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Assessing Scrum Maturity and Organizational Performance in Agile Telecommunications Software Development Projects

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Abstract

The rapid pace of digital transformation requires organizations, particularly in the telecommunications sector, to adopt agile methodologies to improve software development performance. This study aims to analyze the level of Scrum maturity within the Business Process Digitization Tribe using the Scrum Maturity Model (SMM). A quantitative, survey-based approach was employed involving 52 respondents consisting of product owners, scrum masters, developers, QA engineers, and UI/UX designers. Reliability and validity testing confirmed that all constructs met the required thresholds. Descriptive analysis revealed that Basic Scrum Management achieved the highest score, while Iteration & Performance Management obtained the lowest. Structural Equation Modeling (SEM) confirmed that Iteration & Performance Management is significantly influenced by Basic Scrum Management, Requirements Engineering, and Customer Relationship Management, with 58% of the variance explained. The findings indicate that the Business Process Digitization Tribe has reached Level 2 (Managed) of the SMM, meaning that fundamental Scrum practices are consistently implemented, but limitations remain in performance measurement and Customer Relationship Management. This study contributes to the agile maturity literature and provides managerial insights, particularly recommendations for improving backlog refinement, strengthening performance metrics, and fostering a more mature agile culture.

Keywords

Agile, Organizational Maturity, Scrum Maturity Model, Telecommunications.

1. Introduction

The accelerating pace of digital transformation across industries has profoundly changed how organizations design, develop, and deliver products and services. According to McKinsey (2018), more than 70% of digital transformation programs fail to achieve their objectives due to inefficiencies in execution, unclear strategies, and inadequate organizational readiness. In the software industry specifically, the demand for rapid delivery, adaptability to market changes, and enhanced customer experience has positioned agile software development as the dominant methodology worldwide (VersionOne, 2020). Recent surveys show that over 95% of organizations report practicing agile in some form, with Scrum being the most widely adopted framework.

In Indonesia, digital transformation has become a national priority. Projections suggest that the digital economy will contribute up to USD 130 billion, largely fueled by the Information and Communication Technology (ICT) and telecommunications sectors. Telecommunications companies, in particular, are playing a crucial role in enabling this transformation by modernizing infrastructure, delivering digital services, and adapting their operating models to meet global competition.

Despite increasing adoption of Agile and Scrum, many telecommunications organizations continue to face challenges in achieving optimal performance. Reports and case studies highlight recurring issues such as backlog prioritization, sprint planning, velocity measurement, and cross-functional collaboration. Additionally, organizational complexity, hierarchical decision-making, and regulatory environments often constrain agility in large-scale enterprises. These limitations underscore the importance of evaluating Scrum adoption not only in terms of practice, but also with regard to organizational readiness and performance maturity.

The Scrum Maturity Model (SMM) provides a structured framework to assess the degree of Scrum adoption and identify improvement areas. Unlike general-purpose maturity models such as Capability Maturity Model Integration (CMMI), SMM focuses specifically on agile practices, covering dimensions such as basic Scrum management, requirements engineering, Customer Relationship Management, and performance management (Yin et al., 2011). Applying this model in the context of the telecommunications sector makes it possible to assess current maturity levels, identify weaknesses, and recommend actionable strategies for improvement.

This study aims to analyze the level of Scrum maturity within the Business Process Digitization Tribe using the SMM. This study seeks to assess the maturity level of software development processes in the telecommunications sector using the Scrum Maturity Model, while also identifying specific gaps that hinder progression toward higher maturity levels and offering recommendations to strengthen Scrum adoption in order to improve organizational readiness and performance. The findings are expected to contribute both theoretically and practically. From a theoretical perspective, the study extends the application of SMM in the context of

large-scale telecommunications organizations, a domain that remains underexplored in existing literature. From a managerial perspective, the results provide valuable insights for companies seeking to enhance digital product development effectiveness, strengthen their competitiveness, and support broader digital transformation agendas.

2. Literature Review and Hypothesis Development

2.1. Agile Software Development and Project Performance

Agile Software Development (ASD) emerged to address limitations of plan-driven methods by emphasizing iterative delivery, Customer Relationship Management, and responsiveness to change (Beck et al., 2001). Meta-analytic and large-sample evidence suggests agile practices are associated with higher stakeholder satisfaction and project success, particularly in dynamic environments (Serrador & Pinto, 2015; Conforto et al., 2016). Nevertheless, agile outcomes vary widely with organizational context, governance, and team capability (Gren et al., 2015; Kuhrmann et al., 2017). Annual industry surveys consistently report Scrum as the most adopted agile framework globally.

Agile-oriented maturity approaches have evolved through several frameworks that extend traditional maturity thinking into agile contexts. The Sidky Agile Adoption Framework (AAF) introduces staged adoption goals and practices to guide organizations through transformation (Sidky et al., 2007), while the Agile Maturity Model (AMM) integrates agile principles into progressive levels similar to the CMMI structure (Patel & Ramachandran, 2009). In addition, hybrid assessment approaches combine agile practice checklists with capability dimensions across team, technical, product, and organizational aspects to capture the tailoring often seen in real-world applications (Wendler, 2012; Gren et al., 2015). Comparative studies further emphasize the trade-offs in these models, where general frameworks provide broad applicability but limited specificity for Scrum, while Scrum-focused models deliver more actionable depth tailored to Scrum teams (Fernández-Sáez, 2018).

Scaling agile in large enterprises and regulated contexts introduces specific hurdles: multi-team coordination, dependencies, legacy constraints, and compliance (Dikert et al., 2016). Research finds frequent challenges in product ownership (diffuse accountability), technical excellence (insufficient automation), and culture (command-and-control habits), which depress maturity progression beyond mid-levels (Paasivaara, 2017; Fitzgerald & Stol, 2017). Public-sector and state-owned enterprises face additional constraints from procurement and governance, reinforcing the need for organizational-level enablers (leadership sponsorship, agile budgeting, HR alignment) to realize benefits (Conforto et al., 2016; Setiawan & Mahfudz, 2019).

2.2. Basic Scrum Management and Software Requirement Engineering

Scrum prescribes a minimal set of roles, events, and artifacts to support transparency, inspection, and adaptation (Schwaber & Sutherland, 2020). Effective use of backlog refinement, sprint goals, and retrospectives is linked to better lead time, team cohesion, and delivered value though "cargo cult Scrum" emerges when roles blur or bureaucracy limits autonomy (Dikert et al., 2016; Open & Kropp, 2020). Scrum-specific maturity models (SMM) assess adoption depth across levels, from basic management to continuous improvement, focusing on practices like backlog discipline, collaboration, and metrics (Yin et al., 2011; Santos et al., 2015). These often use questionnaires or audits to identify gaps, yet studies note teams frequently plateau at mid-level maturity due to organizational constraints (Paasivaara, 2017).

Maturity models structure capability improvement into levels with defined practices and outcomes. The CMMI is the most established, focusing on process definition, measurement, and continuous improvement (CMMI Institute, 2018). While CMMI improves predictability and quality, its heavyweight nature may conflict with agile values if implemented prescriptively (Fitzgerald & Stol, 2017). Consequently, agile-oriented maturity approaches emerged to assess adoption without sacrificing flexibility (Wendler, 2012).

Literature review shows that the application of basic Scrum management has a significant influence on the practice of software requirement engineering. Scrum, as an agile framework, encourages intense collaboration between developer teams and stakeholders so that software needs can be understood and prioritized iteratively (Paetsch et al., 2003). This approach has been shown to help reduce specification ambiguity and improve the traceability of needs (Inayat et al., 2015; Schön et al., 2017). In addition, the iterative principles in Scrum allow changing needs to be handled more adaptively than traditional methods, which ultimately improves end-user satisfaction (Ramesh et al., 2010). Thus, the integration of Scrum basic principles in the SRE process not only strengthens the quality of requirements documentation, but also supports the achievement of products that are more in line with user expectations (Dikert et al., 2016).

H1: Basic scrum management has a significant impact on software requirement engineering.

2.3. The Determinants of Iteration and Performance Management

Software Requirement Engineering (SRE) is a systematic process of identifying, analyzing, documenting, and managing software requirements to fit business objectives and user expectations (Fernández & Wagner, 2015). Customer Relationship Management (CRM) is defined as an organization's strategy in building, maintaining, and managing long-term relationships with customers through the integration of processes, technology, and data. Meanwhile, basic Scrum management is an agile framework that emphasizes team collaboration, clearly defined roles, and

work management through iterative sprints to generate business value in a sustainable manner (Schwaber & Sutherland, 2017). These three variables are interrelated in creating an adaptive software development cycle, where SRE ensures clear needs, CRM connects user perspectives, and Scrum organizes implementation iteratively to support continuous iteration and performance improvement

A number of studies confirm that various agile management practices and technologies have an important role in improving iteration and performance. Social agile practices have a significant effect on team performance, team autonomy and agile communication encourage psychological empowerment that triggers innovative behaviors. On the other hand, CRM has been proven to make a positive contribution to business performance (Ramlawati et al., 2022), and Fernandes et al. (2023) emphasised that the implementation of an effective and efficient CRM can improve company performance, both in terms of finance, marketing, and operations. In addition, Waspodo (2014) stated that software implementation, including in the context of software requirement engineering, can improve employee performance. These findings show that the integration of software requirement engineering, CRM, and basic scrum management is an important determinant in building effective iterations while improving performance management.

H2: Software requirement engineering has a significant impact on iteration and performance management.
H3: Basic scrum management has a significant impact on iteration and performance management.
H4: Customer relationship management has a significant impact on iteration and performance management.

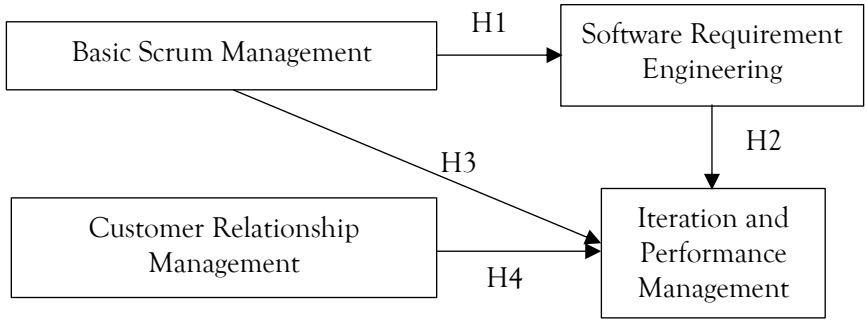

Figure 1. Research Framework

Figure 1 emphasizes the relationship between basic scrum management, software requirement engineering, customer relationship management, and iteration and performance management. Basic scrum management is seen as having a direct influence on software requirement engineering (H1), as well as having an impact on iteration and performance management (H4). Furthermore, software requirement

engineering plays an important role in driving the effectiveness of iteration and performance management (H2), while customer relationship management makes a positive contribution in strengthening the same aspect (H3). Thus, this research framework illustrates that the three independent variables complement each other in forming the main determinants for iteration and performance management.

3. Methods

This study employed a quantitative, survey-based research design to evaluate the maturity of Scrum practices in the telecommunications sector. The SMM was adopted as the primary assessment framework because it provides structured dimensions and levels for measuring Scrum adoption (Yin et al., 2011). A questionnaire was developed based on SMM constructs to capture the perceptions of team members regarding the implementation of Scrum processes within their organizations. This design was chosen to ensure a standardized maturity assessment, enable statistical validation of the instrument, and establish correlations among the key constructs.

The population of this study consisted of software development professionals actively involved in Scrum practices, including Product Owners, Scrum Masters, Developers, Quality Assurance engineers, UI/UX designers, and other supporting roles. Respondents were selected based on their direct engagement with Scrum-based projects within telecommunications organizations. A purposive sampling approach was applied to ensure the inclusion of individuals representing multiple roles and levels of experience, thereby providing a comprehensive perspective on Scrum maturity.

The survey instrument was structured into four main dimensions reflecting the Scrum Maturity Model: basic Scrum management, requirements engineering, Customer Relationship Management, and iteration and performance management. Each dimension was operationalized into measurable indicators using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Demographic questions, including respondents' role, team affiliation, and years of experience, were also included to contextualize the findings. To ensure content validity and clarity, the instrument was reviewed by agile practitioners and piloted with a small group of respondents before full deployment.

Data collection was carried out through an online survey platform to ensure accessibility for respondents across different organizational settings. Participants were assured that their responses would remain anonymous and would be used strictly for academic and professional purposes. Feedback from the pilot test was used to refine question wording, reduce ambiguity, and confirm the suitability of the items in representing the intended constructs.

The collected data were analyzed in multiple stages. Descriptive statistics were first used to profile respondents and calculate the mean and standard deviation for

each construct. Reliability testing was then conducted using Cronbach's Alpha, with values greater than 0.70 considered acceptable for internal consistency. Validity testing was performed using correlation analysis to confirm the relationships between items and their respective constructs. Finally, the results were mapped against the five maturity levels of the Scrum Maturity Model Initial, Managed, Defined, Quantitatively Managed, and Optimizing to determine the maturity stage of Scrum practices within the telecommunications sector. This mapping enabled the identification of both strengths and gaps in adoption, providing a comprehensive assessment of organizational readiness and performance.

4. Results

The demographic distribution shows that developers represented the largest proportion of respondents (46%), followed by QA engineers (17%), product owners (15%), scrum masters (10%), and UI/UX designers (6%). Most participants had two to five years of Scrum experience, suggesting a workforce that is moderately familiar with agile practices. This demographic composition provides a strong basis for assessing Scrum maturity within telecommunications organizations. The details for the respondent demographics can be seen in Table 1.

Table 1. Respondent Demographics

Role	Frequency	Percentage (%)
Product Owner	8	15
Scrum Master	5	10
Developer	24	46
QA Engineer	9	17
UI/UX Designer	3	6
Others	3	6
Total	52	100

Reliable maturity assessment requires sound measurement. Best practice includes item development from theory (Scrum Guide; agile principles), content validation with experts, and statistical evaluation (CFA for construct validity; CR and AVE for reliability and convergence) (Hair et al., 2019). Discriminant validity (Fornell-Larcker, HTMT) and internal consistency (Cronbach's alpha/CR) are standard. To link maturity with outcomes, studies use correlations with lead time, throughput, predictability, and defect trends, or model structural relationships (Gren et al., 2015; Klünder et al., 2019). Combining survey data with objective delivery metrics mitigates common method bias and strengthens inference (Podsakoff et al., 2003).

Table 2. Reliability and Convergent Validity of Constructs

Construct	Cronbach's Alpha	Validity	Composite Reliability	AVE
Basic Scrum Management	0.82	0.62	0.87	0.58
Software Requirements Engineering	0.80	0.59	0.85	0.55
Customer Relationship Management	0.78	0.58	0.83	0.53
Iteration & Performance Management	0.86	0.64	0.89	0.61

Reliability and convergent validity results are shown in Table 2 with all Composite Reliability > 0.70 and AVE > 0.50. All constructs demonstrated acceptable reliability and convergent validity, confirming the robustness of the measurement model across telecommunications organizations.

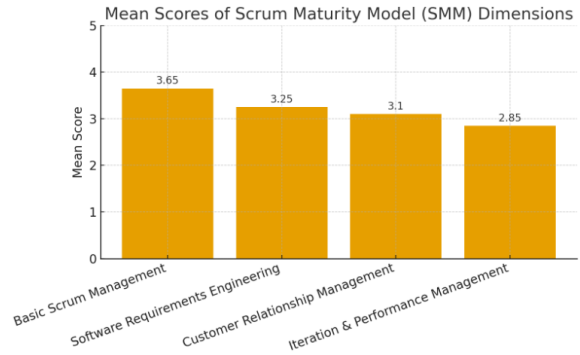

Figure 2. Mean Scores of SMM Dimensions

Figure 2 shows that Basic Scrum Management achieved the highest score (3.65), reflecting consistent application of Scrum ceremonies. Requirements Engineering (3.25) and Customer Relationship Management (3.1) were moderate, while Iteration and Performance Management (2.85) scored lowest, suggesting limited systematic measurement and continuous improvement practices in telecommunications projects.

Table 3. Mean Score of SMM Dimensions and Gap Analysis

Dimension	Current Mean	Interpretation	Mean	Gap
Basic Scrum Management	3.65	Moderate–High	4.00	-0.35
Software Requirements Engineering	3.25	Moderate	4.00	-0.75
Customer Relationship Management	3.10	Moderate	4.00	-0.90
Iteration & Performance Management	2.85	Low	4.00	-1.15

Table 3 shows the mean score and the gaps between the current mean and the target mean. The largest gaps were found in Iteration and Performance Management (1.15), followed by Customer Relationship Management (0.9) and Requirements

Engineering (0.75). This highlights the need for stronger backlog refinement, performance measurement, and stakeholder involvement in the telecommunications sector.

Table 4. Comparison of Mean Maturity Scores by Role

Role	Mean Score	Std. Deviation	Interpretation
Product Owner	3.20	0.35	Moderate
Scrum Master	3.05	0.40	Moderate
Developer	3.40	0.50	Moderate–High
QA Engineer	3.10	0.38	Moderate
UI/UX Designer	2.90	0.30	Low–Moderate
Others	3.00	0.25	Moderate

Table 4 shows the comparison of mean maturity scores by role. Developers reported the highest maturity perception (3.4), while UI/UX designers reported the lowest (2.9). This variation suggests uneven adoption of Scrum across different roles in telecommunications teams.

Table 5. Correlation Matrix of SMM Dimensions

Dimension	BSM	SRE	CRM	IPM
Basic Scrum Management (BSM)	1.00	0.62	0.58	0.65
Software Requirements Engineering (SRE)	0.62	1.00	0.60	0.64
Customer Relationship Management (CRM)	0.58	0.60	1.00	0.55
Iteration & Performance Management (IPM)	0.65	0.64	0.55	1.00

Table 5 shows the correlation matrix shows strong positive relationships among dimensions, particularly between Basic Scrum Management, Requirements Engineering, and Iteration Performance. This suggests that strengthening core Scrum practices is key to improving iteration outcomes to extend the analysis, a structural equation model was illustrated.

Table 6. Structural Model Results (Path Coefficients)

Hypothesis	Path Relationship	β	t-value	p-value	Result
H1	BSM → SRE	0.62	6.12	0.000	Supported
H2	SRE → IPM	0.57	5.45	0.000	Supported
H3	BSM → IPM	0.49	4.88	0.000	Supported
H4	CRM → IPM	0.41	4.02	0.001	Supported

Table 6 shows the path analysis. The result revealed that Basic Scrum Management significantly predicts both Software Requirements Engineering ($\beta = 0.62$, $p < 0.001$) and Iteration & Performance Management ($\beta = 0.49$, $p < 0.001$). Requirements Engineering ($\beta = 0.57$, $p < 0.001$) and Customer Relationship

Management (β = 0.41, $p < 0.01$) also contribute significantly to iteration performance.

Table 7. Coefficient of Determination (R^2)

Endogenous Construct	R^2	Interpretation
Software Requirements Engineering (SRE)	0.38	Moderate
Iteration & Performance Management (IPM)	0.58	Moderate–High

Based on Table 7, the structural model confirmed that Basic Scrum Management strongly influences both Requirements Engineering and Iteration Performance, while Customer Relationship Management also plays a significant role. The model explained 58% of the variance in iteration and performance outcomes, highlighting the importance of strengthening backlog refinement and customer engagement in telecommunications projects. These results confirm that Business Process Digitization Tribe has reached Level 2 (Managed) of the Scrum Maturity Model. While the teams consistently perform Scrum ceremonies, gaps remain in backlog management, stakeholder collaboration, and iteration performance tracking. Overcoming these challenges requires not only technical improvements but also cultural and structural support to enable higher maturity levels.

5. Discussion

The results of the study show that basic scrum management has a significant influence on software requirement engineering. These findings indicate that structured Scrum practices, such as sprint planning, backlog refinement, and review meetings, are able to provide better clarity in defining software needs. This research is supported by Niswati et al. (2022) who stated that the implementation of the scrum method can analyze the potential for changes in determining the requirement system and methods that are responsive to change. Through the Scrum framework, teams gain space to discuss requirements iteratively, thereby reducing the potential for miscommunication and uncontrolled change in needs. Thus, basic scrum management plays an important role in building a more stable, accurate, and consistent requirements foundation for system development.

This study also found that software requirement engineering has a positive effect on iteration and performance management. These results confirm that clearly formulated and well-documented requirements can increase the effectiveness of the iteration process, while minimizing the risk of rework. This research is supported by Social agile practices have a significant effect on team performance. With more structured requirements, teams can work with a higher focus, set priorities appropriately, and achieve expected performance targets. Therefore, the quality of requirement engineering is one of the key factors in the success of iteration management and team performance (Nasrullah et al., 2021; Latuconsina et al., 2022).

In addition, customer relationship management has been proven to make a significant contribution to iteration and performance management. Customer relationships have an effect on performance management. Customer engagement through intensive communication, prompt feedback provision, and a deep understanding of user needs have been proven to strengthen iteration effectiveness and team performance outcomes. With an effective CRM, organizations are able to adjust system development according to market needs, increase customer satisfaction, and accelerate the continuous improvement process (Fernandes et al., 2023).

Basic scrum management has a direct effect on iteration and performance management. These results show that basic Scrum practices, such as clear division of roles, an organized work rhythm, and a continuous evaluation mechanism, are able to drive team effectiveness directly (Verwijs & Russo, 2023). Not only does strengthening the requirement aspect enhance the process, but basic scrum management also fosters a more adaptive and transparent work pattern, thereby positively impacting iterative performance and final development results (Hidalgo, 2019). Thus, it can be concluded that basic scrum management has a dual role, namely strengthening the quality of engineering requirements while having a direct impact on improving team performance.

This study assessed Scrum maturity in the telecommunications sector using the SMM and found that higher levels of maturity are strongly associated with improved requirement engineering, iteration effectiveness, and overall performance management. From a theoretical perspective, these findings contribute to the refinement of agile maturity research by demonstrating how Scrum maturity directly shapes both technical and managerial outcomes within complex organizational contexts. From a practical standpoint, the results highlight the need for telecommunication firms to invest in structured Scrum practices, capacity building, and continuous coaching to ensure that maturity is not only attained but also sustained. Such efforts will enable organizations to optimize requirement processes, strengthen team adaptability, and ultimately achieve superior performance in highly competitive and fast-evolving markets.

6. Conclusion

This study assessed Scrum maturity in the telecommunications sector using the SMM. The results indicate that organizations in this industry are currently at the "Managed" stage (Level 2), reflecting consistent application of fundamental Scrum practices but limited advancement in areas such as backlog refinement, customer engagement, and performance measurement. Reliability and validity testing confirmed that the constructs used in this study were statistically sound, while descriptive results showed that Basic Scrum Management achieved the highest maturity and Iteration and Performance Management scored the lowest.

Correlation and structural modeling further demonstrated that iteration performance is strongly influenced by basic Scrum practices, requirements engineering, and Customer Relationship Management, with the structural model explaining 58% of the variance in iteration outcomes. These findings suggest that while the foundations of agile project management are in place, significant improvement is still needed to embed measurement systems, enhance collaboration, and foster a culture of continuous improvement.

From a theoretical perspective, this research contributes empirical evidence to the agile maturity literature by applying the Scrum Maturity Model in the context of telecommunications organizations, a domain that remains underexplored in existing studies. From a managerial perspective, the results provide actionable insights for practitioners seeking to improve agile adoption and strengthen organizational readiness and performance. Future studies are encouraged to replicate and expand this research across different organizational contexts and industries to further validate the applicability of the Scrum Maturity Model.

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