VISHWAKARMA INSTITUTE OF INFORMATION TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOGY

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TOPIC: Assignment 04: Six Sigma for Consumer Research and Product Development (Case study of PepsiCo)

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Assignment 04: Six Sigma for Consumer Research and Product Development
(Case Study of PepsiCo)

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1. Aim

The aim of this study is to analyze the application of Six Sigma methodologies in consumer research and product development within PepsiCo, one of the world's largest food and beverage companies. The focus is to understand how PepsiCo utilized Six Sigma tools to:

- Reduce variability in product design,
- Enhance consumer satisfaction, and
- Introduce innovative products successfully in a highly competitive market.

This case study demonstrates the practical application of statistical methods in Six Sigma to bridge the gap between consumer expectations and product performance.

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2. Objectives

- To explore the role of Six Sigma in consumer research at PepsiCo and how it helps in gathering, interpreting, and utilizing consumer feedback for product development.
- To study the DMAIC (Define–Measure–Analyze–Improve–Control) methodology applied by PepsiCo in its product innovation cycle.
- To identify statistical tools (like Design of Experiments, Hypothesis Testing, and Regression Analysis) that supported decision-making during product development.
- To evaluate the results and impact of Six Sigma implementation on PepsiCo's business outcomes, including cost reduction, consumer loyalty, and market share growth.
- To highlight lessons learned from PepsiCo's adoption of Six Sigma, providing insights for other industries and engineering students studying Statistical Methods in Six Sigma.

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3. Theory

Introduction to Six Sigma in Product Development

Six Sigma is a data-driven methodology focused on minimizing defects and variations in processes to improve quality. In product development, it ensures that consumer needs are translated into product specifications with minimal deviation, ensuring customer delight.

PepsiCo operates in a competitive market where taste, packaging, health consciousness, and innovation are critical. Six Sigma provides PepsiCo with a systematic approach to:

- Gather and analyze consumer requirements (Voice of Customer – VOC)
- Translate VOC into product specifications using Quality Function Deployment (QFD)
- Use Design of Experiments (DOE) to test different formulations and packaging designs
- Control variability in manufacturing to maintain consistency in flavor and quality

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DMAIC Framework in Consumer Research and Product Development

1. Define
   - Identify the consumer problem or unmet need
   - Define project goals such as improving taste, reducing calories, or designing eco-friendly packaging
2. Measure
   - Collect quantitative data through surveys, taste tests, and sensory analysis
   - Measure performance metrics such as:
     - Consumer acceptance rate
     - Defect rate in packaging
     - Shelf-life variability
3. Analyze
   - Apply statistical methods to analyze consumer feedback and product performance
   - Identify key factors influencing product acceptance (e.g., sweetness level, carbonation,

packaging convenience)

4. Improve
- Redesign the product based on statistical analysis
- Conduct pilot testing and refine formulations

5. Control
- Implement control charts to ensure consistent quality
- Monitor product acceptance post-launch

Statistical Methods Used
- Design of Experiments (DOE): To optimize product formulas and ingredient proportions
- Regression Analysis: To study the impact of independent variables (e.g., sugar, carbonation, packaging type) on consumer satisfaction
- Hypothesis Testing: To verify consumer preference differences between variants
- Control Charts: To maintain product consistency during mass production

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Case Study: PepsiCo

Background

PepsiCo, with brands like Pepsi, Lay's, Tropicana, and Quaker, operates in over 200 countries. It faced several challenges:
- Shifting consumer preferences toward health-conscious beverages
- Demand for sustainable packaging
- Fierce competition from Coca-Cola

As part of its continuous improvement strategy, PepsiCo adopted Six Sigma in the early 2000s.

Step 1: Define Phase – Identifying Consumer Needs

Through Voice of Customer (VOC) surveys, PepsiCo identified key expectations:
- Lower sugar or sugar-free alternatives without compromising taste
- Healthier options with natural ingredients
- Sustainable and convenient

packaging Problem Statement:

"How can PepsiCo reduce calorie content in beverages while maintaining consumer taste satisfaction?"

Step 2: Measure Phase – Collecting and Quantifying Data

Methods Used:
- Sensory Analysis Panels
- Surveys and Focus Groups
- Market Data

Analysis Key Metrics

Defined:
- Consumer acceptance rate (% of consumers preferring the new product)
- Defect rate in packaging (% damaged or leaky bottles)
- Nutritional performance (calories per serving)

Step 3: Analyze Phase – Applying Statistical Tools
- DOE tested different sweetener combinations: aspartame, sucralose, stevia
- Regression analysis revealed sweetness and carbonation levels heavily influence satisfaction
- Hypothesis testing confirmed stevia + sucralose gave taste satisfaction similar to sugar
- Packaging analysis showed preference for resealable, eco-friendly bottles

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Step 4: Improve Phase – Redesign and Pilot Testing

Key Improvements:

- Launched Pepsi MAX and Diet Pepsi, optimized for taste
- Introduced lightweight, recyclable packaging
- Used statistical control to ensure

consistency Pilot Results:
Consumer acceptance rates exceeded 85%, approaching the Six Sigma goal of 99.7% defect-free output.

Step 5: Control Phase – Sustaining Improvements
- Control charts monitored production variables
- Feedback loops maintained post-launch quality
- Regular audits ensured compliance with environmental standards

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Key Outcomes of Six Sigma at PepsiCo

⬛ Product Innovation Success

- Successful launches: Pepsi MAX, Diet Pepsi, Tropicana 50

⬛ Consumer Satisfaction

- Higher acceptance rates due to statistically validated formulations

⬛ Cost Reduction

- Reduced waste in bottling and packaging

⬛ Brand Image Enhancement

- Strengthened PepsiCo's image as health-conscious and sustainable

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4. Conclusion

The application of Six Sigma in consumer research and product development at PepsiCo illustrates the value of statistical methods in solving real-world business problems.
Key Learnings:
- Consumer research must be quantified and analyzed systematically
- Statistical tools like DOE, regression, and hypothesis testing are essential for balancing health, taste, and cost
- Continuous improvement via Six Sigma improves quality, brand reputation, and competitiveness

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5. Future Outlook

As consumer demands evolve toward healthier, sustainable, and personalized products, PepsiCo must continue integrating:
- Artificial Intelligence (AI)
- Predictive Analytics
- Emerging Eco-Friendly Technologies
