Principles of Industrial Engineering
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Lecture 17
Plant Location & Layout: Methods for Selection of Site 4

Hello, I welcome you all in this presentation related with the subject Principles of Industrial Engineering and we are talking about the methods used for selection of the site or location of the plant. So, that the suitable plant or the organization can be developed, installed located suitably, so that it can provide the services, it can produce the goods to the customers at the minimum possible cost and the best possible services can be given.

So, under this category we have talked about the different methods like point method factor rating method, break even analysis method and the load distance method.

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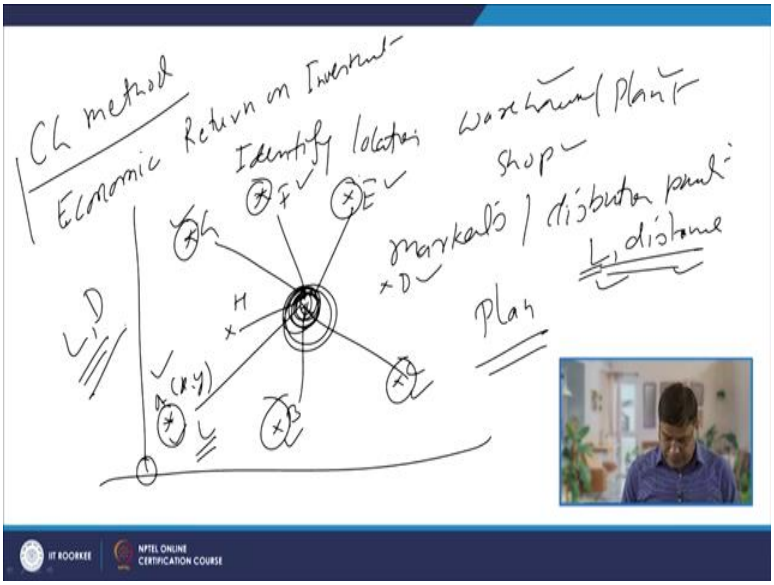

In this presentation basically I will be talking about the centre of the gravity method and the method which is based on primarily on the economics that is the return on investment. So, these two methods in about these two methods, I will be talking in this presentation. So, here CG method is used to identify the location, where a warehouse or a plant or a shop can be located. So, that it is close to the markets, it is close to the distribution points or close to the customer base.

So, in this case also, it uses the coordinate system for locating the, for identifying the location where warehouse plant or bank or hospital can be located say. So, on the with reference to the some point, with reference to with respect to some reference point, the location of the different sites. It is identified on x and y coordinates like say A, B, C, D, E, F, G, H. So, each will be having its own x and y coordinates.

So, if all these points or all these locations are to be served or to be fed with then where we should locate our warehouse. So, that distance to be travelled is minimum for all these locations and that, so here basically the distances to be travelled are minimized by locating the plant or shop or the warehouse in such a way that from that particular location of the plant, the distances to be travelled are to the different sites are minimized.

So, in this process say it, each one will be having their own weight according to the location. That is the distance to be travelled, with respect to some point, some reference point. So, if these are the different points on the two dimensional map or we can say the plan of the area. Then, where is the centre of the gravity of such kind of a, the map or the plan. That is what is identified, considering both, the load to be moved and the distance to be travelled.

So, that the load and distance to be travelled are considered for optimizing the location, for identifying the location of the plant, so that load and distance to be travelled are minimized. So, basically it assumes that each location has its own distance and the load to be moved. So, both L and the D are used to consider the weight of the each location and with respect to that weight, what will be the centre of the gravity of such kind of the 2 dimensional plan. Where if we locate our warehouse, plant or shop, then load and distance to be travelled will be minimum.

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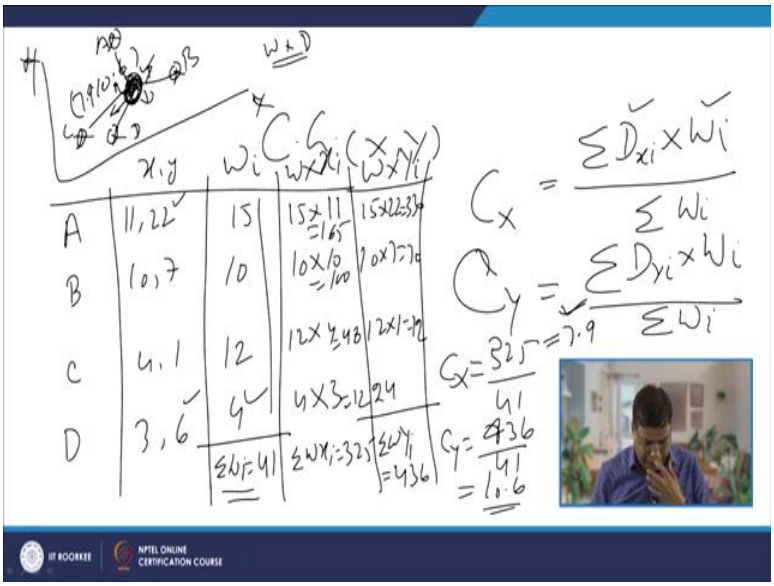

So, to understand this what we do, the centre of gravity of the possible site for locating a plant with respect to the different considering the different potential sites or the sites where the demand exist or plants exist or the different distribution points are there or customer base exists. So, all those things are considered. Let us say, centre of gravity obviously will be coming in terms of the value of the X. The point having the value of the X coordinate and value of the Y coordinate.

So, say the centre of gravity of X coordinate is identified through the algebraic sum of the distance to be travelled. From the different points, some of the distance to be travelled from the different points on the X axis and the corresponding weight divided by some of all these weights, that is the load.

Likewise CY is obtained from the sum of the product of the distance to be travelled in Y direction into the weight or the load to be moved from each of the locations, some of this. All these loads or the weights. That will be, it will be more clear from this example. Here if we see if there are A, B, C and D, therefore distribution points having the coordinates on x, y coordinates of these locations. Say for A 11 and 22, 10, 7 and for C it is 4, 1 and for D it is 3, 6.

And the kind of the load or the weight which is to be moved like say W which is to be moved in and out for the point A is for the location A is 15 for the location B is 10, for location C is 12 and

for location D is 4. Then some of all these weights, algebraic sum of all these Ws say equals to 41. Then what we have to do is the weight in to that distance to be travelled in X. The X coordinate of the location A, so xi. So, 15 into 11 and then 10 into 10. 12 into 4 and 4 into 3 that is how it is 165, 100, 48 and 12. So, sum of all Wxi will be equal to say 3 to 5.

Similarly, we will determine w into yi so product of the W that is the load and the y coordinate. So, here 15 into 22. So, it is coming 330. 10 into 7, so it is 70, 12 into 1, so it is 12 and 4 into 6, so it is 24. And algebraic sum of W into yi that will be equal to say 436. So, let us say W into xi that is a D is the distance xi that is for CX is a 325 divide by algebraic sum of all these weights that is 41.

So, the x coordinate for the CG is coming says 7.9 and similarly Y coordinate for CG will be 436 divided by 41. So, it will be like say 10.6. So, here if we say on X and Y coordinates, the different points have been located like say the D. C and then B and then A. So A, B say D and C, if these are the location of the different locations where from there will be inward and outward movement of the different amounts.

Then considering that the weight or the extent of movement and then their locations the CG is coming out at 7.9. So, considering the weight and the distances to be travelled the CG is coming 7.9 say on X coordinate and on the Y coordinate it is coming 10.6. So, let us say that point is coming here 10.6 Y coordinate and 7.9 X coordinate 7.9 X coordinate.

So, if we locate the plant here, then it will be reducing the distance as well as the algebraic sum of the distance and the weight to be travelled from this point that will be minimum. Now this look, this is the approximate location where we can have our plant or an organization. So, we will try to find out a suitable location nearby this one which will help in locating or the plant or organization suitably.

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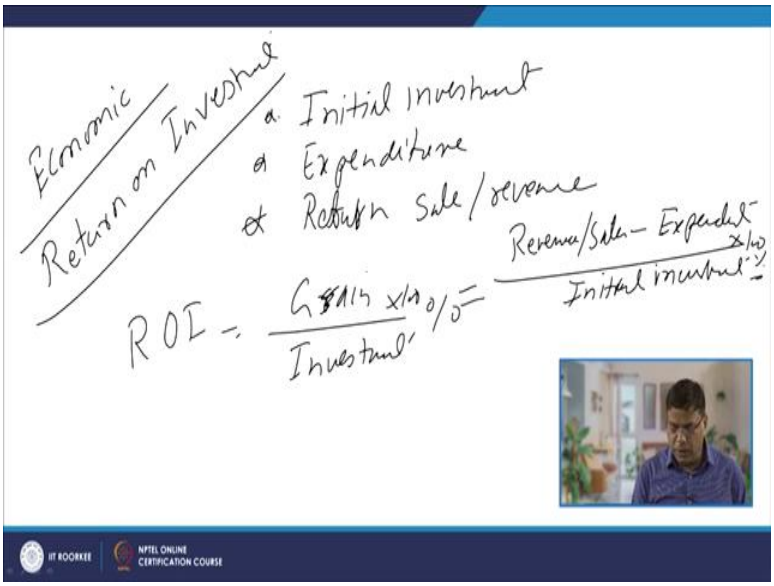

Now, another method is the, is completely based on the economics. That is about the return on investment that is ROI. So, what it assumes whatever is the initial investment is to be made after initial investment, some expenditure, expenditure will be needed to produce the goods and services and when those goods and services are produced we get some returns.

Returns in terms of the sale or revenues. So, basically what we do, for determining this. We try to determine the kind of the net gain, gain divide by the investment. This gives us the kind of the return on investment in terms of the percentage, so into 100, that is what we have to do. So, gain is identified through the revenues or sales which was there minus expenditure, which is there under the different heads divided by the total initial investment which is being made investment. So, this into 100 will be giving us the kind of percentage of the return on investment

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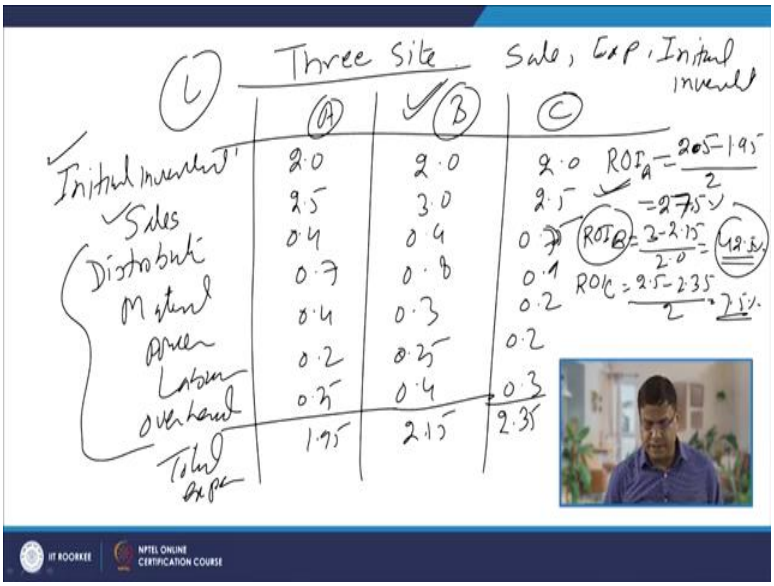

To understand this better we take one example. Like say there are three possible sites, each will be offering the different kind of the sales, expenditure and initial investment. So, let us say the site A, site B and sites C. Here, expenditure is made on different heads for these sites. Say the initial investment in all these cases is same amount in say lakhs.

So, 2.0, 2.0 and 2.0. Initial investment is same in all these three at all these three locations. But the kind of the sale which is there or the revenue which is generated is 2.5 lakhs from A, 3 lakhs from the B and again, 2.5 lakhs from the locations C then we have a lot of expenditure like expenditure on account of the distribution, say on account of the distribution it is 0.4 for A, 0.4 for B and say 0.75 for C location.

Similarly, the expenditure on account of the material is safe 0.7 for A, 0.8 for B, and 0.9 for C location. Then expenditure on power is 0.4, 0.3 and 0.2 for location C and the labour expenditure, expenditure on the labour is 0.2, 0.25 and again 0.2 then expenditure on overhead for producing the things is say 0.25, 0.4 and 0.3.

So, the total expenditure of the different total expenditure is where expenditure on these heads. This is the sale or revenue and this is the initial investment. So, total expenditure for site A is coming say 1.95 for site B is 2.15 and for site C is 2.35. So, if you want to determine the return on investment for site A then what we have total sale is of 2.5 minus 1.95.

That is the expenditure divide by 2 is the investment. So, investment return is say 27.5 percent, 27.5 percent. Likewise for the return on investment for site B is say 3 minus 2.15 divided by 2. So, here return on investment percentage is 42.5. Likewise, return on investment for a site to C is like say 2.5 minus 2.35 divide by 2. So, return on investment is just 7.5 percent.

So, if we consider the return on investment then site B is considered to be one of the most effective site and most economical with respect to the kind of the benefits or the returns will be gained if the plant is located at the site B. Now Once we have identified our site for locating the plant, the next important thing which comes up is the installing the facility, arranging the different facilities in the plants. So, that there is a smooth flow of the resources and it takes minimum time to produce the things. There is a minimum wastage of the resources in terms of the man material or the machinery movement.

So, basically the point is how should we arrange the resources within the organization, so that the flow of the resources or flow of the man material machine becomes smooth in course of the production of the goods and services.

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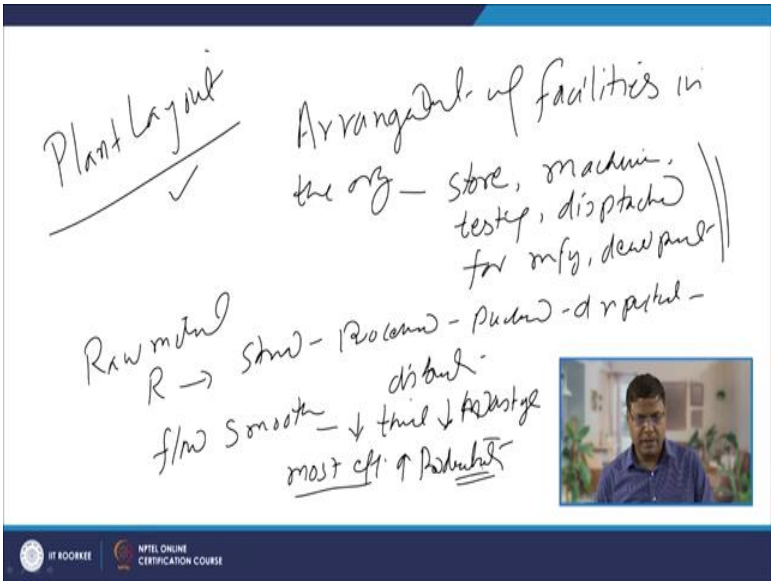

So, that is what falls under the plant layout. plant layout is about the like a, how the facilities will be arranged. Arrangement of the facilities, in the organization these facilities may be in terms of

like rare will be the store, so that things will be inspected and stored shoes issued as in when they are needed.

Where will be the different types of the machines which will be located where the inspection and testing facility will be located where the material will be dispatched where the different facilities to be used for manufacturing, for a development of the goods will be located. So, there are different basic principles which are used in taking decision about the way by which facilities will be arranged. So, that the whatever the raw material is received, it is properly stored.

It is processed after processing, it is packed, dispatched and distributed to the users or to the dealers. So, these the arrangement of the facilities within the plant is identified under the plant. There can be various situations and main goal here is that the flow of the raw material or flow of the information is the flow is smooth is course of production of the goods and services.

There is a minimum time required to do this. There is a minimum wastage in unnecessary movements, unnecessary delays, unnecessary breakdowns and the system works in most efficient manner for with regard to the use of the resources like man material machine and all those facilities which are there. They work efficiently, so that the goal of high productivity can be realized.

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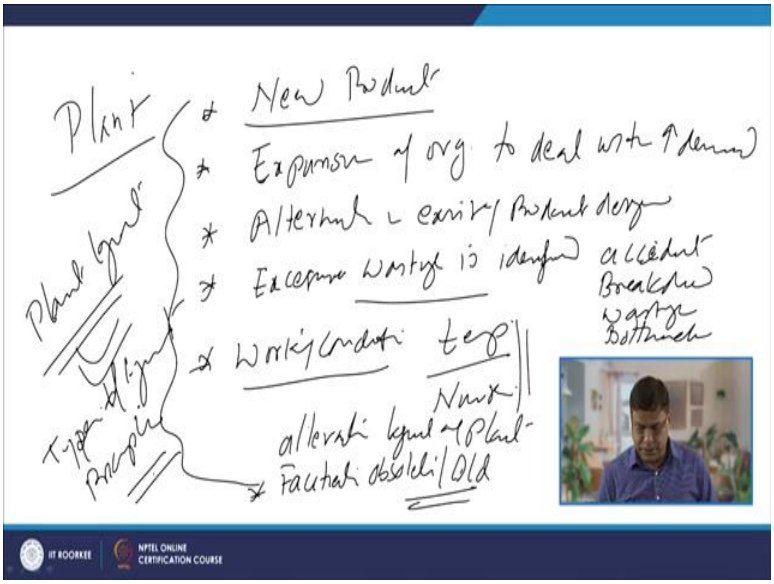

So, under what conditions, this is needed to look into the plant layout like a new product, is to be launched. So, it requires a particular kind of the arrangement of the facilities according to the product to be made or expansion of the organization is a needed expansion of the organization is needed to deal with the increased demand for a product or some kind of the alteration in the existing product designs are forcing us to review the layout of the plant, so that more efficient and smooth flow of the material through the plant can takes place.

So, alteration or change in the existing product designs or excessive wastage is identified. The studies have shown that excessive accidents are taking place. There is a lot of breakdowns or wastage of the time bottleneck. All those things are there and leading to the excessive wastage. So, that needs the reviewing of the layout so that things can be moved efficiently with minimum wastage and the bottle neck. Working conditions are very hostile lake temperature is too high. Noise is too high, so to provide the more comfortable working environment.

It becomes important to make some minor alteration in the layout of the plant, so that more comfortable working environment to the workers can be provided and when developing. So, these are the different conditions under which it may be required to review the existing layout. There is one more possibility that the facilities have become very old. Facilities are absolute, they have become old. So, it is required to come up with the newer infrastructure, which may require the different kind of the arrangement of the facilities.

So, these are the different conditions when it will maybe require to look into the plant layout related aspects. What are the different types of the layouts? Types of layouts? What are there different principles used in developing the layout, which is to be kept in mind well layout is being developed about that I will be talking in the upcoming lectures.

So, in this presentation, basically, I have talked about the two methods which are used for selection of the suitable site for locating the plant. This two methods were like centre of the gravity method and another method was based on the economics considering the return on investment. And I have also given the introduction of the plant layout and when it is required to look into the plant layout related things, thank you for your attention.