



The Effect of Design Thinking Application on Business Model Innovation at PT. RAPP with Creativity of Kaizen Team as Intervening Variable

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ABSTRACT

Business model innovation is one of the key factors in the success of a business. Design thinking is a human-centred approach to problem solving and innovation, has gained significant attention as a methodology that can foster creativity, collaboration and customer centricity in the innovation process. This study seeks to investigate the effect of design thinking application on business model innovation at Riau Andalan Pulp and Paper (PT. RAPP), with the aim of understanding how design thinking can contribute to the development of innovative business models in this specific context. This involves using statistical methods such as hypothesis testing, regression analysis to identify significant relationships or influences between variables related to the influence of design thought and business model innovations in PT. Based on the test results conducted between the design thinking variable and the creativity of the kaizen team variables, it can be concluded that design thinking has a positive and significant effect on the creativeness of the team. It can also be found that the creative ability of the group mediates the relationship between the variable design thinking and the variable innovation variable.

Keyword: Design Thinking, Business Model Innovation, Creativity of Kaizen Team

1. Introduction

Competition in business is fierce, with companies striving to maintain customer loyalty and satisfaction to expand their networks. Retaining customers and making them loyal is challenging, requiring quality products and innovation. Innovation is key in business competition, and its success depends on a company's ability to create a new and innovative business model. Business model innovation is necessary due to the ever-changing business environment. Companies that cannot adapt quickly will struggle to compete in a competitive market. Consumer changes, new technologies, intensified competition, regulatory changes, and shifts in the business environment can affect a company's business model. Business model innovation can help companies meet evolving customer needs, utilize new technologies, and improve financial performance. Design thinking is a human-centered approach to problem-solving and innovation, which can foster creativity, collaboration, and customer centricity in the innovation process. It can be used to identify customer needs, analyze markets, and develop more effective business models. The design thinking process consists of six steps: understanding, observing, defining the problem, finding ideas, developing prototypes, and testing.

PT. Riau Andalan Pulp and Paper (PT. RAPP), a company in the pulp and paper industry in Indonesia, must continuously innovate its business model to maintain a competitive advantage and face market challenges. Design thinking can help PT. RAPP create innovation, but not all design thinking implementations result in successful business model innovations. The creativity of kaizen teams, representing PT. RAPP's continuous improvement approach, can contribute to the business model innovation process.

In a journal titled "Openness to Experience and Team Creativity: Effects of Knowledge Sharing and Transformational Leadership," Zhang. W, et. al (2019) broaden the exploration on the creative work process in groups by coordinating character attributes, information sharing behavior, and innovative leadership. They find that heterogeneity of openness to experience in groups is positively related to group creativity. In a journal titled "A Design Thinking Framework for Circular Business Model Innovation," Goldmann et. al (2019) develop a structure for circular business model innovation (CBMI) in light of a plan figuring approach. The CBMI system was gotten from a different contextual investigation and includes five spaces: basic, exploratory, ideation, prototyping and testing, and arrangement. The results from six case organizations demonstrate that the created structure is helpful for CBMI.

Clauss (2017) identifies 10 subconstructs of plans of action, divided into three aspects. The first aspect, esteem creation development, includes 40 elements that can be categorized into four

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subconstructs: These subconstructs are further explained: (1) New offerings: The development of new items and services through R&D or the use of new technologies. (2) New processes/structures: The association of activities within a plan of action, which determines the level of productivity. (3) New revenue models: Enabling customers to pay for offers in new ways, such as through cross-subsidization or long-term income streams. (4) New capabilities: As abilities are implanted in exercises, new capacities can be created through preparing, consistent learning and information mix. Firms are encouraged to give authoritative individuals with opportunity for self-development and the investigation of groundbreaking thoughts, and to acknowledge botches as these empower capacity working from illustrations learnt (Achtenhagen et al., 2013).

This study aims to investigate the effect of design thinking application on business model innovation at PT. RAPP, focusing on how design thinking can contribute to the development of innovative business models in this specific context. The creativity of kaizen teams may act as a mediating variable in the outcome of a design thinking implementation.

2. Metods

The study location is the place where the study is conducted, for this study the author chose PT. RAPP which is located in Pangkalan Kerinci, Langggam Subdistrict, Pelalawan district, Riau, Indonesia. The type of study is associative research. The data used in this study is quantitative. Source data of this study namely primary and secondary. The population in this study are Members of the business continous innovation and development department, especially those who have been members of the kaizen team at PT. RAPP. In this study, the researcher used the Nonprobability Sampling method with the Purposive Sampling Technique, the samples of this study are selected and based on predetermined criteria relevant to the research became the sample of this study, such as the kaizen team, is people who have been members of the kaizen team at PT. RAPP.

The measurement scale used in this study is the Likert Scale. The Likert scale is a measurement scale used to regulate attitudes, opinions, and perceptions of a person or group of people about social phenomena. In this study, social phenomena have been specifically determined, and here in after referred to as research variables (Sugiyono, 2019). According to Indriin (2019), the SPSS program was used to test this validity. The testing technique that is often used by researchers to test validity is using multiple correlations. This study uses IBM SPSS version 27. According to Noor Wahyuni (2014), the level of reliability is empirically indicated by a number called the reliability coefficient value. High reliability is indicated by the value of xx, close to 1. The general agreement is that reliability is considered satisfactory if Cronbach Alpha > 0.70. This study has one independent variables, one dependent variable and one intervening variable. Therefore just use the Normality Test, Multicollinearity Test, Heteroscedasticity Test, and Autocorrelation Test. The data analysis model used in this study is multiple linear regression. In this case, the researcher describes the typical hypothesis (specific) of the theory to be tested empirically using the t-test, f-test, and coefficient of determination test.

Based on the formulation of the problem, the authors formulate the following hypothesis:

H1= Design thinking has a positive and significant effect on business model innovation.

H2 = Design thinking has a positive and significant effect on team kaizen creativity.

H3= Team kaizen has a positive and significant effect on business model innovation.

H4= Design thinking has a positive and significant effect on business model innovation through team kaizen creativity as a mediating variable.

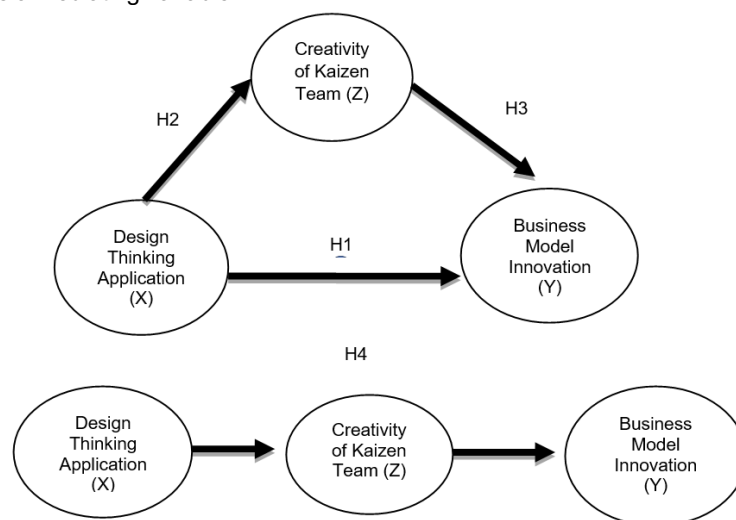


Figure 1 Research Model
 Source: Processed data 2023

3. Result and Discussion

3.1 Characteristics Respondents

The diversity of respondents based on gender can be seen in Table 1 Respondents by gender below.

Table 1 Characteristics of Respondent by Gender

		Gender			Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	Male	39	59.1	59.1	59.1
	Female	27	40.9	40.9	100.0
	Total	66	100.0	100.0	

Source: Processed data 2023

Based on Table 1, it can be seen that there are 40,9 % more female respondents compared to only 59.1 % male respondents.

The diversity of respondents based on department can be seen in Table 2 Respondents based on the type of work below:

Table 2 Charesteristics Respondent based on department

		Department			Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	Social Capital	3	4.5	4.5	4.5
	Riau Pulp	19	28.8	28.8	33.3
	Riau Paper	9	13.6	13.6	47.0
	Fiber Supply	6	9.1	9.1	56.1
	Harvesting	6	9.1	9.1	65.2
	Common Service	2	3.0	3.0	68.2
	BCID	1	1.5	1.5	69.7
	Teknikal	1	1.5	1.5	71.2
	PTSI	5	7.6	7.6	78.8
	Riau Fiber	2	3.0	3.0	81.8
	RAK	2	3.0	3.0	84.8
	Project	1	1.5	1.5	86.4
	APR	1	1.5	1.5	87.9
	AKU	2	3.0	3.0	90.9
	F. Plantation	1	1.5	1.5	92.4
	Share Service	2	3.0	3.0	95.5
	Tech Service	1	1.5	1.5	97.0
	APY	1	1.5	1.5	98.5
	Indra Fiber	1	1.5	1.5	100.0
	Total		66	100.0	100.0

Source: Processed Data SPSS 2023

From table 2 it is known that respondents who are in the social capital department are 3 people with a percentage of 4,5%, Riau pulp are 19 people with a percentage of 28,8%, Riau paper are 9 people with a percentage of 13,8%, Fiber supply are 6 people with a percentage of 9,1%, harvesting are 6 people with a percentage of 9,1%, common service are 2 people with a percentage of 3,0%, BCID are 1 person with a percentage of 1,5%, technical are 1 person with a percentage of 1,5%, PTSI are 5 people with a percentage of 7,6%, RAK are 2 people with a percentage of 3,0%, Riau Fiber are 2 people with a percentage of 3,0%, project department are 1 person with a percentage of 1,5%, APR department are 1 person with a percentage of 1,5%, AKU department are 2 people with a percentage of 3,0%, F. plantation department are 1 person with a percentage of 1,5%, share service department are 2 people with a percentage of 3,0%, tech service department are 1 person with a percentage of 1,5%, APY department are 1 person with a percentage of 1,5%, Indra Fiber department are 1 person with a percentage of 1,5%,. The results show that employees who have provided JDI or have been involved in team kaizen at PT Riau Andalan Pulp and Paper are dominated by employees from the Riau Pulp department.

From table 3 It is known that those who have positions as managers are 3 people with a percentage of 4,5%, supervisor are 11 people with a percentage of 16,7%, team leaders are 6 people with a percentage of 9,1%, coordinators are 1 person with a percentage of 1,5%, instruments are 1 person with a percentage of 1,5%, operator are 13 people with a percentage of 19,7%, technicians are 2 people with a percentage of 3,0%, CEO are 1 person with a percentage of 1,5%, staff amounted to 16 people with a percentage of 24,2%, assistant amounted to 4 people with a percentage of 6,1%, superintendent amounted to 1 person with a percentage of 1,5%, facilitator amounted to 1 person with a percentage of 1,5%, heavy equipment trainer amounted to 1 person with a percentage of 1,5%, HAC amounted to 1 person with a percentage of 1,5%, chainsaw trainer amounted to 2 people with a percentage of 3,0%, Time motion study & analyze amounted to 1 person with a percentage of 1,5%, common service amounted to 1 person with a percentage of 1,5%. The results show that respondents who have been involved in the kaizen team or have provided JDI at PT Riau Andalan Pulp and Paper are dominated by staff positions.

Table 3 Characteristics of Respondents based on Position

		Position			Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	Manager	3	4.5	4.5	4.5
	Supervisor	11	16.7	16.7	21.2
	Team Leader	6	9.1	9.1	30.3
	Coordinator	1	1.5	1.5	31.8
	Instrument	1	1.5	1.5	33.3
	Operator	13	19.7	19.7	53.0
	Teknisi	2	3.0	3.0	56.1
	CEO	1	1.5	1.5	57.6
	Staff	16	24.2	24.2	81.8
	Assistant	4	6.1	6.1	87.9
	Superintendent	1	1.5	1.5	89.4
	Facilitator	1	1.5	1.5	90.9
	Heavy Equipment Trainer	1	1.5	1.5	92.4
	HAC	1	1.5	1.5	93.9
	trainer Chainsaw	2	3.0	3.0	97.0
	Time Motion Study & analyze	1	1.5	1.5	98.5
	Common Service	1	1.5	1.5	100.0
	Total	66	100.0	100.0	

Source: Processed Data SPSS 2023

From table 4 it is known that employees based on length of service working less than 1 year amounted to 2 people with a percentage of 3,0%, length of work 1-5 years amounted to 32 people with a percentage of 48,5%, length of work 6-10 years amounted to 18 people with a percentage of 27,3%, and length of work more than 10 years amounted to 14 people with a percentage of 21,2%. The results show that respondents who have been involved in the kaizen team or have provided JDI at PT Riau Andalan Pulp and Paper are dominated by respondents who have worked for 1-5 years.

Table 4 Characteristics of Respondents based on length of employment

		length of employment			Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	< 1 year	2	3.0	3.0	3.0
	1-5 years	32	48.5	48.5	51.5
	6-10 years	18	27.3	27.3	78.8
	> 10 years	14	21.2	21.2	100.0
	Total	66	100.0	100.0	

Source: Processed Data SPSS 2023

3.2 Classical Assumption

3.2.1 Normality test

Table 5 Normality Test Kolmogorov-Smirnov Equation 1

One-Sample Kolmogorov-Smirnov Test		Unstandardized Residual	
N		66	
Normal Parameters ^{a,b}	Mean	.0000000	
	Std. Deviation	2.14194299	
Most Extreme Differences	Absolute	.110	
	Positive	.110	
	Negative	-.046	
Test Statistic		.110	
Asymp. Sig. (2-tailed) ^c		.045	
Monte Carlo Sig. (2-tailed) ^d	Sig.	.043	
	99% Confidence Interval	Lower Bound	.037
		Upper Bound	.048

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 2000000.

Source: Processed Data SPSS 2023

Based on the output in table 5 above, we can see that the normality test with the Kolmogorov-Smirnov method above is where the asymp. sig value is $0,45 < 0,05$ then in accordance with the basis for decision making in the Kolmogorov-Smirnov Test normality test, then in equation 1 the standardized residual value is "not normally" distributed.

Table 6 Normality Test Kolmogorov-Smirnov Equation 2

One-Sample Kolmogorov-Smirnov Test			Unstandardized Residual
N			66
Normal Parameters ^{a,b}	Mean		.0000000
	Std. Deviation		1.45621704
Most Extreme Differences	Absolute		.092
	Positive		.092
	Negative		-.072
Test Statistic			.092
Asymp. Sig. (2-tailed) ^c			.200 ^d
Monte Carlo Sig. (2-tailed) ^e	Sig.		.173
	99% Confidence Interval	Lower Bound	.164
		Upper Bound	.183
a. Test distribution is Normal. b. Calculated from data. c. Lilliefors Significance Correction. d. This is a lower bound of the true significance. e. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 299883525.			

Source: Processed Data SPSS 2023

Based on the output in table 6 above, we can see that the normality test with the Kolmogorov-Smirnov method above is where the asymp. sig value is 0,200 > 0,05 then in accordance with the basis for decision making in the Kolmogorov-Smirnov Test normality test, then in equation 2 the standardized residual value is "normally" distributed.

3.2.2 Multicollinearity Test

The multicollinearity test is used to determine and show whether in this regression model there is an indication of correlation between independent variables (free). In multiple regression, a regression model must be free from multicollinearity symptoms by looking if the VIF value < 10 and the Tolerance value > 0,10, then the regression model can be declared free from multicollinearity symptoms.

Table 7 Multicollinearity Test Equation 2

Coefficients ^a									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		
		B	Std. Error	Beta			Tolerance	VIF	
1	(Constant)	.108	.995		.109	.913			
	Design Thinking	.520	.122	.357	4.250	.000	.419	2.387	
	Creativity of Kaizen Team	.611	.086	.599	7.130	.000	.419	2.387	
a. Dependent Variable: Business Model Innovation									

Source: Processed Data SPSS 2023

Based on table 7 above, by looking at the tolerance value X 0,419 and Z 0,419 > 0,1 and VIF X 2,387 and Z 2,387 < 10, it can be concluded that the regression model equation 2 in this study can be stated "does not contain symptoms of multicollinearity".

3.2.3 Heteroscedasticity Test

The heteroscedasticity test aims to determine and show whether the regression model occurs inequality of variance from the residuals of one observation to another. Heteroscedasticity test in the regression model this research uses the White method. A good regression model must be free from symptoms of heteroscedasticity, which means that the variance of the residuals must be constant for all variables, by looking at the Chi Square Count value < Chi Square Table.

Table 8 Heteroscedasticity Test Equation 1

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.282 ^a	.079	.050	6.62693
a. Predictors: (Constant), Design Thinking, X_KUADRAT				
b. Dependent Variable: RES1_KUADRAT				

Source: Processed Data SPSS 2023

Chi Square count = n * R square
 = 66 * 0,079
 = 5,214
 Chi Square Table = df = 66 -3
 = 82,529

Based on the output above, it can be seen that Chi Square Count < Chi Square Table of 5,214 < 82,529, it can be stated that in the regression model equation 1 it is stated that "there are no symptoms of heteroscedasticity".

Table 9 Heteroscedasticity Teat Equation 2

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.628 ^a	.395	.344	2.80561
a. Predictors: (Constant), Creativity of Kaizen Team, X_KUADRAT, Z_KUADRAT, Design Thinking, XZ				
b. Dependent Variable: RES2_KUADRAT				

Source: Processed Data SPSS 2023

Chi Square count = n * R square
= 66 * 0,395
= 26,07
Chi Square Table = df = 66 -6
= 79,082

Based on the output above, it can be seen that Chi Square Count < Chi Square Table of 26,07< 79,082, it can be stated that in the regression model equation 2 it is stated that "there are no symptoms of heteroscedasticity".

3.3 Substructure Analysis Equation 1

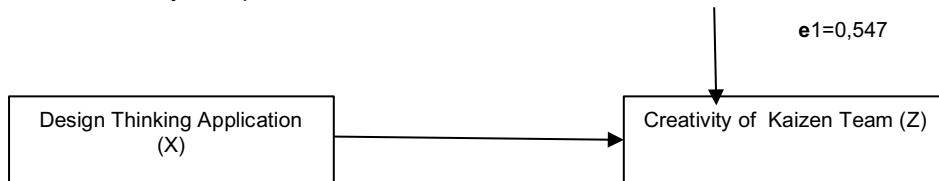


Figure 2 The Effect of Design Thinking on Creativity of Kaizen Team

Source: Processed Data 2023

Equation 1 : $Z = \beta x + e1$ (equation model 1)

3.3.1 T Test

The t test is used to test the independent variable partially on the dependent variable. In this study, the t test was used to determine the effect of the Design Thinking variable on the Creativity of Kaizen Team. To see the results of the t test calculation in equation 1, it can be seen in the table below:

Table 10 T Test

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
		B	Std. Error			
1	(Constant)	2.952	1.404		2.103	.039
	Design Thinking	1.089	.116	.762	9.421	< .001
a. Dependent Variable: Creativity of Kaizen Team						

Source: Processed Data SPSS 2023

Based on the calculation results from table 4.18 above, the t table number is obtained with the provisions of $\alpha = 0,05$ and $df = (\alpha/2: n-k-1)$ or $(0,05/2: 66-2-1) = (0,025: 63)$, so that the t table value = 1,99834 is obtained, it can be seen that the effect of Design Thinking on Creativity of Kaizen Team. Based on the results of calculations using the SPSS 27 program as in the table above, the Design Thinking variable has a t count of 9,421 with a sig value. < 0,001. The provisions for making a hypothesis decision are accepted or rejected, based on the value of $t \text{ count} > t \text{ table}$, $-t \text{ count} < -t \text{ table}$, or if the significance < 0,05, it can be concluded that the hypothesis is accepted. The results of the research in this study, obtained the value of $t \text{ count} > t \text{ table}$ $9,421 > 1,99834$ and a significance value of $< 0,001 < 0,05$, it can be concluded that the hypothesis states the results of the variable "Design Thinking has a significant effect on Creativity of Kaizen Team."

3.3.2 Coefficient of determination

To find how much influence the variable design thinking (X) has on the Creativity of kaizen team (Z), the statistical calculation is calculated using the coefficient of determination.

Table 11 Coefficient of Determination

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.762 ^a	.581	.574	2.159	
a. Predictors: (Constant), Design Thinking					
b. Dependent Variable: Creativity of Kaizen Team					

Source: Processed Data SPSS 2023

Based on the results of the calculation of the Coefficient of Determination in the table above, the value of the Coefficient of Determination (R²) is 0,581, which means that this indicates that the contribution of the independent variable, namely Design Thinking to the dependent variable, namely Creativity of Kaizen Team is 58,1%, while the remaining 41,9% is influenced by other variables that have not been studied or not included in the regression in this study.

3.4 Substructure Analysis Equation 2

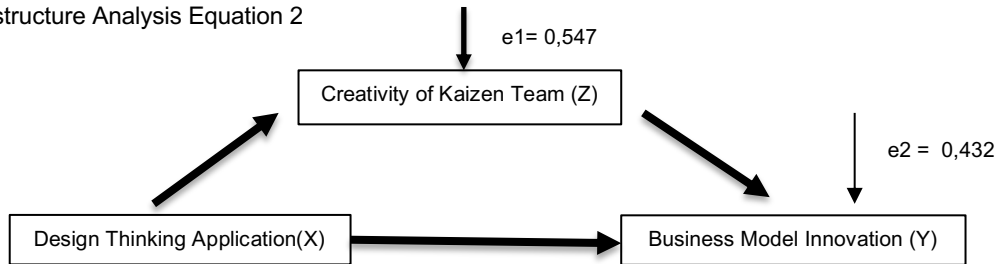


Figure 3 The effect of Design Thinking Application on Business Model Innovation with Creativity of Kaizen Team as Intervening Variable
Source: Processed Data 2023

Equation 2 : $Y = \beta x + \beta z + e2$ (equation model 2)

3.4.1 F Test

The F test in this study was used to test the simultaneous influence of the Design Thinking and Creativity of Kaizen Team variables on Business Model Innovation. A variable is considered influential, if F count > F table, and is declared significant if the Sig value. < 0,05. For the results of the F test in this study, it can be seen in the table below:

Table 12 F Test

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	601.027	2	300.513	137.353	< .001 ^b
	Residual	137.837	63	2.188		
	Total	738.864	65			
a. Dependent Variable: Business Model Innovation						
b. Predictors: (Constant), Creativity of Kaizen Team, Design Thinking						

Source: Processed Data SPSS 2023

Based on the results of the F test calculation in equation 2 above, the F count is 143,454. To determine the value of the F table with a significance level of 5%, as well as degrees of freedom, df (N1) = (k-1) or (3-1) and (n-k) or (66-3), df = (3-1=2) and (66-3=63). Then the results can be obtained for the F table worth 3,14. Therefore, the results of the calculation of F count > F table 137,353 > 3,14 with a sig value obtained < 0,001 < 0,05, then simultaneously the variables of Design Thinking and Creativity of Kaizen Team are stated to have a simultaneous effect on Business Model Innovation.

3.4.2 T Test

The t test is used to test the independent variable (independent) partially on the dependent variable (bound). In this study, the t test is used to determine the effect of Design Thinking variables and Creativity of Kaizen Team on Business Model Innovation. To see the results of the t test calculation in equation 2, it can be seen in the table below:

Table 13 T Test

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.108	.995		.109	.913
	Design Thinking	.520	.122	.357	4.250	< .001
	Creativity of Kaizen Team	.611	.086	.599	7.130	< .001
a. Dependent Variable: Business Model Innovation						

Based on the calculation results from the table above, the t table number is obtained with the provisions of $\alpha = 0,05$ and $dk = (\alpha/2 : n-k-1)$ or $(0,05/2 : 66-3-1) = (0,025 : 62)$, so that the t table value = 1,99897 is obtained, then the Effect of Design Thinking on Business Model Innovation. Based on the results of calculations using the SPSS 27 program as in the table above,

Design Thinking variable has a t count of 4,250 with a sig value. $< 0,001$. The provisions for making a hypothesis decision are accepted or rejected, based on the value of t count $> t$ table, -t count $< -t$ table, or if the significance $< 0,05$, it can be concluded that the hypothesis is accepted. The results of the research in this study, obtained the value of t count $> t$ table $4,250 > 1,99897$ and a significance value of $< 0,001 < 0,05$, it can be concluded that the hypothesis states the results of the variable "Design Thinking has a significant effect on Business Model Innovation".

Creativity of Kaizen Team variable has a t count of 7,130 with a sig value. $< 0,001$. The provisions for making a hypothesis decision are accepted or rejected, based on the value of t count $> t$ table, -t count $< -t$ table, or if the significance $< 0,05$, it can be concluded that the hypothesis is accepted. The results of the research in this study, obtained the value of t count $> t$ table $7,130 > 1,99897$ and a significance value of $< 0,001 < 0,05$, it can be concluded that the hypothesis states the results of the variable "Creativity of Kaizen Team has a significant effect on Business Model Innovation".

3.4.3 Coefficient of Determination

The Coefficient of Determination (Adj R2) basically aims to measure how far the model's ability to explain the variation in the dependent variable (bound).

Table 14 Coefficient of Determination

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.902 ^a	.813	.808	1.479
a. Predictors: (Constant), Creativity of Kaizen Team, Design Thinking				
b. Dependent Variable: Business Model Innovation				

Source: Processed Data SPSS 2023

Based on the results of the calculation of the Coefficient of Determination in the table above, the value of the Coefficient of Determination (Adj R2) is 0,808, which means this indicates that the contribution of the independent variables, namely Design Thinking and Creativity of Kaizen Team to the dependent variable, namely Business Model Innovation, is 80,8%, while the remaining 19,2% is influenced by other variables that have not been studied or not included in the regression in this study.

3.5 Regression Analysis with Mediating

The Effect of Design Thinking Application on Business Model Innovation at PT. RAPP with Creativity of Kaizen Team as Intervening Variable described as follows:

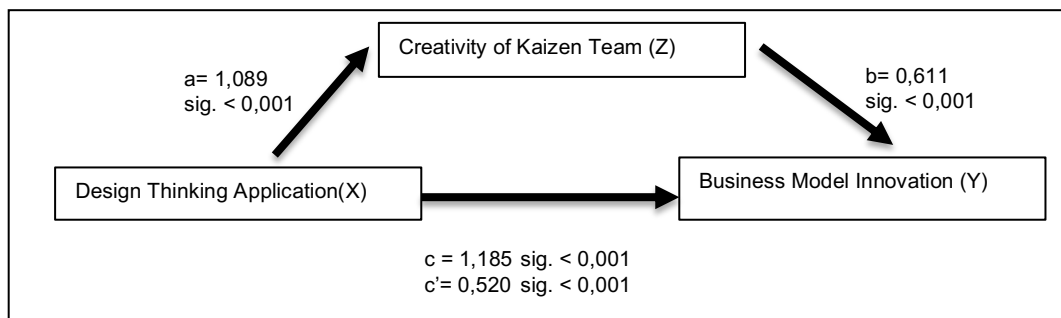


Figure 4 Regression Analysis with Mediating

Source: Processed Data 2023

$$Y (\text{Business Model Innovation}) = \alpha + \beta \text{ Design Thinking} + \beta \text{ Creativity of Kaizen Team}$$

The three regression equations that must be estimated in the Causal Step method are as follows:

1. Simple regression equation of the intervening variable Creativity of Kaizen Team (Z) on the independent variable Design Thinking (X). The results of the analysis found evidence that Design Thinking is significant to Creativity of Kaizen Team (Z) with a significance value of $< 0,001 < \alpha = 0,05$ and a regression coefficient (a) = 1,185.
2. Simple regression equation of the dependent variable Business Model Innovation (Y) on the independent variable Design Thinking (X). The results of the analysis found evidence that Design Thinking is significant to Business Model Innovation with a significance value of $< 0,001 < \alpha = 0,05$ and a regression coefficient (c) = 1,185.
3. Multiple regression equation of the dependent variable Business Model Innovation (Y) on the variable Design Thinking (X) and the intervening variable Creativity of Kaizen Team (Z).

The results of the analysis found that Design Thinking is significant to Business Model Innovation, after controlling for Creativity of Kaizen Team with a significance value of $< 0,001 < \alpha = 0,05$ and a regression coefficient (b) = 0,611. Furthermore, the direct effect c' was found to be 0,520 which is smaller than c =

1,185. The effect of the independent variable Design Thinking on the dependent variable Business Model Innovation is reduced and significant $< 0,001 < \alpha = 0,05$ after controlling the intervening variable Creativity of Kaizen Team. It can be concluded that this model is included in "partial mediation", where the Design Thinking variable is able to directly influence the Business Model Innovation variable or indirectly by involving the intervening variable Creativity of Kaizen Team, or it can be said that Creativity of Kaizen Team mediates the relationship between Design Thinking and Business Model Innovation.

Calculation of Influence Direct Effect

- a. The influence of variable design thinking on creativity of kaizen team = $(X \rightarrow Z) = 0,762$. The direct influence between the variable design thinking on the creativity of kaizen team is 0,762.
- b. The effect of variable creativity of kaizen team on business model innovation = $(Z \rightarrow Y) = 0,357$. The direct influence between the variable creativity of kaizen team on business model innovation is 0,357.
- c. Direct influence between variable design thinking on business model innovation = $(X \rightarrow Y) = 0,814$. The direct influence between the variable design thinking on business model innovation is 0,814.

2. Indirect effect

The influence of design thinking variables on business model innovation through creativity if kaizen team as an intervening variable $(X \rightarrow Z \rightarrow Y) = (0,762 \times 0,357) = 0,272034$.

The indirect effect of design thinking on business model innovation mediated by creativity of kaizen team as an intervening variable is worth 0,272034 and has a total intervening effect $(X \rightarrow Z \rightarrow Y) = (0,762 + 0,357) = 1,119$. The total influence between design thinking variables on business model innovation through creativity of kaizen team as an intervening variable is worth 1,119.

3.6 Sobel Test

The effect of design thinking application on business model innovation with creativity of kaizen team as intervening variable.

Table 15 Coefficient and Standard Error Equation 1

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.952	1.404		2.103	.039
	Design Thinking	1.089	.116	.762	9.421	.000

a. Dependent Variable: Creativity of Kaizen Team

Source: Processed Data SPSS 2023

Table 16 Coefficient and Standard Error Equation 2

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.108	.995		.109	.913
	Design Thinking	.520	.122	.357	4.250	.000
	Creativity of Kaizen Team	.611	.086	.599	7.130	.000

a. Dependent Variable: Business Model Innovation

Source: Processed Data SPSS 2023

From the regression table results show that the regression coefficient value of design thinking on creativity of kaizen team is 0,808 with a standard error of 0,087 and its significance value is 0,000, the coefficient value of creativity of Kaizen Team on business model Innovation is 0,599 with a standard error of 0,083 and its significance is 0,000, so that design thinking has a significant direct effect on business model innovation as well as the creativity of kaizen team has a significant direct effect on business model innovation.

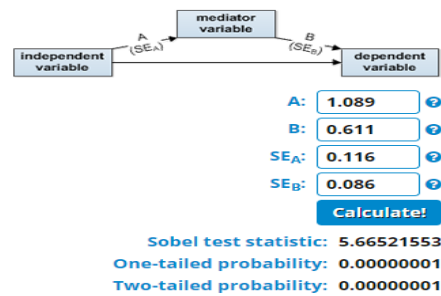


Figure 5 Sobel test
 Source: Processed Data 2023

The results of the analysis with Sobel Test Calculator for The Signification of Mediation Kris Preacher: The results of the analysis with the Sobel test show the statistical value (z value) for the effect of the Creativity of Kaizen Team variable as an intervening variable between the Design Thinking and Business Model Innovation variables. Sobel Test Statistic with 5,66521553 and One-tailed Probability with 0,000 is significant at Two-tailed probability with 0,000. Because the z-value > -1,96 or p-value < α = 0,05, it can be concluded that the indirect effect is significant. In line with previous findings using the causal step strategy, the mediation hypothesis is supported.

3.4 Discussion

The effect of design thinking on business model innovation was found to be significant, with previous research supporting this relationship. Design thinking focuses on understanding user needs, exploring creative solutions, and iterative testing to produce user-centered innovations. The positive and significant effect of design thinking on business model innovation is well-documented in literature.

Similarly, the effect of design thinking on the creativity of the kaizen team was also found to be significant. Design thinking emphasizes empathy, ideation, prototyping, and testing to address complex problems and generate innovative solutions. This relationship is a new finding in the context of the kaizen team's creativity.

Furthermore, the creativity of the kaizen team was shown to have a significant effect on business model innovation. Team creativity is essential for generating groundbreaking ideas and improving task effectiveness. The role of team composition in influencing creative outcomes is highlighted in research.

Finally, the analysis revealed that the creativity of the kaizen team acts as an intervening variable between design thinking and business model innovation. The indirect effect was found to be significant, supporting the mediation hypothesis. This suggests that design thinking positively influences business model innovation through team kaizen creativity as a mediating variable.

4. Conclusion

1. Based on the results of tests conducted between design thinking variables and business model innovation, it can be concluded that design thinking has a positive and significant effect on business model innovation.
2. Based on the test results conducted between the design thinking variable and the creativity of the kaizen team, it can be concluded that design thinking has a positive and significant effect on the creativity of the kaizen team.
3. Based on the test results conducted between the creativity of kaizen team variables, it can be concluded that the creativity of kaizen team has a positive and significant effect on business model innovation.
4. Based on the test results conducted on the variable design thinking and business model innovation with the creativity of kaizen team as an intervening variable, it can be concluded that the intervening variable mediates the relationship between the design thinking variable and the business model innovation variable.

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