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Analysis of The Implementation of SCRUM in The Development of A BBLobster Content Management System

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Abstract

PT Rapier Technology International applies scrum in developing the BBLobster Content Management System (CMS). Scrum is a framework for developing an iterative, flexible, and effective BBLobster CMS designed to deliver significant value quickly. This study aims to identify the problems encountered in scrum implementation and validate the factors that influence the interaction with Scrum adoption during the BBLobster CMS development process using variable measurements. The measurement variables are the team factor variable, individual factor variable, technology factor variable, organizational factor variable, and scrum adoption variable. They analyzed the measurement of the data model (outer model) and structural model (inner model) using SmartPLS 3.0 after data collection using a questionnaire. The results of this study show that the analysis of the structural model test conducted by knowing the value of R-Square (R2) is a team factor variable, individual factor, technological factor, and organizational factor that has an influence of 67.4% on scrum adoption.

Keywords: SCRUM; content management system; measurement variables; SmartPLS

1. INTRODUCTION

PT Rapier Technology International is a company engaged in manufacturing Information Technology (IT). It is in the IT sector and currently offers various products such as websites, mobile applications, Enterprise Resource Planning (ERP) systems, Business Analysis (BA), and Business Intelligence (BI). The new product developed by this company is the BBLobster Content Management System (CMS), which they have been creating using the scrum method since early 2020. Grahafoods is a company engaged in the export and import of lobster seeds. In order to export and import lobster seeds that were previously traded illegally, the BBLobster CMS needs to be developed. The client needs to see the transparency of lobster prices from export and import sales of lobster, from fishermen to management, so that there is no price manipulation for lobster seeds, and to help manage the export and import sales of lobster seeds from the fisherman level to management.

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The scrum method is a project management approach used in software development that is quite popular and widely applied in large companies. Traditionally, the waterfall method has been used from the beginning of a project [1], [2]. However, for the development of the BBLobster CMS, this company has chosen to use the scrum method, which allows for changes to be made from the beginning to the end of the development stage, facilitates repeated testing, and helps to identify bugs faster in order to complete the work. The BBLobster CMS is carried out by three scrum roles: the product owner, the scrum master, and the development team. This approach can help companies manage data and business processes more easily, quickly, and efficiently. However, in applying the scrum method, it is common for developers and users to face obstacles and problems during the problem identification and solution process [3], [4].

The Scrum Adoption Challenge Detection Model (SACDM) is a model used to define the level of scrum adoption in the development of the BBLobster CMS. The SACDM model posits that team factors, individual factors, technological factors, and organizational factors have a positive effect on scrum adoption. These factors can be researched to identify the problems that influence the success of scrum adoption in the development of the BBLobster CMS. The scrum method is capable of satisfying managers' interests in understanding projects and ensuring that project results align with the plan [5]. Additionally, software project management applications can be developed to help teams better comprehend projects. Scrum is not just a software development model but also involves applications that enable project managers, scrum masters, and development teams to efficiently control their respective tasks. Implementing an easy-to-use application of the scrum method can help development teams manage software projects.

The purpose of this research is to identify the problems associated with adopting the scrum method to enhance team performance in software development quickly, effectively, and efficiently [6], [7]. The study aims to investigate the application of the scrum method in developing the BBLobster CMS at PT Rapier Technology International for both practical work students and employees. A Content Management System (CMS) is software that manages the process of creating, updating, and modifying website content. Often, CMS is server-based and multiuser software that deals with content stored in repositories [8], [9], which can be located on the same server, as part of the same software package, or across separate storage. Editors use CMS to create new website content, correct faulty website content, and carry out editorial processes on content [9]–[11].

Scrum is a framework that enables users to solve complex and adaptive problems while simultaneously delivering projects productively and creatively. The scrum method can overcome the ineffectiveness of project management processes and

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work techniques, allowing users to continuously improve project, team, and work environment performance [1], [6].

The software development process using the scrum method consists of three essential scrum roles: the Product Owner, who is responsible for deciding which features and functionality to build and the order in which they should be developed, and who is accountable for the overall success of the solution being developed or maintained; the Development Team, which is composed of people with diverse skills responsible for designing, building, and testing the desired project; and the Scrum Master, who is a technical team leader or anyone else whose job is to help everyone involved understand and embrace scrum values, principles, and practices, and to facilitate the scrum process and help the organization develop a high-performance, organization-specific scrum approach [12]-[15]. The Scrum Master also helps the organization through the challenging change management processes that can occur during the scrum process.

Several artifacts are used in software development using the scrum method, including the Product Backlog, which is the prioritized list of project requirements that the Product Owner develops and maintains. The Development Team determines which items from the Product Backlog can be completed during the upcoming sprint. Sprint Planning is the stage where the team plans the work to be done in the sprint, based on the priorities in the Product Backlog, to ensure that performance goals are achieved quickly and on time [16]. The Daily Scrum is a short meeting where the Development Team reports on what has been completed, discusses any problems, and plans the work for the day. The Scrum Master facilitates the meeting and helps the team solve any problems [6], [17]-[19]. This research focuses on analyzing the application of the scrum method and providing suggestions for factors that must be considered in the development of the BBLObster CMS at PT Rapier Technology International.

2. METHODS

This research consists of five stages: Implementation SCRUM, Hypothesis Test, Measurement Model (Outer Model), Structural Model (Inner Model), and Analysis, as shown in Figure 1.

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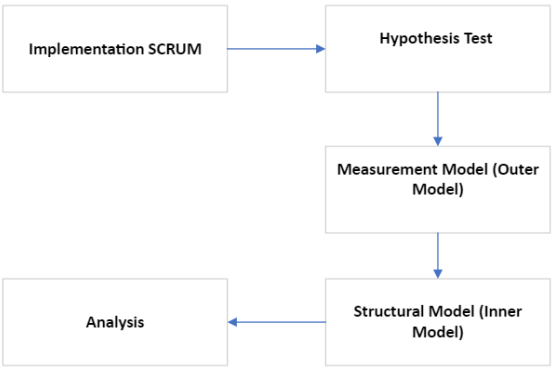

Figure 1. Methods Framework

2.1. Implementation SCRUM

In applying the Scrum method, every developer and user faced constraints and problems experienced by the BBLobster CMS development team. Therefore, the problem identification process is essential which aims to find out the obstacles encountered during the development process so that it is easy to provide the right solution to improve team performance in the development of BBLobster CMS more effectively and efficiently. The SCRUM implementation refers to the scrum process, as shown in Figure 2.

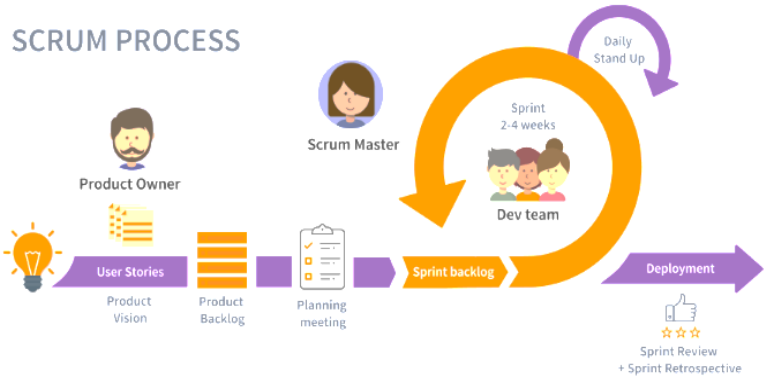

Figure 2. SCRUM Process

Data collection was carried out by distributing questionnaires to company employees involved in the project. There were 18 participants, all of whom were from a team of application developers.

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2.2. Hypothesis Test

The submission of hypotheses in this study was carried out by explaining several hypotheses related to the following variables:
H1: Team factor has a positive effect on scrum adoption
H2: Individual factors have a positive effect on scrum adoption
H3: Technological factors have a positive effect on scrum adoption
H4: Organizational factors have a positive effect on scrum adoption

There are several such hypotheses, as shown in Figure 3.

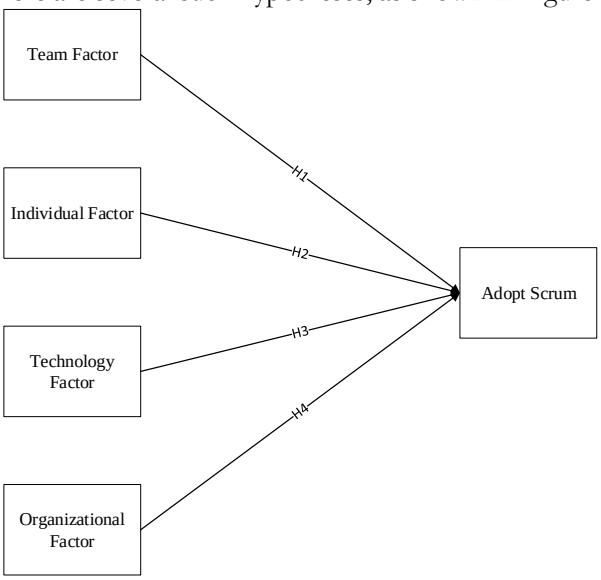

Figure 3. Research Hyothesis Framework

Mathematical equations are numbered in Arabic numerals, open-close brackets, and in align right column position.

$$y(n) = \sum_{k=-\infty}^{\infty} x(k)x(n-k) \tag{1}$$

The equation is written a bit indented and given corresponding ordinal number.

$$net = \sum \quad x_i w_i + b \tag{2}$$

2.3. Measurement Model (Outer Model)

The submission of hypotheses in this study was carried out by explaining several hypotheses related to the following variables:
The measurement model in this study is used to test the validity and reliability as follows:

a. Validity Test
   Validity tests are carried out to determine the ability of the equipment to measure the validity that should be measured. Validity connects to the instrument's accuracy, which states that the measuring instrument measures validly. Construct validity uses two types of validity: convergent validity and discriminant validity.
   1. Convergent Validity
      Convergent validity is a measure of a construct that must be highly correlated and a set of indicators representing a latent variable and underlying the latent variable [14]. The rules of thumb needed to measure convergent validity are outer loading above 0.7, commonality above 0.5, and average variance extracted (AVE) above 0.5.
   2. Discriminant Validity
      The discriminant validity test is judged to be based on the cross-loading assessment with the construct. It has provisions that the cross-loading correlation with other variables must be higher between indicators than other latent variables.

b. Reliability Test
   The reliability test in PLS used in this study 2 (two) methods are Cronbach's alpha and composite reliability. Cronbach's alpha assesses the lower limit of the reliability value of a construct, and composite reliability measures the actual value of the reliability of a construct. Composite reliability is considered a better measurement in estimating the internal stability of a construct. The rule of thumb for measuring Cronbach's alpha or composition reliability should be above 0.7.

2.4 Structural Model (Inner Model)

The measurement of the structural model in SmartPLS is assessed using the R2 value for the path coefficient value, the t-values for each path, and the dependent construct to test the significance of the construct in the structural model. Measurement of the structural model is used with the R-square test (R2), t-statistical test, and path coefficient.

a. R-Square (R2) Test
   Measurement of the structural model of the value of R2 is needed to measure the level of variation of changes in the independent variable related to the dependent variable. A higher R2 value means a better prediction model than the research model.

b. T-Statistic Test
   The t-statistic test is needed to measure the significance of the predictive model in checking the structural model. Tests were carried out in this study by measuring significance with constants and independent variables that affect the dependent variable.

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c. Path Coefficient
The path coefficient value reveals the level of significance in hypothesis testing. The path coefficient score is indicated by the mandatory t-statistic value above 1.96.

2.5 Analysis

Analysis was carried out in this study using quantitative research methods by analyzing research data after data from all respondents were collected. Data analysis activities were carried out by testing the measurement model (outer model) and structural model (inner model) using SmartPLS (Smart Partial Least Square) 3.0 software.

3. RESULTS AND DISCUSSION

3.1 Model Design

The design of the model used with latent variables and manifest variables as shown in Figure 4.

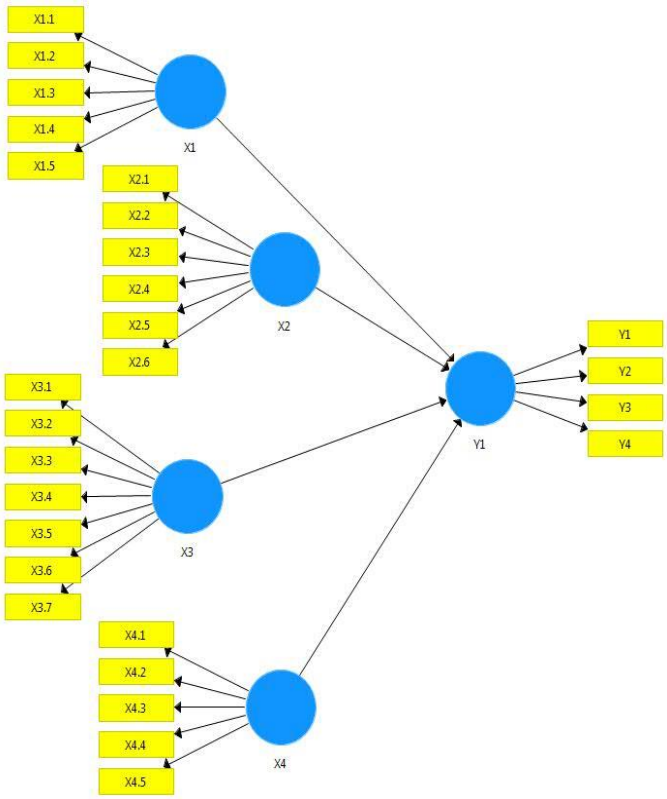

Figure 4. Model Design

In Figure 2 above, the latent and manifest variables are used with the following descriptions:

a. Team Factor (X_1)
   Team factors influence the adoption of a scrum on BBLobster CMS development in the team. Teamwork is a process that completes work with defined goals and manages the required communication-related from each member. The team factor oncogene latent variable (X_1) has five manifest variables: teamwork used with $X_{1.1}$, $X_{1.2}$, $X_{1.3}$, and communication used with $X_{1.4}$, $X_{1.5}$.
b. Individual Factor (X_2)
   Individual factors measure each member has skills, abilities, and professional knowledge of a subject or event. The exogenous latent variable of individual factors (X_2) has six manifest variables: escalation of commitment used with $X_{2.1}$, $X_{2.2}$, and experience used with $X_{2.3}$, $X_{2.4}$, $X_{2.5}$, $X_{2.6}$.
c. Technology Factor (X_3)
   The technological factor is the state of each member getting added value by adopting using scrum. Scrum can take advantage of the benefits to teams, companies, and startup environments, save time, and increase efficiency. The technology factor exogenous latent variable (X_3) has seven manifest variables: compatibility used with $X_{3.1}$, $X_{3.2}$, $X_{3.3}$, and relative advantage used with $X_{3.4}$, $X_{3.5}$, $X_{3.6}$, and $X_{3.7}$.
d. Organizational Factor (X_4)
   The organizational factor is an organizational perspective that creates an environment that helps implement scrum at PT Rapier Technology International. The organizational environment requires support from management to incorporate scrum values that can provide business and organizational change. The technology factor exogenous latent variable (X_4) has five manifest variables: management support used with $X_{4.1}$, $X_{4.2}$, the organizational culture used with $X_{4.3}$, $X_{4.4}$, and training used with $X_{4.5}$.
e. Adopt Scrum (Y)
   The adoption of scrum is a scrum atmosphere that can be needed in the company environment to develop BBLobster CMS in the main framework. Scrum adoption endogenous latent variable (Y) has four manifest variables used with Y_1, Y_2, Y_3, and Y_4.

3.2 Analysis of the Measurement Model (Outer Model)

a. Convergent Validity
   If the convergent validity is carried out by measuring the value of the outer loading above 0.70, then the value of the outer loading is declared convergently valid on the latent variable associated with an indicator using SmartPLS as shown in Figure 5.

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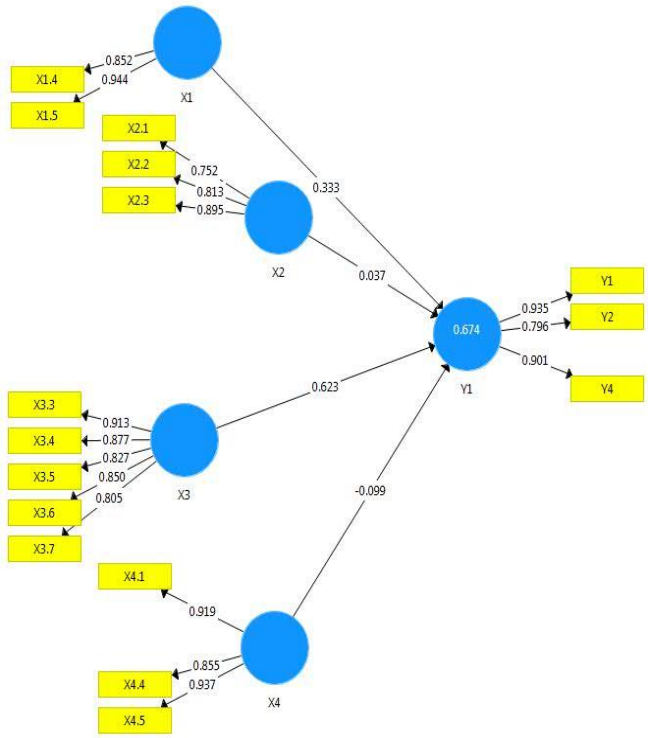

Figure 5. Convergent validity test results in SmartPLS

From the results of Figure 3 above after 11 indicators are $X_{1.1}$, $X_{1.2}$, $X_{1.3}$, $X_{2.4}$, $X_{2.5}$, $X_{2.6}$, $X_{3.1}$, $X_{3.2}$, $X_{4.2}$, $X_{4.3}$, and Y_3 is declared invalid, then the indicator must be removed from the data analysis process. From the results of the convergent validity test in Table 1, all indicators having an outer loading value greater than 0.7 have been declared valid for the convergent validity test.

Table 1. Convergent validity test results

Variable	Indicator	*Outer Loading*	Information
Team Factor	**$X_{1.4}$**	0.852	Valid
	$X_{1.5}$	0.944	Valid
Individual Factor	**$X_{2.1}$**	0.752	Valid
	$X_{2.2}$	0.813	Valid
	$X_{2.3}$	0.895	Valid
Technology Factor	**$X_{3.3}$**	0.913	Valid
	$X_{3.4}$	0.877	Valid
	$X_{3.5}$	0.827	Valid
	$X_{3.6}$	0.850	Valid

Variable	Indicator	*Outer Loading*	Information
	$X_{3.7}$	0.805	Valid
Organizational Factor	$X_{4.1}$	0.919	Valid
	$X_{4.4}$	0.855	Valid
	$X_{4.5}$	0.937	Valid
Adopt Scrum	Y_1	0.935	Valid
	Y_2	0.796	Valid
	Y_4	0.901	Valid

b. Discriminant Validity

Furthermore, the discriminant validity test is carried out to determine the magnitude of the correlation between the constructs and their indicators and indicators from other constructs. To find out that each construct is declared to have a good discriminant value, it is done by looking at the cross-loading value, if the standard value must be above 0.7 or the result of the AVE (Average Variance Extracted) root above the correlation of latent variables in 1 construct, then the indicator is declared valid. as shown in Table 2.

Table 2. Cross loading discriminant validity

Indicator	**Construct**				
	Team Factor	Individual Factor	Technology Factor	Organizational Factor	Adopt Scrum
$X_{1.4}$	**0.852**	0.729	0.370	0.711	0.418
$X_{1.5}$	**0.944**	0.515	0.535	0.404	0.661
$X_{2.1}$	0.503	**0.752**	0.583	0.536	0.478
$X_{2.2}$	0.534	**0.813**	0.407	0.496	0.516
$X_{2.3}$	0.583	**0.895**	0.614	0.435	0.486
$X_{3.3}$	0.475	0.519	**0.913**	0.304	0.819
$X_{3.4}$	0.555	0.590	**0.877**	0.264	0.732
$X_{3.5}$	0.312	0.616	**0.827**	0.494	0.537
$X_{3.6}$	0.587	0.624	**0.850**	0.523	0.617
$X_{3.7}$	0.277	0.442	**0.805**	0.472	0.533
$X_{4.1}$	0.572	0.540	0.292	**0.919**	0.200
$X_{4.4}$	0.514	0.544	0.514	**0.855**	0.253
$X_{4.5}$	0.510	0.545	0.422	**0.937**	0.492
Y_1	0.603	0.636	0.741	0.433	**0.935**
Y_2	0.427	0.324	0.654	0.140	**0.796**
Y_4	0.607	0.607	0.645	0.468	**0.901**

From the results of the discriminant validity test in Table 2, the correlation of the cross-loading value on each item has a value above 0.70, and also the highest value is associated with the latent variable compared to when it is associated with other

latent variables in each item stated that all items are valid. in a discriminant manner. At this stage, the testing of convergent validity and discriminant validity has declared all items valid on all variables and indicators. Furthermore, it can be done with reliability testing.

c. Reliability Test

The reliability test carried out in this study used 2 methods, namely composite reliability and Cronbach's alpha using SmartPLS. If a variable measures the value of composite reliability, Cronbach's alpha is above 0.7, and AVE (Average Variance Extracted) is above 0.5, the variable is declared reliable as shown in Table 3.

Table 3. Composite reliability and Cronbach's alpha

Variable	*Composite Reliability*	*Cronbach's Alpha*	AVE	Information
Team Factor	0.894	0.774	0.808	Reliable
Individual Factor	0.862	0.757	0.676	Reliable
Technology Factor	0.932	0.910	0.732	Reliable
Organizational Factor	0.931	0.900	0.818	Reliable
Adopt Scrum	0.910	0.850	0.773	Reliable

The results of composite reliability and Cronbach's alpha in Table 3 above, shows that all variables have a composite reliability value or Cronbach's alpha above 0.7 and AVE above 0.5 so that all variables can be stated that are reliable.

3.3 Structural Model Analysis (Inner Model)

a. Test The Value of R-Square (R^2)
Measurement of the structural model of the value of R2 which is carried out by calculating the variation of changes in the independent variable is related to the dependent variable. An R2 value is declared to be better if the measurement of the R2 value is higher as shown in Table 4.

Table 4. Value of R-Square (R^2)

Variable	R^2
Adopt Scrum	0.674

The results of the R2 value of the dependent variable in Table 4 above, shows that the R2 value of the scrum adoption variable is 0.674. These variables are team factors, individual factors, technology factors, and organizational factors that have shared an influence value of 67.4% on scrum adoption. The remaining 32.6% is explained by other variables that have not been included in this study. Furthermore, it can be continued to test the hypothesis.

b. Hypothesis Test

Hypothesis testing is carried out in this study to determine the level of significant value that affects between variables. There are 4 hypotheses in this study which were carried out by analyzing the SmartPLS application using the bootstrapping function to determine the significance value by looking at the t-statistical significance value and parameter coefficient values. Acceptance or rejection of a hypothesis if the significance value must bet-value above 1.96 and or p-value below 0.05 at a significance level of 5% (a 5%) then Ha is accepted, and Ho is rejected as shown in Table 5.

Table 5. Hypothesis testing results

Hypothesis	Influence	*Original Sample* (O)	t-statistic	P Values	Information
H1	Team Factors related to Scrum Adoption	0.333	1.120	0.263	Not Significant
H2	Individual Factors related with Scrum Adoption	0.037	0.107	0.915	Not Significant
H3	Technological Factors related with Scrum Adoption	0.623	2.226	0.026	Significant
H4	Organizational Factors related with Scrum Adoption	-0.099	0.270	0.787	Not Significant

3.4 Analysis of Research Results

Contains the results of the discussion and can be compared with the results of previous studies.

a. Influence of Team Factor Related to Scrum Adoption

The results of testing hypothesis 1 of the team factor variable obtained a value that had no significant effect on the adoption of scrum in the original sample of 0.333, the t-statistic value of 1,120 was still below 1.96, and the p-values of 0.263 were still above 0.05, so hypothesis 1 stated that the team factor that had a positive effect on the adoption of scrum in this study was rejected. It can be concluded that the effect of team factors does not affect teamwork on scrum adoption, but team factors are an important aspect for collaboration and teamwork on scrum adoption in BBLobster CMS development.

b. Influence of Individual Factors Related to Scrum Adoption

The results of testing the hypothesis of 2 individual factor variables obtained values that have no significant effect on the adoption of scrum in the original sample of 0.037, t-statistics of 0.107 are still below 1.96, and p-values of 0.915 are still above 0.05, so hypothesis 2 stated that individual factors that have a positive effect on the adoption of scrum in this study were rejected. It can be concluded that the influence of individual factors does not affect scrum adoption in the development of BBLobster CMS, but individual factors are an important aspect because one of the active roles of individuals has a positive influence on determining the success of scrum adoption.

c. Influence of Technological Factors Related to Scrum Adoption

The results of testing the hypothesis of 3 technology factor variables obtained values that have a significant effect on the adoption of scrum in the original sample of 0.623, the t-statistic value of 2.226 is above 1.96, and the p-values of 0.026 are already below 0.05, so hypothesis 3 is stated Technological factors that have a positive effect on the adoption of scrum in this study are accepted. It can be concluded that respondents have benefited and benefited from applying Scrum as a software method. These technological factors affect the development team to improve the performance, productivity, and quality of the BBLobster CMS created. The implementation of scrum can also advance many aspects of the business for future project visibility.

d. Influence of Organizational Factors Related to Scrum Adoption

The results of testing the hypothesis of 4 organizational factor variables obtained values that have no significant effect on the adoption of scrum in the original sample of -0.099, the t-statistic value of 0.270 is still below 1.96, and the p-values of 0.787 are still above 0.05, so the hypothesis 2 stated that organizational factors that have a positive effect on scrum adoption in this study were rejected. It can be concluded that the influence of organizational

factors does not affect and is not significant on the adoption of scrum in the development of BBLobster CMS.

4. CONCLUSION

The results of statistical data analysis and discussion of the implementation of scrum in the development of the BBLobster Content Management System (CMS) indicate that team factors, individual factors, and organizational factors have no significant effect on scrum adoption. While the technology factor has a positive and significant effect on the adoption of scrum. Structural model testing is carried out by knowing the value of R-Square (R2) is a team factor variable, individual factor, technological factor, and organizational factor that has shared an influence value of 67.4% related to scrum adoption.

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