

**FURTHER FACTORS INFLUENCING**  
**DESIGN**

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# FURTHER FACTORS INFLUENCING DESIGN

1. MAINTENANCE, REPAIRABILITY AND PRODUCT DESIGN

2. DESIGN STRATEGIES

3. CUSTOMER PROFILES

4. THE ROLE OF A FOCUS GROUP

5. MARKET RESEARCH

6. DESIGN FIXATION

**FOR MORE FACTORS THAT INFLUENCE DESIGN - DOWNLOAD THE APP "FACTORS INFLUENCING DESIGN" from the App Section of [www.technologystudent.com](http://www.technologystudent.com)**

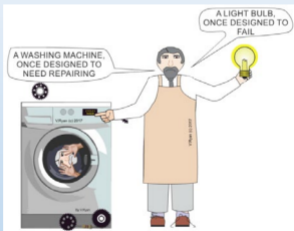
# MAINTENANCE, REPAIRABILITY

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Products are often designed to be thrown away when they fail. This is especially the case in respect to small electronics devices.

However, there is a growing consumer campaign, to ensure that products are as environmentally friendly as possible. One way that this can be achieved, is through designing products that can be repaired and maintained.

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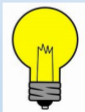


## REPAIR AND MAINTAIN - THE OPPOSITE TO 'BUILT IN OBSOLESCENCE'

V.Ryan © www.technologystudent.com 2019

There was once a time when designers developed products, so that they would eventually fail. This was an attempt to get the customer to buy a replacement product, from the company that provided them with the original. Light bulbs were once manufactured to fail after a certain number of hours. It is believed that washing machines were once designed to fail, forcing the owner to buy spare parts (at a high price) or to buy a completely new machine. For more on built in obsolescence go to [What is Planned Obsolescence?](#)

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# ADVANTAGES OF REPAIRABLE PRODUCTS AND THOSE THAT CAN BE MAINTAINED

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Can be updated, to be more efficient, lengthening their useful life time.

It is cheaper to repair than replace an entire product.

Repairable products are environmentally friendly, as they save/conserves materials and help limit damage to the environment.

Some products need annual checks / servicing, to ensure they continue to work, are safe and efficient (e.g. a car).

Products that can be repaired / maintained are beginning to be popular with consumers.

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more  
ADVANTAGES



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# MAINTENANCE OF PRODUCTS

## KETTLES

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The kettle shown below, is typical of kettles that are often thrown away, when they fail. For instance, when the heating element fails, it is difficult to replace and therefore the customer will buy a new kettle.

Another issue is that products such as this, are often difficult to dismantle, so that there parts can be recycled.

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# MAINTENANCE OF PRODUCTS DRILLS

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Designers must ensure that customers know about maintenance checks and the servicing requirements for the product.

What parts of the drill need checking for damage or normal wear and tear?

**Tap the image for the ANSWER**



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# MAINTENANCE AND SAFETY OF ENGINEERED PRODUCTS

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The proper maintenance of a machine is essentially, if it is to have a trouble free and long useful working life. Without regular maintenance, a machine could literally grind to a halt, or produce inaccurate work pieces and more importantly, become dangerous to use. Regular maintenance and safety checks are a legal requirement.

E.G. a centre lathe – in addition to maintenance checks, safety checks should be carried out before a machine is used. The manufacturers instruction booklet, will state maintenance / safety checks that should be carried out, and how often this should take place. Checks, should be recorded and stored, as they can be regarded as legal documents.

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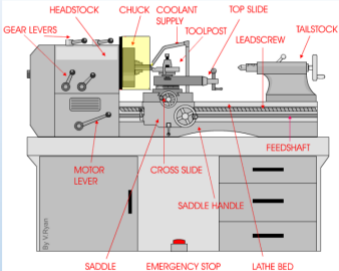


## SOME OF THE SAFETY / MAINTENANCE CHECKS TAKE PLACE DAILY

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Machines must be checked regularly for faults to guards, microswitch operation and to ensure that they work properly. An annual safety / maintenance check is a legal requirement.

**Tap the image below** for more information on safety and maintenance checks



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## REACTIVE AND PROACTIVE MAINTENANCE

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### REACTIVE MAINTENANCE:

This is maintenance that takes place, after a fault has been identified or a part has failed. There will always be times when parts fail or are damaged. For instance, a technician responsible for checking a centre lathe in the morning, before it is used during the day, may spot a damaged guard. He/she will then replace it immediately, or prevent the use of the machine, until the guard is repaired or a replacement arrives. Reactive maintenance means 'reacting', when a fault / damage has already occurred.

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## REACTIVE AND PROACTIVE MAINTENANCE

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### PROACTIVE MAINTENANCE (PREVENTATIVE MAINTENANCE PLAN OF ACTION):

This is often the best form of maintenance. It is when a potential problem / fault is identified, before it causes a failure. This often occurs during routine maintenance and safety checks. For instance, a technician may be carrying out a daily check on a centre lathe and spot that the oil reservoir needs topping up with oil. The reservoir feeds oil onto the gear system that drives the lathe. Without oil, damage to the expensive gears will take place. Topping up the oil reservoir is 'proactive maintenance'.

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# MAINTENANCE AND SAFETY OF MACHINES (BOXED LEARNING EXERCISE)

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Some of the important maintenance and safety checks for a centre lathe, have been identified on the image below and each has an 'empty' box inside which, you will write an explanation

**Tap the image for the exercise**

**MAINTENANCE AND SAFETY OF ENGINEERED PRODUCTS**

**INSTRUCTIONS:** The maintenance of machines and safety checks, are extremely important. For each of the 'checks' shown below, write brief notes in the relevant box, justifying their importance.

Download or open the free pdf interactive mobile Apps, in the App Section of [www.technologystudent.com](http://www.technologystudent.com) for help in answering this question sheet.

<b>DRIVE BELTS / GEARS... CHECKED FOR DEFECTS</b>	<b>CORRECT OPERATION OF STOP/START BUTTONS</b>	<b>GUARD CHECK INCLUDING MISC-SWITCH OPERATION</b>	<b>GREASE FITTING - FEEDS GREASE INTO IMPORTANT BEARINGS</b>
<b>ADJUSTMENTS MADE</b>	<b>OIL LEVEL</b>		<b>MOVING AND SLIDING PARTS CHECKED FOR CORRECT WORKING ORDER</b>
<b>GOOGLES CHECKED FOR DAMAGE TO THE LENS</b>		<b>MAINTENANCE /SAFETY RECORD</b>	<b>OIL MOVING PARTS SPRAY OIL TO PROTECT AND LUBRICATE SURFACES</b>
		<b>EMERGENCY STOP CHECKED</b>	
		<b>COOLANT LEVEL</b>	<b>CLEAN MACHINE AFTER USE</b>

FOR YOUR ENGINEERING NEEDS GO TO [www.technologystudent.com](http://www.technologystudent.com)

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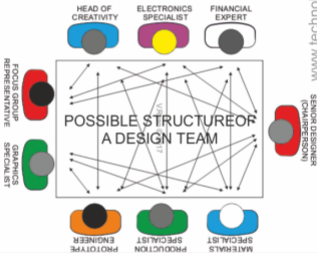
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# COLLABORATION - 1

A **DESIGN TEAM** - sometimes a team of people will work on the design and development of a product.

A design team working on a design problem, are more likely to develop a solution, in a shorter time, than an individual.



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## COLLABORATION - 2

### USER CENTRED DESIGN - E.G. A

focus group, is a small group of people, who are asked a series of questions about a product or service. The group may consist of a cross section of people from society or be made up specifically of potential customers OR clients.

They provide feedback on designs, ideas, design concepts etc.....

Suggest changes to a design or product, the way it looks, the materials it is manufactured from, the colour scheme etc.....

Express their likes and dislikes regarding the product or aspects.

Suggest methods of advertising the product and which types of advertising are likely to be the most successful.

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on Collaboration

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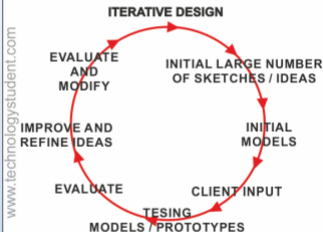


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## ITERATIVE DESIGN STRATEGY

It is a cyclic approach to the development of a product, whereby a design is improved by frequent testing, client feedback, focus groups, materials testing, prototype testing, design development and evaluation, until a final refined / developed design is reached.



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## LONE INNOVATOR / INVENTOR

Sometimes an individual will work by himself / herself, on the design of a product. **EXAMPLE:** Trevor Baylis (1937-2018) invented a prototype for a wind-up radio. In the late 1980s, he realised that people in Third World Countries, could not afford or did not have access to replacement batteries. He developed the worlds first wind-up radio - could be used in remote areas, and wound-up when required. An investor, made it possible to develop the radio and to enable production.

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on Lone Inventors

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## THE SYSTEMS APPROACH

This is a **LINEAR** approach to design. One stage follows another, As outlined below. The opposite to iterative design.

1. DESIGN PROBLEM
2. DESIGN BRIEF
3. IDEAS
4. DEVELOPMENT
5. WORKING DRAWING
6. MANUFACTURE
7. EVALUATE

The systems approach is often applied to the design of electronic and programmable circuits.



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**Tap the link button** for more information  
on the Systems Approach

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## REVERSE ENGINEERING - THEFT?

Some companies operate illegally, taking the work of others and copying their ideas, breaching copyright / patent laws. This is illegal, but it still happens.

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**EXAMPLE:** A company develops an innovative electronic device, that is a commercial success. A competitor company, dismantles the device and learns its secrets (reverse engineering), avoiding years of development costs. They manufacture their version of the device, selling it at a lower cost. Please note - The USA has complained repeatedly, that some Chinese companies have copied and marketed products, developed by companies in the USA. Foreign companies have little chance of winning lawsuits in China.

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on the Design Strategies

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# DEVELOPING A CUSTOMER PROFILE

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A customer profile is an outline of the type of customer likely to purchase your product.

Most companies / businesses constantly update the profile of their customers. A customer profile may vary from one product to another. Developing a customer profile will help you target your advertising and marketing and is an essential analysis tool, and helps in the design process.

Concentrating on potential customers will save you time and money.

**Tap the image** for information / exercises



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# **BUILDING A CUSTOMER PROFILE**

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1. Describe the type of person who could be your typical customer (or will be your typical customer).
2. What is the age range of potential customers?
3. Are potential customers likely to be male or female or does gender matter?
4. What is the geographical location of potential customers? Where are they likely to live?
5. What are the most likely occupations of potential customers?
6. What are the general likes /dislikes of potential customers?
7. What does a typical customer want from the product you design and manufacture?

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on Customer Profiles

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# THE ROLE OF A FOCUS GROUP

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A focus group is a small group of people who are asked a series of questions about a product or service. The group may consist of a cross section of people from society or be made up specifically of potential customers. For instance, a guitar manufacturer may put together a focus group of musicians in order to ask them questions relating to a new guitar design. A bicycle manufacturer may have a focus group of bicycle shop owners in order to determine the type of bicycles likely to sell in the following year.

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## ADVANTAGES - A FOCUS GROUP

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They provide feedback on designs, ideas, design concepts etc.....

They may suggest changes to a design or product, the way it looks, the materials it is manufactured from, the colour scheme etc.....

They may help the designer / manufacturer target or identify potential customers.

They will express their likes and dislikes regarding the product or aspects.

They will say if the product will sell or if it is likely to be popular.

A focus group is likely to suggest methods of advertising the product and which types of advertising are likely to be the most successful.

**Tap the image** for more detail



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# MARKET RESEARCH

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This is where a company/design team takes an initial design concept for a product and tests it out on potential customers or the general public. This is done through questionnaires, interviews and a range of other activities.

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## WHAT ARE THE AIMS OF MARKET RESEARCH?

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To determine if the design concept has any chance of economic success.

Market research often leads to suggestions regarding improving the product so that it is more likely to be successful..

The price the customer is prepared to pay for the product is often determined during market research. This sets an upper limit of cost to the design and production teams.

Market research may suggest how many individual 'units' are likely to sell. If production goes ahead, this will help determine the number of products manufactured during the first run on the production line.

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**MARKET  
RESEARCH**

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# POOR MARKET RESEARCH THE SINCLAIR C5 ELECTRIC CAR

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The C5. It was developed as a commuter vehicle for business men. The vehicle was very small and was dwarfed by other vehicles on the road. It had a limited driving range and speed and consequently looked dangerously out of place. If adequate, targeted market research had been carried out before manufacturing had started, the designers would have realised that this was never going to be a successful product.

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# HOW MARKET RESEARCH CAN BE CARRIED OUT

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A focus group of potential customers discuss the 'pros' and 'cons' of the design concept.

'Cold calling' over the telephone OR calling identified potential customers.

Volunteers can be interviewed individually or in groups.

Online (internet) Questionnaires.

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## WHAT IS DESIGN FIXATION?

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Design fixation, is a problem that all designers face at some point in their careers. It is when a design finds it difficult, to produce a range of innovative solutions, to a design problem. It sometimes takes the form, of a designer producing a number of solutions that are similar, lacking innovation and creativity. It is when a designer fails to break new ground, but follows existing solutions. It is when the designer follows conventional ideas. The saying, 'cannot see the wood for the trees', applies to design fixation. A simple solution may be possible, but sometimes, due to design fixation, a complicated solution is the result. Often, a design becomes focussed on solving a design problem in a particular way, without even considering alternative approaches.

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## HOW TO AVOID DESIGN FIXATION?

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Design fixation confines a designer to limited creativity. It is a regressive cycle, that is sometimes difficult to escape. However, there are strategies that can be employed, that will help a designer regain his / her creativity.

1. Keep solutions as simple as possible, do not over complicate designs
2. Study products that inspire you, they may provide you with a route away from design fixation.
3. Work as a team, collaborating on possible solutions. Bounce ideas of each other and listen to suggestions.
4. Think 'out of the box'. This is not easy, but design from an unusual starting point. Study existing designs, that have broken new ground, for potential inspiration.

**Tap the link button** for many more ways of avoiding design fixation



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