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CRITICAL FAILURE FACTOR USING TOPSIS METHOD – A CASE STUDY OF AN INDONESIAN POULTRY AGROTECHNOLOGY STARTUP

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ABSTRACT

Agile is viewed as a strategy to hasten the development of new products since it is flexible, practical, and cost-effective. The startup firm where the case study was conducted is a poultry retail agrotechnology startup. However, there are several difficulties in practice. One of the company's main products is IoT-based poultry technology solutions and livestock management software. The product development has been using Scrum since January 2022. However, there are still issues with the implementation, such as projects not being finished on schedule, workload being distributed unevenly, and incorrect documentation and reporting on team and company performance. Expectations for project completion might be as high as 80%. However, only 50% of projects are completed. The work process is still ineffective, especially when gathering requirements and reviewing products. The purpose of this research is to identify the critical failure factors that contribute to the failure of Scrum implementation in the company and provide a recommendation to be a strategy to improve Scrum implementation in the company to solve the issues. The TOPSIS approach was employed in the research. The lack of a complete set of agile practices, lack of project management capabilities, lack of agile progress tracking, the organization is too political, and lack of management commitment were the most relevant factors to the implementation failure. Resistance from groups or individuals, lack of customer relationships, and ill-defined customer roles are the ones that have the most negligible impact. Recommendations have been arranged for the company for a strategy to improve the implementation of Scrum.

Keywords: *CFF, Agile, Scrum, Agro Technology, Startup, TOPSIS*

1. INTRODUCTION

1.1. Background

There is a need for innovation and agility in the current software development environment, where demands, technology, complexity, and demand are all moving extremely quickly [2]. Software innovations must be functionalized immediately to fulfil the increased expectations of user demands [3], one of which is the requirement in the agriculture industry. Agriculture technology is a significant driver of the Indonesian economy. The government plans to deploy 70 per cent of innovation and agricultural technology in 2021 and 2022 and 75 per cent in 2023 and 2024, according to the 2020 Ministry of Agriculture Performance Report [4]. In the last six years, several of these agricultural startups have sprouted up [4].

The researcher used a case study of a startup in the agriculture industry for this study. The startup is an agrotechnology firm that specializes in poultry and chicken retail. It was founded in 2018 to ensure Indonesian food security by employing technology to make the supply of chicken meat more accessible and sustainable. The company concentrates on the Internet of Things (IoT)-based poultry technologies and farm management software. Two products and services are being offered. The first offers Software as a Service (SaaS) and Internet of Things (IoT) hardware to farmers, and the second offers B2B and B2C chicken delivery services from farmers that have partnered with the firm. The products have

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helped farmers save over 2 billion rupiahs on feed and power, and the B2B itself has sold over 2 million kg of chicken to more than ten industry partners across Indonesia.

The company's technology-focused business strategy urges the company to keep innovating to meet the community's food needs. It is encouraged to be more agile in establishing business strategies, particularly technological development. Compared to traditional methods, the agile technology development process may be faster, more efficient, and cost-effective [1]. Agile methods have been proven effective in delivering products, especially IT products. In addition, it can improve collaboration with customers, time estimation and overcome defects in the development process [5].

The company has just implemented Scrum in January 2022. They have never used a framework yet. Without adequate planning, the product development process is unstructured or might be described as sporadic. Many companies have started to use agile for the software development process; Scrum is one of them due to the uncertainties and the requirement for dynamic products while preserving product quality [6]. Furthermore, the CTO expects that introducing Scrum would help the company improve product development by assisting in the formulation of product innovation strategy and resource management.

After three months of not being in line with reality, problems such as projects not being delivered on schedule, excessive workloads, and unreliable documentation and reporting on the team and business performance continue to surface. The company has several problems with the product development process. Expectations for project completion might be as high as 80%. However, only 50% of projects are delivered on schedule. The work process is still ineffective, especially regarding requirement gathering and product review.

This research will analyze the critical failure factor, particularly how it might affect the failure of Scrum implementation using TOPSIS methodology, and problems that occur in the implementation of Scrum at the company. Therefore, the research questions are the following:

1. What are the factors underlying Scrum implementation failure in the company?
2. What is a recommendation for mitigating the failure factors?

1.2. State of The Art

According to previous research, the most typical impediments to agile adoption in software development are project management problems and a lack of requirements. The study conducted a survey to identify those issues and challenges related to agile development implementation. The researcher recommends software industry conduct improvement by resolving the problems served by that research as the basis [6]. The variables influencing the success or failure of software initiatives in the industry have also been the subject of previous research. The difficulties encountered in banking industry software development initiatives were recognized by analysis, such as self-organization problems, lack of cross-function collaboration, changes during the sprint, scope creep, lack of a testing plan, and lack of customer and stakeholder commitment. [7], [8]. The critical success factors for adopting Scrum in the telecommunications sector are discussed in the research. The research used a qualitative method that was AHP and resulted in several success factors such as customer participation, effective communication, and team motivation and competencies. The research also found the most negligible impact, that is the management support and organizational culture [9] [10]. It might be challenging to locate research on the causes of or issues with agile projects, particularly in startup case studies. This study will discuss the failure factor of agile software projects in poultry startup.

The researchers will use the TOPSIS methodology. The TOPSIS technique is a strategy for defeating a system by experimenting with multiple options. TOPSIS will rank each failure factors that has been [10]. The research is designed to be a resource for analyzing and improving the company's Scrum implementation.

2. LITERATURES

2.1 Agile

Agile software development is a method that is responsive to change, adaptable, lean, planned, rapid and incremental delivery. The agile product development process emphasizes four main issues: the importance of self-organizing teams over workloads, communication and collaboration between team members, practitioners, and users recognizing change as an opportunity and emphasizing software that is delivered fast and satisfies users' needs [11]. Scrum is one of the approaches that use an agile approach. Scrum is a lightweight framework enabling individuals, teams, and organizations to create value by flexibly

overcoming complex issues. Transparency, inspection, and adaptability are the fundamental principles in Scrum, according to the Scrum Guide 2020 [12]. The Scrum Guide also highlights Scrum values such as courage, openness, focus, commitment, and respect. The Scrum method is done in sprints, which are brief intervals of time. Sprint work varies in size and complexity, is adapted to the challenge at hand and is defined and adjusted in real-time through Scrum [11].

2.2 *Failure Factors of Scrum Implementation*

The research shows there is no formal methodology for determining the Scrum method's success or failure criteria [13]. However, these variables have been observed in various research. Chow and Cao's research highlighted 19 factors from five components of agile project success and failure: organizational structure, process, people, technology, and design [1]. Nasir and Sahibudin identified 26 critical factors of software project success in one country and not specific to agile practice [14]. Sithambaram, Nasir, and Ahmad conducted a comprehensive analysis of the Issues and challenges impacting the successful management of agile-hybrid projects using the grounded theory method and resulted in 38 factors involving participants from Linkedin Inc. companies [15].

Much previous research on critical failure factors has been identified [14]. However, the researcher used a failure factor based on (Chow and Cao), as it has been quoted 786 times in this other study. Failure causes were discovered, according to Chow and Cao, based on learning results from previous project failures. According to Chow and Cao's literature review, the failure factors of an agile project may be divided into five categories and 19 variables, as shown in Figure 1 [1].

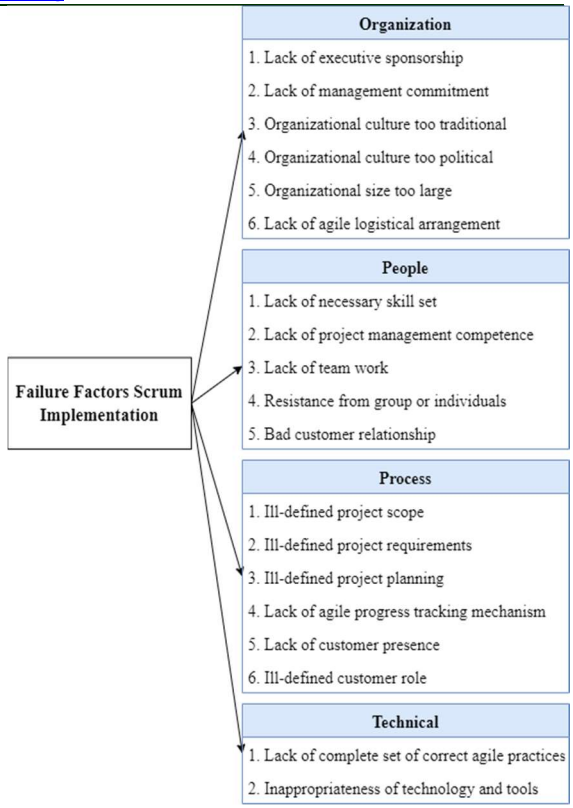

Figure 1: Failure Factors Scrum Implementation

Previous research on critical failure factor based on Chow and Cao shows that CFF differs amongst industries and circumstances.

Table 1: Previous Research using Chow & Cao's CFF

Research	Industry	Method	CFF
[15]	IT Industry	Grounded Theory	Org-1 Org-3 People-1 Process-1 Tech-1 Tech-2
[20]	All companies	Systematic literature review	Tech-1 People-4 Process-2 Process-6
[21]	IT Company	Yugoslavia	Org-1 Org-2

Previous research has been conducted based on Chow and Cao in several industries using several methods. This research aims to identify CFF-specific industry of poultry using the TOPSIS method.

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2.3 *TOPSIS*

TOPSIS is a way to overcome a system by making choices among many alternatives. It may also give a comparison of the evaluated possibilities based on several factors, allowing TOPSIS to enhance decision-making [16].

The TOPSIS technique has the benefit of being able to address decision-making issues with numerous criteria by concurrently creating positive and negative ideal solutions. Other benefits are as follows [17]:

1. It is simple to use.
2. It takes into account a variety of aspects (subjective and objective)
3. Reasonable and straightforward
4. The computation procedure is simple.
5. The approach presents the optimal alternative in a basic mathematical form

The purpose of this study is to use the TOPSIS approach to discover the CFF that significantly impact the failure of Scrum implementation.

3. *METHODOLOGY*

This chapter will outline the research methodology utilized to identify CFF. We are starting with the study phases, research subjects, data-gathering techniques, and data analysis methods.

3.1. Research Phases

This research was conducted with the stages described in Figure 2.

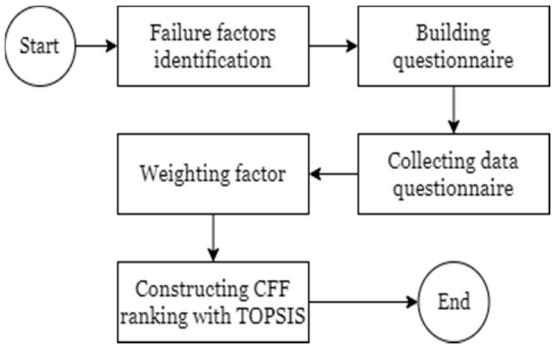

Fig. 2: Research Flow

3.2. Research Subject

The participants in this study are project members, including a CTO, a backend engineer, a software quality assurance officer, a mobile developer, and a product designer. They are survey respondents. We consider the participants to have knowledge of the Scrum methodology and have experience in Scrum in the company.

3.3. Data Collection

The data collection used a structured questionnaire approach with Likert Scale response of 1 to 5. We gave 19 statements to the respondents, shown in Table II.

Table 1: Likert Scale.

Scale	Statements
1	Strongly agree
2	Agree
3	Neutral
4	Disagree
5	Strongly Disagree

3.4. Data Analysis

Determine the weight value of each factor depending on the interview result with the CTO as the person who is accountable for the company's Scrum process. TOPSIS is used to construct a CFF ranking. We carried out seven phases, shown in the following. [18].

1. Construct a matrix table with the responses to the questionnaire

$$A = (a_{ij})_{m\times n} = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ i & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{bmatrix} \quad (1)$$

2. Normalize the questionnaire results matrix table.

$$P_{ij} = A_{ij} \,/\, \sqrt{\sum_{i=1}^{m} A_{ij}^2} \quad (2)$$

i = 1, 2, …, m dan j = 1, 2, …, n

3. Weighting the normalized matrix.

$$v_{ij} = P_{ij} \times w_j \quad (3)$$

i = 1, 2, …, m dan j = 1, 2, …, n
w is a weight of total factor and $\sum_{j=1}^{n} w_j = 1$

4. Determine the positive ideal and negative ideal alternatives.

$$A^+ = \{(max_i\, v_{ij}|j = C_b), (min_i\, v_{ij}|j = C_c)\} = \{v_j^+|j = 1,2,\dots,m\}$$
$$A^- = \{(min_i\, v_{ij}|j = C_b), (max_i\, v_{ij}|j = C_c)\} = \{v_j^-|j = 1,2,\dots,m\} \quad (4)$$

5. Calculate the distance between each option and the positive and negative ideals.

$$S_i^+ = \sqrt{\sum_{j=1}^{m}(v_{ij} - v_j^+)^2, j = 1,2,\dots,m}$$
$$S_i^- = \sqrt{\sum_{j=1}^{m}(v_{ij} - v_j^-)^2, j = 1,2,\dots,m} \quad (5)$$

6. Calculating the relative proximity to the ideal solution

$$RC_i = \frac{S_i^-}{S_i^+ + S_i^-}, i = 1,2,\dots,m \quad (6)$$

7. Ranking from the largest to the least in terms of RCi

4. RESULT

In this chapter, we will discuss the findings based on the analysis result referring to the research phases.

4.1. Identification Failure Factor

Table 2 presents a list of failure factors based on Chow and Cao's study. We provide a factor code for each factor we offer for quick identification.

Table 2: Failure Factor

No	Aspect	Factor	Code
1	Organization	Lack of executive sponsorship	Org.1
2		Lack of management commitment	Org.2
3		Organizational culture is too traditional	Org.3
4		Organizational culture is too political	Org.4
5		Organizational size is too large	Org.5
6		Lack of agile logistical arrangement	Org.6
7	People	Lack of necessary skill set	Ppl.1
8		Lack of project management competence	Ppl.2
9		Lack of teamwork	Ppl.3
10		Resistance from group or individuals	Ppl.4
11		Bad customer relationship	Ppl.5
12	Process	Ill-defined project scope	Pr.1
13		Ill-defined project requirements	Pr.2
14		Ill-defined project planning	Pr.3
15		Lack of agile progress tracking mechanism	Pr.4
16		Lack of customer role	Pr.5
17		Ill-defined customer role	Pr.6
18	Technical	Lack of a complete set of correct agile practices	Tc.1
19		Inappropriateness of technology is tools	Tc.2

There are 19 factors from 4 aspects in the list of failure factors above. Aspects include organizational aspects, which have six components; people aspects, which have four variables, process aspects, which have six factors; and technological aspects, which have two factors.

4.2. Data Collecting

A questionnaire with 19 items developed based on the identified failure reasons was created and used for the data-collecting phase. Then we formed the statements using the Likert Scale framework and added coding for each statement. Afterwards, we give it out to the research subjects. Table 3 shows the compiled data questionnaire.

Table 3: Compiled Questionnaire Result

Question Code	Factor Code	P 1	P 2	P 3	P 4	P 5
Q1	Org.1	2	2	1	2	2
Q2	Org.2	2	2	1	1	2
Q3	Org.3	3	1	1	1	2
Q4	Org.4	1	1	1	1	1
Q5	Org.5	2	3	1	1	1
Q6	Org.6	2	2	1	1	2

Q7	Ppl.1	2	2	2	2	3
Q8	Ppl.2	2	2	2	2	3
Q9	Ppl.3	1	2	1	2	1
Q10	Ppl.4	2	2	1	2	1
Q11	Ppl.5	4	2	1	4	2
Q12	Pr.1	2	1	1	3	4
Q13	Pr.2	2	1	2	3	4
Q14	Pr.3	2	2	2	3	4
Q15	Pr.4	1	2	1	2	2
Q16	Pr.5	4	2	1	4	4
Q17	Pr.6	4	2	1	3	4
Q18	Tc.1	2	2	1	2	2
Q19	Tc.2	1	2	1	3	3

4.3. Data Analysis

The responses to the questionnaire are created into a matrix form at this phase before being analyzed using TOPSIS. Table 4 is a table of matrix results.

Table 4: Matrix Result

Factor	1	2	3	4	5
Org.1	1	3	0	0	0
Org.2	2	2	0	0	0
Org.3	3	1	0	0	0
Org.4	5	0	0	0	0
Org.5	3	0	0	0	0
Org.6	2	2	0	0	0
Ppl.1	0	3	1	0	0
Ppl.2	0	3	1	0	0
Ppl.3	3	2	0	0	0
Ppl.4	2	2	0	0	0
Ppl.5	1	2	0	1	0
Pr.1	2	0	1	1	0
Pr.2	1	1	1	1	0
Pr.3	0	2	1	1	0
Pr.4	2	3	0	0	0
Pr.5	1	1	0	2	0
Pr.6	1	1	1	1	0
Tc.1	1	3	0	0	0
Tc.2	2	1	2	0	0

We use the matrix table as our reference point while employing TOPSIS for analysis. The ranking obtained from the TOPSIS analysis is shown in Table 5.

Table 5: TOPSIS Ranking Result

Factor	Factor	RCi	Rank
Lack of a complete set of correct agile practices	Tc.1	0.5036	1
Lack of project management competence	Ppl.2	0.4624	2
Lack of agile progress tracking mechanism	Pr.4	0.3991	3
Organizational culture is too political	Org.4	0.3917	4
Lack of management commitment	Org.2	0.3853	5
Lack of teamwork	Ppl.3	0.3752	6
Lack of executive sponsorship	Org.1	0.3550	7
Inappropriateness of technology and is tools	Tc.2	0.3540	8
Lack of necessary skill set	Ppl.1	0.3203	9
Ill-defined project planning	Pr.3	0.2419	10
Ill-defined project scope	Pr.1	0.2295	11
Lack of customer presence	Pr.5	0.2194	12
Lack of agile logistical arrangement	Org.6	0.2027	13
Organizational culture is too traditional	Org.3	0.1803	14
Ill-defined project requirements	Pr.2	0.1800	15
Organizational size is too large	Org.5	0.1765	16
Resistance from group or individuals	Ppl.4	0.1235	17
Bad customer relationship	Ppl.5	0.1114	18
Ill-defined customer role	Pr.6	0.0929	19

According to the ranking findings, the top five criteria, or "critical failure factors," are as follows: Lack of a complete set of correct agile practices, Lack of project management competence, Lack of agile progress tracking mechanism, Organizational is too political, and Lack of management commitment.

5. DISCUSSION

According to the TOPSIS analysis result and to answer the first research question, the critical failure

factors of Scrum implementation on Chickin are lack of a complete set of Scrum practices, lack of project management competence, lack of agile progress tracking, organizational is too political, and lack of management commitment. CTO Chickin confirmed the relevancy of the factor. Due to the lack of a project manager or product manager position at Chickin and Scrum expertise. This issue impacts Scrum implementation, including poorly managed progress tracking. Hence, it resulted in to delay in project delivery. To answer the second research question, we will discuss the recommendation to improve Scrum implementation in the company.

1. Lack of a complete set of Scrum

The first factor is the lack of a complete set of Scrum implementations. It can be the result of a failure to implement Scrum properly. As a result, Scrum is not fully implemented and is not carried out following the goals of each process. This issue happened in previous research [15] due to improper implementation of the agile method. To overcome that issue, the researcher recommends providing Scrum and agile workshops or training to stakeholders and project members to increase understanding of and familiarity with the agile process [15]. Other studies have demonstrated that training may improve the chance of an agile transformation's success[19].

2. Lack of project management expertise

The second issue is the lack of project management expertise in Scrum. This issue is related to issue point 1 due to a lack of expertise in project management leads to improper Scrum practice. The same paper suggests hiring individuals with suitable skill sets, such as Scrum and or agile practice, is another recommendation [15]. Project management can benefit from the expertise of individuals who have worked in an agile environment[19].

3. Lack of agile progress tracking

The lack of a progress management system may result in project delays and poorer code quality [20]. Alyahya, Ivins, and Gray, in their research , stated that several factors affect agile progress monitoring. Coordination is required for a project team to have good progress tracking. Alyahya, Ivins, and Gray have highlighted both manual-based and technology-based techniques for managing development progress [22]. Emphasize communication in manual-based systems, such as the daily standup routine agenda, which makes it simple for team members to report progress. Meetings can be held in person or through a video conference. Technology-based approaches include using project tracking system is tools that offer a variety of capabilities that let team members create and modify tasks, produce reports like burn downs, generate notifications and announcements, participate in discussions, and change status and progress [22]. Currently, there are a lot of web-based agile tracking systems. Sharing progress amongst agile teams is more straightforward using web-based technologies [23].

4. Organizational is too political

In contrast to massive corporations, political concerns are uncommon in startups and other previous research. We did not find the political issue in their research. However, it is one of the five critical factors in this instance. There will undoubtedly always be politics in a business environment. Politics is an existence of factors that influence and persuade in creating a strategy and decision in the organization [24]. Politics may be practical if we use it to advance the organizational objective. On the other hand, politics can go wrong if utilize to further personal objectives rather than organizational ones.

Although politics and leadership are frequently linked, their definitions are incompatible. Pinto made several recommendations based on his study when he encountered the project's political landscape [25]

i.) Acknowledge that politics will always exist in the context of an organization, depending on how we use it to further organizational objectives..
ii.) If a disagreement arises, it is essensial to remember that every person has a different background, perspective, and way of thinking. Making sure that the dispute does not interfere with the objectives that will make the project successful is what has to be done..
iii.) Gain skills in persuasion and influence. We should use politics when we discover contrasting understandings and interests of each stakeholder. Influence and persuasion are used to keep the dispute moving toward the desired outcome.

5. Lack of management commitment

This issue is found in previous research in a leader telco company [9] which means company size does not determine the maturity of Scrum implementation

The critical factor in the success of Scrum is management-level commitment. More support from management is needed to keep the Scrum process going [19]. Management commitment demonstrates a focus on implementing something consistent and continuing until it succeeds [26]. The team can believe in management's commitment to change if objectives and expectations are communicated clearly to them and continuous evaluations are conducted [19].

The analysis also discovered three factors that had the most negligible impact on Scrum implementation failure: resistance from groups or individuals, lack of customer relationships, and ill-defined customer roles.

6. CONCLUSION

As a technology startup, it is challenging to continue innovating to meet customer needs and all the changes that occur quickly. Software development problems are unavoidable and can impact product delivery, such as not being delivered on schedule. In improving Scrum implementation, the researcher used the failure elements found in Chow and Cao's research; this study examines the critical Scrum implementation failure factor. The failure factor is made up of 19 failure factors that are divided into four aspects: organization, process, people, and technology.

Our finding to answer Research Question 1 identified five critical failure causes that led to an unsuccessful attempt to implement Scrum, based on the findings of the analysis using the TOPSIS ranking approach. These critical failure causes include a lack of project management skills, a lack of a complete set of agile practices, and a lack of agile progress tracking.

Several recommendations for answering Research Question 2 were received in the discussion. The first factor, the lack of a complete set of agile processes, necessitates training or workshops for the entire project team, including stakeholders. They are additionally, hiring a project or product manager. The second factor—a lack of project management skills—is addressed by the recommendations as well. The recommendation to enhance communication addresses the third factor, the lack of agile progress tracking. There are two ways to communicate: manual-based and technology-based. Manual-based, as in holding frequent meetings through video conferencing or in person, such as daily stand-up meetings. Technology-based, namely using project management is tools to manage projects and track progress. The fourth is organizational is too political, which may be solved by acknowledging the issue, understanding the differences between all parties participating in the project, and developing the ability to influence and convince to proceed with the project immediately if a dispute is discovered. Lack of manager commitment ranks fifth. Determining the management's support is crucial to the project's success. You may build the team's trust by outlining the project's aims and goals.

The TOPSIS calculation also discovered three characteristics that have the most negligible impact on implementation failure: resistance from groups or individuals, lack of customer relationships, and ill-defined customer roles.

CFF being identified, including the relevant mitigation actions, provide poultry startup industries in improving Scrum implementation in their organization. Similar research can be broadened to other startup industries to understand CFF relevant to those industries and whether there are differences in CFF.

7. LIMITATION AND FUTURE RESEARCH

The research's limitations are that it is restricted to poultry industry startups. As a result, the findings do not fully describe the issues startups face in Indonesia. Furthermore, there are not many research participants, namely those actively involved in adopting Scrum at medium businesses. In order to provide a more comprehensive view, further research might be conducted using more extensive case studies and including more people from different backgrounds..

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