Design Practice
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Lecture - 14
Concurrent engineering environment influencing dimensions

Hello and welcome to the Design Practice Module 14. We will be looking at a case study today as I had mentioned in the last module about Concurrent Engineering.

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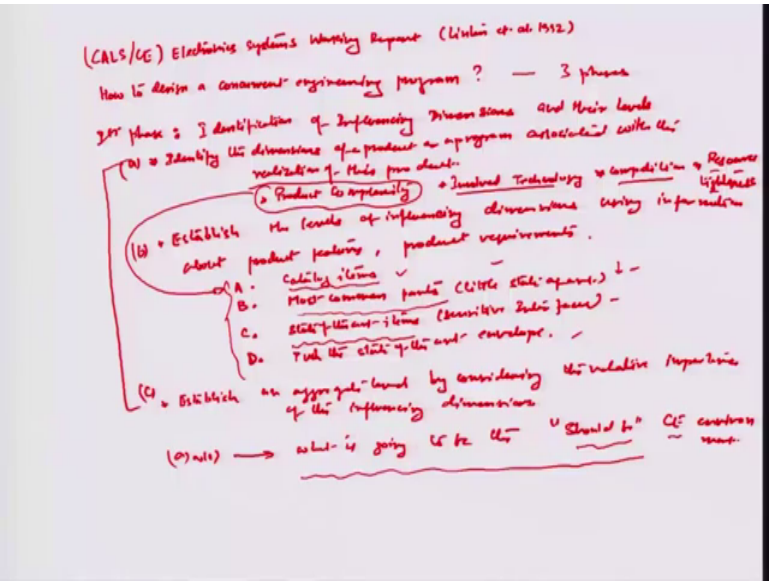

So, this case study was actually done by the electronic system working group of computer aided acquisition and logistic support calls and what they studied is actually about how a working system for the concurrent engineering approach can be developed, so that it starts affecting the decisions, the routine decisions of a company. So, just writing this down here electronics systems working group report and this was actually studied by Linton, another co-workers and reported by them in the year 2000, in the year 1992. So, this philosophy has those oldest then.

So, in this particular report, they try to make a case about how to design a concurrent engineering program and for that there are several phases in which this framework related to the whole part of the product life cycle can be implemented with this idea of concurrent engineering. So, you already know that various phases get involved when we talk about C as opposed to the serial engineering approach, where you know the phases

from the design to the production to the after sales to the service and to even the disposal phase of a product is getting enrolled or it is getting involved in taking decisions at the very beginning related to the design of the product.

So, when we design such a concurrent engineering program, we typically do this in about three phases. So, the first phase is to sort of identify the influencing dimensions of the products and their levels. I will just talk briefly about what these influencing dimensions would mean, ok. So, let us write it down first. So, first phase is related to the identification of influencing dimensions. This is the management case study. So, you have to understand the philosophy behind it, and their levels.

So, typically what we mean by influencing dimension is that you want to identify the dimensions of the product and the programs, ok. That influence the concurrent engineering approach. It could be things like product complexity, product technology competition, resource tightness. So, on and so forth. These are some of the dimensions of the product as such, which you are talking about when you want to develop C program for this product life cycle for this particular product.

So, the first criteria here is to identify the dimensions of a product or a program associated with this product. The realization I would say of this product and some of the dimensions could be for example, product complexity, the involved technology of the product, the competition which is around and then, maybe some resource tightness which is there in the system which is able to realize this product. So, this is how you identify some of the dimensions. So, share it with the product.

The next part here is, once these dimensions are established, you establish the levels of the influencing dimensions on an individual basis and this could be using the information from the product features or the product requirements. Let us say for example, the level of complexity can be related to let say catalog items or most common parts or state of the art items or some of the items where you need to really push the state of the art, ok.

So, there are certain items which are just commonly available of the shelves, there are certain which are higher in complexity and then, there are some where there is no realization even, but then you want to push up the state of the art to realize something which would be helpful for the overall product.

So, these are different levels associated with the product complexity, ok. So, just write this down here. So, you establish the levels of the influencing dimensions using information about the product features, product requirements or any other aspects like that. So, the example which I gave was that you know let us say for example, when we talk about this particular dimension and we want to level into, our split into different levels.

So, the product complexity can be split on the basis of again four different categories. We call level A to B. A level are which includes the catalog items which are easily available in the market, ok. So, you can say the complexity is quite less in such items or there can be again most common parts. So, you have sort of a little state of the art related to the particular product that we are considering, ok. So, there are certain parts designed for the product of the product lines which we are comparing. So, there are certain, so they are just above the catalog items which are commonly available for all parts, are all available products slightly higher sophistication here maybe there is a level C which talks about the really state of the art items.

So, these are the one's which are very particular to the product line that is being manufactured, ok. So, we have the most sensitive interfaces in such products. They are really specially designed for the particular company or the particular product line that the company produces and then, finally those which are not really existent or available, but where you really need to do something or some work to push the state of the art envelope you can say. So, you can say products of the kind where you need to push the state of the art envelop.

So, these levels can be sort of you know categorized into all the dimensions that they have said here involving you know the complexity of the products of the involved technology or let say the competition which is around of resource tightness which is around for a system and you can influence those by laying out different levels of what is available, what is not available or maybe what needs to be found out, and in that manner you can actually increase the level of complexity for these kind of products.

So, then we talk about after all this is done, we want to establish an aggregate level by considering the relative importance of the influencing dimensions and this kind of establishes there should be concurrent engineering environment, ok. So, all this step let

us say A to B, small a to small c are because we want to really establish that what is going to be, should be c environment, ok, concurrent engineering environment. So, this is sort of a planning that needs to be done whenever you are introducing a new product line or a new product system to see what is existing and how it has to be modified, so that it could be a perfectly concurrent engineering environment for the new product line that you are going to be introducing, ok. So, this is the first phase..

Second phase is about identification of the various c elements and their levels, ok. See the elements are mostly related to the organizational structure, for example of the communication which is present or for example, what are some of the organizational requirements or product development methodologies that need to be ascertained for realizing the dimensions, the influencing dimensions at the particular levels that they are intended to, ok.

So, in this manner we are trying to map as to what is going to be the requirement from the organization side or the program side which will be able to gear up for the particular levels of the influencing dimensions, influential or influencing dimensions of the product that have been discussed in the first phase, ok.

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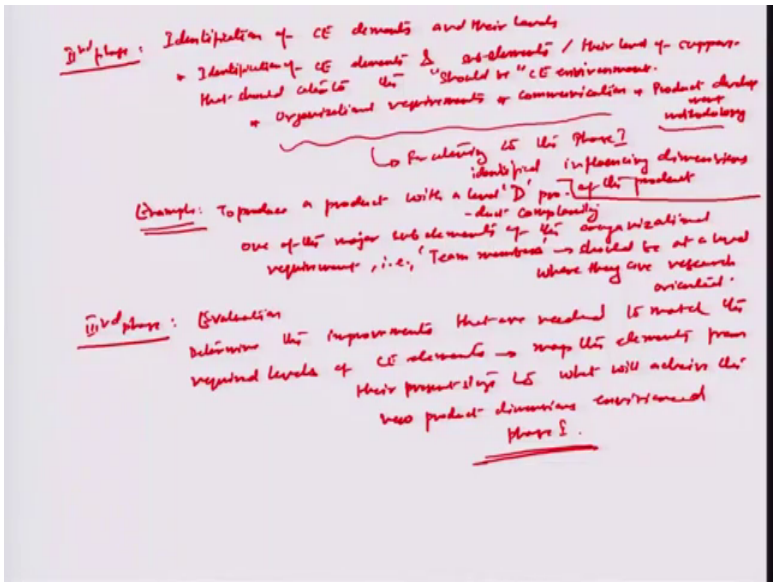

So, let us look into that. So, the second phase now as I have already described is the phase related to identification of again c elements and their various levels. At the end of the day whatever goes into production in a concurrent engineering way should be going

through the organization which is involved in doing the production and therefore, there are aspects, organizational aspects or methodology aspects which need to get involved at some level which will be able to influence the new products which are being launched and their influencing dimensions as such of launching. So, for example, if a product is at a very high complexity level let say the product is for the level d which is about pushing state of the art technology. So, obviously not many such products are available in the market or not many such components are available in the market which will be pushing up the state of the art technology.

So, a lot of R&D needs to be done there. For example, when we are talking about the organizational requirement, so one of the major emphasis would be again ascertain level of the requirements where there would be more research staff than normal staff, ok. So, in this way we are trying to create a matrix where we can define the organizational structure based on which the influencing dimensions levels could get achieved and this way we map what is the current concurrent engineering approach on a very average basis.

After all these dimensions are written down and then, we see how to go ahead to be concurrent engineering approach and what are the areas where we really need to emphasize to make a delta improvement to probably a higher level, so that you could realize what the influential dimensions would be in the intended products.

So, this is a sort of mapping that we are trying to understand. So, let us see here. So, identification of c elements and their levels are basically related to identifying the c elements and sub elements as well as the level of support should be concurrent engineering environment. So, let me write that. So, identification of c elements and even sub elements slash their level of support that should cater to there should be c environment and this could typically be associated with questions like what are the organizational requirements, what are the kind of communications which are needed. For example, the product development methodology that is required to support adequately the c environment and we are in phase one, ok. So, we just write that down product development methodology so on and so forth.

So, these are all to be set at their own corresponding levels for catering to the phase one identified influencing dimensions of the product. For example, I think I just mentioned

that that to produce a product with a level d complexity of the product, one of the major sub elements of the organizational requirements that is team members let say should be research oriented at a level where they are research oriented. So, when you do a hiring strategy, you have to develop a suitable strategy for doing this kind of research oriented member selection.

So, that is how you are going to deal with this particular phase, the second phase and the third phase of course. So, you have to carry out similar analysis for all other concurrent engineering elements which get involved in order to support the activities of phase one and then of course, there is a third phase which is about once you have out laid the various elements of the c environment as well as what is the influential dimension of the products or their levels which get realized or which are planned to be realized by the c environment, you have to evaluate, ok.

So, there is a phase of evaluation and this evaluation is about determining the improvements that are needed to match the required levels to be concurrent engineering environment, ok. So, you have to start with all the concurrent engineering elements and see what is their present level or present stage and try to map into what stage they need to be at how the organization needs to be suitably changed, so that you can attain some of the levels intended for new product lines of the first phase that is you know the influential dimensions of the products.

So, I would just summarize this here by saying it is going to determine, this phase is going to determine the improvements that are really needed to match the required levels of all the c elements that we have been considering so far and map the elements from their present stage to what will achieve the new product dimensions of introduced products in the envisioned phase one, ok. So, phase one actually is the center for all the decisions and this round phase one revolves how phase two should get planned and how phase three should happen, ok.

So, we will try to now give a broad overview about let say for example, when we talk about c environment influencing dimensions, what are those dimensions and what are some of the levels or understanding about let say what is really meant by product complexity or technology or program structure. We will try to look in little more details in this stage.

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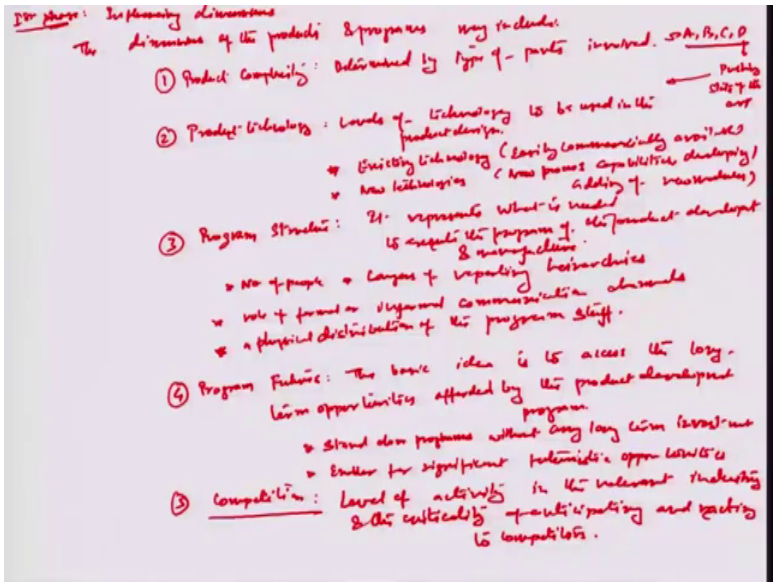

So, when we talk about the first phase, we want to find out what are the influencing dimensions which dictates to build up the concurrent engineering environment. So, the dimensions of the products and programs may include the following product complexity. So, the complexity of the product is really determined by the types of parts which are involved. Parts could be as I told you earlier four different levels catalog parts and then, you know this little state of the art of just common parts or commonly available parts and then, the most state of the art and then, one where the state of the art even needs to push beyond.

So, in case of let say this electronic systems group which may be working on electronic devices and circuits they may be talking about research in thin films and how speeds can be affected in terms of you know communication speech can be affected between the various components in terms of different new technologies, which can be brought in the market.

So, you are talking about level d here which talks more about the new product development aspect where there is a push on the existing state of the art envelope, by changing the realm of materials or methods or maybe sizes particularly when we talk about device sizes so on and so forth. So, that is product complexity I am going to write in details about this is yes determined by type of parts involved which you already know. There are four categories here; level a, b, c and d. I have just described in the last slide

this is the one which talks about pushing state of the art. One example of this could be for example, today if we are developing some kind of a lensing system for the hubble telescope, that is something where a lot of research is needed because you canmot get the requisite resolution and the requisite skill of working unless you are very particular about developing new processes, new methodologies, new material selections which are lighter in weight so on and so forth. So, good station it in place where this telescope is installed, ok.

So, we are talking about really different in terms of innovation or processing aspects when we talk about level d. So, common parts such as cars, refrigerators, computers you know the design of such products may require expertise from a number of disciplines. Disciplines could include mechanical you know engineering trade or electrical or electronics or even metallurgical trades or chemical engineering. Sometimes one expert can really not understand the full spectrum of the functionality of the products when we talk about such complex products, and therefore, a formal committee approach is always a good perspective or brings a good perspective to this whole c strategy when we discuss about this product complexity, the other dimension that we may be interested in this product technology.

So, the levels of technology that can be used in the product design may vary from readily available technologies which are already in the market existing to completely new out of the box technologies which may even need new capabilities, you know capabilities of manufacture for example of a new core technology so on and so forth. So, product technology is a dimension which is related to the levels of technology to be used in the design, ok.

You could consider for example, designing and drafting using available computer software such as what is conventionally available pro engineers or pro ee or autocad package or let say unigraphics that could be one way of going about what is available conventionally, but supposing you wanted to increase the process details of this whole drafting and drawing.

You could as well add new capabilities by adding something like AI or Artificial Intelligence tool which would automatically figure out something and try to draw and give you options, or maybe some very complex relation sort of database based system

where you could actually choose different items which are listed on a conventional catalogue by just doing an image searching rather than keywords searching. So, this kind of very complex product technologies can also be used or conventionally available product technologies can also be used. So, there are different levels now on one project technologies as required by the new core technology that you are proposing to develop through the c approach, ok.

So, let us just record this here. So, this can be existing technologies which are easily commercially available you can say or these can be new technologies which would need new process capabilities are developing slash adding of new modules, so on and so forth. So, that is how you can increase the different levels of product technology. You can also talk about a third dimension of program structure which represents what is needed to be executed at the program level.

So, essentially it would include people who are involved in the program or layers of reporting hierarchies or let us say role of formal informal communication channels which are present within an organizational strategy, structure or physical distribution or even the program staff, ok. So, anything related to the launch of this new activity or new product where we are envisioning CEEE or concurrent engineering approach or with an existing program which is running when we are envisioning conversion into AC environment, we do need to consider the program structure as one of the fundamental influencing dimensions in the product.

So, we just record it there. So, this program is which supports the particular product that we are considering or product lines that we are considering for the setting up of the c environment. So, it represents what is needed to execute the program of the product development you can say a product manufacturer development and manufacture. So, here it could typically include things like number of people who are involved in the program layers of reporting hierarchies in this structure that you have designed you know to support the program or for example, the role of formal or informal communication channels, the physical distribution of the program staff so on and so forth.

So, there can be various levels in such program structure dimension. For example, there can be structures which would vary from a small staff with informal reporting hierarchies and communication channels to a large staff and deep reporting hierarchies, structured

communication channels and again physical distribution across multiple companies which are belonging to the c environment, ok. So, these all different structures are associated with the dimension of program structure involved in setting up c environment. So, there are also again a fourth dimension for c environment or needed for c environment which is about program future. This is a very important aspect that program which is started should not typically be stopped and there should be a strategy or a plan and future for the program to sustain itself and sustenance is only possible when it meets the financial objectives.

So, obviously the basic idea is to assess the long term opportunities afforded by the product development program that has been launched today. You just do not keep into purview the immediate product need that is there which needs to be designed and launched and you know sold in the market, but again more futuristic planning is needed related to how the structure would survive you know for longer amount of time unfortunately when you hire unless it is a contractual appointment. Obviously there are reasons to make. So, the basic idea of program future here is to assess the long term opportunities afforded by the product development program.

So, levels of programs may vary, program futures may vary from a very standalone kind of program without any long term investment requirements all the way to a program that is strategically aligned with you know some kind of futuristic idea, the inter enterprise enablement with significant future opportunities. So, just like you divided the levels of product complexity in this case also from a very basic minimum meet the product or meet the product realization requirement to something which will be strategically effective in the future as an organization can be developed you know as you do this.

So, I am going to now after analyzing all these influencing dimensions lay out a matrix where we will talk about different levels of these individual dimensions and see how they can be achieved through different organizational elements, which will imbibe in the next step that is the phase two of the c environment program which will help us to achieve all these different strategic you know dimensions which are being planned in phase one.

So, you can have for example standalone programs without any long term investment. On the other hand, you could also have something which is an enabler for a significant futuristic opportunities. You can have several levels in between as well the other

dimension which is of major nature and which should be considered as a competition because obviously you cannot stay in business without taking this head on, ok. There is an environment of competition which is around and kind of refers to and the level of activity in the relevant industry and the criticality of anticipating and reacting to competitors moves. Unless you do this, you are not in business. So, obviously competition has to be taken as a dimension, and a very large influential dimension which sets up the stage in phase one which are sort of the requirements you know for sustenance of c environment.

So, here we are talking about level of activity in the relevant industry and the criticality of anticipating and reacting to competitors. So, this dimension kind of emphasizes the need for flexibility, flexibility of the program, and its ability to react quickly to some changes in the competitive environment. Competitions may vary from very basic minimal level to significant pressures to anticipate and react to competitors actions.

So, you can always create again several levels within the competition dimension just as you did in the other dimensions, in order to set stage for what are those requirements for the organization side or for the communication side or for the product development strategy side, so that some of these needs can be satisfied. There are other you know dimensions of influential nature to the phase one of setting up c program, but I am going to close this presentation now and then, look at some of the other dimensions in the next lecture up till now.

Thank you and goodbye.