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Agile Literature Review

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Senior Honors Project

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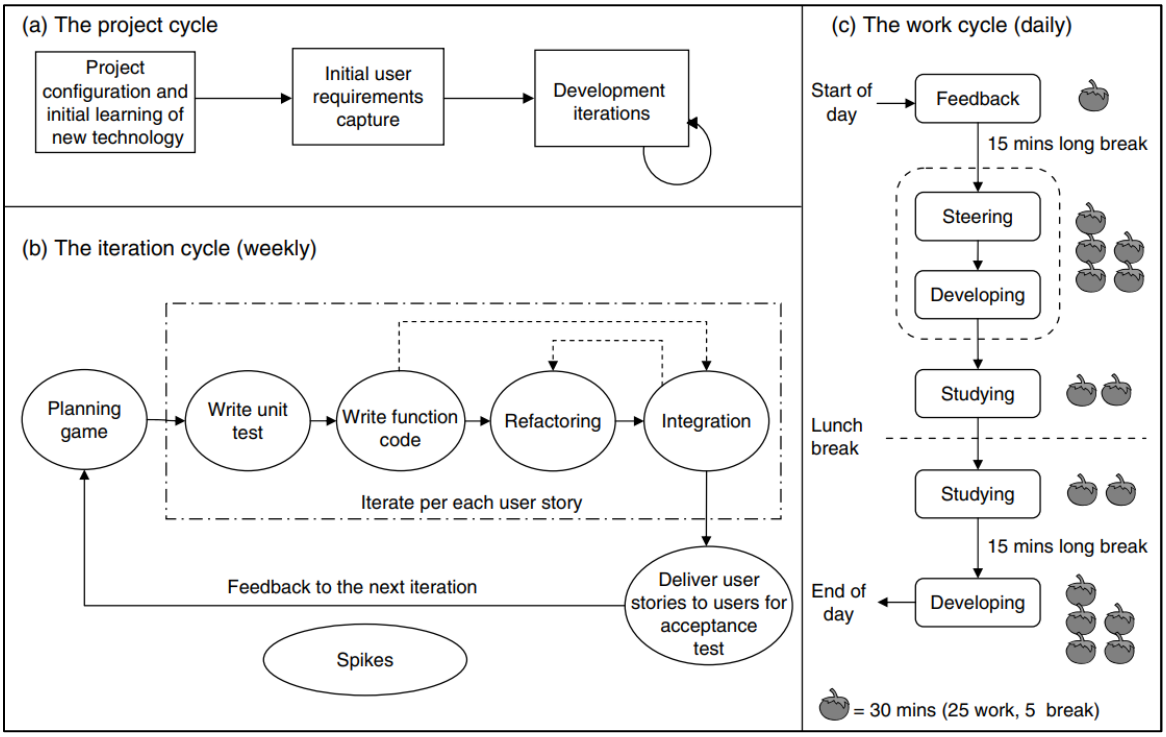
Abstract

Background: Over the last 20 years the software development community has implemented agile techniques over the traditional approach to software development. Agile methods require less upfront costs and increase project flexibility; however, agile methodology is not infallible. Objective: This research seeks to validate the assumption that there is a lack of robust research regarding agile project management and its use in the software development industry. This extensive review of existing literature on the topic will serve as a basis for new research on areas with existing ambiguity. Method: The search engines used to identify relevant literature from 1987 to 2021 on the topic were Business Source Premier and Google Scholar. The procedure used to narrow the search queries was the use of deliberate keywords and phrases such as "agile software development" and "cost of requirement errors". All results were cross-referenced on both search engines to validate the accuracy of each source. Results: 76 papers containing relevant information to agile project management within the software community have been identified: 55 academic journals, 1 book, 1 conference paper, 1 magazine article, 7 periodicals, 10 professional journals, and 1 textbook. 35 papers are critical of Agile methodology, 16 focus mostly on its strengths, 12 focus mainly on its weaknesses, and 13 contain relevant information regarding the cost of requirement errors.

Introduction and Literature Review

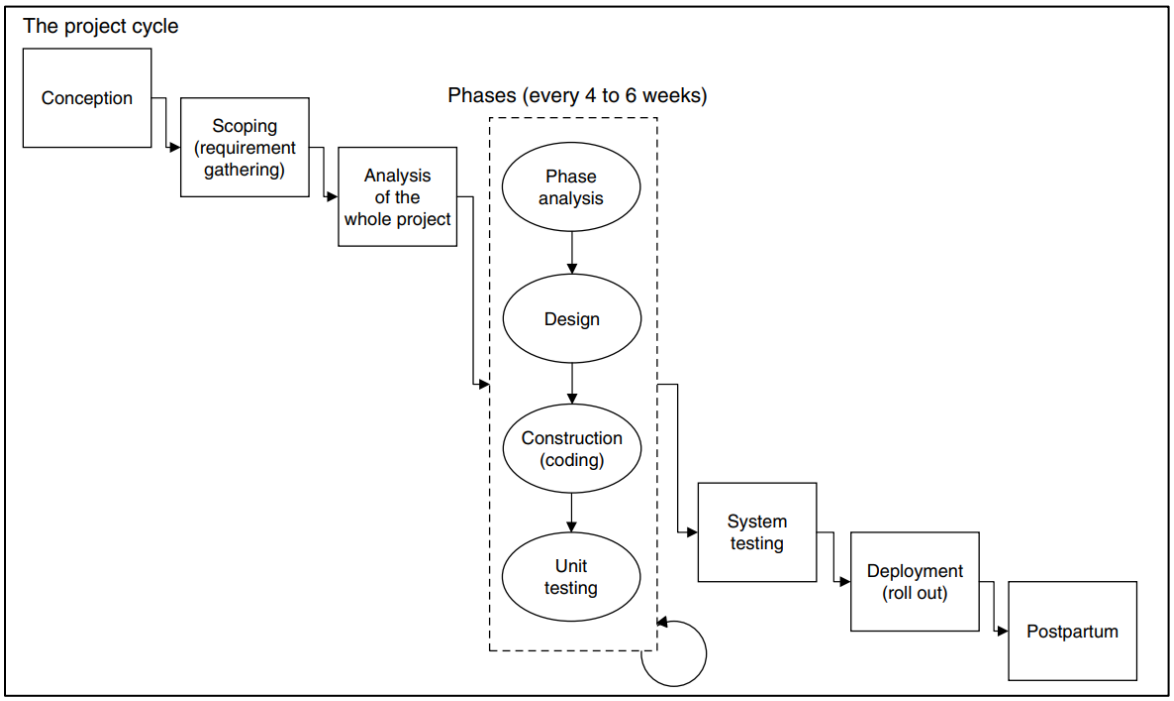
As the dependence on quality software increases with an increasing demand from global infrastructure, the reliance on a precise yet efficient software development process also increases (Luong, 2019). There are several methods of developing software. The two most common are the waterfall-based development cycle, the more traditional approach which defines costs and requirements clearly upfront, and agile software development, a more expeditious path to achieving a goal with partially defined preconditions (Vigden, 2009). Since many organizations think of agile differently, Richard Vigden devised a framework to define "enablers and inhibitors of agility and the emergent capabilities of agile teams" (Vigden, 2009). This served as the groundwork for identifying the advantages and disadvantages for using agile software development over the waterfall approach. Figure 1 is a diagram of the first team observed by Vigden who used an agile methodology while Figure 2 represents the second team that used the waterfall approach. The layout of the Figure 2 reveals the accurate terminology used to describe the software approach since it cascades like a waterfall.

Figure 1 – Development Life Cycle of the Pongo Team



Note. Adapted from Vigden and Wang 2006. A flow following the dotted arrow may happen, but less often.

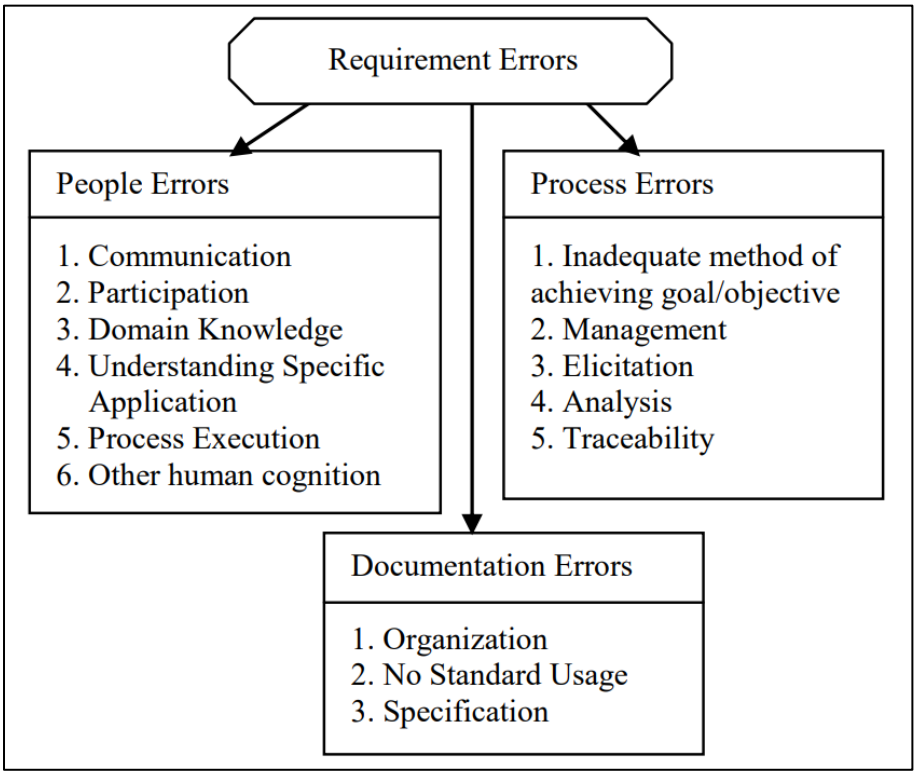
Figure 2 – Development Life Cycle of the SysCheck Team



Note. Adapted from Wang and Vigden 2007.

A critical journal that serves as a foundation for future research on agile software development is from Barry Boehm and Philip Papaccio titled “Understanding and Controlling Software Costs”. Boehm found that “rework typically consumes 30% - 50% of a typical project budget” (Boehm and Papaccio, 1988). This quantification of the impact rework has on project costs plays a large role in influencing the decision organizations must execute when beginning a new software development cycle. If there is a large margin for error when defining requirements at the beginning of a software development project, it may be reasonable to use the waterfall method and clearly define the project scope to reduce future costs of rework. Dean Leffingwell was able to conclude in his book *Managing Software Requirements: A Unified Approach* that “requirements errors can easily consume 25% - 40% of the total project budget” (Leffingwell and Widrig 2000). This builds upon Boehm’s research and further supports the assertion that a high probability of requirements errors will likely increase project costs. Gursimran Walia defined a way of identifying requirements errors using the Error Abstraction Process (EAP) and Requirement Error Taxonomy (RET). The EAP was able to increase productivity while the RET was “useful for improving software quality” (Walia, 2006). Figure 3 presents an accurate organization of requirement errors that arise during a software development life cycle. This RET assists software developers as a catalog of potential errors they may produce within their projects. The first step to solving any problem is by clearly identifying its existence and defining it precisely.

Figure 3 – Requirement Error Classification



By 2015, Pawan Chaurasia recognized the vast number of tools and methods established by researchers to enhance the quality of software development by identifying the possible errors which occur during the project life cycle. First, Chaurasia detailed the stages that lead to failure and focused his paper on the cause of that failure which he refers to as "faults" as shown in Figure 4 (Chaurasia, 2015). He went a step further than Walia and defined an extensive list of all potential errors within a project and a clear description of each as shown in Figure 5 (Chaurasia, 2015). For researchers and developers seeking ways to correct their errors, Chaurasia provides a reference to the academic journal which addresses each possible error. His reference numbers can be found below Figure 5. All articles cited within this review are located in the Agile Literature Directory.

Figure 4 – Failure Life Cycle

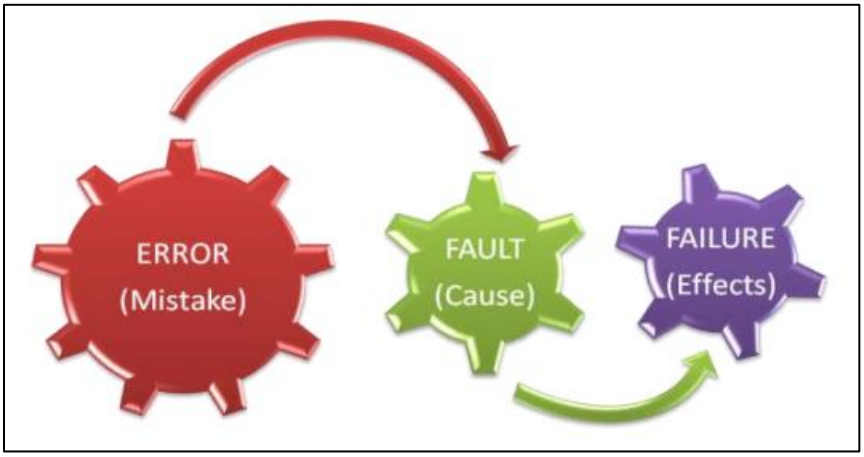


Figure 5 – Requirement Error Taxonomy

SN	Types of Errors	Description	Reference
1	Communication Errors	Insufficient project communication	6
		Requirement editing is not communicated	7
		Lack of communication between developers and users	24
		Poor communication between developers team	11
		Poor communication between development process	25
		Lack of communication information not reach between peoples	26
2	Participation errors	Involvement of users at requirement level	5
		Participate only selected users	27
		Do not involve all the neutrals	7
3	Domain knowledge errors	Lack of domain knowledge	10, 28
		Complexity of problem	11, 12
		Lack of appropriate proper knowledge and information	29
		Lack of proper training	6
		Misunderstanding due to complexity	28
4	Specific application errors	Knowledge of hardware and software specification	31
		Knowledge of input, output and process mappings	32

		Errors in expected output	15
		Requirements are interpreted or predict while solving conflict problems	9
		Knowledge of software interface module	30
5	Process execution errors	Errors in sequence of execution or requirement process	33, 34
		Storage problem, sequence order of stages and missing stages	34, 28
6	Human knowledge errors	Lack of situation awareness problem	14. 26
		Environmental conditions	25
7	Inadequate method	Incomplete knowledge for achieving goals	28
		Errors in achieving goals	28
		Selection of wrong method	36
		Transcription error	8
8	Management errors	Poor management of people & resources	29
		Lack of leadership	13
9	Specification errors	Missing conditions	10
		Errors while documenting requirements	36
10	Organizational requirement errors	Poor organization of requirement	6
		Errors in organizing requirements	22
11	Requirement analysis errors	Selection of incorrect model	35
		Misuse of error solution process	24
		Unsolved issues and problems	10
		Errors while analyzing requirement use cases	24, 37, 38
12	Requirement simulation errors	Inadequate requirement gathering process	10
		Lack of information for source of resources	29

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