

Assignment 3: Research and compare SDLC models suitable for engineering projects. Present findings on Waterfall, Agile, Spiral, and V-Model approaches, emphasizing their advantages, disadvantages, and applicability in different engineering contexts.

1. Waterfall Model

Description: The Waterfall model is a linear and sequential approach where each phase must be completed before the next one begins. The phases typically include Requirements, Design, Implementation, Testing, Deployment, and Maintenance.

Advantages:

- **Simple and Easy to Understand:** The structured approach is straightforward.
- **Clear Milestones:** Well-defined stages make project tracking easy.
- **Documentation:** Extensive documentation supports future maintenance and knowledge transfer.

Disadvantages:

- **Inflexibility:** Changes are difficult to implement once a phase is completed.
- **Late Testing:** Issues are often discovered late in the process, leading to potential delays.
- **User Involvement:** Limited user feedback until the later stages.

Applicability:

- Suitable for projects with well-understood requirements and low risk of changes.
- Ideal for regulatory environments requiring thorough documentation.

2. Agile Model

Description: Agile is an iterative and incremental approach emphasizing flexibility and customer satisfaction. It involves continuous planning, development, testing, and feedback, often using frameworks like Scrum or Kanban.

Advantages:

- **Flexibility:** Easily accommodates changes and new requirements.
- **Customer Involvement:** Continuous feedback from users ensures the final product meets their needs.
- **Early and Continuous Delivery:** Regular releases provide value early and often.

Disadvantages:

- **Less Predictable:** Difficult to predict timelines and costs accurately.
- **Documentation:** Can be less comprehensive due to focus on working software.
- **Requires Skilled Team:** High reliance on team collaboration and experience.

Applicability:

- Suitable for projects with dynamic requirements and a need for rapid delivery.
- Ideal for innovative and user-centric products where frequent feedback is beneficial.

3. Spiral Model

Description: The Spiral model combines iterative development with systematic aspects of the Waterfall model. It focuses on risk assessment and minimization through repeated cycles (spirals) of planning, risk analysis, engineering, and evaluation.

Advantages:

- **Risk Management:** Emphasis on identifying and mitigating risks early.
- **Flexibility:** Iterative approach allows for adjustments based on feedback.
- **User Feedback:** Continuous user involvement improves the quality and relevance of the product.

Disadvantages:

- **Complexity:** Managing and tracking the iterations can be complex.
- **Costly:** The thorough risk analysis and multiple iterations can be expensive.
- **Requires Expertise:** Effective implementation demands skilled risk assessment.

Applicability:

- Suitable for large, complex, and high-risk projects where risk mitigation is crucial.
- Ideal for mission-critical systems and projects with significant uncertainties.

4. V-Model (Verification and Validation Model)

Description: The V-Model is an extension of the Waterfall model emphasizing verification and validation at each development stage. Each phase in the development cycle has a corresponding testing phase.

Advantages:

- **Structured Approach:** Clear and systematic process with defined stages.
- **Early Detection of Defects:** Parallel testing phases ensure issues are caught early.
- **Traceability:** High degree of traceability between development and testing activities.

Disadvantages:

- **Inflexibility:** Similar to Waterfall, making changes mid-cycle is challenging.
- **Overhead:** Additional testing phases can increase project duration and cost.
- **User Feedback:** Limited until later stages, similar to the Waterfall model.

Applicability:

- Suitable for projects where requirements are stable and well-understood.
- Ideal for safety-critical systems where thorough testing and validation are essential.