

**Management Information System  
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**Week - 04  
Supply Chain Management  
Lecture – 19  
Product Lifecycle Maintenance**

Hello and welcome back in this section we will be discussing a topic called Product Lifecycle Maintenance. So, what is involved here is basically when we develop a new product and nowadays we are considering lot of features and products are becoming more technical more sophisticated with lot of software involved, say complex products. The products are becoming more and more complex; take for the example a simple phone.



For example this is the phone, which had very few features to begin with mainly voice call etcetera.

Now, with the advent of number of apps I mean you can do so, many things with your phone. So obviously, with more and more things coming up with new requirement both hardware wise also, as lot of sensors are getting into the phone. For example, lot of vibration components are coming into the phone and these can detect so many things like how many steps you are taking while walking or running.

Even you have watches tracking your fitness. But let us talk about the phone itself. Today, with my phone I can I walk 2 kilometers and it will tell me that I walked 2 kilometers and I have taken 3000 steps and I have burned so, much of calories. And how it is doing that because, it has got lot of hardware built into it, for example. Processors and sensors and they are sensing many things. This is making the phone very complex.

So, all that is now being controlled by something called App. So, we need a software to manage all this and we are not just talking about simply a product design problem which we can do in CAD (computer aided design) for example. Hardware and software together we need to manage the whole lifecycle of the development.

Because, when you start with the development lifecycle nowadays like in the previous section, we were discussing, that when you do a new product development; you have to interact with your vendors and suppliers because, you are developing a new thing. New components will be required and that has to be supplied by somebody right because everything you do not make in house.

So, when such things happen, so you have to manage the whole development process through a tool or a software, one of them is of course, ERP and we have these ERP and what are known as PLM (Product Lifecycle Management) software. So, these are all sophisticated applications coming on top of ERP and beyond ERP I would say.

Because, even the ERP itself have some PLM features, but you need more features. Software vendors are coming up with new softwares because that is also a new business. So, here we will talk about how such technologies, the software's, they work and help you to manage or maintain a product lifecycle. Every product has got a lifecycle.

You know that the phones does not last for long and the models keep changing. Why models keep changing? Because, new things are coming up new designs are coming up, new concepts are coming up. So, the same model you cannot use, as I mean in previous days, of our parents when they used to buy one phone from BSNL and use it for several years.

So, it was only for use for voice and those phones used to last for 30, 40, 50 years. And nobody thought about changing those phone handset unless it went out of order or it fell or broke. But, today that same phone it is becoming such a complex device that you

cannot think of using this same piece for maybe more than 2 years. After that the new features will get added and you will need those new features and this phone would not have those features and you will want to change it.

So, what is the lifecycle of this phone? It took probably 6 months to develop or 3 months, I do not know maybe Samsung must have taken 3 months or 6 months to develop this product. And, then lifecycle of this model will run for maybe 3 or 4 years and after that this model you will not find anywhere in the market. It gets outdated. So, that is the life cycle.



Product lifecycle management is a new set of enterprise application that manages all data and information about a product from it is initial conception to retirement. Retirement means when the product gets withdrawn from the market. And the product is no longer manufactured. Like a car for example, Maruti you know no longer manufactures their Zen model or Maruti Omni van for example, or the Gipsy car is also no longer manufactured.

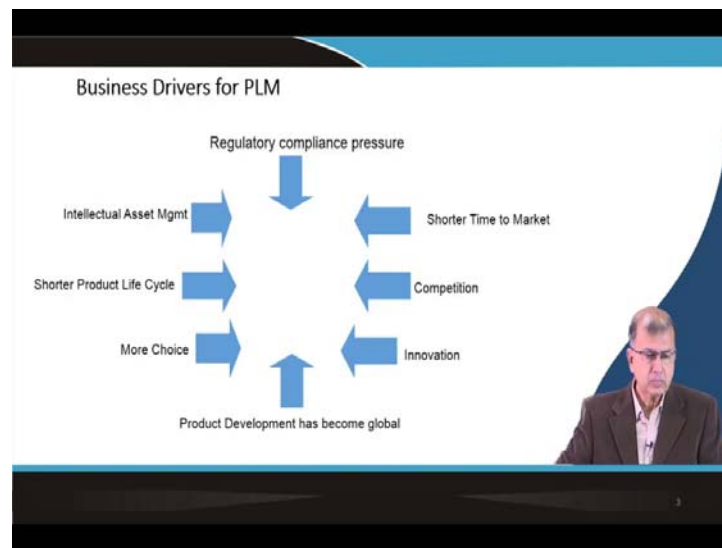
So, even in the car industry we can see, production of a model gets stopped and spares will be available for another maybe 1 or 2 or 3 years and after that we do not know. So, product lifecycle includes: - design, manufacturing and ensuring quality of the product throughout it is lifecycle. Ensuring product safety during its usage and finally, ensure service till the product gets retired from service.

It is very important, when I develop a product, to ensure that it should be safe to use and it should deliver whatever it is supposed to deliver ensuring the quality of service. And finally, it has to be maintained because something can go wrong for which, I have to have adequate spares available for this particular model.

But, after it is retirement may be fine we decide we will stop manufacturing this from say year 2021, but then people already who have bought those in 2021, they will expect to use it for another 1 or 2 years.

So, you have to maintain those, by making spares available for another couple of years. So that, if something goes wrong with some of the product in the market, people should get that service otherwise you will get a bad reputation. Your reputation will be at stake.

So, people next time will think twice before buying a phone from your company, they know that this company suddenly stop production and then you know you will not get service, nor get the spares. So, maybe you should look for alternate supplier.



Business drivers for PLM:- Intellectual Asset Management. Lot of IP gets created during a product design and development process.

Intellectual Property:- that is an intellectual asset and that has to be managed. It has to be driven by a software because, you have to check whether somebody is copying that or not. If there is a copying then you have to sue and when you sue you have to give a lot of data and information. All that data and information will come from your software which

has recorded all the design details. When it was developed, what was developed, time, date, everything gets recorded.

So, the court of law will ask you to give all data for the product that was developed by you. So, they will depend on this data supplied by the software because, there you have the date and time stamp for all the activities. So, these things play big role when you know you have court cases and legal problems happen between different companies.

Shorter product lifecycle - product life cycles are becoming shorter. So, we really use throw and replace products like phones and even cars or whatever nowadays. Earlier day's people used to buy a car and that to last lifelong. Today nobody even thinks of owning a car and then running it for 20 years or 30 years. Every after 7 years, 10 years people change their car for various reasons. So, the life cycle is shorter because you have more choice.

Product development has become global: - That is very important and if we look at, for example, Apple iPhone. It is designed in US in their headquarters. And then components are supplied by Samsung from Korea, Foxconn from Taiwan, other Chinese companies and finally, it is assembled in China.

So, you just see the value chain or the supply chain. Design starts at US, while components get manufactured accordingly at various vendors spread across the world. When a new iPhone model comes up there will be requirement of new components, new processor, and new memory chips new glass etcetera.

So, they will get manufactured at various suppliers and one of the supplier is Samsung a competitor, but still it is a supplier to the iPhone. And then in Taiwan the chip manufacturers and in china many of the body parts are made. And they will get assembled in China.

So, this product development has to be integrated. You have to communicate with everybody, your design details etcetera, contractual terms and conditions. And very important here intellectual asset management because, you are giving Samsung access to your product design and Samsung phone is a competitor for iPhone.

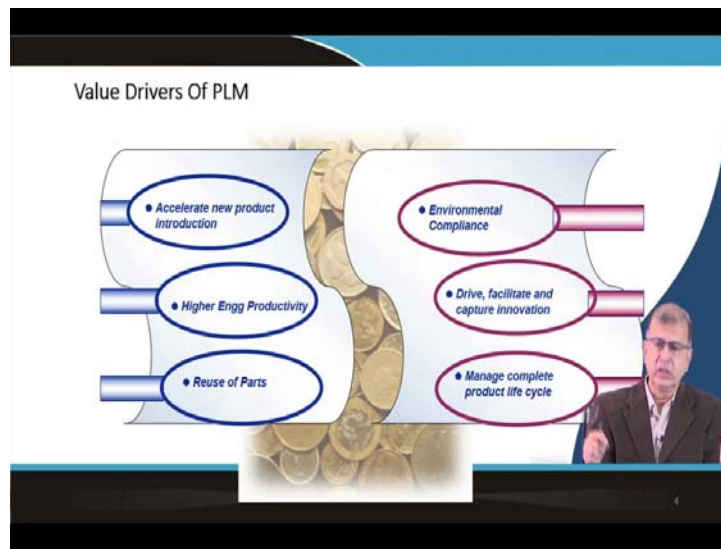
Your competitor is also your supplier. So, things are becoming very complex. Somebody who is my business competitor, is also my trusted supplier. So, all these has to be managed through software tools. So, that is what PLM is all about?

Innovation: - New product means innovations that have to be again captured and managed through PLM software. Competition is talking about shorter time to market. I have discussed this quite lot in the previous section how new product introduction needs to get speeded up. So, that we can reach the market faster because, otherwise competition will come up with a similar product and beat me to the market. So, it is a race about who gets faster to the market.

Finally, regulatory compliance pressure: - because, for any new product where there is lot of features, safety factor is a major criteria for that product. For items like chemicals, then lot of safety issues have to be considered. Even for electronic items, there is a lot of safety concerns, specially related to the batteries etcetera, which can explode and catch fire.

Many things can go wrong in cars as well. When things go wrong, then the authority will come and ask for your product details. And those details will have to be retrieved from your software because the software has the entire lifecycle of this product development cycle stored. What was done, what material was used, what process was done, what was the specification etcetera. All those information now will have to be given to the regulatory compliance authorities to prove, that you had taken during development and manufacturing, all precautions. You did not overlook anything if you think which might have impacted the safety of the device, but somebody might have got injured or somebody might have got killed or some serious injury could happen. Regulatory compliance you have to compile with for which you have to keep track of all your records.

Traceability: - we were discussing in the previous section you have to be able to trace back to all materials that were used, processes followed etc. during the manufacturing of the item. So, everything should be traceable today right, from the raw material to be used, who had supplied, which was the vendor that supplied raw material. So, the entire history has to be tracked and recorded for future tracking. So, these are the business drivers of PLM product lifecycle management.



Now, what are the value drivers? That was the business drivers, now we talk about value drivers.

Accelerate new product introduction:- speed to market we have talked there also, and here it talks about the same thing.

Higher engineering productivity:- When you use a tool or a software for controlling everything from design to manufacturing, productivity improves.

Reuse of parts:- When everything is computerized from design etcetera, then one can choose parts very easily and see and try to fit them in your new product. Because, now the search becomes easier because you have a library you have a catalog online. So, I can go and search by catalog, and locate a similar component.

If I can get it, then I adopt those and that saves designing time, I do not have to redesign a new product or a new component. So, reusing saves lot of money, time etcetera.

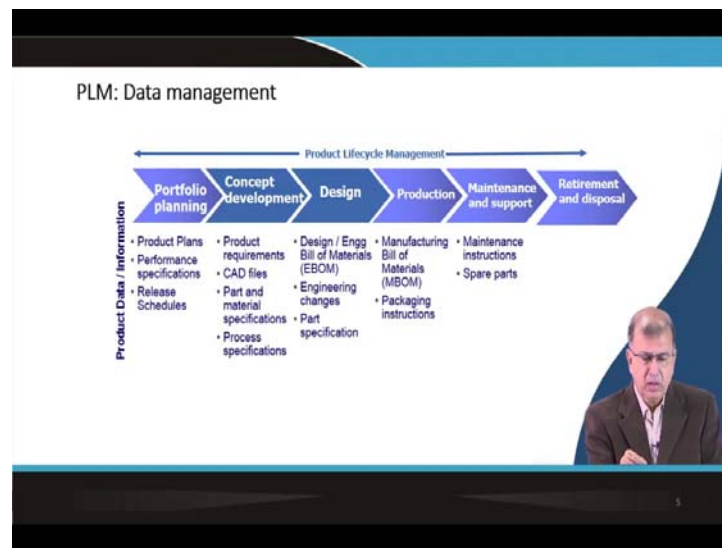
Environmental compliance:- I talked earlier about safety etcetera, or whether it is polluting. When you throw or discard the product, you need to know how to dispose it. So, those things also should be documented in the user manual. Any electronic waste lot of heavy metals and all these are toxic metals present in the processor and electronic chips. So, you just cannot throw it like that even for batteries there are regulatory rules. Maybe we do not follow them in countries like India, but it is coming in a big way. But, in developed countries they do and one cannot just throw a battery or an electronic component anywhere you like.

Drive facilitate and capture innovation:- That is very important because, innovation means lot of ideas coming and unless it is captured in a software tool, they will get lost.

You need to capture the ideas first, then some people will work on it and then you have to decide about a project and take it to some level, before you decide whether it would be worthwhile continuing or not continuing the project.

Manage complete product lifecycle: - That is a big value driver and you have to manage the entire lifecycle from beginning of the idea, the original innovation and take it to a logical end.

We start with development stages to final production and of course, after production, how is the product performing. So, you have to have market feedback, customer feedback and that needs to be recorded as well. Because, when you buy things and you give lot of feedbacks right? So, all that feedbacks get captured into your PLM. So, you get an overall history of the performance.



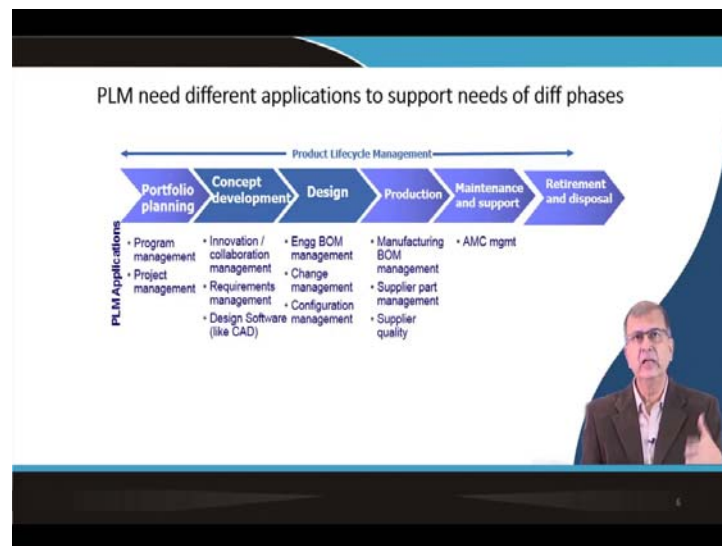
Data management: - of course, everything is based on data. So, this is the product lifecycle management overall lifecycle and the types of product data information which are captured. So, when you are doing portfolio planning you are talking about the original concept area.

Product plans, Performance specifications, Release schedules you plan, when we plan to release concept developments. You had been developing the concept of the product.



Product requirement, CAD (computer aided design) files, Part and material specifications and Process specifications are the various items for which you can start capturing the data in your PLM system.

Design: - You are designing engineering bill of materials engineering changes part specification, then when you are actual manufacturing the manufacturing bill of material packaging instruction. Maintenance and support maintenance instructions spare parts retirement and disposal also you will need to get customers feedback along that which needs to be captured.



So, these are the various data components and data elements at the various lifecycle stages of the product, which needs to be captured in your IT system. PLM needs different applications to support different needs of different phases. Various phases need different applications. So, in the portfolio planning phase it is talking about program management and project management. Because, you have to develop a new product, you have to have a team and you have to take it up as a project.

At the concept development phase, you have innovation and collaboration management. So, now you have to work with teams and the teams can be geographically spread out. Either in different locations within a country or different locations across the world specially for multinational companies most likely the team will be spread out all over the world.

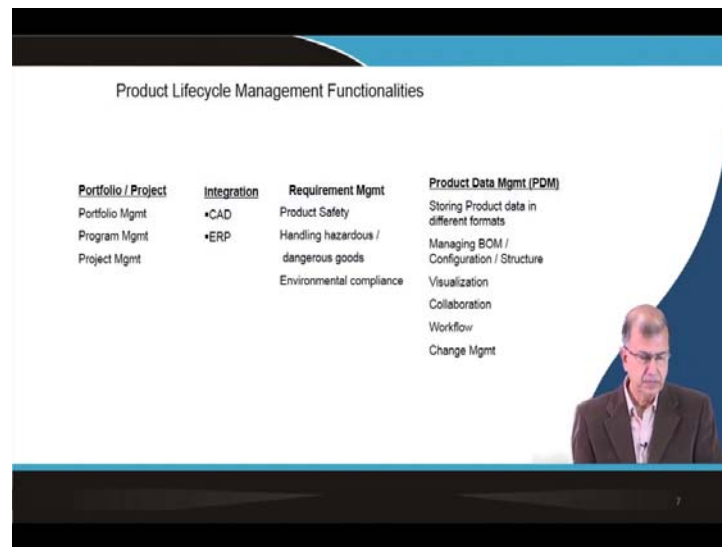
Requirement management: - When you do a concept design, that is, what the product is supposed to do, that is where you think about requirement management. And then you of course, you need a design software. Like CAD to convert all these requirements into specifications and finally into actual technical design.

You need a software like this computer aided design(CAD) tool, which you do on, your computer screen. During the design phase you work with - bill of material management, application change management, configuration management. These are again the software development life cycle (SDLC); and for this Change management and Configuration management will have to be used, because the development will be all software driven.

So, you will have to write several software programs to manage and you do that in the design phase. In the Production phase when you are actually manufacturing the product, you need to have a Manufacturing BOM management and Supplier part management. Supplier will be sending parts and we have to manage that supplier quality.

So, for quality management you need some application. How to manage the quality? And for maintenance support you consider annual maintenance contracts, when you source a product customers buy it and then there is a maintenance agreement depending on of course, the product.

So, for many industrial products you will have a maintenance contract. Like when you buy even a computer you can have a maintenance contract, with your supplier which is annual maintenance. So, he will come and service it whenever there is a problem. Thus we have different applications or tools, which are used during the different phases of a PLM lifecycle.



The functionalities of PLM: - We are talking about Portfolio/ Project, Portfolio management, Program management and Project management. When you are doing Integration you are involving design tool (CAD) and an ERP. So, now you are started designing and then with ERP you have to interact with your vendors and do quality management, manage manufacturing and Sales. So, that is the integration between this CAD and ERP system. Because, from ERP we will trigger the bill of material to do the materials requirement planning and the information will go to your vendor, the supplier through purchase orders etcetera. That is where ERP plays a role.

The requirement management is when you are fixing up the real specification about what this product is supposed to do, you have to consider things like product safety; handling hazardous and dangerous goods and environmental compliance.

So, there are various governmental rules. And you will have to be aware of those rules. So, it is as I said electronic products, are also quite hazardous like the batteries the heavy metals in the chips processors like cadmium etcetera these are very toxic material. So, you have to be very careful about how the wastes and discarded products would be handled.

So, when you are designing you have components and product and you have to keep in mind things about product safety. Because, you might have heard that sometimes in some phones the batteries explode, when you are charging. They even injure the person who is nearby.

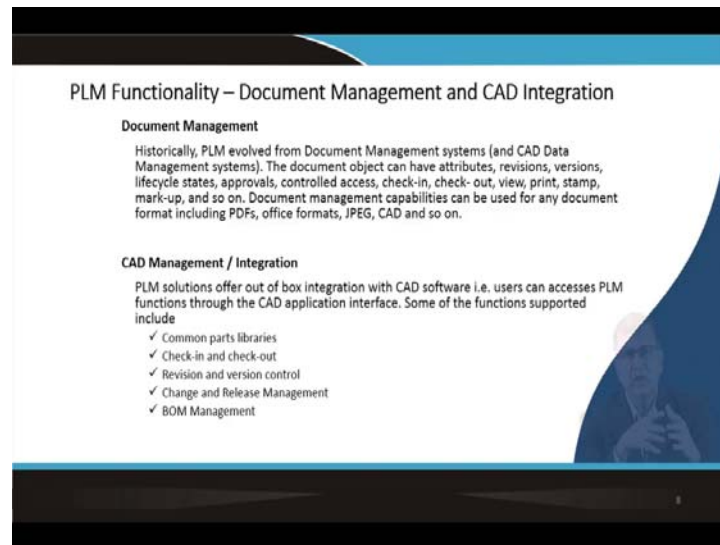
So, you have to take care of all those things related to product safety, handling hazardous and dangerous goods and environmental compliance. The other functionality here is the Product Data Management. Storing product data in different formats, managing BOM configuration structure. These are the things which needs to be taken care of.

Visualization - When you develop a product you try to do visualization maybe 2 D or 3 D whatever so, that you can see it from various angles etcetera. Then you can use it as a proof of concept or also you can show it to potential customers and get their feedback. So, we are designing such a product and this will be the look and feel, it will look something like this. And the functioning will be this, or whatever your comments would be. You can ask your customer, whether he would buy this product or would he like to have some changes to this, or you have some other ideas etcetera.

So, visualization comes in a big way when you can show it to people through software. So, actually the product is not there, but the 3 D views can be shown and you can get feedback of various stakeholders. Maybe you can even use it for the suppliers for example; we can call the suppliers and show them. And they can react and also give feedback and valuable suggestions which you can use in your design.

Collaboration: - It is entirely a collaborative effort as we have been talking about supplier relationship management earlier. How you collaborate with your suppliers? Because the total development has 100 percent involvement of your suppliers, without their involvement you cannot develop new product. So, it has to be really hand in hand completely hand in hand between, the company and your suppliers whenever you are developing a new product.

Workflow: - This is the management part, where, for the process flow operations everybody needs to know, what is going to happen step by step, or what action somebody has to take. So, that is again a part of the data management software or it can be done through the ERP platform. The ERPs are very strong in workflow, change management etc. because, again for every process change, people have to be trained etcetera, and all these will be handled by the change management functionality of your product management tool or ERP tool.



PLM functionality document management and CAD integration: - There is a lot of heavy documentation that goes in when we design a new product, the entire design part of it. The specifications, the control parts, the process, how it will get manufactured or built, who are the vendors who will supply, what, when, etcetera. A huge lot of documentation goes in.

Managing these documents is a big thing and it depends like, when you are building or developing a new aircraft for example, there will be, I have read somewhere that paper drawings / print outs, weigh several tons. This is just an extreme example as it is for a very complex product like an aircraft.

So, historically PLM evolved the document management systems and CAD data management systems. The document objects can have attributes, revisions, versions, lifecycle states, approvals, controlled access, check-in, check-out, view, prints, stamp mark, etcetera. Document management capabilities can be used for any document formats including PDF.

So, the whole thing about document management is that you manage change as you have a lot of changes happening, whenever you are designing something new. Now, how do I know which is the right version, as there can be several versions stored. Now, if you do not name or give file name and the convention properly, using the standard file naming convention, etcetera, which gives the versioning of the document. After sometimes you

will might get confused because, there could be say, version called 5 dot 7. And there are versions 5 dot 8 and 5 dot 9. But, somebody says, he gets a document called version 5 dot 7 and he thinks that is the right document. But, he does not know that further changes have happened in the design and now the latest one is version 5 dot 9.

So, he will start using a wrong document and start working. And after sometimes people would realize that a different version has been used all together for designing the further component and then the whole effort goes waste.

So, maintaining the right version and ensuring that everybody involved always get the correct version, is very crucial and can be managed only through a software. Not possible at all to manage manually. Because, you will do a mistake and you will get confused.

So, this is what a document management system does. These are really specialized software, where documents are stored in various formats JPEG, CAD, PDF, Word etcetera whatever. And they do the versioning of the documents whenever these have undergone any change. So, when you pick up a document from there it will always give you the latest one.

CAD Management and integration: - PLM solutions offer out of box integration with CAD software. CAD software is an independent software product. Nowadays, with availability of computers, nobody uses drawing board and pencil etcetera. They are doing everything on computer software. Users can access PLM functions through the CAD application interface.

CAD application is an independent third party software. There is a company called AutoCAD which makes a very popular CAD package. Now, these are all interfaced with PLM software. So, they are linked and some of the functions which are supported includes: -

Common parts library. - You can have a library function and I can know which are the common parts which are used in multiple products.

Check-in and Check-out function is used for versioning. So, every time I do a change I have to check-in and then I have to check-out after the change is done and the document

version gets automatically changed. Next time when I do a rework, I have to check-in and the file name will automatically change. This takes care of the versioning. This check in and checkout functionality is very strongly embedded. Because, then otherwise you cannot possibly maintain that version control because, you might forget when you do a change and you save it and come out without changing the version of the document.

So, the previous version or the original version has got now two different data or figures. You are saving because somebody had saved earlier; with the same name he has got a document. Now, you have changed it and you have saved it with the same document name. Now when you send him your document, he will get confused as he now has 2 files with the same names. And he does not know what is the difference so, he will have to open up both files and then see what has been changed. It is very difficult and time consuming and it cannot work like that. So, there are the check-in and check-out features, revision and version control in these design software packages like CAD.

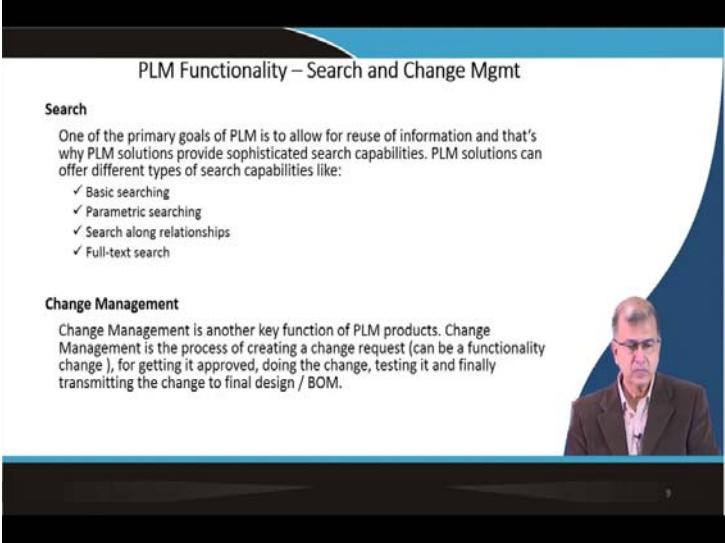
Change and release management: - again something very similar, whenever you do some change in your product etcetera and then you release it. So, this whole thing has to go through a change management process just to ensure only the right thing has got saved and no incorrect thing or old data etcetera have got saved in the system.

Bill of material management: - The whole thing is talking about how to manage a change. Because, when you are doing something new, developing a new product, every day you are changing things and that is what development is all about. You do some trial, do some something else get some extra information you change it you add something. If the requirement changes then you change something else, you change the design.

So, it is under constant change till the time finally, things get frozen. This is the final design after all feedback, trial etcetera and this is what will be manufactured. Even after manufacturing and sales, things can change because, you get feedback from the field that this is not working, that is not working etc. This needs improvement as the sound button is not working or whatever, software is giving a problem, it is hanging etcetera. So, many things happen when it is manufactured and has gone to the market. Then based on the market feedback again you come back to your drawing board and do some changes. So, it is always, I mean, it is the main thing you are doing throughout the lifecycle, that is ,

doing some changes to the product. So, that change has to be managed and all that is you know this document management system coupled with CAD integration here. A common example you will find when every few weeks, you find that the Apps in your phones get updated. Even the main phone's operating system software gets frequently updated for adding new features or for removing defects.

What we are talking is about how these changes are managed such that? Everybody has got finally, this whenever they want to do something; they have the same information the same document and this is extremely important.



The slide is titled "PLM Functionality – Search and Change Mgmt". It is divided into two main sections: "Search" and "Change Management".

**Search**  
One of the primary goals of PLM is to allow for reuse of information and that's why PLM solutions provide sophisticated search capabilities. PLM solutions can offer different types of search capabilities like:

- ✓ Basic searching
- ✓ Parametric searching
- ✓ Search along relationships
- ✓ Full-text search

**Change Management**  
Change Management is another key function of PLM products. Change Management is the process of creating a change request (can be a functionality change ), for getting it approved, doing the change, testing it and finally transmitting the change to final design / BOM.

A small video inset in the bottom right corner shows a man in a suit speaking.

Search and change management: - It is talking about search. Search is another important function in computer driven system, for getting information. And that is why PLM solutions provide sophisticated search capabilities, can offer different types of search like basic searching, parametric searching, search along relationships and Full text search. These are all basically search features and the whole idea is that it should have capability to find out the desired information.

Change management: - I have talked a lot in previous slide. It is another key function of PLM product. Change management is the process of creating a change request. It can be a functionality change for getting it approved, doing the change, testing it, and finally, transmitting the change to final design. Now, this one is slightly different where you request for a change



When you do a Change Request, it has to go through a process and it has to be reviewed by someone and then it has to be approved. There is a change approval board normally (CAB). They will look into the change and they will decide whether this change is acceptable or not. Based on various things, like cost impact due to the change, second thing, whether it is actually required or not, whether it is going to give the benefit what you are thinking as the requester has thought. So, there is an approval step and once it is approved, then it gets incorporated into the final design or bill of material. And if it is rejected fine, then you continue with the old previous one.

PLM Functionality – Manufacturer Part Number and BOM Mgmt

**Manufacturer Part Number (MPN)**

- ✓ This is mainly for managing purchased parts.
- ✓ A manufacturer part number does not appear in company's Bill of Material.
- ✓ This linking is sometime required to quickly order a supplier a particular part and to avoid collisions when two manufacturers coincidentally use the same number for two different parts.

**Bill Of Material Management**

- ✓ BOM Management capability includes building BOM structures, adding or removing parts, comparing BOMs, and managing BOM changes and transformation through their lifecycle.
- ✓ PLM systems help in transformation of a CADBOM to EBOM (Engineering BOM) to MBOM (Manufacturing BOM).
- ✓ PLM systems can manage complex BOMs through their lifecycle and configuration changes.
- ✓ PLM systems also support BOM Cost Management through different BOM comparison.

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Manufacturer part number and BOM management: - These are now bit of technicalities talking about a manufacturer part number. This is mainly for purchase, like if the supplier will give some part. So, you need that part number. So, that has to be part of your bill of materials. So, it has to be an input to your design.

So, it has to be given by supplier so, collecting that information again. You have to maintain that version because, if they do some change to their part that change also has to come to you.

Because, otherwise you will be having a different part number which was the older version now they have in between changed and again there will be a mismatch or error. So, again all these thing is being managed by the software. This linking is sometime required, to quickly order a supplier for a particular part and to avoid collisions, when two manufactures coincidentally use the same number for two different parts.

Bill of material management: - Bill of material management capability includes building bill of materials structure, adding or removing parts, comparing bill of materials and managing bill of material changes etcetera. So, in a development cycle you have multiple bill of materials etcetera. So, you need to compare, find changes etcetera between the two BOM's and all that is of course, done by the software.

PLM systems help in transformation of a CAD-BOM to E-BOM, CAD-BOM means the design BOM E-BOM is the engineering BOM. And then finally, to Manufacturing bill of materials which is the final bill of material which is needed in the shop floor for manufacturing. So, there could be certain differences between these three types of BOM. So, principally they should be very similar overall 95-96 percent should be common.

PLM systems can manage complex BOMs through their lifecycle and configuration. We have been talking about that and PLMs also support Cost Management, through different bill of material comparisons. See one of the features of bill of material you can find out the cost of material because, all components have got a price value both for bought out material or a cost value for in-house manufactured component

So, we can add all the bill of material components and you get the material cost of product. So, different BOMs you can have different cost and you can compare and decide ok, you want to decide which one you want - a costlier product or a less costly product.

PLM Functionality - Product Visualization, Requirement Mgmt

**Product Visualization**

- ✓ PLM solutions provides a dynamic view of the product's 3D CAD model
- ✓ While designing, the designer can manipulate his inputs and based on that can simultaneously see it's effect.
- ✓ This helps in designing in an interactive mode where he can play with lot of parameters and can always see the effect immediately.

**Requirements Management**

- ✓ A new product always starts with a set of requirements. Functional requirements describe product behavior. Non-functional requirements describe how well this behavior should perform.
- ✓ A PLM system can manage requirements like any other object type, linking many-to-many to each other and to other requirements. So, a requirement can have sub-requirements that go into more detail. Requirements can lead to products feature.
- ✓ PLM systems manage all requirements through revision control and change management.

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Product Visualization Requirement Management: - I have discussed earlier that PLM solutions provide a dynamic view of the products. 3 D CAD models which you can show it to your suppliers, vendors, prospective customers etcetera, to get their feedback. And you can refine your design accordingly. While designing you can manipulate inputs and simultaneously you can see its effect.

This helps in designing in an interactive mode that is you are interacting with other people stakeholders, where you can play with a lot of parameters and can see the effect immediately. With online system you can make changes, if somebody suggests the change, you can do it immediately and see what is the effect what is the difference etcetera.

Requirements management: - A new product always starts with a set of requirements. Functional requirements describe the product features, the behavior, what it is supposed to do. And non-functional requirements describe how well this behavior should perform, the quality part and performance related parameters.

But, the working features, what was is the part of the functional requirement are managed in PLM system through revision control and change management.

PLM EHS Functionality – Hazardous Material Tracking


- ✓ PLM EHS Software manages chemical inventory systems and track chemical storage (e.g., inventory), use, and transportation throughout the supply network and end-of-life disposal.
- ✓ This solution ensures that the company meets regulatory requirements relating to product safety and to the management and labeling of dangerous goods – while at the same time protecting employees and the environment.
- ✓ PLM EHS supports dangerous goods management by enabling companies to store and manage regulatory data, classify dangerous goods, perform checks during transport, and compile and update dangerous goods documentation. This data can be automatically transferred and used for packing lists.
- ✓ For any transportation channels (road, rail, sea, or air), PLM EHS ensure that shipments comply with regulations before leaving the premises, and manage dangerous goods storage, transportation, movement, delivery, compliance and reporting.

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Hazardous material tracking again it is a very important feature, I have told earlier I have discussed earlier EHS solutions, they have to be built in. So, wherever you are designing a new product be very conscious about the safety features.

PLM EHS Functionality – Material safety data sheet (MSDS)

- ✓ PLM EHS solution lets the company collect and process product compliance data automatically, enables to document product content and regulatory or sector-specific substance lists and integrates compliance checks and analyses.
- ✓ A specification management database allows to centrally managing substance information (including product composition).
- ✓ A global label management function supports management of many different types of labels that can be printed directly from various business processes (for example, from outbound delivery).
- ✓ A Material Safety Data Sheet (MSDS) documents proper procedures for handling of hazardous materials for workers. PLM EHS software support the generation and storage of MSDS information, such as physical data, toxicity levels, health effects/risks, remedy requirements for spills or accidents, and storage guidelines. PLM systems make this information readily available to workers and downstream consumers that are exposed to these materials.



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Then when it is for a chemical compound chemical products or drugs, and things like that you have something called a material safety data sheet MSDS which lists out all the hazards a potential danger, if something happens goes wrong what we will do.

Behind LPG tankers for example, you see in case of fire you know you can use these. So, that is an MSDS that is the material safety data sheet, which is actually painted on the back of oil tankers and tankers carrying hazardous chemicals. So, they are required to display that information.


PLM Vendors

Some of the leading vendors in PLM space are listed below:

- ✓ CAD (Computer Aided Design) / CAM (Computer Aided Manufacturing) / CAE (Computer Aided Engineering) / Document Management vendors moving into PLM space:
- ✓ PTC
- ✓ UGS
- ✓ Dassault Systèmes / IBM (IBM recently acquired Dassault Systems and another PLM vendor MatrixOne)
- ✓ Agile Software

Leading ERP vendors building PLM solution

- ✓ SAP
- ✓ Oracle
- ✓ IFS



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So, some of the PLM vendors are : CAD, AutoCAD, PTC, UGS, Dassault Systèmes, Agile software are the name of the companies which are involved in developing PLM

products. They make and sell PLM products and leading ERP vendors, like SAP, Oracle etc. also build PLM solution.

So, I said PLM is also a part of the ERP tools, but specialized companies make very specific PLM products like Dassault Systemes would be for aircrafts and related systems etcetera. Product specific PLM software very sophisticated products.

Thank you very much.