

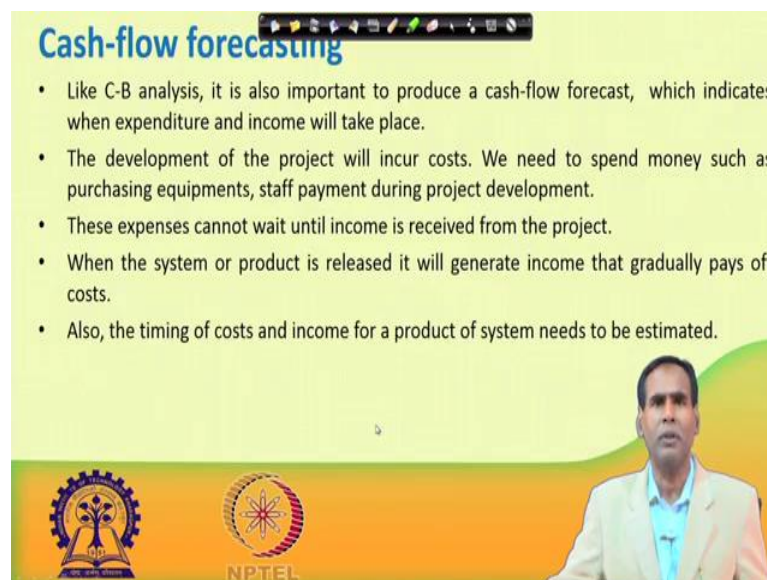
**Software Project Management**  
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**Lecture – 12**  
**Project Evaluation and Programme Management (Contd.)**

Good afternoon to all of you, last class we have discussed about the cost benefit analysis. We have seen the different ways of evaluating proposals one is this technical assessment, then the cost benefit analysis or the financial assessment. So, now, we will take up the next item for individual project assessment. So, that we will see that now today will first see the other item that is left for this individual project assessment that is cash flow forecasting. Then as I have already told you C- B analysis that is the most important analysis among all the assessment among all the feasibility studies financial assessment or C- B analysis is the most important.

So, we will see the detailed steps of C- B analysis, then we will see among one of the steps we have to identify and classify the cost and benefits. So, we will see the details of the different types of the cost and benefits associated with a project.

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**Cash-flow forecasting**

- Like C-B analysis, it is also important to produce a cash-flow forecast, which indicates when expenditure and income will take place.
- The development of the project will incur costs. We need to spend money such as purchasing equipments, staff payment during project development.
- These expenses cannot wait until income is received from the project.
- When the system or product is released it will generate income that gradually pays off costs.
- Also, the timing of costs and income for a product of system needs to be estimated.

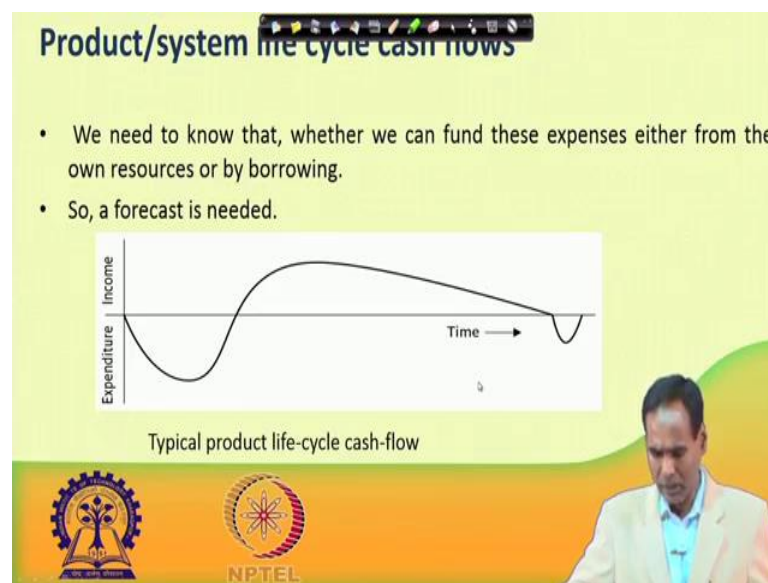
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So, like cost benefit analysis it is also very much important to produce a cash flow forecast. This cash flow forecast indicates when expenditures and income will take plus will take place during the development project.

You know that development of the project will incur some cost. So, we need to spend some money such as purchasing equipment staff payments etcetera during the project development, but these expenses cannot wait until the income until the revenue is generated from the project, we have to spend some money initially. So, when the system or product is released then only it will generate a income that gradually a pays off the cost. But the so, far till that point we cannot wait we have to spend some money, that money maybe we have to spend from the our own resources the companies own resources or by taking loan from banks etcetera.

Also we have to consider we have to take into account the timing of the cost and incomes when cost will incur? When the first income when the first revenue will come out? So, the timing of cost and income for the product that also needs to be estimated.

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The we have already known that whether we have to you know expect we have to think of that this initial fund that we required to start up the project, where the fund will come? So, we need to know that whether the fund the initial fund requirement, the initial expenses whether we can fund them from the organizations own resources or by borrowing or by what taking loan from the banks etcetera.

So, a forecast is needed a typical what forecasting is shown here we are seen as I have already told you during the development of a project, initially we have to spend some money this is the expenditure this is the initial expenditure. So, here what will happen?

No revenue is there because the project just is started. So, some initial expenditure just such as purchasing a hardware software, making the site ready and staff recruitment etcetera we have to make.

And after sometime you see will get gradually the revenue will come up and gradually the revenue the income will increase and this increase so, some time will come, at some point of time this income it will outweigh this expenditure, then it will gradually it will meet the expenses, it will be the expenditure will be equal to what or the income it will pay off the expenditure that we have made initially then the gradually the income will increase and after some years again the expenditure are the income the revenue will come to 0 then it will ask maintenance. So, again you have to put some more expenditure, this is how the typical product life cycle cash flow this looks likes.

So, basically what the importance is I have to forecast a cash flow and cash flow means, it will indicate when expenditure will take place and when the income or revenue will take place.

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**Cost-benefit analysis – Detailed Steps**

1. Identify the costs and benefits pertaining to the project
2. Categorize the various costs and benefits
3. Select a cost-benefit evaluation technique
4. Interpret the results of the analysis
5. Take appropriate action.

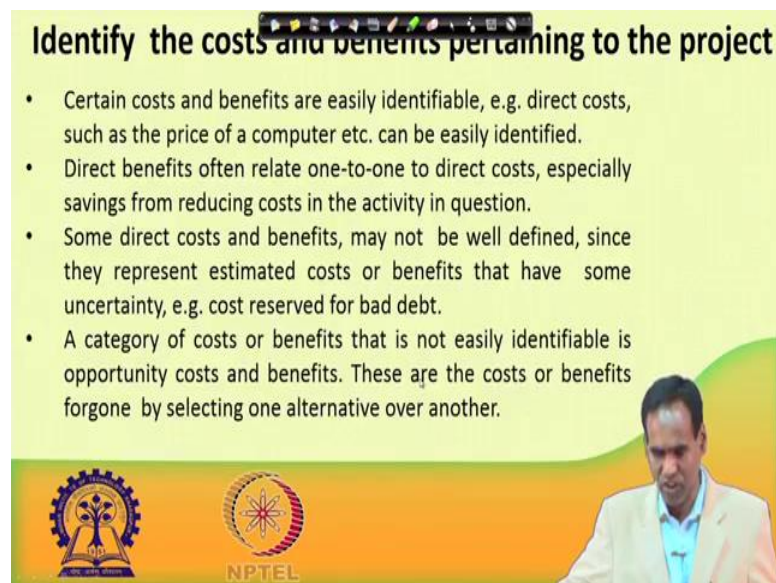
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With this now will go to the detailed steps of this cost benefit analysis, which is very important for successful development project. So, these are the steps for the cost benefit analysis that we have to carry out first we have to identify the cost and benefits pertaining to the project, then we have to categorize various cost and benefits, then we

have to select a cost benefit evaluation technique we will see there are various cost benefit evaluation techniques are there we will see them.

Then we have to interpret the results of this cost benefit evaluation techniques for analysis and then after analyzing the results of the cost benefit evaluation techniques, we somebody are the organization it has to take appropriate action. So, now, let us see the first step.

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**Identify the costs and benefits pertaining to the project**

- Certain costs and benefits are easily identifiable, e.g. direct costs, such as the price of a computer etc. can be easily identified.
- Direct benefits often relate one-to-one to direct costs, especially savings from reducing costs in the activity in question.
- Some direct costs and benefits, may not be well defined, since they represent estimated costs or benefits that have some uncertainty, e.g. cost reserved for bad debt.
- A category of costs or benefits that is not easily identifiable is opportunity costs and benefits. These are the costs or benefits forgone by selecting one alternative over another.

The slide also features the logos of IIT Bombay and NPTEL, and a photograph of a man in a light-colored jacket.

The first step is identifying the cost and the benefits pertaining to the project. You know that the certain cost and benefits that easily identifiable. For example, direct cost such as purchasing a computer and payment to the what a staff members etcetera they can be easily identified.

These direct and the direct benefits very often they relate one to one to the direct cost, the direct benefits will directly relate to the direct cost especially the savings that may be obtained from reducing the cost in the activities in the questions they can be mapped to the what benefits. Some direct cost and benefits may not be well defined they cannot be clearly identified since they represent some estimated cost they are not the actual cost they are estimated cost or they are estimated benefits that have some uncertainty.

So, they cannot be clearly defined, they cannot be clearly measured examples are like the cost reserved for bad debt etcetera. So, this types of direct cost or this types of some of

the benefits they cannot be what they cannot be well define they cannot be clearly defined and they cannot be clearly identifiable they cannot be clearly measured. A category of cost or benefits that is not easily identifiable is opportunity cost. We have taken here example that or some category of cost or benefit that cannot be easily identifiable is opportunity cost and opportunity benefits. So, these opportunity cost or the what do you mean by these opportunity cost or benefits?

Opportunity cost or benefits are the cost or benefits which are forgone by selecting one alternative over another. If you could have taken another alternative you might have you might have got better benefit for somehow you have overlook that somehow you have forgotten that one. So, these are the what. So, this types of cost or benefits those are forgone by selecting one alternative over another alternative. So, the cost or benefit associated with the these types of things are known as opportunity cost. So, these opportunity cost or opportunity benefits they are very much difficult to identify.

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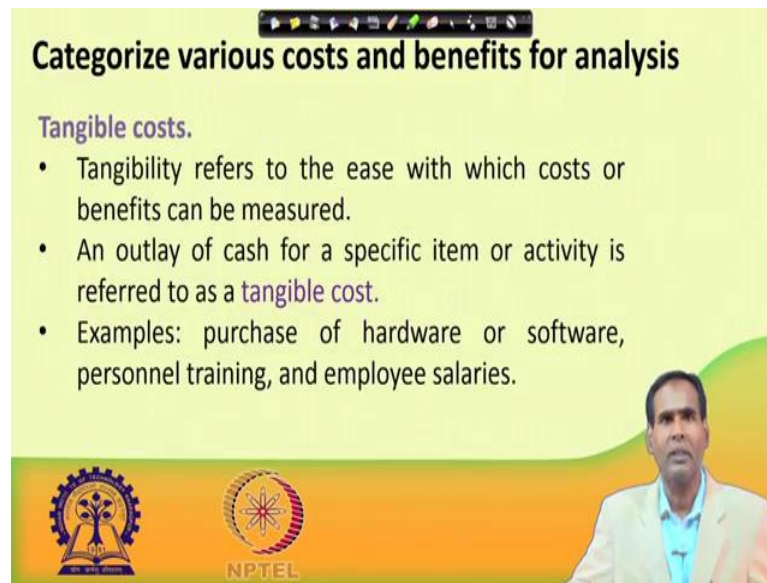
**Categorize various costs and benefits for analysis**

- Tangible or Intangible
- Direct or indirect
- Fixed or variable

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Now, let us see what are the different then the second step as I have already told you first step is identify the cost and benefits, then next step is categorize the various cost and benefits. So, what are the various categories of what are the categories of different various cost and benefits? So, the cost or benefits they can be tangible or intangible, they can be direct or indirect they can be fixed or variable. So, these are the important categories of different cost and benefits let us discuss a one by one.

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**Categorize various costs and benefits for analysis**

**Tangible costs.**

- Tangibility refers to the ease with which costs or benefits can be measured.
- An outlay of cash for a specific item or activity is referred to as a **tangible cost**.
- Examples: purchase of hardware or software, personnel training, and employee salaries.

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So, first one is tangible cost. So, what do you mean by tangibility? Tangibility refers to the ease with which cost or benefits can be measured; how easily you can measure the cost or the benefits. So, tangible means the ease with which the cost or benefits can be measured. An outlay of the cash for a specific item or activity is referred to as a tangible cost. So, tangible cost is defined as an outlay of the cash for a specific item or for a specific activity. So, this outlay of cash for a specific item or activity is called as tangible cost. So, examples of tangible cost are what? Purchase of machineries purchase of devices such as purchase of hardware or different software the what cost required for a training the personnel the cost required for paying salaries the employees these are examples of tangible cost.



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**Categorize various costs and benefits for analysis cont...**

**Intangible costs**

- Costs that are known to exist but whose financial value cannot be accurately measured.
- Example: employee morale problems caused by a new system or lowered company image.
- In some cases, they are easy to identify but difficult to measure, e.g. the cost of breakdown of an online system during banking hours will cause the bank to lose deposits and waste human resources. But, by how much? Difficult to measure.
- In some cases, these costs may be difficult even to identify, e.g. improvement in customer satisfaction due to online systems.

Similarly, what do you mean by intangible cost? So, tangible cost means cost which can be easily measured which can be easily measured what intangible cost means cost that are known to exist, but with the financial value cannot be accurately measured. You cannot easily measure these cost some examples let us see employee morale problems caused by a new system. So, suppose it was earlier some existing system was there.

Now, you have implemented you have installed a new system, you have followed a new system then what kind of morale problems will come to the employees? So, that will incur some cost that you cannot easily measure. So, that is why these are intangible cost. Similarly lowered company image if the company image is lowered is down in the market among the customers then it will also incur some customer the difficult to measure. So, these are some examples of intangible cost. In some cases these intangible cost are easy to identify, but difficult to measure you can identify them, but you cannot measure them.

For example the cost of breakdown of an online system. An online system such as railway reservation system or banking system etcetera it was running, but suddenly they as a breakdown, then some cost is associated with this due to this what the customers may be diverted to what other service providers and so, and so, on. So, here the cost of breakdown of an online system during what the maybe we may take that banking

example, if an online banking system it is a several times it is getting breakdown. So, there are so, many banks why the people will go for only your bank. So, they may migrate to other bank.

So, you lose some amount. So, this will incur some cost. The cost of breakdown of an online system during banking hours will cause the bank to lose deposits as well as waste the human resources, but is difficult to measure by how much amount you will lose, how much money you will lose or how much, but human resources you will lose it is very much difficult to measure. So, this is something about intangible case are caused. So, in some cases these cost may be difficult even to identify. In many cases here we can identify this example have taken that cost of breakdown of an online system here it can be easily identified, but difficult measure.

So, but there are some other cases where these cost may be difficult even to identify you cannot identify, what is about measurement you cannot identify. So, we cannot measure them for example, you see improvement in customer satisfaction due to online systems previously this system was manual. Now you have what followed you have installed your you have implemented on analysis system. So, difficult analysis the customers will satisfied, but how much they have satisfied how to quantify it, it is very much difficult to quantify them or it is very much difficult to what a measure them.

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**Categorize various costs and benefits for analysis cont...**

**Tangible benefits**

- Benefits which can be measured/quantified.
- Examples: Benefits due to completing jobs in fewer hours or producing reports with no errors.


 



So, these are intangible cost so, similarly as we have seen tangible cost and the intangible cost. So, similarly the corresponding category of benefits are there like tangible benefits and intangible benefits. So, benefits which can be measured. So, tangible benefits means these are the benefits which can be easily measured or quantified. For example, benefits due to completing jobs in fewer hours previously the job was for hour you are completing say 10 jobs for due to what automatic a developing a new automation system, you are completing what in what the same what 10 jobs you are completing in half an hour.

So, you are certainly getting some benefits. So, this, but how much this benefits of course, you can you can measure that previously one for one hour you are doing that 10 jobs now the send 10 jobs you are completing in half an hour or for one hour you are completing 20 jobs. So, this can be easily measured on quantified. So, this is an example of tangible benefits. So, similarly producing reports with no errors previously you are preparing the reports manually. So, there are many errors maybe per page say 10, 20 or like that, but after automating in your report almost just one or two errors are coming, this number of errors are present in that reports due to making your system online or automated. So, this can be measured this is an tangible benefit.

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**Categorize various costs and benefits for analysis cont...**

**Intangible benefits**

- Benefits which cannot be easily measured / quantified.
- Example: More satisfied customers or an improved corporate image.
- Both tangible and intangible costs and benefits, should be considered in the evaluation process.
- Management often tends to deal irrationally with intangibles by ignoring them, which should not be.

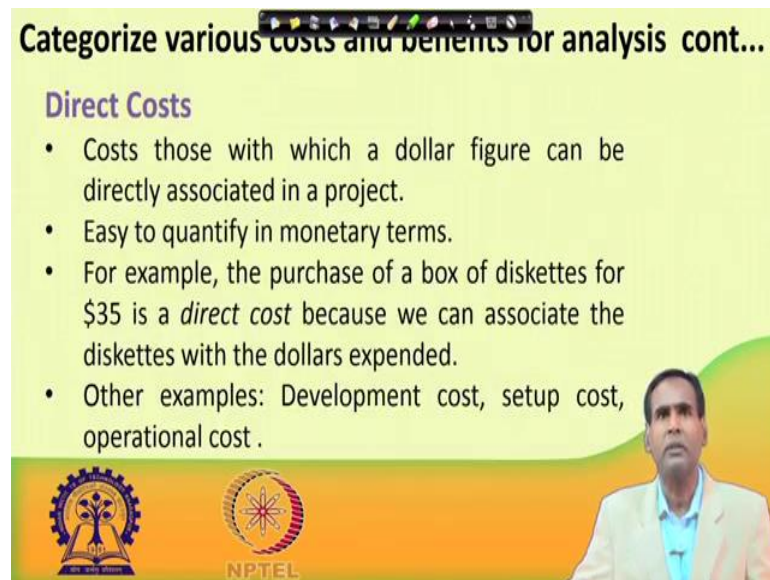
So, producing the reports with no errors of course, this can be measured and quantified you can count the number of errors etcetera. So, this is an a example of tangible benefits.

So, similarly what do you mean by intangible benefit? Benefits which cannot be easily measured or quantified. So, the benefits which you cannot easily measure which cannot easily quantified there intangible benefits, let us take some example more satisfied customers. So, if you are having more number of satisfied customers or your company your corporate has an improved image definitely your benefit will be more but is difficult to measure them it difficult to quantify them.

So, why we are discussing the different types of cost and benefits? Because all the types of cost may be tangible and intangible cost may be tangible or intangible benefits or direct cost indirect cost or direct benefits or intangible benefits all should be considered in the evaluation process. In the cost benefit analysis all the different types of cost and benefits including tangible and intangible cost and benefits direct and indirect cost and benefits they should be considered in evaluation process. It has been observed that many times the management often tends to deal irrationally with intangible cost or benefits by ignoring them we should not be. Very often since these intangible benefits they cannot measure they cannot identify they cannot be identified or they cannot be quantified. So, management they just ignore them only takes can count what like tangible benefits and costs.

So, in that way the assessment the financial assessment the cost benefit analysis cannot be made proper. So, management has to treat equally has to consider all the different cost and benefits similarly in the C- B analysis method.

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**Categorize various costs and benefits for analysis cont...**

**Direct Costs**

- Costs those with which a dollar figure can be directly associated in a project.
- Easy to quantify in monetary terms.
- For example, the purchase of a box of diskettes for \$35 is a *direct cost* because we can associate the diskettes with the dollars expended.
- Other examples: Development cost, setup cost, operational cost .

The slide features a video inset of a man in a light blue shirt and white jacket speaking. At the bottom, there are logos for IIT Bombay and NPTEL.

Next category is direct cost. These are the cost those with which a dollar figure can be directly associated in a project; that means, we can express the cost in a monetary terms either in terms of rupee or in types of what dollar. So, these are the cost with which a dollar figure can be directly associated in a project, it is easy to quantified monetary items. So, this cost can be easily quantified in monetary items let us take a small example.

Suppose you want to purchase box of diskettes or purchase the number of computers, purchase what a set of softwares. So, these are examples of direct cost here why? Because here in this case purchase of the box of diskettes say it is taken thirty five dollar or so, here you can associate the diskettes with the dollars expended. So, since you can assign monetized what values to this cost these are known as direct cost and other examples of direct cost as such as development cost, establishment of the laboratory etcetera, setup cost and operating cost I mean operating running this system after the installation is over, these are some examples of direct cost because they can be easily they can be directly measured, they can be directly quantified.

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**Categorize various costs and benefits for analysis cont...**

**Direct benefits**

- Benefits which can be specifically attributable to the given project.
- Example: A new online system that can handle 25 percent more transactions per day.

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What is about direct benefits? These are the benefits which can be specifically attributable to the given project. So, these benefits can be specifically attributable to the given project that is why these are known as direct benefits let us take a small example. Suppose previously you are your system was running manually; now you have developed a new online system and that can handle 25 percent more transaction per day due to the manually how many transactions you are completing? So, now, due to making it online 25 percent more transactions are completed per day.

So, here directly we are getting the benefit and the benefits these are specifically attribute attributable why? Because due to implementation of the new online system these are examples of. So, this is the example of direct benefit.

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**Categorize various costs and benefits for analysis cont...**

**Indirect costs**

- These costs are the results of operations that are not directly associated with a given system or activity. They are often referred to as overhead.
- Example: Insurance, maintenance, protection of the computer center from heat and fire, lighting, and air conditioning.
- But, it is difficult to determine the proportion of each, attributable to a specific activity.

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So, now will call the a direct indirect cost. So, these are the cost or these cost are the results of operations that are not directly associated with a given system or activity ok. So, this types of cost which are not a this types of cost are not directly associated with a given system or a given activity, normally they are often refer to the often referred to as overhead or overhead cost.

A for example, like insurance, maintenance etcetera these are not specific to a particular system or a particular activity, these are overall these are required for running of the overall organization. So, similarly protection of the computer center from the heat and fire lighting the organization, providing air conditioning facility etcetera these are not specific these are not directly associated with a given system or with given project or a given activity this is the required for overall running of the organization these are examples of indirect cost, but it is a very much difficult to determine the proportion of each of these which are attributable to a specific activity this is very difficult to determine and their proportion.



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**Categorize various costs and benefits for analysis cont...**

**Indirect benefits**

- The benefits which are realized as a by-product of another activity or system.
- Examples: benefits due to selling of fertilizers in a steel plant, selling of empty oil containers (tin boxes), etc.

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Now, what is about indirect benefits? The benefits which are realized as a byproduct of another activity or system. These are not directly actually benefits, but these benefits realized as a byproduct as a side product of another activity or system let us take a small example. See this is a main objective of steel plant is produced what I steels, but by the time this steels are produced also in some cases fertilizers are produced. So, the benefits due to selling of the fertilizers we can consider this as an indirect benefit.

So, similarly you know that the shop keepers they are what selling the oils different oils, but after selling the oils that containers the tin boxes, they also sell it in the what to the in the market. So, the amount the benefit they get out of selling the empty oil containers just like the tin boxes or this what paper cartoons etcetera these are indirect they may be treated as the indirect benefits.

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**Categorize various costs and benefits for analysis cont...**

**Fixed Costs**

- Some costs are constant, regardless of how well a system is used. They are called *fixed costs*.
- Once encountered, they will not recur.
- Examples: Straight-line depreciation of hardware, exempt employee salaries, and insurance etc.

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Now let us come to the last category that as fixed cost versus variable cost. So, some cost are constant regardless of how well a system is used. So, whether you use this system frequently used or less frequently used or do not used at all. So, some cost are constant they are called as fixed cost.

So, they are they are encountered only once normally they will not recur again and again, examples you can see this straight line depreciation of the hardware exempt employee salaries you are one times suppose you have a exempt employee salary etcetera and the insurance etcetera these are one time cost these are known as the fixed cost.

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**Categorize various costs and benefits for analysis cont...**

**Variable costs**

- These costs are incurred on a regular (weekly, monthly) basis.
- They are usually proportional to work volume and continue as long as the system is in operation.
- Example: Costs of computer forms which vary in proportion to the amount of processing or the length of the reports required.

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Similarly, variable cost. So, these cost are incurred on a regular basis in contrast to the fixed cost which are, but only encountered ones they occur only ones whereas, variable cost they are incurred on a regular basis might be weekly monthly or yearly, they are usually proportional to the work volume and continue as long as the system is in a operation.

So, normally they are proportional to the volume of the work and they continue as long as the system is in a operation will take some examples like cost of the computer forms, computer printouts that you want to take which vary in proportional to the amount of processing. So, if you are having large amount of work has to be done large amount of activities have to be processed; obviously, you have to print more computer printouts more computer forms are required. Similarly if a it is a less amount of processing has to be done; obviously, less number of computer forms will be required. Similarly the length of the reports required more activities performed; obviously, the length of the report will be more only few activities are performed the length will be less.

So, here the cost associated with a this applications; obviously, that will be vary according to the volume of the work performed.

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**Categorize various costs and benefits for analysis cont...**

**Fixed benefits**

- These benefits are also constant and do not change.
- Example: Benefits due to the decrease in the number of personnel by 20 percent resulting from the use of a new computer.
- The benefit of personnel savings may recur every month.

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Similarly, let us say about fixed benefits versus variable benefits. These benefits are also constant and they do not change. So, as fixed cost they normally do not change. So, similarly a fixed benefits they are also constant and they do not change. So, some examples of benefits we can say which are fixed benefits like benefits due to the decrease in the number of personnel by 20 percent resulting from the use of a new computer.

You are automating your system previously it was running manually now a new computer system is implemented. So, by this you by due to the use of computer suppose the number of personnel that you are using previously it is reduced by 20 percent. So, this is exactly it is a fixed benefit ok. Similarly the benefit of personnel savings may recur every month, but the benefit of personnel savings how much personnel have been saved? The benefit of a personnel savings they may occur very every month.

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**Categorize various costs and benefits for analysis cont...**

**Variable Benefits**

- On the other hand, these benefits are realized on a regular basis.
- Example: Consider a safe deposit tracking system that saves 20 minutes preparing customer notices compared with the manual system. The amount of time saved varies with the number of notices produced.

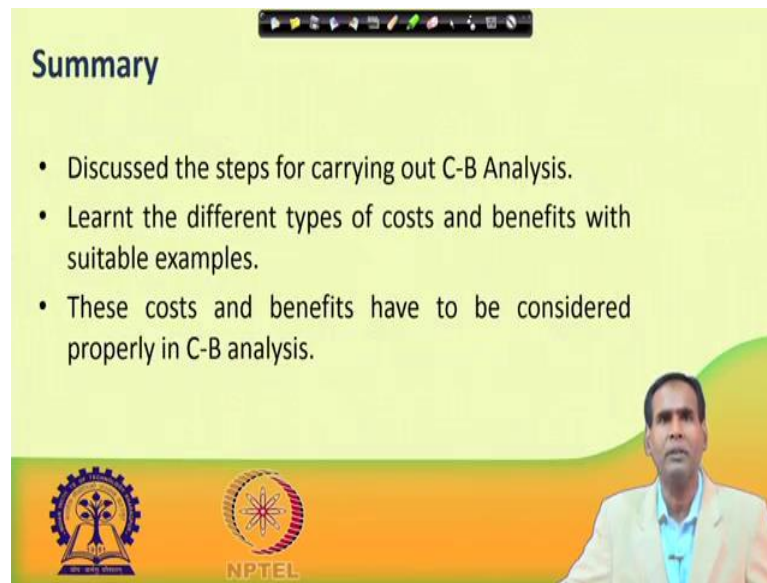
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And variable benefits on the other hand these benefits; that means, variable benefits they are realized on a regular basis, they change. For example, suppose there is a safe deposit tracking system that saves 20 minutes preparing customer notices compared with a manual system.

When it was manual system, it was taking to 20 minutes more for preparing the customer notices after making it automated, after making a computerized that saves 20 minutes of a preparing customer notices. So, this will vary the amount of the time saved it varies with the number of notices produced. How many number of notices are produced accordingly the time saved it will vary. So, that is why this is an example of variable benefit.



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**Summary**

- Discussed the steps for carrying out C-B Analysis.
- Learnt the different types of costs and benefits with suitable examples.
- These costs and benefits have to be considered properly in C-B analysis.

IIT Bombay NPTEL

So, now we have seen that in summary. So, today we have discussed in this class what are the different steps for carrying out C- B analysis. We have learnt the different types of a cost and benefits with suitable examples such as we have seen this direct cost versus indirect cost, direct benefits versus indirect benefits fixed cost versus variable cost fixed benefits versus variable benefits similarly this tangible cost versus intangible cost and tangible benefits versus variable benefits.

So, this cost and benefits have to be considered properly in C- B analysis that is why this classification is required. We have to consider each and every possible type of cost each and every type of benefit during the C- B analysis because you have seen that very often the management, they are not considering they are not taking into account the intangible benefits and intangible what cost because that difficult to measure the difficult to identifiable the difficult to quantifiable.

So, that is why they are ignoring this, as a result the result of C- B analysis will not get proper the financial assessment will not be proper. So, that is why this cost and benefits have to be considered properly while carrying out C- B analysis or while carrying out the financial assessment.

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**References :**

1. B. Hughes, M. Cotterell, R. Mall, *Software Project Management*, Fifth Edition, McGraw Hill Education (India) Pvt. Ltd., 2018.
2. E. M. Awad, *Systems Analysis and Design*, Second Edition. Galgotia Publications Pvt. Ltd., 2009.
3. R. Mall, *Fundamentals of Software Engineering*, Fifth Edition, PHI Learning Pvt. Ltd., 2018.

So, last class as well as this class we have taken these materials from these books mainly serial number 1 by Hughes Cotterell and Mall that book will take here the preliminary book and besides that the different cost and the benefits and the feasibility study on the cost benefit analysis it is well explained in the system analysis and design book by E M Awad and then this some fundamental concepts of feasibility study and this cost benefit analysis and this software project management, some fundamental concepts are given in this fundamentals of software engineering Rajib Mall's book you may refer these references in these books. So, from time to time as and when we will I will use different materials, different books or different resources I will put all those things in due course of time.

So, this is all about these different types of costs and benefits in the next class we will see the other steps of cost benefit analysis. So, today we have seen three two steps that is identify the cost, step 1 and step 2 is your classify or categorize the cost. So, these two steps we have seen of cost benefit analysis, the next step is after identifying and classifying the different cost and benefits we have to use we have to select a proper cost benefit evaluation technique there are so many cost benefit evaluation techniques such as net profit, present value net present value, payback period, internal rate of return. So, those methods are there. So, how to select these methods based on what that will discuss in the next class thank you very much. So, we will take up the selection of cost benefit evaluation technique in the next class.

Thank you very much.