Automation in Production Systems and Management
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Lecture - 09
Automation Principles and Strategies for Process Improvement

As you are aware that our main concern is Automation in Manufacturing and Production Systems. First you must know the characteristic features of typical production system and typical manufacturing systems.

Before we go for implementing an automated system whether across a system or for a particular subsystem of a production all sorts of activities from different perspectives must be identified.

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Now during this lecture session, we will be referring to the principles and strategies for process quality improvement for automation. You need to consider the different kinds of the processes, operations and activities being carried out.

For quality improvement in the process performance certain principles and strategies must be considered.

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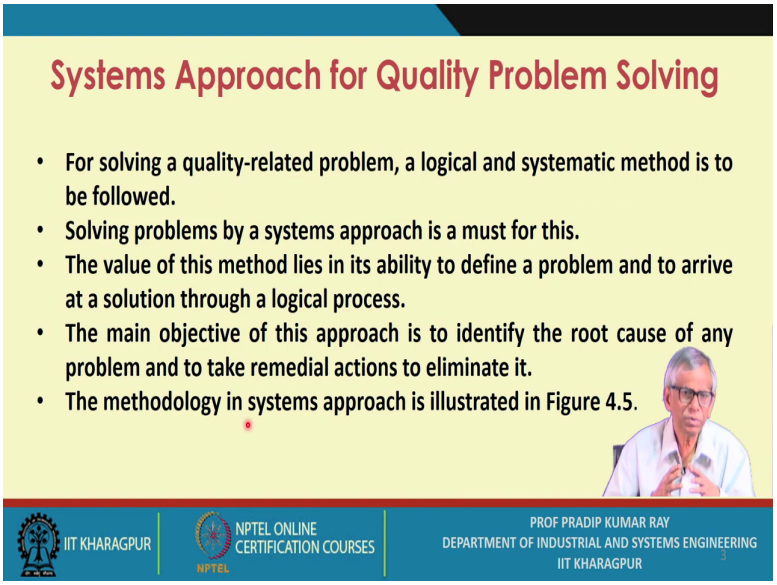

For solving a quality-related problem, a logical and systematic method is to be followed. Solving problems by a systems approach is a must for this. and the value of this method lies in its ability to define a problem and to arrive at a solution through a logical process, which means, We have to formulate the problem.

Once the formulation is done, then you have to search for an appropriate solution. The main objective of this approach is to identify the root cause of any problem and to take a remedial action to eliminate it. Now for identifying the root causes many approaches are there, some are offline, some are online while many times we use statistical process control for a certain given process.

If it is an online real time control and one need to know whether the process is in control or not. If it is out of control one need to identify the causes. Sometimes they are referred to as the special causes or assignable causes.

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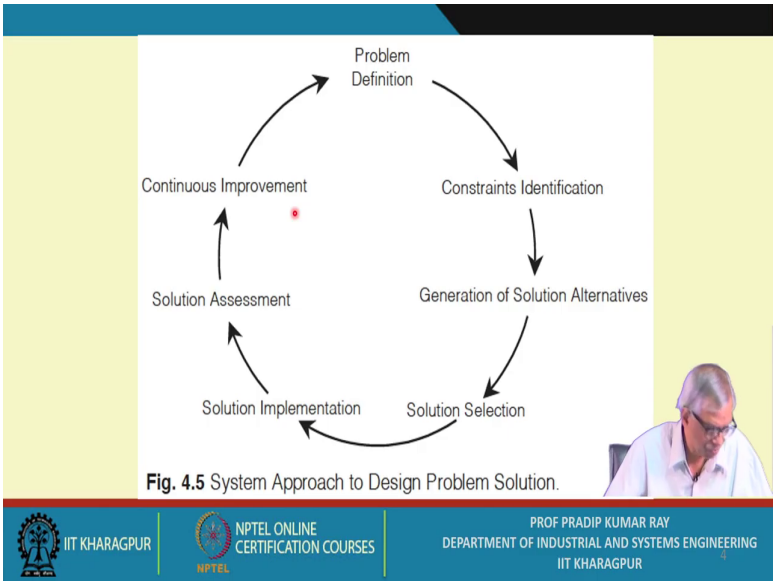

What is the methodology in systems approach? Referring to fig 4.5. First step is to define the problem, second step is to identify the constraints. There will always be some constraints which means, you have to set the objectives in general whether it is maximization problem or minimization problem. Once the identification of different kinds different types of constraints is done, third step is the generation of solution alternatives, solution alternatives could be a just a mathematical model, one can get form solutions or various kinds of heuristics, various kinds of algorithm depending on the type of problem and the dimension of the problem one have selected. Solutions for a particular problem can be multiple. So, the fourth step is to select the solution. Fifth step is to implement the selected solution, sometimes a particular system is to be developed, It means a system is getting implemented. Several sorts of factors needs to be considered while implementation of any system such as resources, time constraints, the amount of investment etc. Ignoring which may cause serious problem.

Sixth step is solution assessment which means checking whether the objective is being fulfilled or not. While there is always a scope for improvement these particular steps called continuous improvement.

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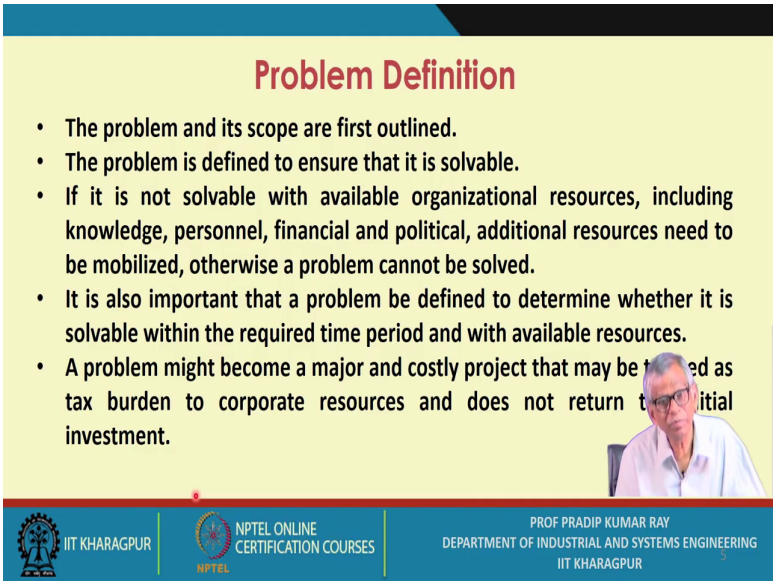

The problem and its scope are first outlined, problem is defined to ensure that it is solvable. If it is not solvable with available organizational resources, including knowledge, personnel, financial and political, additional resources need to be mobilized, otherwise a problem cannot be solved. It is also important that a problem be defined to determine whether it is solvable within the required time period and with available resources. A problem might become a major and costly project that may be treated as tax burden to corporate resources and does not return the initial investment.

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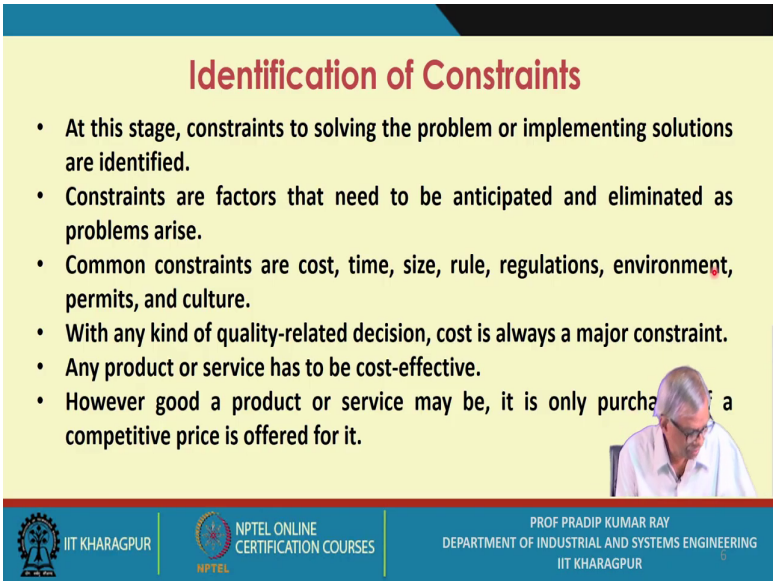

At second stage, Constraints to solving a problem or implementing solutions are identified. Constraints are factors that need to be anticipated and eliminated as problems arise. Common constraints are cost, time, size, rule, regulations, environment, permits and culture. Production rate has changed significantly because of the introduction of a new technology, one might face environment related problems. So, any product or service has to be cost effective. With any kind of quality-related decision, cost is always a major constraint. Any product or service has to be cost-effective. However good a product or service may be, it is only purchased if a competitive price is offered for it.

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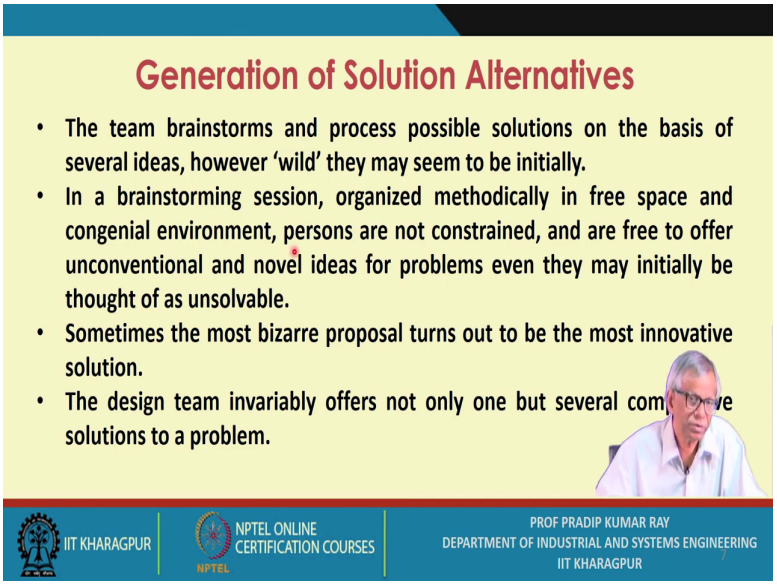

Generation of solution alternatives is the third step where team brainstorms is done so that the solution for the problem can be generated, which means design team or the project team is formed, they brainstorm and process possible solutions on the basis of several ideas; however, 'wild' they may seem to be initially. During a brainstorming session, the opinions or the suggestions from the team members is collected. In a brainstorming session, organized methodically in free space and congenial environment, persons are not constrained, and are free to offer unconventional and novel ideas for problems even they may initially be thought of as unsolvable. Sometimes the most bizarre proposal turns out to be the most innovative solution. The design team invariably offers not only one but several competitive solutions to a problem.

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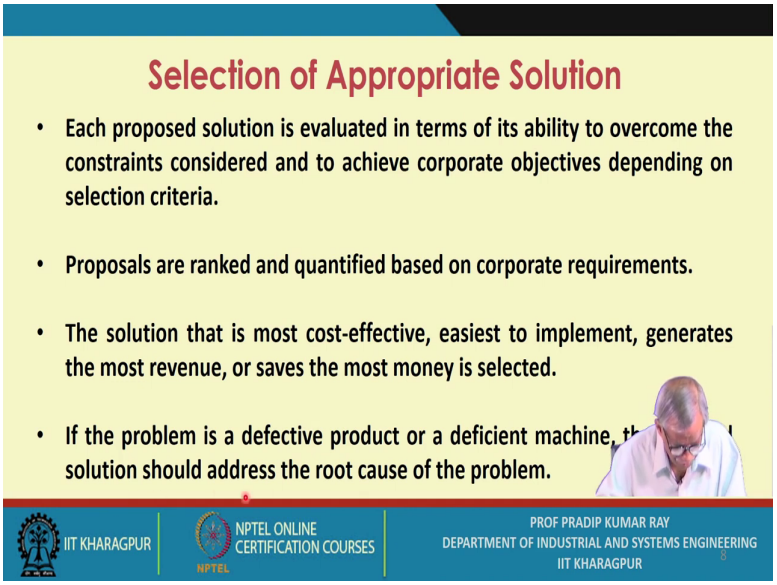

The fourth step is the selection of the appropriate solution. Most cost effective solution is evaluated in terms of its ability to overcome the constraints is considered to achieve corporate objectives depending on selection criteria. Proposals are ranked and quantified based on corporate requirements or the companies requirements of the systems. The solution that is most cost effective, easiest to implement, generates the most revenue or the return on investment, saves the most money is selected because for implementing of a new system there is a cost which is referred to as systemic costs which needs to estimate and the solution which provides the best return on investment is usually selected. So the selected solution should address the root cause of the problem.

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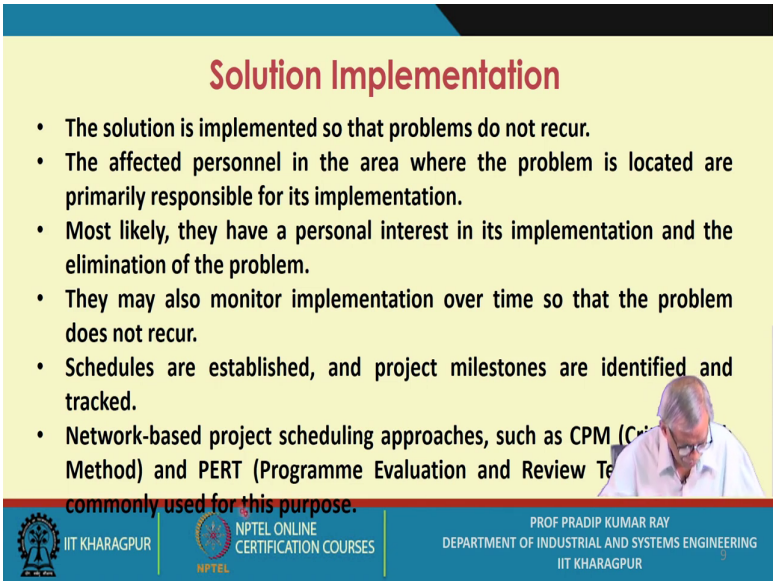

Now, the next important step i.e., fifth steps is solution implementation. The solution is implemented so that the problems do not recur. So once the problem is permanently solved that is considered as the ideal case. The affected personnel in the area where the problem is located are primarily responsible for its implementations, for example, suppose your production system is having one automated subsystem i.e. FMS, you must be aware of that what kinds of problems this particular FMS is facing and you have to think that what could be the solutions for all these problems. At some point it reaches its saturation level. And once it reaches its saturation level means you will get best possible performance from an FMS.

Most likely they have a personal interest in its implementation and elimination of the problem, they may also monitor implementation over time so, the problem does not recur.

Network-based project scheduling approaches, such as CPM (Critical Path Method) and PERT (Programme Evaluation and Review Technique) are commonly used for this purpose.

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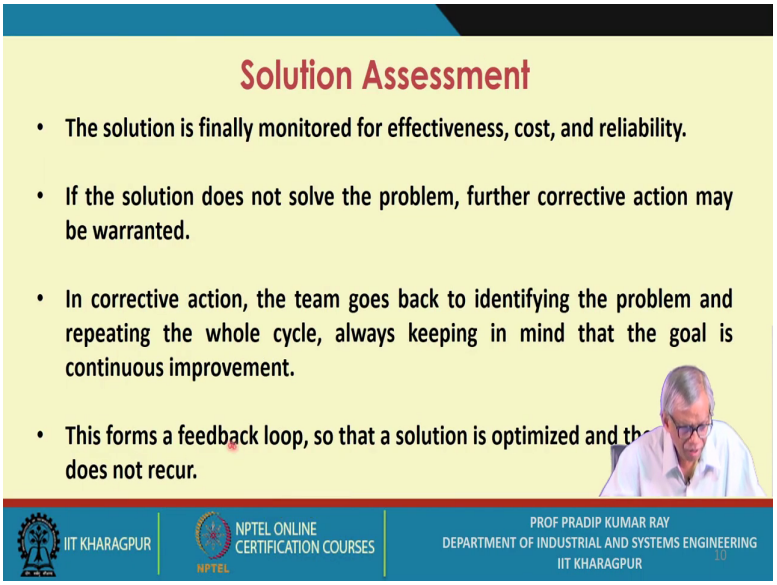

At sixth stage where solution assessment is done, the solution is finally, monitored for its effectiveness, cost and reliability. If the solution does not solve the problem, further corrective action may be warranted. In corrective action, the team goes back to identifying the problem and repeating the whole cycle, always keeping in mind that the goal is continuous improvement. This forms a feedback loop, so that a solution is optimized and the problem does not recur.

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The last stage is continuous improvement which is always possible. Continuous improvement in the quality of products manufactured or service has become a necessary element of an organization's survival in a global economy. In the past if a firm had a quality or low-priced product, the firm probably used to dominate the market. There were several reasons for this, number of firms producing the product was limited.There were also barriers for firms trying to enter the market, such as tariffs, cultural restrictions, cost , technical knowledge or the management skill.

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Now at this point of time, I will be referring to one particular concept called quality loop and under quality loop you will be identifying 11 functions of an organization. All these 11 functions are to be integrated as they are all dependent one another and forms a closed loop.

The American Society for Quality Control (ASQC) has developed quality standards that are basically a set of guidelines for implementing a quality management programme for any company. This standard refers to the concept of 'quality loop', and identifies its elements from market identification to disposal. All these elements may not be relevant for all types of products, particularly for the so-called 'consumer' products. However, for all 'industrial' products, all the elements of the quality loop are relevant. The elements of the quality loop are shown in Fig. 4.2

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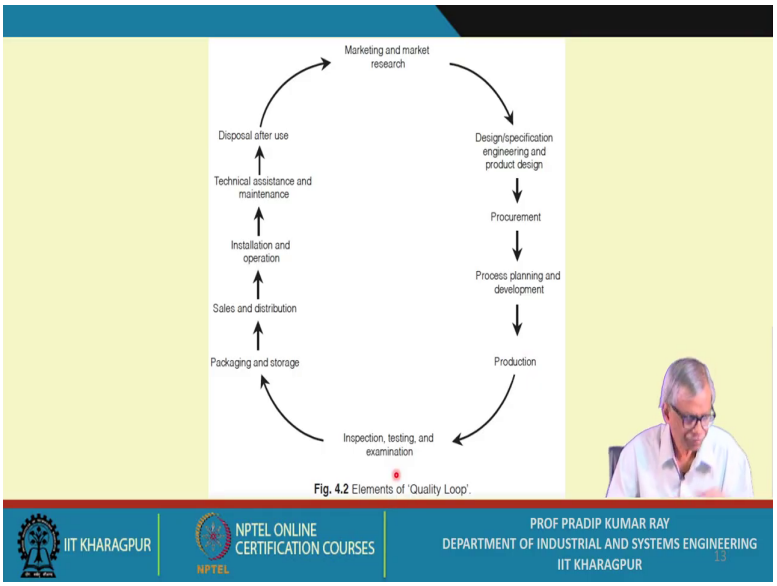

So, before I close the session I will just refer to all these 11 elements. The first one is the marketing and market research, the second one is the design specifications, design or specifications engineering and product design or sometimes this is referred to as product development. Essentially this is an engineering cell of any company then you will have the procurement cell. It is a part of the materials management functions, then you have the process planning and development, next element is the production. Then once a production is over inspection, testing or examinations for final product is done depending on the type of product you produce, the packaging and storage can be made automated. Another function is sales and distribution for final product, then the next one is the installation and operation which is done particularly for the industrial product. Then technical assistance and the maintenance is the tenth one and the eleventh one that is the disposal after use particularly during the production stage you will be creating some amount of wastes.

So, till now you have come to know that what are the activities to be carried out in a typical production or manufacturing system.

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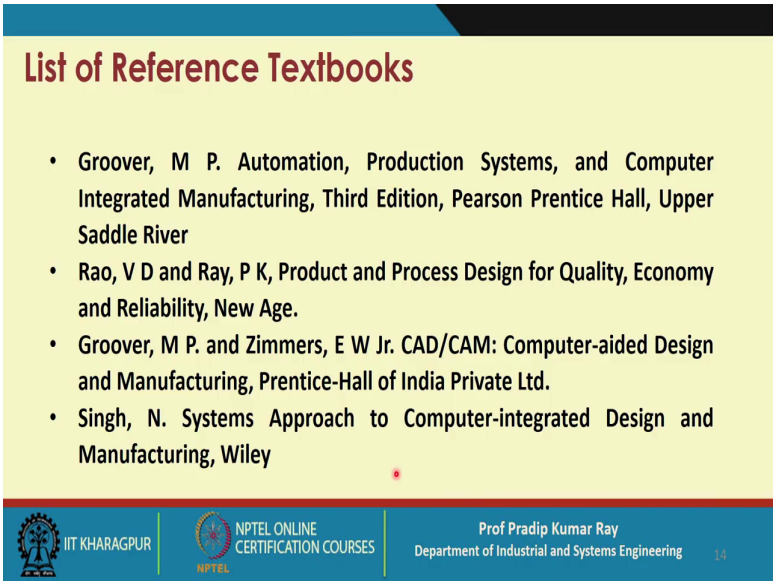

These are the textbooks for reference.