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Evaluation of Scrum-based Software Development Project Management Maturity Level at Bank Z

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ABSTRACT

In the era of growing connectivity and the digital world, the growth of information technology requires organizations to adapt more efficient and effective software development methods. This research aims to measure the maturity level of Scrum-based software development project management at Bank Z, which has been implementing Agile approaches since 2023. With the challenges faced in timely project completion, this research explores the obstacles faced by Scrum teams and provides improvement recommendations to increase the efficiency and effectiveness of software development. The research methodology used includes quantitative and qualitative approaches, with data collection through questionnaires and interviews. The results show that the maturity level of the Scrum process at Bank Z is at level 2 (Managed), with some areas such as backlog management and Scrum meetings being well implemented. However, there is a need to improve transparency and collaboration between teams. Recommendations include increased training and consistent implementation of Scrum practices to achieve a higher level of maturity.

INTRODUCTION

The growth of information and technology continues to gain strength and speed along with the ongoing journey of digital transformation, which poses a great challenge in terms of how to develop individuals with digital and IT capabilities (Djawa, 2023; Surya et al., 2021). In an effort to meet the growing business demands and maintain the sustainability of a company, qualified technology is needed to support activities or work. Technology becomes a supporting tool so that business processes can run effectively and efficiently. The rapid development of technology requires IT organizations to have a flexible, adaptive, and efficient approach in implementing the system to be used. IT organizations need a new approach to managing and developing software to remain competitive (Ding et al., 2024).

For this reason, Agile approaches are emerging as a more agile and adaptive software development technique that enables organizations to deliver high-value software faster. According to researchers, many digital companies are using Agile approaches to deliver products and services to customers more efficiently and reliably (Ghezzi & Cavallo, 2020; Oliveira-Dias et al., 2022; Sjödin et al., 2020). With this approach to software development across business units and product groups, large technology companies are able to design and build features quickly, test them with

customers, and make improvements and updates in rapid iterations. The massive adoption of Agile has led companies to accelerate their innovation by up to 80%. There are several Agile approaches such as XP, Kanban and Scrum.

One of the Agile approaches that has gained popularity in the last decade is Scrum (Damayanthi, 2024). Scrum has become a popular choice in software development that focuses on collaboration, iteration, and continuous delivery, allowing teams to adapt to changes quickly and produce high-quality products. According to Scrum.org, Scrum is a lightweight framework that helps individuals, teams, and organizations to generate value through adaptive solutions to complex problems. Currently, one of the banks in Indonesia called Bank Z is building a digitization system using Scrum and has been ongoing since 2023. The digitalization system aims to help productivity and efficiency in the execution of the work of its employees. The system uses an integrated platform that allows for effective collaboration and communication, which can be accessed remotely or hybrid. This project involves a large and complex team with diverse and dynamic needs with a very tight timeline. The development of a digitization system at Bank Z using Scrum has started since 2023. However, it still faces the issue of late completion. Based on the timeline data (plan vs actual) collected in 2024, it was found that the implementation of the Scrum-based software development sprint was delayed based on the due date planned at the Sprint Planning event.

According to Nuraminah (2015) conducted quantitative research to measure the maturity level of software development project management at Bank Z. Bank Z is an Information Technology service provider company. There are four projects studied. This research was motivated by problems in implementation, where projects did not reach the target time of the software development timeline. The recommendation from this research is to increase the understanding of Scrum for all team members through training and consistent application of Scrum so that the maturity level can be improved. This recommendation was also given by Pambudi (2021) who conducted research on the maturity level of Scrum implementation in government agencies. In addition, also suggested that the implementation of Scrum be combined with other methods and the application of Scrum in a disciplined and consistent manner. Some aspects of the implementation are in accordance with the basic principles of Scrum, such as team formation and the sprint cycle, but there are shortcomings in terms of transparency, cross-team collaboration, and backlog management as well as resistance to changes in a more adaptive and collaborative work culture.

According to Panjaitan & Hardian, (2023) conducted research on the level of process maturity at one of the XYZ startup companies. The startup company uses the Scrum method but faces non-optimal development issues that have an impact on the quality and performance of the XYZ startup company. The study found 24 recommendations consisting of 11 high-priority, 13 medium-priority to improve the maturity level of XYZ startup companies such as establishing roles and artifacts in Scrum, holding Scrum meetings. In research Ridha & Hegarini (2020) states that each process in the Scrum framework has a different level of maturity so that relevant improvements are recommended, with a focus on improving the application of Scrum practices based on the Agile Maturity Model (AMM) so that Scrum can be applied more effectively, increasing the efficiency of managing software development projects. Data was obtained through questionnaires distributed to employees, as well as interviews to ensure consistency of answers with documentary evidence of projects.

Meanwhile, research by Atissalam & Aji (2024) evaluated the implementation of scrum with SMM and AMM. The evaluation is to measure the level of process maturity in a Telecommunications Company. This research uses the Scrum Assessment Questionnaire which consists of 70 questions. The maturity level obtained is 3 with recommendations for standardization and implementation of a disciplined Scrum Retrospective to increase the maturity level to the next level. Other research on several companies/industries that apply Scrum such as research by researchers generally results in a level of maturity between level 1 and level 2. Companies that apply Scrum need to make improvements to the processes in the application of Scrum have been analyzed. The similarities of these studies are the recommendations proposed, namely following and training to help the understanding of the teams involved (Anggraeny et al., 2024; Arifin et al., 2020; Ayunda & Budiardjo, 2020).

This research will be conducted at Bank Z which consists of a complex and large team and some Scrum best practices described in Schwaber and Sutherland (2020) are not applied during the Scrum implementation process which is thought to be the cause of late Scrum completion. Scrum implementation at Bank Z has been carried out since 2022, for this reason it is necessary to measure the maturity level of the Scrum implementation process carried out and then recommendations can be given to Bank Z in order to increase the maturity level of the Scrum process. Measurement of the process maturity level using the Scrum Maturity Model (SMM). To measure the dependent variable, the level of maturity of Scrum practices at Bank Z, several independent variables are used, including the length of team experience in Scrum, the team has received Scrum training (e.g., Certified Scrum Master), the quality of Agile leadership/Scrum Master, the availability of Agile tools and adherence to Scrum practices and the number of members in the Scrum team. These variables are determined based on some previous research results. The difference between this research and other studies is that in addition to wanting to know the level of maturity, the author wants to explore the challenges faced during the implementation of Scrum and this research was conducted in the banking sector.

This research will use quantitative and qualitative research methodologies. Quantitative data will be collected through a questionnaire whose questions are arranged based on the assessment criteria in the Scrum Maturity Model (SMM) to determine the maturity level of digitalization system development at Bank Z. Then to get a deeper insight, qualitative research is conducted. Qualitative data was collected through interviews with the Scrum team (Scrum Master, Product Owner and Development Team) and observation of sprint implementation at Bank Z. The scope of this research focuses on the implementation of the digitalization system at Bank Z, which has been implementing Scrum since 2023.

This research aims to measure the level of maturity of Scrum-based software development project management and provide recommendations for improvement to Bank Z. It is hoped that these recommendations can be used to evaluate the current problems and improve the quality of software development in the next sprint. Hopefully, these recommendations can be used as an evaluation of the problems faced today and improve the quality of software development in the next sprint. This research is expected to provide benefits for Bank Z's Scrum Team, especially for the development team. The results of the research are expected to provide useful input in improving knowledge about Scrum, so that the development process can be carried out on time and more

efficiently. In addition, the results of this analysis are expected to make a significant contribution to the development of more efficient, effective, and adaptive applications at Bank Z. For readers, this research can broaden insights and become a reference for further systematic research, as well as a reference for companies that are implementing Scrum-based systems in their development.

RESEARCH METHOD

Type of Research

In this study, researchers aim to measure the maturity level of Scrum-based software development project management. Based on the level of maturity obtained, recommendations will be given to improve the level of maturity of Scrum-based software development project management at bank Z. Therefore, the type of research used is quantitative research. Quantitative research aims to explain, predict and / or control phenomena through focused data collection of numerical data (Kusumastuti et al., 2020). Quantitative research methods measure variables in this case the level of maturity of Scrum-based software development at Bank Z with a research instrument, namely the Scrum Maturity Model.

Population, Sample and Sampling Technique

According to Kusumastuti et al., (2020) the population is the entire object being studied, in the form of people, objects, events, values or things that happen. Populations can be individuals, groups, organizations, regions, or other research objects that are the target of research. While sample is part of the population to be investigated. In addition, if all members of the population are taken all to be used as data sources, then that method is called a sample. The population used in this study are all employees involved in Scrum development at Bank Z. Currently the Scrum team at Bank X is 55 people. Bank Z Scrum team consists of development team, product owner, and development team. While the samples used in this study are Bank Z employees who have been involved for at least 1 year in Scrum development. The sampling technique used is purposive sampling. In purposive sampling, sample designation is based on certain characteristics or properties that are considered to have a close relationship with the characteristics or properties of the population that are already known (Kusumastuti et al., 2020).

Data, Data Types and Data Collection Techniques

In this study, the data used are the results of responses that have been given by respondents, namely bank Z employees involved in the scrum team. The type of data used is primary data. Primary data is data taken directly from the software development team, such as the results of interviews, questionnaires, or direct observation. Primary data collection using a questionnaire given to the Scrum Master, Product Owner and Development Team. The Scrum Master has been involved for at least 1 year in the Bank Z Scrum team. In addition, to help analyze more deeply to understand the level of adoption and implementation of Scrum at Bank Z, researchers will conduct interviews and discussions with 1 Scrum Master, 1 Product Owner, 2 Development teams.

Data Analysis Method

The maturity level will be measured based on the criteria in the Scrum Maturity Model (SMM) such as:

a. Level 1: Awareness of Scrum.
b. Level 2: Scrum practices are implemented on an ad hoc basis.
c. Level 3: The Scrum process is well organized and documented.
d. Level 4: Quality measurement and control are actively implemented.
e. Level 5: Continuously optimized and improved software development.

Questionnaire Distribution

The questionnaire will be distributed using google form or done online aimed at all employees involved in the development of Scrum-based applications at Bank Z.

Data Tabulation

At this stage the data that has been obtained from respondents' responses through filling in the Google Form, is entered into a table (Microsoft Excel) to be reorganized and calculated for the maturity level of project management at Bank Z.

Maturity Level Calculation

Research from Anggraeny et al., 2024 states that the Scrum Maturity Model method does not explain in detail about how the analysis mechanism of the questionnaire results is obtained. The study used the Agile Maturity Model (AMM) approach and calculated the Key Process Area Rating (KPA Rating) with the following equation:

$$\text{KPA} = \frac{\sum \text{Yn} + \frac{1}{2}\sum \text{Pn}}{\sum \text{Tn} + \sum \text{NAn}} \times 100\%$$

with:

Yn = "Yes" answer

Pn = "Partial" answer

Tn= total of all answers

Nan= number of responses "Not applicable or N/A"

Based on the percentage value of KPA Rating obtained, the interpretation is grouped into several categories, namely:

Table 1. FTC Classification Rating

No.	KPA Rating	Interpretation
1	86% to 100%	Fully Achieved
2	51% to 85%	Largely Achieved
3	16% to 50%	Partially Achieved
4	0% to 15%	Not Achieved

The maturity level of the assessed software development process will be at a level where all KPAs are fully achieved, namely the KPA Rating value ≥ 86% for each KPA. The category of the maturity level of the software development process based on the Scrum Maturity Model can be seen in Table 2. 3 Scrum Maturity Model Levels.

RESULTS AND DISCUSSION

Characteristics of Respondents Based on Role

The characteristics of respondents based on role can be seen in Table 4.1 below:

Table 1. Characteristics of respondents based on Role

Role	Total	Percentage
Development Team	41	91%
Scrum Master (Project Management Team)	2	4%
Product Owner (Business Team)	2	4%

The majority of respondents are the development team with a total of 41 people (91%) of the total observations. While the rest are Scrum Master and Product Owner.

Characteristics based on length of time involved in Scrum development

The characteristics of respondents based on the length of time involved in Scrum projects can be seen in Table 2 below:

Table 2. Characteristics of respondents based on length of involvement in Scrum

Long time involvement in Scrum projects	Total	Percentage
1 - 2 years	17	20%
> 5 years	46	70%
< 1 year	0	0%
2 - 3 years	12	20%
3 - 5 years	8	16%

The majority of respondents who have been involved in Scrum development for more than 5 years indicate that they have deep experience in implementing and managing the Scrum methodology.

Data Collection Methods

The method of collecting data used in this research is using a survey or questionnaire. The questionnaire was given to team members to assess their understanding and implementation of Scrum principles. In addition, to deepen the results of the questionnaire, the researcher conducted an interview with the Scrum Master or Product Owner to get a perspective on the implementation of Scrum. The questionnaire was developed with reference to the Scrum Maturity Model.

The Scrum Maturity Model includes various key aspects/objectives that need to be evaluated. The data collection process includes categories that cover the main aspects of the Scrum Maturity Model that need to be evaluated, including the following:

a. Basic Scrum Management
b. Software Requirements Engineering
c. Customer Relationship Management
d. Iteration Management
e. Standardized Project Management
f. Performance Management

Team maturity level based on Scrum Maturity Model

Based on the data collected, it is known that the development process at bank Z is at level 2. As is known, the Scrum Maturity Model consists of five maturity levels (Initial, Managed, Defined, Quantitatively Managed, and Optimizing) with the following information:

a. Level 1: Initial: The process is still not well structured.
b. Level 2: Managed: Some processes are in place but not yet consistent.
c. Level 3: Defined: Processes are standardized and consistently applied.
d. Level 4: Quantitatively Managed: Processes are measured and managed with objective data.
e. Level 5: Optimizing: Processes are improved on an ongoing basis.

Here is a graph that illustrates the maturity level in each of the key areas of Scrum:

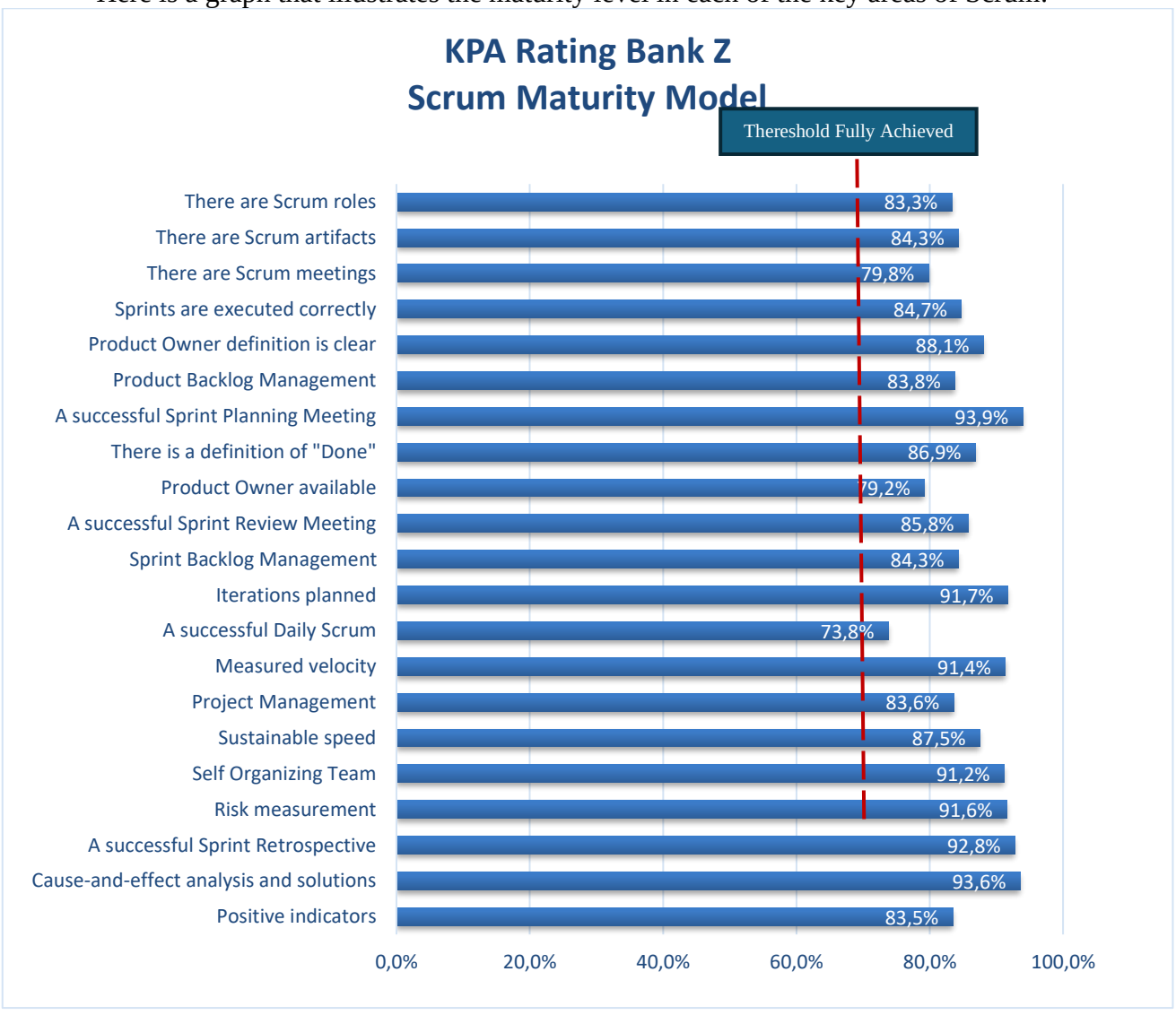

Figure 1. Summary of Scrum Maturity Model Maturity Level Assessment Results

Scrum Maturity Model Measurement Results

In this section, analyze the measurement results on various aspects of project management based on Scrum:

1. **Basic Scrum Management**

Basic Scrum Management describes the initial level in the adoption and implementation of Scrum in a team or organization. At this stage, the team is beginning to understand and apply the basics of Scrum, but may not have fully optimized all the practices and roles necessary for long-term Scrum success.

2. **Software Requirements Engineering**

Software Requirements Engineering is the process associated with collecting, analyzing, documenting, and managing software requirements. In Scrum, requirements management is typically done through a product backlog managed by the Product Owner. At lower levels of Scrum maturity (e.g., at the Basic Scrum Management stage), the Software Requirements Engineering process is often less structured and not optimized, whereas at higher levels (such as Optimizing), this process is more mature and more deeply integrated with the Scrum workflow.

3. **Customer Relationship Management**

Software Requirements Engineering is the process associated with collecting, analyzing, documenting, and managing software requirements. In Scrum, requirements management is typically done through a product backlog managed by the Product Owner. At lower levels of Scrum maturity (e.g., at the Basic Scrum Management stage), the Software Requirements Engineering process is often less structured and not optimized, whereas at higher levels (such as Optimizing), this process is more mature and more deeply integrated with the Scrum workflow.

4. **Iteration Management**

Iteration Management in the Scrum Maturity Model (SMM) refers to how a Scrum team plans, executes, and evaluates each iteration (called a Sprint) in the product development cycle. In each iteration, the Scrum team focuses on completing a prioritized product backlog, with the goal of delivering a usable incremental product that delivers business value. Effective Iteration Management is critical to Scrum's success, as it ensures optimal management of time, resources, and priorities.

5. **Standardized Project Management**

Standardized Project Management in the Scrum Maturity Model refers to the structured and consistent application of project management methodologies to manage projects using Scrum principles. Although Scrum focuses more on managing projects in a flexible and adaptive way, at higher levels of maturity, teams and organizations begin to develop and implement standards in terms of processes, roles, and practices to ensure consistency and effectiveness in running Scrum projects.

6. **Performance Management**

Performance Management in the Scrum Maturity Model refers to how teams and organizations manage, measure, and improve the performance of Scrum teams in achieving goals and delivering value consistently. At each stage of Scrum maturity, teams focus on better ways to monitor, evaluate, and optimize their performance, both in terms of outcomes (outputs) and processes (ways of working).

The measurement results for each of these areas are as follows:

Maturity Level Assessment 2 Common Objectives of Basic Scrum Management

The assessment of the Scrum Management Base consists of 4 specific objectives, namely:

a. There are Scrum roles
b. There are Scrum artifacts
c. There are Scrum meetings
d. Sprints are executed correctly

Based on the results of the maturity level assessment for each specific target in the general objective of Basic Scrum Management, the KPA recapitulation results are shown in table 3 Rating with an average value of 90.4% so that it can be said that this general objective is Fully Achieved. Summary of KPA Rating assessment for the general objective of Basic Scrum Management can be seen in Table 3 below:

Table 3. Basic Scrum Management Assessment Results

General Objective	Specific Objectives	Average
2.1 Basic Scrum Management	2.1.1 There are Scrum roles	83,5%
	2.1.2 There are Scrum artifacts	93,6%
	2.1.3 There are Scrum meetings	92,8%
	2.1.4 Sprints are executed correctly	91,6%
Average		**90,4%**
Fully Achieved		

Scrum roles scored 83.5% which indicates that the roles in Scrum in the organization have been implemented quite well. However, there is still room for improvement in terms of understanding and applying these roles. Roles such as Scrum Master, Product Owner, and Development Team may already exist, but their application is not fully optimized and needs to be further refined to ensure clearer collaboration and responsibilities among team members.

Scrum artifacts scored 93.6% indicating that Scrum artifacts, such as Product Backlog, Sprint Backlog, and Increment, are very well implemented. These artifacts are in place and used consistently to monitor and manage work in product development. This reflects a mature and structured management of the information required in the Scrum process.

Scrum meetings scored 92.8% indicating that Scrum meetings, such as Sprint Planning, Daily Standup, Sprint Review, and Sprint Retrospective, are implemented very well and regularly. These meetings have become an integral part of the Scrum process and are conducted with the aim of improving team communication, transparency, and adaptation to change. While they are excellent, it is possible that some aspects of these meetings could be improved for greater effectiveness.

Sprints implemented correctly obtained a score of 91.6%, which indicates that the implementation of Sprints in the organization is quite good and in accordance with Scrum principles. The Sprint process, from planning to execution and evaluation, has gone well. However, there are still some aspects that need to be improved to ensure that each Sprint runs more effectively and achieves optimal results in accordance with the set goals.

Overall, the scores obtained indicate that Scrum in the organization is fairly well implemented, but there are still some areas that need improvement to reach a higher level of maturity and ensure a more effective and efficient implementation of Scrum.

Maturity Level Assessment 2 Common Goals of Software Requirements Engineering

The assessment of Software Requirements Engineering consists of 3 specific objectives, namely:

a. Product Owner definition is clear
b. Product Backlog Management
c. A successful Sprint Planning Meeting

Based on the results of the maturity level assessment for each specific target in the general objective of Software Requirement Engineering, the KPA recapitulation results are obtained in Table 4 Rating with an average value of 87% so that it can be said that this general target is Fully Achieved. Summary of KPA Rating assessment for the general objective of Software Requirement Engineering can be seen in Table 4 below:

Table 4. Software Requirement Engineering Assessment Results

General Objective	Specific Objectives	Average
2.2 Software Requirements Engineering	2.2.1 Definition of Product Owner clear	91,2%
	2.2.2 Product Backlog Management	87,5%
	2.2.3 A successful Sprint Planning Meeting	83,6%
Average		**87,4%**
Fully Achieved		

The definition of Product Owner clearly obtained a score of 91.2%, indicating that the definition of the Product Owner's role in the organization is very clear and well understood. The Product Owner has a strong understanding of his responsibilities in managing the Product Backlog and prioritizing features or work to be done by the team. Although it is very good, there is little room for improvement to make the understanding and application of the Product Owner role more consistent and accepted by all team members.

Their Product Backlog management obtained a score of 87.5% indicating that Product Backlog management in the organization is already running quite well, but there are still some aspects that need to be improved. The Product Backlog is well managed, but the processes to ensure that the backlog is always properly prioritized and kept up to date may not be fully efficient. This suggests that while the backlog may be well managed, there may be a slight lack of detail or more precise prioritization.

A successful Sprint Planning Meeting scores 83.6%, indicating that the organization's Sprint Planning Meeting is well implemented, but there are some areas that still need improvement to achieve more consistent success. In Sprint Planning, the goals and priorities of the work are usually clearly defined, but it is still possible that some Sprint Planning is not fully efficient or does not always result in a common understanding among all team members. This process could perhaps be further enriched so that all team members feel more involved and coordinated in Sprint planning.

In fulfillment of maturity level 2, the general objectives of Basic Scrum Management and Software Requirements Engineering obtained average scores for key process area assessments of 90.4% and 87.4%, respectively. Both of these scores are interpreted as fully achieved. This indicates that Bank Z has achieved both objectives with a small number of improvement practices to make them more perfect.

Maturity Level Assessment 3 Common Customer Relationship Management Objectives

The assessment of Customer Relationship Management consists of 3 specific objectives, namely:

a. There is a definition of "Done"
b. Product Owner available
c. A successful Sprint Review Meeting

Based on the results of the maturity level assessment for each specific target in the general objective of Customer Relationship Management, the results of the KPA recapitulation are obtained in Table 5 Rating with an average value of 85.6% so that it can be said that this general objective is Largely Achieved. Summary of KPA Rating assessment for the general objective of Customer Relationship Management can be seen in Table 5 below:

Table 5. Customer Relationship Management Assessment Results

General Objective	Specific Objectives	Average
3.1 Customer Relationship Management	3.1.1 There is a definition of "Done"	91,4%
	3.1.2 Product Owner available	73,8%
	3.1.3 A successful Sprint Review Meeting	91,7%
Average		**85,6%**
Largely Achieved		

There is a definition of "Done" scored 91.4% which indicates that the organization already has a definition of "Done" that is clear and well understood by all team members. This definition is important to ensure that any work completed meets agreed quality standards, and all team members understand when work can be considered complete. While this score indicates excellent implementation, there is still scope to improve or update the definition of "Done" to be more comprehensive and cover all relevant aspects as the team and product evolve.

Product Owner is available scored 73.8% which indicates that the availability of the Product Owner in the organization still needs to be improved. Although the Product Owner is available on some occasions, there are times when this role is less present or difficult for the team to reach, which can hinder quick decision making and effective backlog management. This can affect the speed at which the team can respond to changing priorities and customer needs. Organizations need to ensure that the Product Owner is more available and actively involved in the Scrum process to support project success.

A successful Sprint Review Meeting scored 91.7%, indicating that the organization's Sprint Review Meeting was very well executed and successful in achieving its objectives. This meeting allows teams to demonstrate their work to stakeholders and get constructive feedback. This high score reflects a mature process for conducting the Sprint Review, where all parties are involved and can provide useful feedback for the next iteration. While this is already very good, it is possible to improve engagement or the quality of feedback received to make this session more productive.

Maturity Level Assessment of Common Goal Iteration Management

The assessment of Iteration Management consists of specific objectives, namely:

a. Sprint Backlog Management
b. Iterations planned
c. A successful Daily Scrum
d. Measured velocity

Based on the results of the maturity level assessment for each specific target within the general target of Iteration Management, the KPA recapitulation results are shown in Table 6 Rating with an average value of 84.1% so that it can be said that this general objective is Largely Achieved. Summary of the KPA Rating assessment for the general objective of Iteration Management can be seen in Table 6 below:

Table 6. Iteration Management Assessment Results

General Objective	Specific Objectives	Average
3.2 Iteration Management	3.2.1 Sprint Backlog Management	84,3%
	3.2.2 Iterations planned	85,8%
	3.2.3 A successful Daily Scrum	79,2%
	3.2.4 Measured velocity	86,9%
Average		**84,1%**
Largely Achieved		

The definition of "Done" scored 91.4%, indicating that the organization already has a clear definition of "Done" that is well understood by all team members. This definition is important to ensure that any work completed meets agreed quality standards, and all team members understand when work can be considered complete. While this score indicates excellent implementation, there is still scope to improve or update the definition of Done to be more comprehensive and cover all relevant aspects as the team and product evolve.

Product Owner is available scored 73.8% which indicates that the availability of the Product Owner in the organization still needs to be improved. Although the Product Owner is available on some occasions, there are times when this role is less present or difficult for the team to reach, which can hinder quick decision making and effective backlog management. This can affect the speed at which the team can respond to changing priorities and customer needs. Organizations need to ensure that the Product Owner is more available and actively involved in the Scrum process to support project success.

A successful Sprint Review Meeting gets 91.7% which indicates that the organization's Sprint Review Meeting is very well implemented and successful in achieving its objectives. This meeting allows teams to demonstrate their work to stakeholders and get constructive feedback. This high score reflects a mature process for conducting the Sprint Review, where all parties are involved and can provide useful feedback for the next iteration. While this is already very good, it is possible to improve engagement or the quality of feedback received to make this session more productive.

In fulfillment of maturity level 3, the Customer Relationship Management and Iteration Management general objectives obtained an average score for the key process area assessment of 85.6% and 84.1%, respectively. Both of these scores are interpreted as mostly achieved. This

indicates that Bank Z has achieved most of the practices required to achieve optimal results within each area have been achieved.

Maturity Level Assessment of the Common Goal of Standardized Project Management

The assessment of Iteration Management consists of specific objectives, namely:

a. Project Management
b. Sustainable speed
c. Self-Organizing Team
d. Risk measurement

Based on the results of the maturity level assessment for each specific target within the general objective of Standardized Project Management, the KPA recapitulation results are shown in Table 7 Rating with an average value of 87.6% so that it can be said that this general objective is Fully Achieved. Summary of KPA Rating assessment for the general objective of Standardized Project Management can be seen in Table 7 below:

Table 7 Standardized Project Management

General Objective	Specific Objectives	Average
4.1 Standardized Project Management	4.1.1 Project Management	93,9%
	4.1.2 Sustainable speed	83,8%
	4.1.3 Self Organizing Team	88,1%
	4.1.4 Risk measurement	84,7%
Average		**87,6%**
Fully Achieved		

Project management scored 93.9% indicating that project management in this organization is at a very high level of maturity. This means that most of the important aspects of project management have been well implemented, including planning, resource management, scheduling, budget management, and project control and evaluation. This score indicates that the project team was very effective in running the project from start to finish, with little room for improvement. In other words, almost all project managerial elements were achieved according to the set standards.

Sustainable velocity scored 83.8%, reflecting that the organization has a fairly good level of speed or agility in running projects or iterations on an ongoing basis. This means that while most project and product delivery processes can be done efficiently and on time, there is little room to improve speed without sacrificing quality. Sustainable velocity refers to the organization's ability to maintain a productive and adaptive workflow, with processes that can be repeated and applied consistently on subsequent projects.

Self-Organizing Team scored 88.1%, indicating that the organization has succeeded in forming a self-organizing team very well. Self-organizing teams can manage their tasks and responsibilities without the need for close supervision from managers, which supports independence and collaboration within the team. This score means that most teams are already able to work effectively and efficiently with little external intervention, but there is still room to further optimize the team's ability in terms of decision-making and initiative in managing their own work.

Risk Measurement scored 84.7%, reflecting that the organization has a good process for measuring and managing risk. Risk measurement is a very important process for identifying, evaluating, and managing potential risks that may affect a project or organization. This score indicates that most risks are well identified and effectively monitored, although there is little room to improve or increase the precision and depth in the risk management process, such as ensuring that all risks are appropriately measured and risk mitigation is optimized.

Overall, the scores indicate that the organization has a very good level of maturity in project management, sustainable speed management, self-reliant team building, and risk management. While there have been significant achievements, there is still room for further improvement in each of these areas to achieve a perfect level of maturity.

Maturity Level Assessment of Performance Management Common Objectives

The assessment of Performance Management consists of specific objectives, namely:

a. A successful Sprint Retrospective
b. Cause-and-effect analysis and solutions
c. Positive indicators

Based on the results of the maturity level assessment for each specific target in the Performance Management general objective, the KPA recapitulation results are obtained in Table 4.6. Rating with an average value of 82.5% so that it can be said that this general objective is Largely Achieved. Summary of the KPA Rating assessment for the Performance Management general objective can be seen in Table 4.6 below:

Table 8 Performance Management Assessment Results

General Objective	Specific Objectives	Average
5.1 Performance Management	5.1.1 A successful Sprint Retrospective	79,8%
	5.1.2 Cause-and-effect analysis and solutions	84,3%
	5.1.3 Positive indicators	83,3%
Average		**82,5%**
Largely Achieved		

Successful Sprint Retrospective scored 79.8%, indicating that the organization has successfully implemented Sprint Retrospective quite well, but there is still room for further improvement. A Sprint Retrospective is a session held after each sprint (development iteration) to evaluate what went well, what could be improved, and how to improve the process for the next sprint. This score indicates that most teams have done productive reflection and learned from the previous sprint experience. Nonetheless, there is potential to improve the effectiveness of these retrospectives, perhaps by going deeper in problem identification or implementing more appropriate solutions for improvement.

Cause and Effect Analysis and Solution scored 84.3% which indicates that the organization has done a fairly good job of cause-and-effect analysis, which is an important part of problem solving and decision making. Cause-and-effect analysis helps the team identify the root causes of problems encountered during development, rather than just addressing the symptoms. With this score, it can be said that most of the problems faced by the team were well analyzed and appropriate solutions were implemented. However, there is still potential to deepen the analysis process or identify more causal factors to refine the solutions provided.

Positive Indicators scored 83.3%, indicating that the organization is fairly good at setting and measuring positive indicators in their projects or processes. Positive indicators are measures that show good progress or achievement of goals that lead to success. This score reflects that most teams or organizations have identified and monitored relevant indicators to assess the success and impact of their work. However, there is room to improve the selection of indicators or the way they are monitored to achieve this more efficiently.

Recommended Improvement Target

Based on the results of the Scrum Maturity Model measurement obtained, the implementation of Scrum at Bank Z has reached the maturity level at level 2. For this reason, improvements need to be made to reach levels above 2 by implementing practices in Scrum, especially areas that have not yet been fully achieved. The recommendations for improvement to reach maturity level 3 are:

1. **Customer Relationship Management**
   a. Every project needs to ensure that the definition of "Done" is achieved in every iteration.
   b. Every team should respect the definition of "Done"
   c. Each project must ensure that the Product Owner is available to the team.
   d. Every project should ensure that the Product Owner can be contacted easily.
   e. Each project must be able to show the finished software that has undergone testing.
   f. At each Sprint Review Meeting, the Product Owner and other stakeholders provide feedback.
2. **Iteration Management**
   a. The Sprint Backlog must be divided into smaller jobs.
   b. All team members must participate in the estimation
   c. The remaining effort for the estimation of each job is updated daily
   d. Each project should conduct Daily Scrum every weekday at the same place and time.
   e. In the Daily Scrum, problems and obstacles must be identified.
   f. Every team member can see what the others are working on.
   g. Sprint Burndown Chart created and accessible to all team members
   h. Sprint Burndown Chart updated daily
   i. Scrum Master performs regular analysis of Sprint progress

In addition to the implementation of practices in Scrum, some other recommendations that can be considered to improve Scrum maturity based on interviews with Scrum Masters are:

Strengthening Stakeholder Engagement

a. Product Owner: Ensure the Product Owner has a deep understanding of the product and business priorities. Actively involve the Product Owner in all stages of the sprint, from planning to review.
b. Other Stakeholders: Periodically involve other stakeholders in the Sprint Review to get more comprehensive feedback.

c. Definition of "Done": Make sure all team members have the same understanding of what "done" means for each backlog item.

Improving Team Performance

a. Training and Coaching: Conduct regular training and coaching to improve the team's ability to estimate, self-organize, and solve problems.
b. Effective Retrospective: Use retrospective results to identify areas of improvement and create concrete corrective actions.
c. Metrics: Apart from velocity, also look at other metrics such as cycle time and lead time to measure the team's performance.

Improving Daily Scrum Consistency

a. Focus: Make sure the Daily Scrum focuses on three main questions: What did I do yesterday? What will I do today? Are there any obstacles that I am facing?
b. Duration: Limit the duration of the Daily Scrum to keep it short and effective.
c. Participation: Ensure that all team members are present and actively participating in the Daily Scrum.

Strengthening Project Management

a. Tooling: Use the right tools to assist in project management, such as Jira or Trello.
b. Process Standardization: Create a clear and consistent process for all stages of product development.
c. Continuous Improvement: Continue to make improvements to existing processes based on evaluation results.

Organizational Culture

a. Communication: Encourage open and honest communication among all team members.
b. Cooperation: Create a strong culture of cooperation among all teams involved in the project.
c. Focus on Values: Remind the team about Scrum values and how they can help achieve organizational goals.

Practical Implications

Based on the recommendations given, there are several areas that need to be improved in managing software projects using Scrum.

a. Recommendations for organizations to optimize Scrum implementation.
b. Increased role of the Scrum Master in supporting the team.

The importance of further training for team members to understand more about Scrum.

CONCLUSION

Based on the results and analysis of the research that has been conducted, the conclusions obtained show that the level of maturity of software development project management using Scrum at Bank Z is at Level 2 - Managed. These results indicate that the organization or team has reached the stage of basic understanding of Scrum and has a strong foundation and is more structured in applying Scrum more broadly. The maturity level at Level 2 is achieved based on the achievement of the objectives of the Basic Scrum Management and Software Requirements Engineering aspects, which are considered fully achieved. To improve the maturity level and enhance performance in software development, several recommendations can be implemented, including: improving practices related to customer relationship management and iteration management, as well as standardizing project management and project performance management. In addition, a deep understanding of the Scrum framework, including its practices, ways of working, and rules, should be known by all team members. The application of the Scrum framework can deliver maximum

results if applied consistently across all projects, and ongoing training for development teams, product owners, and scrum masters is essential to deepen knowledge for more optimal Scrum application. Bank Z, as a large organization with diversified teams, indicated that Scrum implementation may vary across teams, due to differences in knowledge and experience with Scrum, potentially leading to mixed assessments of maturity levels across the organization.

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