EXERCISE OF CHAPTER 3

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Link: github.com/vatsal-30/SOEN-6841-learning-journal/tree/master/Exercises

Course: Software Project Management (SOEN 6841)

Exercise: 3.2

Exercise 3.2:

Describe the COCOMO technique for deriving effort and cost estimates for software projects?

Answer:

The COCOMO (Constructive Cost Model) technique, developed by Barry Boehm, is a well-established model used for estimating effort and cost in software projects. This model is based on the analysis of many executed software projects and considers multiple influencing factors (known as attributes) that impact the effort required for software development.

Versions of COCOMO

COCOMO can be applied at different stages of a project and has three versions:

1. Basic COCOMO

- Used in the early stages when project-specific information is minimal.
- Effort estimation is based on industry averages for attributes.
- The formula for Basic COCOMO is:

Effort = 2.94 x EAF x $(\text{KLAC})^{E}$

where:

- EAF is the Effort Adjustment Factor derived from cost drivers.
- KLOC represents the Kilo Lines of Code.
- E is the exponent derived from scale drivers.

Basic COCOMO Example

Let's consider a simple example to estimate the effort and cost of a software project using Basic COCOMO.

Given Data:

- Estimated size of the software = 50 KLOC (50,000 lines of code)
- Project type: Organic (a relatively simple, well-understood project with experienced developers)

COCOMO Formula (Basic Model):

Effort (Person-Months) = a x $(KLOC)^b$

Development Time (Months) = c x $(Effort)^b$

Cost = Effort x Average Monthly Salary

For an organic project, the values of a, b, c, d are as follows:

Parameter	Value
a	2.4
b	1.05
c	2.5
d	0.38

Step 1: Calculate Effort

Effort = 2.4× $(50)^{1.05}$

= 2.4 x 57.74

= 138.58 Person-Months

Step 2: Calculate Development Time

Development Time = 2.5 x $(138.58)^{0.38}$

= 2.5 x 7.57

= 18.82 months

Step 3: Calculate Cost

Assuming an average developer salary of $5,000 per month:

Cost = 138.58 x 5000

= $692,900

Interpretation

- The software project **will take approximately 19 months** to complete.
- It will require **about 139 person-months** of effort.
- The total **cost of development** will be **$692,900**.

This estimation can be refined further using **Intermediate COCOMO** by considering **cost drivers** like software complexity, team expertise, and required reliability

2. **Intermediate COCOMO**

   - Applied when more detailed project information is available.
   - Considers cost drivers such as product complexity, reliability, memory constraints, and personnel capabilities.
   - Cost drivers are classified into product attributes, hardware attributes, project team attributes, and project attributes.
   - Uses a refined version of the Basic COCOMO formula with additional cost driver weightings.

3. **Detailed COCOMO**

   - Used to estimate effort for individual phases of a project.
   - Unlike Basic and Intermediate COCOMO, which provide overall project estimates, Detailed COCOMO allows phase-wise breakdown of effort estimation.
   - Each phase considers only relevant cost drivers rather than the entire project.

Key Factors in COCOMO Estimation

COCOMO relies on two key types of factors:

- **Cost Drivers:** These include software safety, developer skill, tool usage, and platform constraints. They are categorized into personal factors, product factors, platform factors, and project factors.
- **Scale Drivers:** These affect how effort increases with project size and include presentness, development flexibility, architecture/risk resolution, team cohesion, and process maturity.

Conclusion

The COCOMO model has evolved over time, leading to **COCOMO II**, which includes further refinements to address modern software development practices. Many organizations customize the model to fit their specific environments by adding or modifying cost factors.

Thus, COCOMO provides a structured and widely used approach to **effort and cost estimation in software engineering**, making it a fundamental technique for project managers and engineers