

# Challenges and Solutions of Agile Software Development Implementation: A Case Study Indonesian Healthcare Organization

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**Abstract**—One healthcare organization in Indonesia has implemented Agile software development (ASD) to complete software development. The organization's problems are post-deployment system bugs, and some software development projects must carry over to the following year. This study aims to assess and provide recommendations for improving agile software development by identifying the challenges faced. Research conducts literature reviews on previous research to identify challenges in ASD in several organizations. Research is also conducted using quantitative methods by surveying software development teams to validate implementation challenges and provide recommendations for these challenges. The results of this study were in the form of a survey attended by thirty-one respondents. The study results found that 14 challenges were faced in other organizations, and 11 were faced by one healthcare organization in Indonesia. Healthcare organizations in Indonesia can apply recommendations to make awareness related to understanding agile software development culture and make adjustments to project documentation by aligning with agile values.

**Keywords**—Agile Software Development; challenge solutions; IT projects; information technology; application implementation; healthcare organization; Literature Review

## I. INTRODUCTION

Information technology (IT) can improve customer service and become an efficient tool. IT implementation is often considered one of the most challenging initiatives for organizations, including in the government sector [1]. Several organizations have changed their software development methods from Waterfall to Agile. By adopting the Agile method, organizations get several benefits, such as shorter time, increased flexibility in handling changing needs, increased productivity, and better alignment between business and IT [2]. Agile methods also need to maintain predictability and controllability [3]. Another agile principle is to welcome changing software development needs and produce software that works regularly with a preference for shorter timeframes [4].

However, transforming into an organization operating in the public sector, especially in an organization with a complex hierarchical structure such as government, is not easy to change the existing bureaucracy. The existence of layers of bureaucracy can hinder the application of agile methods [1]. Large organizations usually have many products and products that are too large for a single team to

develop. The condition creates scaling problems, which require head adaptation and expansion of basic dexterity methods [2]. The problem is also the case in Saudi Arabia, where participants agreed that adopting Agile can be difficult when dealing with customers from government bodies, as the working style tends to be based on Waterfall. They are usually unwilling to be involved in the development team and require comprehensive documentation.

One of the organizations in Indonesia provides health services to the people of Indonesia of 265 million participants. In providing health services to all participants, the organization collaborates with health facilities in Indonesia, such as hospitals or doctor's clinics. The organization is a public legal entity, a government, and a bureaucrat with racy characteristics. The organization runs the business using technology and digitalization. The demand for IT development is increasing, in addition to the demand for speed in project completion, and the limited numbers of teams are challenges in completing system development. Organizations have IT resources in the software development process.

Ninety-six applications are run and developed by the organization's development team, most of which use the waterfall method. In 2022, project development will be dominated by projects with a high urgency category, with a percentage of 43%, as shown in Fig. 1 [5]. This development request requires a rapid completion of development, but there are unclear requirements due to policy changes in the organization.

The organization in the case study implemented an agile software development project. However, in its implementation, standards or frameworks have not been implemented as a reference. The problems were that some projects carried over to the following year, and there were complaints from application users post-implementation. The number of bugs adds work to the I IT development team, where the same group currently holds the development and maintenance functions [6].

In study [6] by looking at some of the existing problems and impacts, evaluating and improving the software development process using Agile is necessary. This evaluation is for the software development process to become better, achieve targets, and produce quality products as stated in the organization's vision and mission and the organization's vision and mission. Evaluation is being done

to find out the challenges and recommendations in implementing agile software development. Implementing Agile software development requires effort and time, but the results can significantly benefit most software development programs [7].

### PERCENTAGE BY PROJECT CATEGORY

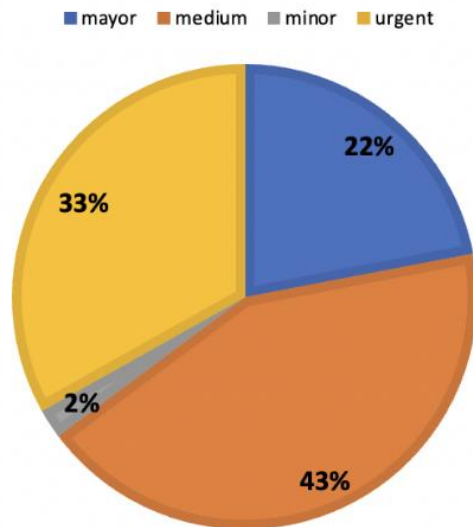


Fig. 1. Software development data by project category.

After determining the root of the problem, they considered the existing conditions in the organization and the implementation of Agile software development at the Indonesian Healthcare Organization. The questions for this research are:

RQ1: What are the challenges of Agile Software Development in the Organization?

RQ2: What are the recommendations for improving Agile implementation in the Organization?

Previous research has been carried out on projects with external resources using different methods, namely document observation. The novelty of this study is a case study on organizations with characteristics of the public sector or government or that have bureaucracy and use survey methods to respondents to validate the challenges faced. The composition of this research paper includes the following: introduction, literature study, methodology, results, and recommendations and it ends with conclusions.

## II. LITERATURE STUDY INTRODUCTION

This section will discuss the basic theory used in the research. These theories relate to Agile and Prior Research.

### A. Previous Research

Several previous studies identified Agile software development; however, no research has been conducted on organizations with public sector and bureaucratic characteristics in Indonesia, and projects have been carried out internally.

Previous research [8], [9], [10], [11], [12] challenges were identified in ASD in organizations with characteristics of the public sector or government and bureaucracy. Previous research [8], [12] was conducted in Indonesia, but both studies had specific problems with projects undertaken by external resources. The difference with research [8] is that the research was conducted by observing project documents to validate challenges. Another study [9], [10], [11] was conducted in other countries, namely Brazil, United Arab Emirates, and New Zealand, to identify challenges faced by organizations in the public sector. These five studies serve as the basis for a survey to validate the challenges faced by Indonesian health sector organizations.

### B. Agile

Agile is an approach or software development method that emphasizes flexibility, team collaboration, responsiveness to change, and continuous delivery of valuable customer results [13]. Agile methodologies have many methods (e.g., Scrum, Extreme Programming [XP], Kanban) that have their unique processes, terms, techniques, and timelines [7].

The development of Agile methods is a response to the failure experienced by organizations to use the more traditional waterfall methods. The Waterfall method is commonly used in large software development projects. Many view the Waterfall process as a heavy and expensive document, and the Waterfall is based on significant initial planning. In each phase of the project, it is necessary to complete a sequence of steps before moving on to the next stage. The linear approach used in Waterfall is in stark contrast to the incremental and iterative empirical methods used in Agile development [1].

Agile Methodology has recently expanded into several branches. The most popular extensions are probably associated with the Scrum framework, which breaks down the entire list of requirements into smaller batches. The list is titled product backlog and is formed by product backlog items. Following specific instructions, the product is developed in stages without sticking to predefined sequences while respecting any changes the customer requires [1].

### C. Challenge and Issue Agile Implementation

Based on previous research, researchers found 14 challenges faced in implementing agile software development. The fourteen challenges can be found in Table I.

TABLE I. CHALLENGES OF AGILE SOFTWARE DEVELOPMENT FROM LITERATURE REVIEW

No	Category	Challenges	References
1	Technique & Ceremony	Lack of discipline in the development processes	[8]
2	IT Infrastructure	Lack of IT infrastructure in deploying the system.	[10]
3	Project Documentation	Lacks sufficient documentation to support a project	[8], [9], [10], [11], [12], [14]
4	Cultural behavior	The organization shows resistance or lack of encouragement in transitioning to an agile approach.	[9], [10], [14]
5	Communication	Communication and coordination among team members are ineffective.	[8], [12]
6	Managed requirements	The project schedule is delayed, requirements are unclear, and there is little anticipation in handling changes.	[11], [12]
7	Roles a project team	The roles of the team were unclear, leading to minimal contributions and duplicated work.	[11], [12]
8	Top Level Management	Lack of top management support, with little knowledge of the execution process.	[10], [11]
9	Internal policy	Inadequate Compliance with standards, policies, regulations, and organizational vision.	[10]
10	Collaboration	Team collaboration is limited because team members are spread out in different locations.	[8], [10], [12]
11	Organization Structure	Organizing meetings is challenging due to convoluted bureaucratic processes.	[8], [11]
12	Interpersonal Conflict	There are personal conflicts within the team.	[11], [14]
13	Individual Competence	Inadequate agile adoption of skills, experiences, and knowledge.	[11], [12]
14	Agile Values	Lack of openness and transparency during the development process leads to a lack of information.	[11]

III. METHODOLOGY

At the methodological stage, the researcher divides the research into three phases [8]. The three phases can be seen in Fig. 2. Phase Research Methodology and the following sections discuss the details of each step.

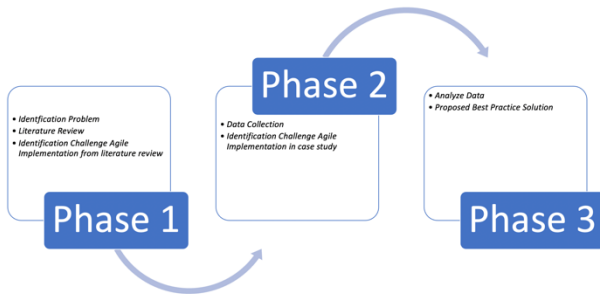


Fig. 2. Stages of research methodology.

A. Phase 1

Phase 1 is the initial stage of the research, where document observations and initial interviews are carried out to explore existing problems. Then, an analysis is conducted to determine the research questions. Based on the following research questions, literature research was conducted using PRISMA (Preferred Reporting Items from systematic reviews and Meta-Analysis). This method was used in previous studies [1]. Following are the steps of the SLR in this study:

1) The first stage is identification on the online database. The database used to search related research consists of IEEE Xplore, ScienceDirect, ProQuest, and Scopus.

2) Search using the keywords (agile software development) AND (Organization) AND ((challenges) OR

(issue) OR (solution) OR (recommendation)). Based on this, 262 documents were obtained. Then, a selection is made based on predetermined search criteria, as shown in Table II, and twenty-four documents are produced.

3) The next stage is screening, namely selecting by reading the title and abstract related to the research question and producing twenty-four documents.

4) The next stage is eligibility, which is done by searching the complete version of the research document and, in the last stage, reading the entire contents of the paper in 24 copies.

5) The final stage is to obtain ten documents by the research questions. All documents obtained are considered relevant to the research topic and can be used as a reference for this research.

The overall description of the literature selection process can be seen in Fig. 3. It shows stages of searching for literature studies.

TABLE II. LITERATURE STUDY CRITERIA

No	Criteria
1	Publications within the last five years, 2018-2023
2	English language
3	Publication of a journal
4	Publication in the form of a journal Complete publication and can be downloaded in full (full text)



Fig. 3. Stages in SLR.

B. Phase 2

Researchers use quantitative data collection methods by conducting questionnaires to the software development team. Questionnaire questions use challenges and categories from Table I. After the questions were compiled, a test was carried out by an experienced team in the field. The software development team will distribute questionnaires, including Manager IT, IT System Specialist, IT Business Analyst, Programmer, Quality Control, and Junior Staff IT.

C. Phase 3

At this stage, an analysis will be carried out to determine what challenges are relevant to the literature review and other challenges in the organization. The analysis results above will provide recommendations for improving the agile software development process. Recommendations are given by looking at the best practices from previous studies.

IV. RESULT AND RECOMMENDATION

This stage explains the results of the questionnaire that has been distributed and analyzed. This section also answers the research questions mentioned in the introduction. The challenges of implementing agile in health organizations in Indonesia and recommendations given to overcome these challenges

A. Result

Based on the research questions formulated, researchers conducted a questionnaire by obtaining 31 respondents from the software development team in the organization. Fig. 4 describes the percentage of the team from 8 positions in the software development team. Respondents with programmer positions were 39%, Junior IT Staff 10 %, Head of IT Department 6 %, IT Business Analyst 13%, It Quality Control 13%, IT Quality Assurance 3%, IT Strategic Plan 3 %, IT System Specialists (System Analysts) 13%.

In Fig 5, 45% of respondents have more than > 5 years of work experience from their current position. Then, 23% have 1 to 3 years of experience, 21.7% have 3 to 5 years of experience, and 8.7% have less than one year of experience. Overall, the technical team that filled out the questionnaire had over three years of experience.

The questionnaire consisted of 17 questions: 1) two demographic questions related to position and work experience, and 2) demographic questions were used to aid a deeper analysis of the questionnaire results. Furthermore, 14 questions are related to the 14 challenges contained in Table I. At the end, there are open-ended questions to identify other challenges that have not been included in the questionnaire. Questionnaire answers use a Likert scale (1 to 5) with the following information:

- Strong Not Agree (SNA)
- Not Agree (NA)
- Neutral (N)
- Agree (A)
- Strong Agree (SA)

The questionnaire results contained 14 challenges, which received a percentage of more than 50%. In other words, the respondents agreed and strongly agreed to the challenges in Table III. In addition, two different challenges were identified in the case study.

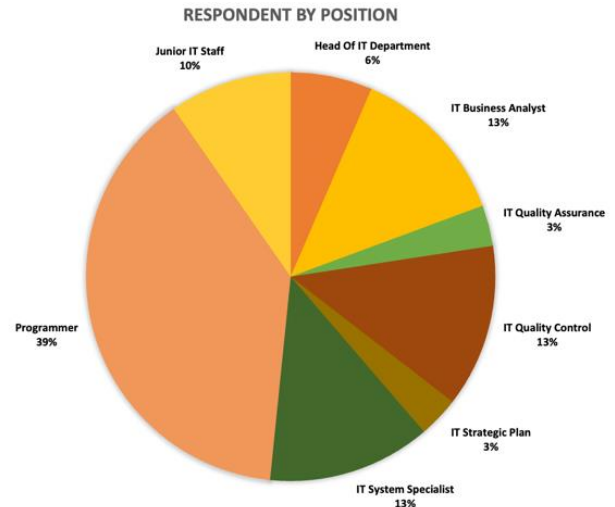


Fig. 4. Percentage of 31 respondents by the position.

Respondents by work experience

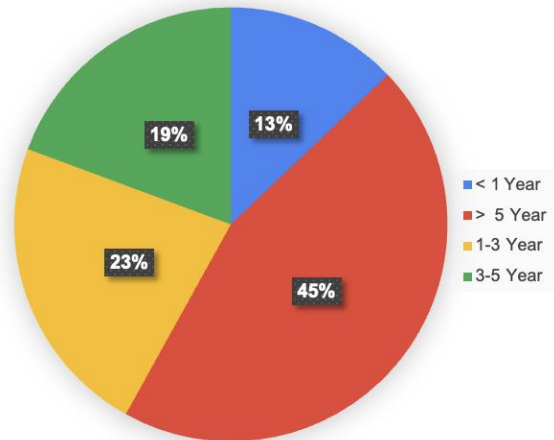


Fig. 5. Percentage of 31 respondents by work experience.

TABLE III. RESULT QUESTIONNAIRE FROM 31 RESPONDENTS

No	Challenges factor	SA	A	N	NA	SNA	SA+A
1	Technique & Ceremony	29%	26%	22%	13%	10%	55%
2	IT Infrastructure	10%	16%	19%	32%	23%	26%
3	<b>Project Documentation</b>	<b>39%</b>	<b>45%</b>	<b>6%</b>	<b>6%</b>	<b>3%</b>	<b>84%</b>
4	<b>Cultural behavior</b>	<b>42%</b>	<b>35%</b>	<b>10%</b>	<b>6%</b>	<b>6%</b>	<b>77%</b>
5	Communication	29%	23%	19%	6%	23%	52%
6	<b>Managed requirements</b>	<b>42%</b>	<b>32%</b>	<b>6%</b>	<b>6%</b>	<b>13%</b>	<b>74%</b>
7	Roles Team	39%	19%	16%	13%	13%	58%
8	Top Level Management	45%	26%	6%	16%	6%	71%
9	Internal policy	26%	29%	19%	10%	16%	55%
10	Collaboration	32%	23%	19%	10%	16%	55%
11	Organization Structure	35%	19%	13%	19%	13%	54%
12	Interpersonal Conflict	3%	23%	13%	29%	32%	26%
13	Individual Competence	22%	23%	10%	16%	29%	45%
14	Agile Values	32%	26%	16%	13%	13%	58%

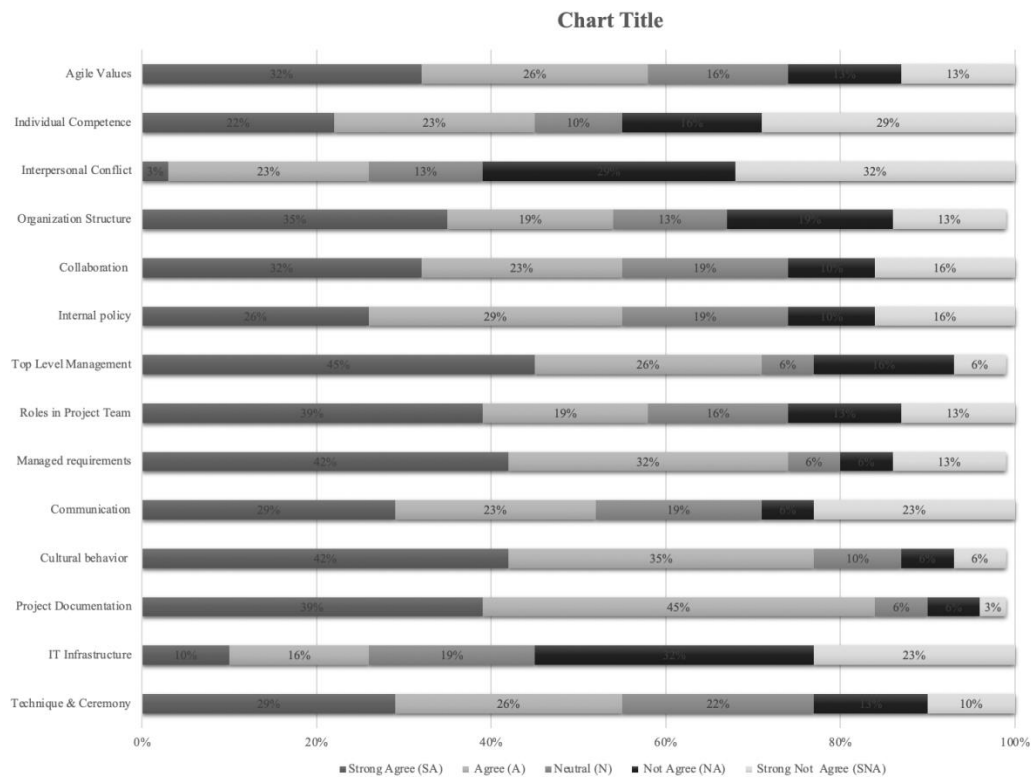


Fig. 6. This graph shows numbers representing the percentage of 31 respondents from the one that strongest agrees to the not agree.

1) *A Challenge of the highest percentage:* Fig. 6. shows three challenges with high percentage values, including project documentation, managing requirements, and cultural behavior. Most respondents agree with these challenges in implementing agile software development in organizations.

- Project documentation. This factor gets the highest percentage in the context of technology. One respondent mentioned in answering an open-ended question on the questionnaire that "current project documentation is not yet flexible. The characteristics of documentation are currently still waterfall-based where

each documentation requires the approval of each unit". In previous studies [2], many organizations faced challenges related to inadequate documentation and the opposite issue of excessive documentation that wastes time and resources on unnecessary information. Agile development presents a solution through a streamlined approach to comprehensive documentation that requires less time and effort. However, it is crucial for upper management to support this approach and for customers to agree upon it from the project's inception [3], [11].

- Culture and structure of an organization. In previous research [3], it was also stated that the primary challenge in adopting Agile lies in the culture and structure of an organization. For Agile to thrive, there must be a genuine embrace of Agile values and principles. A hierarchical organizational structure often poses a significant hurdle to Agile adoption since it necessitates redistributing power and responsibility from management to the development team. Additionally, Agile thrives in a dynamic, supportive, and collaborative environment, which rigid organizational cultures can hinder.

Respondent's statements related to this challenge were "It takes a common understanding between the IT team and UKPF in implementing the agile process," Statements from other respondents, "The entire team must understand the goal of agile," and "The team is not yet familiar with the concept of agile comprehensively."

The current organizational structure is still suitable for the Waterfall methodology. One of the respondents mentioned, "Basically, the organizational structure is still waterfall-based, and each unit works on unit coordination. It should be project-based, and an agile team should be more independent and committed."

- Managed Requirement. The challenges faced by IT project management received the highest score, namely, 34.8% agreed, and 52.2% strongly agreed. This factor is a challenge to the organization's agile implementation. Regardless of project management tools, the respondent stated, "There are no valid tools that are used for project monitoring. So far, they have relied on Excel". There are no tools for project monitoring or tools that can be used for standard team collaboration by the entire team. The team found it difficult to see the progress of each process in system development. Another problem is that there is no project manager role in the team, making it difficult for the team to conduct project development tasks.

2) *A Challenge of the lowest percentage:* Based on Fig. 6, 3 challenges with high percentage values are project documentation, management requirements, and culture behaviour, which get high scores. Most respondents agree that

these challenges are challenges in implementing agile software development.

- Interpersonal conflict. This factor gets the lowest score, namely 26%, meaning that the team is good enough or has no internal conflict, which is a challenge in agile implementation. Leadership challenges get the highest score, namely 65.2%, then agile values, 60.9%, and the other three challenges, namely personal commitment, decision making, and individual competence, get the same deal, 52%.
- Competency is not a challenge in implementing agile, and this has something to do with demographic results because most respondents are workers with more than five years of experience, so they have abilities in their fields.

3) *An Additional Challenge from respondents:* Different challenges are identified from the case study based on the open-ended question at the end of the questionnaire, in which the organization experiences another challenge, namely Overloading work. Based on one of the respondents' answers, "Another challenge is the unbalanced workload of each programmer. A programmer must be able to do many things briefly simultaneously, causing stress from the programmer's psychological side. Something like this needs to be resolved by the project manager on how user needs are balanced with existing resources," and the other, "The challenge is the lack of resources so that one person holds several applications that are being chased by the dateline at the same time."

### B. Recommendation

Based on the challenges faced by the organization, the researchers then provide recommendations that can be taken in the future to make changes to current conditions. Later, it is hoped that the organization will get better results from agile implementation and support organizational goals. The recommendations are as follows.

The following are recommendations based on previous research, and recommendations are given based on the results of questionnaires that get a percentage of agree and strongly agree with a value of more than 50%. The recommendations are given in Table IV.

TABLE IV. RECOMMENDATION IN TECHNOLOGY CONTEXT

Challenge	Recommendation
<b>Technique &amp; Ceremony</b> Lack of discipline in the development processes	<ul style="list-style-type: none"> <li>• Use tools or technologies to support Agile work in the organization [3]. E.g., Trello or Jira</li> <li>• Build a Continuous Delivery pipeline with stages involving both sides[4]</li> </ul>
<b>Project Documentation</b> Lacks sufficient documentation to support its development	Communicate only essential points that need to be documented. Agile identifies critical important points to include in documentation, which is the main focal point for each methodology.[15] Meetings assist individuals in a proper understanding of how to collect information and through what medium the process of gathering information will be beneficial [15]
<b>Culture Behavior &amp; Agile Values</b> The organization shows resistance or lack of encouragement in transitioning to agile values.	<ul style="list-style-type: none"> <li>• A strong culture requires a deep understanding of the organization's goals</li> <li>• Show success stories of agile adoption.</li> <li>• Provide training and increase employee awareness and acceptance of new culture [3]. [3]</li> </ul>
<b>Communication</b> Communication and coordination among team members are ineffective.	<ul style="list-style-type: none"> <li>• Running an effective meeting [16]</li> <li>• Regular face-to-face meetings should be established, as they provide clear communication [7] [13]</li> </ul>

Challenge	Recommendation
	<ul style="list-style-type: none"> <li>• Transparency and efficiency in communication [4].</li> </ul>
<b>Management Requirement</b> The project schedule is delayed, requirements are unclear, and there is little anticipation in handling changes.	Agile teams operate differently from traditional project management structures as they do not rely on project managers. Instead, Agile methodologies like Scrum and XP outline specific roles such as the product owner, scrum master, and coach. These roles are designed to facilitate effective collaboration and ensure the smooth execution of Agile practices. By assigning responsibilities to these distinct roles, Agile teams can streamline communication, enhance productivity, and adapt quickly to changing project requirements. [17].
<b>Roles in Project Team</b> The roles of the team are not clearly defined, leading to minimal contributions and duplicated work.	Reorganize the team by forming small teams, like the scrum team, to create a dedicated team responsible for agile development [18].
<b>Top Level Management</b> There is a lack of top-level management support and little knowledge of the execution process.	<ul style="list-style-type: none"> <li>• Involving top-level management in the change planning and implementation process can increase the sense of ownership and responsibility.</li> <li>• Hire outside experts to be involved in team adaptation as this can provide a better recommendation of benchmarks [18],[15]</li> </ul>
<b>Internal Policy</b> Inadequate agile adoption of skills, experiences, and knowledge.	Creating standards for IT software development on an internal basic policies and supporting existing management can support agile implementation [1]
<b>Collaboration</b> Team collaboration is limited because team members are spread out in different locations.	Use tools or technologies to support Agile work in the organization [3]. E.g., Trello Jira or bit bucket [4]
<b>Organization Structure</b> Organizing meetings is challenging due to convoluted bureaucratic processes.	<ul style="list-style-type: none"> <li>• Create a small project team like the Scrum team [1].</li> <li>• Arrange a dedicated team that is responsible for agile development [18].</li> <li>• Channeling expert's efforts to address high-level issues and to manage collaboration [4].</li> </ul>
<b>Overloading of work</b> This factor is a challenge in agile implementation. Individuals get more than one job at the same time.	<ul style="list-style-type: none"> <li>• They used to meet weekly and later twice a month, only when required and usually after working hours.</li> <li>• Skipping the daily meetings affected the learning process between the team members. This factor eventually led to the failure to learn and implement the agile method correctly [11].</li> </ul>

## V. CONCLUSION

Researchers conducted a literature review of several previous studies and identified challenges in implementing ASD in other organizations with characteristics of the public sector, government, or bureaucracy. Researchers use quantitative methods with surveys to validate and facilitate the exploration of the challenges in implementing ASD in One healthcare organization in Indonesia. This method is simple but can solve the problems faced. It is a differentiator from previous research [8] studies used challenge validation using document observation.

Based on several previous studies, 14 challenges faced by organizations were obtained. This study's findings determine what challenges and recommendations can be provided for the organization. Based on the survey results, researchers found 11 challenges with a percentage value above 50%, agreeing that challenges to other organizations. The three challenges with the highest survey results are project documentation, IT Project Management, and cultural behavior. At the same time, the 3 challenges with the lowest survey results were below 50%, which means that most respondents disagreed that these challenges were felt today in the organization. These challenges are individual competence, IT infrastructure, and internal conflicts. Then, researchers got other challenges besides 14, based on open questions on the questionnaire. The challenge is about workload overload.

After getting the challenges faced by the organization in this case study, the researcher provides recommendations mapped to the challenges faced by the IT team in the organization based on previous studies related to agile implementation, agile adoption, or agile transformation. Some recommendations that can be made include raising

awareness related to agile culture among all IT employees. Regarding problems in Project Documentation, organizations can adjust project documentation to align with agile values. Problems in organizations with bureaucracy, such as government, making changes in the development process become obstacles because of the many administrative processes and approvals given to superiors. Therefore, organizations can adjust the project team to match the role in Agile. Agile using the roles contained in scrum. By assigning responsibilities to these different roles, Agile teams can streamline communication, increase productivity, and adapt quickly to changing project requirements [17].

1) *Research implications:* Other similar organizations can use the results of this study to see the challenges in agile implementation and solutions from best practices suitable for organization healthcare or bureaucratic governance.

2) *Limitations of suggestions for further research:* This study has several limitations on the respondents. Respondents are still limited to the software development technical team. Future research can be carried out for other IT teams, such as IT operations and IT infrastructure.

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