**Design Practice**
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Lecture – 20 & 21
**Organizational elements in concurrent engineering**

Hello and welcome to this module 20 and 21 of the course design practice. We were talking about how to gauge the various sub elements of C environment given some influential dimensions and they are already established level and they are projected level in the; should be environment C environment. So, in context of that we talked about the various sub elements.

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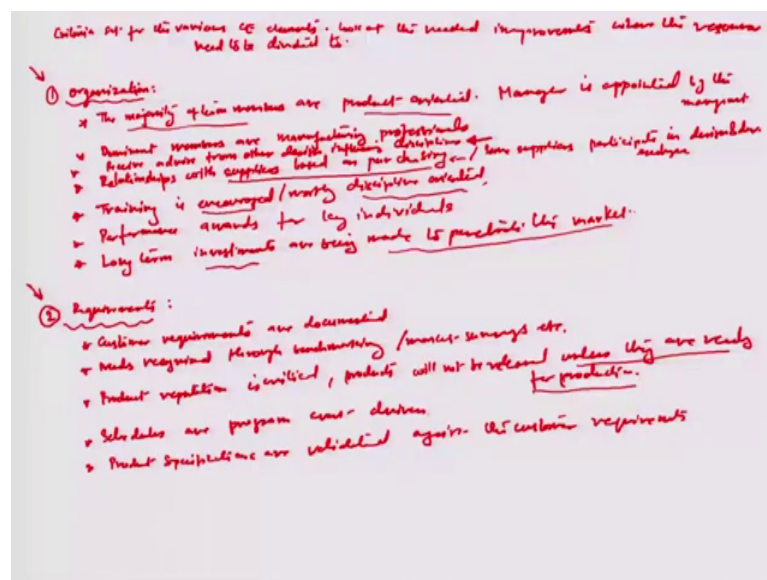
And the various you know factors influencing; the different sub elements including organizational aspects the requirement aspects for the product line.

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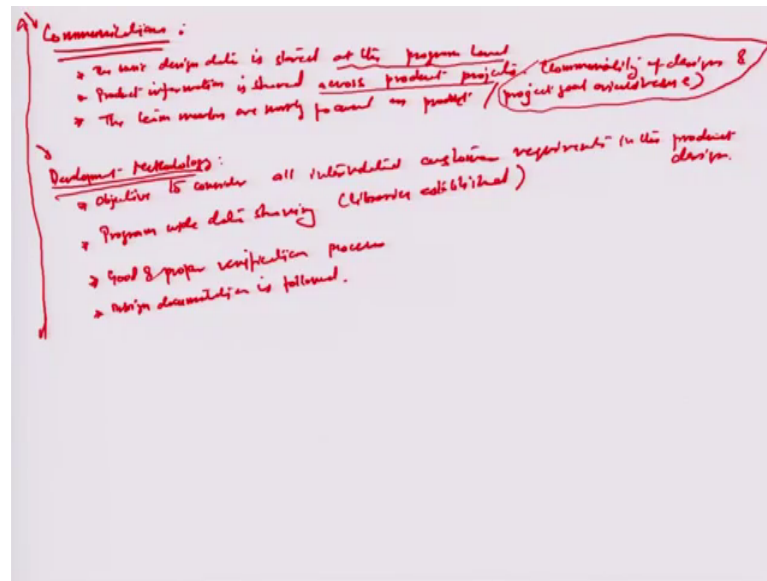
The community communication aspects between the; program stakeholders and then also the development methodology for the product development process and in context of that I would like to also just recap.

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About how the various levels had been earlier set for different organizational elements between A to D into the various sub elements like the membership leadership member contribution business relationship training education responsibilities management decisions. So, on. So, forth

Similarly, a similar analysis was done for the.

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The requirement elements definition schedule types planning methodology and validation.

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And also the communication elements related to working data management, data acquisition, lessons learned from feedback decision treatability interpersonal levels of C environment.

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TABLE 4.7 Concurrent Engineering Self-Assessment Criteria Considering Product Development Methodology Elements

Product Development Methodology Elements	Concurrent Engineering Environments			
	A	B	C	D
Optimization	The theme is customer satisfaction. Review-based optimization; single requirement optimization	Limited interrelated requirement optimization; multiple requirement optimization	Program-wide requirement optimization; Multiple requirement optimization	Total weighted requirement optimization; weighted multiple requirement optimization
Data libraries (single master library source)	The theme is consistency. Control of preferred parts and process libraries; on-line libraries selection assistance	Controlled libraries of reusable module and intent; program accessible network library	Controlled technology-independent libraries; technology information external to tools	Controlled real-time library data from source; technology information external to tools
Development process	The theme is controllability. Product-independent, repeatable, and consistent process; consistent methodology enforcement	Measurement standards definition; key parameter identification tools	Closed-loop control; integrated process methodology	Process improvement and optimization; integrated process optimization
Reviews	The theme is being noninterruptive. Schedule-driven product and process critiques	Event-driven reviews	Immediate issue resolution	Status reporting
Measurements	The theme of measurements is information content. Measurement using function-specific deterministic indices; information systems handle project requirements	Measurement using process-related deterministic indices; expanded information system to include process	Measurement using heuristic predictive indices; statistical process control	Measurement using relevant, analytical, interrelated predictive indices; integrated, enterprise-wide factual data
Analysis architecture	The theme of analysis architecture is hierarchical. Single-level modeling; single-level simulation and analysis tools	Multilevel modeling; multilevel simulation and analysis tools	Mixed mode with multiple view; behavioral modeling with synthesis	Mixed signal/mode process modeling; total synthesis, simulation, and verification capture
Verification	The theme of verification is compliance. Member-dependent verification; complete suite of analysis tools	Multidiscipline verification; multidisciplinary analysis tools	Team verification; compliance monitoring	Correct by construction; compliance assistance

Source: CALS/CE Electronic Systems Working Group Report by Linton et al (1992); Reproduced with permission from Larry R. Linton, Chairman, NSIA CALS/CE Working Group

And then finally, also the product development metallurgy elements related to optimization or maintaining of the data libraries or the development process or the reviews or the measurements or verification or analysis architecture etcetera. So, there were different levels in all these self assessment matrices and you have also found out from the last about two three slides how the different elements map into some of these sub element levels and based on these we want to draw out a matrix for the element slash sub element in a way that we can estimate what is the current level and what is going to be the expected level

So, let us write about this. So, let us prepare the.

We call it the C environment assessment matrix this will give us some you know basis for the allocation of resources in certain zones without really considering a whole lot of improvements to be done which would be more targeted or pinpointed for the overall influencing dimensions to change levels between B and C as was the target given earlier.

So, in this particular case let us say we have the following elements of concurrent engineering and we have different levels here in this environment. Let us call this A, B, C and D. So, the first you know element that we are concerned with is the organizational aspects and in the organizational aspects you know that there are certain sub elements like. For example, team membership is the sub element of the organizational aspect.

So, let us look at where we are placed when we go to the organizational aspect, we find out that you know the organization has a vast majority of team members who are product oriented and then manager is appointed by the management. So, if we look again into the self assessment matrix we see that for the membership if membership tasks perspectives; it is generally appropriate to group them under category a ok.

You can see this particular instance here; in this case also the members have a task V perspective they are on the oriented towards more towards production and or product and. So, therefore, it is a good idea for the team membership to be having a level a ok. So, we just create level a for the team membership just mark this.

Similarly, we look at the second sub element for example; the second sub element in this case is team leadership. And you know that in this model that we are talking about the leader is appointed by the management and if we go back into the self assessment matrix for the organizational elements. You see that for team leadership management appointed team leader is there it is considered to be level A and it is upgradeable to level D of course, all the way to D as you can see here, but right now we are at a level A as regards a team leadership.

So, we will just put level A here on the team leadership the third sub element that we are considering here for the organizational aspect is the team interaction. Again, let us look at what is the feature in the organization which can lead us to map into the self assessment matrix. So, for you know as regards the.

So, we find out that in this particular case in the organization although the dominant members are from manufacturing, but they do occasionally receive advice from other you know design influencing disciplines and. So, there is a sort of a multidisciplinary approach in their you know behavioural pattern as far as advisement goes and if I looked at the organizational aspect again and see the team member contributions there is a case B; here which talks about interface tools and multidisciplinary advisors. So, this is where the most appropriate fit would be of the current status of the organization

So, let us now gauge the team interaction to be at level B based on that, then we talk about business relationships. So, in this case we will just again go back and see what is the kind of relationship level that this organization is at and what is found out is that you know mostly you know there are apart from some themes you know or some specific vendors mostly the relationships with suppliers are based on purchasing of course, there are certain vendors we who are also stakeholders I will just write this down here ah.

So, some suppliers have some stakes participate in the design exchanges design and development exchanges, but they are only few I am not all of them. So, the business relationship seems to be sort of contractual we are very less amount of stake holding is there mostly the environment is purchase driven or you know you can you can say that it is contract based relationship. So, we will get this business relationship at level B of the current organization.

So, business relationships is at level B, then we talk about the next organizational sub element which is about training education and in the training education domain. If we go back to look at how the organization you know in the current form is in terms of managing training. So, we find out that the training is encouraged mostly discipline oriented very specific very focused theme based training and it is not really motivational in nature. So, therefore, the training education could be somewhere around level B. Again which talks about just a little bit of approach multidisciplinary, but again computer based focused training where you know you just learn about the activity that you are doing

So, there is no training education of let us say more motivational cooperative decision making processes or synergistic knowledge based processes and. So, we can say that the level at which the training education of the current level of organization is again B. So, we will just mark that B here again the sub element related to responsibility authority if we look at very closely here responsibility authority you know that in this particular organization.

The performance awards are given to key individuals ok. So, there is some kind of recognition which is there and the responsibility level is really based on some kind of a rewarding bases which again if we go back into the self assessment criterias it hits the category a here where it talks about member responsibilities and rewards.

So, we will just map this into case a and the responsibility authority is at level a of the current organization let us also look at the last element or sub element of the organization which is management decisions. And in this particular case; if we go back again into the requirement of the organization, we find out that long term investments are being made to penetrate into the market and.

So, in a way the management decision that would be there is not going to be just sort of a single phase planning or investment or a profit based cost based decision, but again you know sort of a multi phase planning at a longer horizon of time investments using sort of value based decision support systems which enables case or the level to be at level C

So, we are talking about this particular level here we are not talking about just a single phase of investment or something which is you know positive and decision making, but we are talking about almost a multi phase planning and therefore, you know something

which has a value based decision support system of a longer time horizon ah. So, management decisions if the current level are at level C for this particular organization. So, let us put level C here. So, this is how you gauge all the organizational aspects if we looked at the requirement aspects again

So, let us look at what are the requirement elements or sub elements which have to be considered. So, the first requirement sub element is definition related to the product line which is in question and we already know that you know in our earlier analysis we have said that the requirements in this case are mostly customer requirements which are documented and customer means which are recognized through market surveys and competitive benchmarking.

So, if we again go back into the requirements. So, requirements self assessment matrix; we find out that this corresponds to the level a here which talks about itemize requirements definition or requirements database. So, it is very very specific related to need based you know design ideas ok. So, therefore, the definition happens to be at level A. So, we will just mark the definition at level A.

Similarly, when we talk about the other sub element of requirements; which is schedule types. So, we know from our initial analysis of the organization that for the; requirements you know the product reputation being very critical the products will not be released unless they are ready for production and. So, in a way if we look at what is going to be the level of schedule types that we are considering it has to be an even based schedules are even based or even driven ah.

So, here this corresponds to a case C, if we look at let us say the requirement elements based self assessment criteria for the schedule types the even by schedules happen to be at level C where there is even driven program management tools which are being utilized. So, we will mark this or grade this sub element schedule types at level C somewhere here and then, similarly we have the other sub element for requirement that is planning and methodology that will be the third sub element.

And we will try to find out again using the same comparative method; where we are placed in terms of the current organizations strategy and we see here that the products would kind of get released only when they are ready for production ok.

So, therefore, we can think of a particular level of the planning methodology which more based on synchronization of concurrent interrelated tasks interrelated process driven planning tools to be executed unless that happens we are not able to fore C; whether a product is production ready ok. So, therefore, we talk about level C as far as the planning methodology is concerned this particular level and map that as level C.

Under the planning methodology sub element which is being documented here; when we talk about again validation product validation. So, we know that the validation here. In this particular case is against the customer requirements the product specifications are validated against customer requirements and. So, therefore, you have to have the validation at level beep particularly in this case; because if we look at into the self assessment criteria again for the requirement elements. The validation of interrelated constraints are what actually comes out of the customer requirements and

So, therefore, we will put the validation level at B or level B. Similarly, when we do the same practice for the third element which is communications we have very clear cut you know aspect of communication here for example, the data management accessibility would happen typically on this particular organizational structure that we are talking about at the program level ok.

So, you can see that the basic design data is stored at the program level in the communications module of this particular concrete engineering environment. So, if we look at again the self assessment criteria for the communication elements you see that you know level C really corresponds to a program repository of working data central program database ok. So, this is how at the program level things can be done. So, when we talk about data management and accessibility it happens to be at level C.

So, let us write this sub element here data management accessibility ok. So, we talked about level C in this particular case, when we talked about data acquisition and sharing that is the second sub element. In case of the communication module we find out because you know; we are talking about a concept of product information being shared across product projects and you know you have some kind of you know commonality of design and project goal oriented views in such information being shared.

So, if we looked at the levels the different levels of the section on data acquisition and sharing on the communication sub element self assessment matrix. We see that we are

somewhere here when we talk about data available as generated program sharing central database storage on program network. So, we are talking about the level of data acquisition and sharing to be at level C let us mark level C here for data acquisition and sharing.

Similarly, when we talk about let us say lessons learnt for feedback that is the third sub element and this is mostly about exponential feedback we know that the team members are focused on product and their project goals. So, a very kind of skewed way of thinking here and if I looked at again the lessons learned. So, if you have a consolidated design guide with rational and checking a little bit of structured query capability or with increasingly integrated rules you are talking about a level B where such feedback can be generated.

So, you have some rationale behind; what you are thinking? Although, a very miniscule level of rationale which is good enough at this state, because we talked about again team members focused on their project goals ok. So, slightly above the product orientation. So, we will say that this is a station that level B again when we took a look at design traceability we can record this to be at level C. In this particular case in the organizational aspects ; obviously, there is some kind of communication of design and project goal oriented views which is there of the data and. So, when we look at press ability issues, we are talking about a sort of a program decision rational ownership and a repository with the unstructured keyword search which is available program wide.

So, again something which is where the level of the current organization seems to be and then of course, in the other sub element factor that is interpersonal. In this particular case people are generally focused to the; product or project goals. And in this case we can say that we have sort of equal inputs across the whole program coming out from different sectors which is corresponding to again case C as one can see here where; although, it is not really a knowledge based perspective with generates further knowledge, but you know it is about really the product as such or let us say about the project how it is going? So, that equal input or impact helps in you know sort of interpersonal knowledge generated across several different sectors of the particular program.

So, interpersonal can be mapped at level C. Similarly, we also have a mapping for product development methodology, which I am not going to go into details anymore, but

I am just going to show you how the different sub elements like; optimization, data library, development process reviews measurements analysis architecture verification etcetera are again classified into the different levels A, B, C and D. So, let us just write this down here.

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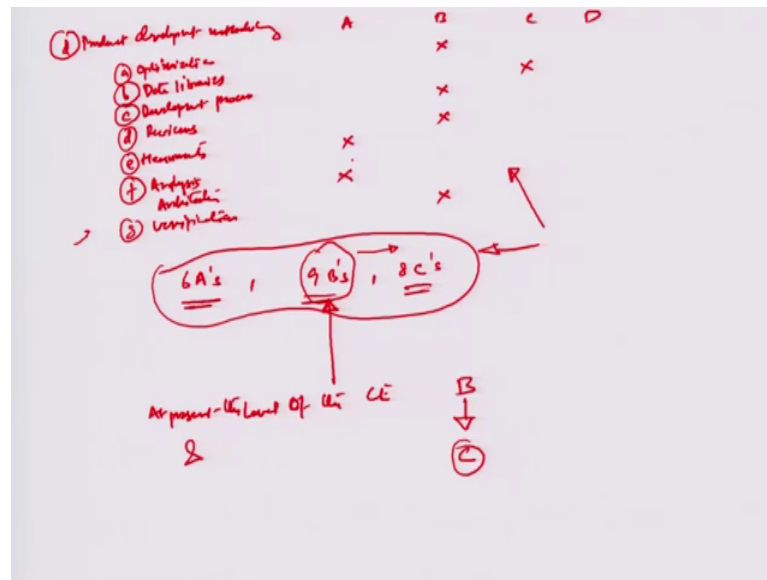
This is element D; in one case we are talking about product development methodology and several sub elements involved. In this case a is related to optimization. So, we know that you know the level of optimization that will be there in this particular case, because we are we are considering all the interrelated customer requirements in the product design. So, we are thinking or we are we are stationed at somewhere around level B. So, with limited interrelated requirements we carry out optimization.

So, let us just grade these into different levels. So, optimization is at level B, similarly in this particular case the data libraries are established across the program to provide application independent data to all projects as well as complete product design data packages. So, this corresponds to a level C, which talks about you know independent libraries technology information external to tools. So, you can think of a level here ok.

So, this is level C, where the data libraries of the program are. So, we just create this level C similarly, when we talk about development process the development process here in this case. So, regarding the development process we have station that level C again sorry level B again which talks about if we look at the product development

methodology; we are having a sort of a good and proper verification process design documentation being followed and then also the verification process is very thorough to ensure proper performance of products delivered to the customers these are the existing levels of the organizer at which the organization is in and we talk about a design methodology which is quite well documented.

So, when we look at the self assessment criterias here for the product development methodology. The development process where the central theme control ability should be based around this which talks about measurement standards definition you know. So, it is a well documented kind of a design process you know you have key parameter identification tools, which are there through which you could access any particular portion measure it measure the efficacy and compare it with definitions.

So, we have there for the development process at level B. Similarly when we talk about reviews again if we look at the section on reviews the reviews are. Typically, in this case even to driven that is what has happened earlier also when we talked about you know even the part related to the requirements that in the requirements section as you ah as you may have found out earlier that the schedules are sort of program even interval.

So; obviously, the review should also be even driven as far as the development methodologies go. So, we will have the fourth sub element here reviews categorized under again category B similarly we have measurements this is another sub element in the product development methodology. So, this is a station that; if we look at the measurements we have sort of a deterministic indices based system where you can have function specific measurement method ok.

So, because it is very methodical the design process is very methodical and well documented it is as well pertinent for us to consider that; in this particular organization, we have a very good measurement information system which can handle sort of varied project requirements. So, we can have the same measurements the station at level a ok. When we talk about again analysis architecture the analysis architecture. In this case has been found to be at level a again and the verification scheme in the product development methodology happens to be at level B which is about multidisciplinary analysis tools based verification.

So, it is a very well defined design methodology so; obviously, these aspects are a part of different sub elements associated with the development methodology here. So, if we in general look at this whole matrix that we have drawn for assessing the current level of the concurrent engineering environment we find out that the way that you know the different A, Bs and Cs are classified a total number of 6 as are recorded. In this particular table as far as B goes then about 9 Bs which are again recorded and as far as Cs go there is no level D. So, C is our 7 actually eight cs which are recorded in this particular scheme of events.

So, as far as the task structuring of the element structuring is concerned you can probably say that again the level of operation here as far as all the elements are concerned is the majority if we have equal weight adjust to all these different elements related to C and. So, at present the level of the C environment is set at B and we want to migrate to C. So, basically we would like to invest into some of these which I have direct consequences which will get into level C.

So, what we are going to do now? What we are going to sort of think of is that? What is the requirement in terms of the influential dimensions? Which will gauge these levels to translate ahead you already know that considering the current scenario the level of difference between the B and the Cs are not very high and. So, if the overall level of the concurrent engineering environment is at level C; then relatively less effort would be needed to establish by directing some of the resources to some of these elements here for making or upgrading the level from B to C ok.

So, we all need all we need is to sort of have a representation majority representation in this matrix; if provided all the elements are equally weighted of more number of Cs than Bs for the environment to change gears into the next higher level you already recorded in the earlier you know few slides that for influential dimensions for the product line to be introduced the manager must consider setting up the environment to level C of the concurrent engineering you know atmosphere or environment from the existing level B.

So, this is the sort of a map which tells that how much effort would be needed to do that in terms of structuring all the elements. So, I hope that you get a good idea about how on a practical situation. Let us say when you know in a management environment needs to be set up for implementing concurrent engineering solutions; one needs to look at

independently for your own specific case, the various elements that are needed or involved in setting up that environment which would be able to assist or influence the product dimensions ok.

And then when any new production line is introduced or any new product is introduced or any new program is introduced in a overall let us say enterprise like environment it is important for one to consider the phase one about; what are the critical dimensions? What are going to be the current levels? Where the level is being is projected for the sales of the new product line to be higher and then accordingly, tweak the; the elements in a manner by limited resources by investing limited resources into them. So, that you could change gears from the current level to A mapped level as necessitated by the phase one influential dimensions of the particular product.

So, this is how you plan a concurrent engineering environment. So, we will sort of round off here this particular module, but in the next module we look at some of the basic tools which are related to by designers to work in a concurrent engineering like; setup and these tools are relatively handy in terms of structured approaches for carrying out the exact customers psyche if it is. Let us say related to failure modes related to a product we have a methodology called f m e a, which means failure mode effect analysis if it is related to training of the voice of the customer there should be a sort of a methodology, where the need the exact need finding a part of the customer should come ahead through a very organized matrix called the quality function deployment matrix Q F D.

So, we will talk about these various aspects of concurrent engineering environments which will enable designers to proceed in a particular manner to do the best product designs. So, with that I would like to conclude this particular module thank you very much and I will see you in the next weeks module.