The manufacturing enterprise is a complex organization consisting of a number of departments whose activities are closely interrelated. In most enterprises, the different activities are usually coordinated and arranged in a closed loop as shown in Fig.22.1. The figure also illustrates the important role played by computers and common data banks in the activities of manufacturing enterprises. Some of the most important activities are discussed below.

1. Sales, market research, and market forecast

Before a new product is manufactured, suitable markets have to be identified, their magnitudes assessed, and the extent of the present and future competition appraised. Product preferences may differ from country to country, or from age group to age group. These and other factors affecting sales have to be carefully studied. Market studies of various types are commonly used to identify the kinds of products that can be profitably manufactured and sold in a given environment.

2. General product concept and design

The initial design of a product is usually done by a number of design specialists. Industrial designers, mechanical and electrical engineers, materials science and other specialists, work in close cooperation at this stage.

A well designed product must be visually appealing, and have the ability to perform its function satisfactorily and reliably through its expected life. It should be easy to use, easy to maintain, and easy to manufacture at a competitive price. It should not place undue physical strain on the user. A further constraint imposed on manufactured products is an environmental one. Products should be made in such a way that they can be easily disposed of or recycled at the end of their useful life without causing damage to the environment.
3. Detailed product design

Once the general design of the product has been finalized, it is necessary to produce detailed drawings of the various components and of the assembled product. Computer aided design (CAD) is nearly always used today, and the drawings are stored in a common data base which is used as a basis for computer aided manufacturing (CAM).

In some cases it may be cheaper and more convenient to purchase standard mass produced components than to manufacture them. It may also be advantageous to purchase large subassemblies or specialized components from outside suppliers. Such a procedure is called outsourcing.

When the detailed design process has been finished, a bill of materials (i.e., a list of all required materials, components, assemblies, etc.) is prepared. This is a document that is central to the whole manufacturing process.

4. Production planning

In the production planning stage, the most appropriate materials, processes, and process parameters have to be chosen. This is no easy task, given the large number of materials and processes which are available today.

Tooling has to be chosen, and suitable dies, jigs, and fixtures have to be made. Fixtures are devices which hold a workpiece in place while work is being done on it. Jigs are devices which hold the workpiece in place and also guide the tools which do the machining.

Group technology is used to identify and manufacture parts which have similar features. It is more economical to use group technology and manufacture families of parts with similar features using the same sequence of processes, than it is to manufacture them individually.

5. Process research and development

Research and development have to play an important role in the activities of a manufacturing enterprise if it is to remain competitive. Old processes have to be improved, and new processes have to be developed.

Computer modelling and process simulation are techniques which are widely used to optimize manufacturing processes. It is also necessary to consider the impact of manufacturing on the environment. Noise, gaseous fumes, smoke,