CHAPTER - 3
PRODUCT DATA MANAGEMENT

SYNOPSIS

Product Data Management (PDM): Product and Product Data, PDM systems and importance, Components PDM. Reason for implementing a PDM system, Financial justification of PDM, Barriers to PDM implementation.

3.1 PRODUCT AND PRODUCT DATA

- A product is the source of company revenues and product data defines and describes the product and its features. If something wrong (For example, wrong entry by mistake) happens with product data, then there will be problem/s with the product. Any problem with the product will result in loss of money or reputation. The product data is important throughout the product life cycle. It may be needed at any time and has to be available whenever or wherever it is needed by who so ever throughout the product lifecycle.

- The term product has been described and discussed in detail in chapter 1. The term "product data" includes all data related both to a product and to the processes that are used right from the imagination stage to design stage to manufacture it during use of product, during its service and also the data related to its disposal phase.

- Whatever is the product made by a company, an enormous volume and variety of product data is needed to develop, produce and support the product throughout the lifecycle. This data can be of various activities like

  o describe the characteristics of the product, or a part of the product.
  o detail of its packaging, or a label, or an identifier.
  o describe a process related to the product.
  o special operations required on products either while manufacturing or packaging.
  o describe a structure such as a BOM or a list of ingredients or parts.
  o describe guidelines related to use of machines or processes.
  o describe a regulation that the product must comply with.
  o installation manuals for maintenance of product.
  o data of various analysis like stress analysis or circuit analysis
  o machining or welding manuals.
  o inspection procedures and guidelines.
  o packaging process and environmental norms.

- Product data is created and used throughout the product lifecycle. Getting it organised, and keeping it organised, are major challenges. If the data is not maintained, it will decay or be discarded. Even the smallest product related information may be crucial at times. As such, it's a major asset, a strategic resource, and should be used as profitably as possible

- Product data is created by different departments from different activities.

For example: NC programs or bill of materials or tool path is created in design and manufacturing department, sales entry or customers feedback is created by sales and service department etc. For much of the twentieth century, paper was the medium for storage, transfer and communication of most product data.

- The mode of collection and storage of this data was 'paper' and the data on particular paper was given a name.

  For example, form, record, report, procedure or policy. A list of collection of data with variety of names is shown in Table 3.1.

Table 3.1

Analytic models	Analysis results	Assembly drawings	As built configuration	Bill of materials
Cad geometry	Consumables lists	Cutaways	Engineering drawings	Change data
Costing data	Customer requirements	Disposal lists	Design specifications	Cut sheets
Equipment logs	Equipment data sheet	Exploded views	Factory layouts	Failure reports
Flow charts	Formulae	Functional specs	Label information	Ingredients list
Line lists	Machine libraries	Maintenance info	Material certification	Mounting data
NC programs	Packaging standards	Parts classifications	Parts lists	Patent reports
Photographs	Pipe specifications	Pneumatic diagram	Process model	Project flows
Project plans	Process plans	Purchasing data	QA records	Recipes
Regulatory rules	Results of calculations	Scanned drawings	Schedules	Service lists
Service manuals	Shop floor instructions	Simulation results	Sketches	Software
Spare part info	Specifications	Standards	Standard costs	Status logs
Test data files	Technical publications	Test results	Tool designs	User guides
User manual	Validation reports	Versioning data	Wiring diagram	Video files
Record	Form	Report	Procedure	Policy
Directive	Guideline	Rule	List	Standard
Template	Document	Protocol	Sheet	Chart
Drawing	File	Folder	Bill	Instruction
Plan	Diagram	Schedule	Log	Order

- As understood from Table 3.1, the same document was called by different names in different organisations. Diagram was also referred as figure, chart, visual, sketch in different organisations. A policy for one company would be a procedure for another, and an instruction for a third. The names were different with similar meaning because these names were not standardised. As a result, the collection that was referred to in one company as a record would be referred to in another company as a report.

- Product data supports the product across its lifecycle. In some cases, for products such as power plants and aircraft, the overall product life may be more than 40 years. During this time, there will be a vast volume of data generated first to design and manufacture the product, and then to support its use.

- Different types of data will be produced and needed at different times. New data will be produced, existing data will be reused and perhaps modified. Over a long life, the product may be repaired or upgraded to such an extent that most of the original product will have been replaced. At all times, the configuration documentation must correspond to the exact state of the product.

- An aircraft may need to be repaired in any part of the world. Information must be available on its exact configuration at any moment and in any location.

- Similarly, product configuration data may be required anywhere in the world for naval vessels. If a ship has problems in the Antarctic, it is preferable to know the exact configuration and to be able to fly a spare part out to it, rather than bringing it back to a Northern Hemisphere port to find out which parts are currently

- on board. At any moment, it may be necessary, for any of a variety of reasons, to look back at the design of a particular part or batch.

- A batch of biscuits may be inedible. A batch of airbags may be faulty. A part may have failed on a 30-year-old aeroplane.

- Many companies must keep original drawings of their products going back over many decades. They must be able, for legal reasons, to trace back the components of their products.

- Customers increasingly want food to be traceable back to its farm of origin. Food producers see this as a key element in increasing consumer confidence in food product safety.

- An audit trail needs to be kept so that it is possible to go back in time and see how, and why, a particular part or product was made. An audit trail is essential to locate and correct design errors. Security needs to be maintained throughout the product lifecycle.

- It is not enough to maintain a secure environment during the development phase. Information must also be secure during the support phase. Just as some designers will not have the right to see some information, some maintenance staff will also have limited access rights.

- During a long product life, major problems can be caused by the departure of key individuals. In some specific areas, they may have unique knowledge, and unless the necessary actions are taken, their departure can have unforeseen effects. This is another activity for which knowledge-based systems are useful.

3.2 PRODUCT DATA MANAGEMENT SYSTEM

- As a product is important to the company, so is its related information or data. The product data will help to trace the product throughout its lifecycle and also for design of new product. As ADHAR card has all the information about the person, PAN card has all financial information of the person, PDM system has complete information about the product throughout its lifecycle. PDM also has the purpose of managing product data which is one of the most important elements of the PLM environment.

- It can manage all the products data created and used throughout the PLC. It can provide exactly the right information at exactly the right time. Throughout the product lifecycle, information is all-important. The PDM application is capable of providing the product related information available wherever it is needed and by whomever it is needed. There are many activities in the product lifecycle and all the activities are to be managed. Huge amount of data is generated when during the management of these activities during the life cycle of a product. the different activities can be understanding the market requirement, product design, design analysis, manufacturing of product, inspection and quality control and product support.

- PDM controls the creation and use of product information throughout a product's life. PDM make it possible to reduce lead times and product costs and improves market share and revenues by improving the use, quality and flow of product data and by supporting new product development and support techniques.

- Many people and different level managers are involved in the workflow of overall process in an organisation. There are many activities that run parallel and often activities overlap. This makes the system complicated as it may be confusing to decide which activity to perform or which activity deadline to follow. Any system that is put in place to manage the product workflow and product information must be sufficiently powerful to maintain control, yet flexible enough to allow the changes, that characterize the product development and support environment, to occur. PDM systems provide support, in this complex environment, to the many activities of the lifecycle such as design, data sharing between multiple users, the tracking of engineering change orders, the management of design alternatives, and the control of product configurations.

- The PDM system needs to have the following characteristics
  - It is able to allow partial, or early, release of data.
  - It needs to allow changes to be made as work progresses.
  - It needs to be able to manage activities that are still primarily paper-based as well as those that are computer-based.
  - It needs to be able to handle scanned paper drawings as well as the data in CAD files.
  - It needs to be able to work with different levels of data definition, and with different representations of data.

- PDM systems need to manage the large volumes of product data generated by computer-based systems. This data and workflow management is essential to improve productivity and to respond more flexibly to customers. PDM systems offer the potential for better use of resources, better access to information, better reuse of design information (since this will be under better control), better control of engineering changes, a reduction in development cost (since it will be easier to be aware of real costs during the engineering phase), a reduction in lead times, and improved security of product information.

- PDM systems help companies to improve their competitive edge. They help improve the productivity of the product development process. They allow companies to be more flexible in their manufacturing. They help companies improve the quality of their products, and they allow these companies to be more adaptable to market requirements, and more supportive of customers.

3.3 THE IMPORTANCE OF PDM SYSTEMS

- The activity of product development in a company is a basically focussed on achieving the set targets. Due to globalisation and competitiveness in the market, companies have to reduce product related cost and lead time as well as increase quality of the products. These activities are the prime targets of the product development cell of a company.

- The quality of a product is defined during the design stage, so the improvements in product quality must be made during the design stage only. But the product development system ensures that the best manufacturing processes are employed so that best quality products are produced.

- Similarly, the cost of product is decided in the design stage only. But this cannot be the final cost as product development stage has a major influence on the product cost and almost 70 % of the costs are defined by these activities. The actual cost depends upon the issues during the manufacturing of the product. Correct decision taken during this stage may keep check on the cost of the manufactured product. The PDM activity takes care to maintain the cost otherwise the expensive product may not be accepted in the market.

- Product development is an upstream activity, meaning it has top to bottom approach. The activities come from top level to bottom level. This means that the product design released by the design department is followed at the shop floor. If mistakes occur upstream, the downstream functions, such as shop floor operations, will suffer. A change made before a design is released is relatively cheap to correct. A change made once a product is in production may be hundreds or even thousands of times more costly to correct.

- A customer is delighted if the quality of product is good. At the same time the improved quality of product will reduce recall and rework and ultimately scrap. This will help to build the brand image of the company and also reduce the administrative activities which were required otherwise.

- PDM has a major influence on the productivity of the product. with PDM system in place, the product development managers will know the exact design status. They will be able to assign resources in a better way and release designs faster and with more confidence. Design engineers will know which parts are available and which procedures should be followed when designing new parts. Manufacturing engineers will be able to see how similar parts have been made previously.

- PDM helps to reduce the time-to-market the new product. this allows the product to come early in the market. The customers review on the product may be considered in the design of improved versions of the product. As the launch of product is quick, the improved versions also come sooner than the competitor's product come to the market.

- PDM has a better control on the product activities and the information associated with it. This helps to reduce the lead time, reduce product cost and improve the product quality. Reduction in time-to-market provides opportunities like higher product cost, capturing market, increase in share and early innovation, ultimately leading to increased profit.

3.4 COMPONENT OF PDM

Product Data Management (PDM) systems are one of the most important components of a PLM solution. They are the primary system component of PLM. They are systems to manage product data and product workflow. The basic components of a PDM system include:

- the information warehouse or vault, where product data is stored.

- the user interface, which provides a customised interface for users. It supports user queries, menu-driven and forms-driven input, and report generation.

- the information management module, which manages the information warehouse. It is responsible for such issues as data access, storage and recall, information security and integrity, concurrent use of data, and archival and recovery. It provides traceability of all actions taken on product data.

- system interfaces for programs such as CAD and ERP.

- information and workflow structure definition functions which are used to define the structure of the data and workflows to be managed by the PDM system. The workflow is made-up of a set of tasks. Data such as resources, events, responsibilities, procedures and standards can be associated to these tasks.

- information structure management functions that maintain the exact structure of all information in the system across the product lifecycle.

- workflow management functions that keep workflow under control, for example, managing engineering changes and revisions.

- system administration functionality which is used to set-up, and maintain, the configuration of the system, and to assign and modify access rights.

- Whatever the PLM strategy that is chosen, it is probable that PDM will be a major constituent. Unless the product data in the PLC is under control, it will be difficult to get the product under control.

3.4.1 Information Warehouse

- The Information Warehouse is used to store all types of product data and information. Information only has to be entered once into the information warehouse. All information is traceable and acts as a single source for all product information.

- Information can be of varying sizes and formats. Information may be text, numeric, or graphic. It may have been created internally or externally. Information will be in various stages of product development.

- It also stores information such as relationships, workflow models, and product configurations. It will store computer applications and technical manuals. It will store procedures and standards.

3.4.2 Information Warehouse Manager

- The role of the Information Warehouse Manager is to store incoming information securely and with integrity, to provide controlled access, and to protect product information.

- The Information Warehouse Manager is sometimes referred to as a librarian module.

- The Information Warehouse Manager must be able to keep track of information outside the company, for example, information that's with suppliers.

- The Information Warehouse Manager provides check-in/check-out facilities for individual files and sets of files. It's used to set-up and maintain parameters describing data characteristics.

- It provides access to information through a range of permission levels. These allow access to be controlled by a variety of criteria such as user, product, project, group, device, state of information, and type of information.

- The Information Warehouse Manager limits access to authorised users. Some users will have view-only rights, some may copy data, others may read and write data.

- The Information Warehouse Manager provides security information on all unauthorized attempts to access data.

3.4.3 Infrastructure

- The basic infrastructure of the environment includes computers and a communications network. The PDM system runs in a multi-vendor computer environment. Some computers may be in the company, some may be in other companies in the extended enterprise, some may be on the Cloud.

- The infrastructure will probably include workstations, personal computers, tablets and smart phones as well as other devices. These may range from smart 3-D devices to less sophisticated 2-D view-only terminals.

- The infrastructure also includes other input devices, such as scanners, and output devices, such as printers and plotters.

- The communications network will include both local area networks (LAN's) and wide area networks (WAN's), so that information can be communicated both on one site and between sites.

3.4.4 System Administration Manager

- The System Administration Manager is the component of the PDM system that allows the initial configuration and environment of the system to be described. The manager will also be used to handle the changes that will occur in the environment.

- The System Administration Manager will be used to define users and applications in the environment, and to define and modify the access rights of individual users.

3.4.5 Interface Module

- Suitable interfaces will be needed for data access directly from a terminal without going through another application. Users may want to know what work they should do next. They may want to check on existing parts or look at test results. The user interface needs to support queries of many different types as efficiently as possible.

- The interface should be common to all the graphics devices in the environment.

- An efficient and secure interface is needed for access by these applications.

- The user interface should be easy to understand and use without lengthy training.

- The interface should include an online help facility.

3.4.6 Product and Workflow Structure Definition Module

- The Product and Workflow Structure Definition Module is used to define the initial structure of a product and also define workflows. The product structure defines the information requirements of a product throughout its lifecycle.

- The product structure describes the information that's needed, or is produced, at each phase of the lifecycle. The workflow is defined as a set of tasks, characterised by resources, events, associated information, responsibilities, decision criteria, procedures to be used, and standards to be applied.

- The product structure and the workflow structure are closely linked. For each group of products, there will be a specific product structure and a corresponding workflow structure.

- New product structures can make use of parts of existing structures. The product structure has to be sufficiently flexible so as to be able to handle changes to information structures and items. The Product and Workflow Structure Definition Module should offer the possibility to add or associate information when enough information is not available to define a product, workflow, or relationship.

3.4.7 Workflow Control Module

- For a particular task, the product structure and the workflow structure will have been defined by the Product and Workflow Definition Structure Module. The Workflow Control Module then manages the workflow of the various activities in progress, and monitors progress. It controls the progress of projects in an event-driven mode.

- Workflow Control Module is in control of the activity. It assigns tasks to individuals, informs them of the resources to be used and the procedures to be followed, initiates the associated actions, and maintains status information. If necessary, the Workflow Control Module can remind users of standard operating procedures, and can check that standards information is accessed.

- It distributes data and documents to the individuals as needed. If the person responsible for the next step is absent, it can automatically pass the work to the most suitable replacement or the next highest authority.

- The module on the basis of the workflow and product structures ensures that all necessary information is available before releasing parts to manufacturing.

- It can notify other people that a change has-been requested. It can initiate messages based on parameters captured at each step. It can notify downstream users that modifications have been made to upstream information.

- It keeps status information up-to-date, and ensures that information is handled as planned.

3.4.8 Information Management Module

- The information items include all the product data needed to specify, build, test, install, operate, and maintain the product, and to support its end of life. This will include information such as specifications, drawings, lists, programs, reports, and installation manuals.

- The Information Management Module is used to describe the exact configuration of a particular product throughout its life. It relates components, subassemblies, and assemblies.

- It maintains a complete history of the product through design, manufacture, delivery and field use to end-of-life and the status of all information is maintained.

- The module can distinguish between the as-designed, as-planned, as-built, as-installed, and as-maintained configurations of the product.

- The module maintains exact configuration information on each individual product. It offers the possibility to navigate product structure by paging down and traversing the workflow and information structures. It allows information to be accessed in many ways, such as by model number and by part number.

3.5 REASON FOR IMPLEMENTING A PDM SYSTEM

- Whenever a new system is to be implemented, there are many people who resist it than the people who accept it. This is commonly seen in any organisation whether private or government. There are many reasons that people or managers make who are reluctant to change and learn new things. They have many reasons to justify that something new is not going to be good. The reasons can be grouped into eleven categories. In each category, most of the reasons can be related both to the resolution of current problems and to proactive improvement of activities across the product lifecycle.