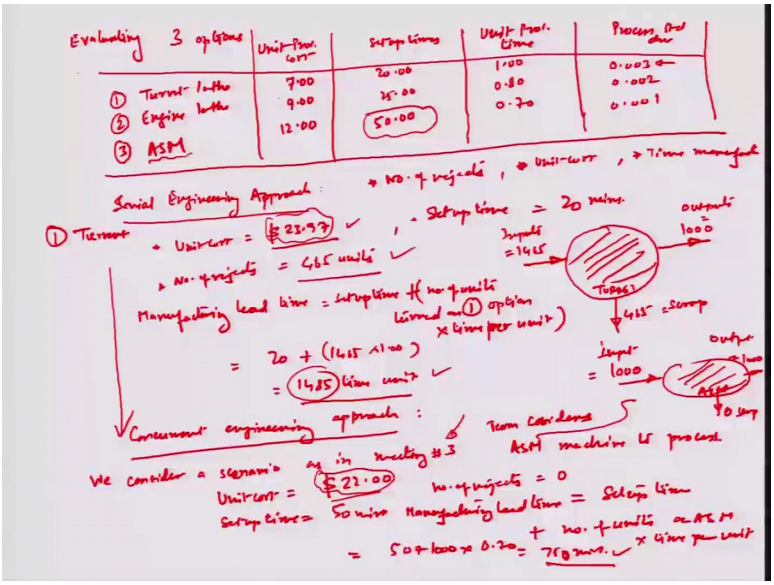
Design Practice
Prof. Shantanu Bhattacharya
Department of Mechanical Engineering
Indian Institute of Technology, Kanpur

Lecture – 13
Benefits of concurrent engineering

Hello and welcome to this design practice module 13. Today we would like to just investigate what are the changes which have been brought in, because of this new concurrent engineering approach in the last few module you have been talking about, if the whole cross functional team works together, with inputs from quality inputs from marketing and sales, or even surveys for input from manufacturing.

The design gets altered suitably to the most economical most optimise designs, but let us look at you know in the serial in engineering approach, when we started with the fines and paradigm based on which there was a unit cost, which was reported or setup time which was reported, how it gets change subsequently, because of the concurrent engineering philosophy.

(Refer Slide Time: 01:01)



So, our problem example here was again about, evaluating three different options, we had three different manufacturing options in mind, one was at turret lathe option, another was an engine lathe ok, and the third was the automatic screw cutting machine. .

And this options were laid out in terms of unit processing cost in terms of setup times, in terms of unit processing time, and process standard deviation, and we found out that you know this three options would have different unit costs as reported in the manufacturing handbook ok, and this was a data given by the manufacturing team also. A different setup times which was like 20 minutes for option 125 minutes for option 2 and 50 minutes for option 3 respectively.

So, the unit processing time that is processing time per unit, in this particular case for the turret lathe was reported to be about 1 minutes per unit 0.8 minutes for the engine lathe, in the component and 0.70 minutes in the a's on the automatic screw cutting machine. Similarly the process standard deviation which was recorded for these 3 different options, and manufacturing options was 0.003, in the first case 0.002 in a second case, 0.001 the minimum standard deviation most accurate system accurate system was defined to be the ASM having said that. Let us now sort of compare both the serial and concurrent engineering approaches.

So, in the serial engineering approach, if you may recall we had obtained, all these values related to number of rejects for all the 3 different machinery, then we also obtained data related to the unit cost ok, probably time of manufacturers well. So, these were recorded for all these pieces which were supposed to be produced namely about thousand pieces which was supposed to be produced.

And we found out that with a mean of 1 inch diameter, and a process and the deviation of 0.0 0.3 inches that is given for the turret lathe. In the turret lathe the unit cost of the product who which came out, happened to be about 23.97 currency units, in this case u s dollars for the turret lathe alone ok. And the setup time which was provided in this particular case was about 20 time units.

So, let us say you know this is in minutes the time units in minutes. So, the setup time was exactly 20 minutes for the turret lathe, and the number of rejects which was the measure of the quality in this particular case, number of rejects happened to be about 465 units, these were the numbers produce which were defective. So, for every 1000 pieces of production in the transformation system, you know you have to enter exactly 1465 pieces out of which 1000 will emerge out, and 1000 good pieces will emerge out and 460 would be the scrap, percentage we should get produced ok.

So, the inputs for again 1465 outputs 1000 scrap units 465. So, number of rejects in this case was 465 units for the turret lathe. So, let us say we are evaluating alternative 1 for the serial engineering approach, and now we would like to also calculate the manufacturing lead time here. So, let us just do that so, manufacturing lead time for the serial engineering approach happen to be again, the total amount of setup time that is being utilise plus the number of units turned on a turret lathe, I will say first option turret lathe is the first option times the time per unit on the turret lathe

So, this then happens to be about 20 plus 1465 times 1.00 time units which is about 1485 time units or minutes in this particular case. So, the serial engineering approach produces with the turret lathe product which has a unit price of about 23.97 dollars, rejects about 465 units, and takes a manufacturing lead time of 1485 units, and this is the alternative which was chosen in the serial engineering approach, but if you look at the concurrent engineering philosophy, you know we consider the scenario in meeting 3 let us say that reflex the concurrent engineering approach.

So, if we supposed that it takes about 0.0 units of time of minutes to process in the ASM or the automatic screw cutting machine. Will have subsequently at 0 reject level the number of good options which are there 1000 pieces to the produced in a very very short amount of time. So, let us see that so, when we talk about a concurrent engineering approach as you may recall.

So, in this particular case we considered a scenario, as in meeting 3, which talks about that the rejects are the higher, and something has to be done, for the customer to accept the overall quality level. And so, the team explode the possibility of using a more accurate machine that is ASM machine to process that the much more accurate level ok.

So, here in this case as you may recall, the unit cost which came out was about close to again 22 dollars and setup time particularly if you consider the ASM comes to about 50 time units of 50 minutes ok.

And similarly if I f I look at the number of rejects in this particular case the number of rejects was 0, that is how it turned up, and manufacturing lead time which happens is constituted of setup time, again plus the machining time which is the number of units on ASM times time per unit that it takes on an ASM. So, this happens to be than about 50 plus 1000; obviously, in this particular transformation in the ASM machine, as emerged

in the third meeting if the transformation changes from a turret to an ASM. In this case have exactly 1000 pieces input, and 1000 pieces output was almost 0 scrap coming out ok.

So, that is how accurate or that is how precise, this particular machine is ok. So, in this particular scenario as we know the number of the manufacturing lead times came out to be about close to 750 minutes ok. If I looked at from the serial engineering to a concurrent engineering approach, this whole fact of reiterating, and some somehow using you know feedback from different sources, and trying to invite in the whole process of thinking the importance of some areas which are not consider to be as important in the serial engineering areas like quality for example.

It helps us to resolve the scenario, and helps us to get into a situation where we are operating as you see at a much much lower set up time of the manufacturing lead time. So, earlier must 1485 minutes, and now it is about 750 so, to about half ok. And that also at a price which is more a similar its price not changing much you see 23.97 dollars for piece was the price which one could get on the turret lathe, and about 22 dollars is the unit cost which would be gotten on the automatic screw machine.

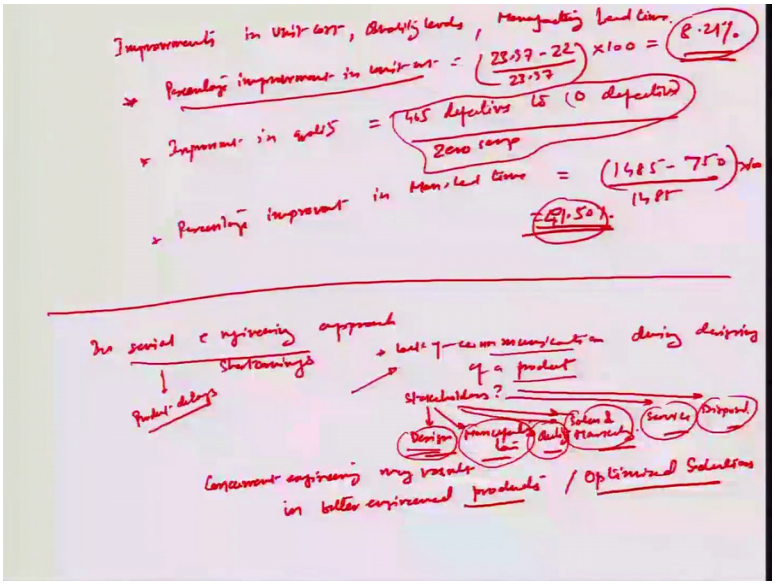
So, infact it is for the better that the cost is also going down by may be a dollars also, and you are able to get at a much lower manufacturing lead time at much lower cost, is scenario where the number of rejects are 0 or number of the quality is very high. So, this happened because of the involvement of several people at the very outset, and the design which is going to be a better design; obviously, is going to include you know the same specifications 1 plus minus 0.0003 on the ASM, whereas at the outside. If you look at ASM, and if you look that the process is expensive you find out that it is not going to work ok.

So, it is about trade off again in this case as you saw the trade off was between the number of rejects, if the number of rejects are lower still the cost comes down, and the processing time is lower still the cost comes down. The question is what is going to be the decision of a company, and this decision would have never arisen had you not involve quality from phase 1 ok.

That is for the benefit can be envisioned, as when we talk about concurrent engineering approaches. So, with this I think 1 thing is very clear if we looked at what are the

improvement levels, you will like to sort of see percentage wise what are going to be the different improvements in the different parameters.

(Refer Slide Time: 11:59)



So, let us say improvements in unit cost of the product, the quality levels for the manufacture of the product, and manufacturing lead time for this product. So, you see that the percentage improvement in unit cost is again about 23.97 minus 22 by 23.97 as for 8.21 percent. So, is reduction on the unit cost by 8 percent improvement in quality is humongous. So, the improvement in quality is almost I would say in 465 defectives to 0 defective ok.

So, this is more or less a total quality managed the system with the very less scrap, 0 scrap comparison to scrap generated earlier, and then of course the percentage improvement in manufacturing lead time is also tremendous its 1485 minus 750 as a percentage represented as a percentage about 49.50 percentage. So, you can think of the improvements in the cost of the lead times ok, and also the quality just because you involved everybody in the decision making process from the very beginning.

So, there are very various other advantages also that concurrent engineering has to offer one of the most important benefits of the concurrent engineering is a although, not explicitly adjust in the very simple example, that we did in the last few modules. In many large development projects particularly, when we are talking about product development the major issue which happens is la the lack of communication between the different

numbers, and the lack of communication can be resolved at the very outset, when we talk about a concurrent engineering philosophy, or accountant engineering approach. .

So, you can probably lead yourself too extensive amount of engineering on the various phases of the product life cycle, when you are putting a concurrent team or concurrent engineering team in place cross functional team in place, because everybody will bring his own perspective on the table, related to not only just the design and the manufacturing phases of a product. But then you know related to the sales, and after sales part and also to some extent even people who are going to look after how the how the product is so, up to the disposal phase of a product life cycle.

So, all the associated experiences couple at the very beginning in the in the design process ok. Because of which maybe delays can we avoid, for example, that that say we just categorised this way that in serial engineering approach, the shortcomings if you look at or first of all lack of communication during designing of a product ok, or lot of communication between all stakeholders.

So, who are the stakeholders? So, stakeholders are members of various part of the product life cycle ok, stakeholders can be the design team, they can also be the manufacturing team, they can be the sales and marketing team, they can also be somewhere around here, quality team they can be team related to let us say the service of the product and even the disposal ok.

So, these are the different aspects of the life cycle of a product before from the from the designing to the realization to the sales, and what you are essentially having in the serial engineering approach is a lack of communication between all these different teams, which get resolved when we talk about concurrent engineering.

So, the lack of communication gets address and so therefore, concurrent engineering may result in I would say better engineered products, because of this knowledge that gets packed on to the product from the very beginning ok. So, may result in better engineer products, or you can also record this is optimise solutions.

So, we are not only concerned with the product, but also the solutions with respect to the production as well as how it channels through the to the consumer. So, typically if you had this shortcoming, if you had the lack of communication in serial engineering this

leads to product delays, because at every phase when the product passes through there is some engineering change on the other which has to be introduced every time to the design phase, also definitely this is not a very good approach in the serial engineering strategy that some company may an vision.

So, the increase in time to reach market can influence various aspects of a product it can lead to probably influencing the acceptance the overall acceptance of the product. The market position related to the product, the project cost overall quality all those things are affected very much when we are talking about the serial engineering philosophy. So, this can be addressed by 12, and it should be on a farm base is that one should be ready to adopt the concurrent engineering strategy.

So, we will not talk a little more details about how do we characterize concurrent engineering environment what are the different components, which are needed for looking into such an environment, and we will actually endorse this through a case study. Case study which would talk about the computer aided acquisition, and logistics support, which was hired by the electronic systems working group by the (Refer Time: 19:37) operation. Which led to a very structured organisational nature, and we shall led to this communication increase by several folds leading to overall benefits as associated with products which were launched through such a platform.

So, we will talk about this electronic systems working group report by LinkedIn and co workers ok. It is a case study, and in context of that we will try to understand what is going to be the concurrent engineering environment, how do implement such environment for any kind of product complexity, product technology, defining program structures, program futures, competition in the market, and many other parametrics like business relationship team scopes, resource tightness, schedule tightness, so on so forth.

So, we will start working on this problem probably from the next module, and I would like to close this particular module, but in the next module we will just discuss this case study by LinkedIn in a more appropriate manner.

Thank you very much.