Maintenance is required in factories to

(1) keep plant in a serviceable condition so that work of the appropriate quality is produced
(2) preserve the fixed assets in a satisfactory condition
(3) reduce the cost of lost production due to plant breakdown.

The work of the maintenance department ranges from major overhauls and replacement of faulty parts to routine servicing and cleaning. The level of maintenance is determined by the demands of the production processes and controlled by the size of the maintenance budget.

Historically maintenance has tended to be an emergency service performed in an *ad hoc* fashion and largely concerned with getting broken-down machines back into service as soon as possible. In recent years there has been a growing awareness of the deficiencies of maintenance and replacement policies. This has led to efforts to integrate them into a more comprehensive approach, known as terotechnology. Terotechnology is concerned with the complete responsibility for physical assets from installation to replacement, including those aspects of equipment design that affect durability and maintenance. Some aspects of terotechnology are illustrated in figure 8.1.

The relative importance of the maintenance function depends on the type of product and the production layout on which it is made. In some process industries maintenance costs can be in excess of 10 per cent of the cost of goods sold. There is no generally accepted measure of maintenance efficiency; however, if the following parameters are calculated periodically they can provide useful trends.

(1) Annual maintenance cost/replacement value of plant maintained.
(2) Annual maintenance cost/annual cost of goods sold.
(3) Down time/total scheduled production time.

### 8.1 Maintenance Policies

These vary from breakdown maintenance, in which the equipment is run until it fails and is then repaired, to preventive maintenance where an attempt is made
to avoid breakdown by anticipating failure or wear and making a timely examination, replacement or adjustment. Preventive maintenance is usually considerably more expensive to operate than breakdown maintenance; however, this additional expense must be set against the savings resulting from minimising the random breakdown of plant. Unless there are overriding considerations of safety, such as in aircraft maintenance, preventive maintenance should be performed only when there is a total annual saving to the company. Breakdown and preventive maintenance are not mutually exclusive; some form of preventive maintenance, regular lubrication, inspection and adjustment, is normally practised on major items of equipment, even when the main policy is one of breakdown maintenance. Conversely, with preventive maintenance the unexpected breakdown will still have to be repaired.

**Preventive Maintenance**

It is difficult to determine the correct level of preventive maintenance to apply. Often help can be obtained from the maintenance schedules proposed by equipment manufacturers, but a record of the frequency of unscheduled breakdowns and their cost, both direct and consequential, is really needed to institute and