Software Project Management 4th Edition

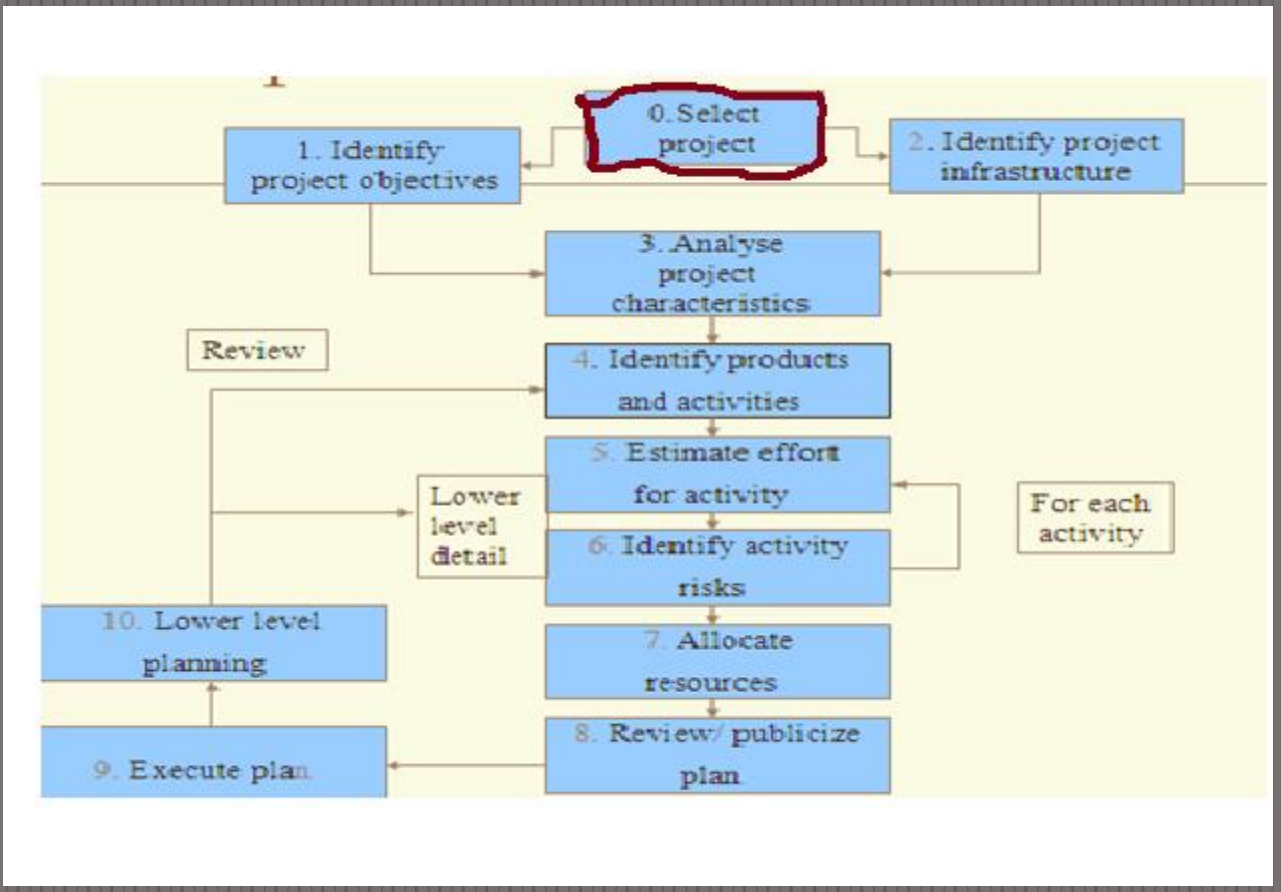
Chapter 3

Programme management and project evaluation

Programme management

- One definition:

  'a group of projects that are managed in a co-ordinated way to gain benefits that would not be possible were the projects to be managed independently' Ferns


0. Select project
1. Identify project objectives
2. Identify project infrastructure
3. Analyse project characteristics
Review
4. Identify products and activities
5. Estimate effort for activity
Lower level detail
For each activity
6. Identify activity risks
10. Lower level planning
7. Allocate resources
9. Execute plan
8. Review/ publicize plan

Evaluation

- Deciding to go ahead with project based on evaluation.
- Based on:
  - Strategic planning or a feasibility study
  - Technical assessment
  - Economic criteria
- So, project evaluation is carried out in Step 0 of Planning process.

Feasibility Study

- A **feasibility study** is a preliminary study undertaken to determine and document a project's viability.
- Results make a decision whether to proceed with the project.
- It is an analysis of possible alternative solutions to a problem and a recommendation on the best *a lte rn a tiv e* .

Strategic Assessment

- Strategic plan-clearly defining the organizations objectives.
- Defining programme and programme goal.
- Project manager or programme director or programme executive be responsible for strategic assessment of a proposed project.

Technical Assessment

- Evaluating the required functionality against the hardware and software .
- This involves questions such as
  - Whether the technology needed for the system exists, how difficult it will be to build
  - Whether the firm has enough experience using that technology.
  - Based on an outline design of system requirements in terms of Input, Output, Fields, Programs.

Economic Criteria

- This involves questions such as
  - Whether the firm can afford to build the system, whether its benefits should substantially exceed its costs.
  - Whether the project has higher priority and profits than other projects that might use the same resources.
  - Also includes whether the project is in the condition to fulfill all the eligibility criteria and the responsibility of both sides in case there are two parties involved in performing any project.

Cost-benefit analysis

- Common way of carrying out an economic assessment.
- Comparing the expected costs of development and operation of the system with benefits.
- Assessment based on:
  - Whether the estimated costs are exceeded by estimated income and other benefits.
  - Whether or not the project under consideration is the best of a number of option.

Cost benefit analysis (CBA)

You need to:

- Identify all the costs which could be:
  - Development costs
  - Set-up
  - Operational costs
- Identify the value of benefits
- Check benefits are greater than costs

(cont..)

- Expressing these costs and benefits in common units:
  - evaluate the net profit
  - Net profit: difference between total benefit accruing from the system and the total cost creating and operating it.
- Common unit of measurement is “Money”.

Costs

- Helpful to categorize costs according to where they originate in the project.
- **Development costs**: Include the salaries and other employment costs of the staff.
- **Setup costs**: cost of putting the system into place.
  - Hardware , recruitment and staff training.
- **Operational costs**: cost of operating the system once it has been installed.

Cash Flow Forecasting

- Indicate when expenditure and income will take place.
- Need to spend money, such as Staff wages during the development stages of project.
- Expenditure from company's resources or from bank.

(Cont..)

- Assumed that cash flows take place at the end of each year.
- Short term projects or candidate projects will be seasonal cash flow.
- Quarterly, or even monthly.

Cost-benefit evaluation techniques

- Proceed when benefits outweigh the cost.
- Methods for comparing projects on the basis of their cash flow forecasts:
  - Net profit
  - Payback period
  - Return on investment (ROI)
  - Net present value
  - Internal rate of return (IRR)

Net Profit

- Difference between the total costs and the total income over the life of the project.
- In simplistic terms, net profit is the money left over after paying all the expenses of an endeavor.

Net profit

Year	Cash-flow
0	-100,000
1	10,000
2	10,000
3	10,000
4	20,000
5	100,000
Net profit	50,000

‘Year 0’ represents all the costs before system is operation

‘Cash-flow’ is value of income less outgoing

Net profit value of all the cash-flows for the lifetime of the application

Table 3.2 *Four project cash flow projections – figures are end of year totals (£)*

Year	*Project 1*	*Project 2*	*Project 3*	*Project 4*
0	-100,000	-1,000,000	-100,000	-120,000
1	10,000	200,000	30,000	30,000
2	10,000	200,000	30,000	30,000
3	10,000	200,000	30,000	30,000
4	20,000	200,000	30,000	30,000
5	100,000	300,000	30,000	75,000

Net Profit

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3	10,000	200,000	30,000	30,000
4	20,000	200,000	30,000	30,000
5	100,000	300,000	30,000	75,000
Net profit	50,000	100,000	50,000	75,000

Pay back period

This is the time taken to break even or pay back the initial investment.

Year	Cash-flow	Accumulated
0	-100,000	-100,000
1	10,000	-90,000
2	10,000	-80,000
3	10,000	-70,000
4	20,000	-50,000
5	100,000	50,000

Payback Period

- Period of time required for the return on an investment to "repay" the sum of the original investment .
- For example, a $1000 investment which returned $500 per year would have a two year payback period.
- Measure that describes how long something takes to "pay for itself“
- Shorter payback periods are obviously preferable than longer payback periods

$$\text{Payback Period} = A + \frac{B}{C}$$

Where,

A is the last period number with a negative cumulative cash flow;

B is the absolute value (i.e. value without negative sign) of cumulative net cash flow at the end of the period A; and

C is the total cash inflow during the period following period A

Cumulative net cash flow is the sum of inflows to date, minus the initial outflow.

Both of the above situations are explained through examples given below.

Payback Period Calculator

Period	Cash Flow	Cumulative
0	-50	-50
1	10	-40
2	13	-27
3	16	-11
4	19	8
5	22	30

Payback 3.58 periods

+ Period − Period

Solution

Year	*(cash flows in millions)*	
	Annual Cash Flow	**Cumulative Cash Flow**
0	(50)	(50)
1	10	(40)
2	13	(27)
3	16	**(11)**
4	**19**	8
5	22	30

Payback Period = 3 + 11/19 = 3 + 0.58 ≈ 3.6 years

Payback Period

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0	–100,000	–1,000,000	–100,000	–120,000
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2	10,000	200,000	30,000	30,000
3	10,000	200,000	30,000	30,000
4	20,000	200,000	30,000	30,000
5	100,000	300,000	30,000	75,000
Net profit	50,000	100,000	50,000	75,000
Payback Period	**4.5 yrs**	**4.7 yrs**	**3.3 yrs**	**4 yrs**

Return on Investment (ROI)

- Also known as Accounting rate of return (ARR)
- Ratio of money gained or lost on an investment relative to the amount of money invested.
- The amount of money gained or lost may be referred to as **profit/loss.**
- The money invested may be referred to as the **asset, capital, principal**.

(Cont..)

$$\text{ROI} = \frac{\text{average annual profit}}{\text{Total investment}} * 100$$

ROI

Table 3.2 *Four project cash flow projections – figures are end of year totals (£)*

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1	10,000	200,000	30,000	30,000
2	10,000	200,000	30,000	30,000
3	10,000	200,000	30,000	30,000
4	20,000	200,000	30,000	30,000
5	100,000	300,000	30,000	75,000
Net profit	50,000	100,000	50,000	75,000
Payback Period	**4.5 yrs**	**4.7 yrs**	**3.3 yrs**	**4 yrs**
ROI	**10%**	**2 %**	**10 %**	**12.5%**

Net present value

Would you rather I gave you £100 today or in 12 months time?

If I gave you £100 now you *could* put it in savings account and get interest on it.

If the interest rate was 10% how much would I have to invest now to get £100 in a year's time?

This figure is the *net present value* of £100 in one year's time

Net present value (NPV)

- Take into account the net profitability of a project and the timing of cash flows.
- It does so by discounting future cash flows with a percentage known as discount rate.
- Present value of any cash flow= $\frac{\text{value in year t}}{(1+r)^t}$

r-discount rate, t- no. of years into the future when the cash flow occurs.

(Cont..)

- Present value of cash flow is calculated by multiplying the cash flow with discount factor.
- Discount factor = $\frac{1}{(1+r)^t}$

- The annual rate by which we discount future earnings is known as ***discount rate*** .
- Disadvantage: Difficulty for deciding appropriate discount rate.

Applying discount factors

Year	Cash-flow	Discount factor @ 10%	Discounted cash flow
0	-100,000	1.0000	-100,000
1	10,000	0.9091	9,091
2	10,000	0.8264	8,264
3	10,000	0.7513	7,513
4	20,000	0.6830	13,660
5	100,000	0.6209	62,090
		NPV	618

NPV

Table *Calculating the net present value of projects 1, 2, 3 and 4*

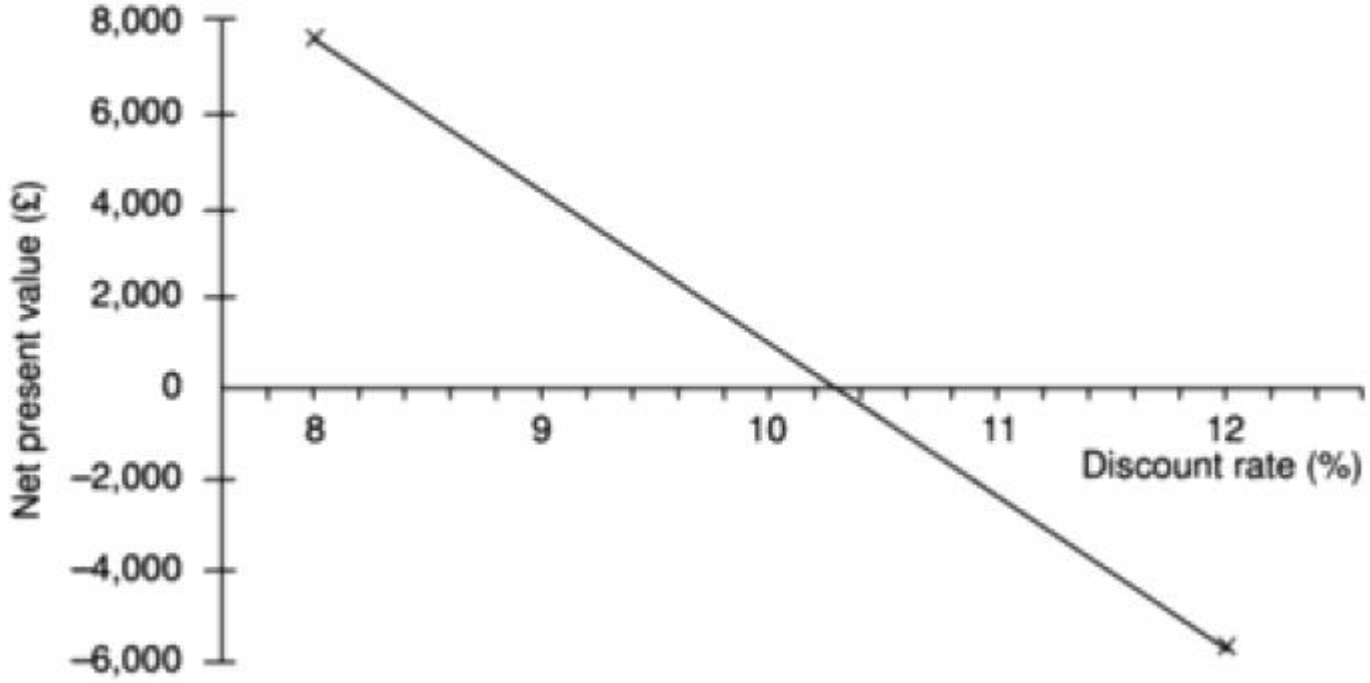
Year	*Discount factor*	*Discounted cash flow (£)*			
		Project 1	*Project 2*	*Project 3*	*Project 4*
0	1.0000	−100,000	−1,000,000	−100,000	−120,000
1	0.9091	9,091	181,820	27,273	27,273
2	0.8264	8,264	165,280	24,792	24,792
3	0.7513	7,513	150,260	22,539	22,539
4	0.6830	13,660	136,600	20,490	20,490
5	0.6209	62,090	186,270	18,627	46,568
NPV		£618	−179,770	13,721	21,662

Internal Rate of Return (IRR)

- It is a measure that compares the different rate of return of projects to analyze project profitability.

IRR

IRR is calculated as that percentage discount rate that would produce an NPV of ZERO.



Estimating the internal rate of return for project 1.

For a particular project, a discount rate of 8% gives a positive NPV of £7,898; a discount rate of 12% gives a negative NPV of –£5,829. The IRR is therefore somewhere between these two values.

$$IRR = R_1 + \frac{(NPV_1 \times (R_2 - R_1))}{(NPV_1 - NPV_2)}$$

Where R1 = Lower interest rate

R2 = Higher interest rate

NPV_1 = net present value with the interest rate R1

NPV_2 = net present value with the interest rate R2

- $IRR = R_L + \frac{N_L}{(N_L - N_H)} \times (R_H - R_L)$
- Where,
- R_H = Higher interest rate,
- R_L = Lower Interest rate
- N_L = Net present value at low interest rate
- N_H = Net present value at high interest rate

Time Period	Cash flow	Discount factor @10%	Present value @10%	Discount factor @20%	Present value @20%
	(200,000)	1.000	(200,000)	1.000	(200,000)
1	15,000	0.909	13,635	0.833	12,495
2	50,000	0.826	41,300	0.694	34,700
3	75,000	0.751	56,325	0.579	43,425
4	150,000	0.683	102,450	0.482	72,300
	Total		**13,710**		**-37,080**

From the present value table above, we can calculate the IRR by using the above IRR formula as below:

IRR = 10% + [13,710 / (13,710 – (– 37,080)] × (20%-10%)

IRR = 10% + [13,710 / 50,790] × 10%

Hence, IRR = 12.70 %

The estimation is most accurate if one NPV used in the formula is positive and the other one is negative. *So if a candidate chooses a discount factor and calculates the NPV of the project which turns out to be negative, a lower discount rate should be chosen for the next discounting so that there is a possibility of obtaining a positive NPV. However, within an exam situation, if a candidate ends up with two positive or two negative NPVs, do not waste time calculating a third. Put the values you have into the formula and complete the calculation;*

Table 3.5 *Three estimated project cash flows*

Year	*Project A (£)*	*Project B (£)*	*Project C (£)*
0	– 8,000	– 8,000	– 10,000
1	4,000	1,000	2,000
2	4,000	2,000	2,000
3	2,000	4,000	6,000
4	1,000	3,000	2,000
5	500	9,000	2,000
6	500	–6,000	2,000

Compute net profit, payback period, ROI, NPV with 8%,10% and 12% discount rates and IRR .

For each of the discount rates, decide which is the best project. What you can conclude from these results?

Table F.3 *The effect on net present value of varying the discount rate*

Year	*Cash flow values (£)*		
	Project A	*Project B*	*Project C*
0	–8,000	–8,000	–10,000
1	4,000	1,000	2,000
2	4,000	2,000	2,000
3	2,000	4,000	6,000
4	1,000	3,000	2,000
5	500	9,000	2,000
6	500	–6,000	2,000
Net Profit	£ 4,000	£ 5,000	£ 6,000
NPV @ 8%	£ 2,111	£ 2,365	**£ 2,421**
NPV @ 10%	£ 1,720	**£ 1,818**	£ 1,716
NPV @ 12%	**£ 1,356**	£ 1,308	£ 1,070

Payback Period	**2 yrs**	**3.12 yrs**	**3 yrs**
ROI	**8.33%**	**10.42 %**	**10 %**

Risk evaluation ,identification and ranking.

- Attempt to identify the risks and their potential effects.
- Construct a risk matrix and classify each risk according to its relative importance and likelihood.
- Importance and likelihood is classified as high (H),medium (M), low (L) or exceeding unlikely (-).

Project Risk Matrix

- Risk Importance Likelihood

Software never completed H -

Project cancelled after design H -

Maintenance costs higher than L L

Expected.

Risk analysis using decision trees

- Decision Trees are excellent tools for helping you to choose between several courses of action
- Also help to form a balanced picture of the risks and rewards associated with each possible course of action.

Decision Trees and Expected Monetary Value (EMV)

- A **decision tree** is a diagramming analysis technique used to help select the best course of action in situations in which future outcomes are uncertain
- **Estimated monetary value (EMV)** is the product of a risk event probability and the risk event's monetary value
- You can draw a decision tree to help find the EMV

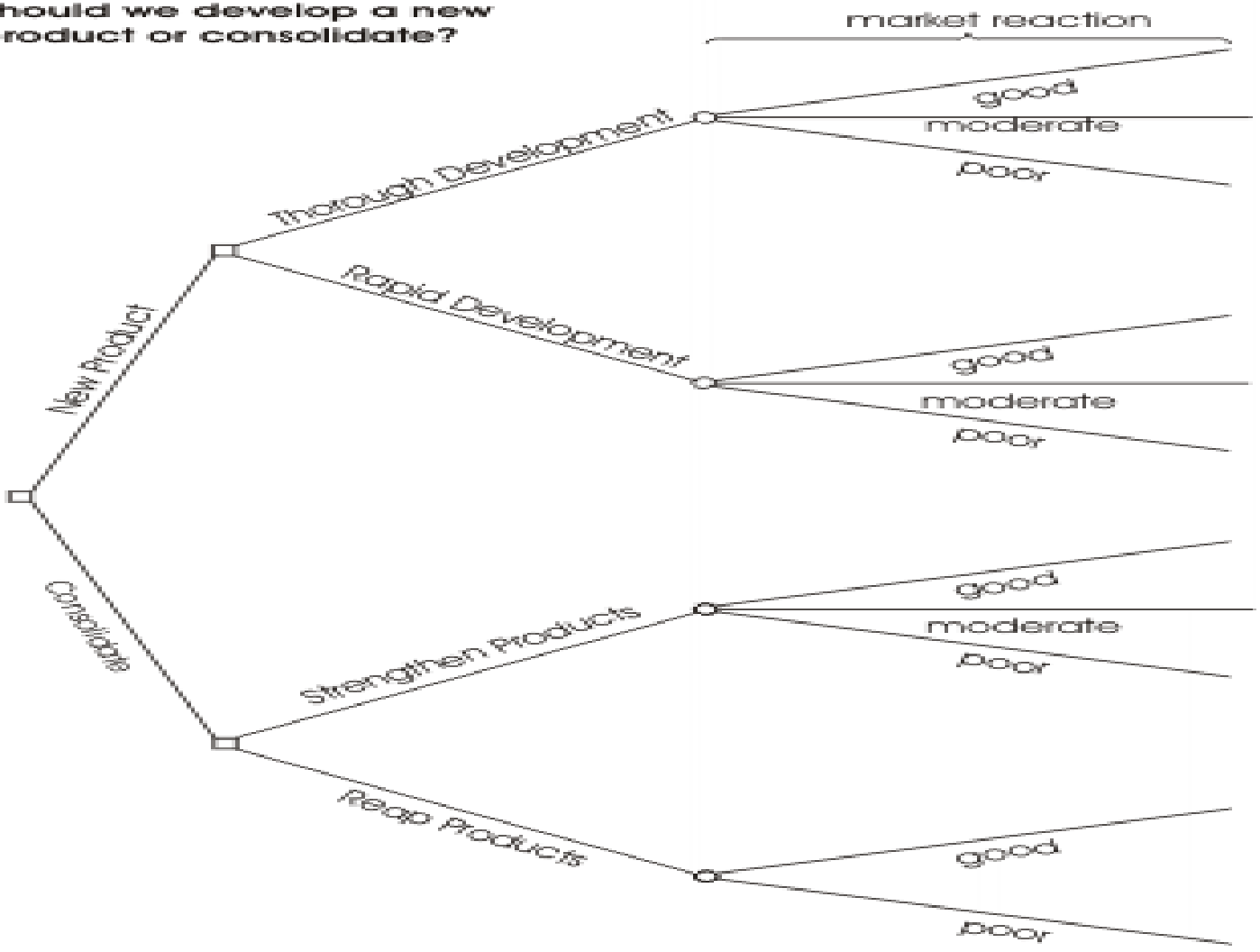
(Cont..)

- start a Decision Tree with a decision that you need to make.
- Draw a small square to represent this towards the left
- From this box draw out lines towards the right for each possible solution, and write that solution along the line
- Keep the lines apart as far as possible so that you can expand your thoughts.

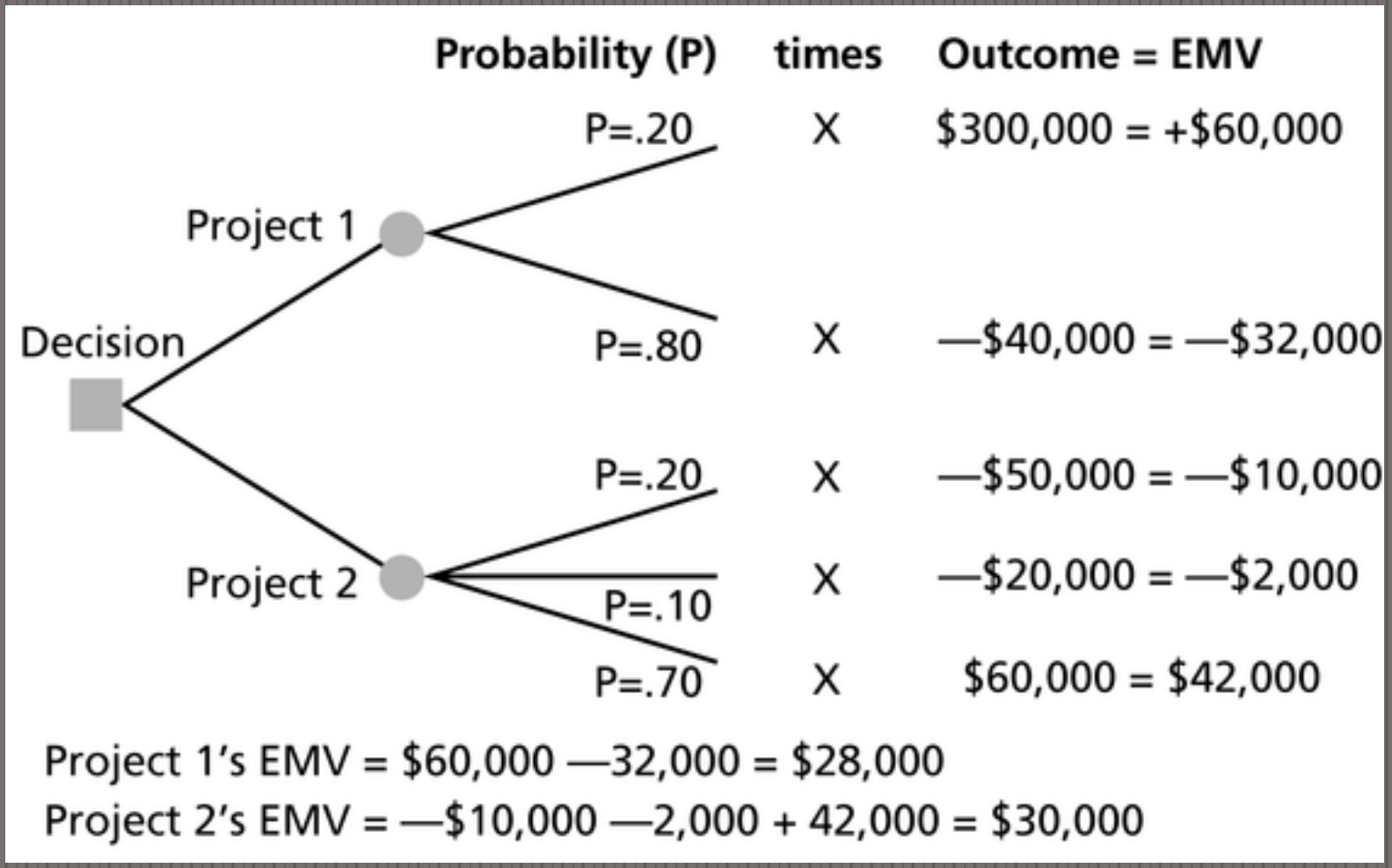
(Cont..)

- 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.
-

Figure 1:
Example Decision Tree:
Should we develop a new product or consolidate?



Expected Monetary Value (EMV) Example



Decision Tree_ scenario

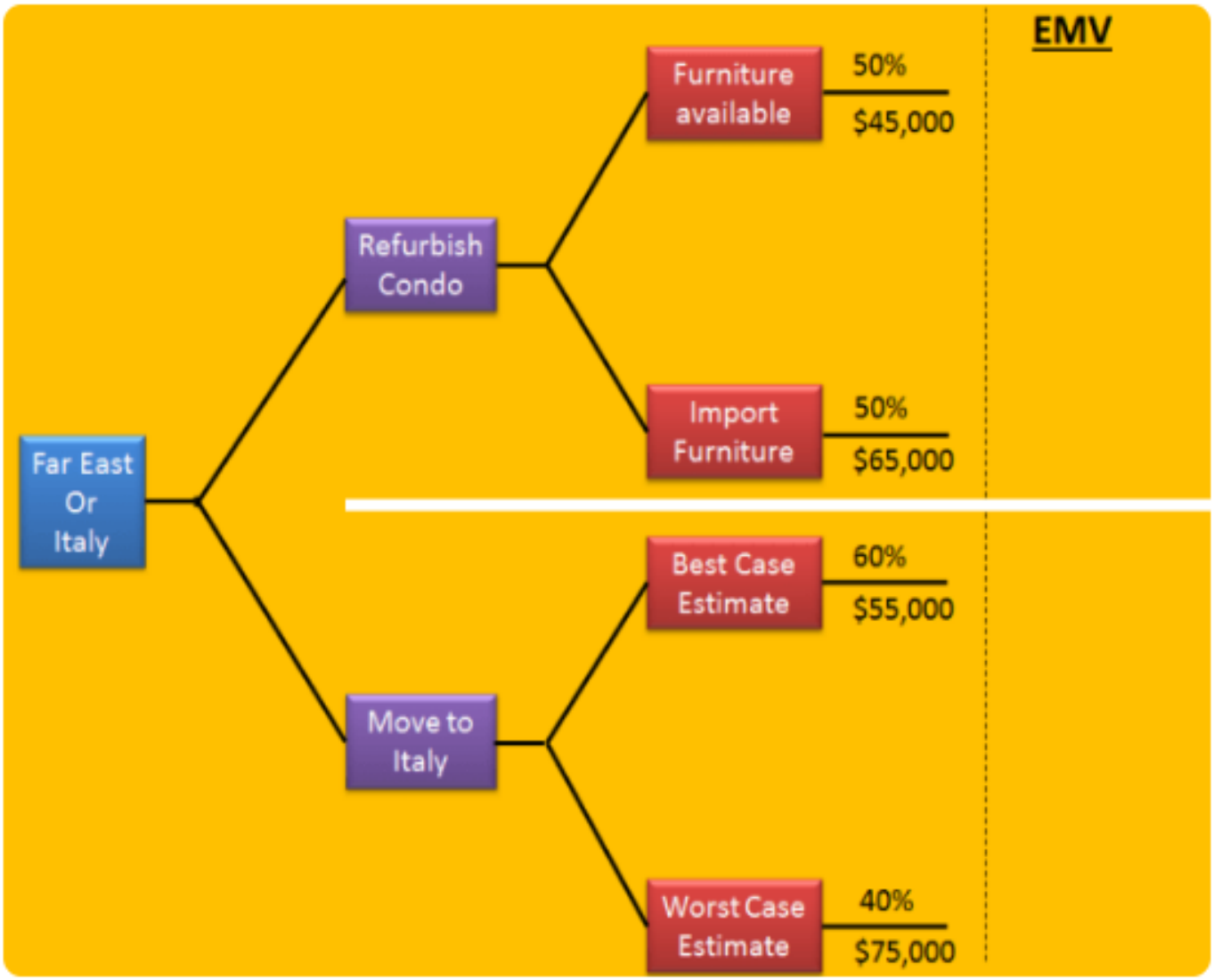
Dave owns a condo (as an apartment house) in the Far East and is considering buying a new apartment in Italy, but his wife would rather spend the money on modernizing their current condo.

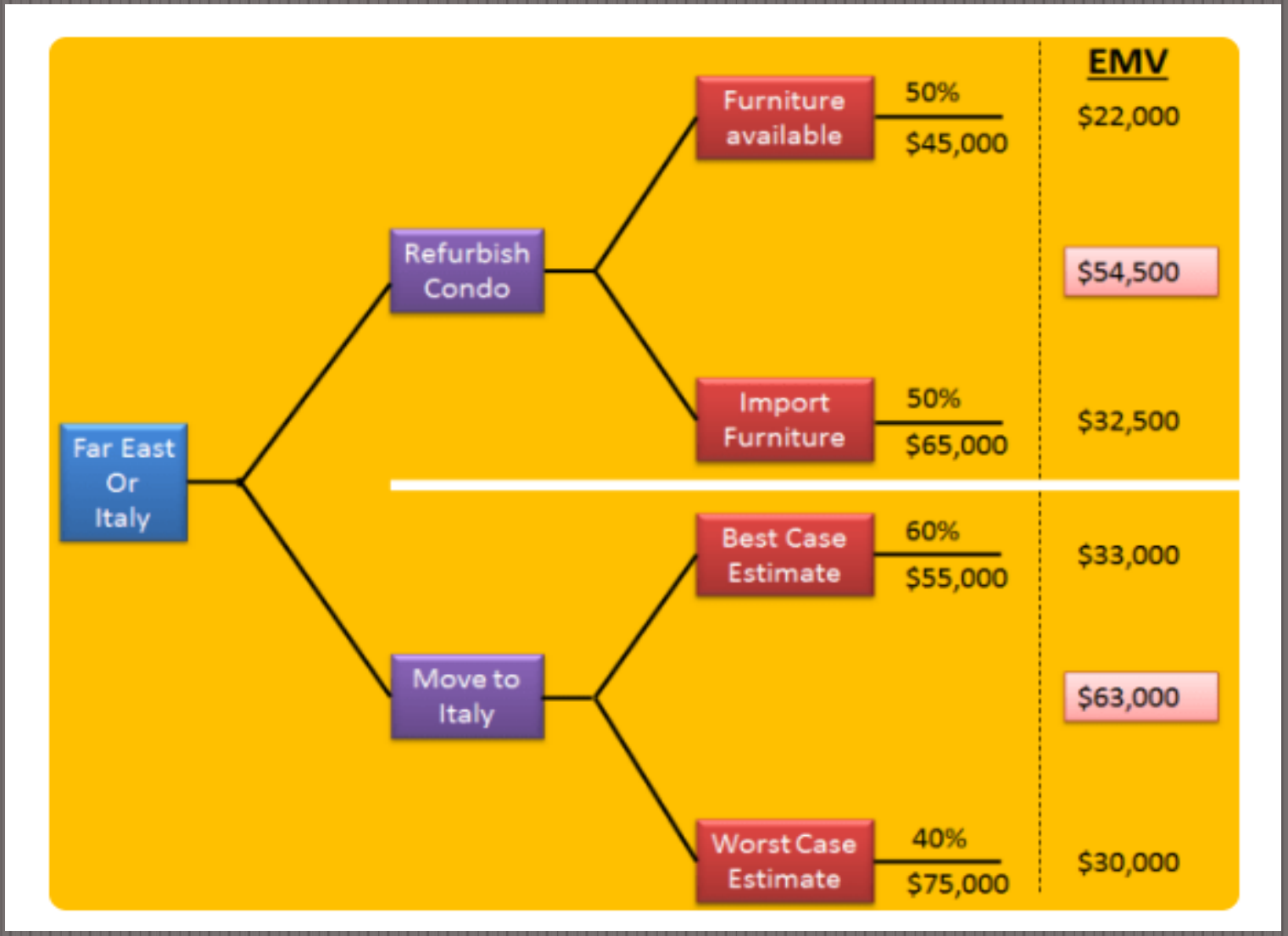
Dave had previously considered modernizing your condo, but purchasing or importing modern furniture in your city has been a problem in the Far East.

Remodelling costs of the condo if new furniture and fittings are available will cost $ 45,000, but there is a 50/50 chance that the furniture is not available locally and will need to be imported which will then cost $65,000.

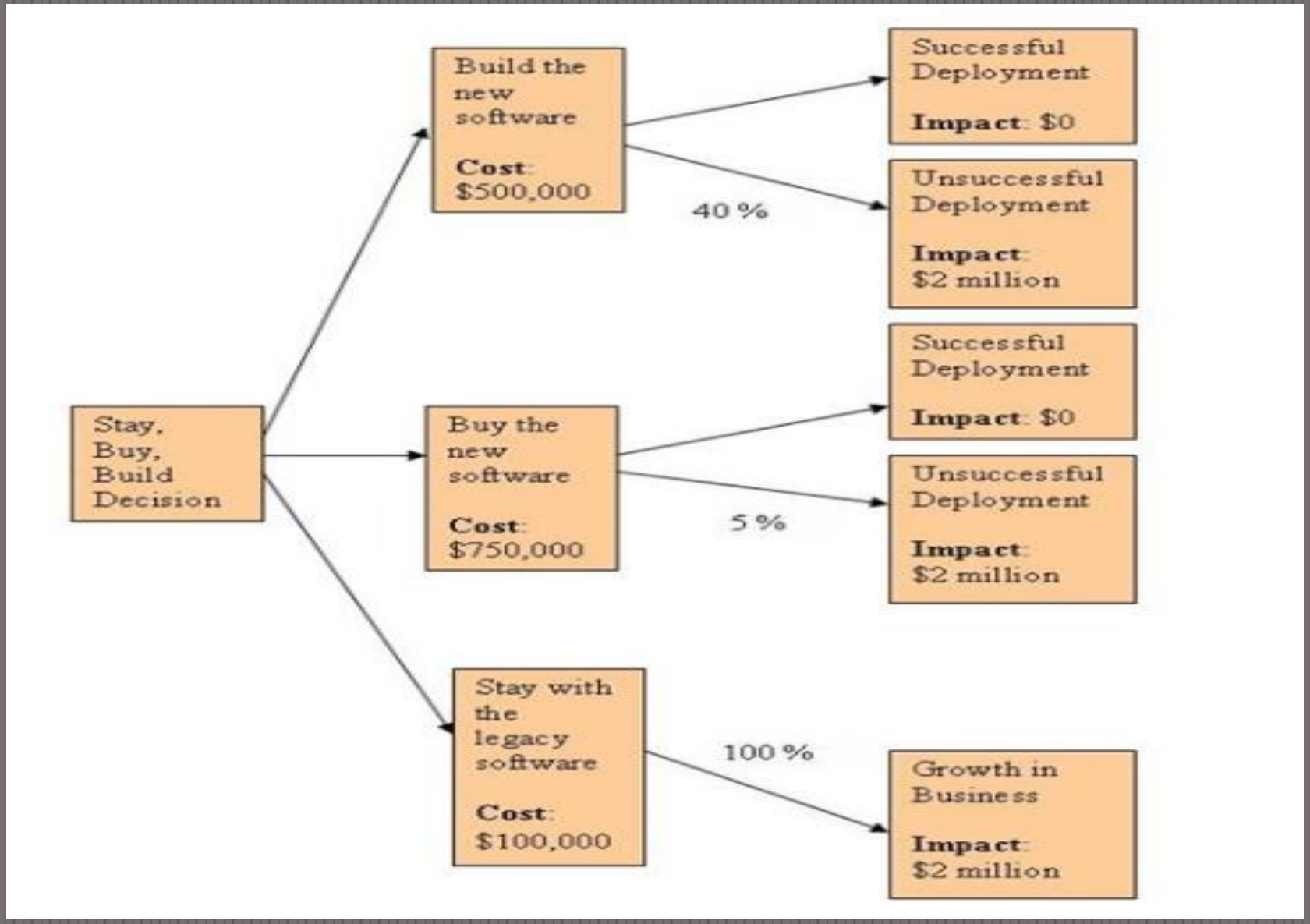
Dave has found an old townhouse in Naples but it will need a lot of work to make it habitable. The price is $ 105,000. He has found a local builder and he has given you a best case cost of $55,000 and a worst case cost of $75,000. The builder advises that the best case is 60% likely.

Dave expects to get $160,000 for the sale of his condo, and now needs to discuss the possible outcomes with his wife. Draw a decision tree and calculate the Net Path Value (Expected Monetary Value).


EMV
Far East Or Italy
Refurbish Condo
Move to Italy
Furniture available
50%
$45,000
Import Furniture
50%
$65,000
Best Case Estimate
60%
$55,000
Worst Case Estimate
40%
$75,000



So this suggests a lower risk cost for **refurbishing.**


Stay, Buy, Build Decision
Build the new software
Cost: $500,000
40 %
Successful Deployment
Impact: $0
Unsuccessful Deployment
Impact: $2 million
Buy the new software
Cost: $750,000
5 %
Successful Deployment
Impact: $0
Unsuccessful Deployment
Impact: $2 million
Stay with the legacy software
Cost: $100,000
100 %
Growth in Business
Impact: $2 million

Decision Tree Complete

- **Build the new software**: $ 2,000,000 * 0.4 = $ 800,000
- **Buy the new software**: $ 2,000,000 * 0.05 = $ 100,000
- **Staying with the legacy software**: $ 2,000,000 * 1 = $ 2,000,000

Now, add the setup costs to each Expected Monetary Value:

- **Build the new software**: $ 500,000 + $ 800,000 = $ 1,300,000
- **Buy the new software**: $ 750,000 + $ 100,000 = $ 850,000
- **Staying with the legacy software**: $ 100,000 + $ 2,000,000 = $ 2,100,000

Decision Trees Example - Making the Decision

Looking at the Expected Monetary Values computed in this Decision Trees example, you can see that buying the new software is actually the most cost efficient option, even though its initial setup cost is the highest. Staying with the legacy software is by far the most expensive option.