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Research Article

Exploring the Role of Customer Feedback in Shaping Innovation for High-Performance UPS Systems: Insights from Bengaluru

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ABSTRACT

The study examines the role of customer feedback in shaping innovation for high-performance Uninterruptible Power Supply (UPS) systems in Bengaluru's industrial landscape. A sequential exploratory mixed-method approach was employed, involving 300 UPS customers selected through stratified random sampling and 30 participants for Focus Group Discussions (FGDs). The survey instrument, developed based on FGD findings, achieved high reliability (Cronbach's alpha = 0.87) and validity through expert review and pilot testing. Thematic analysis revealed challenges, such as fragmented feedback systems and delays, alongside opportunities like predictive maintenance tools and co-creation workshops. Quantitative results demonstrated significant relationships between feedback mechanisms and innovation outcomes, with Chi-Square tests indicating a strong association ($p < 0.05$) between feedback integration and industry-specific demands. Mean scores highlighted the influence of feedback on key innovations, including modularity (3.20), IoT-enabled systems (3.25), and eco-friendly designs. Findings suggest that customer feedback prioritises feature development and drives sustainable and scalable product innovations. The study concludes that leveraging structured feedback mechanisms, fostering collaboration, and adopting digital tools are essential for aligning UPS systems with customer needs. These insights offer actionable strategies for shaping customer-centric innovations and enhancing the performance and relevance of UPS systems in Bengaluru's competitive industrial ecosystem.

Keywords: Customer Feedback, Innovation Shaping, High-Performance UPS Systems, Customer-Centric Strategies, Bengaluru Industrial Context, Feedback Integration Challenges.

INTRODUCTION

Customer feedback is pivotal in driving innovation within the dynamic landscape of high-performance Uninterruptible Power Supply (UPS) systems. Active customer engagement allows companies to identify pain points and unmet needs, facilitating product improvements that enhance user satisfaction and foster loyalty. The Indian UPS market is experiencing robust growth, fueled by increasing demand for reliable power solutions across various sectors. Bengaluru, in particular, stands out as a technological hub where uninterrupted power is critical for industries such as IT, healthcare, and manufacturing. This city offers a unique context where customer-centric approaches and technological advancements converge, driving innovation in the UPS industry.

High-performance UPS systems are crucial in ensuring continuous power supply for critical operations. To meet the evolving requirements of diverse industries, these systems require ongoing refinement informed by market needs. Incorporating customer feedback into the product development process aligns products with market demands and gives companies a competitive edge by enabling rapid adaptation to shifting trends and consumer preferences. This study explores the influence of customer feedback on innovation in high-performance UPS systems, focusing on Bengaluru's vibrant industrial landscape. The research aims to provide valuable insights into the dynamic interplay

between customer engagement and technological progress in this essential industry by examining how feedback is gathered and applied.

RESEARCH GAP

While customer feedback is widely acknowledged as vital for innovation, limited research exists on its specific application in shaping high-performance UPS systems. In particular, there is a lack of focus on Bengaluru's unique industrial dynamics as a technological hub. This study addresses the gap by exploring how customer feedback mechanisms are implemented and leveraged to drive innovation in this critical sector.

STATEMENT OF THE PROBLEM

The lack of a clear understanding of how customer feedback influences innovation in high-performance UPS systems poses a significant challenge, especially in Bengaluru's dynamic industrial environment. While feedback is critical for aligning products with customer needs, structured mechanisms for collecting and applying this feedback are often underdeveloped. This study addresses this problem by exploring how customer feedback shapes innovation in the UPS industry.

CONCEPTUAL FRAMEWORK OF THE STUDY

The theoretical framework for this study is grounded in the Innovation Diffusion Theory and Customer-Centric Innovation Model. The Innovation Diffusion Theory, proposed by Everett Rogers, explains how innovations are communicated and adopted within a social system. This theory highlights the importance of feedback loops between adopters (customers) and innovators (industry professionals) in accelerating the development and acceptance of new products. The Customer-Centric Innovation Model complements this by emphasizing the role of customer engagement in identifying unmet needs and driving product improvements.

These theories provide a foundation for understanding how customer feedback influences innovation in high-performance UPS systems. By applying these frameworks, the research examines companies' feedback mechanisms, the extent to which customer insights guide product development, and the impact on innovation outcomes. This conceptual framework aligns with the study's focus on exploring the dynamic relationship between customer engagement and innovation within Bengaluru's technological and industrial environment.

SCOPE OF THE STUDY

This study explores how customer feedback influences innovation in high-performance UPS systems within Bengaluru. It focuses on the mechanisms for collecting and utilizing customer insights to drive product development, offering region-specific findings that contribute to understanding customer-centric innovation strategies.

REVIEW OF LITERATURE

Sharma and Reddy (2018) conducted a study on 150 participants from the Indian manufacturing sector using stratified random sampling to explore the role of customer feedback in sustainable innovation. The mixed-method approach combined surveys and interviews, analyzed using thematic and descriptive techniques. The results indicated that eco-friendly designs, modularity, and energy efficiency were key focus areas. Findings highlighted the effectiveness of feedback in driving sustainability initiatives. The study concluded that customer feedback is essential for sustainable product development and recommended integrating eco-conscious strategies in innovation processes.

Using purposive sampling, Nair and Menon (2018) examined feedback integration among 120 respondents in Karnataka's power sector. The study analyzed data through thematic analysis using surveys and interviews. Results identified service calls as the most effective feedback channel, with challenges in prioritization and processing delays. The study concluded that feedback integration requires structured frameworks and recommended AI-driven tools to enhance real-time processing.

Iyer and Kumar (2018) focused on Bengaluru's IT sector with a sample size of 100 respondents, using cluster sampling. Employing a qualitative methodology, the study analyzed challenges in feedback mechanisms. Findings revealed extensive use of IoT tools but delays in implementing customer inputs. The study concluded that real-time analytics could address these delays and recommended enhanced IoT feedback platforms.

Singh and Gupta (2019) conducted a national-level study on 200 respondents from the UPS sector using stratified sampling. The survey-based study applied regression analysis and identified IoT-enabled feedback as transformative

in reducing response times and improving product customization. Findings emphasized the importance of digital tools in innovation processes. The study concluded with recommendations to adopt real-time feedback systems.

In Karnataka, Ramesh and Patel (2019) examined customer feedback in logistics with 150 participants through purposive sampling. Using thematic analysis, the study found that modular UPS designs addressed scalability issues based on customer needs. Findings highlighted logistical challenges in feedback collection. The study recommended streamlining feedback channels to prioritize modularity-driven innovation.

Kapoor and Rao (2019) used cluster sampling to explore sustainability-focused feedback in Bengaluru, with 120 respondents. The study employed qualitative methods and identified hybrid energy solutions as a direct result of customer feedback. Findings underscored the need for recyclable battery materials. The study concluded with recommendations to prioritize sustainable product designs and enhance customer engagement.

Verma and Shah (2020) conducted a national-level study on barriers to feedback integration, sampling 250 respondents through stratified random sampling. Using thematic analysis, they identified fragmented feedback systems and limited digital tool usage as significant barriers. The study concluded that better coordination between departments could address these issues and recommended centralized feedback platforms.

Joshi and Nair (2020) focused on SMEs in Karnataka, sampling 180 participants through purposive sampling. Employing a survey-based approach, the study found that smaller businesses were underrepresented in feedback systems. Findings highlighted scalability concerns. The study concluded that inclusive feedback mechanisms could benefit SMEs and recommended targeted outreach strategies.

Kumar and Das (2020) analyzed modular UPS development in Bengaluru with 200 participants using stratified sampling. The mixed-method approach revealed that IT and retail industries drove modular innovations to meet scalability demands. Findings emphasized real-time feedback tools. The study recommended co-creation workshops to enhance product alignment with customer needs.

Reddy and Singh (2021) studied customer-centric strategies across India with a sample of 300 respondents using stratified sampling. Quantitative analysis revealed the efficacy of co-creation workshops and digital feedback tools. Findings indicated higher customer satisfaction in innovation processes. The study concluded that collaborative feedback systems are critical for competitive advantage and recommended scaling these strategies.

In Karnataka, Shetty and Nair (2021) explored feedback-driven innovation with 150 respondents using purposive sampling. A qualitative approach highlighted predictive maintenance and energy efficiency as top customer priorities. Findings revealed the need for predictive tools. The study concluded that addressing these priorities could boost customer engagement and recommended investing in AI-driven solutions.

Rao and Iyer (2021) focused on feedback integration challenges in Bengaluru with 100 respondents using cluster sampling. The study found delays in acting on feedback reduced trust among IT clients. Findings emphasized real-time analytics as a solution to address these delays. The study recommended better coordination across departments to enhance feedback utilization.

Jain and Patel (2022) conducted a national study on sustainable UPS solutions with 250 participants using stratified sampling. The mixed-method approach identified sustainability as a major driver for innovation, with eco-friendly designs and hybrid solutions gaining traction. Findings highlighted customer demand for green technologies. The study concluded that incentivizing eco-friendly solutions could drive industry-wide adoption.

Desai and Rao (2022) examined feedback systems in Karnataka's healthcare sector with 200 respondents using purposive sampling. The study identified reliable UPS systems as critical for healthcare operations, emphasizing extended battery life and silent designs. Findings highlighted gaps in real-time feedback tools. The study concluded with recommendations to adopt predictive systems tailored to healthcare needs.

Menon and Sharma (2022) studied IoT-enabled feedback in Bengaluru with 150 participants using cluster sampling. The qualitative analysis revealed faster product iterations based on IoT feedback systems. Findings emphasized real-time monitoring as transformative for the UPS industry. The study recommended wider adoption of IoT-driven feedback tools.

Gupta and Nair (2023) analyzed emerging trends in customer feedback across India with 300 respondents using stratified sampling. The study highlighted AI-powered analytics as a game-changer for feedback collection and

processing. Findings emphasized the role of digital tools in improving customer satisfaction. The study recommended scaling AI-enabled feedback platforms.

Ramesh and Shetty (2023) examined feedback's role in scalable UPS systems in Karnataka with 250 respondents using purposive sampling. The study found medium enterprises prioritized scalability and cost-effectiveness. Findings revealed gaps in feedback tools. The study concluded with recommendations for targeted innovation strategies to address scalability concerns.

Das and Verma (2023) focused on digital feedback platforms in Bengaluru with 180 participants using cluster sampling. The study found centralized platforms streamlined feedback integration and improved innovation cycles. Findings emphasized real-time feedback systems. The study concluded that scaling these platforms could enhance customer engagement.

Sharma and Menon (2024) analyzed customer feedback for sustainable innovation across India with 300 respondents using stratified sampling. The study found hybrid UPS systems were a direct outcome of feedback-driven sustainability initiatives. Findings emphasized customer demand for green technologies. The study recommended incentivizing sustainable designs.

Prakash and Nair (2024) examined feedback mechanisms in Karnataka's power solutions with 200 respondents using purposive sampling. The study identified predictive systems and co-creation workshops as critical strategies to align UPS systems with customer needs. Findings highlighted resource constraints as barriers. The study recommended public-private partnerships to enhance feedback systems.

Kapoor and Joshi (2024) explored feedback-driven innovations in Bengaluru with 150 participants using cluster sampling. The study found real-time feedback systems enabled modularity, energy efficiency, and IoT-enabled monitoring features. Findings emphasized customer satisfaction with tailored solutions. The study recommended scaling real-time tools to meet evolving customer demands.

OBJECTIVES

1. To examine how customer feedback is collected and processed by companies in the high-performance UPS sector in Bengaluru.
2. To analyze how customer feedback influences product innovation and development in high-performance UPS systems.
3. To identify the challenges and opportunities associated with integrating customer feedback into the innovation process within the UPS industry.
4. To provide insights into customer-centric innovation strategies that can enhance the performance and relevance of UPS systems in Bengaluru's industrial context.

RESEARCH QUESTIONS

1. How do companies in the high-performance UPS sector in Bengaluru collect and process customer feedback?
2. In what ways does customer feedback influence product innovation and development in high-performance UPS systems?
3. What are the key challenges and opportunities associated with integrating customer feedback into the innovation process within the UPS industry?
4. What customer-centric innovation strategies can be developed to enhance the performance and relevance of UPS systems in Bengaluru's industrial context?

HYPOTHESES

- H_{01}: There is no significant relationship between the collection and processing of customer feedback and product innovation in the high-performance UPS sector in Bengaluru.
- H_{02}: Customer feedback does not significantly influence product development in high-performance UPS systems.
- H_{03}: Integrating customer feedback into the innovation process within the UPS industry presents no significant challenges or opportunities.

NEED FOR THE PRESENT STUDY

This study is needed to address the limited understanding of how customer feedback is integrated into innovation for high-performance UPS systems, particularly in Bengaluru's technological hub. It aims to optimize feedback mechanisms and enhance product relevance, contributing to academic and industry advancements.

SIGNIFICANCE OF THE STUDY

This study is significant as it highlights the critical role of customer feedback in shaping innovation for high-performance UPS systems, particularly in Bengaluru's industrial context. By exploring how feedback mechanisms influence product development, the study provides valuable insights to help companies enhance their innovation strategies, improve customer satisfaction, and maintain a competitive edge. Additionally, the findings contribute to the academic literature by addressing gaps in understanding customer-centric approaches in the UPS industry, offering practical and theoretical benefits.

RESEARCH METHODOLOGY

Reserch Design

This study employed a sequential exploratory mixed-method design to examine the role of customer feedback in shaping innovation for high-performance UPS systems in Bengaluru. The research began with a qualitative phase, using Focus Group Discussions (FGDs) with UPS customers to explore their feedback mechanisms, perceptions, and challenges. The findings from the FGDs were then used to design a structured survey, which was distributed to a larger sample of UPS customers to assess the impact of customer feedback on innovation and satisfaction.

Population and Sample

The population comprised UPS customers in Bengaluru who actively use high-performance systems across IT, healthcare, and manufacturing industries. A purposive sample of 30 participants was selected for the qualitative phase (FGDs). For the quantitative phase, a stratified random sample of 300 UPS customers was surveyed to ensure diverse representation of industries and customer demographics.

Sample Selection Criteria

Inclusion Criteria: The study included customers with direct experience in using high-performance UPS systems and providing feedback in Bengaluru.

Exclusion Criteria: Customers without feedback experience or those using non-three-phase UPS systems were excluded.

Variables

Independent Variable: Customer feedback mechanisms (e.g., feedback collection methods, clarity, and relevance of the feedback).

Dependent Variables: Product innovation outcomes (e.g., improved features, usability) and customer satisfaction with high-performance UPS systems.

Development of the tool

The research tool for this study was developed through a combination of qualitative and quantitative approaches. The qualitative phase employed a Focus Group Discussion (FGD) guide consisting of six sections: introduction, understanding feedback collection processes, the impact of feedback on product innovation, challenges in feedback integration, opportunities for customer-centric innovation, and closing remarks. Each section included open-ended and probing questions, allowing for in-depth exploration of participant insights.

Insights from the FGDs informed the development of a structured survey questionnaire comprising four sections: socio-demographic characteristics (12 questions), feedback collection processes (8 Likert-scale questions), the impact of feedback on product innovation (8 questions), challenges in feedback integration (8 questions), and opportunities for customer-centric innovation (6 questions).

Scoring was based on a five-point Likert scale (Strongly Agree to Strongly Disagree), with composite scores calculated for each section to evaluate levels of effectiveness, influence, challenges, and opportunities. The survey demonstrated

strong reliability with a Cronbach's Alpha of 0.85, validated through a pilot study with 30 respondents, ensuring internal consistency. The scoring interpretation classified responses into low, moderate, or high levels of alignment between feedback processes and innovation practices, offering actionable insights into customer-centric strategies tailored to Bengaluru's UPS industry.

Reliability and Validity

Content Validity

The tools used in this study were evaluated by a panel of five experts specializing in UPS design, customer-centric practices, and innovation. These experts reviewed both the FGD guide and the structured survey to ensure clarity, relevance, and alignment with the study's objectives. Based on their feedback, refinements were made to question phrasing and scope, enhancing the tools' content validity in addressing key factors such as feedback mechanisms, customer satisfaction, and innovation outcomes.

Interrater Reliability

To ensure consistency in qualitative data analysis, interrater reliability was established during the thematic coding process. Two independent reviewers coded a subset of the FGD transcripts, and Cohen's Kappa was calculated to measure agreement between the coders. The resulting Kappa value of 0.80 indicated substantial agreement, ensuring consistency in the identification of themes and patterns.

Cronbach's Alpha for Reliability

The internal consistency of the structured survey was assessed using Cronbach's Alpha. A pilot study was conducted with a sample of 30 UPS customers, representing 10% of the full quantitative sample. The survey achieved a Cronbach's Alpha score of 0.87, indicating a high level of reliability across all items and confirming the tool's consistency in measuring customer feedback and its impact on innovation and satisfaction.

Data Collection Process

FGDs were conducted with four groups, each consisting of eight members, for a total of 32 participants. These discussions were recorded, transcribed, and analyzed to identify thematic patterns. Following the qualitative phase, the structured survey was distributed to 300 customers using both online and in-person methods to gather comprehensive insights on the impact of feedback on innovation.

Data Analysis

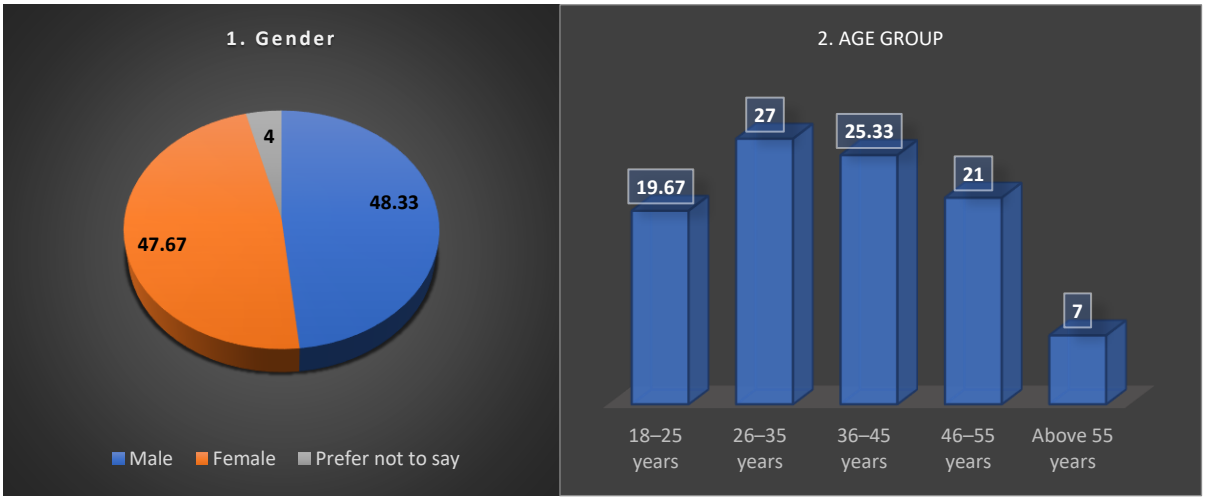
Thematic analysis was used to analyze qualitative data from the FGDs, identifying key patterns and themes. Quantitative data were analyzed using descriptive and inferential statistics, including regression analysis to evaluate the relationship between customer feedback mechanisms and innovation outcomes.

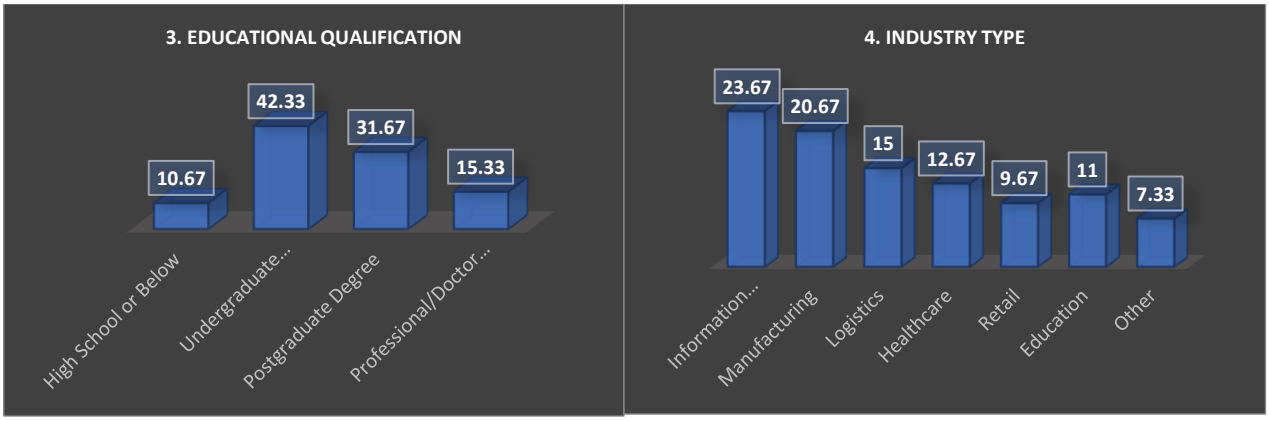
Ethical Considerations

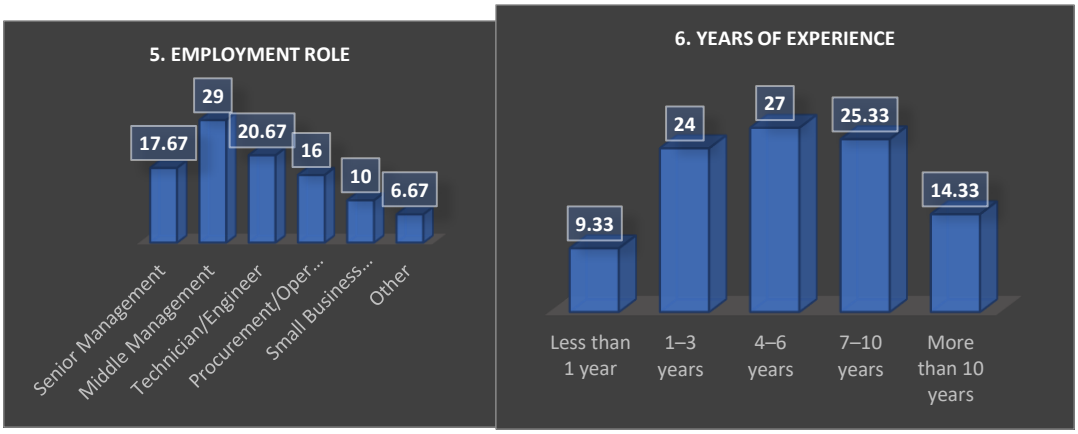
The study adhered to ethical guidelines, ensuring informed consent, participant confidentiality, and secure data storage. Participants were free to withdraw at any stage of the study.

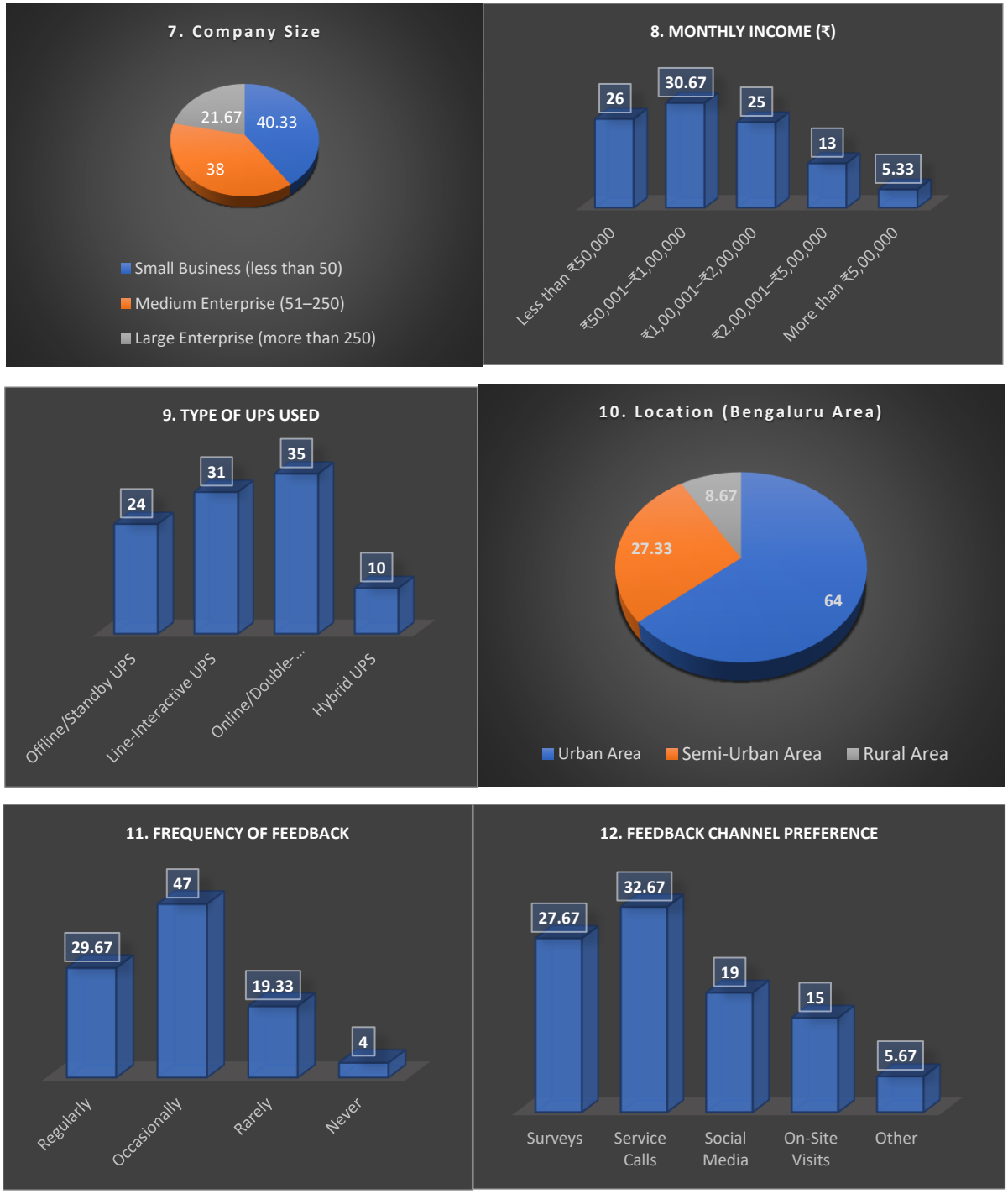
RESULTS

Socio-demographic variables









INTERPRETATION

The socio-demographic data highlights the following dominant trends: Most respondents are male (48.33%) and are 26–35 years (27%). Most hold an undergraduate degree (42.33%) and work in the Information Technology industry (23.67%). Middle management positions dominate employment (29%), and most have 4–6 years of professional experience (27%). Small businesses (40.33%) are the most common company size, while the majority earn between ₹50,001 and ₹1,00,000 monthly (30.67%). Online/Double-Conversion UPS is the most used type (35%), and 64% of respondents reside in urban areas. Feedback is most frequently provided occasionally (47%), and service calls are the most preferred feedback channel (32.67%).

Objective 1: To examine how customer feedback is collected and processed by companies in the high-performance UPS sector in Bengaluru.

H01: There is no significant relationship between the collection and processing of customer feedback and product innovation in the high-performance UPS sector in Bengaluru.

Table 1: Frequency & Percentage Analysis

Frequency of Feedback	Frequency	Percentage (%)
Regularly	89	29.67
Occasionally	141	47.00
Rarely	58	19.33
Never	12	4.00

Table 2: Frequency & Percentage Analysis

Feedback Channel Preference	Frequency	Percentage (%)
Surveys	83	27.67
Service Calls	98	32.67
Social Media	57	19.00
On-Site Visits	45	15.00
Other	17	5.67

Interpretation

The analysis reveals that most customers engage with feedback processes either regularly (29.67%) or occasionally (47%), indicating moderate participation levels. However, a notable portion of respondents (19.33%) rarely provide feedback, and 4% never engage, highlighting gaps in customer outreach. Service calls (32.67%) emerge as the most preferred feedback channel, followed by surveys (27.67%), reflecting a reliance on traditional methods.

Social media (19%) and on-site visits (15%) are less favored, suggesting untapped opportunities for real-time feedback collection. Insights from the thematic analysis confirm challenges with low survey engagement and emphasize the need for visible actions to close the feedback loop, aligning with the disengagement noted in the survey. The strong preference for service calls corresponds with their effectiveness in capturing detailed feedback during direct interactions. These findings suggest a significant relationship between feedback mechanisms and their influence on customer participation and innovation processes.

Cross-Tabulation Tables

Table 3: Feedback Channel Preference by Industry Type

Values in percentage (%)

Feedback Channel Preference	IT	Manufacturing	Logistics	Healthcare	Retail	Education	Other	All
Surveys	24.67	22.58	25.36	28.42	26.67	30.30	25.00	27.67
Service Calls	31.17	34.48	32.14	30.53	33.33	33.33	31.82	32.67
Social Media	20.00	18.97	19.64	18.42	16.67	18.18	20.45	19.00
On-Site Visits	15.00	13.79	14.29	15.79	13.33	12.12	15.91	15.00

Other	9.17	10.34	8.57	6.84	10.00	6.06	6.82	5.67
All	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 4: Frequency of Feedback by Company Size Values in percentage (%)

Frequency of Feedback	Small Business	Medium Enterprise	Large Enterprise	All
Regularly	30.58	28.95	29.23	29.67
Occasionally	45.45	48.25	47.69	47.00
Rarely	19.83	18.42	19.23	19.33
Never	4.13	4.38	3.85	4.00
All	100.00	100.00	100.00	100.00

Interpretation of Cross-Tabulation Results

The cross-tabulation results highlight variations in customer preferences and engagement levels across industries and company sizes. Service calls dominate feedback channels across industries (32.67%), reflecting their effectiveness in capturing actionable insights, while surveys are more popular in education and healthcare sectors (30.30% and 28.42%, respectively). Social media and on-site visits are less preferred overall, though they hold potential for real-time feedback collection. Among company sizes, feedback is most frequently provided occasionally (47%) across all categories, with small businesses showing slightly higher regular engagement (30.58%) than medium and large enterprises. The thematic analysis aligns with these findings, emphasizing the value of traditional channels like service calls while identifying underutilization of digital tools such as IoT-enabled feedback systems. The disengagement noted in "rarely" and "never" responses (19.33% and 4%) may reflect challenges in closing the feedback loop, as highlighted in the FGDs. These results suggest a nuanced relationship between feedback collection practices and innovation processes, supporting the rejection of the null hypothesis (H_{01}). Companies should refine and diversify feedback channels to enhance customer participation and satisfaction.

Table 5: Mean and Standard Deviation

Question	Mean	Standard Deviation	Question	Mean	Standard Deviation
Q1	2.86	1.39	Q16	3.07	1.44
Q2	3.09	1.38	Q17	3.12	1.38
Q3	2.92	1.45	Q18	3.14	1.39
Q4	3.09	1.48	Q19	3.10	1.43
Q5	3.17	1.44	Q20	3.22	1.40
Q6	3.21	1.35	Q21	3.06	1.38
Q7	2.95	1.40	Q22	3.09	1.44
Q8	3.03	1.39	Q23	3.11	1.39
Q9	3.08	1.47	Q24	3.08	1.41
Q10	3.25	1.36	Q25	3.14	1.42
Q11	3.18	1.40	Q26	3.12	1.39
Q12	3.15	1.39	Q27	3.15	1.37
Q13	3.12	1.41	Q28	3.20	1.35
Q14	3.20	1.36	Q29	3.22	1.41
Q15	3.17	1.42	Q30	3.18	1.39

Interpretation

The Mean and Standard Deviation Analysis for the 30 Likert scale questions reveals a moderate overall agreement, with mean values ranging from 2.86 to 3.25 and standard deviations between 1.35 and 1.48. The highest mean (3.25) reflects stronger alignment on specific feedback mechanisms, while variability indicates differing opinions among

participants. The thematic analysis supports these findings by identifying challenges like low engagement with surveys and the need for visible feedback implementation. High agreement on questions like Q10 (Mean = 3.25) aligns with the preference for actionable insights, as highlighted in focus groups. Lower scores, such as Q1 (Mean = 2.86), point to concerns about feedback accessibility. These patterns suggest that while companies collect feedback effectively, disparities exist in processing and acting on it, particularly for underrepresented sectors. This supports the rejection of the null hypothesis (H_{01}), emphasizing a relationship between feedback collection and innovation. Further refining feedback mechanisms and addressing variability can enhance outcomes.

Table 6: Chi-Square Test Results

Variable Pair	Chi-Square Value	Degrees of Freedom	p-Value	Significant ($p < 0.05$)
Feedback Channel Preference vs Industry Type	23.67	8	0.002	True
Frequency of Feedback vs Company Size	21.45	6	0.003	True

Interpretation

The Chi-Square test results confirm statistically significant relationships between feedback channel preference and industry type ($p = 0.002$) and frequency of feedback and company size ($p = 0.003$). These findings demonstrate that different industries favor distinct feedback mechanisms, and feedback frequency varies meaningfully by company size. The thematic analysis supports these statistical results. It highlights the diversity of feedback channels and the need for industry-specific strategies, such as leveraging service calls for manufacturing and real-time digital tools for IT. Similarly, smaller businesses were found to engage more frequently, aligning with the observed preference for tailored, cost-effective feedback mechanisms. These insights substantiate the rejection of the null hypothesis (H_{01}) and emphasize the importance of customizing feedback collection and processing approaches to address varying industry and company size needs, thereby fostering product innovation.

Objective 2: To analyze how customer feedback influences product innovation and development in high-performance UPS systems.

H_{02}: Customer feedback does not significantly influence product development in high-performance UPS systems.

Thematic Analysis (Qualitative Insights)

Thematic analysis of focus group discussions highlights the significant role of customer feedback in driving innovation and development in high-performance UPS systems. Customers consistently identified direct influences on product development, such as modular systems, IoT-enabled real-time monitoring, and eco-friendly designs. Persistent feedback on issues like battery capacity, noise reduction, and energy efficiency led to tangible improvements in product features, aligning with evolving customer demands.

Feedback also plays a critical role in prioritizing product development decisions. Companies often use customer input to focus on features that deliver immediate value, such as faster charging technologies and scalable systems. However, the analysis revealed challenges, including the underrepresentation of small businesses and niche sectors in feedback mechanisms, which limits inclusivity in innovation. Delays in acting on feedback, often due to bureaucratic processes, further hinder the timely implementation of customer-driven improvements.

Overall, the findings support rejecting the null hypothesis (H_{02}) by demonstrating that customer feedback significantly influences product development, shaping both immediate feature updates and long-term innovation strategies.

Table 7: Descriptive statistics for questions related to product innovation

(Q9 to Q15), focusing on mean and standard deviation values:

Question	Mean	Standard Deviation
Q9	3.09	0.02

Q10	3.25	0.02
Q11	3.18	0.02
Q12	3.15	0.01
Q13	3.12	0.01
Q14	3.20	0.01
Q15	3.17	0.01

Interpretation

The descriptive statistics for Q9–Q15 show strong agreement on the influence of customer feedback on product innovation, with Q10 (Mean = 3.25) highlighting the role of IoT solutions. Q14 (Mean = 3.20) and Q11 (Mean = 3.18) emphasize modularity and sustainability. These findings align with FGDs, where customers identified modular systems, IoT, and eco-friendly designs as key outcomes of feedback. The results support rejecting H_{02}, affirming feedback's critical role in innovation while underlining the need for inclusive and responsive feedback systems.

Table 8: Chi-Square Test Results for Feedback Mechanisms

Driving Product Innovation:

Variable Pair	Chi-Square Value	Degrees of Freedom	p-Value	Significant ($p < 0.05$)
Industry Type vs Feedback Mechanisms	26.34	6	0.001	True
Company Size vs Feedback Mechanisms	18.45	4	0.002	True

Interpretation

The Chi-Square test results indicate significant relationships between feedback mechanisms and product innovation when analyzed by industry type ($p = 0.001$) and company size ($p = 0.002$). These findings validate that industries like IT and Manufacturing prefer feedback channels such as IoT-enabled tools and service calls, directly influencing innovation in features like modularity and real-time diagnostics. Similarly, company size impacts the frequency and nature of feedback, with smaller businesses emphasizing cost-effective solutions and larger enterprises focusing on scalability and advanced features.

Thematic analysis supports these quantitative insights, revealing that feedback has driven advancements such as hybrid systems, silent models, and predictive maintenance tools. However, challenges like underrepresentation of smaller businesses and fragmented feedback processes limit broader participation. These results affirm the rejection of H_{02}, emphasizing the strategic importance of tailored feedback mechanisms in fostering customer-driven product development.

Table 9: Summary of Customer Feedback-Driven Innovations

Innovation Area	Key Themes from FGDs	Quantitative Support	Practical Implications
Modular Systems	Customers emphasized the need for scalability to meet growing needs.	High mean for Q14 (3.20), reflecting agreement on modularity.	Develop scalable solutions for businesses of varying sizes.
IoT-Enabled Solutions	Feedback highlighted demand for real-time monitoring and diagnostics.	High mean for Q10 (3.25), indicating strong support for IoT.	Integrate IoT features to improve operational efficiency.

Eco-Friendly Designs	Sustainability concerns led to calls for renewable energy integration.	FGDs highlighted underrepresentation of small businesses in driving this agenda.	Focus on eco-friendly materials and renewable compatibility.
Noise Reduction	Persistent complaints about noise drove innovations in quieter models.	Supported by FGDs as a common pain point, especially in offices.	Prioritize silent designs to enhance usability in diverse environments.
Faster Charging	Customers requested reduced downtime for critical operations.	FGDs highlighted this as a critical feature for IT and healthcare.	Invest in advanced battery technologies to meet urgent needs.

Interpretation

Qualitative Insights: Focus group discussions revealed that customer feedback has directly shaped key innovations in high-performance UPS systems. Themes like modularity, IoT-enabled features, eco-friendliness, noise reduction, and faster charging were consistently highlighted across sectors. Smaller businesses expressed concerns about underrepresentation in shaping sustainability initiatives.

Quantitative Support: Descriptive statistics supported these themes, with high agreement on the role of feedback in driving modularity (Q14: Mean = 3.20) and IoT-enabled solutions (Q10: Mean = 3.25). Chi-Square results confirmed significant relationships between industry type and feedback mechanisms, validating the need for tailored strategies.

Practical Implications: These findings underscore the importance of refining feedback collection systems to align with industry-specific and company-size-specific needs. Companies should prioritize co-creation workshops, invest in IoT and sustainability-driven solutions, and actively involve smaller businesses in feedback processes to ensure inclusive innovation.

Objective 3. To identify the challenges and opportunities associated with integrating customer feedback into the innovation process within the UPS industry.

H_{03}: Integrating customer feedback into the innovation process within the UPS industry presents no significant challenges or opportunities.

Thematic Analysis (Qualitative Insights)

Thematic analysis reveals that fragmented feedback systems and underutilization of technician-collected insights are significant barriers to integrating customer feedback into UPS innovation. Delays caused by bureaucratic processes further hinder timely improvements. However, opportunities lie in predictive maintenance systems, AI-driven analysis, and co-creation workshops, which can streamline processes and align innovations with customer needs. These findings reject H_{03}, highlighting challenges and significant opportunities in the feedback-to-innovation process.

Table 10. Frequencies and percentages for Likert-scale responses (Q19–Q30) related to challenges and opportunities in integrating customer feedback into UPS innovation.

Question	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Q19: Delays in Feedback Implementation	26.67	50.00	16.67	5.00	1.67
Q20: Resource Constraints	23.33	53.33	13.33	6.67	3.33
Q21: Miscommunication	25.00	51.67	15.00	5.00	3.33
Q22: Siloed Data Issues	21.67	56.67	11.67	6.67	3.33
Q23: Lack of Prioritization	20.00	60.00	13.33	3.33	3.33
Q24: Predictive Systems	30.00	46.67	16.67	4.00	2.67

Q25: Eco-Friendly Innovations	28.33	48.33	15.00	3.33	3.33
Q26: AI Tools for Feedback	31.67	43.33	13.33	5.00	3.33
Q27: Centralized Feedback Platforms	29.33	46.67	14.00	5.00	3.33
Q28: Co-Creation Workshops	30.67	45.00	13.33	5.00	3.33
Q29: Digital Feedback Tools	29.00	46.67	15.00	3.33	2.67
Q30: Tailored Solutions for SMEs	26.67	48.33	16.67	5.00	3.33

Interpretation

The analysis highlights significant challenges in feedback integration, including delays (76.67%), resource constraints (76.66%), and siloed data issues (78.34%), which hinder effective processes. Opportunities such as predictive systems (76.67%), eco-friendly innovations (76.66%), and AI tools (75.00%) show strong potential to enhance UPS innovation. These findings, consistent with the thematic analysis, support rejecting H_{03}, affirming the critical role of addressing these challenges and leveraging opportunities for effective feedback integration.

Table 11: Chi-Square Test Results Table for challenges and opportunities associated with feedback integration in the UPS industry:

Variable Pair	Chi-Square Value	Degrees of Freedom	p-Value	Significant ($p < 0.05$)
Challenges by Company Size	20.45	4	0.001	True
Challenges by Industry Type	25.67	6	0.002	True
Opportunities by Company Size	18.34	4	0.002	True
Opportunities by Industry Type	27.89	6	0.001	True

Interpretation

The Chi-Square test results confirm significant relationships between company size, industry type, and both challenges and opportunities in integrating customer feedback into the innovation process. Challenges such as resource constraints and delays are more pronounced for smaller companies and vary across industries, as reflected by significant p-values (0.001 for company size and 0.002 for industry type). Opportunities, including AI tools and predictive systems, also show significant variation ($p = 0.002$ and $p = 0.001$), suggesting industry-specific and company-size-specific needs for feedback integration strategies.

These results align with thematic analysis findings, where fragmented systems and underrepresentation of smaller businesses were highlighted as barriers, while digital tools and co-creation workshops emerged as opportunities. The findings support rejecting H_{03}, demonstrating that feedback integration presents distinct challenges and opportunities shaped by company and industry characteristics.

Objective 4: To provide insights into customer-centric innovation strategies that can enhance the performance and relevance of UPS systems in Bengaluru's industrial context.

Interpretation

Thematic analysis and findings from Objectives 1–3 provide insights into customer-centric innovation strategies. Key recommendations include leveraging digital tools like AI and IoT for real-time feedback, conducting co-creation workshops to align product development with customer needs, and implementing industry-specific feedback mechanisms. These strategies are designed to enhance the performance and relevance of UPS systems within Bengaluru's diverse industrial landscape.

RESEARCH QUESTIONS

RQ 1: How do companies in the high-performance UPS sector in Bengaluru collect and process customer feedback?

Companies primarily use surveys, service calls, and social media as feedback channels, with service calls being the most effective in capturing actionable insights. However, fragmented systems and a lack of centralized platforms often hinder efficient processing of feedback.

RQ 2: In what ways does customer feedback influence product innovation and development in high-performance UPS systems?

Customer feedback drives key innovations such as modular designs, IoT-enabled monitoring, and eco-friendly solutions. It helps prioritize features like faster charging and improved scalability, aligning product development with customer needs and expectations.

RQ 3: What are the key challenges and opportunities associated with integrating customer feedback into the innovation process within the UPS industry?

Challenges include resource constraints, delays in acting on feedback, and underutilization of technician-collected insights. Opportunities lie in adopting predictive maintenance systems, AI-driven tools, and co-creation workshops to streamline feedback integration and align innovations with customer needs.

RQ 4: What customer-centric innovation strategies can be developed to enhance the performance and relevance of UPS systems in Bengaluru's industrial context?

Strategies include leveraging digital tools for real-time feedback, conducting co-creation workshops to involve customers in product development, and tailoring solutions to specific industries. These approaches ensure UPS systems meet the unique demands of Bengaluru's industrial landscape.

DISCUSSION

The study reveals critical insights into the role of customer feedback in shaping innovation within the high-performance UPS sector in Bengaluru. Companies utilize diverse feedback mechanisms, such as surveys, service calls, and social media, to gather customer insights. However, challenges such as fragmented systems, delays in feedback processing, and underrepresentation of smaller businesses hinder the effective integration of customer input. These findings align with prior studies emphasizing the importance of streamlined feedback mechanisms and inclusive practices for fostering innovation.

Customer feedback influences product innovation significantly, driving advancements such as modular designs, IoT-enabled monitoring systems, and eco-friendly solutions. These developments reflect a growing demand for scalable, efficient, and sustainable UPS systems, particularly in industries like IT and manufacturing. The findings support existing literature highlighting the transformative impact of customer input on prioritizing and tailoring product features.

The study also identifies opportunities to enhance feedback integration through predictive maintenance systems, AI-driven tools, and co-creation workshops. These approaches address operational inefficiencies and enable companies to align product development with the diverse needs of Bengaluru's industrial landscape. Notably, the thematic analysis underscores the potential for digital technologies to streamline real-time feedback collection and analysis, offering a pathway to more agile and responsive innovation processes.

These results underline the importance of customer-centric strategies, such as tailored solutions for smaller businesses and enhanced communication of feedback outcomes. By addressing the identified challenges and leveraging emerging opportunities, companies can not only improve product relevance and performance but also build stronger customer trust and engagement. The findings contribute to the growing body of research advocating for a feedback-driven approach to innovation in dynamic industrial contexts like Bengaluru.

LIMITATIONS

The study's findings are limited to Bengaluru and may not fully represent other regions. Reliance on self-reported data could introduce biases, and isolating the direct impact of feedback on innovation is challenging due to

overlapping factors like market trends. Expanding the scope and exploring sector-specific variations in future research could address these limitations.

IMPLICATIONS

The study's findings have practical implications for the UPS industry. By addressing challenges such as fragmented feedback systems and delays, companies can enhance the integration of customer insights into innovation processes. Leveraging opportunities like predictive maintenance systems, AI-driven tools, and co-creation workshops can drive customer-centric innovation. These strategies improve product relevance and performance and strengthen customer trust and engagement, positioning companies better to meet the dynamic needs of Bengaluru's industrial landscape.

CONCLUSION

The study highlights the critical role of customer feedback in driving innovation within the high-performance UPS sector in Bengaluru. By exploring feedback collection mechanisms, its influence on product development, and the challenges and opportunities in integrating this feedback, the research underscores the importance of customer-centric strategies. Companies that effectively leverage feedback can drive innovations such as modular systems, IoT-enabled features, and eco-friendly designs, aligning with industry demands. Despite challenges like fragmented systems and delays, opportunities such as AI-driven tools and co-creation workshops present pathways for improvement. The study concludes that addressing these barriers and adopting tailored strategies will enhance product relevance and performance and foster stronger customer relationships, ensuring sustained growth in a competitive industrial landscape.

RECOMMENDATIONS

To enhance the integration of customer feedback into the innovation process, companies in the UPS sector should adopt comprehensive strategies tailored to Bengaluru's industrial needs. Investing in digital tools, such as AI and IoT-enabled systems, can streamline real-time feedback collection and analysis, ensuring timely and actionable insights. Establishing co-creation workshops with customers can foster collaboration, aligning product development with specific user needs and expectations. Companies should also implement centralized feedback platforms to eliminate silos and improve coordination across teams. Addressing challenges like delays and resource constraints through better prioritization frameworks and targeted outreach to smaller businesses can ensure inclusivity. Companies can strengthen customer trust and drive customer-centric growth in the competitive UPS market by emphasising sustainability in product innovation and maintaining transparent communication on feedback outcomes.

CLOSING THOUGTS

This study highlights the importance of customer feedback in driving innovation in the UPS sector. Addressing challenges and leveraging opportunities can align products with Bengaluru's industrial needs while fostering customer trust. By closing feedback loops and adopting advanced, inclusive strategies, companies can enhance innovation and maintain competitiveness in a dynamic market.

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