# Lecture #11

# ERDM

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# Assignment

- **Course text**
  **WTEC EBM Report**

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- **Graduate Credit:**

# A Product

**Why create a given product?**

- **An explicit customer demand or need**
- **Manufacturer anticipates a need not yet recognized by the customer**

  **The problem: design product and associated processes to meet the customer need.**

  **How to incorporate environmental thinking into the design process??**

# The Design Team

- **50 years ago: Engineers design the product and then ask manufacturing to make it. Loads of manufacturing problems.**

- **15 years ago: DFM. Product designers are asked to produce a "print" that is easy to manufacture. Lack of manufacturing knowledge. Too much burden on product designers.**

- **Current thinking: Concurrent design/engineering. A design team is charged with simultaneously developing product <u>and</u> process designs.**

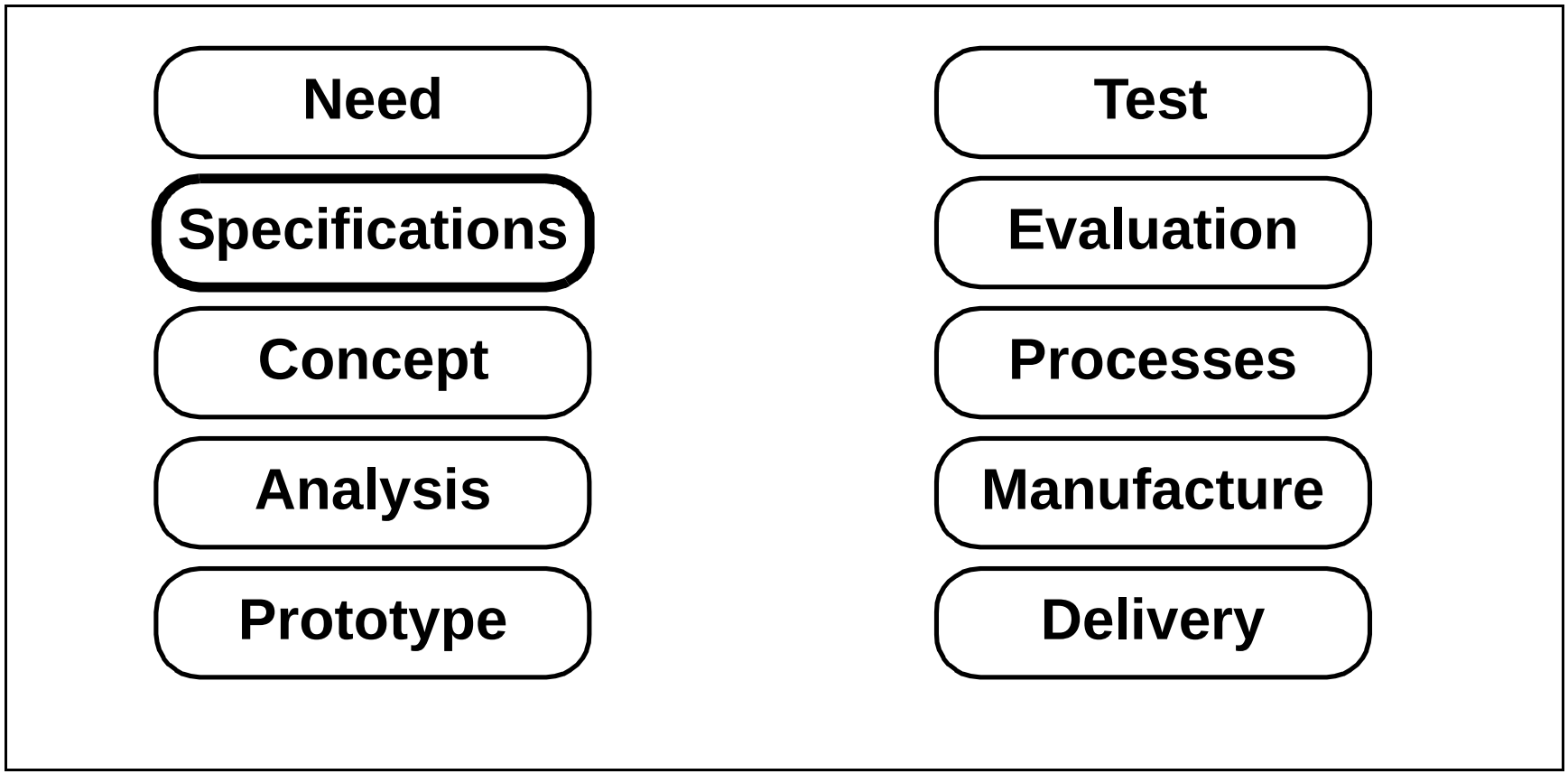
# Who is on the Design Team?

**Design Team**

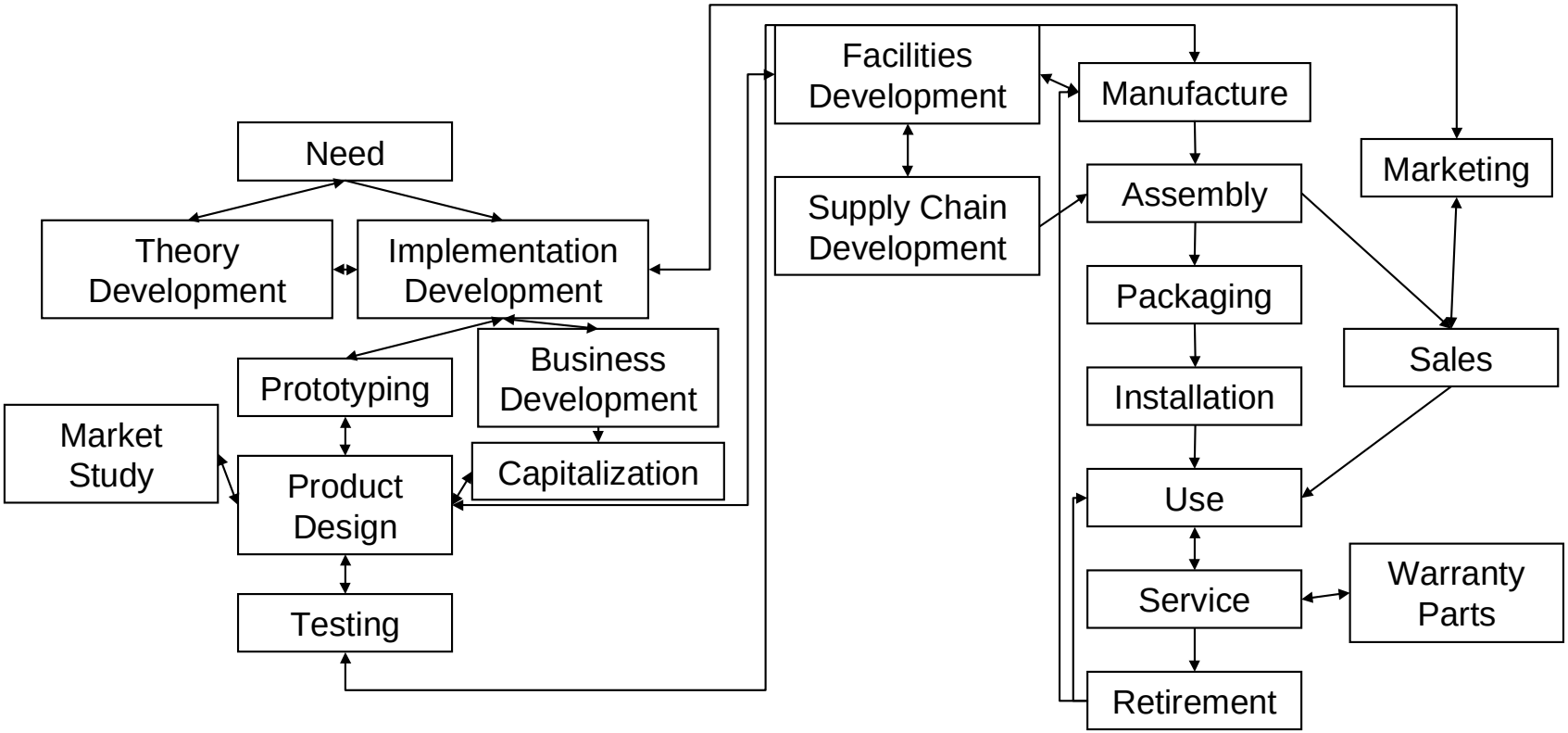
# Concurrent Design

- **Design the product and its processes concurrently using a concurrent design team**
- **Everyone has a say in everything**
- **Level of activity may be likened to that of the floor of the mercantile exchange -- very hectic -- communication!!!**
- **Not always possible as a team but necessary in information gathering**

# The Traditional Product Development Life Cycle



# Another View




**some material from: Dr. Gershenson (MEEM @ MTU)**

# Customer Needs

- **They speak a different language than product designers (red lion fresh fish example)**
- **Imprecise (the car makes a funny noise)**
- **May state in terms of product (“your meatloaf is not as good as the one Mom makes”).**
- **May limit development unintentionally (“why would I need cable TV when there are 3 perfectly good TV stations broadcasting in town?”)**
- **Guidance to designers is not very direct**

# Specification

**Objective: To state what the product must do rather than how the product must do it**

**Add metric precision**

**The specification contains a metric and a value to be achieved or exceeded**

**Could be in the form of a demand, target, or wish:**

- **Vehicle weight must be less than 2000 lbs**
- **The vehicle should weigh less than 2000 lbs**

# How Can We Insure that the Specifications Respond to Customer Needs?

**We need to hear the "Voice of the Customer"**

**How?**

- **Interviews**
- **Focus groups**
- **Observation of product in use**

# Voice of the Customer?

- **Ensures product is focused on customer needs**
- **Identify latent or hidden needs**
- **Provide fact base for justifying specifications**
- **Archival record of needs in development**
- **Ensure no critical customer needs missed or ignored**
- **Develop common understanding of customer needs among development team**

# Quality Function Deployment

- **This is a method to map the “voice of the customer” throughout product (and process) development.**
- **Ensures(?) that the needs of the customer are reflected in the product.**
- **Philosophy: products are customer driven.**
- **Tool: House of Quality**

# What the heck does this have to do with the Environment?

- **We wish to use the QFD method to make sure that the wants/desires/needs of the customer are mapped into the product (and process).**

- **There is no reason why the QFD method cannot be employed to reflect wants from other important stakeholders!**

  **The Environment!**

# Environmental Wants for QFD Should Reflect:

- **Efficient use of material resources**
- **Energy resources**
- **Reduction of by-products, wastes, and side effects**
- **End of Life considerations**

**We are working with <u>simple</u> version of QFD**

# An Example:

**Customer statement: “In the middle of the night, I sometimes wake-up and need a light to allow me to move around the house without bumping into something.” -- this statement defines the need. We have considerable latitude is responding to this need.**

**Other customer input: I don’t want the light to wake up my spouse, I want something that is easy to use, I want something that is inexpensive and long lasting.**

**We will need to consider the environment as we try to select a concept for the design.**

# Concept Selection

## (0: Poor, 3: Best)

| Wants | Priority | Jar of Fireflies | Flash-light | Candle | Clapper on Room Lamp | Glow Stick |
|---|---|---|---|---|---|---|
| Light | 6 | 0 | 2 | 2 | 3 | 1 |
| Localized | 4 | 3 | 3 | 3 | 0 | 3 |
| Easy to Use | 3 | 1 | 3 | 0 | 3 | 3 |
| Inexpensive | 5 | 3 | 2 | 2 | 2 | 0 |
| Long Lasting | 1 | 0 | 2 | 1 | 3 | 1 |
| Environment | 2 | 3 | 2 | 1 | 2 | 0 |
| Total | | 36 | 49 | 37 | 44 | 28 |

# More on Design

- **Best concept design appears to be flashlight**
- **Thoughts heard from one customer:**

  **“I want a cheap flashlight. Batteries are big problem with me. The problem I have with flashlights is that I have a bunch of them all over the house -- all the batteries in my existing flashlights are worn out. I never seem to have time to replace my batteries.”**

# Needs

- **Illumination**
- **Hand held**
- **Portable**
- **Minimize battery replacement**
- **Hazardous Materials**

# Quantifying the Needs

| Need | Priority | Measure | Units |
|---|---|---|---|
| Illumination | 5 | Brightness | Candles |
| Hand held | 3 | Volume | cu. cm. |
| Portable | 3 | Mass | gm |
| Minimize battery replacement | 4 | Time | days |
| Minimize Hazardous Materials | 2 | Mass | gm |
| Energy Efficiency | 3 | Cost | $/yr |

**Note that now we are getting more detailed. We need to think about more quantification.**

# Benchmarking

| Need | Priority | Units | A | B | C | D |
|---|---|---|---|---|---|---|
| Illumination | 5 | Candles | 5 | 7 | 3 | 5 |
| Hand held | 3 | cu. cm. | 25 | 30 | 26 | 20 |
| Portable | 3 | gm | 200 | 250 | 190 | 210 |
| Minimize battery replacement | 4 | days | 60 | 75 | 45 | -- |
| Minimize Hazardous Materials | 2 | gm | 150 | 190 | 120 | 165 |
| Energy Efficiency | 3 | $/yr | 5 | 6 | 10 | 8 |

# Actual Units to Coded Units

| | | Actual | | | | Coded | | | |
|---|---|---|---|---|---|---|---|---|---|
| Need | Units | A | B | C | D | A | B | C | D |
| Illumination | Candles | 5 | 7 | 3 | 5 | 2 | 3 | 1 | 2 |
| Hand held | cu. cm. | 25 | 30 | 26 | 20 | 2 | 1 | 2 | 3 |
| Portable | gm | 200 | 250 | 190 | 210 | 3 | 1 | 3 | 3 |
| Min. battery replacement | days | 60 | 75 | 45 | -- | 1 | 1 | 0 | 3 |
| Min. Hazard-ous Matls | gm | 150 | 190 | 120 | 165 | 2 | 0 | 3 | 2 |
| Energy Efficiency | $/yr | 5 | 6 | 10 | 8 | 3 | 2 | 1 | 1 |

# Benchmarking Results

| Need | Priority | A | B | C | D |
|---|---|---|---|---|---|
| Illumination | 5 | 2 | 3 | 1 | 2 |
| Hand held | 3 | 2 | 1 | 2 | 3 |
| Portable | 3 | 3 | 1 | 3 | 3 |
| Min. battery replacement | 4 | 1 | 1 | 0 | 3 |
| Min. Hazardous Matls | 2 | 2 | 0 | 3 | 2 |
| Energy Efficiency | 3 | 3 | 2 | 1 | 1 |
| Total | | 42 | 31 | 29 | 47 |

**Product D is the best. Good starting point for our design.**

# More on QFD

- **Customer needs defines engineering features/ characteristics**
- **The features determine part characteristics**
- **Part characteristics dictate process features, and so forth**