Formulating Research Questions and Choosing Research Methods

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Scenario 1

Assumptions regarding the context:
Assuming that writing test cases before code implementation improves software quality.
Research questions
RQ1) How would writing test cases before implementation improve software quality?
RQ2) What are the benefits of Test Driven Development over Test Last Development?
Research methodology: Experiment.
Independent Variables: Test cases.
Dependent Variables: Quality of software.
Metrics: Quality Metrics – This can be measured by an estimate of the number of bugs (With the decreases in number of bugs software quality improves).
Object: Testcases
Subject: Researcher
Treatment: To evaluate whether Test Driven Development is better than Test Last Development.
Population: Software
Justification: Experiment is the suitable research methodology for the given scenario as it provides qualitative data which helps us to find better process. We conduct an experiment to collect metrics for the code using both TDD and TLD processes. We compare those metrics to find out which of these two software development processes have better quality.

Scenario 2

Assumptions regarding the context: Assuming that the manager is curious to know about the developer's interest in adopting TDD.
Research questions
RQ1) What is the developer's inclination towards TDD and TLD?
Research methodology: Survey
Data collection: Questionnaire
Data Source: Software Developer

Justification: Survey is conducted among the software engineers to obtain a wide view about our subject of interest**.** Data is collected by preparing questionnaire which covers more work. Questions point out the prime aspects of the development phases and the effort and time involved in them. Information gathered from this helps in analyzing which one of the development processes is better.

Scenario-3

Assumptions regarding the context: Assuming that, the company's current agile development process is not up to expectation. Manager want to make changes to the ongoing process for performance enhancement.

Research questions

RQ1. What are the challenges faced while practicing Agile development process?

Research methodology: Casestudy.

Justification: Case study is considered as a flexible research methodology as it helps the researcher to retain knowledge about the characteristics of real-life events while investigating empirical events.

RQ2. What are the improvements needed to the current Agile development Process?

Research methodology: Survey

Data collection: Interviews

Data Source: Persons involved in software development process such as, software practitioner, developer etc.

Population: A software engineer who participates in interview.

Justification: By conducting interviews with software developers and practitioners, helps us to gain insight or knowledge in making the improvements to the process.

Literature review also helps us as an alternative method for the respective object and research question.

Limitations: Depends on the type of person being interviewed, posing a question towards a developer without knowledge leads to inconsistent data.

Scenario 4 :

Assumptions regarding the context: Assume that our algorithm 'A' does not satisfy expected behavior.

Objective: To evaluate and compare the difference between the algorithm "A" test case which is does not meet the specifications and the algorithm "B" test case which is effective in the current industry.

Scope: To obtain the effective algorithm with high performance.

Test of hypothesis : Algorithm A is more efficient than Algorithm B vice versa.

Research question

RQ 1. What are the factors affecting for the better performance of algorithm "A" when compared to algorithm "B"?

Research Method: Experiment is selected as the correct method for this research.

Dependent variables: Complexity.

Independent Variable: Algorithm.

Data source: From any person related to software development.

Justification: To get better comparison results, this can be achieved using controlled experimental research method. Experiment is chosen as research method as it is more inclined towards an exploratory research and an experiment pertains to a very specific task at hand. The conclusions are drawn, by the time taken for error detection. If the time taken is less, it shows that algorithm is more efficient.