



# D-Lab

Spring 2010



# Today in class:

- Review of the Design Process
- Design for Manufacture
  - No Spare Parts
- Books Assignment
- Readings



# D-Lab

## Design for Manufacture



# DfM Definition:

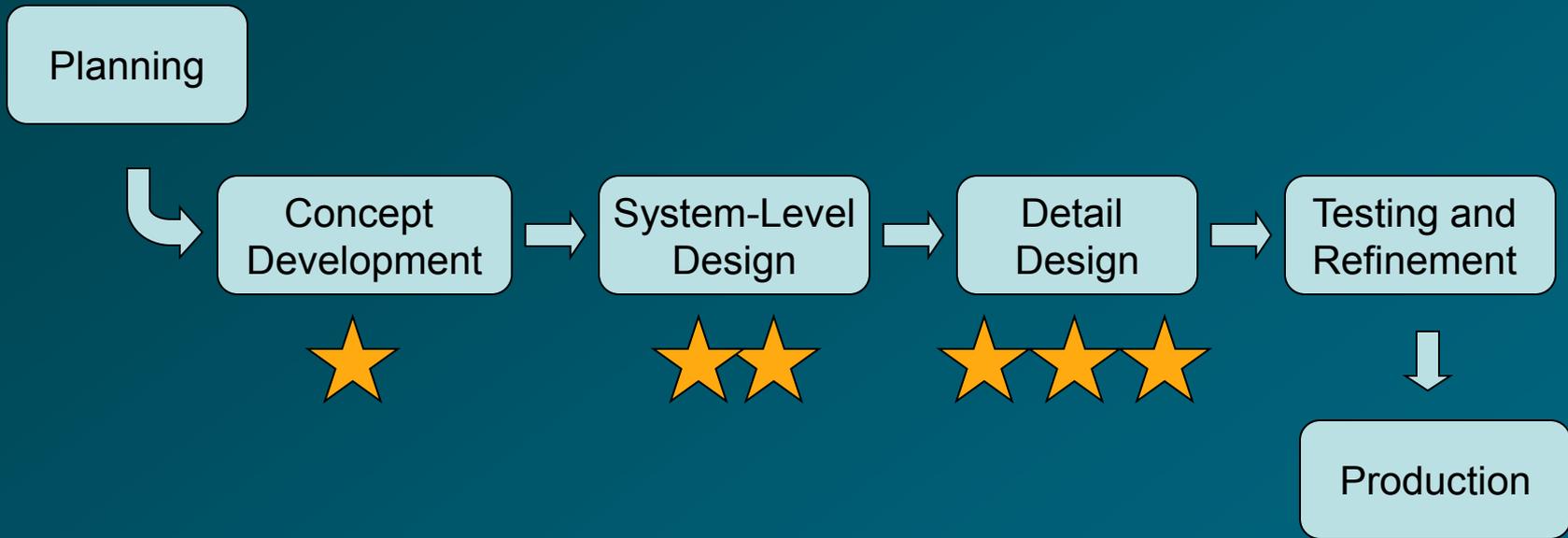
Adapting a design to make it more easily manufactured and to reduce its manufacturing costs.



# DfM Definition:

To give consideration at the design phase of a product how it will be manufactured.

# DfM in the Product Development Process

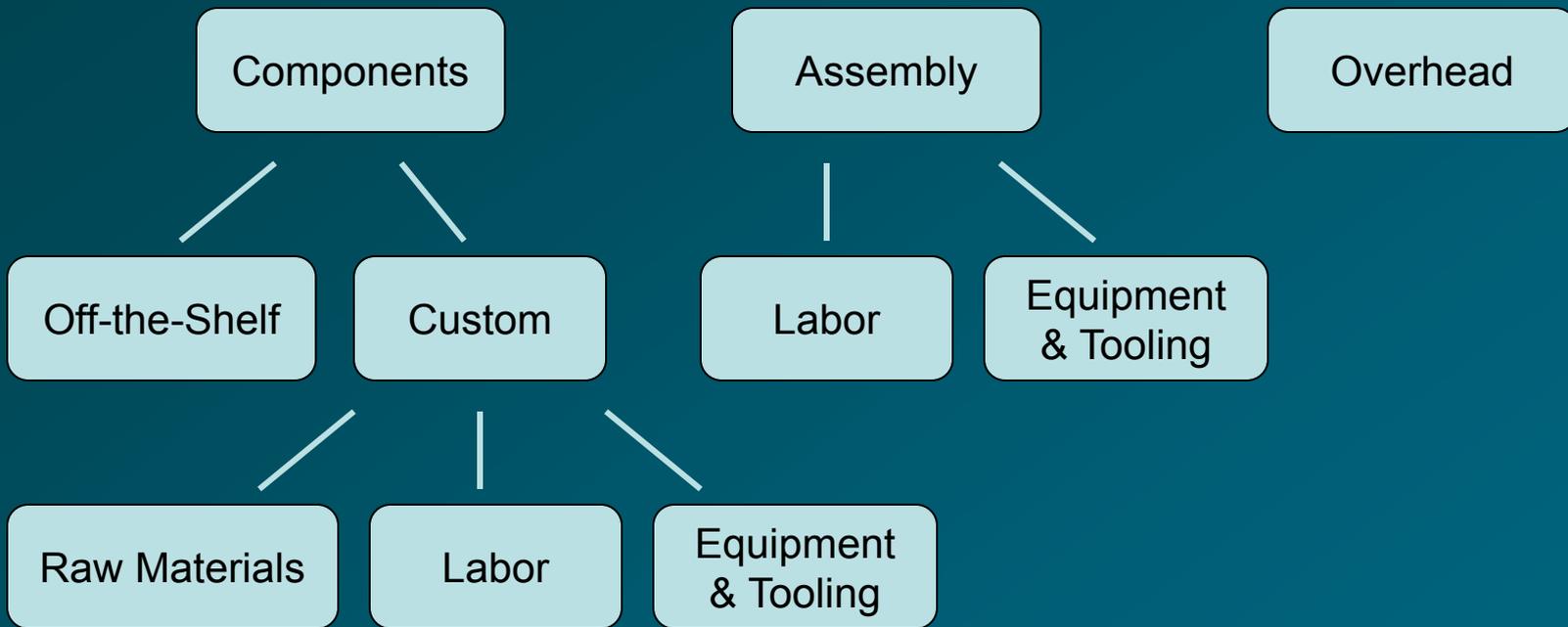




# Special Considerations for Developing Countries

- Job creation
- Resource availability
- Supply chains
- Scale
- Replicability

# Manufacturing Costs



# Four Paradigms

- Manufactured locally  
Assembled locally  
Maintained locally
- Manufactured in urban centers  
Assembled in urban centers  
Maintained locally
- Manufactured in urban centers  
Assembled locally  
Maintained locally
- Manufactured in urban centers  
Assembled in urban centers  
Maintained in urban centers

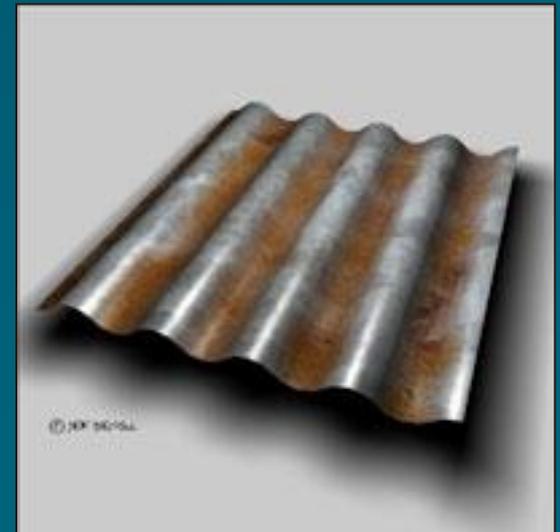




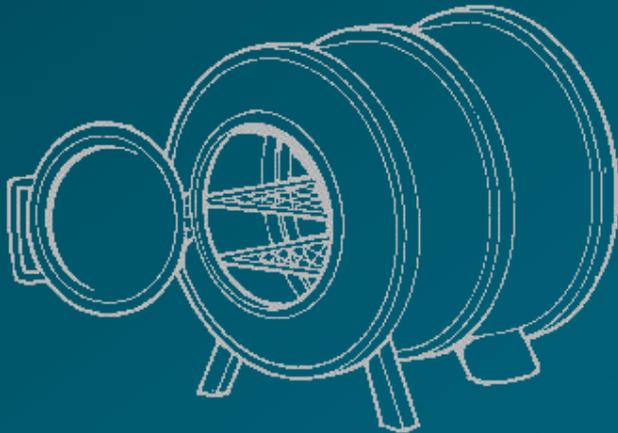
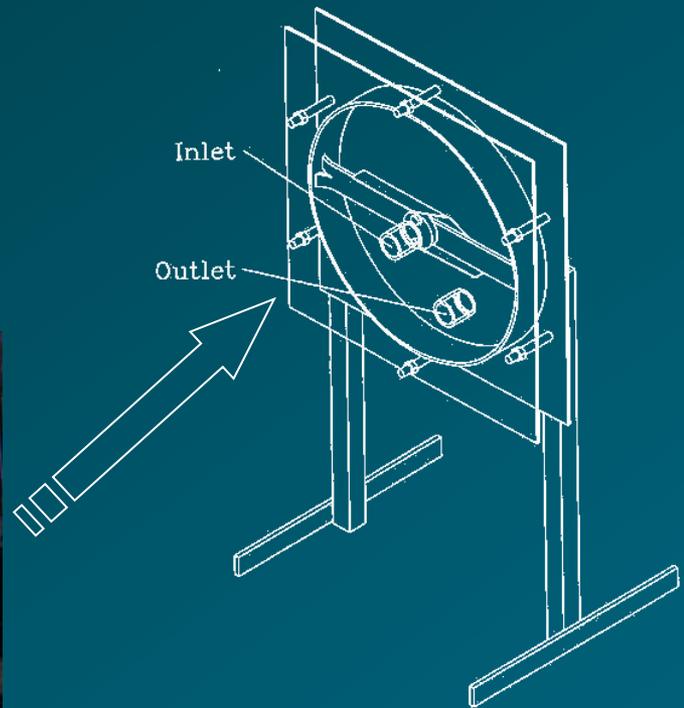
# Commonly Available Materials



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# Car Parts



# Bicycle Parts

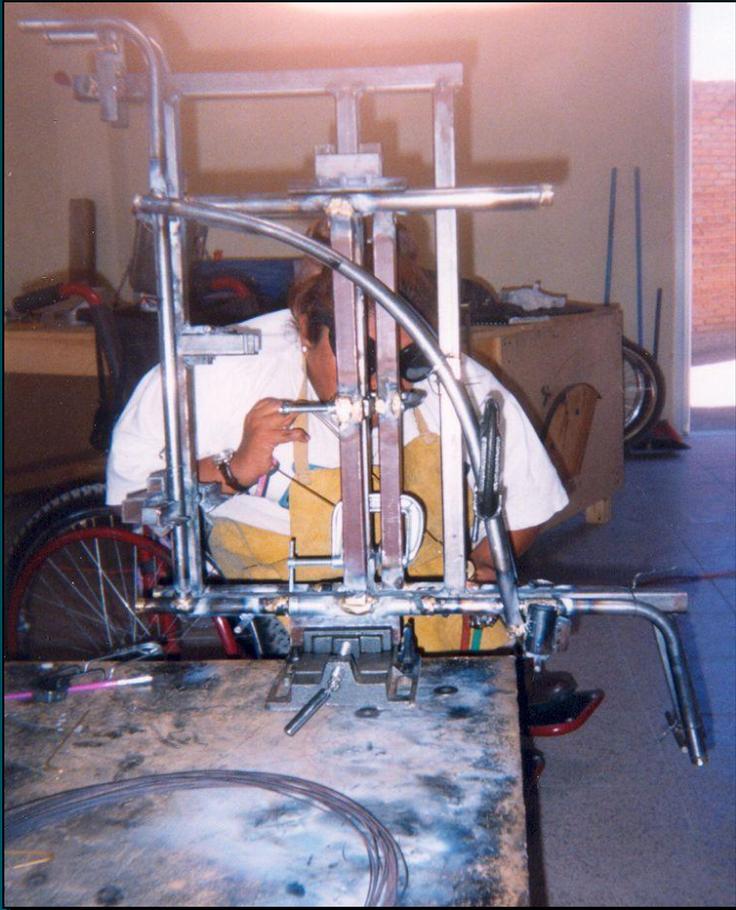




# Best Live-Action Manufacturing in Developing Countries Short Film

Image of "Oscar" film award trophy removed due to copyright restrictions.

# Jigs & Fixtures



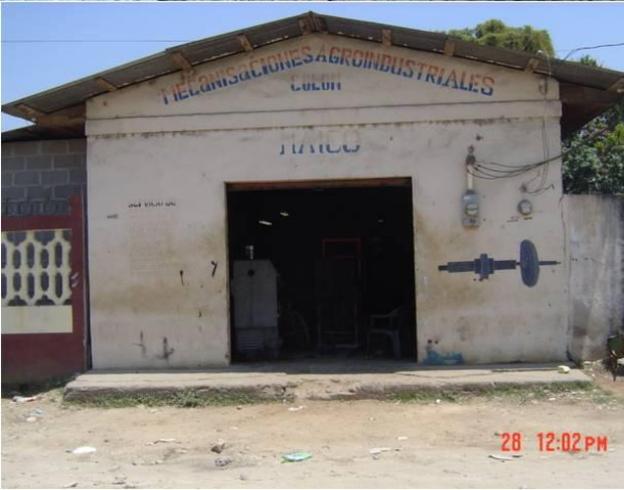




28 11:32 AM



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18

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# Keys to DfM in Developing Countries

- Understand manufacturing capabilities
- Incorporate the most accessible, affordable manufacturing techniques into your detailed design



# Design for Assembly

*"a process for improving product design for easy and low-cost assembly, focusing on functionality and on assemblability concurrently."*

--Vincent Chan & Filippo A. Salustri



# Design for Assembly

- Reduce cost of assembly
- Improve quality and reliability
- Reduce part inventory
- Reduce production equipment

# Special Considerations for Developing Countries

- Job Creation
- Resource Availability
- Scale
- Repeatability

# Assembly Methods

- Manual assembly
- Fixed automatic assembly
- Flexible automatic assembly

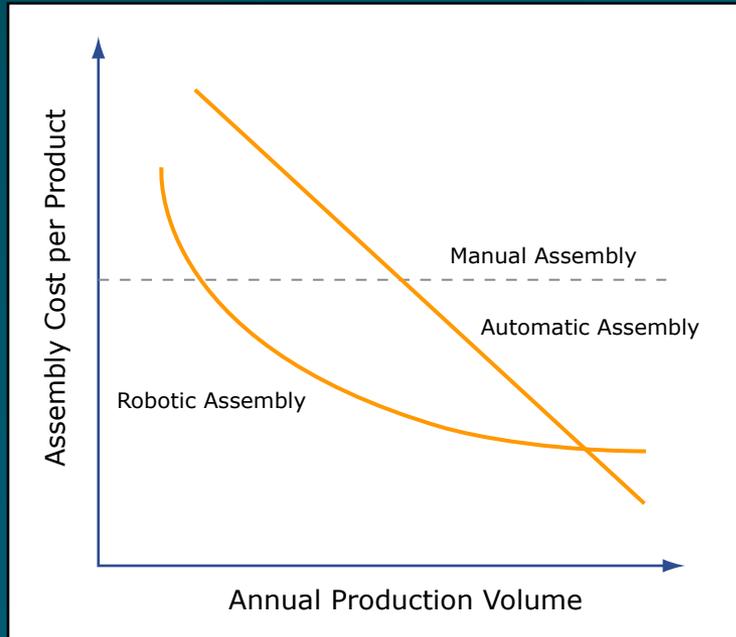


Image by MIT OpenCourseWare.

# Design Guidelines for Manual Assembly

- eliminate the need for workers to make decisions or adjustments.
- ensure accessibility and visibility.
- eliminate the need for assembly tools and gauges (i.e. prefer self-locating parts).

# Basic DFA Guidelines

- minimize the number of different parts - use "standard" parts.
- minimize the number of parts.
- avoid or minimize part orientation during assembly (i.e. prefer symmetrical parts).
- prefer easily handled parts that do not tangle or nest within one another.

# Basic DFA Guidelines

- Minimize part count by incorporating multiple functions into single parts
- Modularize multiple parts into single subassemblies
- Assemble in open space, not in confined spaces; never bury important components or components that require maintenance
- Make parts such that it is easy to identify how they should be oriented for insertion

# Basic DFA Guidelines

- Prefer self-locating parts
- Provide alignment features
- Eliminate fasteners
- Don't put fasteners in places where you can't get access to

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