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IT PROJECT MANAGEMENT STRATEGY IN OVERCOMING DIGITAL LIBRARY TECHNICAL CHALLENGES USING AN AGILE METHOD APPROACH: LITERATURE REVIEW

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Abstract

Uncertainty is a challenge in managing current and future projects, requiring a more flexible and dynamic project management approach. Therefore, the Agile approach is considered as a potential solution to overcome this problem. Agile, which has been widely applied in various industrial sectors, is recognized as a practical and flexible project management method. However, in the context of digital libraries, technical challenges are considered as aspects that can directly affect the project budget and schedule. Although Agile is known for its ability to adapt quickly, uncontrolled change can potentially result in project delays and excessive costs. This article aims to investigate the challenges in this area and identify the best strategies to overcome them. Through systematic literature observations (SLR) including sources such as IEEE Explore, ScienceDirect, Emerald Insight, and ProQuest. Five categories of challenges and seven specific issues were identified. Twelve key strategies were also identified to overcome these challenges. It was found that the most significant challenges came from the Digitalization Process, Digitalization and Information Access, Project Backlog, Broad Coverage Requirements, and Culture & Behavior. These areas are considered key challenges due to their potential to cause delays and cost overruns in projects.

Keywords*: Management, Digital Libraries, Agile Projects, Strategy, Technical Challenges.*

1. INTRODUCTION

The development of information technology has had a major impact on various sectors of life, including digital libraries. Digital libraries are a modern solution to provide efficient and scalable access to information [18]. However, just like the evolution of technology, digital libraries are not immune to evolving technical challenges. In the face of this complexity of change, project management becomes a critical cornerstone to ensure the successful implementation of information technology (IT) in the context of digital libraries [20].

The problems that occur in this digital library are difficulties in converting from analog to digital formats, difficulties in providing access to library collections, especially in large-scale digitization of content, lack of clarity or detailed planning regarding the tasks or work to be completed during each iteration of the project, unreasonable and unsystematic change requests, poorly defined goals, members are not used to change, a lot of resistance to change.

The importance of effective project management strategies in addressing the technical challenges of digital libraries is increasingly apparent. One approach that is becoming increasingly popular and relevant in managing IT projects is the Agile method [8]. This method offers the flexibility and adaptability needed to deal with rapidly changing technology [4]. This research focuses on IT project management strategies using the Agile method approach to overcome technical challenges in digital libraries. The literature review covers the basic concepts and implementation of Agile methods in similar projects.

In a journal entitled "Analysis of Library Information System Design Using the Waterfall Model in Increasing Technological Innovation", I found the drawback of using the Waterfall Model is linear, which means that each stage must be completed before moving on to the next stage. This makes it less flexible in responding to changing needs or problems that arise along the way.

Several studies have shown that IT project management strategy factors that determine success in overcoming technical challenges and in influencing the success of implementing Agile methods in digital libraries. In order to identify the influence of these factors, the Agile method is used or known as iteration [9]. Based on the Agile method, it can be grouped into technological factors [1], [3], [7], [10], technical factors [4], [8], [9], [14], [23], [25], [26], [29], management strategies [2], [5], [6], [11], and Agile method contribution factors.

While the purpose of applying Agile methods shows the achievement of better results and responsiveness to the dynamics of the digital library environment [3], this is indicated by the existence of organizations that feel the increased effectiveness of IT project management in dealing with the technical challenges faced by digital libraries [17], [21], [28].

By engaging with current literature, this research aims to provide an in-depth understanding of the application of Agile methods as a strategic tool in digital library IT project management, with an emphasis on overcoming technical challenges. The results are expected to make a positive contribution to the development of IT project management and digital library management in an ever-evolving era.

This structure will be explained as follows. First, we describe the research methodology, including the search process, inclusion and exclusion criteria. We also demonstrate how we synthesized the data and used two research questions (RQs), which were then used to answer questions that can help understand the technical challenges to digital libraries. Secondly, we present and discuss our findings regarding the application of agile methods in overcoming the technical challenges of digital libraries, and how information technology project management strategies towards digital libraries. Finally, we will explain the rationale for suggestions for further research.

Based on the above, the main objectives of this journal are:

ID	Research Question	Motivation	Research Object
RQ1	Apa Saja Tantangan Teknis Pada Perpustakaan Digital	Mengelompokkan artikel-artikel relevan terkait strategi manajemen proyek teknologi informasi dalam menghadapi tantangan teknis pada perpustakaan digital	
RQ2	Manajemen TI dalam Mengatasi Tantangan Teknis pada Perpustakaan Digital (Q2)	Menyediakan sebuah ringkasan dari penerapan metode Agile dalam mengatasi tantangan teknis pada perpustakaan digital	Hasil Kinerja Metode Agile dapat Berperan Pada Perpustakaan Digital

Figure 1: Main Objectives of the Journal

2. RESEARCH METHODS

Identification and Collection of Literature Review

At this stage, we selected literature using the keywords strategy, project management, information technology, digital library, and agile. After the literature search, we ensured that the articles were relevant to the research. Another method was the conventional and digital literature review approach to test and validate their level of relevance to the initial articles.

1. Problem Analysis (PICOC)

The questions were designed to make the research review more focused and structured. Research questions were designed by determining Population, Intervention, Comparison, Outcomes and Context (PICOC) (Kithcenham & Charters, 2007). The following table 1 illustrates the PICOC structure used:

PICOC	Detail
Population	Research focusing on technical challenges in digital libraries.
Intervention	Analyze research in publications that discuss the technical challenges of digital libraries.
Comparison	There is no explicit comparison in this context as the main objective is to find out the performance results of agile methods can play a role in digital libraries.
Outcome	Knowing the technical challenges that exist in digital libraries, knowing the performance results of agile methods in overcoming the technical challenges of digital libraries.
Context	Research data is taken from national and international journals such as : ScienceDirect or Elsevier.

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2. Data Collection Using the PRISMA Method

Over the past decade advances in systematic review methodology and terminology have required updating the guidelines (Beller et al., 2013). (Page et al., 2020) in their research designed updates in the PRISMA 2020 method to replace the PRISMA method in 2009. There are new reporting guidelines that reflect advances in methods for identifying, selecting, assessing and synthesizing studies. The purpose of the study was to make modifications to the structure and presentation of data items to facilitate the implementation of the PRISMA method.

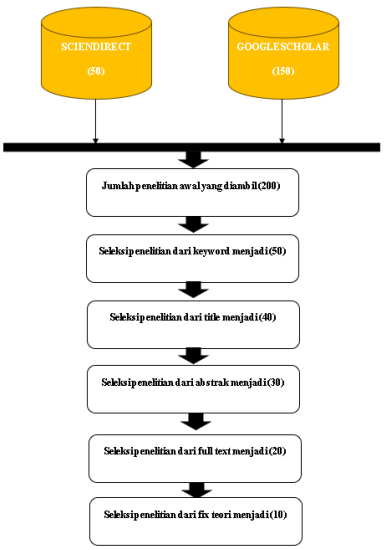

Figure 2: Primary Study Search and Selection.

3. Search Process

The search process was conducted by searching internationally published scientific journals. The search focused on the years between 2020 and 2023, with themes related to IT project management strategies in overcoming the technical challenges of digital libraries using Agile methods. By applying filters for the year range and issues used, around 200 articles were found. Re-filtering was done by matching the most relevant themes, resulting in search results of around 30 articles. Then, a detailed filtering was conducted by focusing on management strategies that affect technical challenges in digital libraries, and the search was only conducted on 30 articles. For more details on the main distribution of the publication of each article can be seen in Figure 3.

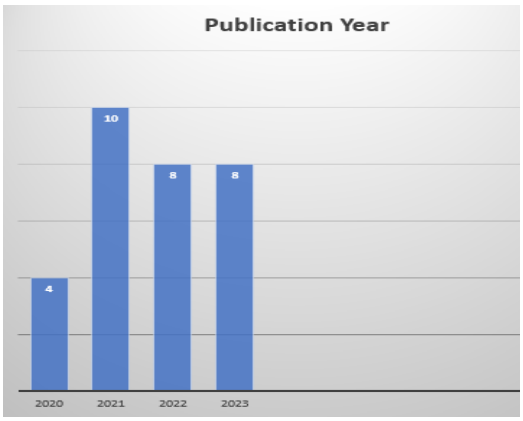

Figure 3. Number of articles published between 2020 – 2023

4. Agile Method

The use of agile methods in this research is to make continuous adaptations to digital libraries, as for this research that I use there are two, the first is planning, test, and launch.

4.1 Planning

Planning is a key stage in the agile methodology that allows the team to understand project goals, identify needs, and plan steps to achieve the desired results. Planning in this study is to solve existing problems in digital libraries such as digitization processes, digitization and information access, project backlogs, broad coverage requirements, and culture & behavior.

4.2 Test

At this stage in order to solve the problem of the palnning that has been made, namely:

1. Agile enables flexible response to change. Agile adaptability helps to cope with complexity and change during the digitization process.
2. Agile brings focus on deliverables that can be implemented in a short time. The challenge of providing adequate access to library collections can be addressed quickly through planned iterations.
3. Agile enables iterative planning and updates in handling the project backlog. This flexibility helps maintain consistency in the design standards of distributed teams and overcomes the problem of lack of defined phases.
4. Agile can accommodate scope changes during planning. Helps deal with requirements that are too broad in scope and reduces risks related to unreasonable changes.
5. Change and continuous improvement are basic principles of agile. Agile can be implemented as a continuous change solution in the context of organizational culture and behavior. Helps overcome resistance to change.

4.3 Launch

In the launch stage, the results of planning and testing are applied, a more detailed explanation of which can be found in the results and discussion section in Figure 5.

Data Synthesis

Data synthesis aims to show the distribution of topics related to information technology project management strategies and technical challenges of digital libraries using agile methods in the form of mapping. At this stage, each article will be accurately selected, which will then record all the information obtained from each selected paper. Researchers used Mendeley and Microsoft Excel as tools to collect and integrate data related to research topics that have a relationship with

information technology project management strategies in overcoming digital library challenges in the form of research themes, theories, research methods, and results obtained [7].

1. Research Theme

Determination of this research theme aims to be able to understand more deeply the science related to the field of information technology project management strategies in overcoming digital technical challenges. Determination of this research theme is due to the existence of several scientific articles that have research themes that are related to each other [8]. In this research, topics related to the field of information technology project management strategies in overcoming digital technical challenges are management strategies, such as technical challenges in digital libraries, with the application of Agile methods. In addition to the topics that became the main categories, the researcher added several subcategories that were used in the article but were not explicitly related to the research theme. The purpose of using these subcategories is to strengthen the theories and concepts that will be discussed in this study.

After grouping the research themes from all the articles obtained, the most common theme found was IT project management strategies in overcoming technical challenges with a percentage of 50%. The second most thematic theme is the application of Agile methods to technical challenges in digital libraries, with a level of 27%, and the third theme is digital library, with a percentage of 23%. For more details on the percentage grouping of research themes can be seen in Figure 4.

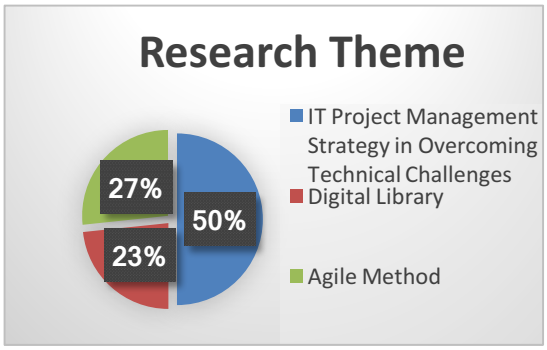

Figure 4. Number of articles based on the research theme

2. Theoretical Basis

Agile methods are widely used to more easily adapt to changing needs and greater flexibility in software development [8]. To understand what factors influence the application of agile methods in an organization's digital library, and how IT project management impacts organizational performance. Following this situation, it is necessary to map the theories commonly used in research on IT project management strategies in dealing with technical challenges in organizations to understand the factors that influence the application of agile methods in digital libraries in organizations and how they impact organizations.

The most widely used theory to find out what factors influence the application of agile methods in organizations or related to IT project management strategies in overcoming technical challenges in digital libraries in organizations is to use agile methods or known as iteration [23], and learning resources [25]. Based on the theory mapping conducted, it shows that each of the eight articles uses agile methods and learning resources theory to discuss topics related to IT project management strategies in organizations. Collect management theory ranked third, with a total use of three articles, and DeLone & McLeon theory ranked fourth with a total use of two articles.

3. RESULTS AND DISCUSSION

What are the Technical Challenges in Digital Libraries (RQ1)

Many studies have been conducted previously with a discussion of what technical challenges occur in digital libraries in organizations using Agile methods [4], [8], [9], [23], [25], [26]. Therefore, in this study, the focus of researchers is what technical challenges occur in digital libraries.

Table 1. List of Technical Challenges of Digital Libraries in Organizations

Technical Challenges	Problem	Reference
Digitalization Process	Difficulty converting from analog to digital format.	[3], [7], [10], [17], [21], [28].
Digitalization and Information Access	Difficulties in providing access to library collections, especially in large-scale digitization of content.	[2], [9], [12], [13], [18], [19], [24], [27], [29].
Project Backlog	Lack of clarity or detailed planning regarding the tasks/work to be completed during each project iteration.	[5], [7], [8], [10], [14], [29].

Wide Coverage Requirements	• Unreasonable and unsystematic change requests. • Objectives are not well defined.	[1], [4], [6], [18]
Culture and Behavior	• Members are not used to change. • There is a lot of resistance to change.	[5], [11], [15], [16], [20], [22].

From Table 1, the first category of challenges is the difficulty of converting from analog format to digital format to control scope and change [14]. We are aware that some organizations face obstacles in the process of converting or transforming information that was originally in analog form into digital format [10], [14]. This problem becomes complex because organizations "ideally" have IT Service Management (ITSM) to convert from analog to a format that can be managed and stored by electronic devices. Due to the difficulty of the digitization process, organizations have limited accessibility and increased costs, as well as the potential loss of data or information. This will potentially cause a negative impact on various aspects of the organization in a digital environment.

The second category of challenges is digitization and information access [3]. The problem in this category is the challenge of providing users with adequate access to collections, especially when digitizing content on a large scale [3], [21], [30]. This problem can result in limited user access, suboptimal resource management, and limited innovation and development.

The third category in the research is project backlog, another challenge in agile software development is maintaining consistency in the design standards of distributed teams [8]. In addition, the lack of defined phases for each iteration [9], [25], [26], any sudden changes in the middle of an iteration, can create problems when completing the project backlog.

The fourth category of challenges is overly broad requirements identified as a significant challenge among the 20 challenges of agile software development [28]. This is because unreasonable and unsystematic changes [28], can put the development team in trouble, resulting in overlapping tasks in their duties. The next problem we identified is that goals are not well defined and the completion status is unclear. Agile on the other hand, accepts scope changes during planning [14], [9].

The last category is related to culture and behavior. According to Le Grand and Rebecca (2019), one of the challenging cartographies is culture and behavior. Agile methods are a solution of continuous change and improvement [4]. It is challenging in terms of scope and technical changes because some members of the organization are not used to change and have a lot of reluctance to change [11], [16], [22].

What are the IT Management Strategies in Overcoming Technical Challenges in Digital Libraries (RQ2)

How this is done answers RQ2. The extracted IT management strategies were collected and analyzed, then mapped to the sub-section challenges. The mapping results can be seen in detail in Table 2.

Table 2. IT Management Strategies in Overcoming Technical Challenges

Category	Solution	Reference
Difficulty converting from analog to digital format.	• Conduct an in-depth analysis of the conversion that will be digitized. • Create clear and standardized conversion guidelines. • Apply the Best Practices in Digitizations method.	[8], [3], [21], [17], [30]
Difficulties in providing access to library collections, especially in large-scale digitization of content.	• Implementing the Strategy Integration System method. • Build scalable infrastructure . • Organize training for staff and users on new technologies, search tools, and other features.	[13], [23], [10], [7], [1], [28], [3], [21]

No clear phase in each iteration	• Clarify the components (objectives, resources, schedule, tasks) in each iteration of change planning that occur during the iteration are prioritized. • Remove checkpoints at each iteration	[8], [23], [26], [14], [10], [9], [4], [25].
Unreasonable and unsystematic change requests, and poorly defined objectives.	• Commitment to planning in agile methods. • Important stakeholders assess progress and respond. • Implement change control methods.	[19], [2], [18], [24], [12], [13], [20], [5].
Members are not used to change and there is a lot of resistance to change.	Apply the Change Management method.	[13], [9], [29], [6], [27], [11], [15], [16], [22].

From Table 2, we understand that different solutions can be applied to more than one problem category. From an organizational point of view, we now know that an Agile mindset should be developed within the organization. In digital libraries, analysis of the conversion process is important to understand the complexity and potential technical issues arising during digitization, creation of clear and standardized conversion guidelines to help guide project teams on standardized steps to overcome conversion difficulties by applying Best Practices in Digitalizations methods to help ensure that the conversion process is carried out with the best suitable methods.

Providing adequate access in large-scale digitization of content is a major challenge. Applying the strategy integration system method helped align the project strategy with the library's access needs. The development of scalable infrastructure, a crucial step to respond to the challenge of providing access on a large scale. A training program for staff and users, aligned with the solution, helped improve skills and understanding of new technologies, search tools, and other features that support access to digital collections.

Lack of clear phases in each iteration can lead to unclear project planning. Clarifying the components of each iteration, such as objectives, resources, timelines, and corresponding tasks helps in more purposeful planning. Removing checkpoints at each iteration, provides the necessary flexibility to respond to changes more effectively.

Unsystematic change requests can disrupt the flow of the project. Commitment to planning in agile methods helps reduce the risk of unreasonable change requests. Involving stakeholders to assess progress and respond helps keep project goals well-defined. Applying change control methods provides a framework for managing change in a controlled and systematic manner.

Team members' resistance to change can hinder project progress. Applying change management methods helps to better manage change, which can reduce resistance to change and improve team member adaptation.

Performance Results Agile methods can play a role in digital libraries (RO1, RO2)

Table 3. Application of Agile Methods and Problem Solutions

No	Problem	Solution (application)
1.	Difficulty converting from analog to digital format	Agile enables flexible response to change. Agile adaptability helps cope with complexity and change during the digitization process.
2.	Digitization and access to information	Agile brings a focus on deliverables that can be implemented in a short period of time. The challenge of providing adequate access to library collections can be addressed quickly through planned iterations.
3.	Project backlog	Agile enables iterative planning and updates in dealing with project backlogs. This flexibility helps maintain consistency in the design standards of distributed teams and

		overcomes the problem of lack of defined phases.
4.	The coverage requirements are too broad	Agile can accommodate scope changes during planning. Helps deal with overly broad requirements and reduces risks related to unreasonable changes.
5.	Culture and Behavior	Change and continuous improvement are the basic principles of agile. Agile can be implemented as a sustainable change solution in the context of organizational culture and behavior. Helps overcome resistance to change.

The table above provides an overview of the problems faced in digital libraries and how the application of agile methods can be a solution to each of these problems.

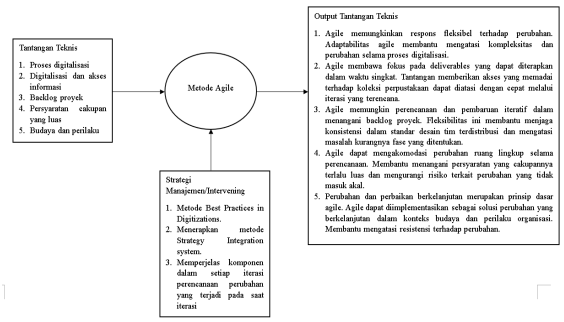

Figure 5. Research Model

4. CONCLUSIONS AND SUGGESTIONS

In the research entitled "IT Project Management Strategies in Overcoming the Technical Challenges of Digital Libraries Using the Agile Method Approach: A Literature Review", the following conclusions were drawn:

1. The major challenges in digital libraries involve the digitization process, digitization and information access, project backlog, wide coverage requirements, culture & behavior which are considered as triggers for delays and overspending in projects.
2. The study provides an in-depth understanding of the technical challenges faced by digital libraries, providing valuable information to organizations and practitioners.
3. Five challenge categories and seven additional issues provide a holistic view of the complexity of technical challenges in the digital library environment.
4. The use of agile methods, particularly in addressing technical challenges, scope, and change, is recognized as a practical solution based on the study findings.

The suggestions for this research are as follows:

1. Strengthen training and team capacity, organize regular training for digital library staff and users on new technologies, search tools and other features to improve understanding and ability to deal with technical challenges.
2. Scalable infrastructure development, invest in scalable infrastructure development to support digitization and information access at scale, to overcome the challenges of providing access to library collections.
3. Increased commitment to agile planning, ensure commitment to agile planning by involving key stakeholders in assessing progress and responding to change, and applying change control methods to manage change in a controlled manner.
4. Emphasis on Best Practices, implement clear and standardized conversion guidelines and Best Practices in Digitizations methods to ensure the conversion process is done in the best way suitable for the organization.
5. Effective change management, implement Change Management methods to better manage change, reduce resistance to change, and improve team members' adaptation to changes that occur.

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