Carbon Accounting and Sustainable Designs in Product Lifecycle Management

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Week 09

Lecture 39

Integrated Pl, SLM and ALM

Welcome to the week 9 of the course Carbon Accounting and Sustainable Designs in Product Lifecycle Management. We have discussed about the carbon accounting, we discussed about the sustainable design product lifecycle management is discussed in detail.

We discussed about certain models, certain software solutions and what is carbon sequestering, what is carbon credit. Various techniques have been discussed which takes you to the greener solutions in various streams of the focus maybe whether it could be material, whether it could be energy, whether it could be waste disposal. Those tips were discussed in the last weeks.

This is week 9 where I will give you brief introduction to the integration of PLM, SLM and ALM. Which means PLM has an integral systems in it, it is service lifecycle management and application lifecycle management.

By service lifecycle management, I mean what happens after sales, lifecycle of the product when it is in use. In product lifecycle management, we talk about the design of the product. We talk about the process design, we talk about manufacturing and all the other functions that we had discussed in the previous weeks.

Also, we discussed about what happens after sales to small extent. Now, after sales whatever is being managed that is taken care by service lifecycle management which take

case of multiple aspects of the product that is specifically providing benefits to the customer. In the terms of service, in the terms of the product that is tangible, by actively interacting with clients after the sale, manufacturing enterprises can explore new avenues to provide value.

Ultimately leading to the creation of additional revenue streams in future. If we provide good service, when you get to purchase a car, when you get to purchase a motorbike, when you get to purchase a mobile phone.

You always try to see do we have service stations, do we have service stations close by, do we have local service stations, do we have in-house service, do they provide home visit services or so. So, all those aspects also you take into consideration that comes the part of the service lifecycle management.
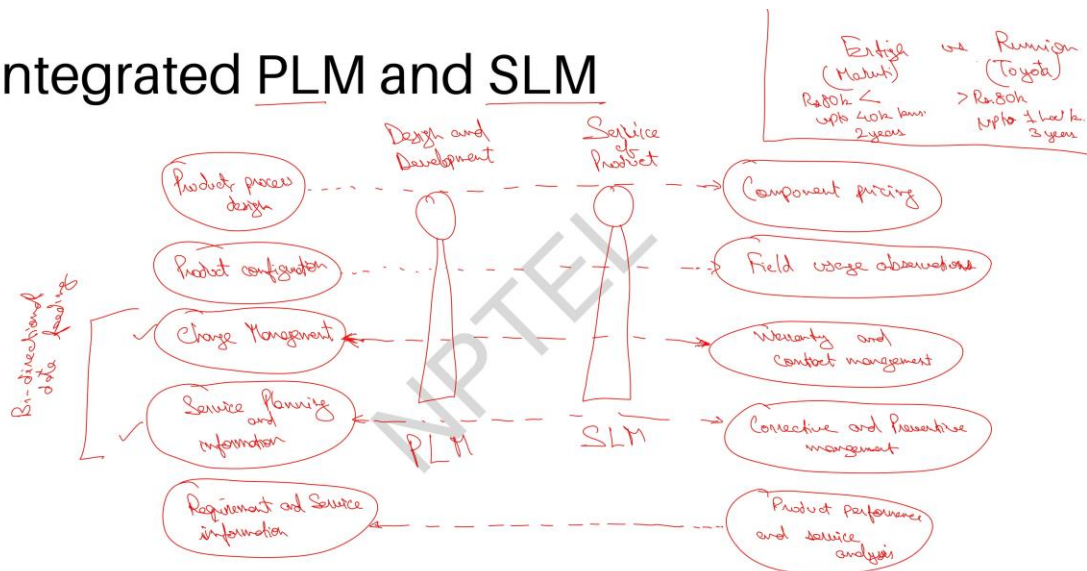
Then comes the application lifecycle management. Application is majorly the software solution, the Android application, iOS application, window-based applications or the solutions that you see, lifecycle management of the solution. What would be the user interface?

I talked about certain aspects in the software solution designs and this would be further detailed by Dr. Prabol Pratap Singh in the coming lectures in this week itself. Application lifecycle is understanding the customers viewpoint or what will be the user interface. What will be the user interaction what will be the user experience while using your application this has to be updated.

With the time when new and new features comes, it has to be updated and with these features, new colors, new variables, those all have to be updated in the application. So, those application lifecycle management, whether it is in your mobile, whether it is in your laptop or it is in your desktop solution.

So, this is application lifecycle management. So, I will talk about the service lifecycle management first.

Integrated PLM and SLM

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(Maruti)   (Toyota)
Rs.80k <   > Rs.80k
upto 40k kms.   upto 1 lac k.
2 years   3 years

Design and   Service of
Development   Product

Product process design - - - - - - - - - -> Component pricing

Product configuration - - - - - - - - - -> Field usage observations

Change Management <- - - - - - - - - -> Warranty and contract management

Bi-directional data sharing

Service Planning and information <- - - - -> Corrective and Preventive management

PLM   SLM

Requirement and Service information <- - - - - -> Product performance and service analysis

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Integration of product lifecycle management and service lifecycle management. We have seen the levels of a product lifecycle management. By implementing SLM, producers gain deeper insight into the product performance among customers.

This helps them to identify when and where the items require maintenance and this helps to improve the accuracy of product servicing. So, by the full use of service level management or service lifecycle management, the current components in service operations can be transformed into being cost oriented to being focused on generating better earnings. So, what do we have in PLM? Let me just jot down the components once again, we had product and process design. We had product configuration, we had change management, we had service planning and information,

then requirement and service information was there. So, this was our entity that is our product life cycle management. So, that is we majorly focus upon the design and development of product. Now, when design and development focused it is PLM other entity that goes in parallel to it. That is service lifecycle management where service is majorly focused.

Service of product. So, when we talk about the product process design here, the first component that comes in service lifecycle management is component pricing. It is when the product and process design is there for the product. So, what would be the pricing of

the component? Because this pricing would reflect upon the warranty period that you give.

For example, there are cars. Ertiga is one car. That is Maruti Ertiga, Toyota, Rumion is another car. So, you take this case. Ertiga versus Rumion.

This is by Maruti. This is Toyota. This car, Romeo, is around 80,000 rupees. A gross is different variance more than what Ertiga is offering. But this is offering the service up to 1 lakh kilometers and up to 3 years.

On the other hand, Ertega is offering service which is 80,000 rupees lesser than Rumeon. However, basic design, engine capacity, everything is similar. If not even similar, it is same engine is being used here. But here the service that is being provided here is up to 40,000 kilometers and it is for 2 years. So, this is the difference.

So, component pricing is made accordingly when you have a product and process design itself. So, that reflects upon your component pricing as well. Now, when we talk about the product configuration, product configuration in product life cycle management has a parallel component in service lifecycle management that is field usage observations whatever configurations we have here in the product. So, this observations during the usage in the field helps us to understand whether the components or the configurations.

That we have designed is working at par or not change management definitely is there. When change management is there in product lifecycle management changes could happen at any instant, so this is a two way interaction with warranty and contract management; so this is I will put arrows on both the sides. The change management determines the warranty and contract management and the other hand warranty and contract is an output that is taken from the change management system itself or the word warranty. What change could happen, what components would have to be replaced very frequently in the cases of accident itself. What components could be replaced or what components has to be warrantied, what guarantee has to be given, what contract has to be given when we sell a product.

Service planning and information is here in the PLM side. In the integration of PLM with SLM service planning and information has corrective and preventive management here. It is also a two way interaction. Now, requirement and service information is here in PLM this is talking about the requirement and service these requirements come from the

service in the service we have product performance and service analysis. And please note here, now this arrow is going from right to left.

Product performance, product service analysis helps us to understand what are the requirements and service information. So, this is a bidirectional data feeding here in change management and in service planning. I will put it here. This is bi-directional data feeding. A comprehensive product requirements for field service technicians and also product issues revealed by those specialists can consequently assist in the engineering team to make the design improvements.

By having the information that is generated by SLM services, it is made sure that a convenient Availability and simple considerations are taken for certain results and businesses can discover methods to identify root causes of the solution problems and establishing a troubleshooting methods for that.

Integrated PLM and SLM

(COMPONENTS OF...)

1. Analysis, planning, and forecasting (component pricing) (parts)
2. Managing of enterprise assets
3. Logistics management
4. Management of service knowledge
5. Management of Warranty(ies) and Contract(s)
6. " " corrective and preventive actions
7. Analysis of service performance
8. Management of returns and repairs

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So, if I talk about the components of SLM, I will put here components of SLM. So, elements comprising SLM definitely we have analysis, planning and forecasting. When I say forecasting, it is forecasting of the component.

I am talking about the component of the tangible product here these are the parts pricing as we had the assets here. So, managing of enterprise assets then we have logistics

management. Management of the service knowledge as we mentioned the management of warranty and contract. Then we have management of corrective and preventive actions.

Then analysis of service performance. And the last component I would like to put here is management of returns and repairs. This is majorly we are talking about a service.

Integrated PLM and ALM
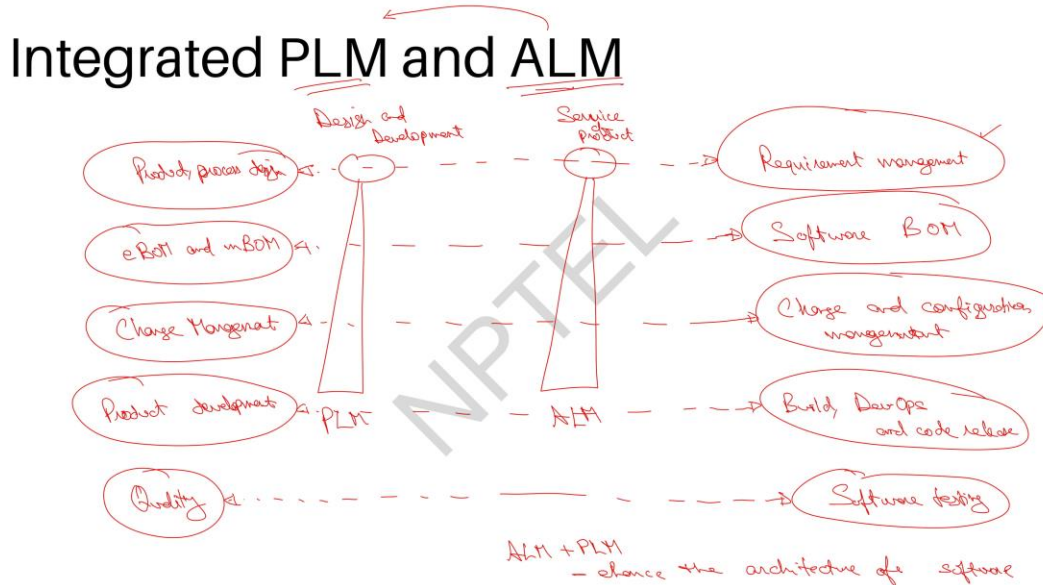
Now, when we try to integrate PLM with ALM (Application Lifecycle Management). Service lifecycle management was to plan, manage, deliver and analyze service information that is parts and warranty throughout the service lifecycle.

That is it is majorly focusing upon the medium to large size that is fast growth is required here. Now, application lifecycle management manage the product requirements that is system models, software configuration, test plans, defect.

For the strong growth, an application has to be built, an application that is something interacting with the consumer directly. So, that application, for instance, if you look at various car service providers or the vehicle service providers, you can have an immersive experience of the interiors of the vehicle. You put Toyota Romeo in there.

You put Maruti Ertiga there. You will have maybe 15 to 20 pictures of the exteriors of the car. Then there would be immersive experience of how the interiors look like. Then the different videos would be shown there that how the car is running. Then it would be

showing the engine performances, the comparative assessments between the engines, the comparison between two or three cars.

Those are all there. Those are the part of the ALM (Application Lifecycle Management). If it is provided by the product designer itself that is the company who is developing or manufacturing this product.

If they are developing this application they would be having better rights over it that is the copyrights over it. And they will be able to provide the insights which are very intrinsic because a designer themselves are providing these inputs to the application lifecycle management.

Let us try to cast a glance over the ALM and PLM. ALM and PLM utilize distance methodologies functioning within the confines of their respective repositories. The technology structure of product might range from mechanical to mechatronics.

Now, ALM and PLM systems handle complex regulatory compliances and product safety requirements in a worldwide smart product development setting nowadays. So, there are internet of things, there are industrial internet of things, there is smart manufacturing, there are digital twins, all of these help the PLM to integrate with the application lifecycle itself.

Now, software applications are increasingly assuming control over larger and more extensive functions previously handled by the hardware. Now, integration of PLM and ALM is crucial in development of the system that encompasses both software and hardware elements.

So, let me try to put my PLM and ALM here once again. So, this is my entity that is my product lifecycle management where the major function is design and development to put the components of a ALM system. That is application lifecycle management which is again talking about the service of product.

So, when we have product and process design here. In PLM, we have the requirements management in ALM. And when we have the engineering bill of material that is the bill of materials of the product and machine bill of materials or bill of processes that is m below m bill of materials. This gives us the bill of materials for software. You call it the bill of materials, you call it the bill of the tools which are required to develop the software.

So, it could be bill of material, it could be you call it the different languages that you need to purchase or freeware that you are using to develop a software that is there for software bill of material. Change management is here in PLM and accordingly we have change and configuration management that is here in ALM.

Now, when product development is here in PLM, we are talking about a development of the product. We develop the application accordingly that is the build of the application, the ops and code release these all are related to the product development and definitely when we talk about quality in the product

we talk about the software testing here and one thing that is to be noted carefully here is these are all bilateral relations. So, whatever arrows I draw here is two direction because software as and when there is a change as and when there is new requirement in design this application has to be changed immediately.

So, that the user who is using this application should not feel that the data is outdated in the application. So, there is always a two-way interaction between product lifecycle management and application lifecycle management. So, ALM facilitates the seamless integration of people, processes, technologies throughout the whole software development lifecycle.

Therefore, enhancing the architecture and management of the software applications. So, I will have to put it here. ALM plus PLM, this helps to enhance the architecture of software that is one benefit. Then creating an application for smart device without an ALM akin to devising a strategy in a state of delusion. Because without ALM the explicit guidance to the software to the product development team is missing.

So, it is crucial element for successful organizations in the present day. So, different focus areas could be requirement management or we talk about the designing, planning, estimating. Then configuration management, change management, release management, quality assurance, deployment, maintenance and support. Then it helps in audit, metrics, reporting all those are the benefits that we get from an integration of ALM and PLM systems. So, this was a quick lecture on the integration of the PLM with SLM and ALM.

I would like to talk about the ESG in the next lecture and after that I will close my part of the course.