Carbon Accounting and Sustainable Designs in Product Lifecycle Management

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Week 07

Lecture 31

Carbon and Business Data (Part-3)

Hello friends, welcome back to the course Carbon Accounting and Sustainable Designs in Product Lifecycle Management. This course is being instructed by Professor Deepu Philip, Dr. Amandeep Singh Oberoi, Dr. Prabal Pratap Singh, I am Amandeep. We are discussing about the PLM, we are discussing about the carbon and business activities, the carbon emission activities in this week.

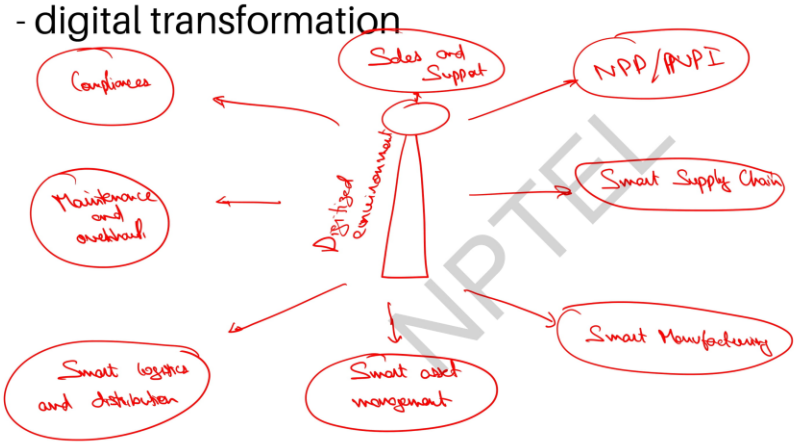
And the mapping and acquisition of the carbon data from the system level to the functional level to the process level. And we try to talk about the carbon and business data steps, mapping, acquisition.

In this lecture, I will try to talk about digital transformation and operational technology because we talked about the operation and monitoring of the data. The operational technology is an important part to be discussed upon.

Carbon and business data

- digital transformation

AI,
IIoT
BPM



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Carbon and business data

- digital transformation

1. PREDICTIVE ANALYTICS FOR PROBLEM ANTICIPATION
   - Utilize IoT, IIoT, (AI) and data to foresee potential issues
   - proactive measures and strategic (Predictive / preventive) overhauls.
2. REAL-TIME INTERACTION WITH DIGITAL THREAD
   - Factory-floor operators connection → with field services
   - enhance communication and responsiveness
3. ENHANCED PRODUCT QUALITY AND PERFORMANCE
   - Minimize the gaps in understanding product characteristics
4. ADAPTATION TO MARKET DYNAMICS (GLOBAL OVERVIEW)
   - product positioning / competitiveness
   - changing standards (international)

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Regarding digital transformation, technology nowadays plays a key role in function of an organization. Many expert system, you call it AI, you call it big data, you call it IIoT, which is industrial internet of things or you call it big data management. These are widely recognized industry terms nowadays.

Human development technological expertise when combined with predictive analytics. Now has capability to anticipate potential issues and subsequently provide options for the resolution. Whether this could be the general operational issues which are there in manufacturing concern. Or we nowadays need the carbon accounting systems connected to the sensors, connected to the internet of the things and so on. Now, the implementation of digital connection between the factory floor and product lifecycle management in conjunction with on-field services.

Facilitates an immediate or maybe instantaneous communication and collaboration between the developers, between the engineers or specialists, whosoever are stakeholders here. So I would call it stakeholders or the components of the people contributing to the system here. So this is my digitized environment. So, there are certain contributors to that specifically I will talk about it term smart manufacturing or you call it the new product design or new product information And smart manufacturing a new product, it has to be smart supply chain.

So, real-time monitoring and control is one of the requirement nowadays. This is obtained through digital transformation of these systems. Then we have with us are SCADA systems or maybe smart asset management, sales and support many other components are there. So, when connected together this enables distributors to gain deeper understanding of layout design considerations and performance deficiencies which enhances the product quality and performance. So, to put down certain pointers here the digital transformation is important to have a predictive analytics for problem anticipation.

We utilize IoT or IIoT and sometimes AI and input data into it to foresee potential issues. Potential issues that is we need to have a proactive measures and strategic all halls strategic you call it the predictive along with. Preventive overhauls of the systems. Preventive is that is planned in the beginning itself. Predictive is that is monitored whenever the requirement is there before any breakdown to happen it is predicted and it is corrected there.

Then in case we are talking about the smart manufacturing, smart systems here, smart asset management if you try to say. That is there digital transformation also needs smart logistics and distribution. Then as I said the maintenance and overhaul. That is taken care by the predictive systems. Then sales and support.

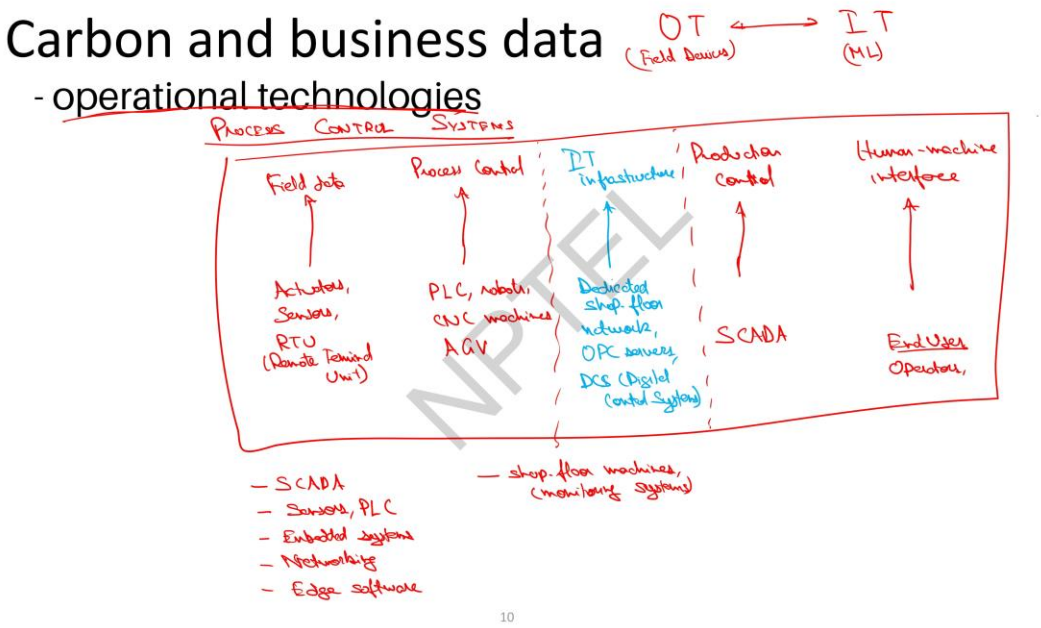
Everything goes in lines with the compliances. Compliances means the ISO compliances, the compliances with the government systems, the compliances with the international standards or so. That is, a successful execution of PLM assignment necessitates a comprehensive layout or drafting of the enterprise procedures that involves strategic re-engineering required to optimize the PLM technique. So here the market dynamics are undergoing a serious transformation nowadays, thereby leading to an increased product complexity. The context of multinational manufacturing businesses has also come.

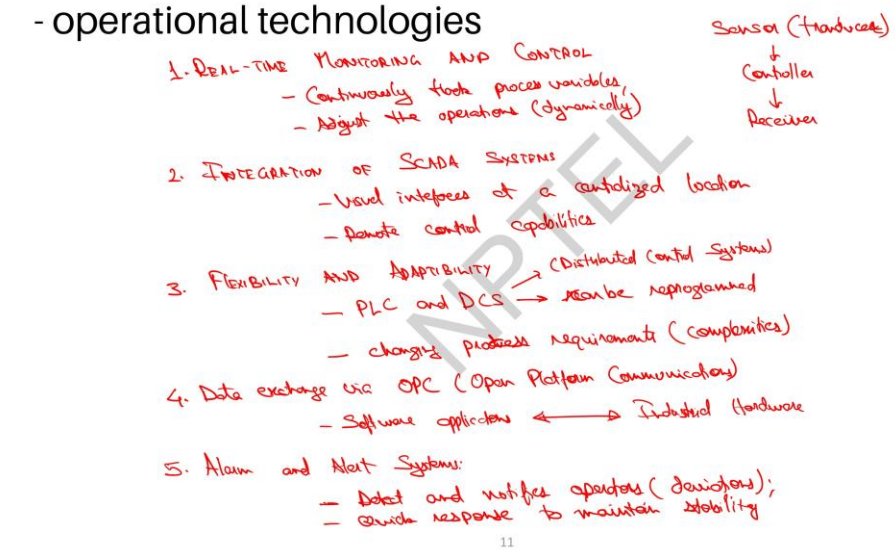
So competition in the worldwide market are subject to a constant evolution. So there is an increasing trend among enterprises to prioritize cost effectiveness in order to expedite preparations, And expedite the product launch. So, that is why the integration of industrial internet of things, the analytics in big data management, the AI. The product lifecycle management is also there and is required to have information exchange throughout the entire process.

I talked about the operational technology. So, digital transformation also has real-time interaction with digital trend. That is it connects factory floor operations with PLM and field services. So whatever is happening in the factory through the sensors while sitting in the administrative offices itself the breakdown or small predictive systems or predictive alarms which are there happening on the floor could be monitored. So that means I would put it here factory floor operations connection and now these connections are also taken further with field services.

So, this helps to enhance the communication and responsiveness. Along with this the product quality and performance definitely is enhanced. That is, the understanding of design, performance gaps leading to higher quality and operational efficiency is there. So, we try to minimize the gaps in understanding product characteristics. Then global overview of data processing adaptation to marketing reviews.

All are also the digital transformation benefits or the characteristics. So I will put it as adaptation to market dynamics that is a global overview. This addresses changing standards or geopolitical influences requiring agile strategies to stay competitive and to accelerate the market readiness. So, I would just jot it down here as the product positioning or competitiveness. So there are changing standards that is international. So those are all reflected upon when we are using a digital transformation system.





This is possible while having a efficient operational technologies. When I am talking about operational technologies, I will talk about the process control systems, I will talk about the digital control system, maybe the PLCs that is programming logic controllers or you call it the object linking and binding systems. Those are all maybe part of the SCADA. The SCADA we discussed in the previous lecture in brief.

So, let me try to now see various Process control systems which are there when trying to monitor there, what is there? We are having data from field. We are having field data which is being monitored using actuators, sensors or RTU. RTU is our Remote Terminal Unit.

So this is monitor field data is monitored then process control is monitored this is monitor how using program label logic circuits robots the CNC machines or automated guided vehicles also So here we have our production control which is also mentioned in the previous lectures that this is controlled through majorly SCADA. In between the production control and the process control I have IT infrastructure, information technology. Infrastructure that is a dedicated shop floor network is there and we have OPC servers OPCs are the operational process control servers. Or DCS, which are Digital Control Systems.

So, here in the process control systems, if I say operational technology, then I am talking about the human and machine interface is one of the parts of it. That is the end user, the person who is going to use the product that you have developed or the operators who are working on the machines. Human machine interface is also important here. So, these are all elements of a process control system. So, the field of industrial process control encompasses the surveillance and regulation of equipment and systems which enhances efficiency across several industrial sectors.

So, whether the process control system use various operational technologies like those are mentioned here it could use I could just listed down SCADA as the first one then maybe sensors Or PLCs you call it now the human machine interface is already mentioned there. We can use the embedded systems. Right embedded systems and when we are talking about the embedded system the network of the system is very important. Then we have along with it the softwares or you call it edge software.

Definitely these are all taking inputs or interacting with shop floor machine. Shop floor machines that is the monitoring systems. Which are installed on the shop floor machines. This operational technology is used to have a process control. Control, what does it do?

The process control systems helps us to have a real-time monitoring and control. Which means it continuously tracks process variables For instance, in WTPs or STPs, water treatment plants or sewage treatment plants, in the sewage treatment plants, what is the quality of the water that has finally going out of our treatment plant? So, how is the time being taken? How are the processes working?

Is the mixing, is the agitation system working proper or not? Everywhere the sensors could be installed. These sensors could be monitored using the computers which are in the offices itself. Maybe nowadays Android applications are there. Using those applications itself, the color monitoring is there.

Color monitoring in a way, whenever there is an alarm, the red color would be there or green color would mean the systems are running fine. So, multiple systems that are real-time monitoring and control is there that continuously track the process variables. And we can also adjust the operations dynamically to maintain optimal. That is when the color has become orange or red. What we can do is we can start another system, another agitator in the STPE which can help us to enhance the system capability or the speed of the system.

We can adjust the operations dynamically. Adjustive operations I would put dynamically. This maintains the optimal performance and stability. Real-time monitoring is also one of the primary functions of the process control system that is to gather and transmit data obtained during or after. Live during the operations of manufacturing processes.

The process under consideration is worked upon using a basic device basically consisting of a sensor commonly referred as the primary transducer which receives the input. It incorporates a controller that enhances the input ultimately resulting in a processed output facilitated by a receiver. So, we have a sensor or transducer, we have a controller and we have a receiver. Now, integration of SCADA system It is also there.

It provides a centralized oversight of visual interfaces. Visual interfaces at a centralized location for the real-time data monitoring and remote control capabilities. Now, definitely when we are talking about the operational technologies, we will talk about flexibility and adaptability. Flexibility and adaptability implies the PLCs or DCS We have programmable logic controllers or we have the DCS which are distributed control systems.

So, these are the systems which can be reprogrammed in a way because we are talking about adaptability to change. Adaptability that is whenever the changing process requirements and complexities are there, so we can adapt. Changing process, I would say not product, changing process requirements or complexities that is what our process control systems helps us to do along with it the data exchange via OPC. OPC here is Open Platform Communications. So, PLCs you know DCS I will just put also the abbreviation form here.

So, this is distributed control systems. Data exchange via open platform communications means standardized interface for seamless communication between software applications and industrial hardware. So, we have software applications and we have industrial hardware. This exchange of data or communication is possible when we are trying to use the process control systems like these. Definitely when we are talking about SCADA, last but not the least, I will put alarm and alert systems.

Alarm and alert system means it detect and notifies operators right what are being so what is being notified so any deviations or issues so that quick response is there. Quick response to maintain stability as close as possible. So we talked about the operational technology and information technology. There is an interaction between operational technology and information technology as well. Like operational technology is majorly talking about production monitoring or SCADA.

Information technology is talking about enterprise applications or asset management or communication technologies. So these also interact with each other so that the overall machine learning that is there in information technology and the field devices which are here in operational technologies are able to talk to each other. So, that real time digital transformation of data is there. So, this is what the product control systems helps to have the information controlled or monitored at a centralized place. Now, I will show you a video where you will try to see an example where the systems or the sensors give the information and those are monitored and those are changed or controlled by an operator.

And this also eliminates use of lot of human resources, use of many maintenance and other facilities which were the otherwise required. So, let us watch this video and we will close this lecture.

Before we talk about Digital Vengeance, it's important to talk about Mars Digital Engine, because the Mars Digital Engine concept is an approach to how we transform, and it includes three components. The first one starts with the user-centric approach, which is about putting the users in the center of everything we do as part of our design thinking. The second step we take is once we identify the problem, now we apply artificial intelligence and data to understand and also solve the problems using digital components and digital solutions that we have.

Once we have the solution defined and once we roll it out, then we look at automation, how can it be automated and multiple times with ease and with speed. That yielded into a structure in terms of conducting digital hackathons, conducting in terms of digital ventures which we define as a small test and learn experimentation for opportunities that we want. All the martians all the associates employees in the mars to come and contribute and also drive those quick test and learns in a faster pace so this whole concept of test and learn is about trying. The ideas that you have, trying the needs of the consumers or the end users, keep them engaged in the process from the beginning and take those ideas and define those North Star opportunities. And test them quickly to see which ones and simulate them and understand which ones will go forward, which ones are failing fast and then we learn from it and reapply the learning to continue the sprints.

During the pandemic, the sales teams were not able to reach to the retailer to sell them and we came up with this idea of creating an app where the retail stores can put their orders right into the WhatsApp application. We prototyped really fast and we produced the experience from an end-to-end perspective to the end users and we got the feedback in a very rapid pace and then moved forward fast. It really disrupted how the retail stores can put orders in without the sales agents entering into the stores. We introduced test and learns to understand how we can connect with the pet parents virtually and now we are investing more into telemedicine and building more telemedicine based solutions Where care can be taken back into the home of the parent.

The reason why digital ventures is important is it requires the right skills, it requires the right people, the right mindset, the right culture to be able to be bold, to be engaging consumers, to also brainstorm out-of-box thinking. Where we can bring new ideas, new North Star opportunities and challenge in a very positive way. It's a continuous evolving sprint and it's like a marathon of sprints. So that's why this digital venture is continuous, ongoing. And as we see a lot of these test and learns or experimentations being successful, we can pick them and then drive them to scale.

Versus if we fail fast, we'll put those learnings and make sure the next sprints so that we can see how we can take those learnings into action. These iterations will help us to do continuous improvement and also drive game-changing products and digital solutions out in the market. We want most of these sprints to be successful because the intention is you fail fast, you keep the learning and you mature it to the next sprint. One way or another, your ultimate destiny is to launch a successful service or a product. So there are very few cases where you're literally stuck and you're not moving forward.

I hope you enjoyed the video. We talked about the digital transformation. We talked about the operational technology and how information technology is also important here. So, with this I am closing this lecture and we will talk about the carbon accounting using the sensors to acquire the data and further we will talk about data analytics in the coming lectures.

Thank you.