table no. 3. Table of Correspondence between Stages of the Process and Tools Used

Stages of the Process	Tools Used
Choosing the problem	Pareto Diagram
Identification and clarification of the problem	5Why
Identification of the underlying causes of the problem	Brainstorming Cause and Effect Diagram (Ishikawa) Weighted Voting
Searching for possible Solutions	Brainstorming Decision Matrix Action Plan
Follow-Up on the solution	Dashboard

Source: Developed by the authors

The table above outlines the systematic approach used to address and resolve issues, ensuring that each stage of the problem-solving process is supported by relevant tools to enhance decision-making and the effectiveness of the implemented solutions.

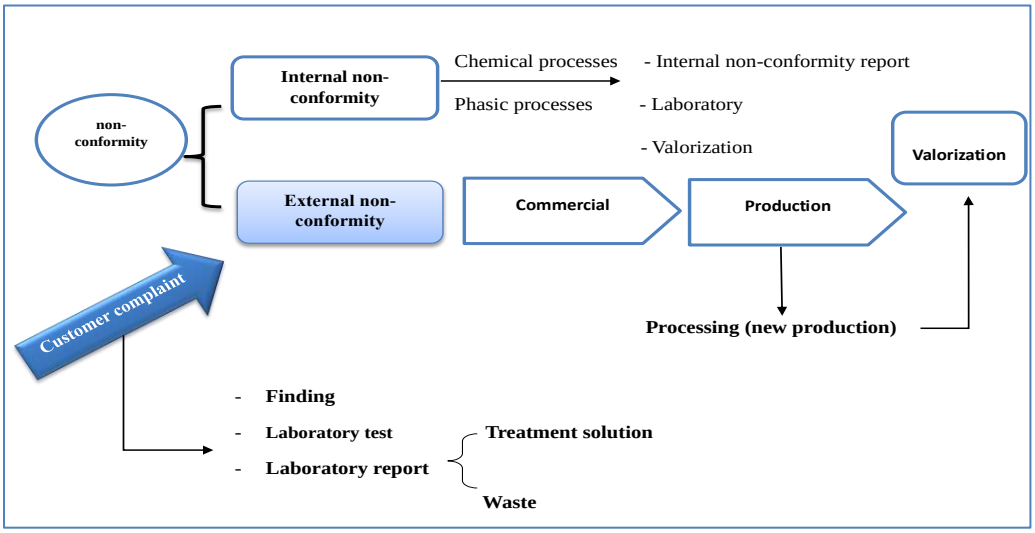
Results

We present the results by starting with a detailed diagram that summarizes customer complaint management at ENAP, specifically focusing on external non-conformities.

Description of ENAP's Complaint Management Process

The diagram below summarizes the customer complaint management process at ENAP, focusing on external non-conformities.

Figure no. 1. Customer Complaint Management process (Product Non-Conformities) at ENAP



Source: Developed by the authors

Figure presenting the Non-Conformity (N-C) management process illustrates how a customer complaint leads to either an external or internal non-conformity, followed by the corresponding steps for addressing it. A customer complaint triggers the identification of an external non-conformity, which is then communicated to the relevant departments, particularly the sales department. After analysis, the non-conformity is addressed by the production team, which takes the necessary corrective actions. Finally, the process concludes with the evaluation of the actions taken to resolve the issue and improve future quality. In parallel, internal non-conformities can be identified and resolved internally, following a similar process but without direct customer involvement.

Identification of the Problem to Address

By examining the internal documents of ENAP company from the current year and analyzing archives from previous years, we identified three major problems: (1) Incorrect determination of needs, (2) Cases of product non-conformity, and (3) Delays in delivery times. Our analysis included the presentation of the company, its organizational chart, and documents related to customer complaints, such as complaint forms, return slips for recycling, and non-conformity reports. We conducted an in-depth examination of the sales department's process reviews, which provided essential indicators such as the number of complaints, processing times, and customer satisfaction rates. Additionally, the analysis of non-conformity processing procedures and associated practices, and tests conducted on non-conforming products, highlighted significant risks associated with

product quality management, including environmental factors and packaging-related issues.

Based on these observations and documentary analyses, we decided to focus our efforts on issues of product non-conformity. This decision is justified by the high frequency of complaints related to non-conformity from customers, corroborated by the abundance of documents addressing this subject. Thus, although three problems have been identified, our choice to concentrate the study on non-conformities stems from their significant and repetitive impact on customers, underscoring the need to improve the management and processing of non-conforming products.

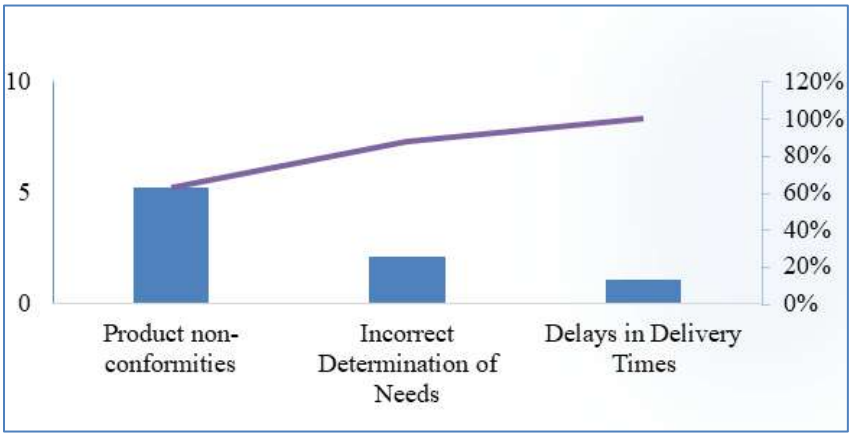
By using the responses gathered during interviews regarding the most frequent problem in customer complaints, we identified this issue using the Pareto method, as shown in the diagram and table below:

Table no. 4. Complaint frequencies

Customer complaints	Quarterly Frequencies	Cumulative	Frequency	Cumulative
Product non-conformities	5	5	63%	63%
Incorrect Determination of Needs	2	7	25%	88%
Delays in Delivery Times	1	8	13%	100%

Source: Developed by the authors

Figure no. 2. Complaint frequencies (Pareto)



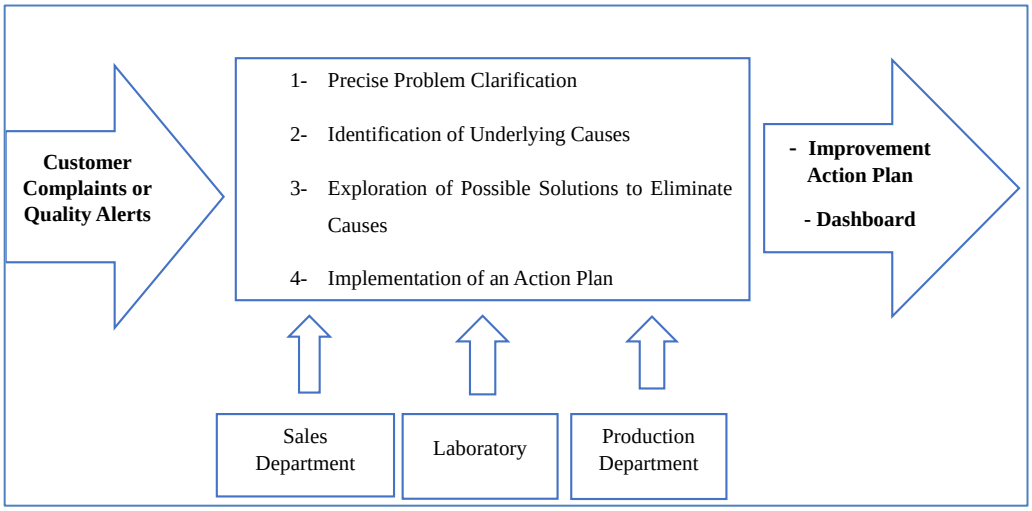
Source: Developed by the authors

The results indicated that 80% of customer complaints at ENAP stem from 20% of product non-conformities. This demonstrates that this type of complaint has been the most frequent at ENAP during this period, further supporting our decision.

Application of Problem-Solving Approach

The objective of this article was to adopt a problem-solving method to address customer complaints by following five essential steps, illustrated in the summary diagram below.

Figure no. 3. Summary diagram of our study approach



Source: Developed by the authors

Figure illustrates a structured process for managing complaints or quality alerts reported by customers. Here are the steps:

- Problem Identification: We first clearly identified the reported problem, whether it is a customer complaint;
- Causes Classification: Next, we analyzed and classified the potential causes of the problem, prioritizing the most likely ones, as seen in the Ishikawa diagram;
- Solutions Search: After identifying the causes, we looked for appropriate solutions, which sometimes required changes in work methods, equipment, or operator training;
- Implementation of an Action Plan: Once a solution was found, we implemented a corrective action plan in collaboration with various departments (sales, laboratory, production);

- Evaluation of Actions' Effectiveness: Finally, we evaluated the effectiveness of the corrective actions taken to improve of product quality and reduce the number of customer complaints.

This methodology aims to solve the problem by eliminating its root causes and implementing preventive measures. It involves the use of various tools to identify fundamental causes and propose effective and sustainable solutions.

Problem Identification

The first step involved defining the issue of customer complaints due to product non-conformities by collecting detailed data to understand its scope and characteristics. This data collection process facilitated the development of effective and sustainable solutions.

Table no. 5. The QQOQCP Tool

Questions	Questions	Answers
What?	How is that a problem?	Customer complaints due to product non-conformities
Who?	Who are the responsible parties? Who is concerned?	The sales department The laboratory department The production department The department heads
Where?	Where is it located?	ENAP company (CHERAGA production unit) Production process
When?	Since when? Since when did the problem appear?	Since the launch of the first sales of paint products by ENAP.
How many?	How many complaints do we have? What other numerical data do we have?	Between 5 and 7 each quarter The cumulative complaints and profitability
How?	How does the problem manifest? How to solve the problem?	Following customer complaints (online, face-to-face, by phone, written). Through the problem-solving approach
Why?	What objective are we aiming to?	Minimize customer complaints in order to ensure the company's profitability and maintain a level below one complaint per month.

Source: Developed by the authors

Causes Classification

In this critical problem-solving phase, we employed several quality tools to determine the root causes of customer complaints regarding non-conforming products.

This step was based on brainstorming, the cause-and-effect diagram (Ishikawa), and weighted voting to prioritize the causes according to their importance.

The brainstorming session, on March 6, 2023, included four participants: the laboratory manager and three engineers. This session aimed to identify the root causes of customer complaints related to non-conforming products, a problem that had been observed since January 2023.

Table no. 6. Identification of Underlying Causes / Brainstorming

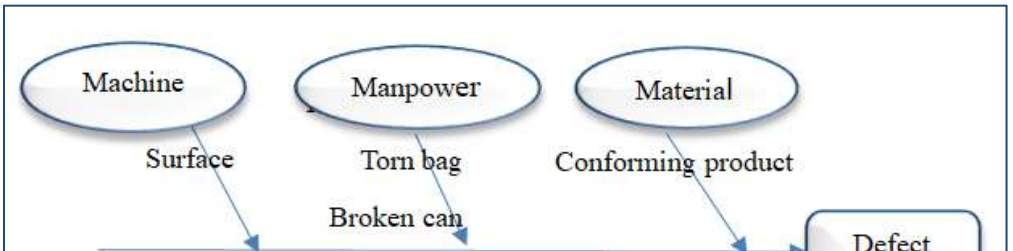
Problem	Non-Conformity	Explanation
Causes	Floating	Irregular spots appear in the paint when the mixing is poorly executed.
	Skin	A thin layer develops on the surface of the paint, thereby altering its composition. .
	Soft Deposit	When the paint becomes sticky, it is a problem that is noticed after use, as changes are observed on its surface.
	Conforming Product	It is when a product appears good on the surface but conceals many undetected safety or durability issues.
	Rusty Packaging	This occurs when paint cans and boxes start to rust in humid environments, which affects the quality of the paint used indoors.
	Surface Hardening	This is when the paint dries quickly on the surface but remains soft underneath.
	Broken Canister	It occurs when the paint canister is damaged due to mishandling.
	Torn Bag	It is when the bag containing the paint is torn, which can affect the quality of the paint and make it dirty.

Source: Developed by the authors

Discussions during the meeting led to the identification of several potential causes, which were subsequently filtered to focus only on those considered most relevant.

After the brainstorming session, we employed the cause-and-effect diagram (Ishikawa) to classify the identified causes into various categories. This diagram offered a clear visual representation of the relationships between the causes and the product non-conformity reported by customers.

Figure no. 4. Classification of Underlying Causes / Cause-and-Effect Diagram



Source: Developed by the authors

Analyzing the Ishikawa diagram concerning customer complaints about non-conforming products reveals several potential causes. First, within the "Materials" category, certain conforming products might be contributing to the issue. Next, in the "Methods" category, deposits and floating materials are also under suspicion. The "Manpower" category brings attention to factors such as torn bags or broken canisters, which could lead to errors during production. In the "Machines" category, surface hardening may impact the components of the paint. Lastly, in the "Medium" category, the presence of skins or rusty packaging could also be responsible for quality defects.

In conclusion, this cause-and-effect diagram (Ishikawa) highlighted several potential causes, which we explored to identify the fundamental causes in the next stages of the analysis.

To prioritize the identified causes, we employed the weighted voting method. Participants, including the laboratory manager, the quality manager, the production department head, and the sales department head, assigned scores to the causes on a scale from 1 to 3 (defined internally), where 3 represents the most significant cause.

Table no. 7. Identification of Fundamental Causes / Weighted Voting

The	**L.D.H.** Laboratory	**Q.M** Quality	**P.H.** Productio	**S.H.** Sale	**Total point**	Nbr of	Product s	Ranking (Ascendin

Causes	Departmen t Head	Manage r	n Head	s Hea d	**s P**	Voter s N	P * N	g Order)
Surface hardening	1	1	1	1	4	4	16	8
Skin	2	1	1	2	6	4	24	5
Soft deposit	3	3	3	3	11	4	48	1
Torn bag	1	1	1	2	5	4	20	6
Conformin g product	3	2	3	2	10	4	40	3
Rusty packaging	2	3	1	1	7	4	28	4
Broken can	2	1	1	1	5	4	20	7
Floating residue	3	2	3	3	11	4	44	2

Source: Developed by the authors

The voting process identified, the fundamental causes of the non-conformity issue: Soft Deposit, Floating Material, and Conforming Product. These causes will be addressed in the following steps to formulate corrective solutions.

Solutions Search

This step involved exploring and selecting potential solutions using three key quality tools: brainstorming, the decision matrix, and the action plan. On March 27, 2024, a brainstorming session with the laboratory team was organized to identify practical solutions for customer complaints related to product non-conformities. Based on the session and the data, several solutions were proposed to address the root causes, focusing on identifying the most suitable solutions to resolve the issue.

Table no. 8. Summary of proposed solutions/ Brainstorming

Problem	Root cause	Proposed solution
Customer complaints due to product non-conformities (complaint about the Glyfer economical product)	Soft deposit Floating or floating layer	**S1:** Recycle the finished product by following the recycling instructions and considering the quantities recommended by the laboratory department. **S2:** Raise awareness among production staff about adhering to the operational procedures for each product.
	Conforming product	**S1:** Design more resistant and secure packaging to prevent damage during transport and storage. **S2:** Establish a strengthened quality control system throughout the production process. **S3** Recondition torn bags by repairing and

		refurbishing them for future use, following the procedures recommended by the technical department.

Source: Developed by the authors

After identifying the appropriate solutions for each root cause, we used a decision matrix to compare them according to established criteria. This method helped us select the best solution by assigning a score to each based on its degree of conformity to the criteria, while excluding those that did not meet all the requirements. We used a scale of 1 to 3, as this was a collective choice proposed by the participants for its simplicity and effectiveness (Table no. 9). This scale allowed for clear ranking of the criteria without complicating the analysis, avoiding ambiguities that might arise from a broader scale. We assigned a weight of 3 to financial investment, as it was deemed essential to ensure the viability of the proposed solutions. The impact on product quality received a weight of 1, as it was less central to managing complaints. Effectiveness, with a weight of 2, was considered important for the rapid implementation of solutions but remained less of a priority than financial cost. Finally, customer satisfaction, with a weight of 3, was placed on the same level as financial investment, as meeting customer expectations was a key objective.

Table no. 9 Decision Matrix Criteria

Criteria Weighting	
Financial Investment	3
Positive Impact on Product Quality	1
Effectiveness	2
Customer Satisfaction	3

Source: Developed by the authors

For each solution (Recycling, Reinforced Packaging, Awareness, Quality Control, Reconditioning), we multiplied the scores assigned by each participant for each criterion by the weighting of that criterion. This step was performed for each participant. Once the weighted scores were obtained for each criterion and each solution, we summed the weighted scores from all participants to calculate the total score for each solution (Table no. 10).

Table no. 10. Decision Matrix for Solutions

Solutions	**Laboratory Service Manager**	**Assistant 1**	**Assistant 2**	**Quality Manager**	**Total**
Recycling	27	23	24	24	98
Reinforced	15	12	23	17	67

Packaging					
Awareness Campaign	24	23	24	21	92
Quality Control	26	18	24	25	93
Reconditioning	14	12	17	13	56

Source: Developed by the authors

The decision matrix involved several participants, including the laboratory department head, the sales department head, the production department head, and two laboratory technicians. The participation of the laboratory technicians was essential due to their direct involvement in analyzing non-conformities. These technicians, on the front lines of conducting tests, possess in-depth knowledge of test results and detected defects. Their presence provided precise and concrete technical data, facilitating a better understanding of the causes of non-conformities. Additionally, with their practical experience in quality control, they were able to propose realistic improvement avenues, ensuring that the discussed solutions were applicable and based on reliable technical observations. Based on the results obtained from this matrix, the solutions that received the highest scores for addressing the identified problem are recycling, staff awareness, and quality control of products before shipment.

Implementation of Action Plan

Before the final phase, with the assistance of the sales department manager, we developed an action plan encompassing all feasible solutions and their final objectives.

Table no. 11. Action Plan

Action	Objective	Responsible	Duration	Outcome
Optimize the recycling formula	Minimize costs and avoid customer complaints (approximately 3,300,000 DZD)	Laboratory	15 days	Cost reduction, customer satisfaction, and waste prevention
Enforce strict adherence to operational procedures in line with annual and quarterly awareness plans	Train managers responsible for handling customer complaints related to non-conforming products (approximately 2,200,000 DZD)	Production department	Each step of the process has a specific duration	Increased employee bonuses, product verification and inspection before shipment, avoid

				product returns
Verify and control products before shipment to customers, leveraging acquired expertise	Ensure compliance with customer requirements, avoid returns of non-conforming products	Sales department	Weekly	Reduced number of complaints, ensuring product conformity

Source: Developed by the authors

The action plan effectively addressed customer complaints by focusing on recycling to minimize costs, enhance satisfaction, and reduce waste. It outlined clear roles and responsibilities for each department and included measures such as training, adherence to procedures, and quality control to improve product conformity and reduce complaints.

Evaluation of actions' effectiveness

As the final step, we established a dashboard aimed to confirm the achievement of the objectives of reducing the number of complaints and increasing customer satisfaction rates.

Table no. 12. Dashboard

Objective/ Indicator	Objective	Achievement	Difference	Effectiveness
Revenue with Customer Complaints (85 KDA)	85 KDA	100 KDA	15	0%
Customer Satisfaction Rate	80 %	90 %	12%	115%
Revenue Share from New Industrial Customers	5 %	26%	21%	520 %
Number of Complaints with Return of Goods from Industrial Customers	4	4	0	5%
Average Time to Process Complaints from Industrial Customers	21 days	10 days	11 days	50%

Source: Developed by the authors

From a global perspective, there has been a decrease in the number of customer complaints has decreased compared to before the implementation of the approach, leading to an increase in customer satisfaction.

Results and Discussion

The present study relied on a qualitative approach that integrated document analysis, observation, and interviews to investigate the management of customer complaints. For a comprehensive analysis, we employed tools such as the Pareto and QQOQCCP method for clarification. This approach allowed us to uncover the root causes of the issues and propose targeted solutions. The findings demonstrated a significant decrease in complaints related to non-conforming products, resulting in enhanced customer satisfaction and product quality.

To initiate the discussion of the obtained results, we compared our study to those conducted by other authors across various industries, as shown in the table above (Table no. 13).

Table no. 13. Comparison of Results and Literature Review

Our Results	Literature Review	Conformity	Justification
Reduction in the Number of Customer Complaints	Pandey & Raut (2017)	Positive	Although the approaches and tools used were different, the results were validated.
	Teplická et al. (2023)	Positive	Despite the diversity of tools used, the quality of the results remains consistent.
Increase in Customer Satisfaction Rate	Pandey & Raut (2017)	Positive	Effectiveness of the Tools Used
	Marguerand & Gillet-Goinard (2006)	Negative	No results were obtained.
Improvement in Product Quality	Thangaiah et al. (2018)	Positive	Diversity of Quality Tools

Source: Developed by the authors

Various studies have utilized different methodologies to address similar issues. For instance, Pandey & Raut (2017) favoured a quantitative approach, justified by a more extensive study population, whereas our qualitative approach focused on a more specific and targeted context. This methodological divergence can be attributed to the varying research objectives and specific contexts. In selecting the most frequent problems, we applied the Pareto principle, which was the appropriate tool based on the specific objective of the study. In causes' analysis, we employed brainstorming and weighted voting, while other studies have utilized techniques such as the 5 Whys analysis and the Ishikawa diagram. For example**,** Teplická et al. (2023) adopted the QRQC (Quick Response Quality Control) method, which focuses on the rapid identification of anomalies and the immediate determination of their causes, alongside the Ishikawa diagram and the Lorenz curve. The variations in the application of these tools can be attributed to the specificities of each industry or company, the available resources and

expertise. Despite these differences, all studies share a common goal: to identifying the root causes of problems to enhance product quality and customer satisfaction.

In terms of problem-solving, Hidayat et al. (2021) utilized the DMAIC approach (Define, Measure, Analyze, Improve, Control), which differs from our method but also aims to reduce customer complaints. This diversity in approaches illustrates the multiple pathways available to achieve similar outcomes in addressing quality issues. To classify solutions and create an action plan, we implemented a decision matrix, inspired by the CARREDAS approach Marguerand & Gillet-Goinard (2006) which was similarly adopted by Pandey & Raut (2017) for their corrective and preventive actions (CAPA). The decision matrix facilitated effective structuring and prioritization of the proposed solutions.

In summary, although we employed various methodologies and tools, the outcomes of our study, and those of comparative studies, indicate a convergence in the effectiveness of approaches aimed at reducing customer complaints and enhancing product quality. While adapted to our specific context, our methodological choices, yield comparable results, underscoring the importance of a comprehensive understanding of customer needs and the continuous improvement of processes to achieve sustainable results.

Conclusion and Recommendations

The main objective of our article was to apply a problem-solving methodology to assist ENAP Company in reducing customer complaints related to product non-conformities. We addressed the central issue of implementing these methodologies by examining the complaints, identifying the problems, researching and analyzing the root causes, and proposing suitable solutions.

Using a qualitative approach, we combined literature reviews, document analyses, exploratory interviews, and applied quality tools in the sales, laboratory, and production departments. Key tools included Pareto analysis and the QQOQCCP method. We identified fundamental causes such as soft deposits, superficial foams, and compliance issues.

We recommended recycling finished products according to laboratory guidelines, using sturdier and safer packaging to prevent damage, ensuring proper packaging and storage of paint, applying rigorous quality control at all stages of production, training workshop managers on effective work methods and proper use of materials, following ISO 10002:2018 guidelines for customer complaint management, and raising awareness of best operational practices. A proposed action plan includes the recommended solutions, objectives, responsible individuals, timelines, and expected outcomes. This plan has led

to significant results, including a reduction in complaints and returns, an increase in customer satisfaction, and an improvement in product quality. The problem-solving method has proven effective in strengthening customer loyalty, with the majority of ENAP customers reporting average satisfaction levels after complaints were resolved.

Challenges encountered included the limited number of articles on problem-solving with simplified quality tools, time constraints, difficulties accessing the laboratory, and the company's confidential data. Analyzing these obstacles is crucial for obtaining more relevant results.

Future perspectives include assessing the environmental impact of the proposed solutions, conducting comparative studies across different industries, implementing longitudinal studies to evaluate the effectiveness of solutions and track performance over time, integrating ISO 10002 guidelines into ENAP's system, conducting comparative analyses with other companies in the paint industry or other sectors, studying the environmental impact of solutions for sustainability, combining quantitative and qualitative approaches to complaint management, and examining trends in industrial standards, agile methodologies, and innovative practices for problem-solving.

Our research demonstrated the importance of rigorously applying problem-solving methodologies to improve customer complaint management. It provided concrete tools and strategies to resolve current issues of product non-conformities and to establish sustainable practices that enhance customer satisfaction and product quality. This research significantly contributes to the field by offering a structured model that can be adapted to other industrial contexts, thereby highlighting the importance of systematic commitment to quality and customer satisfaction as essential levers for business performance and competitiveness.

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