Manufacturing System Technology - II
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Lecture – 02

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Hello and welcome to this Manufacturing Systems Technology Part 2, course - module two. We were talking about costs of quality in the last module, and let us look at why costs. So, as we already know that one important aspect of product development is really to translate the need of the customer into the product specifications. So, the customer requirement you can say into the product specifications. So, the manufactured products which do not meet the specifications have to be necessarily repaired before giving to the customer, so that they can start meeting the needs and aspirations of the customer itself. So, the prime quality costs for supplying the satisfactory products to the customers include producing, identifying, avoiding or repairing products that do not meet the customer requirements. So obviously, if you introduce you know quality at the process itself, process stage itself by designing the process in way that it produces high quality then there may not be many deviations and this quality costs would come down.

So, there is some kind of penalty matrix that you are associating with every non-conformance stage which is happening through the process control or even at the product design stage. So, and this costs has to be over all minimized which are also known as

quality costs or costs in order to ensure that whatever is the output of the process is meeting the customer need. And this can happen only if you do process improvements and process balancing at every stage; so that you have zero defects produced from the process and zero non-conformance of you know any kind of standards or quality frame work which has been laid out. So, the goal should be really continuously to shift the endeavor towards value where these costs come down to minimal numbers.

Let us look at some of the costs which can be categorized into many different categories. So, there are prevention costs and I am going to give brief introduction about these different costs, may be do some calculations at certain time to figure out how this cost can be attributed you know and how quality loses can be sort of minimized by doing process design etcetera. There are appraisal costs, and there are internal failure costs and external failure costs associated with product.

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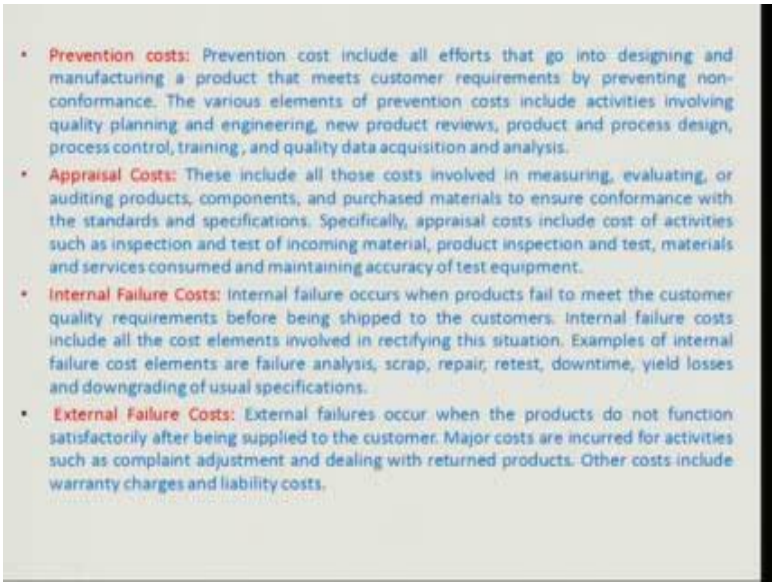

So, let us look at some of these different categories and what they really mean. So, the prevention cost includes all efforts that go into designing and manufacturing a product that meets customer requirements by preventing non-conformance. So, you introduce checks and balance everywhere for example, in while the product is being designed or the process is being designed, we have to have enough scope in the design for quality planning and quality engineering. So, this may at the outside seem to be non-value added activity, but it is important because you know when you are laying out process with certain specification the conformance to that specification is absolutely important aspect for you know repeating the process again and again to produce many products. So, there

are various elements of prevention costs you know which includes activities involving, let say quality planning and engineering in all organizations there is you know quality system department or quality engineering department which actually thus process added which thus product added, all though different things to ensure at every level that there is some kind of non-conformance.

So, this has to be in the part of the design of the organization, you have to put these components which are additional costs which you are trying to impose which will rather prevent the non-conformance to standards of specifications. So, this is sort of futuristic activity that is being planned at the design stage itself of the organization. So, that you ensure that there is repeatability, although it may not seem to have initiate return when the process lay out has been done etcetera, but the deviation happens because it is a dynamic machinery or dynamic part or dynamic system and these deviations have to be kept within control.

So, you can even also have prevention costs by let say new product reviews; for example, you know what is the perception or the need, mapping of the customer or even aspirations of customer behind certain product, you know customer thinks x y z different things about a certain line of cars for example, certain line of auto motors for example, So, the reviews would be able to sort of get incorporated and the design stage itself, so that there is enough quality and that need can be somehow mapped, so that is also a prevention cost prevention cost of things in business to be meeting whatever the customer wants and the ability of the business to change itself completely dynamically. So, that that mapping can happen at every level is prevention cost product.

Process designed is very, very important issue at every stage you will have to have process control, you will have to have training, you will have to have quality data acquisition analysis. So, these are additional costs which are imposed on the system although there may not be with any direct value added to the product, but just to ensure that there is no non-conformance. This prevention of quality non-conformance or prevention of inappropriate quality to happens. So, these are indirect costs, which are burst on to the systems so that is what prevention costs prevent non-conformance and the cost associated with preventing that non-conformance.

Obviously, there would be appraisal, which is needed at every stage which includes measurements all quality parameters are somehow subjected to a thorough check in

terms of some measurements for example, the diameter of shaft may be 1 inch plus minus 0.03 inches. So, this is a dimension and tolerance given in the design itself, when the process should be able to meet this guidelines as it produces and so how do you know that the process is meeting the guidelines; obviously is by measuring the output diameter of the shafts which is coming out of let say CNC lathe, or some kind of process which produces this turning. So, all those costs which are involved in measuring evaluating or auditing and this appraisal cost come into picture because of the prevention in the design itself. So, you have a scope for quality aspects or quality you know auditing or quality data acquisition at the system level itself, which imposes these costs.

So, these come because you know you can actually try to validate the components which are coming out raw materials in your system the purchase material you know to ensure the conformance with these standards and the specifications before feeding it on to the systems. So, these are additional appraisal costs where you are appraising, you are trying to measure, you are trying to evaluate the standard, you know compliance of the particular part that is going through in the flow in flow out system of the process. So, these most specifically, the appraisal costs would include costs of activities related to inspection, test of incoming material, there is for example, parts inspection cell which is always there, and we are talking about vendor development or supplies chain management systems. So, the parts inspection goal here is to sort of see that if you are having two sources from which same part is coming or both the sources complying to the standards laid out. And if there is some kind of deviation when the PI of the parts inspection has a responsibility added responsibility to go and do process audit at the vendor end and seeing what is the reason for the non compliance and trying to remove that so that comes realistically into the system and the system get does not get altered much. So, you have product inspection and tests materials in services consumed and maintaining accuracy of the test equipments. So, these are all part of the appraisal costs.

There is internal failure costs which means that this is related to when the product is in the production stage itself and it is not yet gone to the customer. So, it is not yet gone from the per view of the your production unit to the let say the dealer or the customer and this is a huge amount of you know saving if you have a little slightly more internal failure costs; obviously, it has to come down that is going to the basic philosophy then the external failure costs. So, you have to in any event ensure that the internal failure costs may be sort of higher so that the external failure costs does not come at all because

that actually is related to the perception of the customer about the company and that perception is something that you cannot lose you can effort to lose that.

So, internal failure occurs when products fail to meet customer quality requirements before being shift to the customer, examples may be something like failure analysis, scrap repair, retest, downtime, yield losses, downgrading of usual specifications. Sometimes which happen because of some constraints and some meeting of the production lead times issues there is lot of pressure to create parts or you know creates systems which are non-complying to for all standards sometimes and then later on not leave them out of the purview of the production and when the right tuning is there you can probably replace some of the components there so that you know you may be get them back on track in the quality standard which has been laid down.

So, for example, let say in production line in cars you may have a concept of you know because of the unavailability of a certain material which is of critical importance let say for example, there is a tyre automotive tyre and there is unavailable on the line. So, you can mount different tyre which is available or different grade of tyre which may otherwise not meet this specification and try to ensure that the production is smoothly done. And before dispatching into the customer try to do the changes and the quality inspection therein at that stage so that some re work is done so that the there is compliance you know over all compliance of the guidelines of the specifications laid out. So, these are also a part of internal failure costs. Sometimes the management does need to take the decisions where because of the some kind of unavoidable consequences related to certain aspect of the process the - overall process should not get ((Refer Time: 10:50)), so, there is conscious decision making which is involved in that case, but then again it is an internal failure and that costs get accrued on to the overall product costs.

Obviously, it is much better than getting an external failure costs which is when the product do not function satisfactorily after being supplied to the customer and this is something you cannot afford. These days the companies really are help and done I would say arresting the warranty issues which come from the market, and each and every warranty complaint is treated very severely at the level of the quality engineering or the quality systems management group of particular company, because that is something that one cannot afford because this really creates pressure on the customers mind to change this decision about buying that particular product and this is something that is essentially amounting to losing business.

So, therefore, external failure costs by and large should be avoided; although there are certain issues which would happen with time for example, when there is dynamic machinery and it is trying to you know be used or it is being used for very long time for many cycles there is bound to be some deviation in the particular machinery, and this deviation is something which eventually will result in some kind of failure. So, therefore, people really look at maintenance plans and forced maintenance plans, sometimes the manufacturer provides force maintenance plans just for this reason that you are compliance to the standard even if when the product is performing with the customer should never go out and the customer should have a good perception of the product all through the product life time, so that is what mostly these companies are intending these days that once it is sold to the customer the liability of the failure also partly owned by the company. And though these are major costs, which are incurred for activities such as compliant adjustment and dealing with returned products; other costs like warranty charges liability costs etcetera. By and large should be avoided and should be limited to the internal failure costs level. So, this is what is the cost structure for ensuring that, there is quality system in place or deployment.

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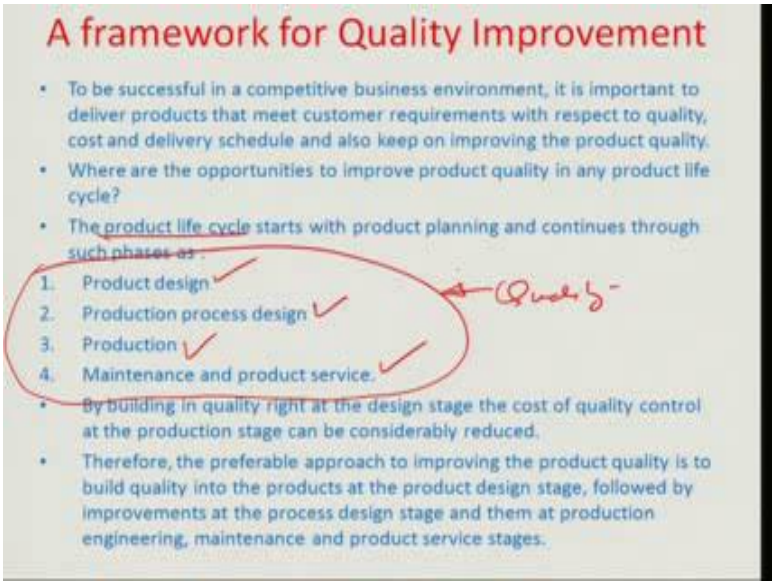

The other issue is over all you know there has to be frame work where you have this quality improvement at every stage of particular business and the quality has to have its presence in all the different phases of the product life cycle as such. You know that the life cycle starts with the product design stage then with the production process design stage the actual production stage and then the maintenance and product service stage. So,

these all four formulate a part of the product life cycle. So, there has to be a presence of quality in all these four stages related to the product life cycle, and you have to build frame work, so that there is possibility of improvement quality wise at every stage of this product life cycle, so that you can build the right quality at the design stage. So, some of the cost of quality control and production stage can considerable reduced because of the quality by design.

And also the preferable approach to improving the product quality is to build quality into the products so the product designs stage, so that again you know the overall costs of maintaining the product compliance is reduced. So, typically these two stages designed and of the product and the design of the production process are very, very critical, because this would allow you flexibility to change the overall guidelines the envisioning system plan which would ensure that you know everything is complained. So, the flexibility can be utilized at the design of the product of the design of the process stage itself. So, this brings us to the end of the module two of this Manufacturing Systems Technology, Part-2. We will talk in the future modules about how to design the products and the process to ensure full compliance of the quality, so that will do in the subsequent module.

Thank you.