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Software Project Management :

- Risk
- Quality. (how much standard product needs to follow, what client can pay)
- Cost
- Resource. (what client can provide as software/hardware)
- Requirement. (client's need)
- Deployment (when the product needs to be ready)

CPMC D → deployment → Releasing. feedback.

communication req analysis → Planning. (Time standard.)

construction → coding, testing.
modelling. (diagram: use case diag. scenario based model)

Maintenance:
Control Management.
Change / configuration Management.

- Product
- Process → Tasks, work products
- SDLC Models.
  - → incremental
  - → waterfall.
  - → evolutionary
  - → prototyping.
- Class-collaboration-Responsibility.
- Quality Function Deployment
- CMM vs CMMI process flow.

- canary → internal organisation.
  beta → small public / devs
  alpha → public all
- Software does not break down bad.

Software project Management → Bob Hughes.

Business Case :

① Cost
② Delivery date
③ Features of the system

Stakeholder:
→ Client
→ Developer
→ Tester
→ Manager

→ Functionality.
→ Quality.
→ On time
→ Budget.

Project Planning → Project Monitoring ↓↑ Project Plan Revision → Project Closing

Risks: acceptable risks ; unacceptable risks.
Scaling risk from 0 to 1
Known risk (Impact is low) ; Unknowing risk (Impact is high)

Bugs, Environment errors, System Crashes, Last minute changes
Risk Management, Risk mitigation.

Project Portfolio Management :

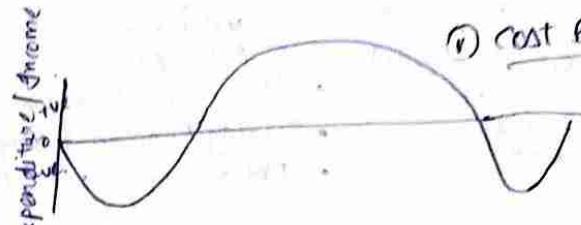
Provides overview of all projects that the organisation is undertaking. • Portfolio definition.
• Portfolio management & • Portfolio optimisation
↓
diff. project are going on one project code can be shared to get better delivery data and less cost (optimisation)

Prioritise over sharing of the project or not.

Project 1: minus money, 10K (borrowing money to make a project)
(Big project for a long time)
1st year: + 5K (5K earning)
2nd year: +5K (5K earning)

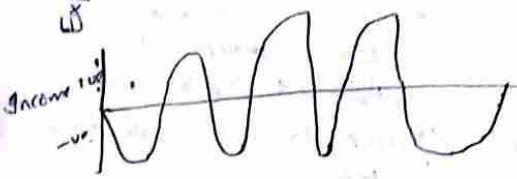
Project 2: -10K (0th year)
+5K (1st year)
+8K (2nd year)

(1) Cost Benefit Analysis (CBA)



(The income over a time should be +ve so that it can be worked upon continuously)

Project made to turn profitable.



(Not a desired pattern

The final turnover of a project is not the only criteria to judge a project. The consistency of profit vs expenditure (using cost benefit analysis) is also important.

- Net profit income
- Return of investment.

(2) Cash Flow forecasting:
When expenditure & cash flow should happen.
Company borrow for a project predicting future cash flow is difficult. especially in inflation.

Cost Benefit analysis evaluation Technique:

(i) Net profit. (Total profit after a period of time)

(ii) Pay back period (Time to break even) (ignore profit after break even)

(iii) Return on investment = $\frac{\text{Average annual profit}}{\text{Total investment}} \times 100$ → (Net profit / year)

i.e. $\frac{(50K/5)}{100K.} \times 100 = 10\%$

100 - 2 year.
8s invested

Net present value:

↳ present value = $\frac{\text{value in year } t}{(1+K)^t}$

10,000 × 0.9091 → 9091
10,000 × 0.8264 → 8264
10000 × 0.7513 → 7513
20000 × 0.6830 → 1366 ∴ NPV = 618
100000 × 0.6209 → 62090

ind = var = NULL

var =

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Capital Budgeting: Investment decisions are called capital budgeting decision.

Cost-Benefit Analysis.

(i) Net Present value (value of return of investament) } Discounted cash flow
(ii) Internal rate of return (% of roi)
(iii) Profitability index (profit ratio for money spent) }
(iv) Payback period. (time to recover investment } Non discounted cash flow

oppurtunity cost: taking 1st project & not the 2nd & willing to ignore profit or loss of 2nd.
1st: govt. with company
2nd: or. with bank.

Cash Flow:- Discounted cash flow: Rate of return that an organisation is willing to lose in order to invest & gain profit from a project in future.

Future value of money = Present value of money $\left(1 + \text{Discounted rate}\right)^{\text{no. of years}}$.

Q: i.e. $FV = PV(1+K)^n$ ⟶ (like compound interest)

$\therefore \boxed{PV = \frac{FV}{(1+K)^n}}$

Present value = ₹100 (invested)
Discounted rate = 8% (may earn 8% per year) = 8/100

ex: 1st year = 108.00
5th year = 146.93
16th year = 317.21
} Future value for 1st, 5th, 15th year

Q: If ₹100 is to be received after 1 year / 5 year / 15 year
Discounted rate of interest = 8%.

⇒ $PV = \frac{100}{(1+0.08)^1} = 93$

$PV = \frac{100}{(1+0.08)^5} = 68$

$PV = \frac{100}{(1+0.08)^{15}} = 32$

(i) Net present value = present value of cash inflow - present value of cash outflow.

ex: Net Salary in salary slip = gross income - deduction

if NPV > 0 → accept project
NPV < 0 → reject project
NPV = 0 (tangible benefits) ∴ greater the NPV, better the prospects

Singleton pattern
Factory method

ex: Sum of 400,000 (→ main outflow.) is invested today may give series of below cash inflows) in future.

70,000 in 1st year.
120,000 in 2nd year
140,000 in 3rd year.
140,000 in year 4
40,000 in year 5

(Future values are given, need to calculate present value)

If opportunity cost of capital (→ discount rate.) is 8% per annum, then should we accept or reject project.

$$\Rightarrow PV = \frac{FV}{(1+K)^n}$$

$$\downarrow NPV \propto \frac{1}{\text{discounted rate}\uparrow}$$

$\therefore$ 1: PV = 64814.81 $\left(\frac{70000}{(1+0.08)^1}\right)$

2: PV = 102,880 $\left(\frac{120,000}{(1+0.08)^2}\right)$

3: PV = 111136.51 $\left(\frac{140,000}{(1+0.08)^3}\right)$

4: PV = 102904.18 $\left(\frac{140,000}{(1+0.08)^4}\right)$

5: PV = 27223.32 $\left(\frac{40000}{(1+0.08)^5}\right)$

$\therefore$ Net present value = PV of cash inflow − PV of (→ investment.) cash outflow

= 408959.49 − 400000

= 8959.49 > 0 $\therefore$ accept the project.

(ii) Internal rate of return: The discount rate at which NPV becomes zero is the Internal rate of return.

ex:

Discount rate = 8%. NPV = 5000

Discount rate = 12%. NPV = 0 → is the Internal rate of return.

Discount rate = 20%. NPV = −7000

$\Rightarrow$ ex: cost of a project is 1000, incremental cash flows are

Year 1: 200
Year 2: 300
3: 300
4: 400
5: 500

Compute IRR if opportunity cost of capital is ~~cost~~ 12%.
Should we accept the project

PV 1: $\frac{200}{(1+0.12)^1} = 178.57$

PV 2: $\frac{800}{(1+0.12)^2} = 639.16$

PV 3: $\frac{800}{(1+0.12)^3} = 213.53$

PV 4: $\frac{400}{(1+0.12)^4} = 254.21$

PV 5: $\frac{500}{(1+0.12)^5} = 283.71$

NPV = 1169.81 − 1000 = 169.01 > 0 (∴ accept)

(Increase the discount rate, NPV will decrease)

(iii) Profitability index. : For every dollar spent, how much we got back

PI = cash inflow / cash outflow

Q: Required rate of return = 12% p.a

sum of 25,000 invested

5,000 in year 1, 9k 2nd, 10k 3rd, 10k 4th, 3k 5th

⇒ K = 12% outflow = 25 k

after rate, inflow = 26600k.

∴ $PI = \frac{26600}{25000} = 1.07$

(accept project)

(iv) Payback period. : time taken for project to generate money for itself.

Payback period (discount) : use k. to find PV from FV

Payback period (non discounted) : PV = FV

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Risk Evaluation:

	Importance	Likelihood.
1. Change in Requirements	Medium	Medium-Low
2. Budget	High	Medium-High
3. Competitions for product	High	High
4. Delaying Deadline	High	Medium
5. Resource strategies	Low	Low
6. Security	High	Medium

Risk Matrix

Payroll application value. income

Q: 8 lakh per year → 1 out of 10 chance (no competitors)

6.5 lakh per year → 6 out of 10 chance (in b/w) (some less similar app before it comes.)

1 lakh per year → 3 out of 10 chance (competitors launches similar app)

dupt cost = 7.5 lakh, Sales expected to be constant for at least 4 yrs.

Annual cost of marketing = 2 lakh

Would launching the application be good decision?

⇒ Need to make income forecast table:

	Annual Sales income ₹	profitability (p)	Expected value ₹ x p.
High	8₹	0.1	80,000
Medium	6.5₹	0.6	390,000
Low	1₹	0.3	30,000
Expected income per year.			5,00,000 5 lakh.

Since dupt cost is one time, ignore for now.

cost - sales = 20₹ − 8₹ (4 years) = 12₹ profit.

but low profit risk is 30% which is significant.

∴ Do not take this project.

Risk profile Analysis:

Use cost benefit tree.

Σ (prob x profit) - (prob x loss)

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Agile Methodologies

→ Crystal Technologies
→ Atern (formerly ASDM)
→ Feature Driven Development
→ Scrum -*-
→ Extreme Programming.

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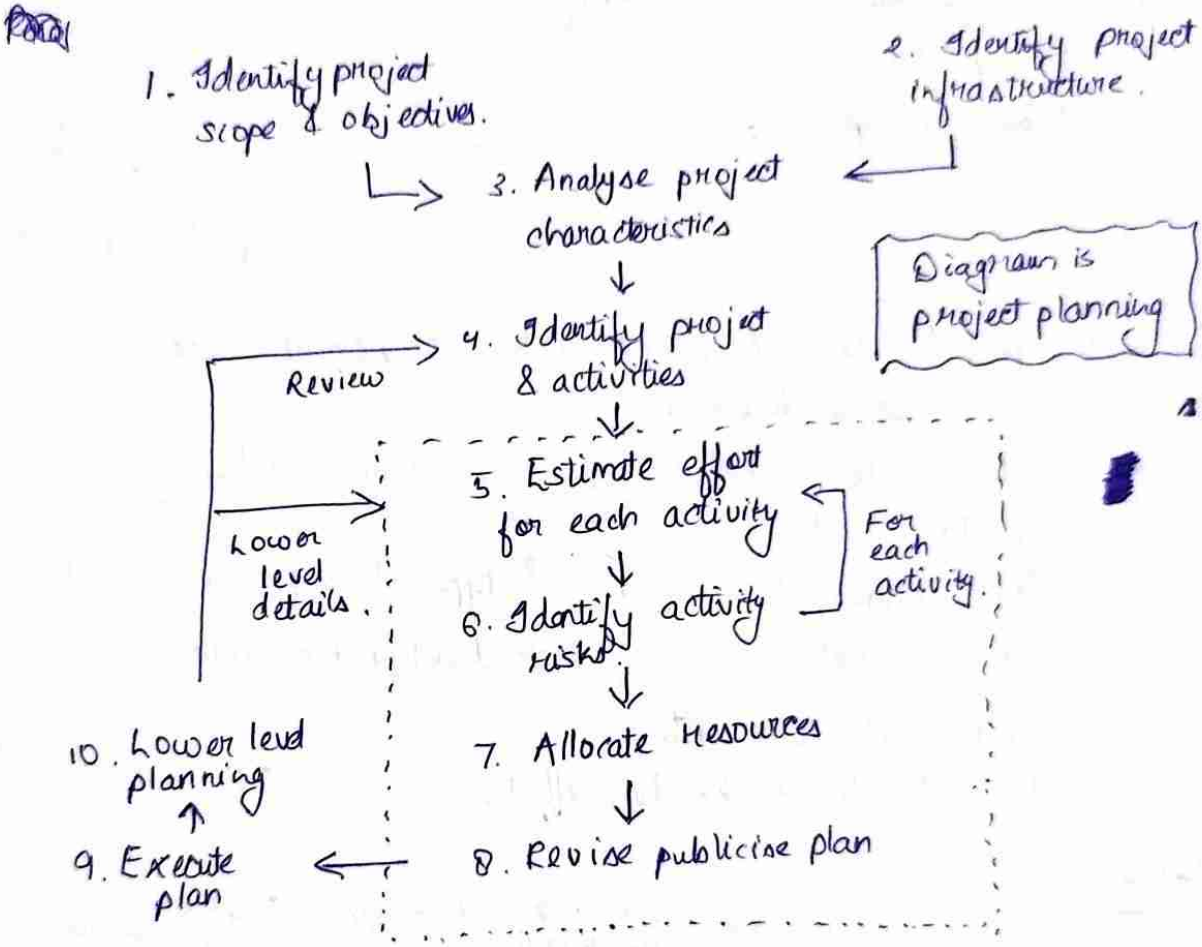
Software effort estimation

delievered on time, within budget and with required quality.

less manpower → miss deadline
more manpower → project on time but manpower for other project lost.



Software estimation takes place in step 3 & step 5 in particular.

- KLOC → 1000 lines of code. (SLOC source)
  coupling
  cohesion.
- cyclomatic complexity : 10 is more complex than 5
- productivity (SLOC per work month) (Question imp)

2 m question:

- Parkinson law: work expands to fill time available
- Brooks law: putting more people on a job makes it later.

- Work-month (wm) is popular unit for effort measurement (or person-month) → by developer on project

software estimation effort technique:

→ top down
→ bottom up.

good, cheap, quick.

- bottom up: breaks the project into component tasks
  iterative breaking
  - procedural code-oriented approach: major activity is writing code.
    (a) Envisage the number & type of software modules
    (b) Estimate SLOC of each identified module.
    (c) Estimate work content
    (d) Calculate work-days effort.

- SLOC Tool for Code
- Cyclomatic complexity.

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- top down approach: → estimate based on experience of developers. → estimating time
  - parametric models (estimating cost based on parameters like no. of modules and no. of objects or connections to database)

$$\text{effort} = (\text{system size})(\text{productivity rate})$$

ex: system size in form of KLOC and have specific value of 3 KLOC while productivity is 40 days per KLOC

$$\therefore \text{effort} = 3\,\text{KLOC} \times \frac{40\,\text{days}}{\text{KLOC}} = 120\,\text{days}$$

Some parametric models such as that implied by function points are focused on task/system size while others such as COCOMO are more concerned with productivity factors.

23/9/22 • Albrecht Function Point Analysis:

5 major user components:

→ External input types: input transactions which update internal computer files

→ External output types: transactions where data is output to user

→ External inquiry types: provide info. but without updation of internal files.

→ Logical internal files: standing files used by a system such as record types (relational table)

→ External interface file types: allows input & output for common files for applications.
ex: Bankers Automated Clearing System (BACS)

IFPUG file type complexity. (For Albrecht complexity multiplicities)

No. of record types ↓	No. of data types → <20	20-50	>50
1	Low	Low	Avg
2 to 5	Low	Avg	High
>5	Average	High.	High

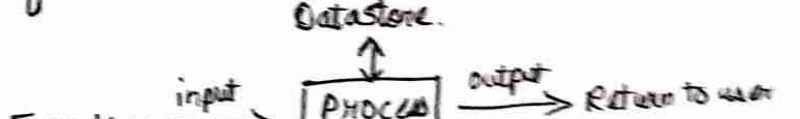
Technical complexity adjustments (TCA) calculation has many problem

(FP count = No. of record/class + No. of data types)

• Function Point Mark 2:

Information processing size is initially measured in unadjusted function points (UFP's)

transaction:



UFP are calculated as:

Wi × no. of input data types
We × no. of entity referenced
Wo × no. of output data types

] Wi, We, Wo are weights given by developer

ex: $W_i = 0.58$ $W_e = 1.66$ $W_o = 0.26$

No. of input = 9#

No. of entity referenced. = 2

No. of output data element = 10

∴ FP = $9 \times 0.58 + 2 \times 1.66 + 10 \times 0.26 = 11.14$ FP