

## **UNIT-4**

### **Chapter-5**

# **Product Life Cycle and Product Data Management**

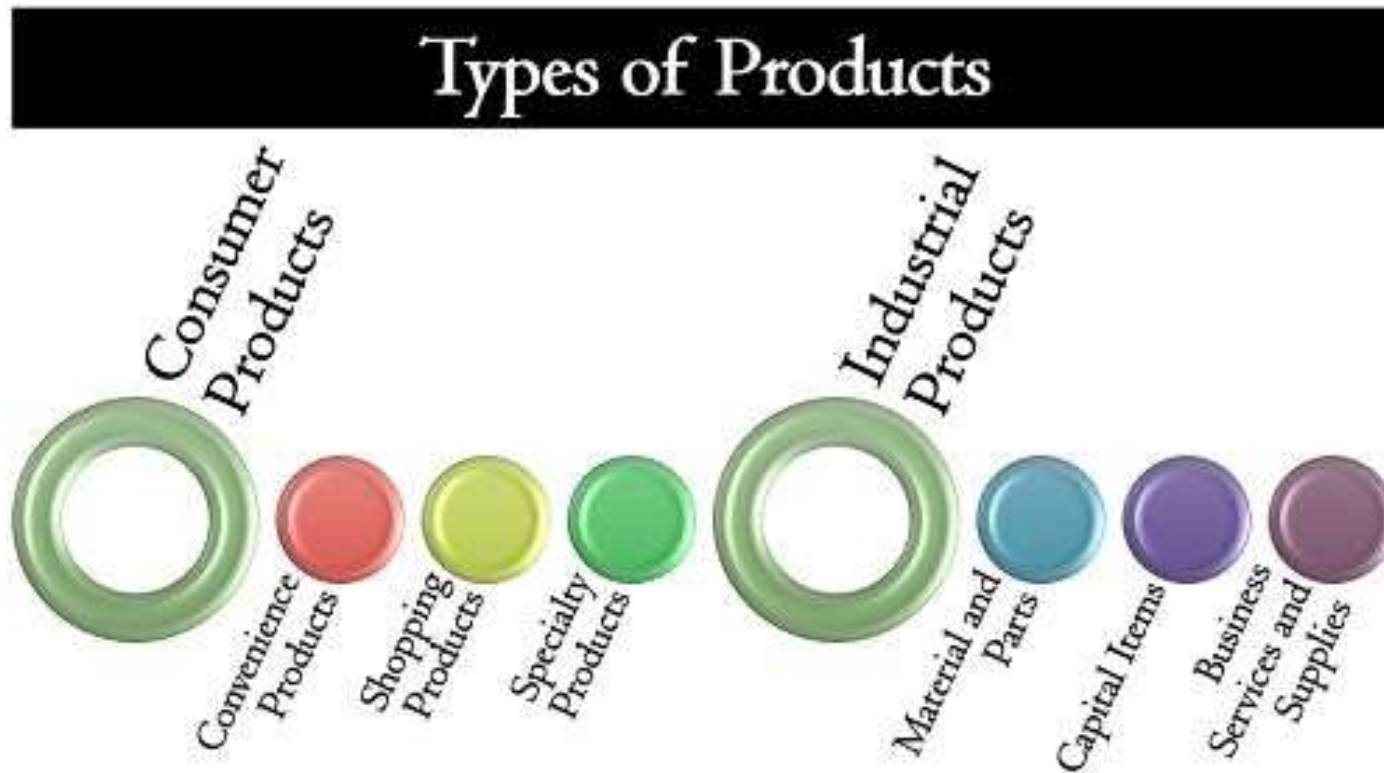
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## Product Life Cycle (PLC)

- **Definition:** Product life cycle can be defined as the analysis of the complete life span of a product. It is divided into five stages, i.e., development, introduction, growth, maturity and decline. It is an essential tool for analyzing the prospective success or potential of a new product through research and development.
- Just like humans, a product also has a life cycle which involves multiple stages. However, a product can be saved from declining in the market if necessary steps are taken on time to improvise or replace it.

## Types of Products

- A product is a good or service which can be sold in the market. These products can be classified under the following two categories:



## Types of Products

### 1. Consumer Products

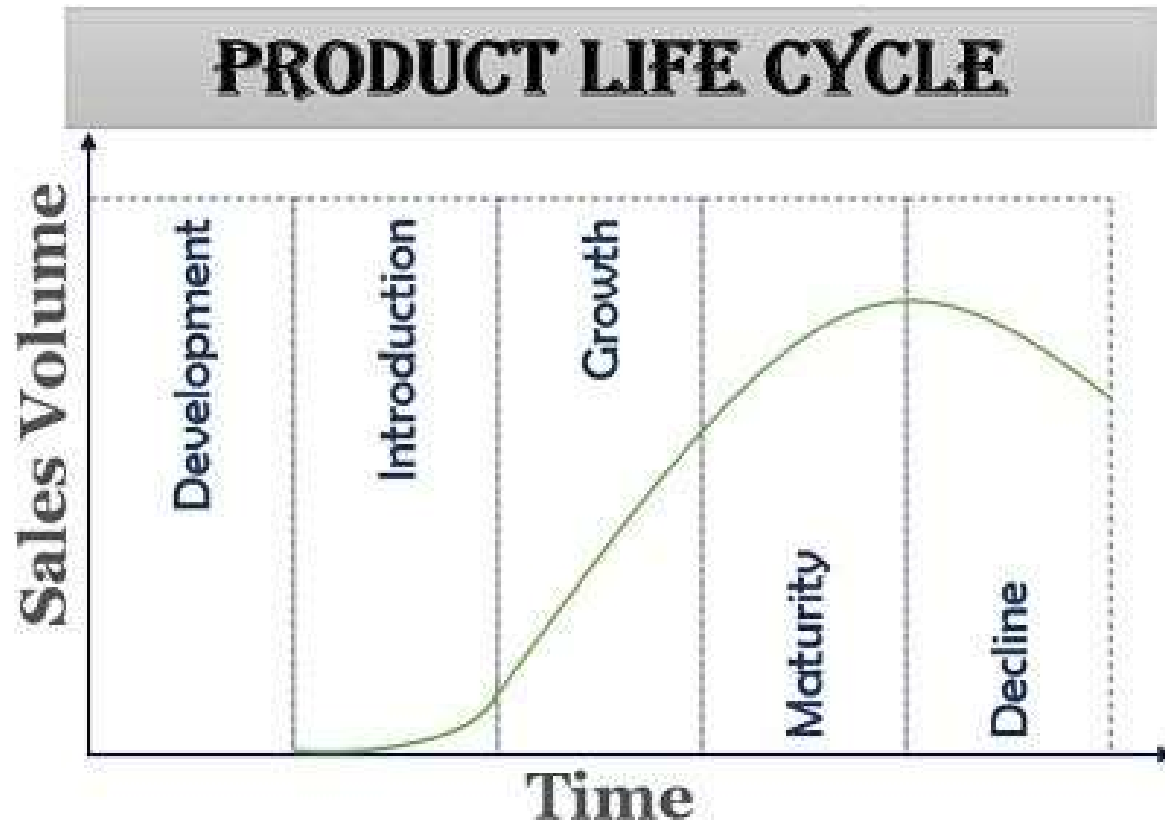
- The goods or services purchased by individuals to meet their personal needs are considered as consumer products. These are primarily of the following three types:
- **Convenience Products:** The products which are available with ease and fewer efforts and bought in small quantities are known as convenience products. It includes sugar, milk, stationery, newspapers, medicines, etc.
- **Shopping Products:** Purchase of these products are dependent upon consumer's choice and preference and requires time and efforts for shopping. Most durable products, such as electronic appliances, furniture, jewelry, etc. are categorized under shopping products.
- **Specialty Products:** The products which require a lot of efforts to be selected and the demand for these are quite limited and expensive. The examples of specialty products are sculptures, artwork, paintings, etc.

## 2. Industrial Products

- The goods and services utilized for the production of consumer goods are known as industrial products. These products are divided into the following three types:
- **Material and Parts:** The raw material and the tools or supporting equipment used for the production of the consumer products are termed under this head. The various items belonging to content and parts are cement, steel, plastic, motor, pump, trolley, etc.
- **Capital Items:** The fixed assets used for manufacturing, supply and management of consumer goods are defined as capital items. It includes machines, land, plant, building, etc. together with its installation.
- **Business Services and Supplies:** These products are the secondary goods or services which support the manufacturing activities. The services include advertisement, transportation, legal services, etc. and supplies consist of office supplies such as pen, files, papers; whereas maintenance supplies like paint, lubricants, brooms, etc.

## Product Life Cycle Stages

- The product life cycle includes five stages defining the journey of a product in the market. Let us now discuss each step of the product's life in details below:



## 1. Development Stage

- The first stage of the product life cycle is the development stage at which the new product generates. Here, the company needs to pay off various cost involved in product research, manufacturing or acquisition without generating any revenue from it. The features of this stage are as follows:
  - Generation of a workable product idea
  - Making investment
  - No sales revenue

## 2. Introduction Stage

- At this stage, the new product is launched in the market, and the prospective customers are acquainted with it. The demand for the product is created at this stage. The characteristics of the introduction stage are as follows:
  - Creation of the product's demand
  - No or low-profit stage
  - May encounter brand issues
  - Low sales volume
  - Promotion and free samples



### **3. Growth Stage**

- The third stage of the product life cycle is the growth stage where the product sales, demand and profits accelerate. It consists of the following characteristics:
- Sales increases rapidly
- Constant price
- Market segment penetration
- High marketing and promotional expenses
- Manufacturing cost decreases
- High-profit margin

## 4. Maturity Stage

- The sales of the product are at its peak and price is competitive at the maturity stage. The features of this stage are as follows:
- Low cost due to high production volume
- Industrial profits decline
- High competition
- Optimum sales volume
- Market saturation
- The entry of new competitors
- Requires brand differentiation or feature diversification to sustain in the market

## 5. Decline Stage

- This is the last stage of the product where the demand shrinks and its sales start declining. The features of the decline stage are mentioned below:
- Sales volume decreases gradually
- Product price falls
- Low margin
- Implementation of new strategies
- Introduction of a new product

## **Advantages of the Product Life Cycle**

- A product life cycle is extensively used by the organizations to understand and estimate the performance of a product in the market. The company can benefit in the followings ways from a product life cycle:

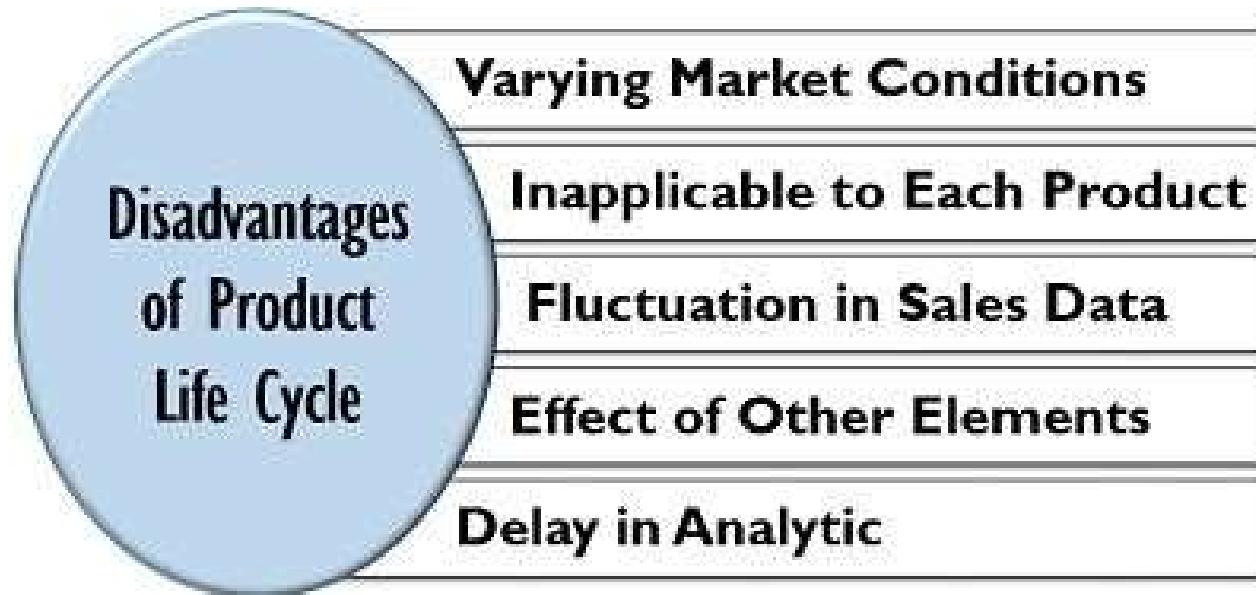


## **Advantages of the Product Life Cycle**

- **Easy Sales Forecasting:** The product life cycle is an estimation of the sales which the product will be able to make in its life span.
- **Competitive Advantage:** Analyzing the life of a product in the market and framing the strategies accordingly, helps the company to face competition.
- **Defined Strategies:** If the company is aware of the product's future performance, the company can determine and plan the strategies in the long run.
- **Decision Making:** To make crucial decisions related to the product such as product development or improvement, product life cycle analysis is essential.
- **Marketing Target and Positioning:** Product life cycle provides for targeting the right audience and establishing the brand image of the product.

## **Disadvantages of the Product Life Cycle**

- The product life cycle is a mere forecast and depends upon the prospective sales estimate. It has various other limitations which are as follows:



## Disadvantages of the Product Life Cycle

- **Varying Market Conditions:** The market conditions vary from place to place, and the same product life cycle may not be suitable for every market.
- **Inapplicable to Every Product:** Some services like mobile network and computer software, keep on frequently updating from time to time. However, it does not mean that the brand gets obsolete.
- **Fluctuation in Sales Data:** Variation in the sales data is essential for the product life cycle. But it is difficult for the company to predict such information to plot the PLC curve.
- **Effect of Other Elements:** The analysis of the product life cycle is also affected by the various elements of the 4 Ps of the marketing mix, including the product itself, price, place and promotion.
- **Delay in Analytics:** The product life cycle requires collection and analysis of the sales data, which is delayed or unavailable at times.

## Product Life Cycle Management

- The management has to concentrate on various business areas or fields to make the product a success. Following are the specialized management fields which need to be taken care of right from the launch of the product to its decline in the market:





## Product Life Cycle Management

- **Manufacturing:** The cost of production of goods and services matter and vary to a great extent during a product's life cycle. This cost very high at the development stage whereas it gradually decreases at the growth and maturity stages.
- **Marketing:** The strategy for marketing the product varies at each stage. When the introduction stage requires excessive marketing and promotion, unlike the growth stage where the product requires less publicity and is popular among customers, this strategy changes entirely at the decline stage.
- **Financing:** The initial capital requirement at the introduction stage of a product is quite high. Whereas, at the growth and maturity stage, the product self finances itself through sales and profit earned by it.
- **Development:** At the development stage of a product, the management needs to focus on research and analysis. It invests maximum time, energy and efforts in the development of a new product.
- **Information:** The collection and analysis of potential data, including market trends, effective means of promotion, prospective growth, etc. are necessary for the management.

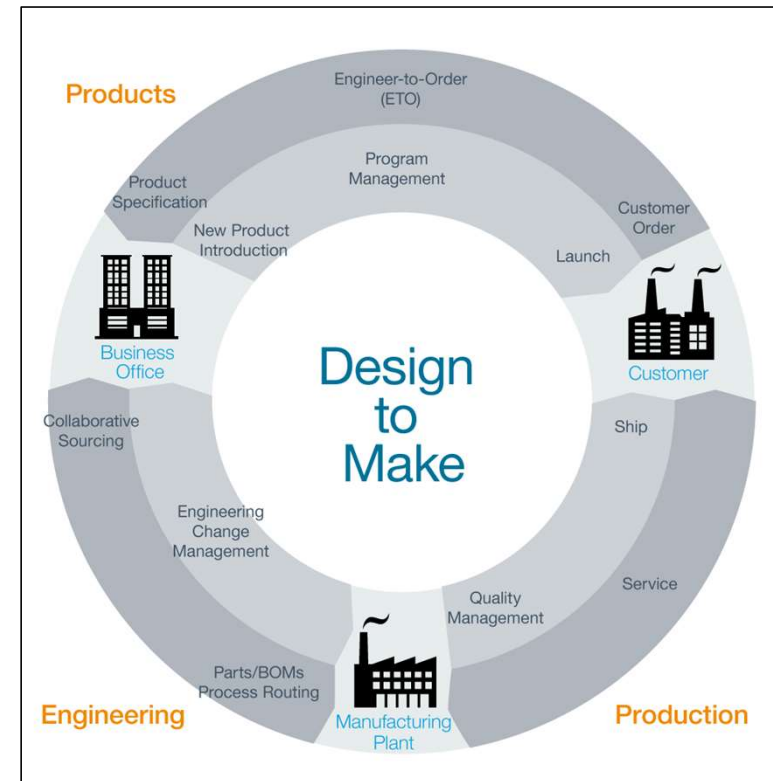
## **Product Lifecycle Management (PLM) orientation**

- Product lifecycle management is the process of managing product-related design, production and maintenance information. PLM may also serve as the central repository for secondary information, such as vendor application notes, catalogs, customer feedback, marketing plans, archived project schedules, and other information acquired over the product's life.
- The PLM process manages:
  - Products and parts, including those which are used for tooling, inspection, calibration, training, operation and maintenance
  - Documents that define the performance, functional and physical attributes of an item.
  - Ancillary documents that are used for training, operation and maintenance of an item
  - Electronic computer files that support the product's design, development, production and subsequent post-production phases
  - Material content, including reporting on legally-proscribed or hazardous substances and the identification of part recycling and disposal methods.
- Organizations that adopt PLM report that revenues increase, while per-unit product cost and administrative overhead is reduced.

## History of PLM

**Some of the milestones in evolution of PDM/PLM include:**

- 1960's: New display methods and equipment, first CADD draft and design applications, sketchpads and light pens bring innovation into the design process
- 1970's: Introduction of CAD/CAM systems, automated 2D drafting, first independent production workstations
- 1980's: PC systems were born into the real world, introducing 3D systems, PDM problematic grows up on importance
- 1990's: Parametric CAD/CAM/CAE systems integrates together with other PLM components, global market brings large PLM systems cooperation through all over the world, HW components prices and introducing IT systems rapidly grows the CAx/PLM market area



## **Benefits of Product Lifecycle Management (PLM)**

- **PLM software can help people improve their understanding of how products are designed, built and serviced.** Most users appreciate centralized access to all product-related information; they feel more productive and efficient. But the benefits are quite concrete and easy to demonstrate.
- These benefits can be categorized as
  1. Increase sales revenue
  2. Reduce product unit costs
  3. Reduce administrative and clerical overhead

## 1. Increase revenue

- It's fairly intuitive that shorter design times and faster change cycles yield earlier product introductions and optimized products, resulting in earlier revenue and longer product life.

### 1) Reduce design time

PLM avoids wasted design effort through

- immediate, managed access to all design data
  - concurrent reviews by affected data consumers without distracting designers
  - elimination of lost or damaged files
  - consistent, data-rich bills of materials with real-time cost roll-ups
  - reapplication of existing items in new designs
- Some PLM systems allow tasks to be attached directly to an document or part, keeping both designers and project managers in the loop.
  - Companies have reported time-to-market reductions of up to 75%. This may allow you to launch several months early, and grab sales for your product from your competition.

## **2) Accelerate release and change cycles**

- Perhaps the most remarkable impact of PLM is the substantial efficiency gained when processing product releases and changes. A non-automated process usually requires extensive document collection and copying efforts, repetitive and error-prone change order creation, and relying on time-consuming interoffice mail or on an engineer or change analyst walking the package from office to office. Involving supply chain partners may require express parcels, insecure or lost mail, irrelevant or incorrect file attachments, and a host of other time-wasters.
- By design, a PLM system contains all product information in a secure central location; allows multiple users simultaneous access to the data; provides templates for change types, including pre-defined review workflows, approving departments and interested observers; identifies all dispositioning tasks and rolls up cost impacts automatically; and utilizes email so there is no lag between one person's approval and the next person's notification. Changes can typically be pulled back, reworked, and resubmitted without leaving your desk to chase down a physical package.

## **2. Reduce product cost**

### **1) Conduct more comprehensive, less intrusive collaboration**

- Real-time visibility into evolving designs encourages early and frequent design checks; these permit sourcing, production, quality and service specialists, as well as supply chain partners, to provide timely feedback. Include all aspects of the product plans, drawings and procedures for production, inspection, service, repair and disposal. This information is available in a single location, without having to distract designers with on-going requests for in-process data.

### **2) Purchase fewer parts in larger volumes**

- Part re-use is difficult in larger organizations with significant numbers of parts. Relying on designers' memory or searching through the ERP system is a hit-or-miss affair, resulting in almost-identical parts being sourced. PLM encourages item exploration, which avoids sourcing new parts that are functionally similar to items already in inventory.

### **3) Increase production experience**

- Earlier product introductions ensure longer production runs; increased production experience results in more rapid, on-going cost reductions.

### **4) Reduce production rework and scrap**

- Changes are reviewed by all affected parties; on-line review and approval is faster and more comprehensive than paper-based change process; bills of materials are consistent and can include documentation on production and inspection processes.



### **3. Reduce overhead**

#### **1) Simplify regulatory and contractual compliance**

- If your development or production process is subject to audit by a third party, a PLM product can simplify review and acceptance. It's far easier to document your process when it's based on commercial-grade documentation and system configuration reports, particularly if the PLM vendor is sensitive to regulatory issues, and has experience designing compliant products.

#### **2) Mitigate and, if required, report on a product's environmental impact**

- Government regulations both restrict the types of materials contained in products and specify more stringent environmental-impact reporting.
- Europe's Waste Electrical and Electronic Equipment ("WEEE") and Restriction of Hazardous Substances in Electrical and Electronic Equipment ("RoHS") directives address product environmental impact and require material tracking and, in some cases, data reporting. The US Environmental Agency also prohibits or restricts the use of certain hazardous materials, and your company may be required to track and report on certain compositions.

- New efforts are underway, particularly in the electronics and automotive industries, to increase the use of environmentally-friendly materials, and supply chain partners often require detailed materials reporting via a Materials Declaration.
- Manual calculations, particularly for hazardous substances that are measured in parts per million (ppm) or parts per billion (ppb), can be time-consuming, imprecise and error-prone. PLM systems that can automatically calculate and report product material composition across a bill of materials radically simplify the task.

### **3) Reduce process administrative and clerical costs**

- Depending on your industry, for every 8 to 12 engineers and designers a manual document control and change management process may require a change analyst, administrator, document checker, or clerk. Implementing a PLM system may allow you to cut that ratio to 20:1 or better.

## **Essential elements of PLM**

PLM can be thought of as both (a) a repository for all information that affects a product, and (b) a communication process between product stakeholders: principally marketing, engineering, manufacturing and field service. The PLM system is the first place where all product information from marketing and design comes together, and where it leaves in a form suitable for production and support.

A few analysts use "PLM" as an umbrella term that includes engineering CAD (for "information authoring"). But product-related authoring tools can include word processors; spreadsheet and graphics programs; and even requirements analysis and market assessment tools. PLM systems, on the other hand, are necessarily broad to encompass the entire reach of a product lifecycle, and therefore are primarily focused on data management, rather than data authoring.

## **The essential elements of PLM are:**

- Management of design and process documents
- Product structure (bill of material) management
- Central data vault (electronic file repository)
- Part and document classification and metadata ("attribute") management
- Materials content identification for environmental compliance
- Product-focused project task assignment
- Workflow and process management for approving changes
- Multi-user secured access, including "electronic signature"
- Data export for loading downstream ERP systems

## Differences between PLM and PDM

### **PLM manages product information within a database**

- PLM specifies and controls the complete, approved engineering design: requirements, specifications, procedures, configurations. It defines the current product structures and planned changes, as well as maintains the history of all previous design decisions.
- PLM data is usually created and managed by engineering in cooperation with other product managers in purchasing, production, quality, service and sales. It's the container for how to buy, fabricate, assemble, test, calibrate, inspect, install, repair and even sell the end product. PLM is a cross-department information storehouse, and its data is often exported to manufacturing systems and supply chain partners.

- PLM manages objects – parts, documents, change forms, and supporting data – within a database. These objects have:
- Descriptive attributes like owning organization, identifying number, name/title, revision (technical content) and lifecycle (business rules for what can be done with that content), weight and unit of measure. CAD files (and any other files) can be attached to database records to further describe the object.
- Relationships to other objects: parts have requirements, specifications, inspection procedures, etc.; assemblies have components with quantities; purchased parts have approved sources; designed parts have design drawings.
- These attributes and relationships are created, reviewed and approved using system rules and change workflows.

## **PDM manages CAD files within a computer file system**

- CAD drawings are files, and reside principally in a computer's file system or on a network share. A CAD file often represents a single part, but several files may represent one part or one file can represent multiple parts.
- Product data management ("PDM") is a specialized file system manager, somewhat like a CAD-oriented Windows Explorer. PDM's primary job is to manage mechanical CAD files, and the linkages between related files. These related files (the "model") are usually in a proprietary format defined by the CAD vendor.
- PDM assists in organizing the mechanical aspects of a product, but it's the CAD model (or its derivative drawings), and not PDM itself, that has utility to downstream users.

## **PLM as engineering discipline**

- The purpose of engineering design activity is to create complete documentation for the manufacture and support of a product throughout its lifecycle.
- PLM, building on the earlier discipline of configuration management ("CM"), is a process for ensuring that a product consistently meets the agreed-upon specifications throughout its life.
- The PLM effort includes identifying, documenting and verifying the functional and physical characteristics of an item; recording how an item is produced; and controlling changes to a product and its documentation. The PLM process should also provide an audit trail of the decisions that affected the product design.
- The PLM process is embodied in rules, procedures, techniques, methodology and resources to ensure that:
  - The configuration of a product is documented
  - Changes that are made to a product's configuration in the course of development, production and operation are beneficial and can be implemented without adverse consequences.
  - Modifications are managed until fully incorporated into production and, if necessary, field items.



## Product Data

- Product data defines and describes the product, and the product is the source of company revenues
- If it's not managed, then, like anything that's not properly organised and maintained, it won't perform as required. **[For more issues in Product Data – Refer 2.3 Product Data issue from book Product Lifecycle Management: Paradigm for 21<sup>st</sup> Century Product Realisation. By John Stark, Springer]**

analysis results	CAD geometry	costing data	regulations
ingredients lists	customer requirements	patent reports	engineering drawings
QA records	design specifications	disposal lists	label information
flowcharts	shop floor instructions	functional specs	failure reports
user manuals	machine libraries	wiring diagram	maintenance info
NC programs	packaging standards	parts classifications	parts lists

## **Product Workflow**

Product flow during its whole life can be identified in 3 basic part:

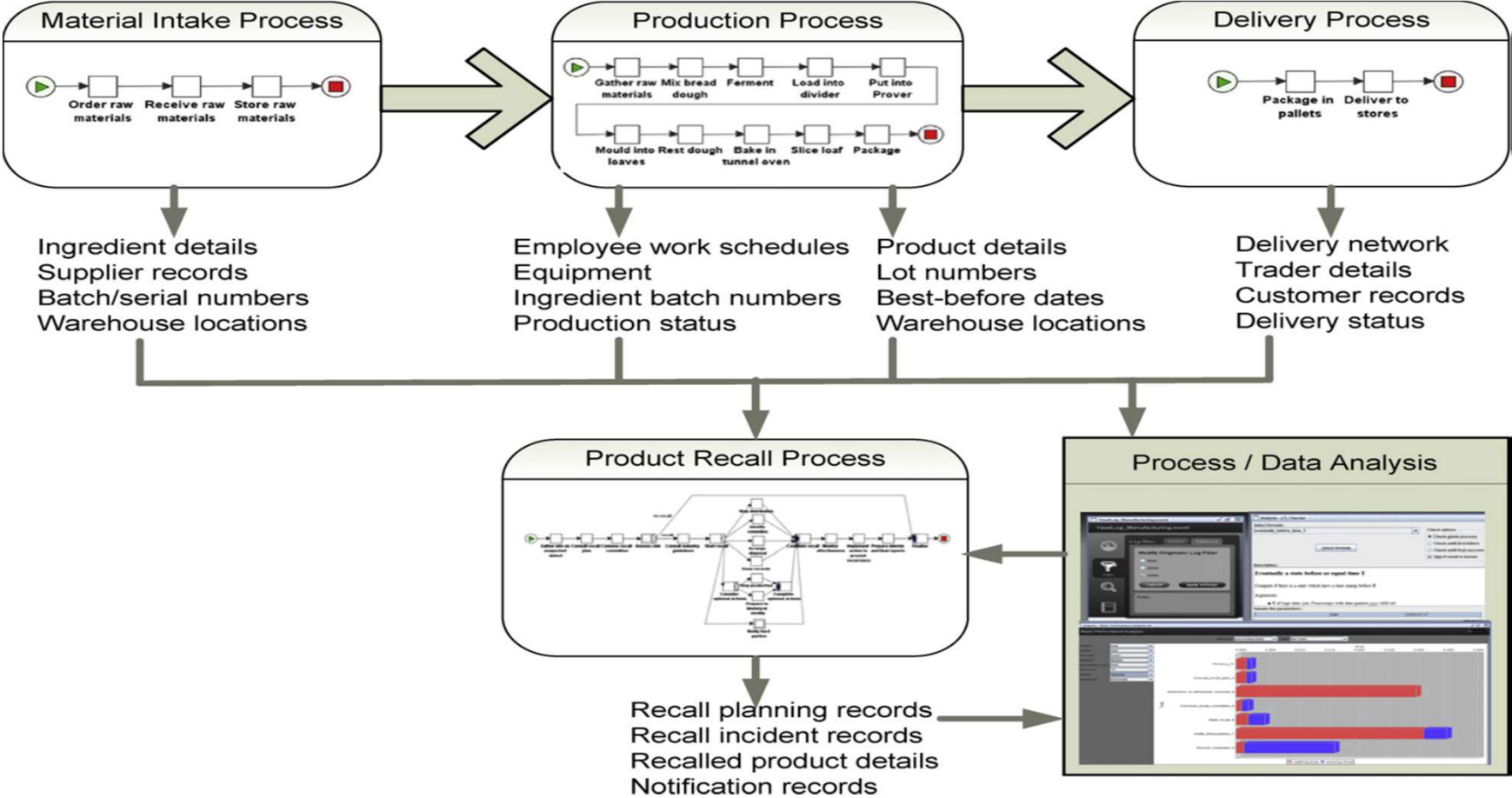
- 1) Product Specification
- 2) Product Used by the customer
- 3) Product retirement and Recycling

Any change in information of product must be communicated to the respective department and should synchronize at all levels of Product Lifecycle.

## **Product Workflow**

- A product might start life in the marketing department, and then go through conceptual design, engineering design and analysis, testing, detailed design, manufacturing engineering, process planning, tooling, NC programming, production planning, purchasing, machining, assembly, testing, packaging, technical publishing and installation,

# Product Data workflow



# Product Workflow



## Product Workflow

Suppose, a Product is to be designed and it takes 25 weeks to complete the process in various department.

Service – 1 week

Engineering – 2 week for change in product

Marketing – 1 week to review a change

Manufacturing – 3 week

Total – 37 weeks

<i>Marketing</i>	<i>Engineering</i>	<i>Manufacturing</i>
2 weeks		
	7 weeks	
1 week		
	3 weeks	
		2 weeks
	2 weeks	
1 week		
	1 week	
		3 weeks
	1 week	
		2 weeks

