Advanced Green Manufacturing Systems
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Lecture – 02
Dynamics part-II

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So, continuing the previous topic where we left out we are going back into talking about the Manufacturing Systems and how the productivity is linked with the manufacturing systems. And in the previous slide we have already seen the manufacturing system as a transformation process we called it as a conversion of raw materials into desirable products and this conversion process is what we called as a transformation process.
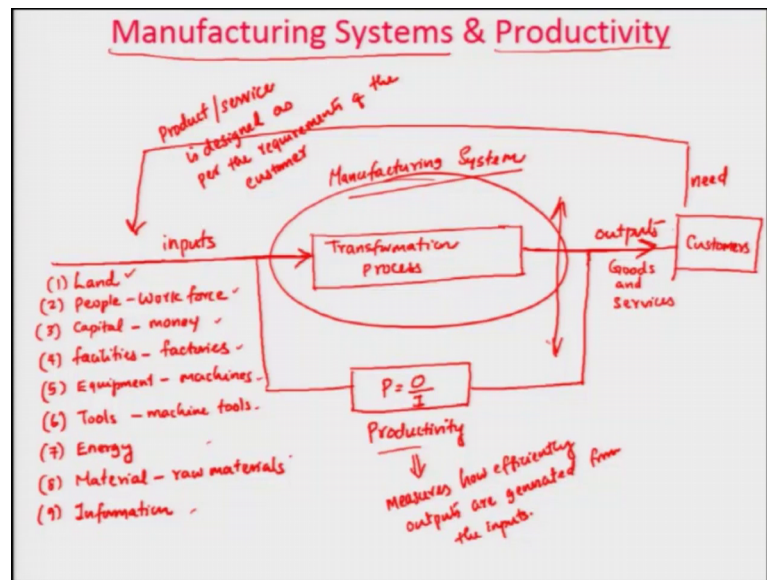
So, when you think about it you can think about the manufacturing system like this let us call this as the manufacturing system and this has the manufacturing system has inside the at the transformation process. So, the transformation process has both ok. Whereas, inputs there are coming into the system and what will have outputs ok, these outputs goes to the what we call as the consumer or customers. So, the transformation process takes the inputs which is the manufacturing system and converts it into outputs. What are these outputs? Outputs are mostly goods and services.

So, the outputs are in the form of goods and services and what are the inputs. So, either large in list of inputs majority of the inputs are land, then there is people or what we called as work force in the some people call it as man also then there is capital the, other way to think about it is money. Then facilities ok, some people call it as factory is also or the places where this happens, then you can think about is as equipment the colloquial term for equipment is machines then we have is tools they are also combined with the machine. So, that is the some people called it as machine tools this term is also used.

This machines and its tools then you have energy this is the one that drives the machines, then you have is materials or some people call it as popularly known as raw materials, then we have also what we have is information, information about the process and other things or what tool to use what is a raw material things like that. So, all these inputs gets fed into what we call as the transformation process and the transformation process

produces what we call as outputs which are goods and services which are a given to the customer. And the customer is the customer is the one that provides the need the customer need is judged and then the product or service is designed product or service is designed as per the requirements as per the requirements of the customer ok.

As per the customer requirements the product or service is or the good or service goods or service is designed and then this transformation produce process produces that. The question then we have is where is this productivity, how manufacturing system is linked with the productivity and this linkage happens right here I will call it like this P is equal to O over I ok.

So, this is where the productivity and manufacturing systems are linked, if you really want to you visualize it is the ratio of outputs to inputs or in a way you are saying that what percentage or what percentage of the outputs are being generated by the inputs which are in the form of land, man, money, factories, machines, machine tools, energy, raw materials, information, etcetera all these things are fed into the transformation process and how efficiently. So, the productivity to a large extent measures how efficiently we do it.

How efficiently outputs are generated are generated from the inputs. So, that is the major aspect of the productivity measure. So, this is how we can think about as a manufacturing system and the productivity getting integrated this is the integration this part is where we are integrating both manufacturing and productivity.
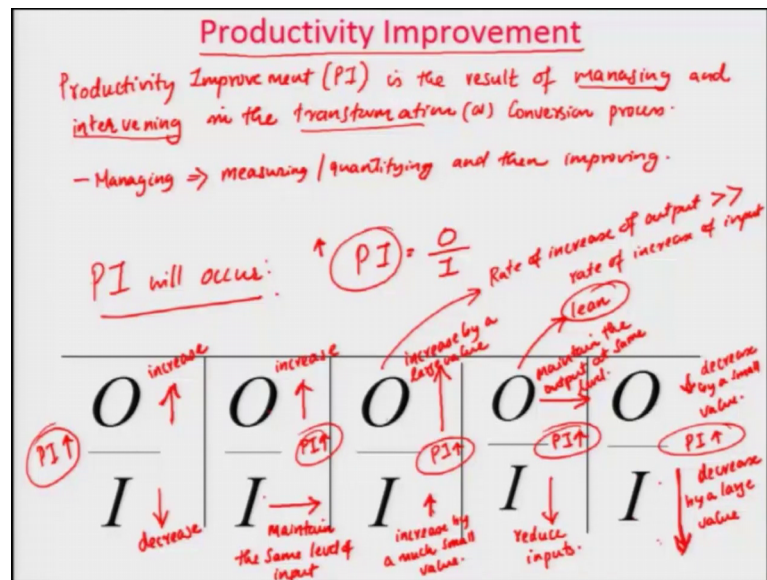
Now, productivity improvement that is another major topic of manufacturing and let us talk about productivity improvement really quickly; because this is important for us to talk about this in the sustainable or the green manufacturing system. Typically the productivity improvement productivity improvement productivity improvement PI what its typically called as is the result of is the result of result of managing and intervening and inter intervening in the transformation process in the transformation the transformation or work process or we can call it as the conversion process or conversion process ok.

So, what we are talking about is we are managing or intervening in the transformation or the conversion process. So, we are getting in into this process and then we are trying to do something ok. The role of managing is there managing is managing employees measuring or quantifying, quantifying measuring or quantifying and then improving that is what we talk about us managing in this regard.

So, even think about thus the PI the productivity improvement will occur ok, majority of the time the productivity improvement will occur if you can think about it as the output PI is we remember PI is the ratio of outputs over inputs. So, if you do this increase the output and decrease the input. So, this is increase the output and decrease the input if you do there then the value of productivity will go up there since the denominate numerator is increasing and denominator is decreasing there is ratio this value of PI will increase.

Then the second option is increase the output and you do this which is maintain the same level of input ok. So, what we are saying is that while the input remains constant the output is increased or the denominator remains constant and the numerator increases that is a case still then the value of productivity improvement will go up. Then there is another way to think about it is this then where increase by a large value and we do a increase by a much small value.

You might not be able to stop the inputs from increasing, but the rate at which the input. So, this one is the we are talking about is the rate of increase of output is greater than rate of increase of increase of input we talk about this much greater than. So, you increase the output by a do numerator by a much large quantity while the increase in the denominator or the input is by a very small quantity if you do that than your productivity will also improve.

Then the third one is this not a third one the fourth one is this maintain the output level output at same level ok. So, you are maintaining the output at the same level, in the same time you can basically think about it as reduced inputs. So, while you are not in increase. So, the numerator value remains the same the output remains the same, but you are trying to reduce the inputs or to a large extend this kind of an approach is what people call it as lean manufacturing that you do not focus on increasing the output you maintain the same output, but consume less to produce the same output.

So; that means, you are reducing the wastage and that there process you are actually trying to achieve what we called as a lean system then there is another one which is you reduce the output, but you reduce the input drastically. So, decrease by a large value ok, here decrease by small value. So, what we are saying here is that the rate of decrease the rate of decrease of the input is way much higher than the rate of decrease of the output.

So, the denominator reduces at a much large value compare to that of the output thereby resulting in the productivity to be improved. So, these are the five options the first option again is increase the output decrease the input. So, your PI will increase in this regard the other option is increase the output well maintain the same level of input. So, your productivity improvement will also be positive in this regard.

So, increase the output by a very large value while only increasing the input by a very small value. So, the productivity improvement will also grow up by a large value, then

you maintain the same level of output while reducing the inputs a large value. So, then what happens is your productivity improvement will happen in this case also and you can decrease the output by as very small value in the same time decrease the input by a very large value which will also result in improving your productivity.

So, when people talk about productivity improvements these are the 5 options in which you can achieve productivity improvement in the system.

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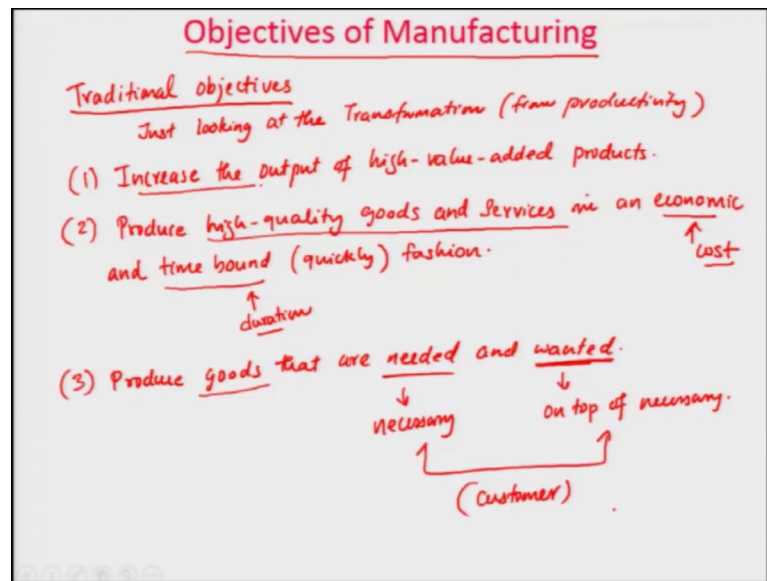
Then the next topic that we would like to talk about today is: what are the objectives of manufacturing. So, we talk about within two ways we talk about the traditional objectives. So, in the time memorial when people who are talking about it as this is just looking at the just looking at the transformation from productivity angle we are just looking at the productivity angle.

So, the major objectives of manufacturing traditionally have been 3, they are include increase the output of output of high value added products ok. So, we are saying that increase the output you know at all cost increase the output of the high value added products as the 1st option or the 1st objective.

The 2nd objective is produce high quality produce high quality goods and services goods and services produce high quality goods and services in an economic and time bound fashion or you call it as quickly time bound fashion ok. So, what we are saying is that we

have to produce high quality goods and services in an economic and type of fashion. So, economic is the cost and time bound is the time or like duration to manufacture the goods. So, you take the as short of a time as possible and produce it at a cheaper rate that this what the second most objective of the traditional manufacturing has been. Then the 3rd one is produce goods that are needed and wanted ok.

So, need and want are two different things because need is something that is necessary this is necessary this is more like on top of necessary. So, this is like you want I need food, but I want sweet kind of a thing ok. So, sweet is not a necessary thing ideally speaking, but its more of a luxury in that regard. So, ensure that you deal with the basic needs and as well as the luxurious needs as well. So, produce the goods there can satisfy such kind of needs. So, these are the needs of the customer ideally speaking we are talking about the customer in this regard.

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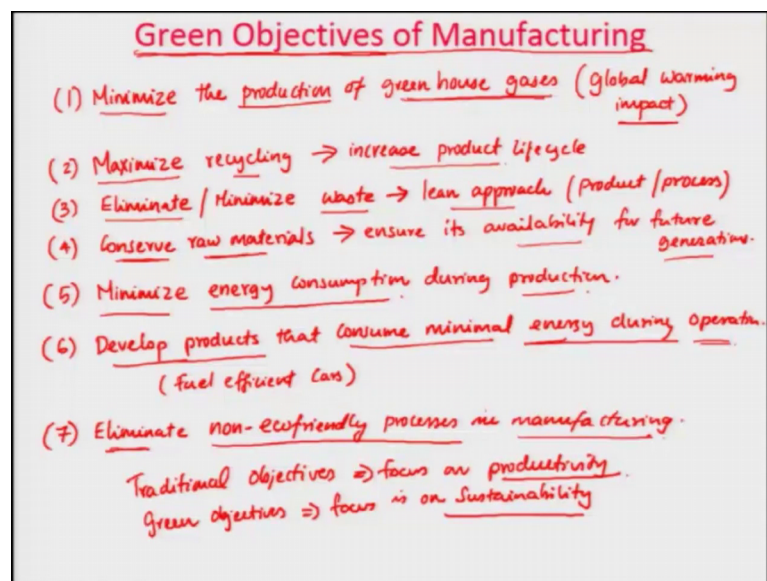
Now, when we talk about the green manufacturing then the objectives do change, from the traditional manufacturing while the traditional objective is do remain their what we are talking about is the in the green manufacturing the objectives get a different flavor or it is somewhat different as that of the traditional manufacturing.

So, the first major objective in this one will be they minimize the production of green grows production of greenhouse gases greenhouse gases ok. So, this is the carbon dioxide and all those kind of things or this is what we called as global warming const

impact. So, in the green manufacturing one of the main things is reduce or minimize the production of green greenhouse gases. So, that the impact of global warming can be reduced that is one of the first green objectives in manufacturing.

Then the second one is maximize recycling. So, one other objective in this regard is you maximize recycling or in the way you try to recycle and they ensure the. So, it is what we called as increase the life cycle increase product life cycle in one form or the other ok. Like newspaper becomes newsprint which can be used to make corrugated modes for packaging which can be later use to make some another product then we ok, then we also talk about eliminate waste or eliminate or minimize waste ok.

So, this the lean approach or what we are trying to say is lean approach ensure that the waste in both product and process both type of waste it includes event the time and other aspects should be eliminated then the fourth one is conserve raw materials. So, the conservation aspects ok; so, ensure that your raw materials. So, it is like ensure its availability for future generations.

So, we do not just consume and exhaust everything the future generations also have a chance to do the same thing by conserving the raw materials. Now then the 5th alternative is minimize energy consumption energy consumption during production when you are producing goods and services ensure that you minimize the energy consumption or your reducing the energy because energy is one of the inputs in this regard.

Then 6 develop products develop products or services products that consume minimal energy during operation energy during operation ok. So, an. So, what happens is make products or build products they are consume lesser energy compared to the typical one an example of it is fuel efficient curves will curves that are highly fuel efficient.

So, that it will only consume less fuel or in a way less energy is required for operating this vehicle. Then 7th one eliminate non eco friendly eliminate non eco friendly processes in manufacturing. So, what we are saying here is that whatever is the non eco friendly processes that are available in the or you are pack following in the manufacturing eliminate them.

So, the grain main green objectives once again going through that is the you are trying to minimize the greenhouse gas emissions. So, that you are global warming can be reduced

and you are want to maximize the recycling. So, that in which you are trying to focus on the product life cycle of the system, you are trying to eliminate or minimize the waste which is more like resulting in a lean approach both in the cases of the product and process and have a lean process.

You are conserving the raw materials which means for future generations your thing about the sustainability of it future generations will also get a chance to build the same thing and you are trying to minimize the energy consumption during production. So, find a way to reduce the energy that is use to during productions and then the develop products there consume minimal energy or in a way whatever the product that you are building during its operation ensure that it consumes minimal energy.

Then eliminate non eco friendly process is in the manufacturing ok. So, what happens is the manufacturing whatever processes you follow you ensure that there are no process which is non eco friendly or it is creating a scenario in such a way that it is harming the environment in this process. So, these objectives, this green objective are quite different when compared to the traditional objective of the manufacturing. So, the traditional objectives the traditional objectives focus on the focus is on productivity.

 The green objectives the focus is on sustainability ok, that is the main difference that you need to understand between the traditional manufacturing and the green manufacturing while one emphasizes on productivity the most that there are emphasizes on sustainability the most. So, with this what we have done is we are come to the conclusion of the first major topic of the or the interaction part of this course and what we will do is we will have a brief discussion about product life cycle in the next class, we could not cover that in today's class.

And once you finish the product life cycle we will go into what are the what is optimization and what are some of the important techniques and tools of optimization that you need to understand. And then I will also give you a brief idea about statistics that are required for this course and then in the process in then we will get into the other advanced topics of this course. Thank you very much for your patient listening, please go through the lecture slides once again and do your assign reading and how fund focusing on green manufacturing systems which are the need of the our because otherwise what will happen is the greenhouse gas or the global warming will actually make this world

not livable for us. So, let us ensure that we do sustainable manufacturing or green manufacturing for the future generation it is our responsibility.

Thank you very much.