Engineering Design

Importance of Engineering Design

Objectives of this lecture

- **Importance and challenges of Engineering design**
- **Introduction to Engineering Design Process**

Outcomes

- **By the end of this lecture, you will be able to:**

- **Understand the importance and challenges of design**
- **Appreciate the difference between conventional and systematic design**
- **Describe the systematic design process**
- **Identify who your Customers are**

Skills needed by a designer

- Sketching, technical drawing, CAD
- Creativity, problem solving, project management
- Properties of materials, manufacturing
- Applications of science, eg. Chemistry (e.g. corrosion protection, painting, plating)
- Statics, structures, dynamics, strength of materials, kinematics, and mechanisms, stress analysis
- Electrical and Electronics
- Fluid Mechanics, thermodynamics, heat transfer
- Fluid Power, electrical phenomena, industrial controls
- Environmental Issues
- Experimental Design, performance testing of materials
- Oral Communication, listening, writing, teamwork skills
- Awareness of feasibility and cost issues
- Safety and Ethical Issues and legislations.

How this lecture fits in...

- So far you have covered the essential skills a designer needs e.g.:
  - –Team Work and forming companies
  - –Research
  - –Report writing
  - –Communication skills (Presentations)
- This lecture will give you the necessary tools and steps to enable you to start designing any engineering product.
- Future lectures will focus on these steps in more detail as well as ethical aspects.

Why Design is Important?

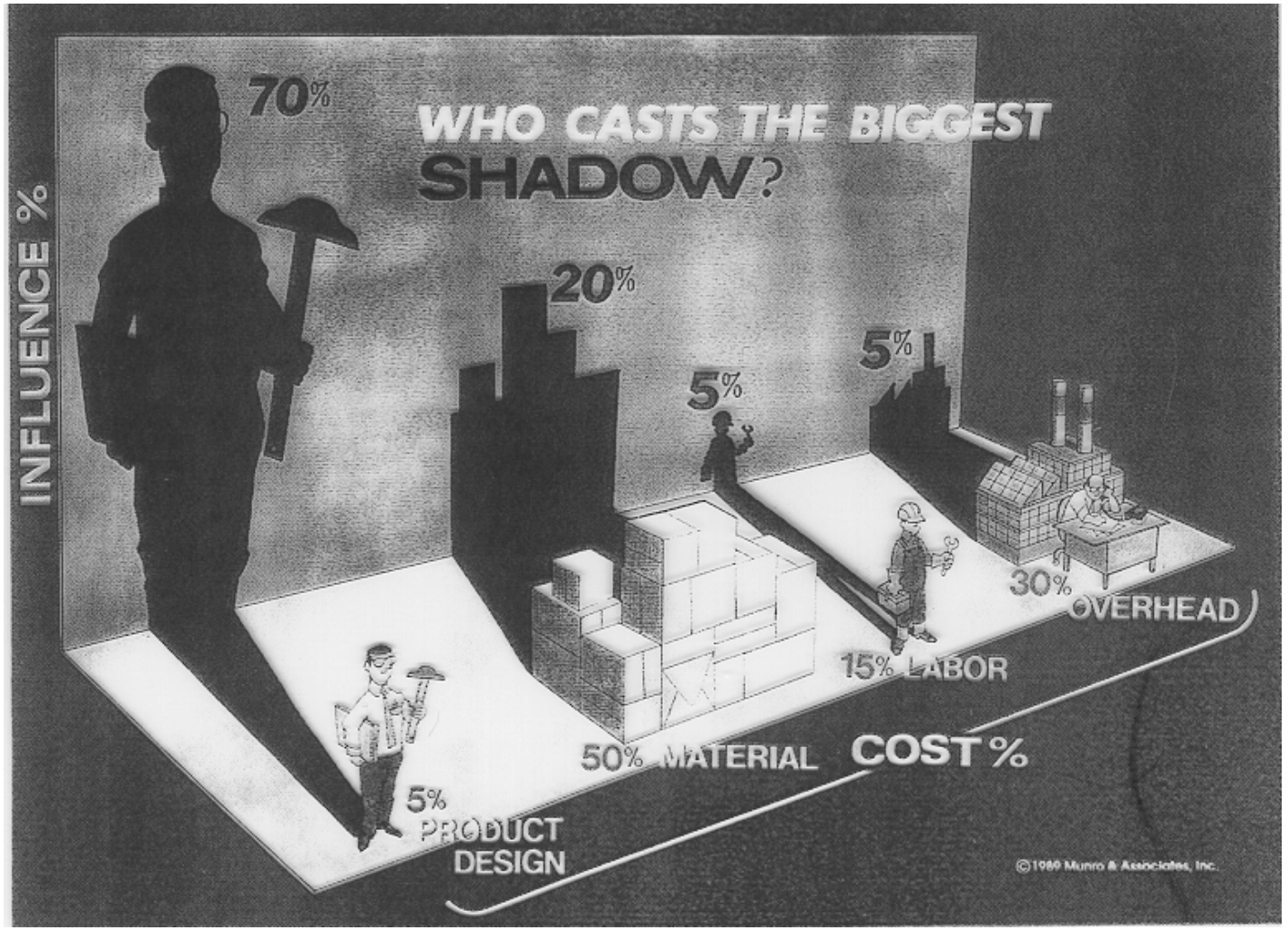
- **Without Design, there is no product!**
- **With a poor design, no matter how good the manufacturing methods are, or quality control, etc, the end product will still be a bad idea and no one will buy**
- **Most people will buy something based on the design followed by the quality**
- **What about cost?**

Why Design is Important?

- **Most end-users do not know/care about the details or technical features of a product.**
- **They look only at the design … both the functionality of the product and the way it looks.**
- **Think about how people choose to buy a kettle or even a mobile phone.**

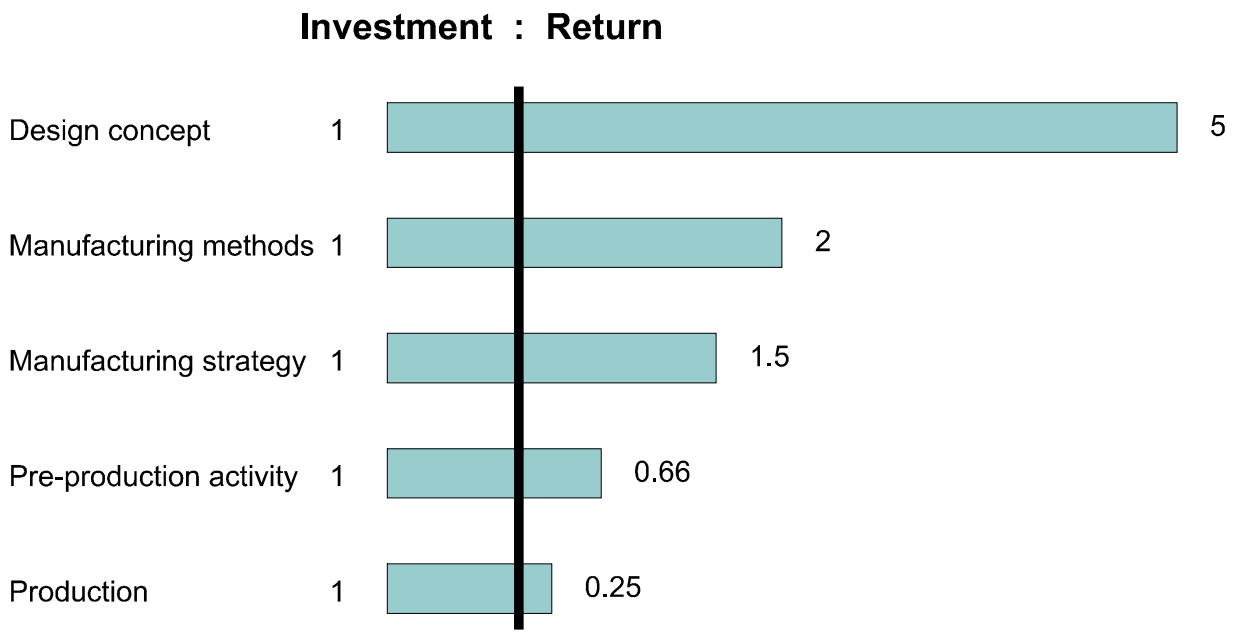
Why Design is Important?

- *Importance of Design*
- *Difficulty of Design*
- *Identifying Customers*
- *Conventional Design*
- *Systematic Design*



Why Design is Important?

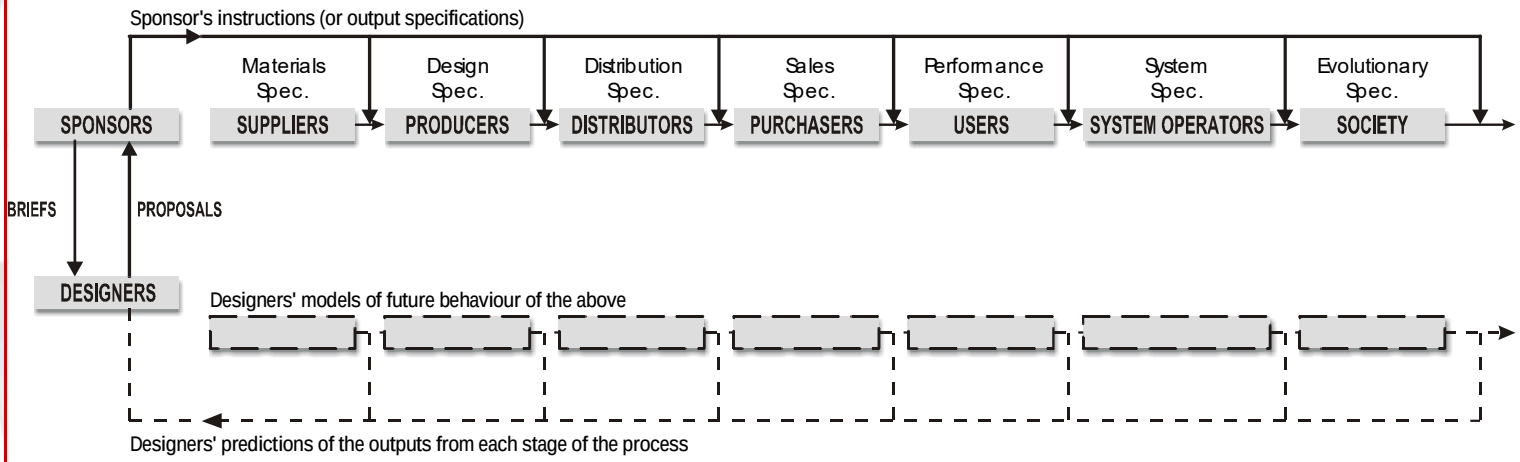
- **Investing at the design stage has the biggest return on investment for a product.**



Source: Managing Product Creation; A DTI Publication Paul Burall 1990

Why Design is Difficult

- **Designers have to predict each step of the product's life.**

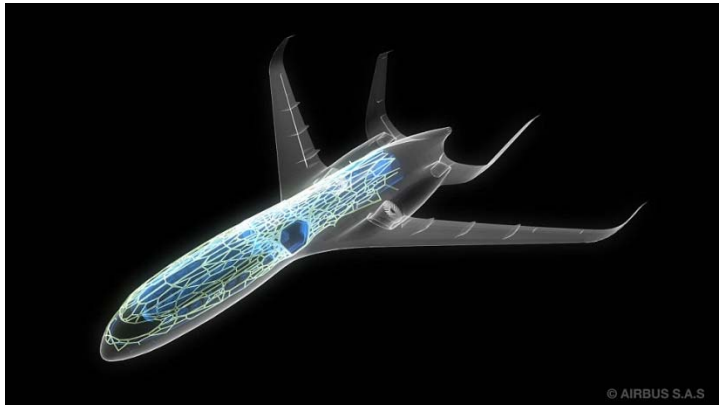


Identifying your Customers

- **Everyone has a different opinion / desire on how a product should be designed…**
- **Customers of a product are NOT just the end-users.**
- **Who do you think are customers of an airplane?**
- **Customers include the people that manufacture, maintain, sell, dissassemble… etc.**

How an Airplane should be Designed –
According to:

Engineering
Maintenance
Operation
Sales
Passengers
Pilots
Airport
Services



Identifying your Customers

- **Each company… your task as a design team is to identify and list on a piece of paper as many customers as possible for a mobile phone…**
- **You can use the internet to help you.**
- **You have approximately 5mins!**

The Design Process

- **Two Schools of thought:**
  - **Conventional Design**
  - **Systematic Design**

Conventional Design

- **Back of the envelope approach**
- **Come up with an idea, test it and improve on it**
- **Successful… first space shuttle was built using conventional design**
- **Usually inefficient way of designing and sometimes there are other better ideas that have not been thought of.**

Systematic Design

- **Follows a number of clear predefined steps from the start of the project to its completion**
- **Makes the design approach transparent, rational and independent of a specific branch of industry.**
- **Clear steps**
- **Definite starting and finishing points**
- **More opportunities for weakness Identification**
- **Shorter training time**
- **Broader training**

Engineering Design Process

1) **Requirements**
2) **Specifications**
3) **Conceptual Design**
4) **Embodiment Design**
5) **Detailed Design**