

# Product Development

MAE 2250

# Products

- Engineered
- Discrete
- Physical

## **Goal**

Develop good products quickly and cheaply

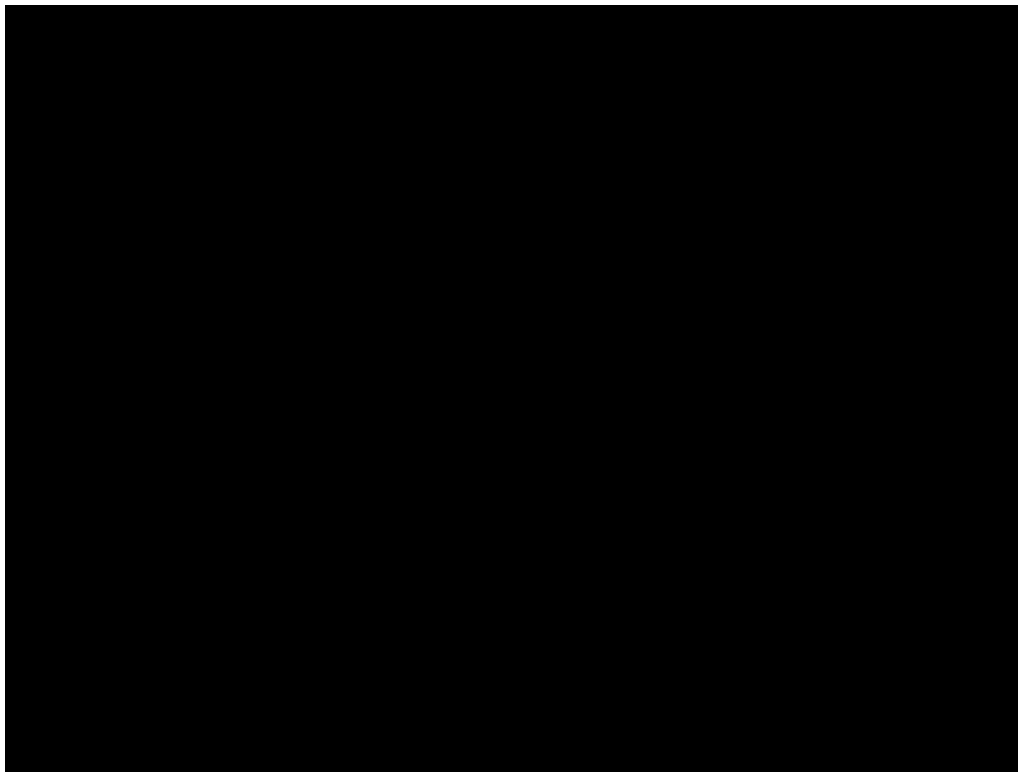
# The Challenges of product development

- Customers
- Tradeoffs
- Dynamics
- Details
- Time pressure
- Economics

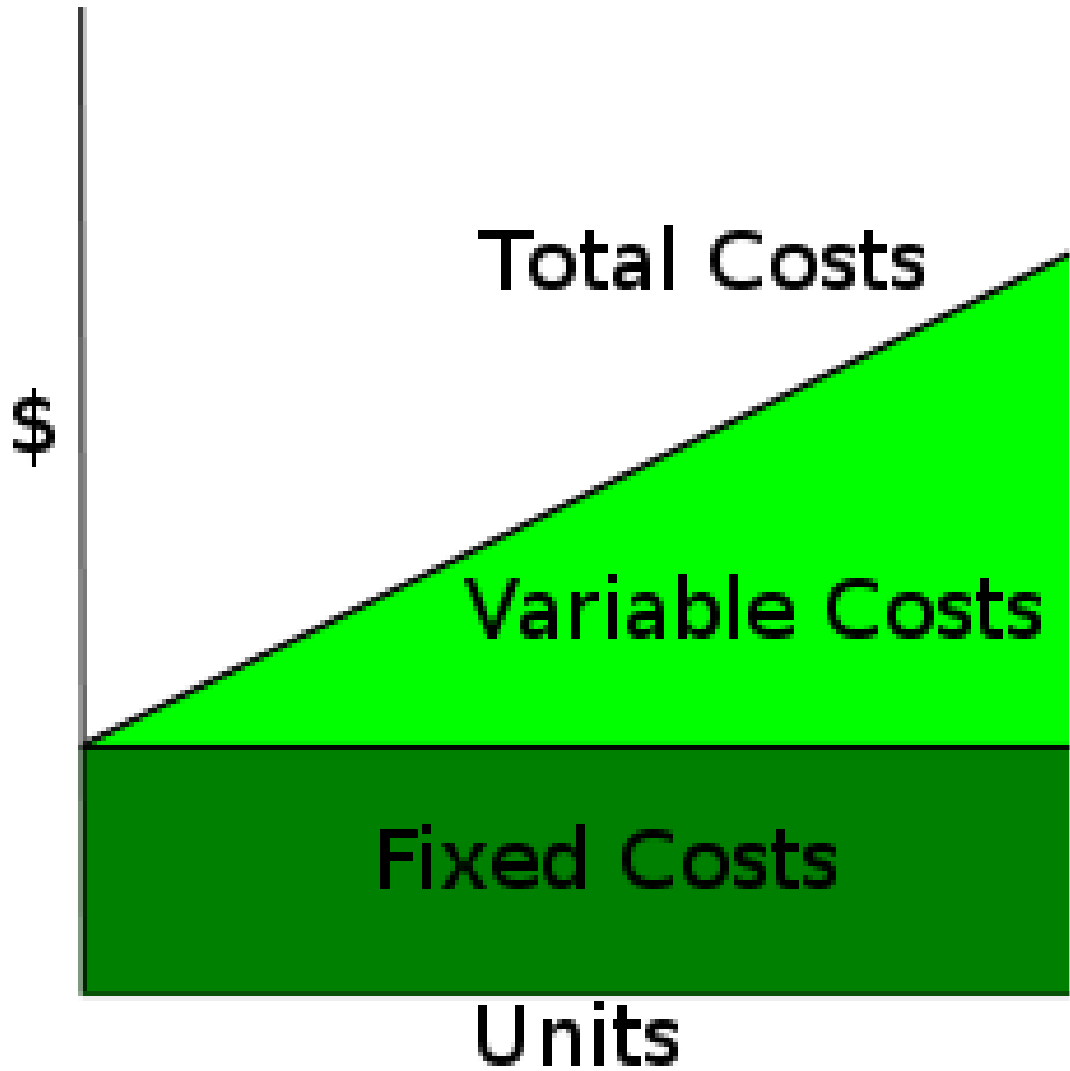
# Interesting!

- Creation
- Impact
- Competition
- Interactive

Like **sport** and **arts**



<http://www.youtube.com/watch?v=M66ZU2PClcM>



# Costs

- Design team salary – Fixed or variable?
  - A – Fixed
  - B - Variable



# Costs

- Assembly labor salary – Fixed or variable?
  - A – Fixed
  - B - Variable

# Costs

- Materials – Fixed or variable?
  - A – Fixed
  - B - Variable

# Costs

- Real Estate— Fixed or variable?
  - A — Fixed
  - B - Variable

# Costs

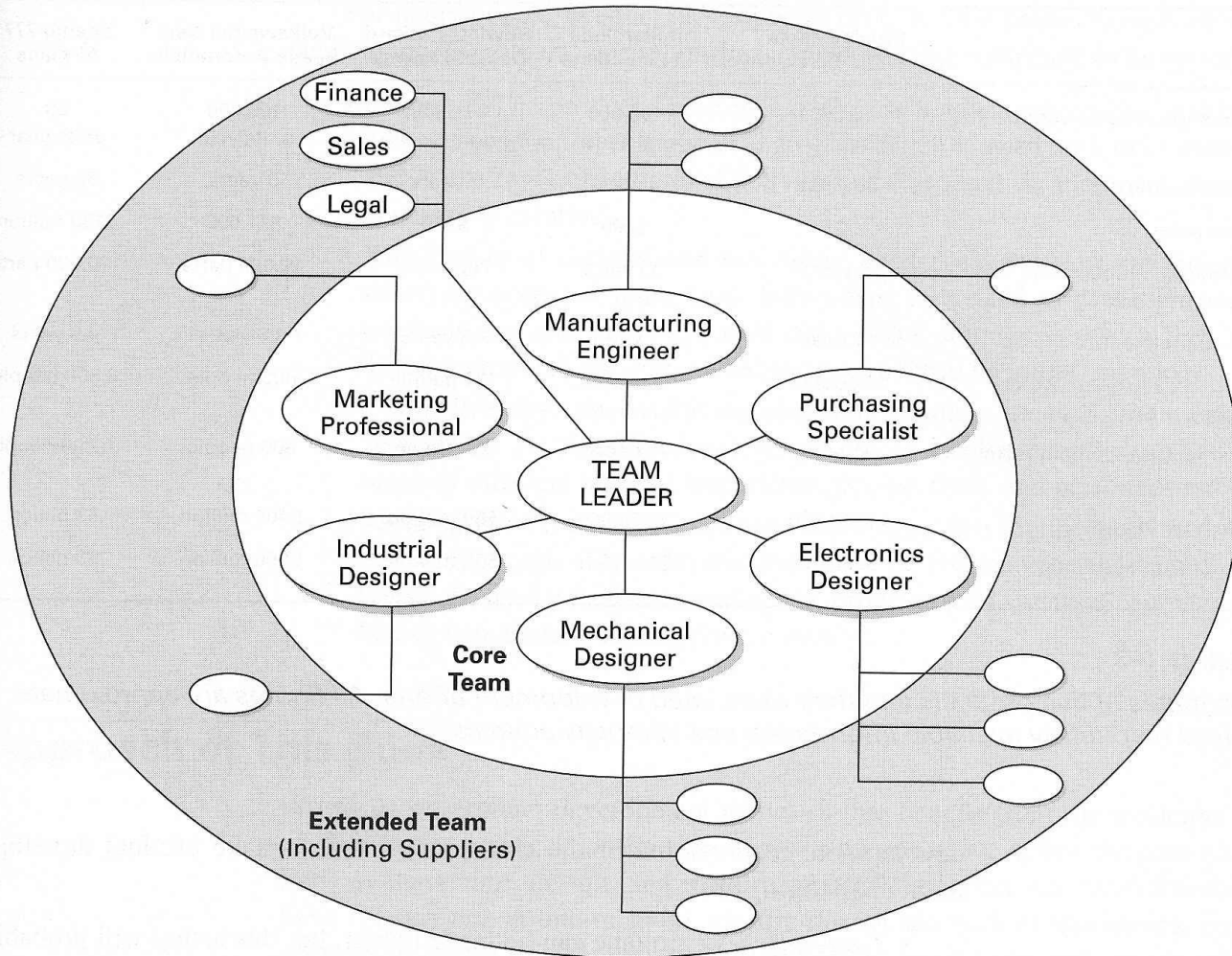
- Fixed Costs
  - Development team
  - Special production equipment
- Per product
  - Materials, manufacturing operations
- Per time
  - Real estate, labor

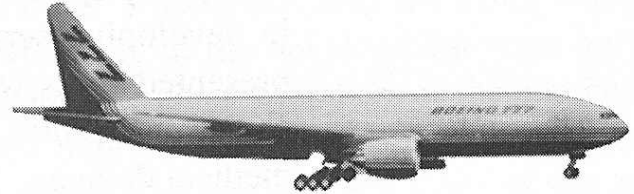
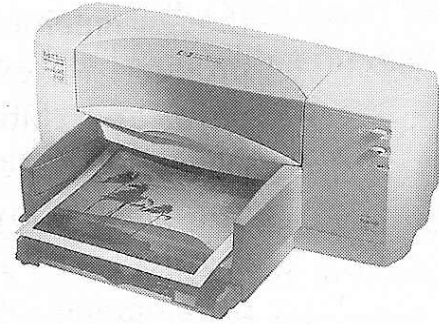
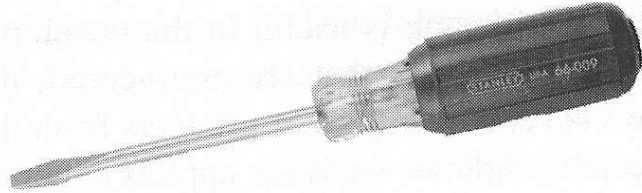
# Development Cost & Time

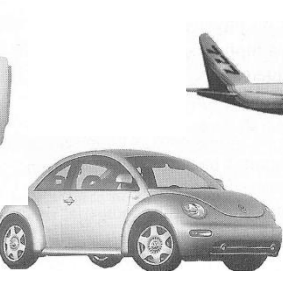
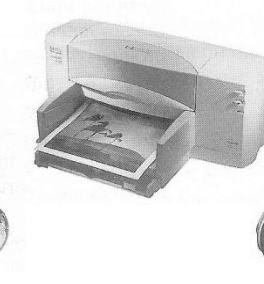
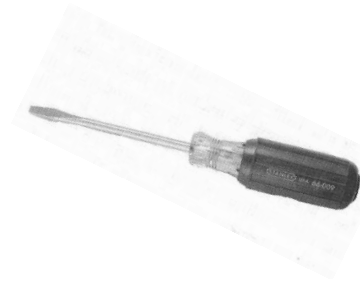
- **Cost:** roughly proportional to the number of people on the project team and to the duration of the project
- **Time:** Until the first mass-produced product reaches a paying customer

Brainstorm: Who is on the team?

# Cost & Time







**Stanley Tools  
Jobmaster Screwdriver**

**Rollerblade  
In-Line Skate**

**Hewlett-Packard  
DeskJet Printer**

**Volkswagen New  
Beetle Automobile**

**Boeing 777  
Airplane**

Annual production volume

Sales lifetime

Sales price

Number of unique parts  
(part numbers)

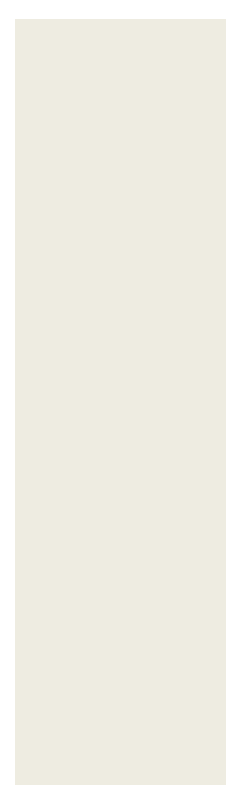
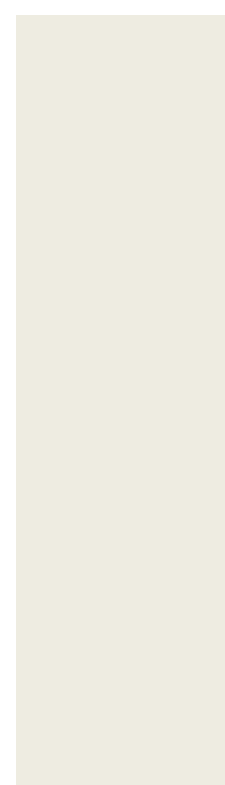
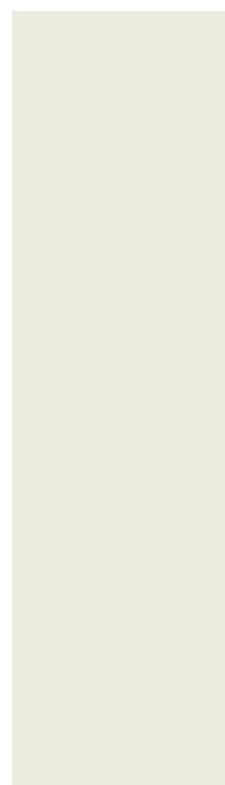
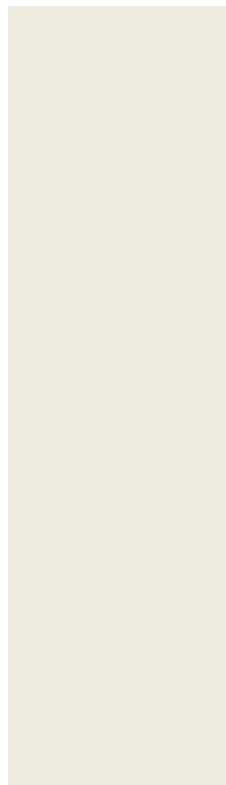
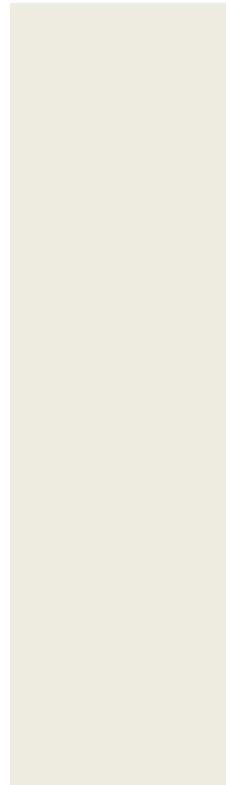
Development time

Internal development team  
(peak size)

External development team  
(peak size)

Development cost

Production investment





# Phases

- Phase 0: Planning
- Phase 1: Conceptual design
- Phase 2: System design
- Phase 3: Detail design
- Phase 4: Testing and refinement
- Phase 5: Production ramp-up



**Iterate**

# Conceptual Design

- Identify needs
- Establish target specifications
- Generate concepts
- Select concept(s)
  - Test/Analyze concepts
  - Refine specs
- Plan project (downstream activities)

PDR

# Preliminary Design Review (PDR)

- Product choice (market/need rationale)
- Customer needs (distilled, sorted, prioritized)
- Specifications (quantitative, benchmarked)
- Potential designs (morph chart)
- Selected concepts (min 3)
- Final choice (rationale, decision matrix)
- Project schedule (milestones, responsibilities)

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PDR

CDR

SAR



**Iterate**

System Acceptance Review