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Development of design concepts driving factors for technology acquisition in small and medium aluminium industries

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Abstract

The Small and Medium Enterprises (SMEs) in the aluminium sector in Yogyakarta play a strategic role in supporting both the local economy and other industries. Observations indicate that 41 aluminium SMEs have low production capacities, primarily due to their reliance on traditional technologies. This study explores the relationship between factors driving technology acquisition—organizational motivation, partner involvement, desired technology, and acquisition scenarios—and the intention to adopt new technology within the aluminium SMEs in Yogyakarta. Using the Spearman rank correlation test and SPSS software for data analysis, the study involves five aluminium SMEs: TS Aluminium, ED Aluminium, SP Aluminium, WL Aluminium, and Kripton Gamajaya Aluminium. The results show a significant relationship between organizational motivation and the intention to acquire technology, with a correlation value of 0.844. Positive relationships were also found between partner involvement, desired technology, and acquisition scenarios and the intention to acquire technology, with correlation values of 0.703, 0.712, and 0.837, respectively. This research aims to assist the Technical Implementation Unit for Metals (UPT Logam) in encouraging aluminium SMEs to pursue technology acquisition.

Keywords

Small and Medium Enterprises (SMEs), Aluminium SMEs, Technology acquisition

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Introduction

The global demand for aluminium is projected to reach 119.5 million tons in 2030, up from 86.2 million tons in 2020. Electricity, machinery, transportation, construction, and cutlery sectors account for the 37% increase in aluminium demand. The five regional categories with the highest aluminium demand levels are China, Asia (excluding China), the United States, Europe, and the Global region. Asia is anticipated to constitute the second category with the highest aluminium demand, with a rate of 26% [1].

Indonesia is renowned for its abundance of natural resources and exceptional biodiversity. Indonesia succeeded in repositioning itself as a significant producer of primary aluminium materials, including bauxite, in 2017 [2]. The aluminium industry's empowerment presents Indonesia with a significant opportunity to stimulate the national economy, given its potential. By offering supervision and support to small and medium-sized aluminium industry participants, efforts have been undertaken to capitalize on this opportunity. The national economy is significantly bolstered by SMEs, which contribute to GDP growth, employment creation, and the development of social welfare [3].

One of the initiatives of the Yogyakarta City Government to improve the competitiveness and industrial design of Small and Medium Enterprises, particularly in the Aluminium Small and Medium Industry (IKM) sector, is the Technical Implementation Unit for Metal (UPT Logam) [4]. With an average production capacity of less than 500,000 kg, the city of Yogyakarta is home to 41 registered Aluminium SMEs. One of the factors contributing to the low average production capacity of Aluminium SMEs is the low level of new technology acquisition. In Yogyakarta, small and medium-sized enterprises (SMEs) that specialize in aluminium production continue to implement conventional and straightforward technologies. In a business environment that is both dynamic and swiftly evolving, these constraints present a challenge for Aluminium SMEs to remain competitive. Aluminium small and medium-sized enterprises (SMEs) must continuously adapt to the changing demands and preferences of consumers by incorporating new technologies to enhance efficiency. In addition, the advancement of aluminium SMEs is significantly influenced by the support provided by UPT Logam, a partner in the aluminium industry.

Mortara explores that the factors that motivate small and medium-sized enterprises (SMEs) to adopt or acquire technology are closely linked to the factors that drive this adoption or acquisition [5]. These factors include organizational motivation, partner involvement, desired technology, and technology acquisition scenarios. As a result, the objective of this study is to examine the factors that influence the acquisition of new technology in the Aluminium SMEs of Yogyakarta City. The Technical Implementation Unit (UPT) of Metals is anticipated to benefit from this research by promoting the acquisition of technology by Aluminium SMEs.

Theoretical Framework

Technology acquisition is a process that involves obtaining new technologies from external sources, thereby bypassing internal research and development to improve efficiency [5]. It can also be understood as the incorporation of innovative ideas and technological knowledge into an internal innovation system, complementing and supporting internal ideas and knowledge. Based on this, companies can create value for customers and enhance their market competitiveness by offering superior or more

innovative products or services [6]. Technology acquisition plays a key role in technology management within industrial organizations [7].

According to [5], several factors drive SMEs to acquire technologies, including organizational motivation, partner involvement, desired technology, and technology acquisition scenarios. Organizational motivation refers to the process by which every member of an organization strives to achieve the organization's goals based on desires or incentives. Strong organizational motivation can drive sustainable growth, particularly related to the level of acceptance and acquisition of technology within the company [8].

Partner involvement are individuals or groups that collaborate in business endeavors, whether as business partners or co-workers, and actively participate in the business [5]. Collaboration with partners is a crucial instrument for accessing information and expertise that impacts business processes, ultimately adding value for consumers. Decision-making regarding partnerships can consider the partner's ability to manage collaborative relationships to achieve optimal business outcomes [9]. Successful partnerships can provide advantages to companies, such as technological advancements and improved cost and time efficiency in production [10].

Technology refers to a collection of tools and methods designed to increase efficiency in various human activities [11]. The need for new technology, or desired technology, is the aspiration to purchase or use a technology—whether it be tools, machinery, processes, or methods—with the goal of facilitating production activities. New technology needs should align with the company's requirements, ensuring continuous updates and modernization, as well as ongoing process improvements [12].

The technology acquisition scenario describes how a new system will be utilized to support human activities by introducing external technology that is expected to improve efficiency, effectiveness, or innovation in business processes or daily life. Technology acquisition scenarios help investigate shifts in technology adoption patterns due to potential changes or intervention strategies [13].

Intention to acquire technology refers to the desire or internal drive to undergo the technology acquisition process as an effort to obtain new technologies [14]. The intention to acquire technology must take into account factors such as organizational motivation, involved partners, desired technology, and technology acquisition scenarios [5].

Method

The population in this study consists of 5 aluminium SMEs in Yogyakarta, namely TS Aluminium, WL Aluminium, ED Aluminium, Kripton Gamajaya Aluminium, and SP Aluminium. The sampling technique used is purposive sampling and quota sampling. Purposive sampling involves selecting samples based on criteria determined by the researcher. Quota sampling involves setting a specific number of samples. The sample

in this study includes aluminium SME actors, consisting of owners, managers, or expert employees, resulting in a total of 10 respondents from the aluminium SMEs.

Validity and reliability tests were used to assess the research instrument. The validity test used the Pearson product-moment correlation coefficient. The decision-making process involved comparing the calculated Pearson product-moment correlation coefficient (r-value) with the table value (r-table). Validity refers to a test or measurement used to determine the accuracy of an instrument (Puspasari & Puspita, 2022). Reliability testing is performed to measure the consistency of the instrument used. In this study, the instrument used is a questionnaire. A questionnaire is considered reliable if respondents' answers remain consistent over time. The Cronbach's alpha value must be greater than 0.6, which is the threshold for reliability testing. If the questionnaire items have a Cronbach's alpha value > 0.6, they are deemed reliable or consistent in measuring the questionnaire [15].

The research method employed is Spearman's rank correlation test, which aims to identify relationships between variables. The data used are typically ordinal or ranked. In performing Spearman's rank correlation, the data does not need to follow a normal distribution, as this is a non-parametric test [16]. The interpretation of Spearman's rank correlation test results follows three stages: measuring the significance of the relationship between variables, measuring the strength of the relationship between variables, and assessing the direction of the relationship between variables. In the first stage, if the significance value is less than 0.05 (< 0.05), the variables are considered to have a correlation, and vice versa. In the second stage, if the correlation coefficient is close to 1, the two variables have a very strong positive relationship, meaning that as the value of one variable increases, the value of the other variable also tends to increase. Conversely, if the correlation coefficient is close to -1, the two variables have a very strong negative relationship, meaning that as the value of one variable increases, the value of the other tends to decrease. If the correlation coefficient is close to 0, there is no significant relationship between the two variables. In the final stage, the correlation coefficient is used to measure the strength and direction of the relationship between two variables. The direction of the relationship can be seen from the sign (positive or negative) of the correlation coefficient. If the correlation coefficient is positive, the two variables have a direct relationship, meaning that as the value of one variable increases, the value of the other also tends to increase. Conversely, if the correlation coefficient is negative, the two variables have an inverse relationship, meaning that as the value of one variable increases, the value of the other tends to decrease. The strength of the relationship can be seen from the absolute value of the correlation coefficient, which ranges from 0 to 1. The closer the value is to 1 (either positive or negative), the stronger the relationship between the two variables [17].

The research approach applied is descriptive quantitative research. Data collection was conducted using research instruments, including observation, interviews, and questionnaires, which were used for statistical analysis to test hypotheses. The model

development framework in this study is illustrated in Figure 1. Based on this framework, there are four research hypotheses as follows:

a. Hypothesis 1
   H0 x1y: There is no significant relationship between organizational motivation and the intention to acquire technology in aluminium SMEs in Yogyakarta.
   Ha x1y: There is a significant relationship between organizational motivation and the intention to acquire technology in aluminium SMEs in Yogyakarta.

b. Hypothesis 2
   H0 x2y: There is no significant relationship between partner involvement and the intention to acquire technology in aluminium SMEs in Yogyakarta.
   Ha x2y: There is a significant relationship between partner involvement and the intention to acquire technology in aluminium SMEs in Yogyakarta.

c. Hypothesis 3

   H0 x3y: There is no significant relationship between desired technology and the intention to acquire technology in aluminium SMEs in Yogyakarta.
   Ha x3y: There is a significant relationship between desired technology and the intention to acquire technology in aluminium SMEs in Yogyakarta.

d. Hypothesis 4

   H0 x4y: There is no significant relationship between technology acquisition scenarios and the intention to acquire technology in aluminium SMEs in Yogyakarta.
   Ha x4y: There is a significant relationship between technology acquisition scenarios and the intention to acquire technology in aluminium SMEs in Yogyakarta.

The questionnaire in this study consists of 25 statements from five tested variables: organizational motivation, involved partners, desired technology, technology acquisition scenarios, and the intention to acquire technology. These statements were adopted from previous research that examined the acquisition of new technology, particularly in IKM Logam. The 25 statements are measured using a five-point Likert scale, ranging from "strongly disagree = 1" to "strongly agree = 5." The specific statements for each variable are presented in Table 1.

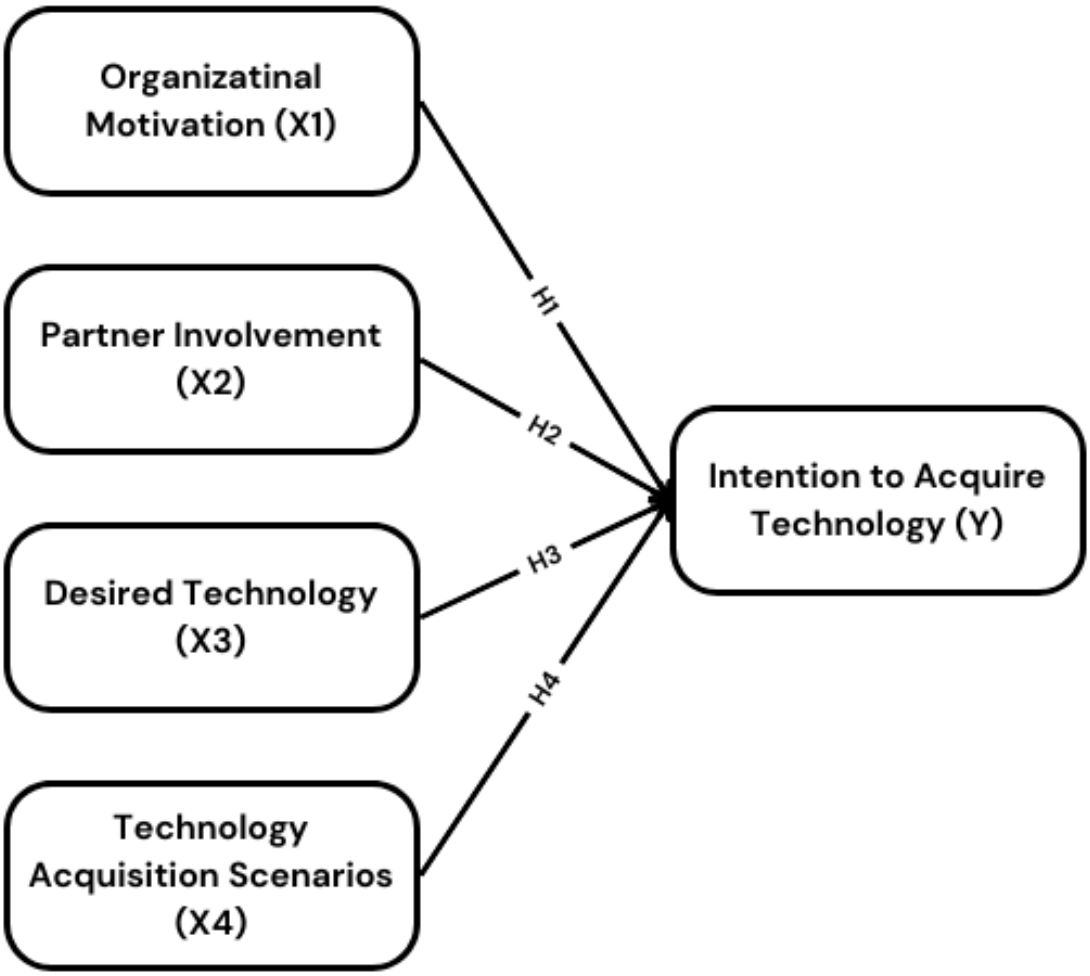

Figure 1. Conceptual research model

Table 1. Research questionnaire items

Variables	Statement Items
Organizational Motivation	I believe the organization in SMEs needs to develop new technological capabilities. I believe the organization in SMEs needs to increase the range of strategic options. I believe the organization in SMEs needs to improve efficiency. I believe the organization in SMEs needs to respond to competitive environmental changes due to rapid technological changes and fast-moving market competition.
Partner Involvement	There is collaboration to create a strategic vision to achieve desired goals. The collaboration works well and functions effectively. There is a shared vision regarding the strategic importance of collaboration. There is mutual dependence between partners. Collaboration adds value for both partners and customers. There is market acceptance of the outcomes from partner collaboration. Partners possess the technical skills to solve various issues.
Desired Technology	There is research on new technologies suitable for implementation in SMEs. Technology development leads to new innovations. New technology development results in new products with novel concepts.

Variables	Statement Items
Technology Acquisition Scenario	There is commercialization, where a product developed through research becomes a marketable good or service for SMEs. SMEs are prepared to adopt technology based on the Technoware component (sophistication of machinery). SMEs are prepared to adopt technology based on the Humanware component (human skills and knowledge in using new technology). SMEs are prepared to adopt technology based on the Infoware component (documentation, blueprints, operational and maintenance manuals). SMEs are prepared to adopt technology based on the Orgaware component (institutions or organizations coordinating production activities to achieve organizational goals). SMEs implement new technologies in the marketplace.
Intention to Acquire Technology	There is a desire to acquire technology There is a willingness to prepare new technologies to run the business. There is interest in technology acquisition based on well-informed decisions. There is confidence that SMEs can develop new potential through technology acquisition. There is belief in the capability to execute and implement technology acquisition.

Results and Discussion

The data processing is carried out statistically using the multiple regression analysis method. The first step taken is the testing of the research instrument in the form of validity and reliability tests, as shown below. Validity and reliability can be seen in Table 2.

Table 2. Validity and reliability test of the questionnaire

Variable	Alpha	Statement Items	r-pearson	r-tabel	Result
Organizational Motivation	0.859	X1.Item1	0.849	0.632	Valid and reliable
		X1.Item2	0.851	0.632	Valid and reliable
		X1.Item3	0.798	0.632	Valid and reliable
		X1.Item4	0.876	0.632	Valid and reliable
Partner Involvement	0.871	X2.Item1	0.824	0.632	Valid and reliable
		X2.Item2	0.824	0.632	Valid and reliable
		X2.Item3	0.687	0.632	Valid and reliable
		X2.Item4	0.864	0.632	Valid and reliable
		X2.Item5	0.706	0.632	Valid and reliable
		X2.Item6	0.808	0.632	Valid and reliable
		X2.Item7	0.717	0.632	Valid and reliable
Desired Technology	0.811	X3.Item1	0.830	0.632	Valid and reliable
		X3.Item2	0.784	0.632	Valid and reliable
		X3.Item3	0.671	0.632	Valid and reliable
		X3.Item4	0.918	0.632	Valid and reliable
Technology Acquisition Scenario	0.890	X4.Item1	0.931	0.632	Valid and reliable
		X4.Item2	0.831	0.632	Valid and reliable
		X4.Item3	0.837	0.632	Valid and reliable
		X4.Item4	0.712	0.632	Valid and reliable
		X4.Item5	0.898	0.632	Valid and reliable

Variable	Alpha	Statement Items	r-pearson	r-tabel	Result
Intention to Acquire Technology	0.870	Y.Item1	0.790	0.632	Valid and reliable
		Y.Item2	0.790	0.632	Valid and reliable
		Y.Item3	0.946	0.632	Valid and reliable
		Y.Item4	0.764	0.632	Valid and reliable
		Y.Item5	0.798	0.632	Valid and reliable

Data validity testing, commonly known as validity testing, is used to determine whether an item statement created in the form of a questionnaire is valid or not to be used as a measuring tool in data collection for research. This validity test is conducted by correlating the value of each question item with the total value or overall value. Reliability testing is used to determine the level of consistency of the measuring tool against respondents in answering each question item created in the form of a questionnaire, ensuring it can be relied upon or deemed suitable for use as a measuring tool in conducting research. Based on Table 2, it can be concluded that the questionnaire is valid and reliable.

The next process is the Spearman rank correlation test on each variable. The following are the results of the test on the first variable shown in Table 3.

Table 3. Spearman rank correlation results for organizational motivation variable

Correlations				
			TotalX1.Item1-4	TotalY.Item1-5
Spearman's rho	TotalX1.Item1-4	Correlation Coefficient	1.000	.844**
		Sig. (2-tailed)	.	.002
		N	10	10
	TotalY.Item1-5	Correlation Coefficient	.844**	1.000
		Sig. (2-tailed)	.002	.
		N	10	10

** Correlation is significant at the 0.01 level (2-tailed)

Based on the results of the data processing conducted between the organizational motivation variable and the intention for technology acquisition, a significance value or sig. (2-tailed) of 0.002 was obtained. Thus, it can be concluded that the significance value is 0.03, which is less than 0.05. This means that in this first hypothesis, there is a significant relationship between the organizational motivation variable and the intention to acquire technology.

The strength of the relationship is obtained with a correlation coefficient value of 0.844. This means that the strength of the relationship between the organizational motivation variable (X1) and the technology acquisition intention variable (Y) is very strong. Meanwhile, the direction of the relationship has a positive value of 0.844. This means that the direction of the relationship between the organizational motivation variable (X1) and the technology acquisition intention variable (Y) is unidirectional. Thus, it can be interpreted that if organizational motivation increases, the intention to carry out technology acquisition will also increase.

Therefore, it can be concluded that H0 is rejected and Ha is accepted. This means there is a very strong and significant relationship with a unidirectional direction between organizational motivation and the intention to acquire technology.

The following are the test results on the second variable shown in Table 4.

Table 4. Spearman rank correlation results of partner involvement variables

Correlations

			TotalX2.Item1-7	TotalY.Item1-5
Spearman's rho	TotalX2.Item1-7	Correlation Coefficient	1.000	.703*
		Sig. (2-tailed)	.	.023
		N	10	10
	TotalY.Item1-5	Correlation Coefficient	.703*	1.000
		Sig. (2-tailed)	.023	.
		N	10	10

* Correlation is significant at the 0.05 level (2-tailed)

Based on the results of the data processing conducted between the partner variables involved and the intention for technology acquisition, a significance value or sig. (2-tailed) of 0.023 was obtained. Thus, it can be concluded that the significance value of 0.023 is less than 0.05. This means that in this second hypothesis, there is a significant relationship between the partner involvement variable and the intention for technology acquisition.

The strength of the relationship is indicated by a correlation coefficient of 0.703. This means that the strength of the relationship between the partner involvement variable (X2) and the technology acquisition intention variable (Y) is strong. Meanwhile, the direction of the relationship is positive with a value of 0.703. This means that the direction of the relationship between the partner involvement variable (X2) and the technology acquisition intention variable (Y) is unidirectional. Thus, it can be interpreted that if the number of partner involvement increases, the intention to pursue technology acquisition will also increase.

Therefore, it can be concluded that H0 is rejected and Ha is accepted. It means there is a strong and significant relationship with a unidirectional direction between the partner involvement and the intention for technology acquisition. The test results for the third variable shown in Table 5.

Based on the results of the data processing conducted between the desired technology variable and the intention to acquire technology, a significance value (2-tailed) of 0.021 was obtained. Thus, it can be concluded that the significance value of 0.021 is less than 0.05. This means that in this third hypothesis, there is a significant relationship between the desired technology variable and the intention to acquire technology.

Table 5. Spearman rank correlation results of desired technology variables

Correlations				
			TotalX3.Item1-4	**TotalY.Item1-5**
Spearman's rho	TotalX3.Item1-4	Correlation Coefficient	1.000	.712*
		Sig. (2-tailed)	.	.021
		N	10	10
	TotalY.Item1-5	Correlation Coefficient	.712*	1.000
		Sig. (2-tailed)	.021	.
		N	10	10

* Correlation is significant at the 0.05 level (2-tailed)

The strength of the relationship is indicated by a correlation coefficient of 0.712. This means that the strength of the relationship between the desired technology variable (X3) and the technology acquisition intention variable (Y) is strong. Meanwhile, the direction of the relationship is positive with a value of 0.712. This means that the direction of the relationship between the desired technology variable (X3) and the technology acquisition intention variable (Y) is unidirectional. Thus, it can be interpreted that if the desired technology increases, the intention to acquire technology will also increase.

Therefore, it can be concluded that H0 is rejected and Ha is accepted. This means there is a strong significant relationship with a unidirectional correlation between the desired technology and the intention to acquire the technology. The test results for the fourth variable shown in Table 6.

Table 6. Spearman rank correlation results for technology acquisition intention variable

Correlations				
			TotalX4.Item1-5	**TotalY.Item1-5**
Spearman's rho	TotalX4.Item1-5	Correlation Coefficient	1.000	.837**
		Sig. (2-tailed)	.	.003
		N	10	10
	TotalY.Item1-5	Correlation Coefficient	.837**	1.000
		Sig. (2-tailed)	.003	.
		N	10	10

** Correlation is significant at the 0.01 level (2-tailed)

Based on the results of data processing conducted between the technology acquisition scenario variable and the intention to acquire technology, a significance value or sig. (2-tailed) of 0.003 was obtained. Therefore, it can be concluded that the significance value of 0.003 is less than 0.05. This means that in this fourth hypothesis, there is a significant relationship between the involved partner variable and the intention for technology acquisition.

The strength of the relationship is indicated by a correlation coefficient value of 0.837. This means that the strength of the relationship between the technology acquisition scenario variable (X4) and the technology acquisition intention variable (Y) is very strong. Meanwhile, the direction of the relationship is positive with a value of 0.837. This

means that the direction of the relationship between the technology acquisition scenario variable (X4) and the technology acquisition intention variable (Y) is unidirectional. Thus, it can be interpreted that if the technology acquisition scenario increases, the intention to carry out technology acquisition will also increase.

Therefore, it can be concluded that H0 is rejected and Ha is accepted. This means that there is no very strong significant relationship and the direction of the relationship is unidirectional between the technology acquisition scenario and the intention to acquire technology.

Conclusion

In the relationship between the organizational motivation variable and the intention to acquire technology, it can be concluded that H0 is rejected and Ha is accepted. This means there is a very strong significant relationship and a unidirectional relationship between organizational motivation and the intention to acquire technology. In the relationship between the involved partner variable and the intention to acquire technology, it can be concluded that H0 is rejected and Ha is accepted. This means there is a strong significant relationship and a unidirectional relationship between the partner involvement and the intention to acquire technology. In the relationship between the desired technology variable and the intention to acquire technology, it can be concluded that H0 is rejected and Ha is accepted. This means there is a strong significant relationship and a unidirectional relationship between the desired technology and the intention to acquire technology. In the relationship between the technology acquisition scenario variable and the intention to acquire technology, it can be concluded that H0 is rejected and Ha is accepted. This means there is a very strong significant relationship and a unidirectional relationship between the technology acquisition scenario and the intention to acquire technology. The variable that has the strongest relationship with the intention to acquire technology is the organizational motivation variable, with a correlation coefficient value of 0.844. Based on the research results above regarding organizational motivation, involved partners, desired technology, and technology acquisition scenarios, the intention for technology acquisition has a unidirectional and positive relationship. This means that aluminium SMEs actors must pay more attention to or enhance these four factors so that the intention for technology acquisition increases, because the four factors, which include organizational motivation, involved partners, desired technology, and technology acquisition scenarios, are interrelated or correlated with the intention for technology acquisition.

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