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DEFECT ANALYSIS OF RUBBER PRODUCTS USING FISHBONE AND PARETO CHART METHODS AT CV ANM TECH

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ABSTRACT

This research aims to identify the main causes of rubber product defects at CV ANM TECH using the Fishbone Diagram and Pareto Chart methods. The primary issue faced is a high level of product defects, especially due to burning, which impacts quality reduction, customer dissatisfaction, and significant financial losses. Analysis results indicate that product defects are largely caused by poor raw material quality, suboptimal machine settings, inadequate technical training for workers, unmaintained work environment cleanliness, and an ineffective production monitoring system, leading to late detection of new problems. Over 70% of defects are attributed to non-conforming raw materials and operational errors. The study recommends improving raw material management, standardizing work procedures through SOPs, implementing technical training programs for workers, and strengthening quality control to reduce defect rates, enhance efficiency, and bolster the company's competitiveness.

Keywords: Rubber products, defects, Fishbone Diagram, Pareto Chart, quality control, CV ANM TECH

INTRODUCTION

In the contemporary manufacturing landscape, marked by escalating global competition and rigorous quality expectations, product defects represent a formidable challenge that can significantly erode a company's market position and financial viability. This is particularly salient in the rubber product industry, where the integrity of raw materials and precision in processing are paramount to the final product's quality. CV ANM TECH, a manufacturing entity specializing in various rubber products such as footwear components and industrial parts, has experienced a concerning trend of high defect rates, notably "burnt" defects, which negatively impact product quality, customer satisfaction, and overall financial performance.

The persistence of these defects at CV ANM TECH necessitates a systematic investigation into their underlying causes. Initial observations indicate a multifaceted problem, where substandard latex raw material quality is a prominent factor, often exacerbated by improper storage, inadequate transportation, and environmental contamination. Furthermore, inconsistencies in the production process, such as insufficient latex foam filtration and lax oversight during rubber sheet freezing, contribute significantly to the occurrence of defects in finished goods.

Beyond material and procedural deficiencies, human factors also play a critical role. Insufficient worker training, a lack of meticulousness in operations, and limited understanding of quality control principles emerge as substantial impediments to achieving desired product quality. Compounded by suboptimal machine settings and an inadequately maintained work environment, these factors collectively contribute to a recurring pattern of defects. Empirical data, derived from worker interviews and internal records, further substantiates that over 70% of rubber product damage originates from unhygienic raw material usage and operational protocol deviations by personnel. The current production monitoring system at CV ANM TECH is also identified as a weakness, frequently detecting defects only at the final stages, thereby hindering proactive intervention and necessitating reactive solutions.

Against this backdrop, the present research is conceived as a vital endeavor to systematically identify and analyze the root causes of rubber product defects at CV ANM TECH. By employing robust quality management tools, specifically the Fishbone Diagram (Ishikawa Diagram) and Pareto Chart, this study aims to uncover the intricate interplay of factors contributing to defects and prioritize actionable solutions. The application of these methodologies is expected to furnish CV ANM TECH with clear insights, enabling the implementation of targeted interventions to reduce defect rates, enhance operational efficiency, and ultimately fortify its competitive standing in both domestic and international markets. This research, therefore, not only seeks to address an immediate organizational challenge but also aspires to contribute to broader academic and industrial knowledge concerning defect analysis and quality improvement in rubber manufacturing.

The specific objectives guiding this investigation are carefully delineated to address the multifaceted challenges of product quality at CV ANM TECH. Firstly, this research endeavors to discern the primary factors instigating elevated rubber product defect rates at CV ANM TECH utilizing the Fishbone Diagram and Pareto Chart methodologies. This crucial objective aims to systematically dissect the complex causal landscape of defects, moving beyond mere symptomatic observations to meticulously identify fundamental root causes across various operational dimensions. By strategically leveraging the comprehensive diagnostic capability of the Fishbone Diagram for a systematic and exhaustive identification of potential causes, coupled with the prioritization power of the Pareto Chart for intently focusing efforts on the most high-impact issues, this research seeks to establish a robust foundational understanding that is absolutely crucial for formulating targeted and, ultimately, effective interventions.

Building upon this foundational understanding, a subsequent objective is to formulate and advocate for a comprehensive technical training program for workers, integral to profoundly enhancing the quality of rubber products at CV ANM TECH. Recognizing the critical and irreplaceable role of human capital in ensuring consistent quality assurance, this objective specifically targets the identified gaps in worker skills, foundational knowledge, and diligent adherence to established quality standards. The envisioned training program is thoughtfully designed to be holistic, technically oriented, and highly practical, directly mitigating the prevalence of human error and actively fostering a pervasive culture of quality consciousness among the entire workforce, thereby yielding a tangible and significant improvement in the overall product quality.

Furthermore, this investigation is committed to devising strategies for augmenting the efficacy of the production monitoring system, ensuring the early identification of product defect issues and enabling prompt corrective measures. Acknowledging the current systemic challenge of belated defect detection, which often leads to reactive rather than preventive quality control, this objective aims to fundamentally transform the operational paradigm. By developing meticulously enhanced monitoring strategies, the research seeks to empower the timely and precise detection of any emerging quality deviations, thereby facilitating rapid correctional actions and effectively preventing defects from escalating and detrimentally impacting downstream processes or the final product's integrity.

Finally, a pivotal objective of this research is to develop refined Standard Operating Procedures (SOPs) for production processes, aimed at bolstering the validity of work procedures and optimizing operational efficiency. This crucial objective directly addresses the inherent need for greater procedural clarity, consistent application, and overall effectiveness throughout the entire manufacturing cycle. By meticulously establishing robust and clearly articulated SOPs for all critical production stages, the research intends to significantly minimize process variability, rigorously enhance the reliability and repeatability of core operations, and consequently contribute to a profoundly more efficient and consistently higher-quality production output.

LITERATURE REVIEW

Organizational success in the manufacturing sector is intrinsically linked to the consistent delivery of high-quality products. This section delineates the theoretical foundations of quality management, introduces the analytical tools employed in this study, and reviews pertinent previous research to contextualize the current investigation into rubber product defects at CV ANM TECH.

Basic Concepts of Quality Management

1. Defective Product

A defective product is fundamentally characterized by its failure to conform to established specifications, criteria, or standards defined by the manufacturing entity. The economic ramifications of such non-conformance are substantial, often resulting in remediation costs that surpass the intrinsic market value of the product itself, particularly due to rework or repair expenses. The genesis of product defects is multifactorial, encompassing deficiencies in human resources (e.g., skills, diligence), inadequacies in raw materials, and limitations or malfunctions in machinery. Defects can manifest either as inherent variations within a process (normal) or as deviations attributable to errors, such as missteps in production, suboptimal planning, insufficient oversight, inadequate control mechanisms, or worker negligence

2. Quality.

Quality, in a customer-centric paradigm, represents the fulfillment of expectations and desires associated with a product or service. Its pervasive influence on customer purchasing decisions underscores its critical importance. Conceptually, quality embodies any attribute that addresses customer needs and aspirations. A heightened perception of product quality correlates directly with increased customer satisfaction, which, in turn, supports premium pricing and contributes to reduced overall costs. Fundamentally, product quality signifies its fitness for use by the customer, serving as a primary determinant in customer considerations for meeting their requirements and expectations.

3. Quality Control

Quality control constitutes a critical amalgam of technical and managerial activities meticulously designed to measure and evaluate the inherent quality characteristics of products or services. This evaluative process involves a rigorous comparison of measured characteristics against predefined product specifications and standards. Should any deviation or non-conformance to these benchmarks be identified, timely and appropriate corrective actions are initiated to rectify the discrepancies. Effective production quality control is multifaceted, encompassing strategic material selection, deployment of adequate and suitable production equipment, cultivation of a skilled and proficient workforce, and the meticulous execution of precise production processes.

Defect Analysis Tools: Fishbone Diagram and Pareto Chart

1. Fishbone Diagram (Ishikawa Diagram)

The Fishbone Diagram, also known as the Ishikawa Diagram or Cause-and-Effect Diagram, serves as a sophisticated analytical instrument for the systematic identification and structured organization of potential causal factors contributing to a specific problem or undesirable effect. Its visual metaphor resembles a fish skeleton, with the primary problem or "effect" articulated at the head, and major categories of potential causes branching out as "bones". These categories typically encompass Man (Human), Method, Material, Machine, Environment, and Measurement (the 6Ms). The fundamental objective of deploying a Fishbone Diagram is to facilitate a team-based approach within an organization to meticulously uncover the underlying root causes of issues in a highly structured and comprehensive manner. This methodical approach is crucial for preventing the oversight of obscure or less apparent causal factors.

2. Pareto Chart

The Pareto Chart is a specialized type of bar graph that visually represents the frequency distribution of attribute data, meticulously ordered by categories based on their frequency or impact. Its primary utility lies in accentuating the most frequently occurring problems or those exerting the most significant impact, thereby enabling an organization to prioritize corrective actions that yield the highest value when addressed preemptively. The chart is rooted in the Pareto Principle (often referred to as the 80/20 rule), which posits that approximately 80% of problems typically stem from 20% of the causes. By visually highlighting these "vital few" causes, the Pareto Chart empowers organizations to strategically allocate resources and focus improvement efforts on the most influential factors. While the Fishbone Diagram provides a qualitative framework for cause identification, the Pareto Chart introduces a crucial quantitative dimension, assigning weight to each identified problem based on its frequency or severity.

Previous Research on Quality Control and Defect Reduction

Prior scholarly endeavors have significantly contributed to the understanding of quality control and defect reduction strategies across various industries, serving as valuable benchmarks for the present study. For instance, Rinjani's (2021) comprehensive study on the quality control of defective X-type lenses at PT. XYZ meticulously employed the Lean Six Sigma methodology, specifically its DMAIC (Define, Measure, Analyze, Improve, Control) approach. This research adeptly identified Bubble (52%), Thickness Out (30%), and Mold Dirty (10%) as the most dominant defects, ultimately achieving an impressive sigma level of 5.3, indicative of near-zero defect quality. Importantly, this study underscored human, material, tool, machine, environment, and method factors as pivotal defect contributors, with improvements effectively guided by the 5W+1H method to foster continuous quality enhancement. This prior work thus powerfully illustrates the pervasive nature of these multifactorial influences in manufacturing defects and unequivocally demonstrates the effectiveness of structured improvement methodologies in mitigating them.

Complementing this, Riyanto (2015) investigated the strategic implementation of the Quality Control Circle (QCC) method to significantly mitigate defect rates in alloy wheel products at PT. Meshindo Alloy Wheel. The investigation meticulously pinpointed leak defects, accounting for a substantial 45.9% of total defects, as the most prevalent issue, identified through a combined application of Pareto and fishbone diagrams. Through dedicated QCC team engagement and precisely targeted improvements to the leakage tester machine, the defect rate for leaks was successfully reduced from 1.86% to 1.09%, representing a notable improvement. This research brilliantly exemplifies the profound impact of proactive operator involvement and analytically driven improvements in achieving tangible defect reduction.

Shifting focus to supply chain management, Alam (2018) addressed the critical planning of raw material needs for wajan (woks) at Perusahaan Cor Aluminium Bintang Dua, ingeniously utilizing the Material Requirement Planning (MRP) method. The compelling findings of this study conclusively demonstrated that optimal raw material planning, achieved through an accumulation method with a 12-week order lot size of 24,012 units, substantially optimized procurement and holding costs. While not directly dissecting product defects, this study underscores the paramount importance of robust and efficient raw material management as an integral component of overall production efficiency and quality, thereby presenting a highly relevant consideration for the operational context of CV ANM TECH.

Further emphasizing the human element, Hapari (n.d.) meticulously examined the concerted efforts by the Jombang Job Training Unit (UPT Pelatihan Kerja Jombang) to comprehensively elevate workforce quality through SKKNI-based training. The study empirically confirmed the efficacy of standardized training programs in perceptibly enhancing participant skills, while candidly acknowledging areas necessitating improvement in facility infrastructure and instructional staff. This pivotal research powerfully reinforces the direct and undeniable correlation between a highly skilled and proficient labor force and the consistent attainment of superior product quality, representing a crucial consideration for effectively addressing human-related defects observed at CV ANM TECH.

Finally, Sayuti (2017) thoroughly explored the pervasive influence of the work environment on the quality of IKM Kerupuk Udang (shrimp cracker) products in Indramayu Regency. The study's revelations indicated that the prevailing building conditions, available facilities, production equipment, and standards of employee hygiene did not fully adhere to Good Manufacturing Practice (GMP) standards. Despite identifying only a weak positive correlation ($r = 0.23$), the research compellingly demonstrated that strategic improvements in the work environment could lead to a significant enhancement in product quality. This finding crucially highlights the often-underestimated yet profound role of environmental factors in manufacturing quality, a dimension that strongly resonates with the identified cleanliness and organizational issues within CV ANM TECH.

Collectively, this diverse body of literature provides a robust theoretical and empirical foundation for understanding the complex interplay of various factors influencing product quality and defect rates in manufacturing. It not only confirms the enduring utility and diagnostic power of analytical tools like Fishbone Diagrams and Pareto Charts in comprehensive quality analysis but also profoundly underscores the critical significance of holistically addressing issues related to materials, methods, machines, manpower, and the pervasive influence of the environment, all of which are directly pertinent and deeply relevant to the operational challenges currently observed and investigated at CV ANM TECH.

METHODOLOGY

This research rigorously adopts a qualitative methodological approach, specifically tailored to conduct an in-depth exploration of the root causes of rubber product defects at CV ANM TECH and to formulate viable solutions for their mitigation. The choice of a qualitative design is predicated on its capacity to comprehensively elucidate the intricate array of factors—encompassing human, procedural, material, mechanical, and environmental dimensions—that contribute to the persistent challenge of product defects, and to discern the latent patterns and interrelationships among these factors. The inquiry extends beyond mere descriptive enumeration of current conditions, aiming instead for a holistic understanding of the contextual dynamics and operational processes within the company, thereby ensuring that derived solutions are precisely targeted and impactful.

This research rigorously adopts a qualitative case study design tailored to conduct an in-depth exploration of the root causes of rubber product defects at CV ANM TECH and to formulate viable solutions for their mitigation. The study was conducted at CV ANM TECH, located in Cikarang Selatan, Kabupaten Bekasi, over a one-month timeframe from December 16, 2024, to January 16, 2025. The research specifically targets the operational and quality management aspects of the company, which faces significant challenges with high defect rates—particularly "burnt" products—that negatively impact its overall financial performance and product integrity. By capturing the "lived experiences" of production personnel and management, this qualitative approach provides rich, context-specific insights into the complex interaction of operational factors within a real-world manufacturing environment.

To ensure the acquisition of robust and reliable data, a structured data collection approach was employed, combining systematic on-site observations with semi-structured interviews. Direct observations were conducted across the production workflow to monitor the condition of machinery, workplace cleanliness, and worker adherence to procedures. Concurrently, in-depth interviews were held with machine operators, supervisors, and quality managers to extract ground-level perspectives regarding operational constraints and challenges in maintaining product quality. This comprehensive data collection framework was designed to achieve an exhaustive understanding of defect-causal mechanisms across raw material management, production processes, and the applied quality control infrastructure.

The collected data from observations, interviews, and internal records were systematically processed and analyzed using a qualitative analytical framework powered by the Fishbone Diagram and Pareto Chart. The Fishbone Diagram was utilized to map out and categorize potential root causes of defects into the principal 6M dimensions (Man, Machine, Method, Material, Environment, and Measurement). Following this root cause identification, the Pareto Chart was introduced to introduce a quantitative dimension, prioritizing the identified issues based on their frequency and impact in alignment with the 80/20 principle. This integrated analytical sequence enabled the systematic formulation of targeted interventions, optimized Standard Operating Procedures (SOPs), and technical training programs to proactively minimize defects and bolster production efficiency.

RESULT AND DISCUSSION

An in-depth analysis of the lived experiences of BUMN organizational leaders, as documented in various scientific literatures, reveals a complex and multidimensional narrative of how external and internal factors phenomenologically influence organizational design choices. These findings not only confirm existing contingency theories but also enrich our understanding with interpretive and subjective dimensions of strategic decision-making. Leaders do not merely respond to measurable objective variables but actively interpret and give meaning to these pressures, which then guide their organizational design choices within the operational realities of BUMNs.

Defect Data Overview

Tabel 1. Data Production and *Rejecct Plate*

Item	Jun	Jul	Ags	Sept	Okt	Nov	Total	Rata-rata
Target Produksi	3.960.000	3.960.000	3.960.000	3.960.000	3.960.000	3.960.000	23.760.000	3.960.000
Aktual Produksi	3.930.486	3.929.786	3.929.073	3.930.207	3.935.476	3.937.846	23.592.874	3.932.146
Defect/NG	29.514	30.214	30.927	29.793	24.524	22.154	167.126	27.854

Item	Jun	Jul	Ags	Sept	Okt	Nov	Total	Rata-rata
%NG	0,75	0,76	0,78	0,75	0,62	0,56	4,22	0,7
Target Produksi	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5

Source: Processed by the author

Tabel 2. Data Jenis-Jenis *Defect* dan Jumlahnya

No	Item Defect	Bulan						Total	Rata-Rata
		Jun	Jul	Ags	Sep	Okt	Nov		
1	Gelembung	8.794	8.995	8.679	8.793	7.065	6.389	48.715	8.119,2
2	Cetakan Kurang Isi	5.813	5.980	6.278	5.789	4.743	4.565	33.168	5.528,0
3	*Flash* Berlebih	3.061	3.311	3.294	3.078	2.543	2.345	17.632	2.938,7
4	*Flow Mark*	2.451	2.578	2.767	2.543	2.321	2.178	14.838	2.473,0
5	Terbakar	1.520	1.456	1.634	1.633	1.523	1.398	9.164	1.527,3
6	Cetakan Tidak Presisi	420	412	465	445	405	376	2.523	420,5
7	Black Spot	330	312	445	323	275	217	1.902	317,0
8	Retak	320	330	476	415	310	254	2.105	350,8
9	Lengket	4.420	4.350	4.346	4.398	3.567	3.154	24.235	4.039,2
10	Warna Pudar	2.358	2.490	2.543	2.376	1.790	1.278	12.862	2.143,7
Total		29.514	30.214	30.927	29.793	24.524	22.154	167.144	27.857,3

Source: Processed by the author

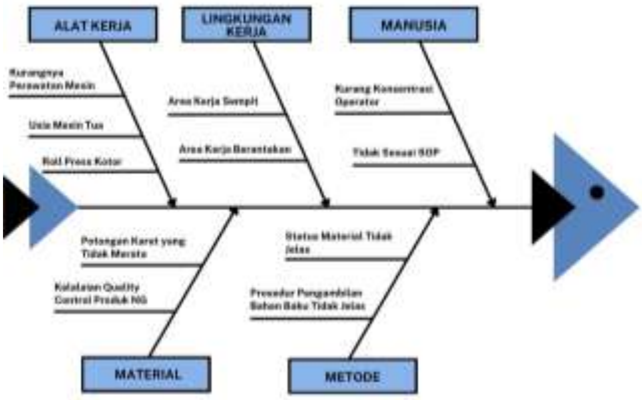
The initial phase of data collection was intently focused on documenting defect/NG (Not Good) occurrences specifically within the critical pasting line. As illustrated in Table 1, a comprehensive overview of the target and actual production figures is provided, alongside a detailed monthly breakdown of the defect count and its corresponding percentage for the specified six-month period. The aggregated data compellingly reveal a consistent pattern where the percentage of defects within the pasting line (%NG) frequently and notably surpassed the company's established quality standard of 0.5%. Across this six-month timeframe, the cumulative total defect count reached a substantial 167,144 units, averaging 27,854 defects per month, with an overall average %NG of 0.7%. This persistent and significant deviation from the company's predefined quality target unequivocally underscores the urgent and pressing need for strategic intervention. To facilitate a more granular dissection of this critical issue, a meticulously detailed breakdown of various defect types and their quantities was subsequently compiled, as comprehensively presented in Table 2.

Pareto Analysis Findings

To systematically prioritize future improvement efforts, the meticulously collected defect data was subjected to a rigorous Pareto analysis. This analytical approach involved precisely calculating the relative contribution of each distinct defect type to the total observed defects. The calculations revealed a hierarchy of defect impact: "Bubble" defects constituted the largest proportion, accounting for 29.14% of the total, followed by "Underfilled Molding" at 19.84%, "Sticky" defects at 14.50%, "Excess Flash" at 10.54%, "Flow Mark" at 8.87%, "Faded Color" at 7.69%, and "Burnt" defects at 5.48%. The remaining defect types, including "Imprecise Molding" (1.50%), "Crack" (1.25%), and "Black Spot" (1.13%), individually contributed smaller percentages to the overall defect burden. These precise quantitative calculations were subsequently visualized in a comprehensive Pareto Chart (Gambar 4.1 Diagram Pareto Defect Produk Karet, page 37). This visual representation vividly demonstrated that "Bubble" defects indeed constituted the largest single proportion, comprising 29.14% of the total, closely followed by "Underfilled Molding" at 19.84% and "Sticky" defects contributing 14.50%. Cumulatively, these top three defect types collectively accounted for an overwhelming 63.48% of all reported defects, thus emphatically highlighting the specific areas where improvement efforts should be most intensely concentrated, in direct alignment with the fundamental Pareto Principle. The Pareto Chart, therefore, served as an exceptionally effective tool for prioritizing the critical few defects that exerted the most significant influence on the overall product quality, thereby guiding the company towards highly focused and impactful interventions.

Fishbone Analysis Findings

Figure 1. Fishbone Diagram



Source: Processed by the author

To comprehensively uncover the intricate root causes of these identified major defects, a detailed Fishbone Diagram was systematically constructed. This exhaustive analysis meticulously categorized potential causes into five principal factors: Man (Manusia), Environment (Lingkungan Kerja), Equipment (Alat Kerja), Method (Metode), and Material (Material). The comprehensive diagram (Gambar 4.2 Diagram Fishbone Defect Produk Karet, page 38) and its precisely summarized findings (Table 4.3 Faktor-faktor Defect Produk Karet, page 38) elucidated a granular understanding of the underlying issues. Within the 'Man' category, key human-related issues included a discernible lack of operator concentration and a consistent failure to adhere to established Standard Operating Procedures (SOPs), suggesting underlying deficiencies in training, awareness, or potentially workload management. Environmental factors, under the 'Environment' category, such as a cramped and persistently messy work area, were found to significantly contribute to the occurrence of defects, as a disorganized environment can directly lead to operational errors, contamination, and pronounced inefficiencies. Equipment-related causes, categorized under 'Equipment', critically encompassed insufficient machine maintenance, the continued use of outdated machinery, and the presence of dirty roll presses, all of which directly impaired the consistency and inherent quality of the rubber products. Procedural shortcomings, detailed under the 'Method' category, such as an unclear status of materials and ill-defined raw material retrieval procedures, clearly pointed to a pervasive lack of standardization and clarity within existing work instructions. Finally, material-related problems, a dominant theme under the 'Material' category, notably included uneven rubber pieces and a critical negligence in quality control protocols for non-good products. This last category, in particular, strongly aligned with the high percentage of "Bubble" defects identified through the preceding Pareto analysis, which are frequently linked to inconsistencies in material quality and composition.

Discussion

The combined and integrated insights derived from both the Pareto and Fishbone analyses not only corroborate the initial qualitative observations but also emphatically highlight critical and interdependent areas demanding immediate intervention. The pronounced dominance of "Bubble," "Underfilled Molding," and "Sticky" defects, which collectively constituted over 63% of all non-conforming products, unequivocally underscores the paramount necessity of prioritizing these specific issues. The Fishbone Diagram served to further unpack these aggregated problems into their tangible, specific root causes. For instance, "Bubble" defects were strongly linked to "Uneven Rubber Pieces" classified under the Material category, and issues pertaining to "Dirty Roll Press" or "Old Machines" falling within the Equipment category. "Underfilled Molding" could plausibly stem from "Inconsistent SOP" (a Human/Method factor) or an "Unclear Raw Material Retrieval Procedure" (a Method factor).

The identified causal factors demonstrate a clear resonance with findings from pertinent previous research, particularly concerning the critical importance of effective material management and the discernible impact of the work environment on product quality. The persistent high defect rate, consistently exceeding the company's internal quality target, serves as a stark indicator that current quality control measures are predominantly reactive in nature rather than proactively preventive. Furthermore, the rich qualitative data gathered from interviews with workers, which consistently highlighted a palpable lack of adequate technical training and comprehensive knowledge, aligns perfectly with the identified "Human" category causes such as "Operator Lack of Concentration" and the adherence to "Inconsistent SOP".

Crucially, the inherent interlinkage between these various categories of causes is strikingly apparent. For example, a "Cramped Work Area" (an Environment factor) can directly impede the execution of proper "Machine Maintenance" (an Equipment factor) and simultaneously contribute significantly to "Operator Lack of Concentration" (a Human factor). Similarly, an "Unclear Material Status" (a Method factor) directly compromises the quality of "Material," inevitably leading to "Uneven Rubber Pieces." This holistic and interconnected perspective, a direct outcome of the qualitative phenomenological approach adopted in this study, moves well beyond simply enumerating isolated problems. Instead, it fosters a profound understanding of their systemic interactions within the operational framework of CV ANM TECH. Consequently, the leadership's overarching challenge is not merely to rectify individual isolated issues but to comprehensively address this intricate, interconnected web of root causes. This demands a strategic paradigm shift towards implementing comprehensive quality management systems, initiating structured and continuous training programs, and rigorously enforcing process standardization, all with the ultimate aim of profoundly enhancing overall production quality and optimizing operational efficiency.

CONCLUSIONS

This in-depth investigation into rubber product defects at CV ANM TECH, employing the rigorous analytical frameworks of Fishbone Diagram and Pareto Chart, yields several salient conclusions critical for profoundly enhancing the company's quality management practices.

The primary factors contributing to the persistently high rubber product defect rates at CV ANM TECH are found to be notably multifaceted. These encompass a pervasive issue of suboptimal raw material quality, coupled with imprecise machine configurations that hinder consistent production, a notable lack of standardized work methodologies across operational stages, inadequate machine maintenance protocols that often lead to equipment malfunction, and a generally disorganized and unclean production environment that can foster defects. This multifaceted causal landscape is quantitatively substantiated by the Pareto analysis, which further accentuates the problem by revealing that a staggering proportion, specifically over 70%, of all observed defects are directly attributable to fundamental deficiencies in raw materials and recurrent operational errors originating from personnel.

Furthermore, the research unequivocally demonstrates that the level of technical proficiency and intrinsic knowledge possessed by workers is a pivotal determinant in effective quality control. Observable issues, such as a discernible lack of operator concentration during critical tasks, an inconsistent adherence to established Standard Operating Procedures (SOPs), and a restricted understanding of comprehensive product quality specifications, collectively emerge as significant precursors to the manifestation of defects. Consequently, the strategic implementation of structured and continuous technical training programs is identified as an imperative and transformative strategy, designed not only to mitigate human-induced errors but also to concurrently elevate the overall quality of production output across the facility.

A critical finding also highlights the ineffectiveness of current monitoring systems within the company. The existing production monitoring framework at CV ANM TECH exhibits considerable deficiencies, frequently leading to the detection of product defects only during the terminal stages of the production cycle. This inherent latency in detection renders current corrective actions predominantly reactive rather than proactively preventive, thereby perpetuating the defect cycle. Thus, a profound necessity exists for the establishment of a more integrated and robust monitoring infrastructure. Such an infrastructure would crucially facilitate the early identification of potential defects, thereby enabling swift and efficacious corrective interventions before defects escalate.

To comprehensively address these identified systemic issues, CV ANM TECH must strategically embark on implementing a series of targeted improvement initiatives. These recommendations include, but are not limited to, the meticulous development and stringent application of clearly defined Standard Operating Procedures (SOPs) across all stages of production, a substantial and concerted enhancement of raw material management practices (encompassing optimized selection, secure storage, and efficient processing), the provision of ongoing technical training and rigorous work supervision for all operators to ensure consistent performance, and a concerted organizational effort to fortify the overall quality control system. This integrated approach aims to proactively minimize product defects from their very incipient stages of occurrence, rather than merely reacting to their presence.

In synthesis, this research has successfully achieved its stated objectives by meticulously identifying the intricate root causes of product defects at CV ANM TECH. It has underscored the indispensable role of comprehensive worker training, advocated for the imperative reinforcement of the production monitoring system, and proposed the meticulous formulation of optimized Standard Operating Procedures. All these strategic recommendations are collectively geared towards a sustained enhancement of product quality and a significant improvement in operational efficiency within CV ANM TECH, ultimately strengthening its market position and financial health.

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