RISK MANAGEMENT PROCESS

Lecture 4

RISK MANAGEMENT PROCESS

STEP2: RISK ASSESSMENT

QUANTITATIVE RISK ANALYSIS

QUANTITATIVE RISK ANALYSIS TOOLS AND TECHNIQUES

- Sensitivity Analysis
- Scenario Analysis
- Probability Analysis
- Expected Value Analysis
- Decision Tree Analysis
- PERT Analysis

EXPECTED VALUE ANALYSIS

- Expected Value Analysis is a technique of determining the "Risk Magnitude"
- Taking into consideration **Probability and impact actual values and also concurrency of events**
- "Impact and Probability" (Calculated by Previously explained techniques and known from previous experiences and records),
- Impact and Probability **are multiplied mathematically to get one value**

EXAMPLE 1:-

Risk	Probability (P)	Impact (I)	Expected Value (EV)= (P)*(I)	Rank
Changing of Soil Condition	25 %	$50,000	$12,500	2
Delay of Material Delivery	60 %	$100,000	$60,000	1
Late Decision Making	30 %	$25,000	$7,500	3

EXAMPLE 1:-

For Third Event Corrective and/or Preventive Actions should be taken into consideration, but for First and second events if the corrective action will cost us more that Risk Consequence it is better not to consider it

Risk	Expected Value (EV)= (P)*(I)	Corrective and/or Preventive Action Cost
Changing of Soil Condition	12,500	40,000
Delay of Material Delivery	60,000	75,000
Late Decision Making	7,500	3,500

EXAMPLE 2:-

If we consider a project will has probability of:

- 70% to be completed on time with profit of $3,000,000
- 15% to be completed on time with profit of $3,500,000
- 20% of failing to be completed on time with loss of $1,000,000

What is the expected value of profit and Loss ?

(EV) for Profit/Loss=

(3,000,000*0.70+3,500,000*0.15-1,000,000*0.20) = $ 2,825,000

EXAMPLE 3:-

If we consider we will have productivity drop, this productivity drop will cost additionally the figures indicated in the following table corresponding to each probability in order to calculate the EV of additional cost due to productivity drop and also productivity increase

Probability	25%	30%	40%	60%	70%	10%
Cost of productivity drop	110,000	120,000	150,000	200,000	250,000	-80,000

(EV) for productivity drop additional cost =

(110,000*0.25 +120,000*0.30 +150,000*0.40 +200,000*0.60 +250,000*0.70 - 80,000*0.10) = 410,500 EGP

QUANTITATIVE RISK ANALYSIS TOOLS AND TECHNIQUES

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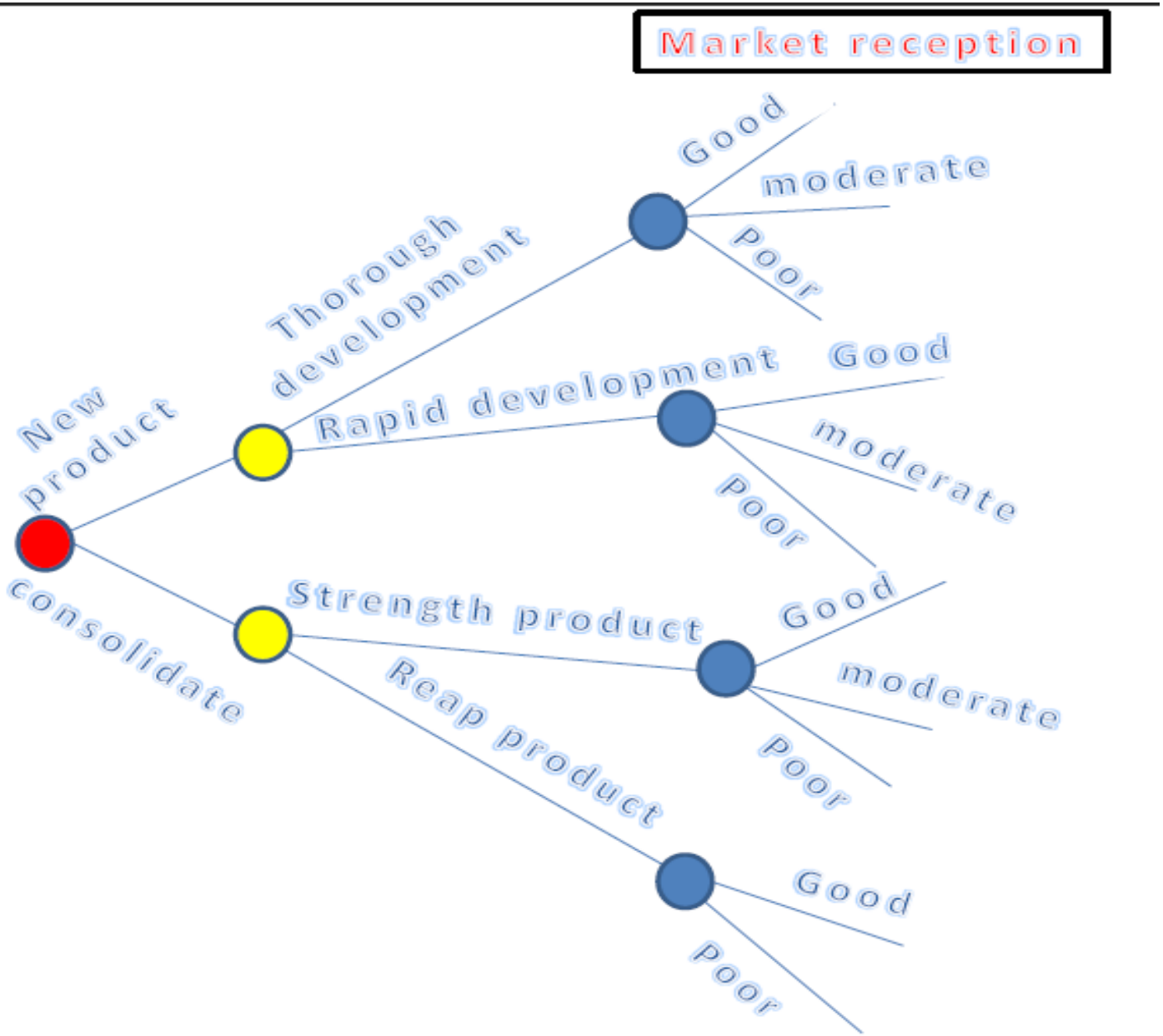
DECISION TREE ANALYSIS

Benefits of Using Decision Tree:-

-Useful tools for helping to choose between several courses of action.

-Provide a highly effective structure within which you can explore options, and investigate the possible outcomes of choosing those options.

-Help to form a balanced picture of the risks and rewards associated with each possible course of action.


Market reception
New product
Thorough development
Rapid development
Strength product
Reap product
Consolidate
Good
moderate
Poor
Good
moderate
Poor
Good
moderate
Poor
Good
Poor

HOW TO USE THIS TOOL ?

-You start a Decision Tree with a decision that you need to make. Draw a small square to represent this on the left hand side of a large piece of paper, half way down the page.

-From this box draw out lines towards the right for each possible solution, and write a short description of the solution along the line. Keep the lines apart as far as possible so that you can expand your thoughts.

HOW TO USE THIS TOOL ?

-At the end of each line, consider the results. If the result of taking that decision is uncertain, draw a small circle.

- If the result is another decision that you need to make, draw another square.

-Squares represent decisions, and circles represent uncertain outcomes.

-Write the decision or factor above the square or circle. If you have completed the solution at the end of the line, just leave it blank.

HOW TO USE THIS TOOL ?

-Starting from the new decision squares on your diagram, draw out lines representing the options that you could select.

-From the circles draw lines representing possible outcomes.

-Again make a brief note on the line saying what it means.

- Keep on doing this until you have drawn out as many of the possible outcomes and decisions as you can see leading on from the original decisions.

HOW TO USE THIS TOOL ?

-Once you have done this,

-review your tree diagram.

-Challenge each square and circle to see if there are any solutions or outcomes you have not considered.

-If there are, draw them in. If necessary, re-draft your tree if parts of it are too congested or untidy.

-You should now have a good understanding of the range of possible outcomes of your decisions

EVALUATING YOUR DECISION TREE ?

-Now you are ready to evaluate the decision tree.

-This is where you can work out which option has the greatest worth to you.

-Start by assigning a cash value or score to each possible outcome.

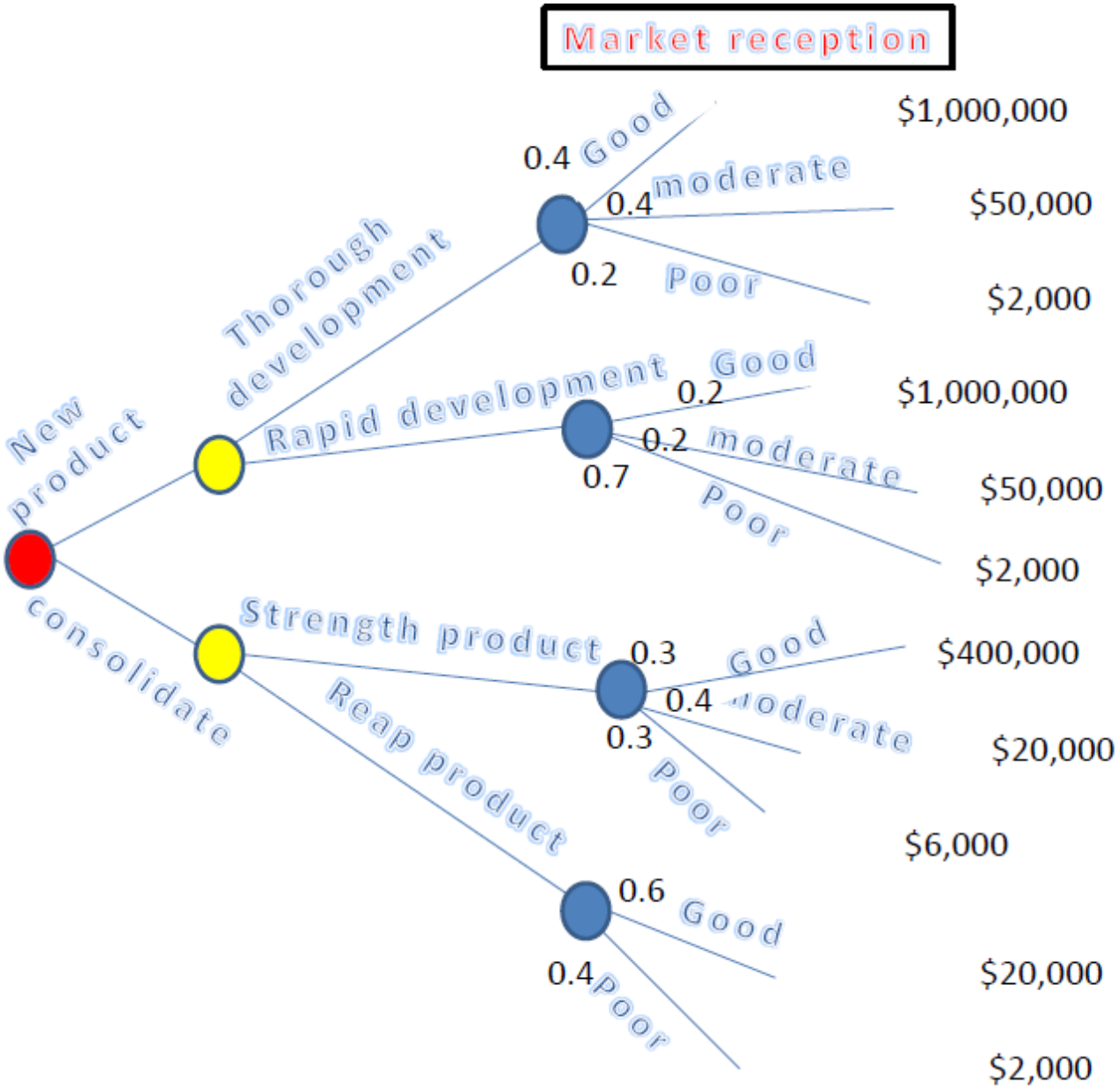
-Make your best assessment of how much you think it would be worth to you if that outcome came about.

EVALUATING YOUR DECISION TREE ?

-Next look at each circle (representing an uncertainty point) and estimate the probability of each outcome.

-If you use percentages, the total must come to 100% at each circle. If you use fractions, these must add up to 1.

-If you have data on past events you may be able to make rigorous estimates of the probabilities. Otherwise write down your best guess.


Market reception
New product
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Reap product
consolidate
0.4 Good
0.4 moderate
0.2 Poor
0.2 Good
0.2 moderate
0.7 Poor
0.3 Good
0.4 moderate
0.3 Poor
0.6 Good
0.4 Poor
$1,000,000
$50,000
$2,000
$1,000,000
$50,000
$2,000
$400,000
$20,000
$6,000
$20,000
$2,000

CALCULATING TREE VALUES?

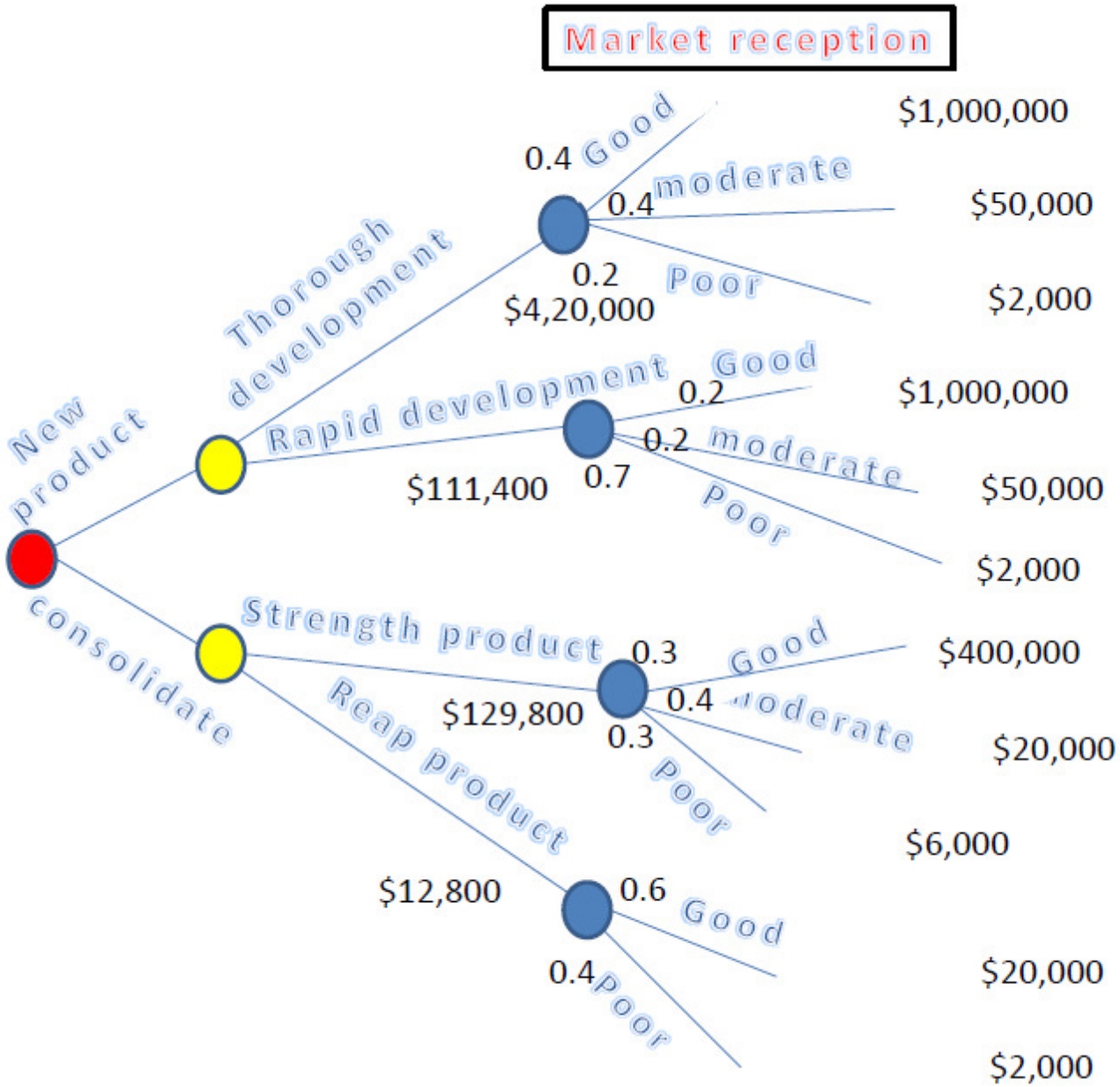
-Once you have worked out the value of the outcomes, and have assessed the probability of the outcomes of uncertainty, it is time to start calculating the values that will help you make your decision.

-Start on the right hand side of the decision tree, and work back towards the left. As you complete a set of calculations on a node (decision square or uncertainty circle), all you need to do is to record the result. You can ignore all the calculations that lead to that result from then on

CALCULATING THE VALUE OF UNCERTAIN OUTCOME NODES?

-Where you are calculating the value of uncertain outcomes (circles on the diagram), do this by multiplying the value of the outcomes by their probability.

The total for that node of the tree is the total of these values.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0.3 Poor
$129,800
0.6 Good
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$2,000
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$20,000
$6,000
$20,000
$2,000

VALUE OF THAT DECISION NODE

- Write down the cost of each option along each decision line.
- Subtract the cost from the outcome value that you have already calculated.
- This will give you a value that represents the benefit of that decision.
- **Note that amounts already spent do not count for this analysis these are 'sunk costs' and should not be factored into the decision.**
- When you have calculated these decision benefits, choose the option that has the largest benefit, and take that as the decision made.

EXAMPLE

In this example, the benefit we previously calculated for 'new product, thorough development' was $420,400.

We estimate the future cost of this approach as $150,000. This gives a net benefit of $270,400.

The net benefit of 'new product, rapid development' was $31,400.

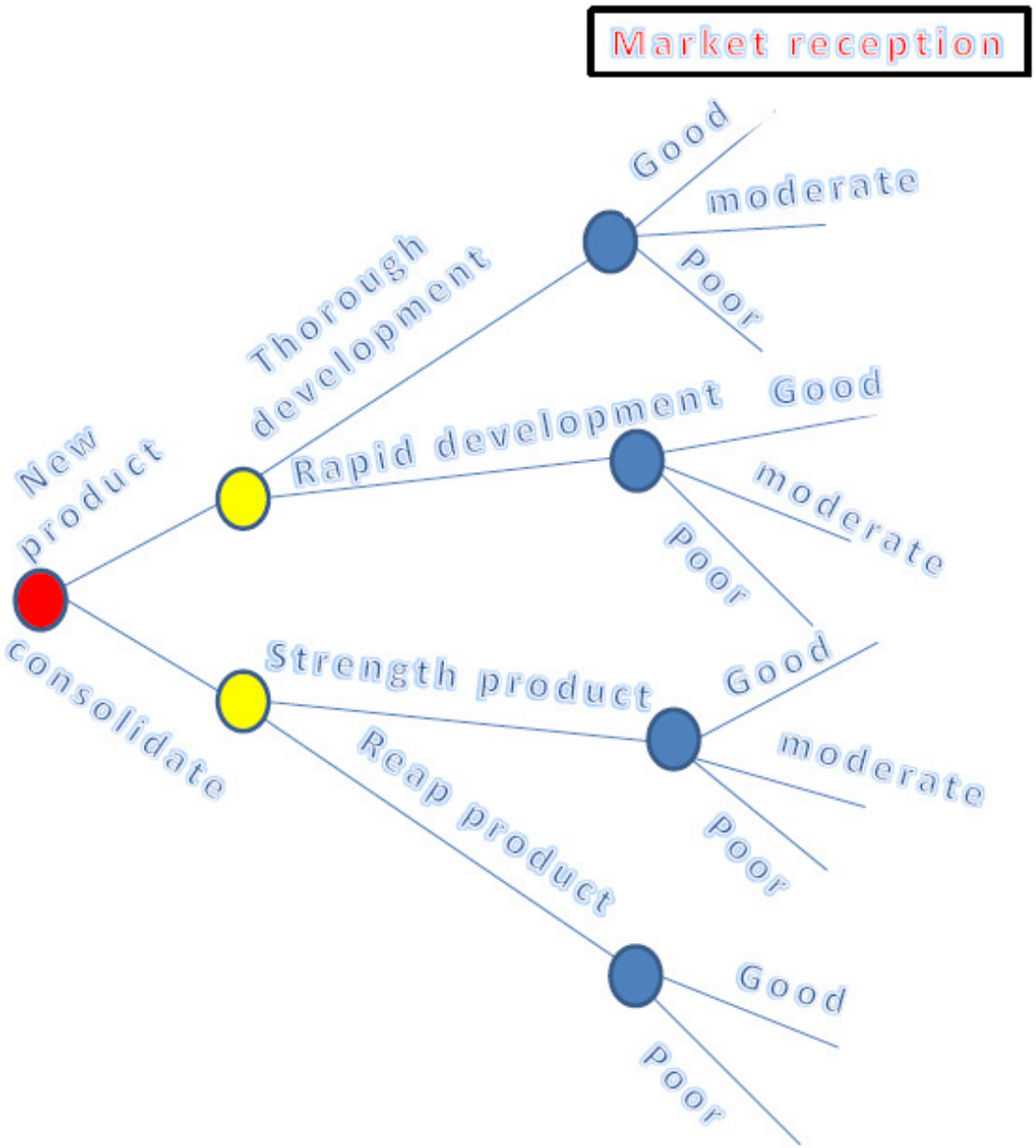
On this branch we therefore choose the most valuable option, 'new product, thorough development', and allocate this value to the decision node.

RESULT

By applying this technique we can see that the best option is to develop a new product.

It is worth much more to us to take our time and get the product right, than to rush the product to market.

And it's better just to improve our existing products than to botch a new product, even though it costs us less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PERT

- PERT is a method to analyze the involved tasks in completing a given project, especially the time needed to complete each task, and identifying the minimum time needed to complete the total project.
- PERT was developed primarily to simplify the planning and scheduling of large and complex projects.
- It was able to incorporate uncertainty by making it possible to schedule a project while not knowing precisely the details and durations of all the activities.

PERT

It is more of an event-oriented technique rather than start- and completion-oriented.

- It is used more in projects where time, rather than cost, is the major factor. It is applied to very large scale, one-time, complex, non-routine infrastructure and Research and Development projects.

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PERT AND RISKS

- In the typical practice of preparing the project schedule and cost estimate, they are prepared based on Single Time and Single Cost Values for each event/activity.
- Summation of single values for time and cost shall be our project total Duration and total Cost.

Due to complexity and nature of construction projects, we expect always to deal with uncertain events .

- Uncertain events are results of risks our project is facing or likely to face.

CONCLUSION

Due to Uncertainties which could probably result Risks, single-point estimates are less accurate, thus PERT Technique is used to deal with a range not a single point.

PERT Analysis could be useful; when no historical records exist to help in calculation of single point time and cost whether for the activity or for the project.

EXAMPLE FOR UNCERTAINTIES OF ESTIMATION OF TIME AND COST

- If we express the duration of excavation activity in one project through a range of (25-30 days) to be completed; this is more realistic and comprehensive than a single point estimate (27 days) for example.

All this because we don't have enough information for reaching the single point estimate

As declared, PERT was developed and is more commonly used for project scheduling, however the same concept could be applied for cost estimating as well

PERT CALCULATIONS

PERT exercise could be performed using three values (Estimates) for each activity and/or Complete Job, these three values are:

- **Optimistic Value (a)**
- **Most Likely Value (m)**
- **Pessimistic Value (b)**

OPTIMISTIC VALUE (A)

- Consider best possible circumstances while carrying out the task
- This value represents our pessimistic determination that all **good** things and conditions for the task duration/cost are likely to occur.
- The Optimistic value is equal to the shortest duration and/or the least cost for a task and/or a complete job.

MOST LIKELY VALUE (M)

- Consider **normal** circumstances while carrying out the task
- This value represents our best determination for the task duration/cost
- The Most likely value is equal to the **single-point** value we used to calculate in case of normal planning (risk free calculations (no risk is taken into consideration)

PESSIMISTIC VALUE (B)

- Consider **worst** possible circumstances while carrying out the task
- This value represents our pessimistic determination that all **bad** things and conditions for the task duration/cost are likely to occur.
- The Pessimistic value is equal to the Longest duration and/or the highest cost for a task and/or a complete job.

CALCULATION OF ACTIVITY DURATION USING PERT:-

Te (Expected Time for Activity) = (a + 4m + b)/6

Be (Expected SD for Activity) = (b-a)/6

PROBABILITY OF COMPLETION :-

PERT provides the means to calculate the probability of completion by a certain time/date, for example:-

If Probability of completing the project within 60 weeks is 80 %

Then Probability of completing the project later than 60 weeks is 20 %

THANK YOU