IENG 481: Project Engineering
Session 2.1: Projects and Value Analysis

Shaligram Pokharel

August 2023

Notes orientation, ©Shaligram Pokharel

Agenda

- We talked about why organization do the project
  - Strategic, Compliance, Operational, Strategic/Operational, Social Responsibility
- What are the types of project companies run?
- The relation between project purpose and the deliverables
  - Every project has a purpose and they have to meet it through the deliverables
- How values are assessed for the project?
  - Financial criteria
  - Non-financial criteria

Therefore, companies do different types of projects to sustain their business

- What major types of project are there?
  - Bread and butter projects
  - Pearl projects
  - Oyster projects
  - White elephant projects

Bread and Butter

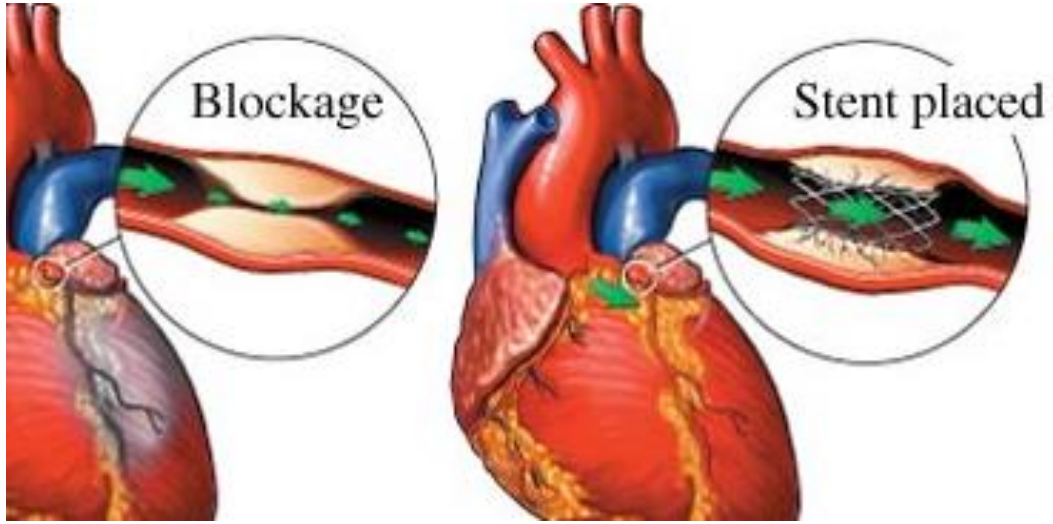
- These are the projects they are run on a regular basis, usually in small teams and smaller but persistent impact in short period of time
  - There are maintenance projects which should be run frequently
    - These projects enhance the efficiency of the production system (operational projects)
    - These projects need to be done on a regular basis
      - Regular basis could be in a stated time period (4/5 years)
    - If these projects are not done, the petroleum company would not survive.
  - Windows of Microsoft and ios of Apple are being continuously updated (operational) and new versions are developed (strategic/operational)
- Projects generate benefits although it might be small
- The success rate of doing the project is high as they are easy to think, design, develop and implement

Pearl type

- These are the projects that are run by an organization when they see substantial commercial advantage if a proven technology is used in the project/product/service.
  - Of course, it gives strategic advantage to the company so they are strategic projects as they can lead to substantially improved technology (if only small improvement but make a lot of money, they are still strategic/operational).
- They have high likelihood of success as they use proven resources (so it is less risky)
  - Once they are successful, they make substantial benefits to the comp
    - There may be many attempts before the project becomes successful
  - Intel-Pentium to □

Oyster type

- These types of projects have very high commercial payoff, if breakthrough can be obtained through the technological development.
- Of course, it gives strategic advantage to the company
  - The potential to succeed is very low, but still organizations invest in this type of project.
  - Therefore, many of these projects fail but effort is persistent.
- These are strategic projects



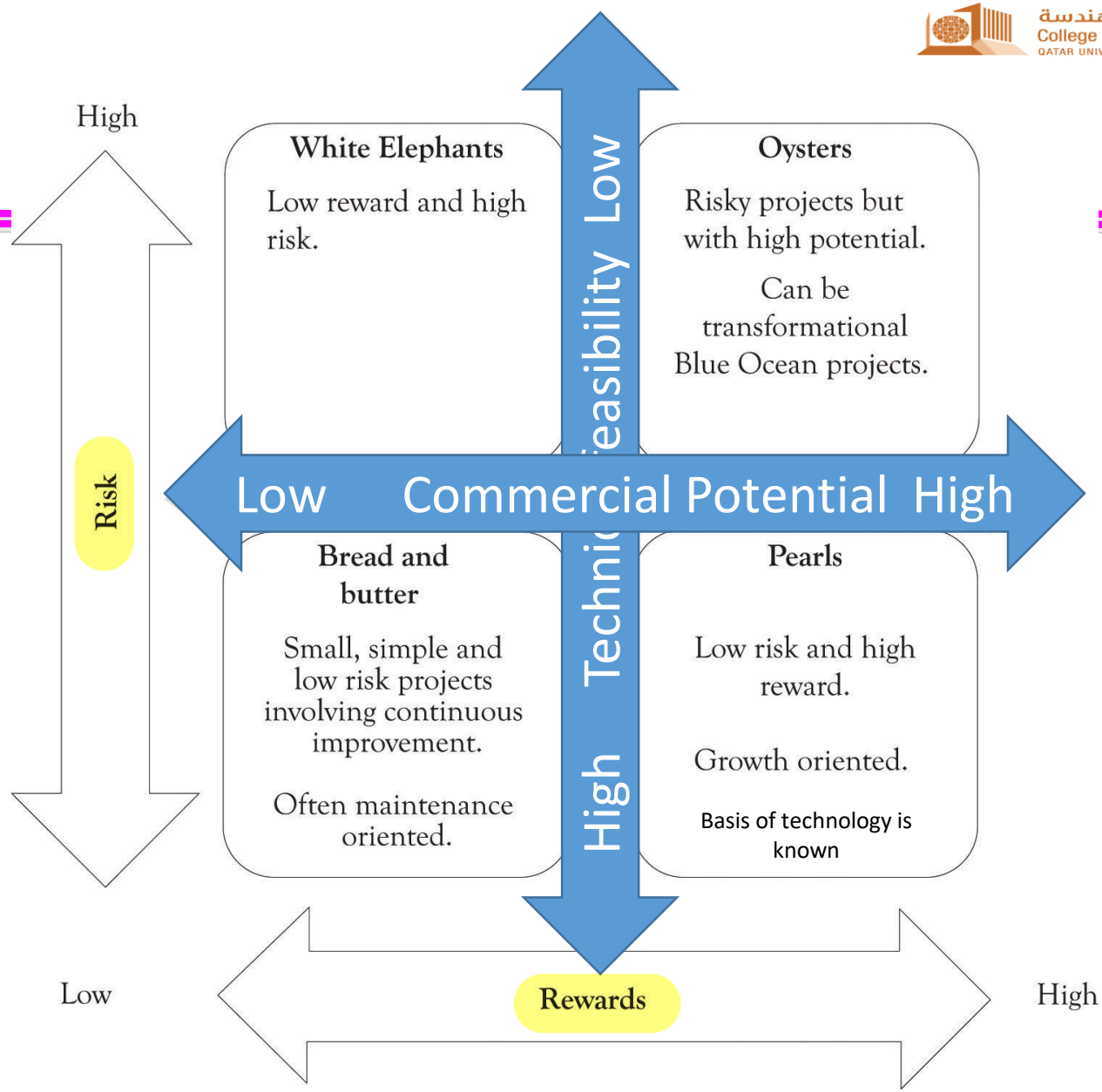
White elephant type

- These type of projects are run usually on the wish from the top (strategic),
  - Someone is a driver for developing this type of one time projects
  - They consume a lot of resources but they are anticipated as pearl
    - They might have shown a lot of promises on benefit or value for the project during inception and development.
    - But once the project is started, even knowing that it may not bring a lot of benefits, it is still continued
  - They have low likelihood of success (usually it is mentioned), but decision makers say that if it is successful, it is going to bring a lot of benefits (like oyster)
  - White elephant projects either bring no or low payoffs by nature.
    - If they bring higher payoff, they would not be called white elephant.

105-story-1080 ft, RyugyongHotel in Pyongyang is North Korea
Construction began 1987 to complete in two years
As of 2020 it remains incomplete and closed to the public.
https://www.uritours.com/blog/ryugyong-hotel-north-koreas-tallest-building/

Notes orientation, ©Shaligram Pokharel

What type of project is it?

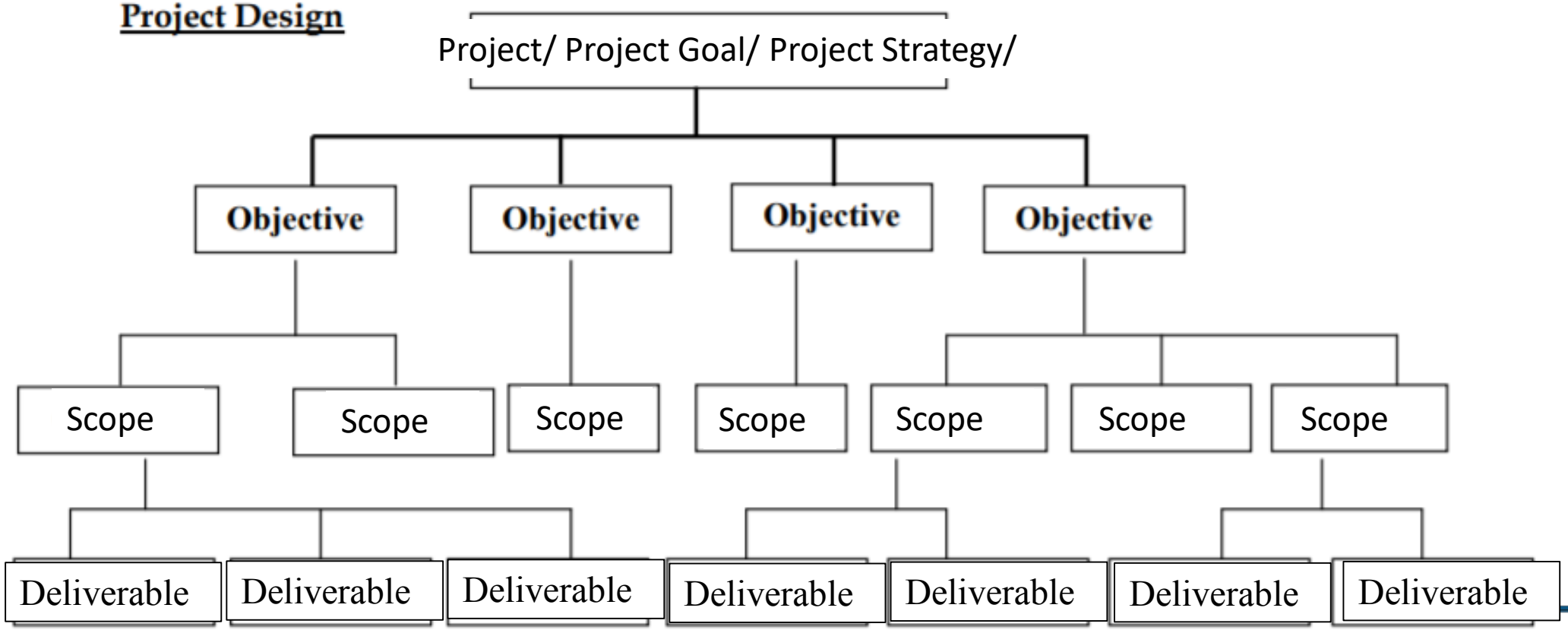


http://2012books.lardbucket.org/books/creating-services-and-products/s17-07-the-project-selection-model-co.html

Purpose to the deliverables of a project

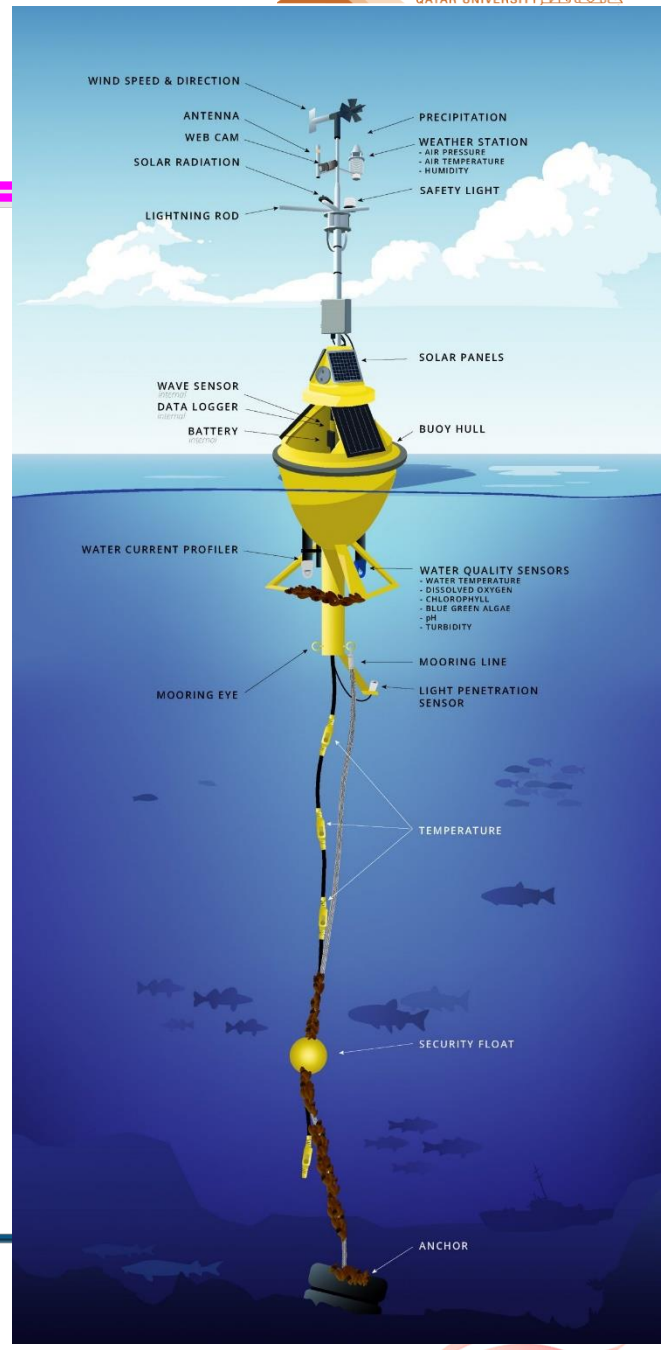
The project needs to understood in as much detail as possible

Handout
Project Design



Project and purpose: Example

- Project Purpose:
  - Developing a system for the development of dynamic transportation routes using programmable buoys
- Project objectives (what makes the project meet the purpose?)
  - The focus here is to develop the product that would sustain harsh environment, dynamic placement of buoys, dynamic evaluation of shortest possible routes



Project purpose to deliverables: For example

- Purpose
  - Developing a system for the development of dynamic transportation routes using programmable buoys
- Objective
  - 1.1 To develop buoys that lasts longer in the harsh sea environment
    - Performance measure (what I measure to achieve this objective?):
      - The endurance test: No damage for 2000 days of operations per buoy
      - The number of times per month the buoy should be charged for night operation: No more than one charging every month
  - 1.2 To design the best possible route under different conditions
    - Performance measure (what I measure to achieve this objective?):
      - The maximum time taken for travel: It should not be more than 2 hours for average wind speed of 5 meter per second
  - 1.3 To dynamically place the buoys as guides for the boats
    - Performance measure (what I measure to achieve this objective?):
      - The buoys can be programmed for change in the position and the replacement can be done within 15 minutes along the path
  - 1.4 Project Management
    - Performance measure (what I measure to achieve this objective?):
      - Project Procurement timings: procurement should finish within one month of the start of the project
      - Supplier selection: supplier selection does not take more than 10 days.
      - Risk management: All known risks are managed within a day
      - Cost management: One budget review is done every four months
      - Material availability: Daily stock of materials should be 120% of the materials required

Objective to scope and deliverables

- 1.1 To develop buoys that lasts longer in the harsh sea environment
  - 1.1.1 Scope: Use the material that are not corrosive and decayed due to sunlight and saline water chemicals.
    - Deliverables:
      - 1.1.1.1 Study materials;
      - 1.1.1.2 Select materials;
      - 1.1.1.3 Study the possibility of materials to be used for buoys
  - 1.1.2 Scope: Develop the capacity to manufacture and recycle buoys
    - Deliverables:
      - 1.1.2.1 Study the current capability;
      - 1.1.2.2 Study investment requirements;
      - 1.1.2.3 Study technology absorption;
      - 1.1.2.4 Invest on capacity enhancement

Objective to scope and deliverables

- 1.2 To design the best possible route under different conditions
  - 1.2.1 Scope: Focus on the start and end points
    - Deliverables:
      - 1.2.1.1 Study alternatives to anchor boats in the starting point;
      - 1.2.2.2 Study the alternatives to anchor boats in the end point
  - 1.2.2 Scope: Study different weather conditions
    - Deliverables:
      - 1.2.2.1 Get meteorological data;
      - 1.2.2.2 Evaluate harshest weather conditions;
      - 1.2.2.3 Evaluate the mildest weather conditions
  - 1.2.3 Scope: Propose alternative routes
    - Deliverables:
      - 1.2.3.1 Develop routes;
      - 1.2.3.2 Study maximum time to be taken;
      - 1.2.3.3 Study minimum time to be taken

Objective to scope and deliverables

- 1.3 To dynamically place the buoys as guides for the boats
  - 1.3.1 Scope: Develop PCB to control boys
    - Deliverables:
      - 1.3.1.1 Source resources to develop PCB;
      - 1.3.1.2 Provide requirements;
      - 1.3.1.3 Evaluate PCBs;
      - 1.3.1.4 Source PCBs
  - 1.3.2 Scope: Develop wire and wireless capacity for receiving instruction and exchanging information
    - Deliverables:
      - 1.3.2.1 Source skills;
      - 1.3.2.2 Study wireless possibility;
      - 1.3.3.3 Enhance wireless and wired communication control
  - 1.3.3 Scope: Develop homeostatic control for self management of placement within five meters of original placement
    - Deliverables:
      - 1.3.3.1 Assemble PCB in buoys;
      - 1.3.3.2 Test the assembly;
      - 1.3.3.3 Make changes in the assembly;
      - 1.3.3.4 Commission assembly

Notes orientation,
©Shaligram
Pokharel

1.4 is not done! You will do it later

Project Value Analysis (what values does the project bring?)

- Financial Criteria
  - Could be to see if the project will make a profit over the long term
  - Could be to evaluate the total cost and see if this is worth investing compared to other projects
  - There are different types models used for evaluations, we focus on
    - Payback,
    - Net present value (NPV)
    - Internal rate of return (IRR)
    - Return on investments (ROI)
    - Decision Tree

Project Selection Criteria

- Non-financial Criteria
  - Projects are not necessarily chosen based on explicit financial criteria
  - Sometimes projects are developed for generating social value, or something called corporate social responsibility
  - There are different models used for the evaluation, we focus on
    - Checklist model
    - Risk analysis of projects
    - Strategic fit model
    - Scoring Models
      - Project Selection Matrix
      - Multi-weighted criteria

Projects for payback
Project costs/benefits with and without the time value of money

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1			Cash flow Project A	Project A Cumulative Cash flow			Discounted	Project A Cumulative Cash flow				Cash flow Project B	Project B Cumulative Cash flow			Discounted	Project B Cumulative Cash flow		
2		Year			Years to Pay		0.15		Years to Pay		Year			Years to Pay		0.15		Years to Pay	
3	This is investment year	0	700000	-700000		Formula used	-700000	-700000			0	400000	-400000			-400000	-400000		
4	From here money is made	1	225000	-475000	3.11	E4=(B4-B3)-(D4/C4)	195652	-504348	3.5778		1	110000	-290000	3.64		95652	-304348	4.18	
5		2	225000	-250000	2.11		170132	-334216	2.9644		2	110000	-180000	2.64		83176	-221172	3.66	
6		3	225000	-25000	1.11		147941	-186274	2.2591		3	110000	-70000	1.64		72327	-148845	3.06	
7		4	225000	200000	0.11	3.1 years	128644	-57630	1.448		4	110000	40000	0.64	3.6 years	62893	-85952	2.37	
8		5	225000	425000	-0.89		111865	54235	0.5152	4.5 years	5	110000	150000	-0.36		54689	-31263	1.57	
9		6	225000	650000		G4=C4/(1+$G$2)^B4	97274	151509	-0.56		6	110000	260000			47556	16293	0.66	5.7 years
10		7	225000	875000		G5=C5/(1+$G$2)^B5	84586	236094			7	110000	370000			41353	57646	-0.39	
11		8	225000	1100000		G6=+C6/(1+$G$2)^B6	73553	309647			8	110000	480000			35959	93605		
12		9	225000	1325000		Similarly for others	63959	373606			9	110000	590000			31269	124874		
13		10	225000	1550000			55617	429223			10	110000	700000			27190	152065		

You can also calculate balance remaining from investments

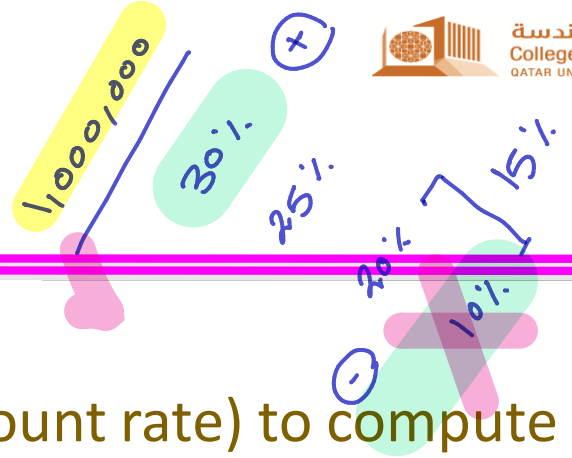
Payback with discounted costs and discounted benefits

Year	Discount Rate	Costs	Discounted costs	Accumulated disounted costs	Benefits	Discounted benefits	Accumulated discounted benefits	Balance
0	15%	700000	700000	700000		0	0	700000
1		30000	26549	726549	225000	199115	199115	527434
2		50000	39157	765706	225000	176208	375323	390383
3		50000	34653	800359	225000	155936	531259	269099
4		50000	30666	831024	225000	137997	669256	161768
5		50000	27138	858162	225000	122121	791377	66785
6		50000	24016	882178	225000	108072	899449	-17270
7		50000	21253	903431	225000	95639	995087	-91656
8		50000	18808	922239	225000	84636	1079723	-157484
9		50000	16644	938884	225000	74899	1154622	-215739
10		50000	14729	953613	225000	66282	1220905	-267292

Payback analysis

- Good things
  - Measures the time the product/service of the project will take to recover project after investment.
  - Emphasizes cash flows, a key factor in business.
  - With time value of money and a good cash flow analysis, the evaluation may be considered practical.
- Limitations
  - Usually good for short period as risks on benefits are not considered

Financial Models (cont'd)



- The Net Present Value (NPV) model
  - Uses management's minimum desired rate-of-return (discount rate) to compute the present value of all net cash inflows.
    - Positive NPV: project meets the investor's minimum desired rate of the of return and is eligible for further consideration.
    - Negative NPV: project does not meet investor's desired rate of return, therefore, rejected.

$$\text{Project NPV} = I_0 + \sum_{t=1}^{n} \frac{F_t}{(1+k)^t} \quad \text{where}$$

I_0 = Initial investment (since it is an outflow, the number will be negative)

F_t = net cash inflow for period t

k = required rate of return

$$NPV = I_0 + \sum_{t=1}^{n} \frac{F_t}{(1+k)^t}$$

m

Projects with Net Present Value

	B	C	E	F	K	L	N	O
1		Cash flow Project A	Discount rate			Cash flow Project B		
2	Year		15%		Year		15%	
3	0	700000	$429,223	NPV=-C3+NPV(E2,C4:C13)	0	400000	$152,065	=-L3+NPV(N2,L4:L13)
4	1	225000			1	110000		
5	2	225000			2	110000		
6	3	225000			3	110000		
7	4	225000			4	110000		
8	5	225000			5	110000		
9	6	225000			6	110000		
10	7	225000			7	110000		
11	8	225000			8	110000		
12	9	225000			9	110000		
13	10	225000			10	110000		

Internal rate of return (IRR)

$$NPV = 0 = CF_0 + \frac{CF_1}{(1+IRR)} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_3}{(1+IRR)^3} + \ldots + \frac{CF_n}{(1+IRR)^n}$$

Or

$$0 = NPV = \sum_{n=0}^{N} \frac{CF_n}{(1+IRR)^n}$$

- IRR is the return on the investment made in the project over a considered product lifecycle.
  - Assuming that the project investments are done in year 0 only
  - Min feasible IRR is the rate when NPV = 0 (with obtained IRR)
- Remember, the PV values are not the same as the last one used for NPV calculations
  - Should we invest in Project B? It still has a positive IRR!

We $i = 10\%$ → NPV +
IRR
We $i = 20\%$ → NPV −
NPV = 0

Where:
CF_0 = Initial Investment / Outlay
$CF_1, CF_2, CF_3 \ldots CF_n$ = Cash flows
n = Each Period
N = Holding Period
NPV = Net Present Value
IRR = Internal Rate of Return

NPV = 0

	A	B	C	G	J	K	L	N	O
1			Cash flow Project A		Guess IRR		Cash flow Project B		
2		Year		PV values with IRR	15%	Year		PV values with IRR	
3	This is investment year	0	-700000	-700000		0	-400000	-400000	
4	From here money is made	1	225000	173384	IRR	1	110000	88423	
5		2	225000	133609	=IRR(values, guess)	2	110000	71078	
6		3	225000	102959	J7=IRR(C3:C13,$J$2)	3	110000	57136	O7=IRR(L3:L13,$J$2)
7		4	225000	79340	30%	4	110000	45928	24%
8		5	225000	61139		5	110000	36919	
9		6	225000	47114		6	110000	29677	
10		7	225000	36306		7	110000	23856	
11		8	225000	27977	Test for Sum of NPV with IRR	8	110000	19176	
12		9	225000	21559	TEST	9	110000	15415	TEST
13		10	225000	16613	=SUM(G3:G13)=0	10	110000	12391	=SUM(n3:n13)=0

Relation between NPV and IRR

Relationships Between the Internal Rate of Return, Net Present Value and the Cost of Capital

If	Then	Capital Budgeting Decision
NPV < 0	IRR < Cost of Capital	Reject the investment from the cash flow perspective. Other factors could be important.
NPV = 0	IRR = Cost of Capital	Provides the minimum return. Probably reject from the cash flow perspective. Others factors could be important.
NPV > 0	IRR > Cost of Capital	Screen in for further analysis. Other investments may provide better returns and capital should be rationed, i.e., go to the most profitable projects. Others factors could be important.

https://maaw.info/IRRNPVandCostofCapital.htm

Return on Investment (ROI)

- When we are looking at the profitability of the project, then we are looking at the rate at which investments are returned.
- Therefore, there can be calculations for Simple rate on investments of PV based rate on investments.

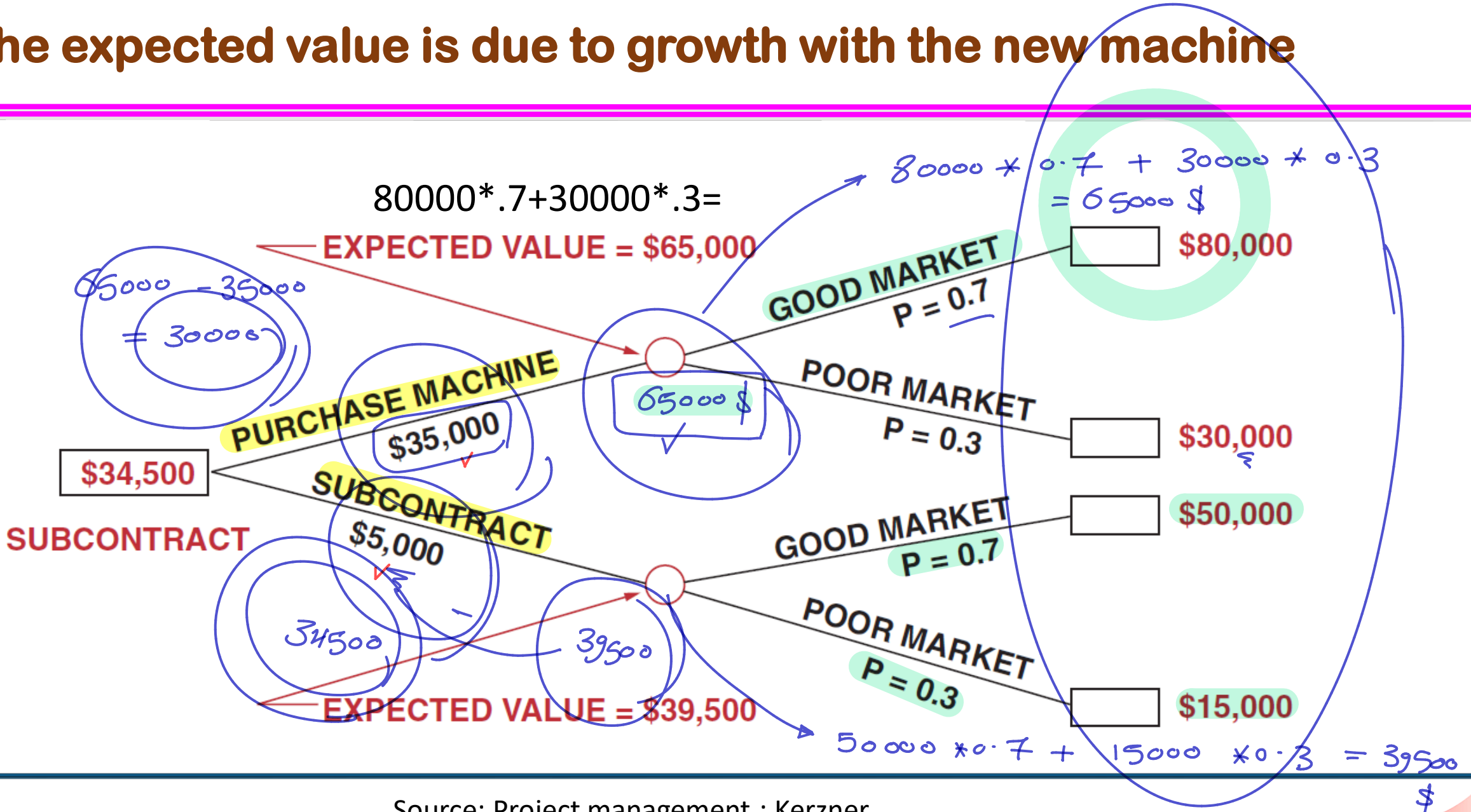
$$\text{Simple ROI} = \frac{\text{Gains} - |\text{Investment Costs}|}{|\text{Investment Costs}|}$$

	A	B	C	D	E	G	H	I	N	O	P	T	U	V	W
1			Cash flow Project A		Project A Discounted Cash flow					Cash flow Project B		Project B Discounted Cash flow			
2		Year		Cumulative Gains		Cumulative discounted gains	Simple ROI	PV based ROI	Year		Cumulative Gains			Simple ROI	PV based ROI
3	This is investment year	0	700000		-700000		H4=(D4-$C$3)/$C$3	I4=(G4-$C$3)/$C$3	0	400000		-400000		V4=(P4-$O$3)/$O$3	W4=(U4-$O$3)/$O$3
4	From here money is made	1	225000	225000	195652	195652	-67.9%	-72.0%	1	110000	110000	95652	95652	-72.5%	-76.1%
5		2	225000	450000	170132	365784	-35.7%	-47.7%	2	110000	220000	83176	178828	-45.0%	-55.3%
6		3	225000	675000	147941	513726	-3.6%	-26.6%	3	110000	330000	72327	251155	-17.5%	-37.2%
7		4	225000	900000	128644	642370	28.6%	-8.2%	4	110000	440000	62893	314048	10.0%	-21.5%
8		5	225000	1125000	111865	754235	60.7%	7.7%	5	110000	550000	54689	368737	37.5%	-7.8%
9		6	225000	1350000	97274	851509	92.9%	21.6%	6	110000	660000	47556	416293	65.0%	4.1%
10		7	225000	1575000	84586	936094	125.0%	33.7%	7	110000	770000	41353	457646	92.5%	14.4%
11		8	225000	1800000	73553	1009647	157.1%	44.2%	8	110000	880000	35959	493605	120.0%	23.4%
12		9	225000	2025000	63959	1073606	189.3%	53.4%	9	110000	990000	31269	524874	147.5%	31.2%
13		10	225000	2250000	55617	1129223	221.4%	61.3%	10	110000	1100000	27190	552065	175.0%	38.0%

What about decision tree?

- Decision tree is to be chosen when there are uncertainties represented by probabilities
- They can be for selecting one among projects
  - Or selecting on buying new product or maintaining the existing one.
    - For example, QAPCO produces chlorine and every six years they have to maintain chlorine producing plant (shutdown and maintain).
      - While planning for one maintenance, QAPCO came to know that there is a new technology in the market which produces chlorine faster and produces less environmental problems
        - *Should QAPCO buy and install the new plant OR*
        - *Should QAPCO maintain the existing plant and reinstall?*
      - What is the chance that the new plant is going to give more production?
      - What is the chance that the maintained plant is going to give more production?
      - What about the cost of maintenance?
    - In this type of situations, decision tree becomes a good analysis method.

The expected value is due to growth with the new machine

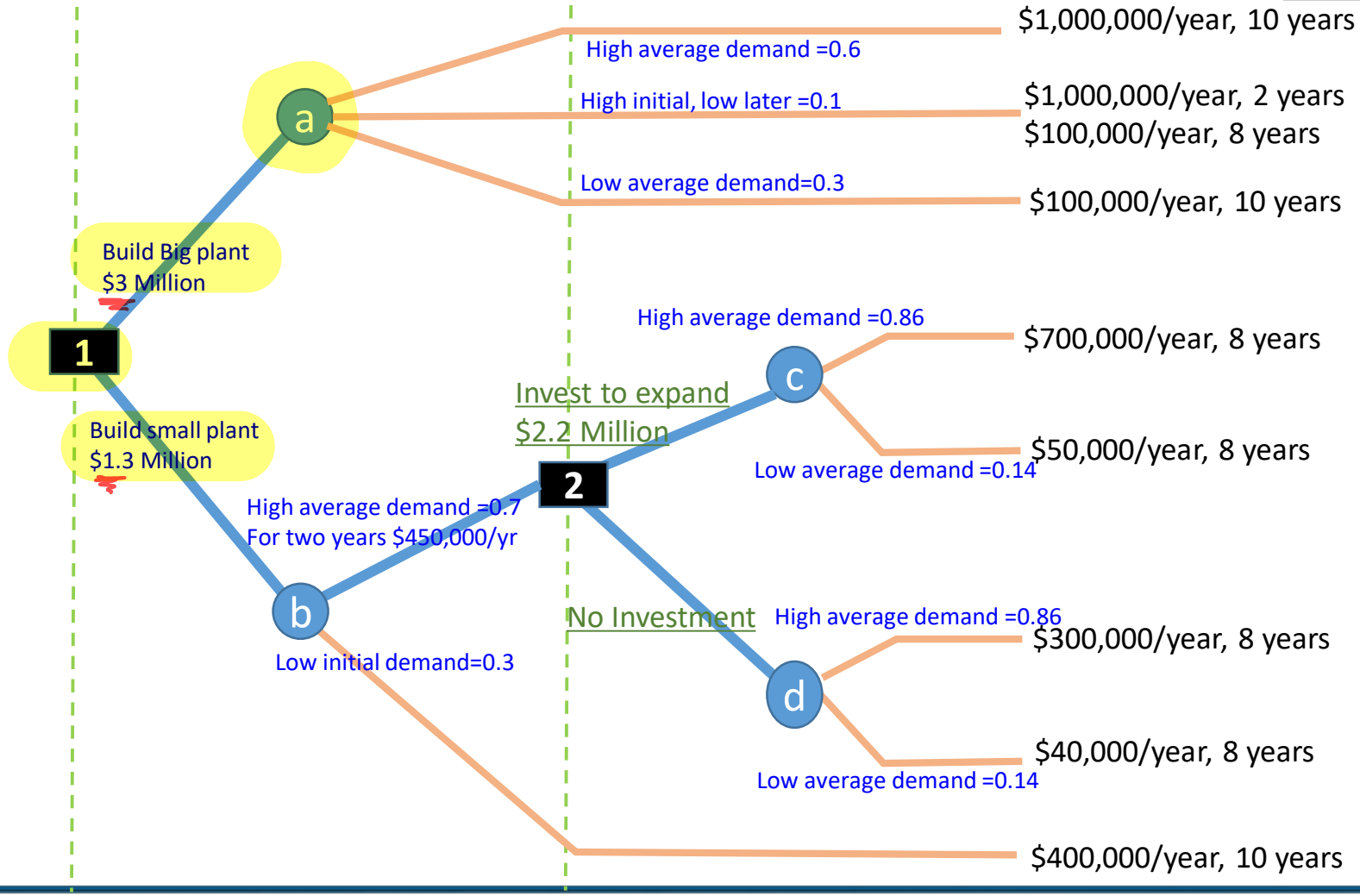


Source: Project management : Kerzner

Decision tree method in a chemical company

- Assume that a company is looking at whether to establish a larger (high production plant) or a small plant.
  - If small plant is chosen it can be expanded depending on the market situation.
- So there is a second decision point, if small plant is chosen.
- Assume if big plant is chosen
  - A 60% chance of large sales; 10% of initial high and then low; 30% of low sales
  - A 40% chance of a low demand, developing initially as follows:

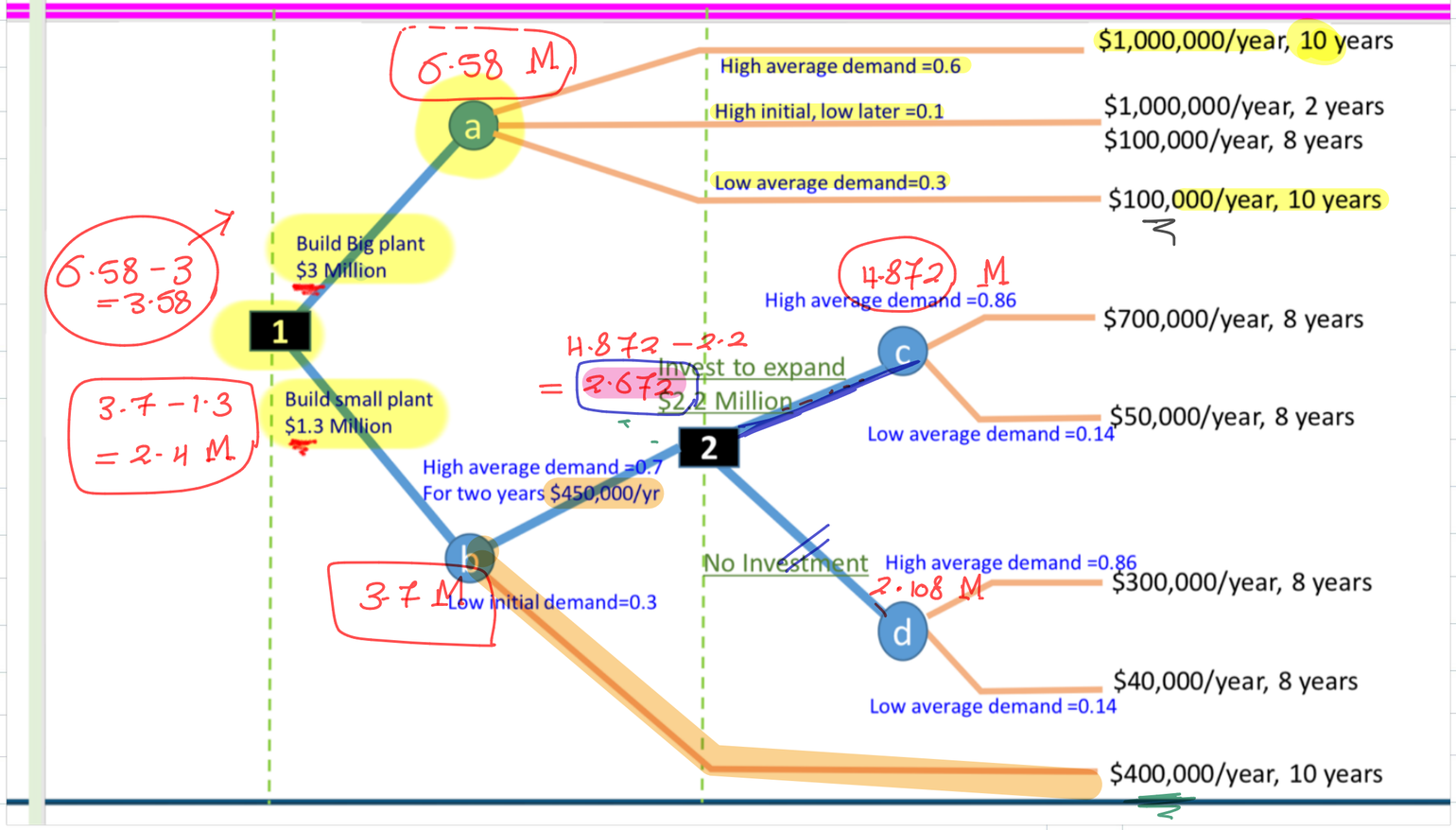
Decision tree: Build big plant or small?



https://hbr.org/1964/07/decision-trees-for-decision-making

Notes orientation,
©Shaligram
Pokharel

Decision tree: Build big plant or small?



$$\Rightarrow EV_a = 0.6(1M * 10) + 0.1(1M * 2 + 0.1M * 8) + 0.3(0.1 * 10) = 6.58\ M$$

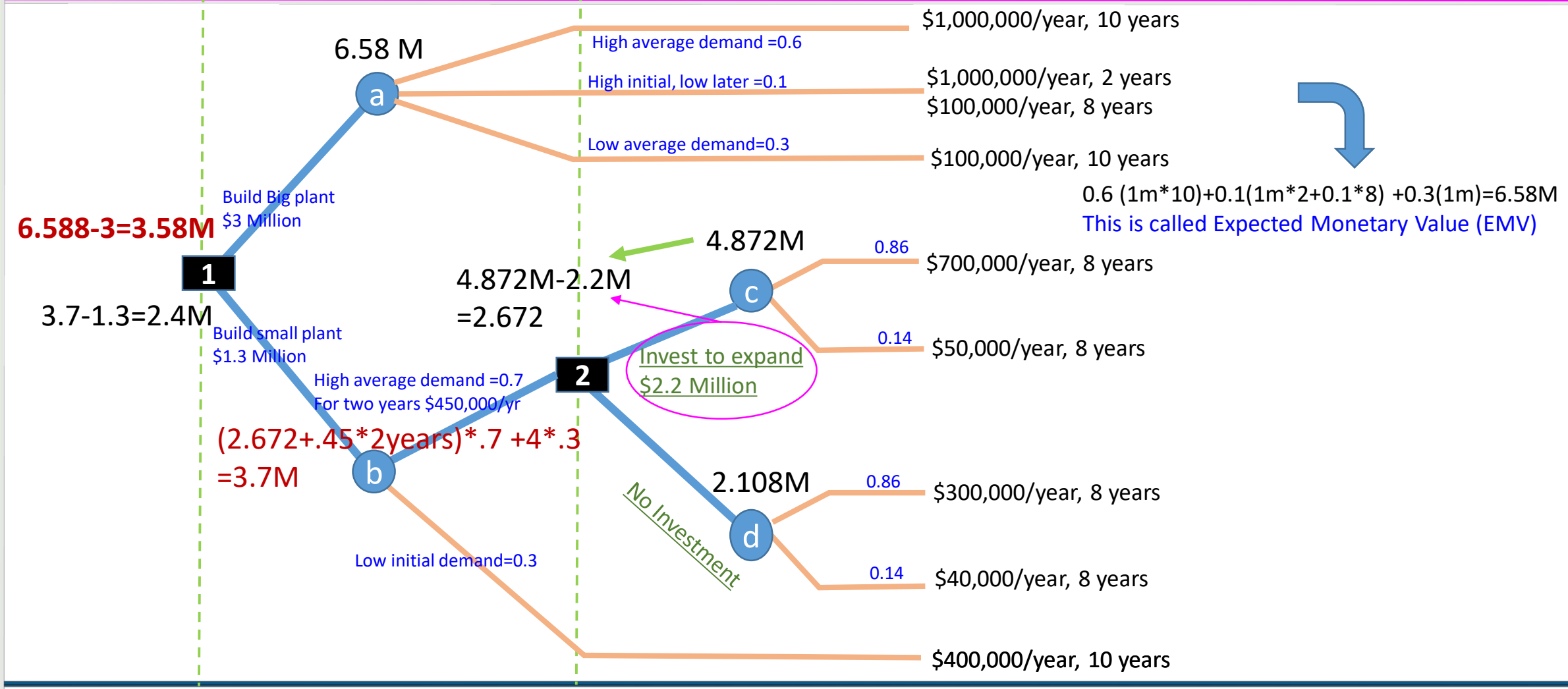
$$EV_c = 0.86(0.7 * 8) + 0.14(0.05 * 8) = 4.872$$

$$EV_d = 0.86(0.03 * 8) + 0.14(0.04 * 8) = 2.108\ M$$

$$EV_b = 0.7(0.45 * 2 + 2.672) + 0.3(0.4 * 10) = 3.7\ M$$

Our Decision is Build Big Plant

So what is the decision?



https://hbr.org/1964/07/decision-trees-for-decision-making

Notes orientation,
©Shaligram
Pokharel

Non-Financial Criteria: Checklist Models

- Uses a list of questions to review potential projects and to determine their acceptance or rejection.
- Fails to answer the relative importance or value of a potential project and doesn't to allow for comparison with other potential projects.

Example of questions for checklist

Topic	Question
Strategy/alignment	What specific strategy does this project align with?
Driver	What business problem does the project solve?
Success metrics	How will we measure success?
Sponsorship	Who is the project sponsor?
Risk	What is the impact of not doing this project?
Risk	What is the project risk to our organization?
Risk	Where does the proposed project fit in our risk profile?
Benefits, value, ROI	What is the value of the project to this organization?
Benefits, value, ROI	When will the project show results?
Objectives	What are the project objectives?

Example of Questions for Checklist

Topic	Question
Organization culture	Is our organization culture right for this type of project?
Resources	Will internal resources be available for this project?
Approach	Will we build or buy?
Schedule	How long will this project take?
Schedule	Is the time line realistic?
Training/resources	Will staff training be required?
Finance/portfolio	What is the estimated cost of the project?
Portfolio	Is this a new initiative or part of an existing initiative?
Portfolio	How does this project interact with current projects?
Technology	Is the technology available or new?

Risk analysis of projects

- In the preliminary phase, that project proposal phase, the idea is to understand how does the project impact if it is to be taken up by the company.
  - The impact is in terms of type of risks that may occur and probability that risk will occur
  - And the probability that if the risk occurs the project or the company doing the project will have negative impact.

Risk Analysis Model

Risk Analysis for a wind farm

Brief Risk Assessment

Purpose: To draw attention to apparent project risks that will need management attention.

What are the four major risks of this project?
1. *Government incentives curtailed*
2. *Land use injunction*
3. *Energy price decrease*
4. *New import tax*

Rank risks above by "probability" and "impact" on the chart below by High, Medium or Low.

Risk Intensity Rating

Risk	Probability	Impact
1. *Government incentives curtailed*	*High*	*High*
2. *Land use injunction*	*Medium*	*High*
3. *Energy price decrease*	*Medium*	*Medium*
4. *New import tax*	*Low*	*High*

Check other project risk factors:

Complexity	Low	☐	Average	X	High	☐
Resource skills	Good	X	Okay	☐	Lacking	☐
Technology	Low	☐	Average	X	High	☐

Reviewed by *Rachel* **Date** *April 1, 2xxx*

Multi-Weighted Scoring Model

- Uses several weighted qualitative and/or quantitative selection criteria to evaluate project proposals.
  - Each criteria is assigned a weight.
  - The weights provide relative form of importance of one criteria over the other
    - That means, if criteria 1 is given a weight of 3 and criteria 2 is given a weight of 5, criteria 2 is considered more important than criteria 1.
- This method allows comparison of projects with a view to select the project with most weighted score of criteria.

Scoring Models: Project selection matrix

Criteria / Weight	Stay within core competencies	Strategic fit	Urgency	25% of sales from new products	Reduce defects to less than 1%	Improve customer loyalty	ROI of 18% plus	Weighted total
	2.0	3.0	2.0	2.5	1.0	1.0	3.0	
Project 1	1	8	2	6	0	6	5	66
Project 2	3	3	2	0	0	5	1	27
Project 3	9	5	2	0	2	2	5	56
Project 4	3	0	10	0	0	6	0	32
Project 5	1	10	5	10	0	8	9	102
Project 6	6	5	0	2	0	2	7	55
⋮								
Project *n*	5	5	7	0	10	10	8	83

Multi-Weighted Criteria

- Take the example of choosing five different proposals for a new bicycle.

Criteria / Weight	Strong sponsor	Supports business strategy	Urgency	10% of sales from new products	Competition	Fill market gap	Weighted total
	2.0	5.0	4.0	3.0	1.0	3.0	
Project 1	9	5	2	0	2	5	68
Project 2	3	7	2	0	5	1	57
Project 3	6	8	2	3	6	8	99
Project 4	1	0	5	10	6	9	85
Project 5	3	10	10	1	8	0	107

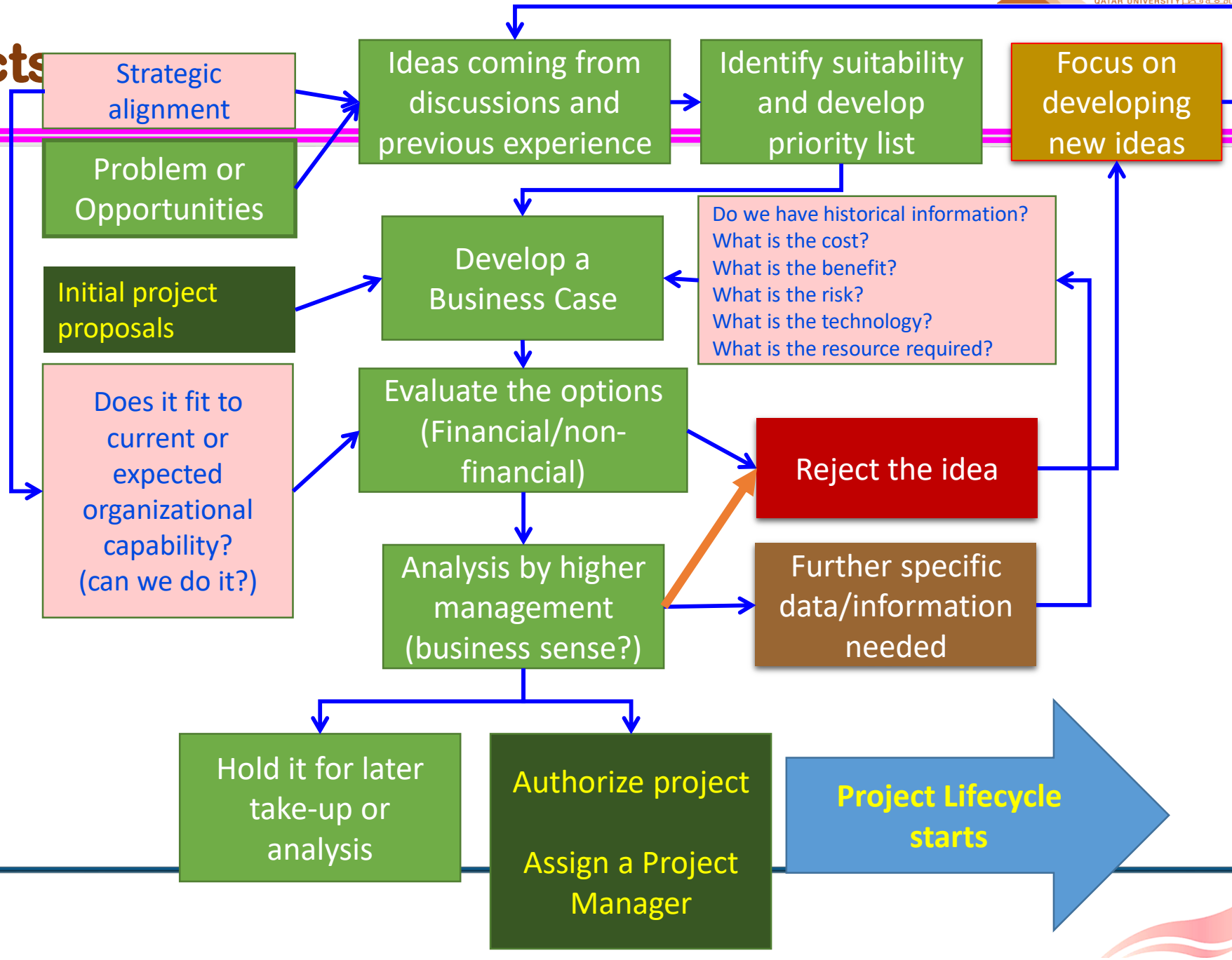
What if the weights on criteria change?

- Say strong sponsor changed from 2.0 to 5.0?

Criteria / Weight	Strong sponsor	Supports business strategy	Urgency	10% of sales from new products	Competition	Fill market gap	Weighted total	Weighted total Changed
	2.0	5.0	4.0	3.0	1.0	3.0		
Project 1	9	5	2	0	2	5	68	95
Project 2	3	7	2	0	5	1	57	66
Project 3	6	8	2	3	6	8	99	117
Project 4	1	0	5	10	6	9	85	88
Project 5	3	10	10	1	8	0	107	116

- Criteria can change based on the organization
  - Weights can be given to
    - Support of business objectives
    - Having sufficient money
    - Having a customer support
    - Knowledge on technology
    - Availability of technology
    - Timing required for implementation
    - Level of NPV
    - Risk factors
    - Number of outcomes (bi-product outcomes)

Selecting projects



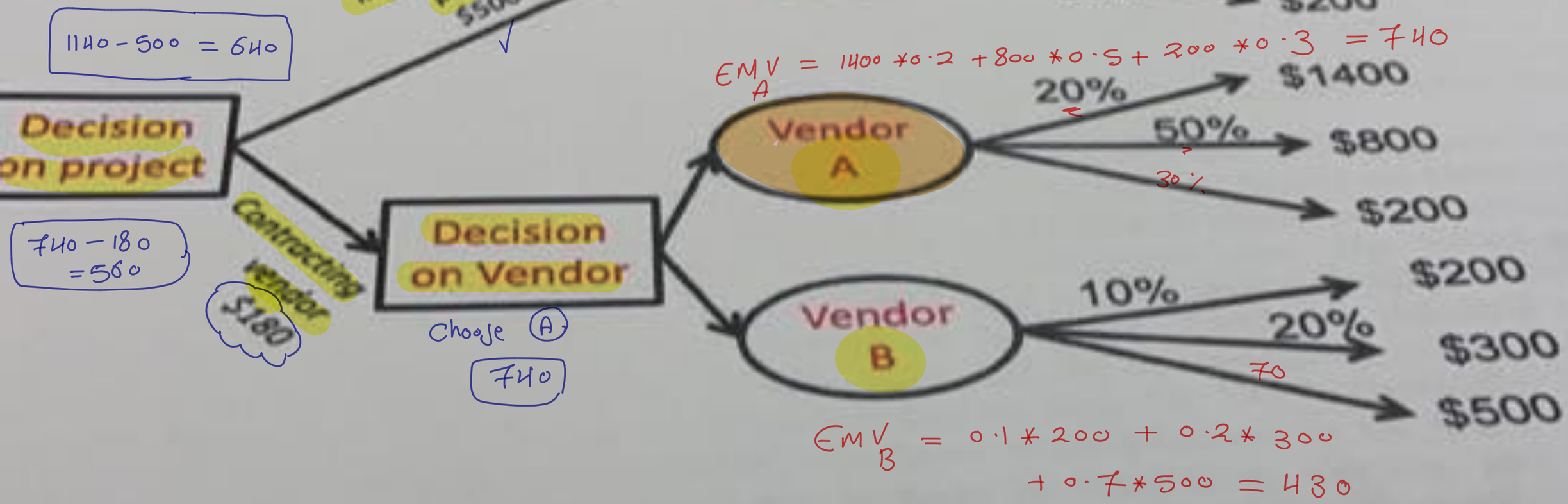
Summary

- Projects are of different types
- Project purpose should be related to the deliverables
  - All objectives of the project should be measurable
  - Scope defines the objective further
  - Deliverables provide what exactly are to be provided as an output of the project.
- Project selection uses financial or non-financial criteria
- Once the project is selected
  - A project manager is assigned
    - A team is formed
    - Resources are provided
    - Project lifecycle will start
    - Much of the information in business case would be useful in the project lifecycle

estion 2.

Based on the diagram below, what is your decision for the selection of the project. Show your calculations and justify your answer. (20 marks)

EMV New plate = 0.6 * 1500 + 0.2 * 600 + 0.2 * 600
= 1140 $



w plant : our Desicion is installing own Plant *

*