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Implementing Agile Testing Methodologies in Banking Software Project

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ABSTRACT

Agile software development has been increasingly popular in a number of sectors in recent years. Financial businesses are used to this tendency since it requires them to respond to changes in their business environments more swiftly. Agile approaches have emerged to address the limitations of old ones. In response to the ever-changing and dynamic nature of the business environment, software development businesses are increasingly implementing agile methodologies. The word "Agile" originally arose in the disciplines of software development and project management around thirty years ago. It is used to research with wide-ranging implications, and it is utilized at different levels and in different circumstances. Scrum, kanban, large-scale scrum (LeSS), spotify model, continuous integration, Scaled Agile Lean Development (SCALeD), and many more variations of the agile methodology have emerged. Initially implemented at the individual software development and team level, agile has developed into projects, programs, solutions, and portfolios over time, ultimately reaching full-service growth into an enterprise level framework. In order to examine agile methodologies, models, and practices in a less researched area of the banking and financial services industry—from software development and modelling to large-scale case study organization levels—a unique methodology to surveying the literature has been presented in this paper. The study's conclusion outlines the contributing variables, best practices, advantages, and lessons that professionals in the banking and financial services industries may apply to create a simplified, agile deployment.

Keywords- Scaled Agile Framework, Large-Scale, Banking and Financial Services, Agile Implementation, Software Development, Business Environment, Enterprise Level, Industrial Sectors, Scope and Implications.

I. INTRODUCTION

Information Technology (IT) is coming under more and more scrutiny in the operations of financial services organizations. Financial institutions account for the majority of IT investment in the US economy, with banks spending up to 15% of non-interest revenue on IT [1]. These days, banks are increasingly susceptible to environmental and social issues. They definitely need an agile framework more than any other institution because of their larger social responsibility [1, 2]. The current quick pace of change makes traditional software development methodologies, such as Waterfall, unsuitable, and a significant percentage of Systems Development (SD) failures are ascribed to them [2]. Furthermore, one industry that uses a lot of big, monolithic legacy systems is banking. It could be more challenging for them to keep up with the rapid advancements in software development [2, 3].

Agile, a term that originated in the software development field and has become popular in the twenty-first century, has always drawn interest from practitioners in a variety of fields and settings [2, 3]. The word "agility" describes a real-time software development process that continuously develops new components while simultaneously generating and learning from client-induced modifications and enhancing client interactions [3, 4]. The agile technique has been reorganized into a number of models, including the Spotify model, Scaled Agile Framework (SAFe), Kanban, and scrum, depending on features, types, and velocity [5]. PMI explains,

"Project management is a particular type of management that helps a process get done and may use a variety of methods and resources".

The definition of agile project management is,

"a method based on a set of guidelines with the goal of providing project management in a way that is much more adaptable and iterative in order to assist customers by

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producing highly valued and unique products with excellent schedule, budget, and quality performance [4, 5]. Over the years, the agile approach—which was first presented as a compartmentalized approach to software development—has evolved into projects, cross-functional solutions, portfolios, and an enterprise-level guiding framework [5, 6]. Banks are intricate, heavily regulated organizations with a wide range of duties and social obligations. The conventional approach of banking functions is well-structured and requires a high degree of confidence to be instilled, whereas agile techniques carry out continuous releases and iterative upgrades [6]. Based on the author's actual experience from the information technology business in 2018, a functional agile framework from one of the top financial institutions has been provided in a logical design [6, 7].

The strategic role and organizational structure of IT as a business function, which extends much beyond the conventional duties of developing, managing, and maintaining IT systems, are also impacted by these changes. Information technologies help businesses maintain and grow their competitive advantages by promoting cost-effectiveness, high-quality goods and services, or even by bringing about disruptive developments in the market. As a result, [7], IT is changing from a supporting role to a cross-functional organizational competence that is essential to the development of new products and processes across a wide range of sectors, making it a crucial component of a digital business strategy. Achieving a speedier time-to-market is frequently necessary to meet business demands [7, 8], which calls for iterative and customer-centric development methods [8, 9]. Thus, agility may be defined as an organization's dynamic capacity to quickly adjust to new market changes, expedite procedures, and actively create their own competitive position through the improvement of innovative performance and flexible resource allocation [9].

The goal of project management is to complete tasks on schedule, within budget, while adhering to the original specifications and agreed-upon quality. Accurate project planning at the outset and subsequent project execution in accordance with this plan are considered the hallmarks of successful project management. Monitoring the projects' development is necessary for their execution [6, 7]. Software projects have long been managed using the same instruments, strategies, and processes as traditional projects for many years. However, most tools, methods, and processes in the field of software engineering are rendered useless due to an inescapable aspect of change. The initial approach was to improve the plan and analysis in order to reduce or stop the modifications [7, 8].

Stabilization efforts have been directed at processes and products without yielding the desired results, but this has never been sufficient to stop or avert change [8, 9]. Studies reveal that rather than working on tasks completed correctly the first time, software professionals spend between thirty and fifty percent of their time on rework. Rework is both relatively usual and acceptable in traditional professions like building and mining, as well as physically achievable [9], especially after certain milestones. It is considered that there won't be any further relevant work when a task is finished [9]. The software industry has been looking for various ways to address the issue of significant change. Prototyping techniques and iterative lifecycle models were created beginning in the 1980s, and agile approaches were later prioritized for managing organizational changes. Figure 1 [9, 10]. These days, a sizable portion of software projects employ agile. Although agile systems welcome change and see it as and opportunity, they lack the range of tools available in plan-driven project management, particularly when it comes to calculating future projections and providing a quantitative status depiction. For software engineering projects, conventional project management tools, processes, and approaches might be modified or swapped out for more efficient ones in order to deliver the best of both worlds [10]. [10, 11].

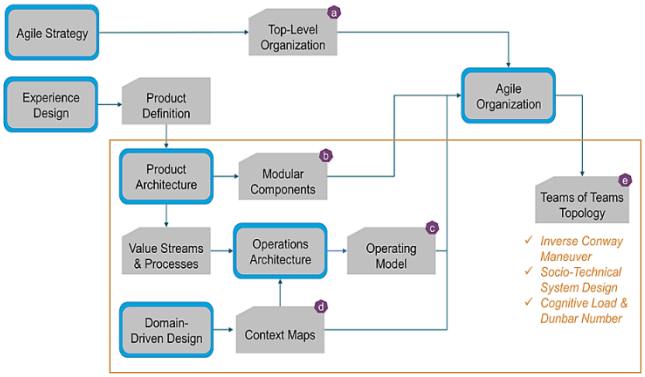

Figure 1 An agile framework's architectural schematic for a bank. [11]

Although banks employ a variety of agile techniques, SAFe is the most often utilized approach [10, 11]. SAFe is explained,

"As a collection of guidelines and best practices with an implementation roadmap to help firms through the transition, this approach seeks to scale agile approaches for large enterprises" [11].

This difference in how agile techniques and banking operations are implemented presents research problems and opportunities for a thorough literature analysis to learn more about the agile fitting elements in the Banking and Financial Services (BFS) industries. The following list of research issues is relevant to this study [11, 12].

- ***RQ1:*** *What are the drawbacks of reviewing the body of literature in the banking and financial services industries?*
- ***RQ2:*** *Are there any best practices from the body of research that might be applied to the BFS domains and corrective actions that could be derived from the difficulties?*
- ***RQ3:*** *While banking frameworks are more organized and follow a traditional approach, agile methods operate on continual updates. What success factors enable the*

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combination of agile techniques with banking functions to function?

The goal of this article is to take an unusual strategy to survey the literatures of agile methods, designs, as well as procedures from the development of software and modelling to large-scale case study organization levels and determine various causal factors, challenges, advantages and lessons for practitioners of BFS sectors to envision successful Agile implementation. This is based on the first literature review and the research inquiries that emerged from it [11, 12].

II. LITERATURE REVIEW

Before creating the literature search strategy, there was a wealth of generic literature on agile approaches to project management and software development. Following the establishment of a literature search strategy and the use of keyword filtering criteria, such as "banking" and "agile adoption" (explained in more detail in the Methodology section), fewer public domain papers that aligned with the study's research objectives were found.

2.1 Modelling and Agile Software Creation

An exploratory questionnaire on agility for traditional software sectors reveals that agile project management is the result of a number of software development techniques created specifically for software developers. Notable books mention numerous forms of agile software development, including scrum, adaptive (lean) development, dynamic development of systems method, [12], extreme programming, and scrum. These sources attest to the fact that agile project management originated from the use of agile to software development projects. This special paper investigates new project scenarios and agile methods and enablement in a non-software business [13].

The authors of this seminal study carried out a systematic examination of the literature and identified six agile project management techniques, including the use of product vision concepts, straightforward project plan conversation tools and procedures, iterative planning, self-managed and self-directed teams during creation, and routinely tracking and improving processes [15].

Results of this exploratory survey demonstrates that four agile project management practices most frequently utilized by non-software companies with reference to project plan were, updating frequency, fig. 2, [15, 16], use of minimal textual description to refine the project plan, coordinated and mutually responsible teams for plan development, and variance of iterative planning applied.

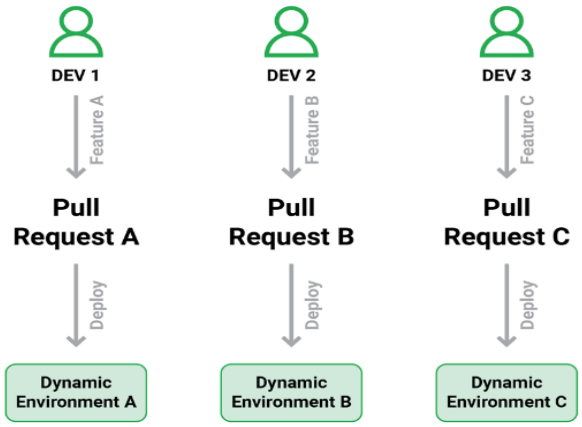

Figure. 2 SDLC optimization through redesigned Continuous Integration. [15],

One of the main tenets of agile the development of software is the delivery of functional software to end users in periodic, iterative sprints with a real-time relationship between business processes and software production [15, 16].

The agile declaration for software development, which applies the principles of systems thinking to software creation such as creating working software, responding to changes, connecting with customers, and so on, was prepared by the original proponents of these agile methods. This agile the manifesto has been adopted and scaled by established businesses in an agile manner. This fascinating article on agile models first addresses a completely agile model and then goes on to explore how Spotify has adopted agile principles across the board for their whole organization [15].

The results of integrating logical, unified processes with agile methodologies (such as agile modelling, test-driven architecture, database refactoring, as well as so forth) in a small- to mid-scale banking project that seeks to replace the conventional client-server-based construction with service-oriented architecture and automate the operations for managing numerous concurrent customer meetings with a single authentication feature [16, 17].

2.2 Project management and the use of agile methods in BFS industries

The degree of favourability conditions in the implementation of agile methods for overseeing initiatives and developing software reveals that companies with less hierarchy, flexible interactions, a focus on people, involvement from customers, and assignments with frequent modifications to specifications are better suited for adopting agile techniques [17, 18].

The major interactions of agile the digital revolution using bizdev and agile techniques in a large-scale case study bank are covered in depth in this seminal work [18]. These approaches, which are distinguished by independent and varied teams and experimental development aimed at attaining shorter times to market and customer-centric digital solutions, were chosen for the case study bank's the digital revolution [18].

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The application of an agile approach to compliance with regulations projects for a single qualitatively financial services case investigation and another calculating regulatory study demonstrates that the benefits outweigh the drawbacks, which include inadequate testing, uncompleted documentation, and difficulty realizing solutions. Agile is quickly evolving into the state-of-the-art dominant methodology for projects [18, 19]. The advantages include collaboration, flexibility, individual autonomy, interpersonal autonomy, streamlined installations, thus and increased productivity. This article has covered how agile project management supports ongoing innovation, adaptation of people and processes, and the delivery of cutting-edge goods to clients in the face of extreme uncertainty.

III. RESEARCH METHODOLOGY

Through the use of well-known research databases including Elsevier, Sciences Direct, MDPI, Emerald, Springer, Scholar Space, Researcher Gate, IEEE Explore, Social, and others, this paper has conducted a unique and methodical review of the available literature. The method of search was developed in accordance with the objectives of the research survey, and the appropriate pieces for review were found using keywords like "agile approach" or [18], "agile project leadership" or "agile adoption," and "banking," however or "banking business" or "financial services." The duration of the search was set as 2010–2022, which covers ten years of recent publications for review that correspond with the development of cutting-edge Agile techniques like SAFe, [19, 20], Continued Integration, Less, and so forth. The number for research (56 articles) relevant to agile deployment in the finance and banking sectors has been noted in the search results for the specified criteria for searching and time period [19]. After these articles had been retrieved and evaluated, a specific group of 16 articles that met the search parameters and the predetermined goals (as demonstrated in Table 1) were found, providing further context for the study issue.

Table 1 Results of your search based on your goals and search criteria. [19]

Search Database	Number of papers
Elsevier	1
Science Directs	2
Springers	3
Emerald Journal	2
IEEE Xplore	1
Scholar Space	1
SSINTELO	1
MIT Sloan Management Review	1
Research Gates	1
Journal Of Applied Research In The Digital Economy	1
Other: JP Morgen Chase Bank	1
Total	16

This technique makes it easier for this systematic work to determine different causes, difficulties, advantages, [19, 20], and lessons from the chosen articles for a fresh literature review. Their insights have greatly aided in classifying the literature study into three primary areas: factors leading to large-scale agile execution in financial services and financial businesses and other traditional industries; agile application development and modelling; and adopting agile methods and management of projects in both the financial and banking industries [20, 21]. These themes helped guide the author in an exhaustive approach to analysing the results of the research survey.

IV. RESULTS AND DISCUSSION

The initial phase of the agile evolution over the last three decades, which began in the development of software and modelling and spread to a variety of domains like methods offspring's, management of projects, a cross-functional agility as well, portfolio-level deployments, enterprise adoption of technology, and full-service transformations, is symbolized by the findings of this recently published survey of studies with the development of three major themes [20, 21]. The evidence from each of the three primary themes of the literature review was synthesized [20, 22], and the challenges were used to identify the contributing variables and remedies. Success characteristics and standards of excellence were then summarized in order to analyse how well the organization fit the requirements of adopting agile in the field of financial services and banking [21, 22].

4.1 Identifying Causing Factors and Corrective Actions from Difficulties

When merging the agile continuous improvement approach with the conventional framework, there are scheduling and cost-effectiveness concerns that arise during deploying and tests [22, 23]. The main answer to these challenges is to optimize the testing framework [24]. Owing to the somewhat favourable results of implementing agile techniques for projects in which traditional and agile methodical practices exist alongside in the advancement of information technology, remedial factors include methodical flexibility, implied information, establishing requirements rigorously, and teams working together [24, 25]. In order to improve working connections, teammates should have regular negotiating sessions to discuss their priority tasks with members of supporting groups. This will solve challenges with agile implementation that arise from a growing variety of objectives and responsibilities for team participants [25]. Planned regulation implementation dates present obstacles when using agile methodologies in regulatory compliance projects, as they limit the opportunity for pilot implementations and regulatory function changes [26, 27].

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In order to increase productivity and compete with fin-tech companies, banks in some significant regions still need to climb a high learning curve when it comes to using agile methodologies and adopting an agile mind-set [28, 29]. Traditional banking characteristics and the stability imply challenges for change, external rules and regulations complicate changes in the banking sector, and significant changes may jeopardize external stakeholder trust, to name a few specific challenges facing the sector.

4.2 Key Success Factors and Recommended Procedures for Examining Agile Fitment

Many lessons, success factors, and best practices have been discovered based on the findings of numerous literatures. These insights are helpful in analysing how well agile techniques fit the adoption of agile practices in the financial services, banking, and conventional sectors. Agile project management techniques have been found to be applicable in conventional non-software sectors when creative projects with versatile leadership approaches, cross-functional, self-autonomous teams, and knowledgeable managers are possible [26, 27]. Robust data demonstrates the beneficial relationships between digital software creation and business functions, which are bolstered by completely agile models as constituents of agile software development concepts. The agile project team frequently embraced the open communication and honesty of agile modelling while transforming traditional techniques to agile methodologies [28].

According to the two sections of the results and discussion [29], the investigations and findings of the comprehensive examination of literatures talked about the evolution, difficulties, solutions, best practices, and lessons learned of agile from programming and modelling to various stages (methods, initiatives, cross operations, portfolios, massive amounts business, full-service, and so on) or businesses (software growth and development, production, both of banking, finance, and so on). In order to help practitioners plan for effective agile applications in the BFS domain names this article takes a unique approach to reviewing the research on agile methodologies, models, and practices at different tiers. Additionally, it identifies the corrective measures and success attributes of agile fitment in the Mortgage Banking and Financial Services industries [28]. These are outlined in Table 2 Rehabilitation Measures and Success Attributes [24, 29].

Table 2 Corrective Actions and Success Factors. [30]

Agile Method / Level / Industry	**Remedial Measures**	**Success Attributes**
The conventional structure of a bank is merged with agile continuous integration.	Regression examination is optimized for the testing framework in order to be co-integrated with the Agile methodology.	The adoption of agile modelling concepts, which prioritize transparency and honesty above traditional frameworks, results in a notable shift.
Adoption of Agile techniques in a bank's IT project is favourable.	Flexible methodology, implicit knowledge, rigorous requirement definition, and cooperative teams.	Able to adjust to changes, continuously manage the project timeline, establish challenging performance targets focused on the needs of the client, and create reasonable financial benchmarks.
The use of agile project management in conventional, non-software businesses.	Better working connections are developed via regular negotiating sessions between team members and support groups on tasks that are prioritized.	Innovative initiatives with skilled managers, cross-functional, self-autonomous teams, and a flexible management style.
Organizing projects for regulatory compliance.	Timeliness and innovation are addressed by a blended framework that combines an agile approach with a conventional framework.	Increased adaptability of Agile development methodologies combined with scheduled testing and deployment.
Agile adoption in geographically competitive environments (German Banking as one example).	Agile mentality throughout the Bank would increase competitiveness versus Fintechs and efficiency.	In order to restructure typical projects, agile CoE, agile coaches acting as product owners, and COBIT implementation are used to identify risks and mitigating controls.
At the financial institution's portfolios level, agile fitment.	Combine agile frameworks that are adaptable and traditional frameworks for portfolio	Combining all projects into a single portfolio, using resources effectively, and holding regular

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	management, or use hybrid approaches like agile scrum and Kanban.	status meetings for the portfolio.
Confidence of stakeholders in large-scale agile transformations (SATP, SAFe).	Improved customer engagement may result from top management's involvement from the beginning and throughout the Agile deployment process.	Innovation culture, strategy alignment, delegation of some power and tasks by Senior Management, and pilot study for early adoption.

V. CONCLUSION

This study assesses previous research on agile approaches, models, and practices in a methodical and thorough manner, including everything from software development and modeling to large-scale case studies at the organizational level in the understudied banking and financial services industries. The results and analysis of this study demonstrate that when practitioners in the banking and financial services industries seek to embrace agile implementation, they need to consider a variety of difficulties, cause variables, remedies, best practices, and success features. There are difficulties and barriers in the way of the agile transformation in this industry because of the old banking ideals and methods. When implementing agile methodologies, models, and practices, practitioners must balance adhering to regulatory complexity with teaching and service the client to build reliable and enduring connections. Section 4 and its sub-sections present a thematic summary of agile implementations using cutting-edge methods at various levels, primarily for the financial sector and banking and finance domain. The overall overview includes corrective measures and success characteristics, and it may offer practitioners useful guidance on reduced measures and critical success factors for adopting agile practices. Evidence from the literature points to potential directions for further study in the areas of classifying IT Governance systems, implementing state-of-the-art hybrid agile methodologies, and expanding the application of agile to other sectors.

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