Principles of Industrial Engineering
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Lecture-14
Plant Location & Layout: Methods for Selection of Site

Hello, I welcome you all in this presentation are related to the subject, Principles of Industrial Engineering. In the previous presentation we have talked about the various factors that we should consider for selection of the site. Now, in this presentation we will be talking about the different methods which can be used for selection of a site in light of the factors which should be considered.

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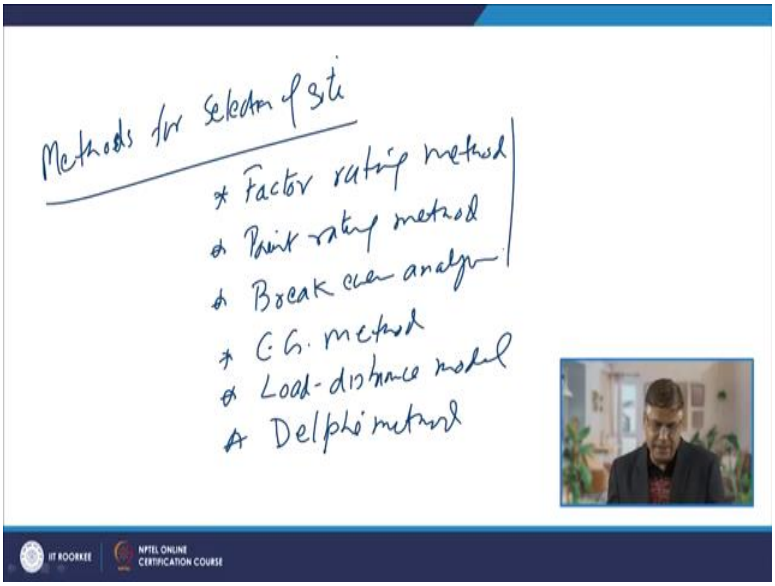

So therefore, 5 methods which are normally used for choosing a site for locating a plant and these methods are like, methods for selection of site for locating a plant, the first method which is very simple and very commonly used is the factor rating method. Second method is the point rating method. Third is the break even analysis, break even analysis method. Fourth is the centre of the gravity method.

This is called CG method, centre of the gravity method. There is one more method like drop load distance method or model for selection of the site. And there is one qualitative method that is called Delphi method. So these are 5-6 methods about which we will be talking. In this presentation basically we will try to talk about 2 or 3 methods. And each approach used in each method is a little bit different.

And so as per the suitability and the case and the kind of the organisation or the plant for which a site is to be selected, the suitable method can be used for selection of a plant location.

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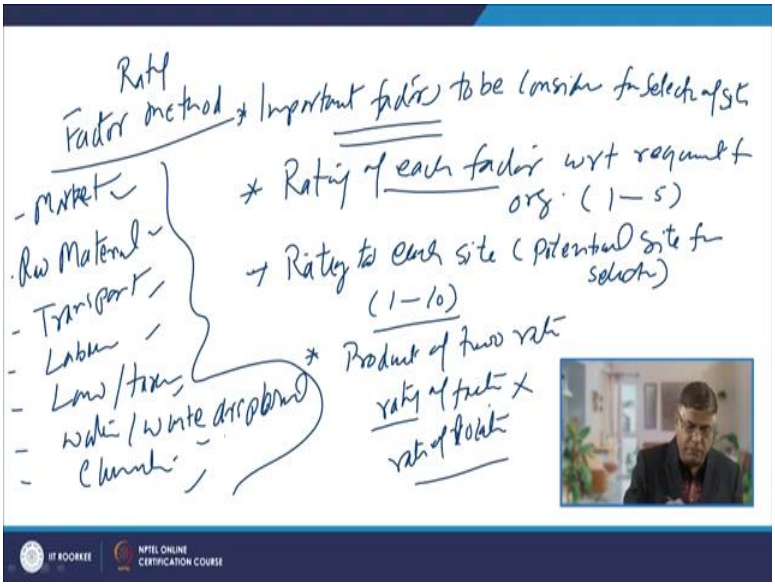

So as far as the factor rating method is concerned, factor rating method. So factor rating method means there are various factors that we have to consider for selection of a site for a particular type of plant. So what are the important…? So as per the type of the plant for which we are looking for a site, the important factors are identified. So the first asked first step here is what are the various important factors that we should consider, factors to be considered or factors that matter for location of a site for a particular type of plant. So factors to be considered for selection of site for a particular type of plant, those are to be identified.

So we prepare a list of the factors, thereafter, all these factors like the kind of the market where it is located, the kind of the raw material which is to be used and its availability, market raw material, then there is a kind of the transport facility that is being looked, that the importance of the transport facility, then there is the kind of the labour which is needed, the kind of the laws and state taxation policy which is there, the kind of the water and the waste disposal policy which is there and the kind of climate conditions.

So these are the various factors. There can be other factors also. But all these factors may not be equally important for all the sites as well as for all types of the plants. So after identifying the important factors to be considered for selection of site for a particular type of organisation, we have to give the rating. So each factor rating is given to each of the factors,

rating of each factor with respect to the importance of that factor for a particular type of organisation for which we are coming up.

Like market may not be that, location of the market may not be important, but availability of raw material is very important. Or likewise transport may not be important, but availability of skilled labour is important. So the different sites may not be equally good in terms of the proximity to the market or availability of raw material, transport to the labour, taxation policy, water availability and water waste disposal and then climate conditions, et cetera.

So, but anyway if the factor matters in a little bit then that has to be listed and then after listing it has to be rated. So rating of each factor with respect to the importance for this particular kind of organisation for which we are looking at the site. So this rating with respect to the, rating each factor with respect to the requirement. For requirement or importance for the organisation for which we are looking for site.

And this rating is given in a scale of 1 to 5 which means, if the proximity to the market is very high then the rating factor for the market will be 5 and if the proximity to the market is not that important, then it will be rated as 1. And after giving the rating to each of the factors, what we do? Then we give the rating to each site, each potential site which is being considered.

So each site or we can say potential site which is being considered for selection. Potential site for selection is again rated for each of these factors. And that is done in a scale of 1 to 10. So basically we get the 2 ratings, one rating of each factor with regard to its importance for particular organisation and the second is rating of the particular site with regard to the suitability of the various factors for that particular site.

And once these 2 ratings are available, we try to identify the 4 of the 2 ratings that we have identified like rating of factor multiplied by rating of that particular factor for a particular location, rating of location for that particular factor, product of these 2 is identified. And then sum of all these factors, sum of all these factors for each of the site is determined.

The site which offers the maximum voltage, that is chosen for locating the plant which will be representing the cumulative effect of all these factors and the importance that we have given to the various factors and to the different sites. That will be reflecting in such kind of the cumulative rating.

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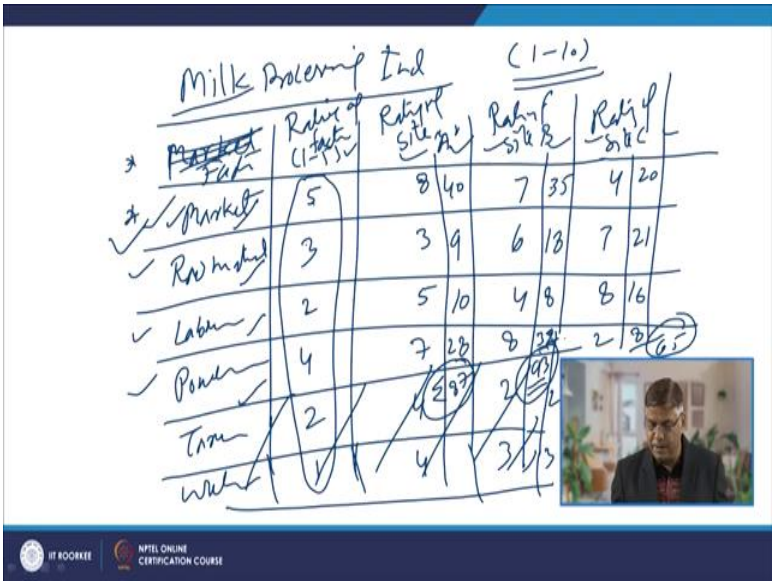

So now, with an example we will see like for locating an industry say milk processing industry is to be located. So, the site will be considered. They need to see where the market is located. Market is one factor. So it is always required that such kind of the industry is located close to the large population. So proximity to the market is important. So market is one factor.

So and then will be having that, like say rating of factor, rating of factor and then here we will have the rating of the site for this factor. So rating of the site for each of the factors rating of a site A with respect to the market. Then rating of site B for the same factor, then rating of the site C for the same factor. So, likewise we will be having the with respect to the market the each site will be rated in a scale of 1 to 10 and the each factor will be rated in a scale of 1 to 5.

So here we will write simply like this is the factor. So here the first factor is say market. Right? Then we will have to see the kind of the raw material, where from milk will be coming. Raw material. Then they will have to see that how about the labour or the manpower who will be working in the organisation. For the different sites the different, the access to the raw material may be different, access to the labourers may be different for each of the site.

And then we may have like for running the system we may require power and then likewise we may have other factors like taxation or the availability of the water, etc. So now each of these factors will be rated in a scale of 1 to 5. Say proximity to the market is important, so will be rated say 5. Raw material, the milk will be coming from the nearby villages, so close

to the market is not that important, but if it is located close to the market then it may not be it may not be rated high.

So say its importance is given 3 because it will be coming from the different sources. Then labour is say rated 2 because easy access to the workers and the power availability is, it is crucial for a smooth functioning of the organisation, say rated 4. So wherever the plant is located, we have to rate the importance of these factors with regard to the significance of these factors for that particular type of plant.

So taxation, say may not be that crucial because for such kind of the product like say milk most of the governments give subsidies and the relaxations. So like availability of the water, say it is easily available will be rated less, not that important right. Now, each of these sites will be rated in a scale of 1 to 10. So, site A with respect to the, now these ratings are reflecting the importance of the different factors.

Now, the each site, how good a particular site is with respect to these factors, that is what will be rated. So say A site is very good with respect to the market, is very closely located to the market. So it will be rated like say 8. The raw material access is not that easy, so it will be rated low like say 3. Then, labour is available reasonably, availability of labour is reasonable so say rated 5.

Power availability is good. So it will be rated 7. Taxation is high. So it is like a undesirable things so it will be rated low. Water availability is limited, so it will also be rated low. So likewise now we will have that different other sites also. So each of the sites has to be now rated with respect to these factors. Say this. So now, let us say the site B is rated 7, 6, 4, 8, 2, 3. And likewise, the site C is rated 4, 6, 7, 8, 2.

Likewise say 2 and 3. Now, what we have to do is we have to do the product of each of these factors with the rating, product of the rating of the factor and the rating of that site. So, 8 into 5 into 8, 40, 5 into 7, say 35, 5 into 4, say 20. Then 3 into 3, 9. 3 into 6, 18. Now, 3 into 7, 21, 2 into 5, 10. 2 into 4, 8 and 2 into 8, 16. Now like say another factor like 4 into 7, 28; 4 into 8, 32 and 4 into 2, 8.

Now let us assume this, all these factors also there, say let us say we strike off at this moment. Now what we will do? Say consideration is there now for only 4 factors. So what we will do, we will just make a sum of all these factors. So, 40 plus 9, 49 plus 10, 59, and

plus 28. So it will be like 87. Now, likewise, we will make some of these also. 32 plus 18, 58, and then 35, 93. And likewise, we will make sum of this 24, 45 and 65.

So if we consider just 4 factors here, market for these 3 different sites, and what you get? Market, raw material, labour and power. Then the cumulative effect of all these factors on, cumulative rating of all these factors for these 3 different sites coming out, 87 for site A, 93 for site B and 65 for site C. So here considering the market, raw material, labour and power, the site B comes out to be the most effective.

So out of 3, considering the market, raw material, labour and power, the site B will be an attractive choice and we may think of choosing this site. So basically, what we have to consider, the methods are simple, develop a list of the factors that matter for a particular type of the plant and then give the rating to each of the factors with respect to the kind of importance of these factors for that particular plant, but that particular type of the plant and then rate the different sites.

And then the rating of the site and the rating of the factor, the product of these 2 is obtained and then sum of all these, the products for each of the sites for different factors is obtained to see really which site will be attractive.

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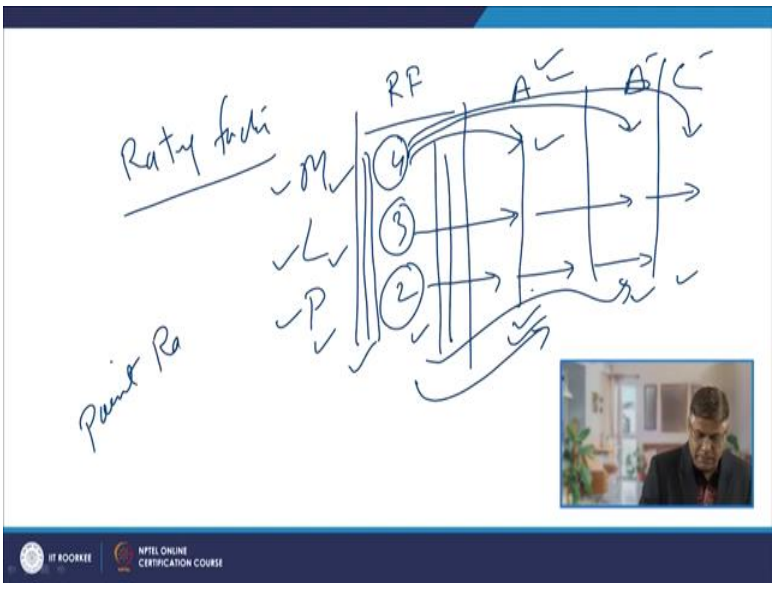

In this case what we have seen, the rating factor which we were multiplying that was fixed. Like based on the importance of a particular factor for a particular type of organisation, say we have identified with respect to the market or labour or power, we have identified some

importance of importance factor, like say 4 or 3 or 2. Now, this factor is a rating factor is multiplied with the rating factor for each of the site, A, B, C, each of the site.

So here rating is given for the suitability of market, labour or power, for each of the site, but the same factor is multiplied to the site A, then same factor is multiplied to the site B and then same factor is multiplied to the site, the factor rating being given, a rating being given to the site C with the respect to the market, labour or power. In this case, the multiplying rating factor is common for all these site ratings.

The point here is that the importance of ratings for each of the site may not be the same. Site A, importance of the market for site A may be different for the market B and C. Likewise importance of the labour for site A may be different from site B. Similarly, importance of the power factor rating may not be equally important for B and C. So it may be power rating may be very important for site A but it may not be important for B and C.

So the point here is that multiplication of the common rating factor to the rating of the sites is not a very justified way because in this way, we are giving the equal importance to the different factors for the different sites, which may not be the true case. The different importance of the different factors at different sites may be different and to deal with this situation, to come out effectively with this situation or this kind of the deficiency is effectively taken care of by another method that is called point rating.

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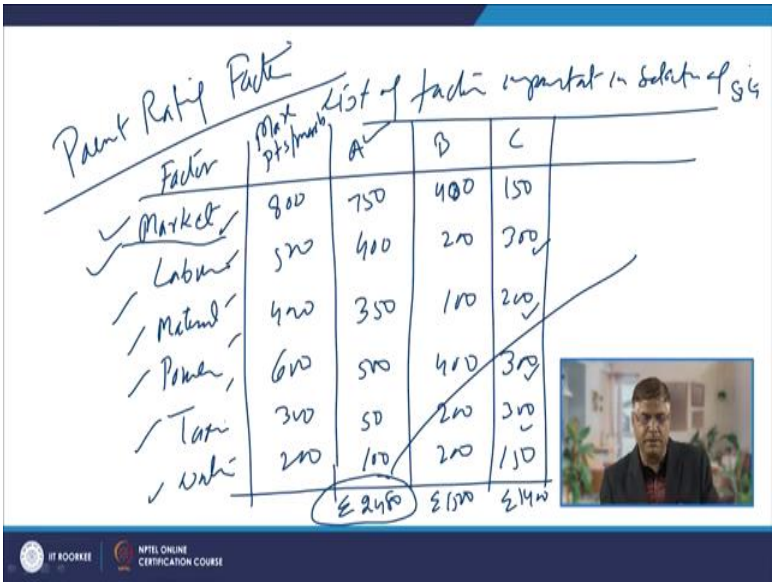

So in case of the point rating factor, basically the point rating factor, in this case again we prepare the list of factors important in selection of site. In any case that has to be developed.

Then we identify what is the maximum weightage which can be given to a particular factor. Beyond that weightage of that factor may not be important. So like say here we have factor which are being considered like say, market demand, where market is located; then labour; then material, raw material; then power; then taxation; then water or any other factor likewise.

Because all these factors at the end will be affecting the total cost or smooth running of the organisation. So now what we do? Basically we give the, these are the factors that are important for us that for which we have developed a list of the factors important for a selection of the site. Then we give the maximum, we identify the maximum points or the marks which can be given to a particular site.

Say depending upon the type of organisation, the type of product which is being made, type of service which will be offered, we try to give the importance in terms of the maximum points that can be allocated to a particular factor based on the importance that is what is. If the market is extremely important maybe we give like say 800 is the maximum point, labour 500, material availability 400, power availability is very crucial for smooth functioning, say 600, taxation say 300, water availability 200.

So we identify the maximum points which can be given. So these are again the based on the relative importance. Now, we have the complete freedom to rate each of the site on this maximum scale like say a, b, c, 3 sites are the potential sites for choosing as a possible location where plant can be installed or developed or located. So what we will be doing?

The site A will be rated in terms of the market and we have the complete freedom to give any marks or any number of the points starting from like say 1 to 800. So if the site A is very good, then it will be rated say 750. If the site B is moderate with respect to the market, then it is a rated 400. Then site C will be rated, if it is very poor with respect to the proximity to the market, then it will be rated say to 150.

Likewise, the labour factor for site A will be rated say if it is very attractive, then it will be rated 400. Say it is it 200, this is rated 300, material availability as per the ease of availability of the material in terms of the cost with, each of the site will be rated maximum in the scale of 1 to 400 and we can give any points to the site A or B, maximum up to the 400. So, say it is rated 350, 100 if it is not that good and 200.

The power availability is very good say for site, then it will be rated say 500 and moderate then it will be rated like say 400 for site B and availability is very problematic for C then it will be rated as like say 300. Taxation is a very adverse point, taxation is high say for site A, then it will be rated poorly, 50 and the taxation is moderate then it will be rated say 200. And if the taxation is very attractive, maybe like no taxation kind of situation then it will be rated 300 out of 300.

Availability of the water is a problem, then 50, let us say moderate. If it is very good then 200 out of 200 and the water availability is not there then again or it is very limited then maybe say rated 150. Now, what we have done? We have given the maximum marks which can be allotted to a particular factor and then different factors are rated in that scale. Here we have complete freedom to give any points or marks.

Now, all these sites, we will try to obtain sum of all these points are marks for each of these sites. So 750 plus 800, 1200. Or like say 1000, 1400, 1800 and 2450, then 4677 and 8 1500, sum is 1500 and here 150, 300, 600, 900, 1200, 1400. So 300, 600, 800, 1100 and 1400. So sum of all these point is 1400.

So if we see considering the sum of all these points, well considering all these points, all these factors rated for the different sites and what we can see that sum of all these factors is maximum for site A, so which suggests that site A is attractive with respect to all these points and we can locate now, the plant, the site A accordingly.

I will conclude this presentation now. In this presentation basically I've talked about the methods which can be used for selection of the sites. These 2 methods were like factor rating method and the point rating method. Point rating method gives us more freedom to consider, to give the relative importance to the various factors for selection of the site. Thank you for your attention.