Unit.-4

Software Metrics and Project Estimations

→ **Metric:-** quantitative measure of the degree to which a given system, component or a process possess a given attribute. Ex:- no. of errors per review.

:- **Indicator:** a metric or a group of metric that provides useful insight to the software project, process or product only.

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Provides insight to the product manager so that they can adjust the process and make things better.

Ex: formal review methods provide a higher return on time investment

Process Indicators :- enable a Software Engineering organization to gain insight into the efficacy of the existing process (tasks, paradigm, milestones) to ansr what works and what doesn't to provide long term Software process improvement.

Project indicators enable the software project manager to → asses the work tasks and status of project
→ uncover the areas which can become critical.
→ track potential risks.
→ adjust the work flows.
→ evaluate the project team's ability to control quality Software.

Metrics for Requirement Model.

→ These metrics evaluate the entire Requirement model with intent of predicting the size of resultant system.

Size:- Size is sometimes the indicator of design complexity but always it is an indicator of increased coding integration and testing effort.

Function Based Metric:- or function point metric can be used effectively measuring the functionality delivered by the system.

It can be used to

→ determine the cost to code, integrate or design, testing.

→ predicting the number of errors that will be encountered during the testing.

→ predict the number of component or source line in the implemented system.

→ FPs are derived using a relationship based on software's direct information domain and qualitative assesment of software complexity.

Function points:-

1) No. of Input (External)

2) No. of external output (reports, screens, error messages)

3) No. of external queries online input that results in immediate software response.

4) No. of internal logical file

6) No of external interface files

	count	simple	average	complex
No. of user inputs		x	4	
" " user outputs		x	5	
" " external inquiries		x	10	
" " logical files		x	10	
" " external interfaces		x	7	

→ count total

$$FP = \text{count-total} \times [0.65 + \Sigma fi (0.01)]$$

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Complexity adjustment values.

#Metric for Requirement Specification Quality.

RSQ metric include the lack of ambiguity, correctness, verifiability, modifiability, completeness, understandability, consistency, traceability and reusability.

$$nr = nf + nnf$$

↓ ↳ non functional requirements.

functional requirements

Three Software Specification Quality metrics

① Q1 : Specificity (lack of ambiguity) $= \left(\frac{nui}{nr}\right)$

no. of requirements having identical interpretations.

② Q2 : Completeness.

$Q2 = \frac{nu}{nixns}$ → no. of unique functional requirement

→ (no. of input stimuli) Ins and no. of

Q3:- correctness $\left(\frac{nc}{nc+nv}\right)$

nc = no. of correct requirements
nnv = no of non validated requirements.

Metrics for Software quality:-

① Correctness:- it is a degree to which the software performs its required function. Common measure is defects per KLOC.

② Maintainability:- is the ease with which the system can correct if error is encountered, adapt to new changes.

MTTC = Mean time to change is the time taken to analyze the change, design, implement the change, test it and distribute the change to all users.

③ Integrity:- is a system's ability to withstand attacks to its security.

Threat: probability that attack will occur,

Security:- probability with which attack will be repelled

Integrity = $\sum [(1 - \text{threat}) \times (1 - \text{security})]$

④ Usability:- quantifies the ease of use.

Measured it!:-

1) Physical or intellectual ~~System~~ skill required to learn the System.
2) Time required to become moderately efficient.
3) net increase in productivity.

DRE:- a quality metric that provides benefit at project and process levels.

DRE: It is a measure of filtering ability of quality assurance and control actions. as they are applied throughout all process framework activities.

$$DRE = \frac{E}{(E+D)}$$

$$DRE_i = \frac{E_i}{(E_i + E_{i+1})}$$

E_i → no. of errors found in SE activity i

E_{i+1} → errors not found in SE activity i

COCOMO Model.

Cost constructive Model this model is used for estimation of size, effort and duration of project

Cocomo model is hierarchy of estimation models

Uses

Object points - indirect measure to measure the size of the system that is computed using -

(1) Screens :- form to take input (interface)

(2) Reports :- Summary of data like the no of girls admission in college for this year.

(3) 3GL Components - modules or system will be using or system will be built on them.

Objtype	Simple	Medium	Complex
Screen	1	2	3
Report	2	5	8
3GL components			10

NOP = Ob $\times (100 - \%\ reuse)/100$

Productivity :- NOP/effort

effort = NOP/prod

No. of modules reused in this application.

Effort :- $\left[LOC \times B^{0.333}/P^3\right] \times \frac{1}{t^4}$

B = Skills factor

for small programs :- 5 to 15 KLOC = 0.16

for Big program greater than 70 kloc = 0.39

P = productivity parameter → represents overall maturity of the develop and environment and level of programming used

P = 2000 = for real time syst

P = 10,000 = for telecommunication

P = 28,000 for Business applications

timin

↓

minimum development time $= \left(\frac{8.14 \times LOC}{P^{0.43}}\right)$

$\left(E = 180 \times B \times t^3\right)$

Risk Management.

Reactive Risk Strategy

→ It monitors the Sqtwaie project for likely risks.
→ Resources are kept aside to deal with them when the problem occurs.
→ Sqtwaie team doesnot take any action till any problem occurs.
→ As soon as a problem is discovered quick/ rapid actions are taken to correct the problem.
→ This is also called as fire-figuting mode.

Proactive Risk Strategy

Begins long before when the technical work is initiated.
Potential risks are identified, their impact and probability are analyzed and they are ranked by importance.
The Sqtwaie team then develops a plan to tackle the risks.
As all the risks cannot be avoided a plan is made to respond in a controlled and effective manner.

→ Risk characteristics: Uncertainty :- Risks are probable i.e they might happen or not.

→ Loss :- If Risk becomes a reality unwanted consequences or losses will occur.

→ Types of Risk that can occur when a Sqtwaie is built.

1. Project Risk :- That threaten the project plan That is if these risks becomes a reality than the planned schedule will slip and the cost will increase. Project risks identify potential budget, schedule, resources, personnel, requirements and their impact on Sqtwaie.

Technical Risk:- It threatens the quality and timeliness of technical risk become a reality then the implementation may become difficult or impossible. Technical risk identify design, interface, implementation, verification

Buisness Risk:- threatens the viability of the Software project and even jeopardize the project or product.

- Market Risk: Building the excellent product that no body wants.
- Strategic Risk: Building a product that no longer fits into the company's overall buisness strategy.
- Sales Risk: Building a project that sales team doesnot know how to sell.
- Management Risk: Loosing the support of senior manage due to change in people or focus.
- Budget Risk: Loosing budgetry or personal committment.

Known Risks are known after the evaluation of → Project plan, buisness and technical environment, Reliable information sources.

Predictable Risk: extrapolated from past experiences
Ex:
→ Lost will increase
→ Poor communication with customer.
→ dilution of staff effort.

Unpredictable Risk:- occur but difficult to identify in advance.

Risk Identification:- is a systematic attempt to specify threats to the project plan.

(1) Generic Risk:- That are common for all the Software and they are identified by those who have a clear

Understanding of technology, the people and the environm

② Product Specific Risk:- Identify by looking into the project plan and Software Statement of Scope and by asking a question "what special characteristic of this product may threaten our project plan?"

One method to identify risk is risk item checklist
① Product size
② Business Impact
③ Stakeholder characteristics
④ Process Definition
⑤ Development Environment
⑥ Technology to built
⑦ Staff size and turnover.

Components of Risk:-

① Performance Risk: The degree of uncertainty that the product meets requirements and fits into intended use.
② Cost Risk: The degree of uncertainty that the product budget will be maintained.
③ Support Risk: The degree of uncertainty that the developed software will be adapted, enhanced & corrected
④ Schedule Risk: The degree of uncertainty the project schedule will be maintained.

→| Impact of Risk. it is divided into 4 categories:
① Catastrophic (1)
② Critical (2)
③ Marginal (3)
④ Negligible (4)

Risk projection:- is an attempt to rate the risks in two ways:-

① The probability that the risk is real.

② The consequences associated with the risk, if it occurs

#Software team, project Manager they perform 4 steps in risk projection.

①→ Establish a scale of likelihood of Risk.

②→ Delineate the consequences of a Risk

③→ Estimate the impact of risk on the project & product

④→ Writing down the overall accuracy of risk projection so that there will be no misunderstanding.

Risk Table:- Risk Table is a technique for risk projection.

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Consist of 4 columns

Risk Summary	Risk Category	Probability	Impact	RMMM
↓	↓			↓
discription of risk	one of the 7 categories			Pointer to Paragraph in Mitigation, Monitoring and Risk Management plan.

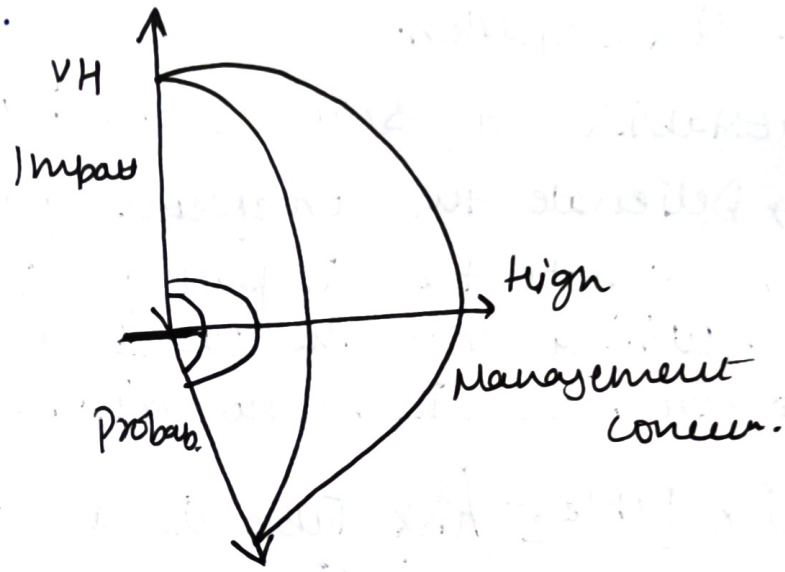
→ Rows are sorted by probability and impact in descending order.

→ Drawing a horizontal cut-off line indicating the risks that will given further attention.

#. Risk Impact, Risk Probability, Management Concern

The risk factor for which the impact is high but probability of occurrence is low the time management will not devote a greater time to it.

But High Impact risk that have moderate to high probability and low Impact risks that have high probability should be carried forward to the risk analysis step.



Assessing the Risk Impact

Three factors that affect the consequences that occur likely if a risk occurs

Its nature:- indicates the problem if risk occurs.

Its scope:- how serious risk is, combines severity of risk with its overall distribution.

Its timing:- The time of impact.

Risk Exposure = P x C

P → Probability of occurrence of risk

C → Cost to the project the risk should occur

Risk refinement :- Risk may be identified at early stages of program (product) development and over the time when we learn the project, then we can divide the risk into the set of detailed risk for easy monitoring, mitigation and management.

Representing Risk in CTC format → Condition - transition
- Consequence

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Given that <condition> there is a concern that (probability) <Consequence>.

RMMM plan :-

① Risk Mitigation (Avoidance) → primary activity that can be achieved using a plan.

② Risk Monitoring : Project Manager monitors the factor to provide indicator risks are becoming likely or not.

③ Risk Management and Contigency Planning

→ is to tackle the risk when they become a reality and mitigation strategy failed.

RMMM steps incur additional project cost

Software Safety and Hazardous Analysis

The software quality assurance activity ensure that all the potential hazards have been identified.

Alternative to RMMM is RIS (Risk information sheet)
RIS is managed using a database system so that creation, info. entry, priority sorting and other analysis may be accomplished easily.