

ME 395 Introduction to Mechanical Design

Needs Identification and Problem Definition

Outline of Process

- Project Initiation
- Identify Customer
- Gather Information
- Identify Requirements
- Create Product Design Specification

a. Project Initiation

- Directive from Supervisor
- Request for Proposal
- Request from Marketing
- Request (complaint) from Customer
- Government Notice

Project Initiation Driven by:

- Demands of Customers (better performance, lower cost)
- Competition (impending better product).
- Technological Change (new material, production method etc.)
- Government Regulation (emission controls, safety, energy etc.)

b. Identifying Customer

Who is the customer?

- User
- Purchaser
- Internal Customer
- Regulator
- Stakeholders

c. Gathering Information

From:

- Customer/Stakeholder
- Benchmarking
- Organization
- Other

Information from Customer

- Interviews
- Focus Groups
- Surveys
- Complaints (Praise)
- Warranty Information

Focus Groups

- 6 to 12 (Potential) Customers
- Discussion Led by Facilitator
- Prepared Questions about Product (or Potential Product)
- Record of Responses
- Follow Up on Responses

Surveys

- Written Questions
- Face-to-Face, Mail, Web
- Best for Existing Products
- Questions re. Features
- Open-ended Questions
- Best to do Trial Run

Constructing survey

- Determine Purpose
- Determine Data Collection Method
- Identify Information Sought
- Design Questions
- Arrange Questions
- Pretest Survey
- Administer Survey

Survey Questions

- Clear and Unambiguous
- Precisely Focused
- Unbiased
- Keep it Short!

Survey Question Categories

- Attitude Question
(e.g. do you like this feature?)
- Knowledge Questions
(e.g. do you know how this feature works?)
- Behavior Questions
(e.g. how often do you use this feature?)

Survey Question Forms

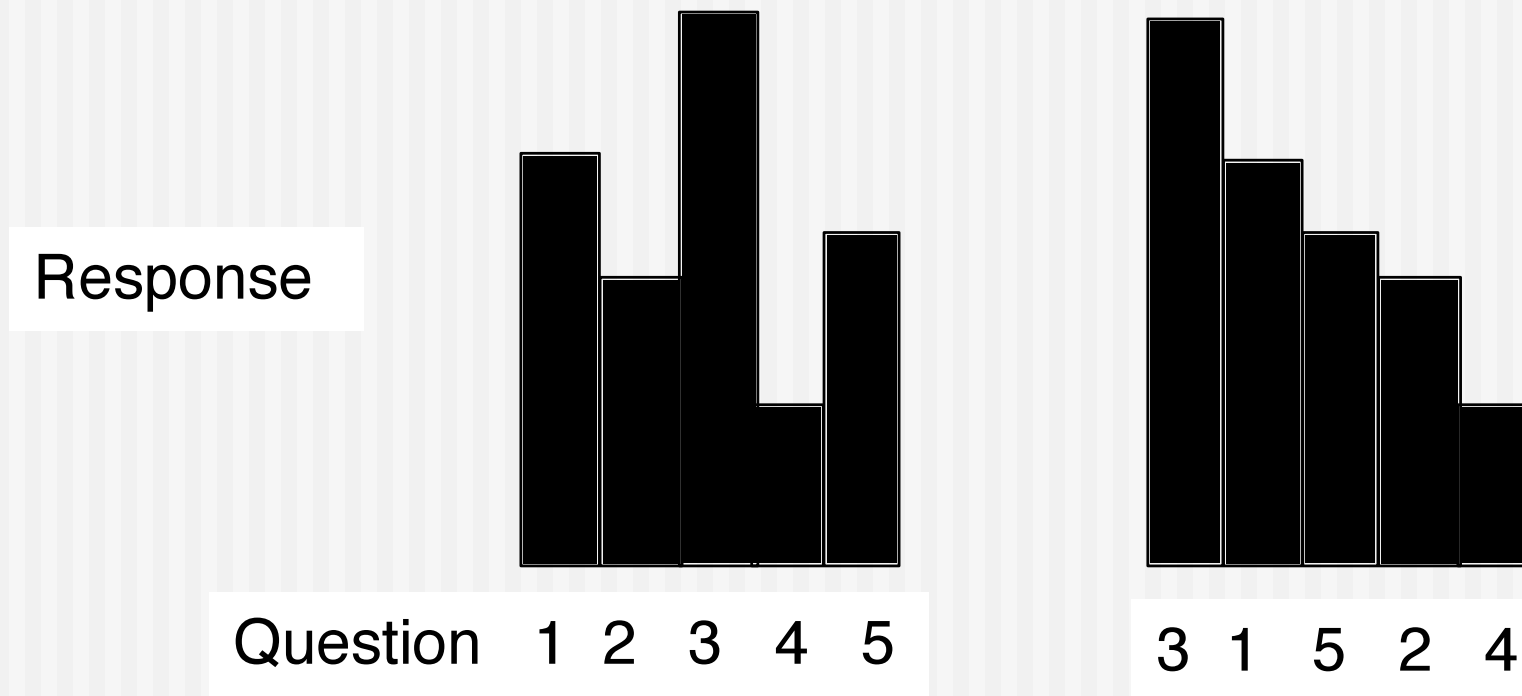
- Yes, No, Don't Know
- Strongly Agree to Strongly Disagree
(maps into numerical score)
- Rank Order
- Preference
- Open Ended

Affinity Diagram or Process

- Used to group similar ideas, problems, approaches etc.
- Can use “post-its” on board to form groups
- Once groups are formed, headers can be generated
- Important that all participate and understand concepts.

Interpreting Survey Results

- Pareto Diagram (what's important?)



Interpreting Survey Results (cont.)

- Needs vs. Wants
- Correlations:
 - does some customer segment want different things?
 - are some requirements exclusive or bundled?
 - Can help guide product marketing and styles etc.

Benchmarking

- Compare company's operations with those of other companies
- Could involve competitors or companies in other fields
- Could treat product, design and manufacturing procedures, marketing, billing, customer service etc.

Benchmarking Process

- Select Product, Process etc.
- Identify Key Metrics
- Identify Best-in-Class Companies
- Collect and Compare Metrics
- Develop Programs and Actions to become Best-in-Class
- Continuing Process

Reverse Engineering

- Similar to Benchmarking but narrower in scope
- Involves testing and dismantling product (product dissection) to understand how competitor has met customers requirements
- Can be used to copy product features

d. Customer Requirements (CR's)

Global Perspective of Human Needs:

- Physiological Needs
- Safety and Security Needs
- Social Needs
- Psychological Needs
- Self-fulfillment Needs

See further categorization by Dieter

CR Levels

- Expecters (basic features expected in all products of class)
- Spoken (specific features customers say they want)
- Unspoken (important things not talked about by customers)
- Exciters (things that make the product distinct and desirable)

CR Categories

- Performance
- Time
- Cost
- Quality

Some characteristics, like reliability, can impact all of above

Dimensions of Quality

- Performance
- Features
- Reliability
- Durability

Dimensions of Quality (cont.)

- Serviceability
- Conformance
- Aesthetics
- Perceived Quality

Customers often relate different dimensions of quality

Quality Dimensions for Refrigerators

Performance

- Efficiency
- Temperature
- Temperature Distribution
- Humidity Control
- Others?

Quality Dimensions for Refrigerators (continued)

Features

- Size (volume)
- Automatic Defrost
- Ice Maker/Water Dispenser
- Freezer Light
- Others?

f. Product Design Specification (PDS)

- Basic reference document for design and manufacture
- As complete and quantitative as possible
- Avoids how requirements are to be achieved
- Often surprisingly detailed and complex

Components of PDS

- In-use Purpose and Market
- Functional Requirements
- Corporate Constraints
- Social, Political and Legal Requirements

PDS -Purposes and Market

- Product Title
- Purpose or Function
- Predictable Unintended Uses
- Special Features
- Competitive Products

PDS -Purposes and Market (cont.)

- Intended Market
- Need for Product
- Relationship to your Other Products
- Anticipated market Demand (units, years)
- Target Selling and Retail prices

PDS- Functional Requirements

- Performance
- Physical Requirements
- Service Environment
- Human Factors (aesthetics, ergonomics, training etc.)
- Life Cycle Issues

PDS- Life Cycle Issues

- Useful Life (warranty life)
- Reliability (mean time between failures?)
- Robustness
- Maintainability (diagnosis, testing, repair and replacement)
- Retirement and Recyclability
- Cost of Operation (energy, staffing etc.)

PDS- Corporate Constraints

- Time to Market
- Manufacturing Requirements or Restrictions
- Suppliers
- Trademarks, Logos and Brands
- Financial Requirements (ROI)
- Ethical Constraints

PDS- Social, Political and Legal Requirements

- Corporate Responsibility
- Safety and Environmental Regulations
- Standards
- Safety and Product Liability
- Patents and Intellectual Property