

Analytical Study on Customer Satisfaction in Forging Products of Varying Sizes

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Abstract:

This study investigates the relationship between dimensional variations in forged products and customer satisfaction across multiple industrial sectors. Data was collected via a structured questionnaire targeting professionals from procurement, production, and quality departments in industries like automotive, aerospace, oil & gas, construction, and heavy machinery. Analysis reveals that dimensional accuracy is a significant factor influencing satisfaction, with operational impacts including production delays, part rejection, and rework. The findings emphasize the need for clearer tolerance standards and suggest process improvements for greater precision in forging operations.

Keywords: Forging industry, Dimensional accuracy, Customer satisfaction, Size tolerance, Quality control

I. INTRODUCTION

Dimensional accuracy is vital in forging, especially in sectors like automotive and aerospace. This study explores how it impacts customer satisfaction and suggests ways to improve quality and trust.

Background of the Study: The forging industry serves precision sectors like automotive and aerospace, where accuracy is critical. Despite tools like CAM and monitoring systems, dimensional errors still occur, causing rework, rejections, and customer complaints. Past studies focused on strength and cost, but not on dimensional accuracy. This study fills that gap. Case studies show over 200 lost machine-hours yearly due to size issues, with surveys confirming it as a major source of complaints.

Dimensional accuracy & B2B Customer Satisfaction:

Dimensional accuracy is how closely a part matches its design. Small errors can cause fit issues, risks, or delays in precision industries. This study focuses on size variation and its impact on B2B customer satisfaction, apart from cost or delivery. Consistent dimensions build trust in industrial markets.

Research Questions:

RQ1: How frequently do customers face dimensional issues?

RQ2: What impact do these issues have on operations?

RQ3: What tolerances are acceptable to customers?

RQ4: What improvements do customers suggest?

Objectives of the Study

1. Measure how size variation affects customer satisfaction

2. Identify common dimensional issues and their severity
3. Define acceptable tolerance levels
4. Gather customer suggestions for improvement
5. Recommend ways to reduce variation and improve accuracy

Scope of the Study: Focus on B2B customers in precision sectors like automotive and aerospace. Based on external customer feedback, it covers frequency of size issues, operational impact, and expectations. The goal is to improve dimensional quality to boost customer satisfaction and supplier credibility.

II. LITERATURE REVIEW

In today's competitive manufacturing, dimensional accuracy is key to customer satisfaction and business success. Despite better tools and systems, the forging industry still struggles with size variation. This chapter reviews studies on product quality, forging defects, dimensional accuracy, and quality systems, focusing on their impact on customer satisfaction.

Product Quality & Customer Satisfaction:

Dimensional accuracy is vital for fit and function in forged parts. Studies (Garvin¹; Parasuraman et al.²; Kumar et al.³; Mittal & Gupta⁴) highlight how high-quality products, good service, and TQM improve satisfaction and loyalty.

Forging Defects & Dimensional Issues:

Forging defects, especially dimensional ones, cause rework and rejections. Research (Singh⁵; Hasan & Omar⁶; Fujikawa & Ishii¹³; Cholewa & Gontarz¹⁴) suggests using tools like FEM, expert systems, and better die design to reduce errors.

Dimensional Accuracy & Manufacturing Performance:

Precision in dimensions affects performance, assembly, and trust. Studies (Shirani et al.⁷; Stebner et al.⁸; Haverila¹²) show that consistent quality improves efficiency and

customer satisfaction in industrial markets. **Quality Management Systems & Customer Feedback:** QMS like Six Sigma and customer feedback loops (Sahoo & Tripathy⁹; Nilsson et al.¹⁰; Rossomme¹¹; Birch-Jensen¹⁵) help ensure consistency and address evolving customer needs, especially in B2B settings.

Identified Research Gap: While many studies explore quality and defects, few focus specifically on how small size variations affect B2B customer satisfaction and trust. This study fills that gap by examining the direct link between dimensional accuracy and client perceptions in the forging industry.

III. RESEARCH METHODOLOGY

This study used a quantitative survey to examine how size variation in forged products affects customer satisfaction. The survey targeted professionals in procurement, quality, production, and management from industries like automotive, aerospace, and construction. A combination of descriptive research (to measure satisfaction and trends) and exploratory research (pilot testing to refine the survey) was used for accuracy and relevance. Data was collected online via a structured Google Forms questionnaire, receiving 300 valid responses from a purposive sample of industry professionals. The survey included sections on respondent details, size and quality assessment, and customer satisfaction. Fieldwork lasted three weeks, and pilot testing improved clarity and response quality. The approach ensured reliable, real-world insights into how dimensional accuracy impacts customer satisfaction.

IV. RESULTS

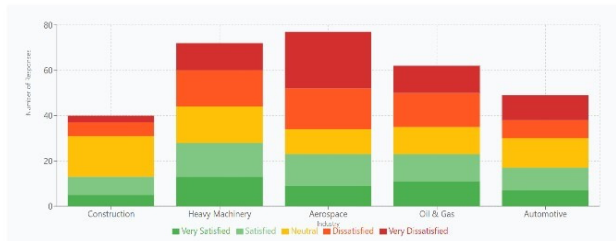
The survey analyzed industry experiences with forged product accuracy across sectors

like aerospace, construction, automotive, oil & gas, and heavy machinery.

Industry Satisfaction: Aerospace showed the highest dissatisfaction, with 43 out of 77 respondents expressing concerns. In contrast, the construction sector reported mostly neutral to positive feedback.

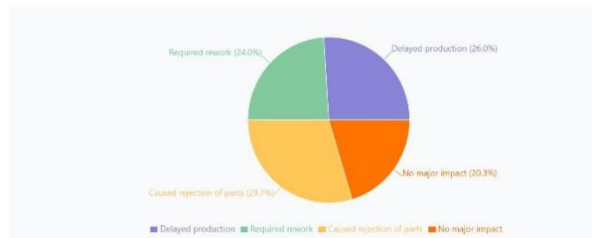
Industry	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Construction	5	8	18	6	3
Heavy Machinery	13	15	16	16	12
Aerospace	9	14	11	18	25
Oil & Gas	11	12	12	15	12
Automotive	7	10	13	8	11

Overall Satisfaction by Industry



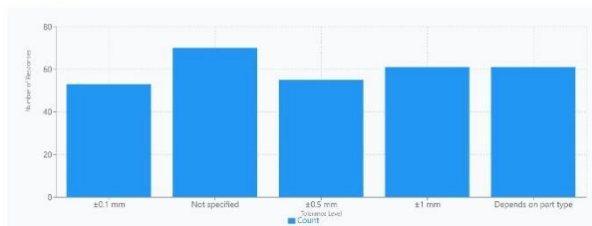
Operational Impacts: Size variations caused part rejection in 29.7% of cases, production delays in 26.0%, and rework in 24.0%. Only 20.3% reported no significant impact.

Impact of Size Variation



Tolerance Preferences: The most common acceptable tolerances were ± 1 mm (61 responses), ± 0.5 mm (55), and ± 0.1 mm (53). However, 70 respondents selected “Not Specified,” highlighting a communication gap in tolerance documentation.

Tolerance Levels



Additional feedback emphasized the need for automated measurement, clearer tolerance communication, and better supplier-buyer coordination.

V. LIMITATIONS

The study used 300 self-reported responses from key industries, relying on respondents’ honesty and accurate recall. Selected departments (procurement, quality control, production, management) may not fully reflect all operational perspectives.

Validity & Reliability: Although a structured questionnaire was used, interpretations of technical terms like “tolerance” varied, affecting consistency. Response bias may exist, with over- or under-representation of certain sectors. The large number of “Not Specified” tolerance answers highlights communication gaps and possible misunderstandings.

Data Issues: Missing or inconsistent responses, especially on tolerance, required data cleaning and exclusion of some entries. Follow-ups improved response rates but were limited by time.

Recommendations for Future Research: Industry-specific surveys, pre-testing, interviews, and clearer definitions could improve data accuracy and reduce ambiguity.

VI. CONCLUSION

This study found that dimensional accuracy issues in forged products cause part rejections, delays, and rework, impacting costs and satisfaction. Aerospace and heavy machinery industries showed higher dissatisfaction than construction. Many respondents reported unclear tolerance standards, highlighting poor communication between buyers and suppliers. Improving quality control and clearer tolerance specs can reduce problems and boost supplier reliability.

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