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Software Project Management:

→ Project: A Project is well defined task, which is a collection of several operations done in order to achive a goal (eg: Slw development & delivery) A Project can be Characterize as:-

- Every Project may has a unique & distinct goals.
- Project has its start & end time

Software Project Management

A Slw project management is the complete procedure of slw development from requirment gathering do testing and maintence, carried out according to the execution methodologies, in a specified period of time to achive intended Slw Product.

→ Need of Slw project management

Delivering a high quality product while staying within the clients budget and completing the project on time are important component of the Slw organization.

The image shows the triple constraint for Slw Project. It is an essential part of the Slw organization to deliver quality product keeping the cost within

Client budget constrain & delivery the project as per scheduled. There are several factors, both internal and external, which may

→ S/w Project manager:

A S/w Project manager is a person who undertakes the responsibility of executing the S/w project. S/w project manager is thoroughly aware of all the phases of SDLC that the S/w would go through. Project manager never directly involved in the producing the end product but he controls & manage the activities involved in production

→ Responsibilities of Project manager.

↝ Managing People
- Act as a Project leader
- managing human resources.
- Setting up reporting hierarchy etc.

↝ Managing Project
- Defining & setting up project scope
- Managing Project management activities
- Monitoring Progress & Performance
- Risk analysis at every phase
- → take necessary steps to avoid or come out of problems
- → Act as Project spokes person.

S/w Management Activities

S/w management include many activities, that include: planning
1) Project planing & tracking
2) Project resource management
3) Scope management

4 → Estimation management
5 → Project risk management
6 → Scheduling management
7 → Project communication management
8) Configuration management

1) Project Planing

In the planning phase, all the necessary task identified & scheduled. the development team then work on completing these task in the execution phases. It is imp. to track the progress of analysis phases of programing in order to ensure that the project is on track. tracking allows managers to see where the project stands in progress & identify potential issues.

2) Project Resource Management.

In order to successfully manage a S/w development project, it is imp. to have clear understanding of the required resources. This include both human & material resources. human resources include the development team, as well as any other individuals who are involved in the project.

3) Scope Management

One of the most imp. aspect of project management is scope management. this is the process of ensuring that all of the work required to complete the project is included in the scope. There are variety of tools that can be used to help with the scope management such as project templates & WBS (work breakdown structure) chart

4) Estimation Management

Estimation is the process of determing how long a project will take to complete & how much it will cost. this is an important part of project management, as it allows managers to set realistic expectations for the project. A variety of tools can be used for estimation, such as historical data & bottom up analysis. it is also imp. to have a clear understanding of the development process inorder to make accurate estimates.

5) Boject Risk Management.

Risk management is the process of identifying & assessing risk that could potentially impact the Boject. this include things include things like schedule delays, cost overruns, & scop creep. there are a variety of tools that can be used to help risk management, such as risk registers & SWOT analysis.

6) Scheduling Management:

Scheduling is the process of creating a scheduling for the project. this includes tings like. identifying when each task will be completed & who will be responsible for completing it, it allows manger to ensure that everything is on track

7) Boject Communication Management

Communication is a key part of Boject management This includes things like sending updates to stakeholders. as well as communicating changes to the development team ~~how the validity of~~

8) Configuration Management:

Configuration Management is the process of managing the development team work this includes things like keeping track of code changes & managing development tools, it is imp part of Boject management, as it allows to keep track of the project progress

S/w metrics

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Project Estimation.

For an effective management accurate estimation of various measures is must. With correct estimation manager can manage & control the project more efficiently & effectively.

Project estimation may in value following

→ S/w Size Estimation:

S/w size may be estimated either in terms of KLOC (Kilo Line of code) are by calculating number of S/w size may be estimated. Lines of code depends upon coding practices & function points vary according according to the user or S/w requirement.

→ efforts estimation

The managers estimate efforts in Terms of personal requirement & man hour. required to produce the S/w. For efforts estimation S/w size should be known. this can be derived by managers experiences, organization historical data or S/w size can be converted into efforts by using some standard formulas.

→ Time estimation

once the size & efforts estimated the time required to produce the S/W can be estimated efforts required is segregated into Sub categories as per the requirement specification & interdependency of the various components of the S/W. S/W task divided into smaller tasks, activities or events by work breakthrough Structure (WBS). The task are Scheduled on days to day basis. or in months. The sum of time required to complete all task in hours or days is the total time invested to complete the project.

— Cost estimation.

This might be considered as the most difficult of all because it depends on many elements than any of the previous ones for Cost estimation, it required

- Size of S/W
- S/W quality
- H/W
- Additional S/W tools, licenses etc
- Skilled personnel with task specific skills
- Travel involved
- Communication
- Training & Support

Project estimation techniques.

Project estimation techniques are

→ Decomposition Techniques
  → loc (Line of code)
  → FP (function point

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→ Empirical estimation technique
→ cocomo model
→ Putnam model

⟹ LOC (Line of code estimation)

Estimation is done on behalf of of numbers of lines of code in the S/w product. LOC clearly consist of all lines containg the declaration of any variable, and executable & non executable statements. As loc only count the volume of code, we can only use it to compare an estimate project that use the same language and are coded using the same coding standard.

Features:

variation such as Source line code are used to set out a codebase.

LOC is frequently used in some kind of arguments.

They are use in assessing project performance an efficiency.

Advantages:

- most used metric in cost estimation
- its alternates have many problems as compared to this metric.
- it is very easy in estimating the efforts

Disadvantages:

it is very difficult to estimate the LOC of the final program from the problem specification

it correlates poorly with quality & efficiency of code

it doesn't considers complexity.

eg:

```
void main()
{
int FN, SN, tN;
Count << " Enter two integers";
Cin >> Fn >> SN;
// Sum of two numbers stored in variable Sum
Sum = Fn + SN
// Print sum
Count << FN << "+" << SN << "=" << Sum;
return 0;
}
```

— Loc = 11

— Loc without cout & space = 9

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fp (Functional Point) analysis

Functional point analysis was initially developed by Allan J Albrecht in 1979 at IBM. and futher modified by (IFPUG) International function point user group.

fp analysis may be used for the test estimation of product. The functional size of the product is measured in term of function points, which is a standard of measurement to measure the s/w application.

-) objective of fpA

- The objective of fpA is to measure the functionality that user request & receives.
- fpA is used to measure sw development + maintenance independently of the technology used for implementation.
- It should simple enough to minimize the overhead of the measurement process.
- It should be a consistent measure among various projects and organization.

Types of fp analysis

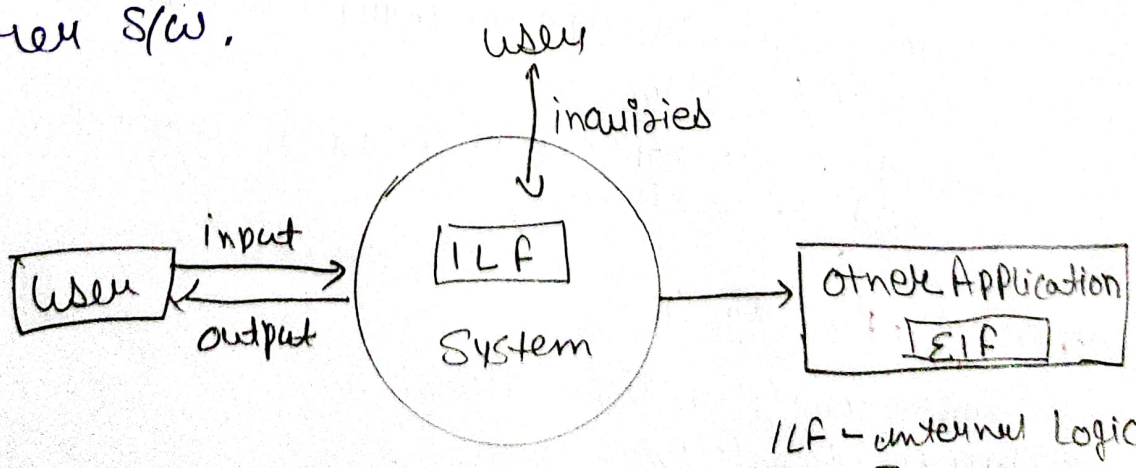
→ Transactional functional Type
→ Data functional Type

→ Transactional functional type :

- External Input (EI) : EI processes data or control information that comes from outside the application boundary. The EI is an elementary process.
- External output (EO) : EO is an elementary process that generate data or control information sent outside the application boundary.
- External Inquiries (EQ) : EQ is an elementary process made up of an input/output combination that result in data retrieval.

→ Data functional Type :

- Internal Logical file (ILF) : A user identifiable group of logically related data or control information maintained within the boundary of the application.
- External Logical File (ELF) : A group of users recognizable logically related data or control to the S/W but maintained within the boundary of another S/W.



ILF - Internal Logical files
ELF - External Logical files

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Types of FP Attributes

Measurements Parameters	Examples
Number of External input(EI)	Input screen & tables
Number of External output(EO)	output screens & reports
Number of External inquiries(EQ)	Prompts & interrupts
Number of internal files(ILF)	Database and directories
Number of External files(ELF)	Shared database & Shared routines

formula = $F.P = UFP * CAF$

$FP = Count - Total * [0.65 + 0.0] * \Sigma(fi)]$

$= Count * CAF$

(Total)
(UFP)

UFP = Sum of all EI, EO, EQ, ILFs & EIF's

CAF = $0.65 + (0.01 * \Sigma fi)$

where fi = value adjustment factor based on responses to all 14 questions.

1) Data Communication
2) Distributed data processing
3) Performance
4) Heavily used Configuration
5) Transaction Rate
6) online Data Entry
7) End-user Efficiency
8) Online update
9) Complex Processing
10) Installation Ease
11) Reusability
12) operational Ease
13) multiple sites
14) facilitate Changes

0 No influence
1 Incidental
2 moderate
3 Avg.
4 Significant
5 essential

~~answered b/w 0 to 5 only.~~
rate of each factor scaled 0 to 5

Eg: weigh factor

functional unit	Low	Average	High
EI	3	4	6
EO	4	5	7
EQ	3	4	6
ILF	7	10	15
ELF	5	7	10

⇒ given counts

EI = 10 (Low complexity), EO = 13 (high complexity)
EQ = 4 (Avg complexity, EQ = 2 (high Complexity)
ILF = 2 (Avg. Complexity); ELf = 9 (Low complexity)

→ So UFP calculated as

EI = 10X3 = 30, EQ = 2X6 = 12
EO = 13X7 = 91, ILF = 2X10 = 20
EQ = 4X4 = 16, ELF = 9X5 = 45

TOTAL = UFP = 214

→ So CAF calculated as

$$CAF = 0.65 + 0.01 \times \Sigma F_i$$

what is ΣF_i

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Σfi = total complexity adjustment value

fi are the degree of influence & are based on responses on influence Standard questions.

→ Factor value is given always for all 14 question but by default we will estimate all 14 questions has 2

⇒ then $\Sigma f_i = 14 \times 2 = 28$

$$CAf = 0.65 + (0.01 \times 28)$$

$$CAf = 0.93$$

TOTAL- $\boxed{ff = UFP \times CAF}$

$$= 214 * 0.93$$

$$\boxed{ff = 199.02.}$$

Cost Estimation:

for any S/w Project it is necessary to know how much it will cost to develop and how much development time will it take. these estimation are needed before development is initiated, but how it is done. Several estimation procedures have been developed and are having the following attributes in common.

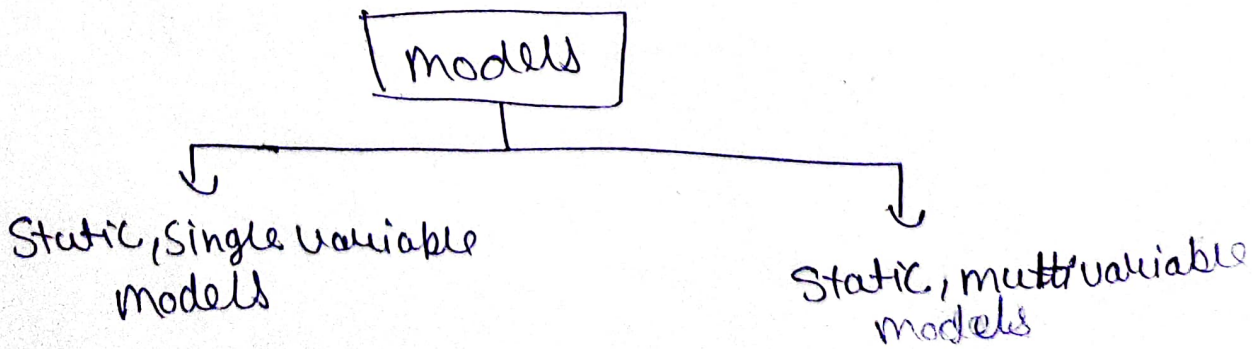
1) Project Scope must be established in advanced.
2) S/w metrics are used as a support from which evaluation is made
3) The project is broken into smaller pcs which are estimated individually.
4) Delay estimation
5) Acquire one or more automated estimation tools.

Use of Cost estimation model

During the planning stage it is crucial to determine the number of engineers needed for a project and create a schedule. monitoring the project progress ensures it follows procedure & requires corrective action if needed.

Cost estimation models.

A model may be static or dynamic. in static model a single variable is taken as a key elements for calculating cost & time. in a dynamic model, all variables are interdependent and there is no basic variable



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→ **Static, Single Variable Models:** When a model makes use of single variable to calculate desired values such as cost, time, efforts etc. it said to be a single variable model

equation is

$$C = aL^b$$

Where

C = cost
L = size
a and b are constants

The SLW Engineering Laboratory established a model called SEL model, for estimating its SLW product. this model is an example of the static, single variable model.

$$E = 1.4L^{0.93}$$
$$DOC = 30.4L^{0.90}$$
$$D = 4.6L^{0.26}$$

Where

E = Efforts (Person per month)
DOC = Documentation (no. of pages)
D = Duration (D, in months)
L = Number of lines per code

→ Static, Multivariable Models:

These models are based on Method, they depends on several variables describing various aspects of the S/w development environment. In Some models several variables are needed to describe the S/w development process & Selected equation combined these variables to give the estimate of time & cost. these model are called multivariable models.

WALSTON & FELIX develop the models at IBM provides the following equation give a relationship b/w line of Source code and efforts.

$$E = 5.2L^{0.91}$$

in the same manner duration of development is given by

$$D = 4.1L^{0.36}$$

The productivity index use 29 variables which are found to be highly correlated productivity

$$I = \sum_{i=1}^{29} W_i X_i$$

Where

W_i is the weight factor for i^{th} variable and

$X_i = (-0, 0, +1)$ the estimator give X_i one of the values $-1, 0, or +1$ depending on the variables do decrease, has no effects or increase the productivity.

⇒ Static Single & multivariable model eg:

Eg: Compare walston-felix model with the SEL model on S/W development expected 8 lines/code & Persons year of efforts.

a) Calculate the no of line Source code that can produced

The amount of manpower involved = 8PY

$$\text{Per in month} = 96 \text{ Person-Month}$$

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The data is calculated in ~~months~~ months

$$C = a \cdot L^b$$

→ Single variables

$E = 1.4L^{0.93}$ = convert formula

$\Rightarrow L = (96/1.4)^{1/0.93}$

$= 94.264$ LOC

→ multivariables

$E = 5.2L^{0.91}$

$\Rightarrow L = (96/5.2)^{1/0.91}$

$= 24.632 \approx$ LOC

b) Duration in months can be Calculated by means of Equation

→ Single variable

$D = 4.6(L)^{0.26}$

$= 4.6(94.264)^{0.26} = 15$ mths

→ multivariable

$D = 4.1L^{0.36}$

$= 4.1(24.632)^{0.36} = 13$ months

C) = Productivity is the line of code produced Per Person/month (year)

$P = \frac{LOC}{P}$

single $P = \frac{94264}{8} = 11783$ LOC / Person-year

multi $P = \frac{24.632}{8} = 3.079$ LOC / Person-year

↳ Productivity Means line of code divided by Persons Per year.

D) Average maning is the average number of persons recruited Per month in Project

Single variable → $\frac{96 P-m}{15 m} = 6.4$ Persons

multi variable → $\frac{96 P-m}{13 m} = 7.4$ Persons.

.P-

Avg. Person per month = $\frac{\text{No of Person month}}{\text{Duration}}$

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S/w metrics

A S/w metrics is a measure of S/w characteristic which are measurable & countable. S/w metrics are valuable for many reasons including measuring S/w performance, planning, workitem measuring productivity and many other uses.

→ Classification of S/w metrics.

1) Product metrics
2) Process metrics

→ Product metrics: These are the measures of various characteristic of the S/w product.

- Size & complexity of the S/w
- Quality & Reliability of S/w

→ Process metric: these are measures of various characteristics of the S/w development process. For eg, the efficiency of fault detection. They are also used to measure the characteristics of methods, techniques, & tools that are used for developing S/w.

Types of metrics

1) Internal metrics: internal metrics are used for measuring properties that are viewed to be greater imp. to s/w developer. eg LOC (Line of code)

2) External metrics: are used to measure properties that are viewed to be greater importance to user eg: Portability, Reliability, functionality etc

3) Hybrid metrics: its combination of product, process & resources metrics. eg: cost per FP (Function Point)

4) Project metrics: are used by Project manager to check the Project progress. data from past projects are used to collect various metrics like time, cost these estimates are used as base of new S/w.