

Comparing Scrum Maturity of Digital and Business Process Reengineering Groups: A Case Study at an Indonesia's State-Owned Bank

Gloria Saripah Patara, Teguh Raharjo

Faculty of Computer Science, Universitas Indonesia, Jakarta, Indonesia

Abstract—Bank XYZ, an Indonesia's state-owned bank, has been conducting business and digital transformation throughout its organization. Based on a recent McKinsey survey, less than 30% of organizations succeed in transformation. Fast changing business requirements and various technology-based initiatives enforce the organization to employ an Agile methodology and Scrum, to cope with the situation. Group Grp-DGT and Grp-BPR are two groups in Bank XYZ that manage their projects using Scrum. Grp-DGT develops digital projects, whereas Grp-BPR develops Business Process Reengineering (BPR) projects. Scrum maturity in both groups needs to be appraised to promote sustainability in the long run. Comparing Scrum maturity between digital and BPR projects has not been done in the previous works, especially in a state-owned bank in Indonesia. This research will help the organization through the research output which are Scrum maturity level at both groups and proposed recommendations to improve Scrum practices. The other organizations can benefit from the recommendations as well. Scrum maturity model (SMM) is used to appraise the practices, while Agile Maturity (AMM) is used to calculate the maturity rating. From this research, it is found that Grp-DGT has reached maturity level 5 (optimizing), whereas Grp-BPR is still at level 1 (initial). Based on assessment results and Scrum guides, the recommendations are then drafted. There are 15 recommendations proposed to Grp-BPR to reach level 2 and onwards.

Keywords—Transformation; scrum; digital project; BPR project; scrum maturity model; agile maturity model

I. INTRODUCTION

Business transformation has become a catch-all term for years now. It refers to how organizations reach their fullest potential. It aims to improve overall performance by generating more revenue, reducing operational expenses, and improving both customer satisfaction and productivity among employees [1]. Business processes are reengineered to be more efficient and optimized in terms of the way customer performs their financial transactions. In line with this business transformation, digital transformation has been progressing in organizations. It utilizes cutting-edge technologies to boost the current operations and to create new business opportunities [2–5]. Based on McKinsey survey [6], there are more than 80% organizations that have undertaken efforts to apply digital transformation in the past five years, and less than 30% succeed it. To win these transformations, the organizations have to manage their projects effectively. Agile project management fits the condition. It has been used in business

process improvement [7, 8]. It is rapid and adaptive to change, builds effective communication among all stakeholders, brings customer into the team, and promotes a self-managed team. It also delivers software rapidly and incrementally to compete with fast-changing market [9–11].

Bank XYZ has been aggressively performing both transformations through its two groups (or divisions in other organizations). Those groups are Digital Group (Grp-DGT) and Business Process Reengineering Group (Grp-BPR). Grp-DGT is a group developing digital projects, whereas Grp-BPR is a group developing BPR (Business Process Reengineering) projects. Bank XYZ needs Scrum maturity assessment as a part of evaluation of the current software development process in both groups. This gap raises two questions: What is the current maturity level of Bank XYZ? How does Bank XYZ improve its level? To answer these questions, this research intends to compare Scrum maturity level in Grp-DGT and Grp-BPR. It also recommends improvement in Scrum practices based on the assessment results. These recommendations can be used to support product delivery sustainability in the long run.

There are few previous case studies in Indonesia that conduct Scrum maturity assessment. Scrum maturity model (SMM) is used to perform an assessment to Scrum practices in a telecommunication company [12], an education technology startup [13], and two software development companies [14, 15]. They proposed recommendations to the organizations based on assessment results. Panjaitan et al. [14] discussed the results and the recommendations in a thorough approach. In addition, Scrum maturity level can also be compared between two groups as conducted in research [16] and [17]. Setiawan et al. [16] compared Scrum practices in a Corporate Strategy group and an Information Technology (IT) group at a telecommunication company, whereas Zelfia et al. [17] compared an IT group and a temporary unit at a state-owned bank. Comparing groups in a state-owned bank that develop digital and BPR projects has not been done previously.

Problem identification and root cause analysis are performed through direct observation and semi-structured interview. Literature study is then performed to find previous related case studies to be used as theoretical foundation and research instrument's drafting guidelines. This research will combine Scrum maturity model (SMM) and Agile maturity model (AMM) to appraise the Scrum practices and to calculate key process area (KPA) rating respectively.

Elicitation is performed by administering an online questionnaire to the respondents. Then, recommendations are proposed based on assessment results. Conclusion, limitations, and future work are also described.

This paper is constructed as follows. Section II depicts an overview of Agile methodology, Scrum framework, and Scrum maturity model. Section III explains about the research methodology utilized in this study. Section IV describes the results and the discussion related to this study's purpose including proposed recommendations for the organization. Section V shows the conclusion of this study's result, limitations, and suggestion for the future study.

II. LITERATURE REVIEW

A. Agile Methodology

Agile is a way of thinking based on values, governed by principles, and manifested in numerous practices. Based on the circumstances, agile practitioners favor certain practices over others. Agile software development was formalized in 2001 through the Agile Manifesto [9, 18].

There are four values in the Manifesto, and they are promoted in software development process [9, 14, 18–22]. Those values are (1) individuals interacting to arrive at solutions, (2) focus on delivering well-functioning software, (3) customer and developers collaborating constantly, and (4) emphasizing on responding to requirement change.

Twelve principles were derived from the values, to clarify them [9, 18, 20–22]. Those principles are (1) prioritizing customer satisfaction, (2) receiving requirements change, (3) delivering well-functioning software constantly, (4) daily interaction and collaboration between business people and developers, (5) motivating individuals to build the project, (6) using face-to-face conversations to share information to and within development team, (7) project progress is evaluated through a well-functioning software, (8) development sustainability is achieved when the sponsors, developers, and users maintaining their pace constantly, (9) constant focus to technical excellence and good design, (10) simplifying things to maximize outcome and impact, (11) self-organizing teams promotes the best designs, specifications, and architectures, and (12) the team gives thought on how to be more effective, then calibrates and consequently adjusts its behavior.

Fig. 1 illustrates the interconnection among values, principles, and practices of the Agile Manifesto.

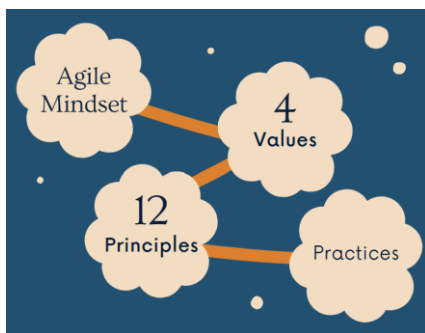


Fig. 1. The interconnection among the values, principles, and practices of the agile manifesto.

Despite the term “agile” becoming popular after the Manifesto, the viewpoints and methods have been practiced for many years before that [9, 11]. It is a superset term covering various techniques and frameworks. Fig. 2 shows the relationship among Agile and the other related terms. It is depicted as a superset term pointing to all kinds of approaches which meet the values and principles of the Agile Manifesto. Agile and the Kanban Method are shown as subsets of lean because they practice the same concepts, such as attention to value, incremental delivery, and effective process [9]. Based on a recent survey mentioned in [13, 17], Scrum is the most popular Agile approach among other approaches.

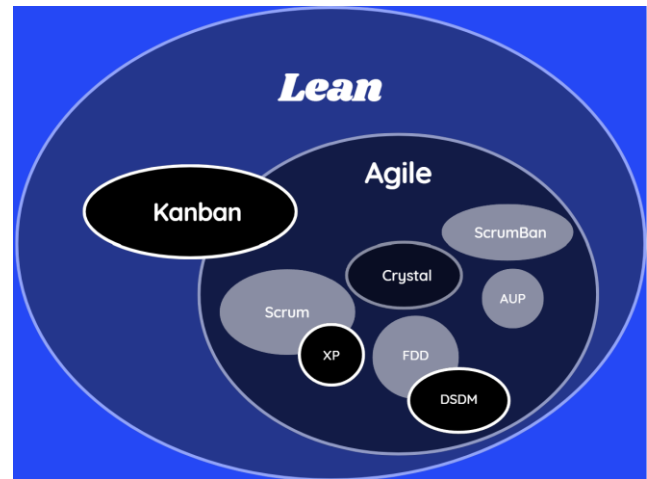


Fig. 2. Agile and other approaches [9].

B. Scrum Framework

Scrum is a simple and nimble framework that aids people, teams, and organizations in achieving goals and creating value by employing flexible approaches to solve complex problems. Empiricism and lean thinking are the foundation of Scrum. Empiricism means that the team constantly learns and improves from their past wrongdoings. Decisions and changes are made based on what the customer really needs, rather than what the developers think the customer needs. Whereas lean thinking focuses on providing benefit to the customer and assumes that anything else is inessential.

There are three primary ideas or pillars of empirical process: transparency, inspection, and adaptation [23, 24]. According to Schwaber et al. [24], transparency is mirrored through Scrum's artifacts that are visible to those performing the task. On the other hand, inspection and adaptation are implemented through four formal events in an iteration.

In Scrum, the product is delivered using an iterative, incremental approach to manage risks and to optimize predictability [24]. Commitment, courage, focus, openness, and respect are Scrum values. People's proficiency over these values determines the success of Scrum utilization throughout its process. As mentioned in [23], the process is categorized into five phases: (1) initiation, (2) planning and estimation, (3) implementation, (4) review and retrospective, and (5) release.

Based on Schwaber et al. [24], there are three roles in a Scrum development team who collectively focus their effort on a common goal, that is a product goal. The roles are

Product Owner (PO), Scrum Master (SM), and developers (DEV). VMEDU [23] categorized these three roles as core roles, and added business stakeholders, supporting services, vendors, and Scrum guidance body as non-core roles. An ideal team usually comprises of 5-9 members, 1 PO, 1 SM, and 3-7 DEVs. The team is self-organized, and each member has their own responsibilities.

The PO is the voice of business stakeholders and accountable for ensuring that the value is delivered through product increments. He or she articulates prioritized business requirements which are managed in the product backlog. The product backlog, including its items, must be visible, transparent, and understandable to the developers. The developers have specific skills to build the product. They are accountable for drafting a plan and backlog for Sprint. They also ensure deliverables quality through a Definition of Done and adapt their plan daily to meet the Sprint Goal. The Scrum Master is an individual who enables the team and the entire organization to understand what Scrum is, both theory and practice. He or she is also accountable for ensuring a proper work environment by removing impediments, so the developers can focus on delivering a high-value increment [23, 24].

Sprint is the centre of Scrum, where the team turned the business requirements into value. Fig. 3 illustrates Scrum flow for a Sprint. It is timeboxed for one to four weeks. When a Sprint concludes, it is immediately followed by a new Sprint. There are four events contained in a Sprint: Sprint planning, Daily Scrums, Sprint reviews, and Sprint retrospectives. In Sprint planning, the team discusses why this Sprint is valuable, what can be delivered, and how the selected work can be delivered. The Sprint backlog is defined in this event. Sprint goal, the selected product backlog items, and the delivery plan are part of Sprint backlog. Sprint goal is inspected daily through a Daily Scrum. The developers can synchronize their tasks, discuss potential problems, and plan for the next tasks. Definition of Done (DoD) is adhered during development. The developers then will demo the increment to stakeholders in a Sprint review event. The purpose is to obtain a review on the increment and discuss what to do next according to the current environment. The Sprint is concluded in the Sprint retrospective where future improvements are discussed [24].

Product backlog, Sprint backlog, and increment are the three artifacts mentioned in [24]. Information transparency to all team members is promoted through these artifacts, so they can be inspected, and an adaptation can be performed accordingly. A product backlog consists of ordered business requirements which are called product backlog items (PBIs). This artifact is changed based on the review or discussions with the stakeholders. The collection of PBIs which are selected to be delivered in a Sprint is called a Sprint backlog. The developers update and add more information into it along the Sprint. It must be completed to meet the Sprint goals. Increment is a delivered value which consists of the selected PBIs that have been completed in a specific Sprint. It is a steppingstone to the product goal.

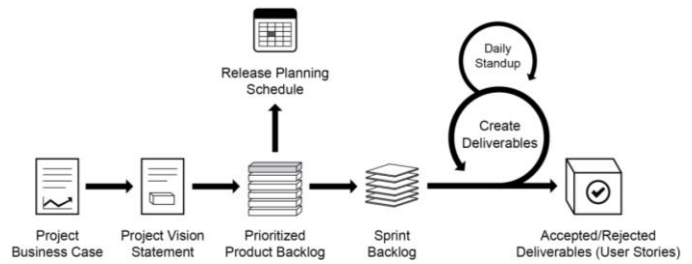


Fig. 3. Scrum flow for a sprint [23].

C. Scrum Maturity Model

According to Hutabarat et al. [25], a maturity model in a project management is a continuous process to recognize, evaluate, apply, and reassess the opportunities to improve constantly in project implementation. It is one of the organization success factors which has many types of projects, programs, and portfolios. In line with that, [14, 15] added that maturity model is a technique to evaluate the maturity level and development process capability. It continuously directs and enhances the organization's development process to avoid project failures.

The SMM refers to two maturity models, which are the AMM and the capability maturity model integration (CMMI) [12, 14]. The AMM links the Agile software development practices to maturity levels to make it simple, comprehensible, and applicable. It is designed based on Agile software development values, practices, and principles [26]. Fig. 4 depicts the AMM from an initial level to sustained level. At the initial level, an organization has not defined Agile development process clearly. At the explored level, the organization has shown more structured and complete software development practices than the first level. When an organization has practices related to customer relationship management, pair programming, communication, testing, and software quality, then it has reached the defined level. The improved level can be reached when an organization has collected of development process detailed measurement and has practiced software quality measurements. Finally, at the sustained level, an organization constantly enhances their processes through surveys and do not hesitate to have innovative initiatives [14, 26].

The CMMI is a process model that explicitly states what an organization should do to define, comprehend, and encourage behaviors that guide to improved accomplishment [27]. CMMI-DEV V1.3 mentioned that CMMI has five maturity levels: (1) Level 1 - Initial, (2) Level 2 - Managed, (3) Level 3 - Defined, (4) Level 4 - Quantitatively managed, and (5) Level 5 - Optimizing. The processes are usually ad hoc and disordered at level 1. A stable environment is usually not provided to support processes. Level 2 can be achieved when the processes are managed and performed according to documented plan. An organization achieves level 3 when processes are well described and comprehended, and are well explained in standards, procedures, tools, and techniques. At level 4, quantitative objectives for quality and process performance are established by the organization, and then utilizes them as barometer for projects management. The objectives are drafted and proposed based on the requirements

elicited from the business stakeholders. Finally, at level 5, an organization pays attention to constantly enhancing process performance through incremental and innovative processes, and technological refinement [28].

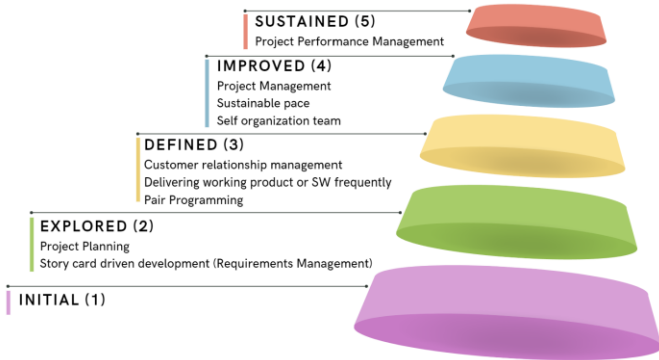


Fig. 4. Agile maturity model staged representation.

The SMM uses the same five levels as in CMMI. Its primary purpose is to guide organizations on promoting self-improvement and client’s active involvement. In addition, it also helps organizations to adopt Scrum on a staged approach by providing list of goals, objectives, practices, and metrics for every level [29]. Table I describes goals and their objectives at every level, starting from level 1 (Initial) to level 5 (Optimizing).

TABLE I. GOALS AND OBJECTIVES OF SCRUM MATURITY MODEL

Level	Code	Goals and Objectives
1 – Initial	L1	-
2 – Managed	L2.1	Basic Scrum Management
	L2.1.1	• Scrum Roles Exist
	L2.1.2	• Scrum Artifacts Exist
	L2.1.3	• Scrum Meetings Occur and are Participated
	L2.1.4	• Scrum Process Flow is Respected
	L2.2	Software Requirements Engineering
	L2.2.1	• Clear Definition of Product Owner
L2.2.2	• Product Backlog Management	
L2.2.3	• Successful Sprint Planning Meetings	
3 – Defined	L3.1	Customer Relationship Management
	L3.1.1	• Definition of Done exists
	L3.1.2	• Product Owner available
	L3.1.3	• Successful Sprint Review Meetings
	L3.2	Iteration Management
	L3.2.1	• Sprint Backlog Management
	L3.2.2	• Planned iterations
L3.2.3	• Successful Daily Scrum	
L3.2.4	• Measured Velocity	
4 – Quantitatively managed	L4.1	Unified Project Management
	L4.1.1	• Unified Project Management
	L4.2	Measurement and Analysis Management
L4.2.1	• Measurement and Analysis Management	
5 – Optimizing	L5.1	Performance Management
	L5.1.1	• Successful Sprint Retrospective
L5.1.2	• Positive Indicators	

III. RESEARCH METHODOLOGY

A. Research Stages

The objective of this research is to assess the level of Scrum maturity practices and propose recommendations for Bank XYZ’s software development process.

This research is designed to use an explanatory sequential mixed-method approach. As illustrated in Fig. 5, its stages start from problem identification to drafting suggestions for future work. The research problem is identified through an observation and semi-structured interview with a Scrum Master from group Grp-DGT and a Scrum Master from group Grp-BPR. Scrum maturity assessment has never been done in both groups, and these Scrum Masters also agreed that the assessment needs to be done to evaluate the current process. Literature study is then performed to obtain previous case studies with the same research questions. At this stage, theoretical foundations are acquired. The next stage is to construct the assessment questionnaire which is used as the research instrument. It is constructed based on SMM assessment questions. After the elicitation process, the data is analyzed using KPA rating formula from AMM. Maturity level at each goal is interpreted using this rating. The assessment result is used to find Scrum practices that need to be improved, and to draft proposed recommendations based on those findings. As the final stage, the author concludes the research and gives suggestions for future work.

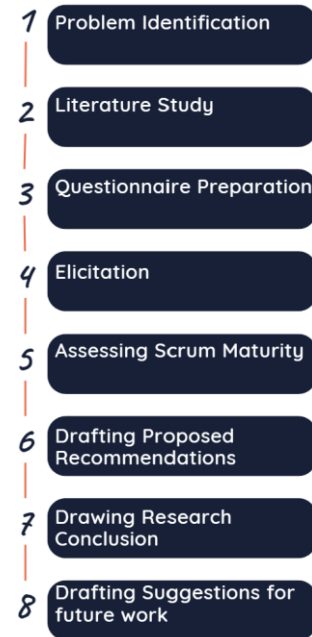


Fig. 5. Research stages of scrum maturity assessment at bank XYZ.

B. Instrument

This research uses a questionnaire as an instrument to collect data from respondents. The questionnaire is drafted based on SMM assessment questions explained in Yin et al. [29]. As described in Table II, there are 91 Scrum practices in total that will be assessed. All practices are transposed into questions which can be responded to as ‘Yes’, ‘Partially’, ‘No’, and ‘N/A’ (not applicable).

TABLE II. DETAIL COUNT OF ASSESSED SCRUM PRACTICES ON THE QUESTIONNAIRE

Goal/ Objective Code	Count	Goal/ Objective Code	Count	Goal/ Objective Code	Count
L2.1	28	L3.1	9	L4.1	1
L2.1.1	3	L3.1.1	3	L4.1.1	1
L2.1.2	9	L3.1.2	2	L4.2	2
L2.1.3	10	L3.1.3	4	L4.2.1	2
L2.1.4	6	L3.2	22	L5.1	11
L2.2	18	L3.2.1	8	L5.1.1	5
L2.2.1	5	L3.2.2	6	L5.1.2	6
L2.2.2	7	L3.2.3	5		
L2.2.3	6	L3.2.4	3		
Total of Assessed Scrum Practices	28 + 18 + 9 + 22 + 1 + 2 + 11				91

C. Elicitation

The questionnaire is drafted and distributed using Google Form. The questionnaire respondents are selected using purposive sampling technique. It is used to obtain data from the ones who understand the research problem [30]. There are four respondents who will fill out the questionnaire. They are two Scrum Masters who involved in digital projects and two Scrum Masters who involved in BPR projects.

D. Maturity Assessment

The appraisal of Scrum practices is performed using a questionnaire to obtain how practices are implemented in the projects. Data collected from the questionnaire will be analyzed using the KPA rating which is used in AMM [26]. The term “process area” in AMM is on a par to term “goal” in SMM. KPA rating can be calculated using equation as shown in (1).

$$R = \frac{\sum(Y_n) + \frac{1}{2} \sum(P_n)}{\sum(T_n) - \sum(NA_n)} \times 100\% \quad (1)$$

Where:

R = KPA rating

Y_n = ‘Yes’ responses

P_n = ‘Partially’ responses

T_n = Total assessed Scrum practices

NA_n = ‘N/A’ responses

Calculated KPA rating can be interpreted based on following categories [26]:

- 1) *Fully achieved*: 86% to 100% practices in the assessed KPA have been applied and proofs can be provided.
- 2) *Largely achieved*: 51% to 85% practices in the assessed KPA have been applied and proofs can be provided.
- 3) *Partially achieved*: 16% to 50% practices in the assessed KPA have been applied and some proofs can be provided.
- 4) *Not achieved*: 0% to 15% practices in the assessed KPA have been applied and a little or no proof can be provided.

IV. RESULT AND DISCUSSION

Scrum maturity assessment results are discussed for each level, starting from level 2 to level 5. KPA rating interpretation that will be mentioned along the discussion is coded as F (Fully Achieved), L (Largely Achieved), P (Partially Achieved), and N (Not Achieved). Scrum Masters who filled out the assessment questionnaire are also coded as X1 and X2 for the ones seated in group Grp-DGT. While Scrum Masters seated in group Grp-BPR are coded as Y1 and Y2.

A. Groups Assessment Result – Scrum Maturity Level 2

Basic Scrum Management (BSM) and Software Requirements Engineering (SRE) are two goals in Scrum maturity level 2. Table III shows the maturity level assessment results on first mentioned goal. KPA rating obtained for Grp-DGT is 95.53%. Scrum practices in four objectives listed in the table below are applied to more than 86.00% or applied almost entirely in project development. So, it can be said that BSM goal reaches Fully Achieved. On the other hand, KPA rating for Grp-BPR is 80.97%. Scrum practices in the listed objectives are applied to more than half of them, but it’s still lower than 86.00%. It means that the rating is interpreted as Largely Achieved.

TABLE III. ASSESSMENT RESULT OF BASIC SCRUM MANAGEMENT

Objectives	Grp-DGT		Grp-BPR	
	X1 (%)	X2 (%)	Y1 (%)	Y2 (%)
Scrum Roles Exist	100.00	100.00	50.00	100.00
Scrum Artifacts Exist	100.00	100.00	77.78	100.00
Scrum Meetings Occur and are Participated	90.00	100.00	60.00	81.25
Scrum Process Flow is Respected	83.33	91.67	83.33	91.67
Rating per Scrum Master	92.86	98.21	69.64	92.31
Rating per group	95.53		80.97	
Interpretation	Fully Achieved		Largely Achieved	

As shown in the Table IV, both Grp-DGT and Grp-BPR scored the same result for Software Requirements Engineering (SRE) goal assessment. The KPA rating is 94.44% which means that Scrum practices in three objectives listed in the table below are applied more than 86.00% or applied almost entirely in project development. So, it can be said that the rating for both groups in SRE goal can be interpreted as Fully Achieved.

TABLE IV. ASSESSMENT RESULT OF SOFTWARE REQUIREMENTS ENGINEERING

Objectives	Grp-DGT		Grp-BPR	
	X1 (%)	X2 (%)	Y1 (%)	Y2 (%)
Clear Definition of Product Owner	100.00	90.00	100.00	100.00
Product Backlog Management	85.71	100.00	85.71	92.86
Successful Sprint Planning Meetings	91.67	100.00	100.00	91.67
Rating per Scrum Master	91.67	97.22	94.44	94.44
Rating per group	94.44		94.44	
Interpretation	Fully Achieved		Fully Achieved	

B. Groups Assessment Result – Scrum Maturity Level 3

Customer Relationship Management (CRM) and Iteration Management (IMG) are the goals in Scrum maturity level 3. Table V shows the maturity level assessment results on first mentioned goal. KPA rating obtained for Grp-DGT is 91.66%. Scrum practices in three objectives listed in the table below are applied to more than 86.00% or applied almost entirely in project development. So, it can be said that CRM goal reaches Fully Achieved. Whereas KPA rating for Grp-BPR is 94.44% which means that Scrum practices in the listed objectives below are also applied to more than 86.00% or almost entirely in project development. So, the rating can be interpreted as Fully Achieved.

TABLE V. ASSESSMENT RESULT OF CUSTOMER RELATIONSHIP MANAGEMENT

Objectives	Grp-DGT		Grp-BPR	
	X1 (%)	X2 (%)	Y1 (%)	Y2 (%)
Definition of Done exists	100.00	100.00	100.00	100.00
Product Owner available	100.00	100.00	100.00	100.00
Successful Sprint Review Meetings	62.50	100.00	87.50	87.50
Rating per Scrum Master	83.33	100.00	94.44	94.44
Rating per group	91.66		94.44	
Interpretation	Fully Achieved		Fully Achieved	

As shown in the Table VI, assessment result for goal IMG scored slightly different at 87.74% for Grp-DGT and 87.91% for Grp-BPR. It means that Scrum practices in three objectives listed in the table below are applied more than 86.00% or applied almost entirely in project development. These ratings can be classified as Fully Achieved.

TABLE VI. ASSESSMENT RESULT OF ITERATION MANAGEMENT

Objectives	Grp-DGT		Grp-BPR	
	X1 (%)	X2 (%)	Y1 (%)	Y2 (%)
Sprint Backlog Management	68.75	75.00	75.00	81.25
Planned iterations	100.00	91.67	83.33	90.00
Successful Daily Scrum	100.00	100.00	100.00	100.00
Measured Velocity	100.00	100.00	100.00	100.00
Rating per Scrum Master	86.84	88.64	86.36	89.47
Rating per group	87.74		87.91	
Interpretation	Fully Achieved		Fully Achieved	

C. Groups Assessment Result – Scrum Maturity Level 4

Two goals in Scrum maturity level 4 are Unified Project Management (UPM), and Measurement & Analysis Management (MAM). Table VII shows the maturity level assessment results on first mentioned goal. KPA rating obtained for Grp-DGT is 100.00% which is undoubtedly interpreted as Fully Achieved. It means that Scrum practices in an objective listed in the table below are applied entirely in project development. On the contrary, KPA rating for Grp-BPR only reaches 75.00%. Scrum practices in the listed objective are applied to more than half of them, but it's still lower than 86.00%. It means that UPM goal reaches Largely Achieved. Grp-BPR's rating is a bit contrast compared to Grp-DGT's perfect rating.

TABLE VII. ASSESSMENT RESULT OF UNIFIED PROJECT MANAGEMENT

Objectives	Grp-DGT		Grp-BPR	
	X1 (%)	X2 (%)	Y1 (%)	Y2 (%)
Unified Project Management	100.00	100.00	100.00	50.00
Rating per Scrum Master	100.00	100.00	100.00	50.00
Rating per group	100.00		75.00	
Interpretation	Fully Achieved		Largely Achieved	

Assessment result for MAM goal is shown in Table VIII. Grp-DGT scored 100.00%, whereas Grp-BPR scored 87.50%. It means that Scrum practices in the objective listed in the table below are applied entirely in Grp-DGT's project development. Whereas Grp-BPR applies more than 86.00% or applies almost entirely in project development. These KPA ratings can be interpreted as Fully Achieved. Despite having the same interpretation, a Scrum Master in Grp-BPR didn't perfectly satisfy with the practices.

TABLE VIII. ASSESSMENT RESULT OF MEASUREMENT AND ANALYSIS MANAGEMENT

Objectives	Grp-DGT		Grp-BPR	
	X1 (%)	X2 (%)	Y1 (%)	Y2 (%)
Measurement and Analysis Management	100.00	100.00	100.00	75.00
Rating per Scrum Master	100.00	100.00	100.00	75.00
Rating per group	100.00		87.50	
Interpretation	Fully Achieved		Fully Achieved	

D. Groups Assessment Result – Scrum Maturity Level 5

There is only one goal in Scrum maturity level 5, that is Performance Management (PMG). Table IX shows that the KPA rating obtained for Grp-DGT is 91.66% which means that Scrum practices in two objectives listed in the table below are applied to more than 86.00% or applied almost entirely in project development. So, it can be said that PMG goal reaches Fully Achieved. Whereas KPA rating for Grp-BPR is 75.00% which means that Scrum practices in the listed objectives are applied to more than half of them, but it's still lower than 86.00%. So, the rating can be interpreted as Largely Achieved.

TABLE IX. ASSESSMENT RESULT OF PERFORMANCE MANAGEMENT

Objectives	Grp-DGT		Grp-BPR	
	X1 (%)	X2 (%)	Y1 (%)	Y2 (%)
Successful Sprint Retrospective	90.00	100.00	100.00	80.00
Positive Indicators	75.00	100.00	75.00	50.00
Rating per Scrum Master	83.33	100.00	86.36	63.64
Rating per group	91.66		75.00	
Interpretation	Fully Achieved		Largely Achieved	

KPA rating and interpretation of each goal is shown in Table X. Grp-DGT ratings are more than 85% for all Scrum maturity goals. It means that Grp-DGT assessed as Fully Achieved overall or Scrum practices are applied almost entirely in project development. Whereas Grp-BPR has three goals with KPA rating less than 86.00%, namely goal BSM, UPM, and PMG. It means that Grp-BPR needs further improvement to reach Fully Achieved overall.

TABLE X. ASSESSMENT RESULT SUMMARY

Level	Goals and Objectives	Grp-DGT	Grp-BPR
		Rating (Int.)	Rating (Int.)
2	Basic Scrum Management	95.53 (F)	80.97 (L)
	• Scrum Roles Exist	100.00 (F)	75.00 (L)
	• Scrum Artifacts Exist	100.00 (F)	88.89 (F)
	• Scrum Meetings Occur and are Participated	95.00 (F)	70.62 (L)
	• Scrum Process Flow is Respected	87.50 (F)	87.50 (F)
	Software Requirements Engineering	94.44 (F)	94.44 (F)
	• Clear Definition of Product Owner	95.00 (F)	100.00 (F)
	• Product Backlog Management	92.85 (F)	89.28 (F)
	• Successful Sprint Planning Meetings	95.83 (F)	95.83 (F)
3	Customer Relationship Management	91.66 (F)	94.44 (F)
	• Definition of Done exists	100.00 (F)	100.00 (F)
	• Product Owner available	100.00 (F)	100.00 (F)
	• Successful Sprint Review Meetings	81.25 (F)	87.50 (F)
	Iteration Management	87.74 (F)	87.91 (F)
	• Sprint Backlog Management	71.87 (L)	78.12 (L)
	• Planned iterations	95.83 (F)	86.66 (F)
	• Successful Daily Scrum	100.00 (F)	100.00 (F)
	• Measured Velocity	100.00 (F)	100.00 (F)
4	Unified Project Management	100.00 (F)	75.00 (L)
	• Unified Project Management	100.00 (F)	75.00 (L)
	Measurement and Analysis Management	100.00 (F)	87.50 (F)
5	Performance Management	91.66 (F)	75.00 (L)
	• Successful Sprint Retrospective	95.00 (F)	90.00 (F)
	• Positive Indicators	87.50 (F)	62.50 (L)

TABLE XI. CURRENT VS EXPECTED MATURITY

Code	Objectives	Current (%)	Expected (%)
L2.1.1	Scrum Roles Exist	75.00	86.00
L2.1.2	Scrum Artifacts Exist	88.89	86.00
L2.1.3	Scrum Meetings Occur and are Participated	70.62	86.00
L2.1.4	Scrum Process Flow is Respected	87.50	86.00
L4.1.1	Unified Project Management	75.00	86.00
L5.1.1	Successful Sprint Retrospective	90.00	86.00
L5.1.2	Positive Indicators	62.50	86.00

As illustrated at Fig. 6, there are four objectives that will be discussed further as their ratings are below the expected rating which is equal to or more than 86.00%. Those objectives are (1) Scrum roles exist, (2) Scrum meetings occur and are participated, (3) Unified project management, and (4) Positive indicators. Whereas there are three objectives that exceed the expected rating: (1) Scrum artifacts exist, (2) Scrum process flow is respected, and (3) Successful Sprint retrospective.

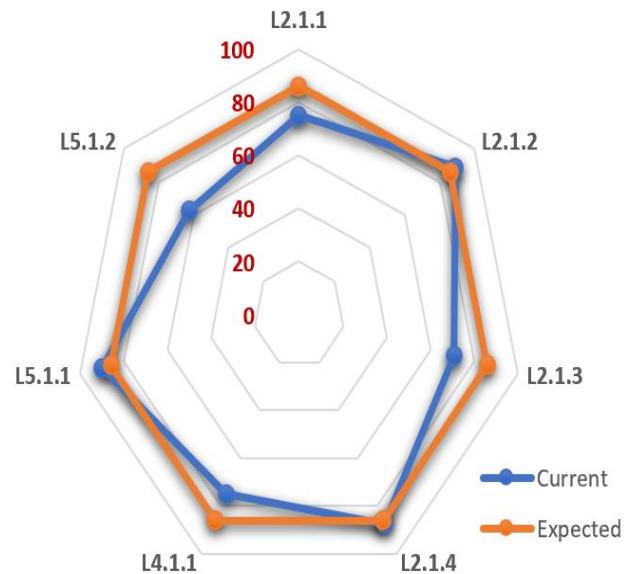


Fig. 6. Comparison of the current and expected maturity.

E. Scrum Practice Recommendation

Improvement recommendations are proposed to Grp-BPR because the assessment found that there are three SMM goals that don't reach Fully Achieved. The goals that need improvement regarding the application of the Scrum practices are Basic Scrum Management (BSM), Unified Project Management (UPM), and Performance Management (PMG). These goals are spread at SMM level 2, level 4, and level 5. Table XI describes seven objectives of the mentioned goals. Three objectives from BSM goal, one objective from the UPM goal, and two objectives from PMG goal. The rating of each objective is compared against the expected rating.

Table XII describes recommendation of improvement that can be done by Grp-BPR to reach Fully Achieved overall. The recommendations are based on SMM questionnaire responses, Scrum Guide [24], SBOK Guide [23], and A Guide to Scrum and CMMI [27].

TABLE XII. RECOMMENDATION OF IMPROVEMENT

Goals	Objectives	Recommendation
Basic Scrum Management	Scrum Roles Exist	Product Owner (PO) is a person who collect requirements from business stakeholders. He or she must ensure the team comprehends the value they are going to deliver. PO must be appointed as the project starts. He or she must know the responsibilities of a PO.
		Developers are people who build and deliver value collectively. They work based on business requirements written in a product backlog. The role must exist and staffed as the project starts.
	Scrum Meetings Occur and are Participated	Release planning is held optionally to obtain commitment over an increment delivery plan. Responsibilities, needed resources, and activities are discussed at this event.
		In release planning event, Scrum Master (SM) and PO must be present.
		Daily Scrum is one of the events that occurred in a Sprint. Developers discuss their task progress and its impediments.
		This event must be held daily on workdays to inspect progress toward Sprint goal and adapt the Sprint backlog as needed.
		Developers must attend Daily Scrum event, whereas PO and SM can attend it as developers, if they are working on Sprint backlog.
		In Sprint review event, the team presents the increment that they have built to the stakeholders. This event must be held once every Sprint.
		Sprint retrospective is held to discuss on how to better the next Sprint, in terms of the value's quality and process effectiveness. This event must be held once every Sprint.
		SM and developers must attend Sprint retrospective, whereas PO isn't mandatory to attend it.
Unified Project Management	Unified Project Management	All projects must adhere to the entire goals, objectives, and practices described in Scrum Maturity Level 2 and 3. Project Management Office (PMO) can enforce procedures to support the adherence.
Performance Management	Positive Indicators	SM coaches the team to successfully perform their tasks. SM should also remove the impediments throughout the project. Servant leadership style helps boosting the team's growth and energy level in their Scrum journey.
		A survey, at least once every Sprint, can be conducted to obtain the team's satisfaction level. This survey can also be part of Sprint retrospective.
		A survey can be conducted to obtain the stakeholders' satisfaction level. This survey can also be part of Sprint review.
		SM must ensure Scrum process has been adhered. Proper planning and task estimation should promote a work-life balance. Extra working hours must be minimized.
		SM must promote a psychologically save environment for the team. Constructive criticism and discussions in every event are welcome.

V. CONCLUSION

This research aimed to compare the Scrum maturity between two groups at Bank XYZ, namely Digital Group (Grp-DGT) and Business Process Reengineering Group (Grp-BPR). Based on assessment result, the recommendations for improvement are proposed to better Scrum practices at both groups. The following conclusions are drawn according to the research:

1) Group Grp-DGT has reached Scrum maturity level 5 (optimizing). KPA ratings of SMM goals are interpreted as Fully Achieved overall. Whereas Grp-BPR is still at level 1 (initial). Goal "Basic Scrum management" appraised as Largely Achieved with rating 80.97%. There are two objectives in this goal that don't meet the minimum rating to be appraised as Fully Achieved. Moreover, goal "Unified project management" and "Performance management" are also appraised as Largely Achieved with the same rating 75.00%.

2) Proposed recommendations for Scrum practices improvement are aimed for Grp-BPR due to its three goals are appraised as Largely Achieved. Deeper into the objective's rating, there are only four out of seven objectives whose ratings are below 86%. The recommendations are then drafted according to SMM questionnaire responses ("partially" and "no") in these four objectives. There are 15 recommendations in total for three goals consisting of nine recommendations for "Basic Scrum management", one recommendation for "Unified project management", and the last five recommendations for "Performance management". These recommendations can be used to improve Scrum practices in Bank XYZ, specifically at Grp-BPR group.

This research output can be used by Bank XYZ as a part of evaluation of the current project development process in Grp-DGT and Grp-BPR groups. Bank XYZ is also able to use it to tackle current problems in the other projects or initiatives that are not covered in this research or proposed by other groups. It would also provide aid in increasing Scrum maturity level of the next projects or Sprints in Grp-DGT and Grp-BPR groups. The other organizations, as required, would also benefit from the research output by applying the recommendations to those specific objectives.

VI. LIMITATIONS AND FUTURE WORK

This research utilized Scrum maturity model (SMM) to perform assessment to project development process at Grp-DGT and Grp-BPR groups of Bank XYZ. The elicitation was performed using a purposive sampling technique where there were four respondents participating, two respondents seated as Scrum Master at Grp-DGT, and the other two respondents seated as Scrum Master at Grp-BPR. The distributed questionnaire has 91 questions in total. There were 15 recommendations to improve four objectives that were found below the expected KPA rating.

There are some limitations of this research: (1) using only questionnaire to collect data, (2) proposed recommendations of improvement are based on SMM questionnaire responses

and Scrum guides, (3) risk impact of the unrealized Scrum practices is not investigated or being the part of the research questions, and (4) scope of study is limited to Bank XYZ.

Based on those limitations, it is suggested for the future researchers to do these works: (1) combining questionnaire, interview, and other data collection techniques to enhance the quality of the assessment results, (2) drafting the recommendation based on the combination of Scrum guides and Scrum expert judgment, (3) investigating risk impact of the unrealized Scrum practices, and (4) extending the case study scope by including some selected financial institutions.

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