

Analysis of Cement Distribution Strategy Through Competitive Strategy and Distribution Channels with Innovation Strategy as Intervening at PT. Solusi Bangun Indonesia (PT. SBI) Narogong Plant

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Article Info

Competitive Strategy,
Distribution Channels,
Innovation, Cement
Distribution Strategy

Abstract

This study analyzes the effect of competitive strategy and distribution channels on the cement distribution strategy of PT. Solusi Bangun Indonesia (SBI) Narogong Plant, with innovation serving as an intervening variable. The research adopts a quantitative approach using primary data collected through questionnaires distributed to 93 managers at the Narogong Plant in Bogor Regency. Data analysis was performed using the Smart PLS 3.0 software to test both measurement and structural models. The results reveal that competitive strategy and distribution channels have a positive and significant influence on cement distribution strategy. Furthermore, both variables significantly affect innovation, which in turn has a positive effect on the distribution strategy. Innovation mediates the indirect influence of competitive strategy and distribution channels on cement distribution, indicating its essential role in enhancing distribution efficiency. The findings demonstrate that innovation-based competitiveness strengthens the company's ability to adapt to market fluctuations, optimize delivery routes, and reduce operational costs. The high R-square values (0.886 for distribution strategy and 0.746 for innovation) indicate strong model reliability. Overall, this study provides managerial insights for PT. SBI in implementing innovation-driven strategies to improve operational efficiency and maintain sustainable competitiveness in Indonesia's cement industry, where production capacity continues to exceed domestic consumption.

1. Introduction

Cement is one of the most essential materials in the construction industry, playing a crucial role in infrastructure development. As the demand for cement continues to rise, efficient distribution strategies become increasingly important to ensure timely delivery while minimizing costs. PT. Solusi Bangun Indonesia, a leading national company in the cement industry, operates several plants, including the Narogong Plant, Cilacap Plant, and Tuban Plant, to meet market demand. One of its primary products, Dynamix General Use 40 kg cement, has a high demand and requires an optimized distribution system to maintain efficiency.

Despite the company's extensive distribution network, PT. Solusi Bangun Indonesia faces several challenges in its logistics operations. The increasing complexity of distribution routes, fluctuating market demands, and rising transportation costs

necessitate a more strategic approach to cement distribution. Currently, the company lacks a standardized route optimization system, leading to inefficiencies such as underutilized fleet capacity, high operational costs, and extended delivery times.

This issue became particularly evident during the COVID-19 pandemic (2020-2022), when decreased demand resulted in inefficient fleet utilization. To address these challenges, an advanced route optimization algorithm is required. One of the most effective methods for solving complex routing problems is the Ant Colony Optimization (ACO) Algorithm. Inspired by the foraging behavior of ants, the ACO algorithm has been widely applied in logistics and supply chain management to determine the most efficient delivery routes. Previous studies have demonstrated that ACO outperforms traditional optimization techniques such as the Nearest Neighbor Algorithm (NNI), Dijkstra's

Algorithm, and Genetic Algorithms in solving vehicle routing problems.

This study aims to implement the Ant Colony Optimization (ACO) Algorithm to optimize the cement distribution routes for the Narogong Plant, with the goal of reducing distribution costs, maximizing fleet utilization, and improving delivery efficiency. By leveraging ACO-based route optimization, PT. Solusi Bangun Indonesia can enhance its competitive strategy in the cement industry, ensuring sustainable business operations and improved service quality.

Given the increasing competition in the Indonesian cement industry, where the national production capacity (119 million tons in 2023) far exceeds domestic consumption (69.7 million tons in 2023), a strategic and innovative approach to distribution is essential. Implementing a competitive strategy through ACO-based route optimization will not only improve operational efficiency but also strengthen the company's position in the market. Thus, this research seeks to contribute to the field of logistics optimization and competitive strategy in the cement industry, providing insights into how advanced computational algorithms can enhance distribution efficiency and business sustainability.

2. Method Study

Place and Time of Research

Place study conducted at PT. Solusi Build Indonesia, Bogor and will be carried out in the period July 2024 to by September 2024.

Study This use design quantitative with instrument model taking sample use questionnaire and interview. Variables in study is Variables Independent That is Variable X1= Competitive Strategy, X2= Distribution Strategy, Z= Innovation and Y= Distribution Strategy.

Population, Sample and Sampling Method

Population in study This are the Managers who work in Cement Manufacturing at the Narogong Plant PT.Solution Build Indonesia

with sample study is 93 in Bogor Regency, West Java. Sample in study This use census where are the Managers at the Narogong Plant PT.Solution Build Indonesia to become sample study

Method Data collection

Data Collection Methods in Research

There are several methods that can be used for data collection in research, as explained by Slamet Riyanto and Aglis Andhita (2020:28-29). First, **Observation** is the process of collecting data directly from the object being studied. This data collection method is not limited to questionnaires but can also include checklists, field notes, photographs, videos, and the like. The data obtained from observation is typically primary data and requires further processing.

Second, **Documentation** involves gathering data from past events. Documentation data can include written records, images, works, observation results, interviews, and more. The data obtained from documentation is mostly secondary data, which must be interpreted for further analysis. Third, a **Questionnaire** is a data collection technique where a set of questions or statements is provided to respondents to answer. Questionnaires can be in conventional (printed) form or in online formats (such as Google Forms). The instruments used in this study aim to produce accurate data using the Likert scale.

Method of Analysis and Testing

In this study, the data analysis method used is the Smart Partial Least Square (PLS) version 3.0. The following procedure is followed in the Smart PLS analysis:

Measurement Model Testing (Outer Model)

In this phase, the measurement model (outer model) is evaluated using three main tests: testing the reliability of indicators, testing the reliability of constructs, and testing the validity of constructs. **Reliability Indicator Testing** explains the loading factor value, which shows how well an indicator represents latent variables. A loading factor value greater than 0.7 indicates that the indicator is valid. **Reliability**

Construct Testing is used to ensure internal consistency, with an acceptable limit of greater than 0.7, indicating that the construct is reliable.

Construct Validity Testing examines convergent validity using AVE (greater than 0.5) and discriminant validity using the Fornell-Larcker criteria.

Structural Model Testing (Inner Model)

In the structural model testing (inner model), five tests are conducted: collinearity testing, R-Square (R^2) testing, path coefficient testing, effect size testing (f^2), and predictive relevance testing (Q^2). **Collinearity Testing** ensures that there is no multicollinearity between the variables by checking the VIF value (less than 5). **R-Square (R^2) Testing** evaluates

the strength of the model's predictive ability.

Path Coefficient Testing explains the strength and direction (positive or negative) of the relationship between latent variables. **Effect Size (f^2) Testing** assesses the relative impact of an independent variable on the dependent variable. **Predictive Relevance (Q^2) Testing** evaluates the model's capability to predict data.

3. Results and Discussion

Convergent Validity Actual Test

In the first convergent validity test for factor loading, all indicators were declared valid because their values were above the rule of thumb, which is > 0.70 . Table 1. below shows the actual convergent validity results. test .

Table 1
Convergent Validity Test

Outer Loading	(X1) Competitive Strategy	(X2) Distribution Channels	(Y) Cement Distribution Strategy	(Z) Innovation	Intervening Effect 1	Intervening Effect 2
INOV1				0.720		
INOV2				0.760		
INOV3				0.823		
INOV4				0.773		
INOV5				0.753		
SB1	0.831					
SB2	0.791					
SB3	0.733					
SB4	0.853					
SB5	0.713					
SD1		0.740				
SD2		0.817				
SD3		0.797				
SD4		0.729				
SD5		0.721				
SPS1			0.749			
SPS2			0.781			
SPS3			0.769			
SPS4			0.773			
SPS5			0.719			

Source: Research data processed 2024

Validity convergent use AVE test too show that all variables are valid. For variable (X1) Competitive strategy (SB) is declared valid because its value on rule practical namely 0.70, the most small 0.713 and the most large 0.853. For the variable (X2) Channel distribution (SD) is declared valid because the value is above rule practical which is 0.70 with mark lowest is

0.721 and the value highest is 0.817. For the variable (Z) Innovative (INOV) also declared valid because the value is above rule practical namely 0.70 and the value lowest is 0.720 and the value highest is 0.823. For the variable (Y) Distribution Strategy Cement (SPS) also said to be valid with mark lowest 0.719 and value highest 0.781.

Table 2
Reliability and Validity Test

Construction Reliability and Validity	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
(X1) Competitive Strategy	0.817	0.836	0.873	0.582
(X2) Distribution Channels	0.796	0.801	0.860	0.554
(Y) Cement Distribution Strategy	0.774	0.780	0.847	0.526
(Z) Innovation	0.758	0.780	0.840	0.517

Source: Research data processed 2024

From the table above, the Cronbach's value Alpha and composite reliability of all variable values is greater than 0.7, this shows that all variables in the table have good reliability or are reliable. Also from Average Variance Extracted (AVE) based on the criteria,

the variable value is more than 0.5, then all variables have good reliability.

Discriminant Validity Actual Test

Test Discriminant The validity shown in Table 3 shows that the results of the top latent variable values in each group are greater, which indicates that the Discriminant Validity is good.

Table 3
Discriminant Validity

Discriminant Validity				
Fornell Larcker Criteria				
	(X1) Competitive Strategy	(X2) Distribution Channels	(Y) Cement Distribution Strategy	(Z) Innovation
(X1) Competitive Strategy	0.763			
(X2) Distribution Channels	0.852	0.744		
(Y) Cement Distribution Strategy	0.916	0.853	0.725	
(Z) Innovation	0.856	0.802	0.894	0.719

Source : Research data processed 2024

Validity discriminant show all burden cross between indicators and valid variables because the value is above 0.70 which is rule practical validity discriminant use *cross loading* . Size validity discriminant construct that is theoretical No may each other related , whereas size validity convergent construct that is theoretical must related One The same other .

Good validity convergent and also discriminatory is form validity construct . By therefore , with proven that all indicators are valid, it is said that construct is valid, then it can done test reliability and for inner model test consisting of R - square and significance tests . Validity discriminant with burden cross shown on table 4.

Table 4
Cross Loading

Cross Loading	(X1) Competitive Strategy	(X2) Distribution Channels	(Y) Cement Distribution Strategy	(Z) Innovation
INOV1	0.398	0.409	0.491	0.509
INOV2	0.656	0.518	0.670	0.760
INOV3	0.714	0.657	0.700	0.823
INOV4	0.640	0.606	0.731	0.773
INOV5	0.623	0.668	0.597	0.689
SB1	0.831	0.694	0.757	0.639
SB2	0.791	0.525	0.692	0.689
SB3	0.666	0.652	0.565	0.569
SB4	0.853	0.732	0.847	0.783
SB5	0.652	0.661	0.593	0.557
SD1	0.603	0.740	0.621	0.610
SD2	0.663	0.817	0.717	0.663
SD3	0.665	0.797	0.590	0.592
SD4	0.527	0.633	0.621	0.510
SD5	0.704	0.721	0.614	0.597
SPS1	0.573	0.640	0.680	0.560
SPS2	0.702	0.575	0.781	0.729
SPS3	0.573	0.434	0.665	0.602
SPS4	0.715	0.745	0.773	0.626
SPS5	0.736	0.676	0.719	0.710

Source: Research data processed 2024

Discriminant validity with cross loadings shows that all variables show a good level of validity for competitive strategy,

distribution channels, innovation and cement distribution strategy.

discriminant validity test uses Heterotrait-Monotrait Ratio (HTMT) shown in table 5 below:

Table 5
Heterotrait Monotrait

Heterotrait-Monotrait Ratio (HTMT)				
	(X1) Competitive Strategy	(X2) Distribution Channels	(Y) Cement Distribution Strategy	(Z) Innovation
(X1) Competitive Strategy				
(X2) Distribution Channels	1,066			
(Y) Cement Distribution Strategy	1,135	1,080		
(Z) Innovation	1,076	1,031	1,163	

Source: Data processed by Research 2024

Based on measurements Heterotrait-monotrait ratio or HTMT shows that all variables in this study are good because they are still around the number 1 which is the measurement limit (Latan & Noonan, 2017) .

This shows that the existing variables are valid and not each other related. Like as it is measurement on Statistical collinearity on table 6 below:

Table 6
Collieary Statistics

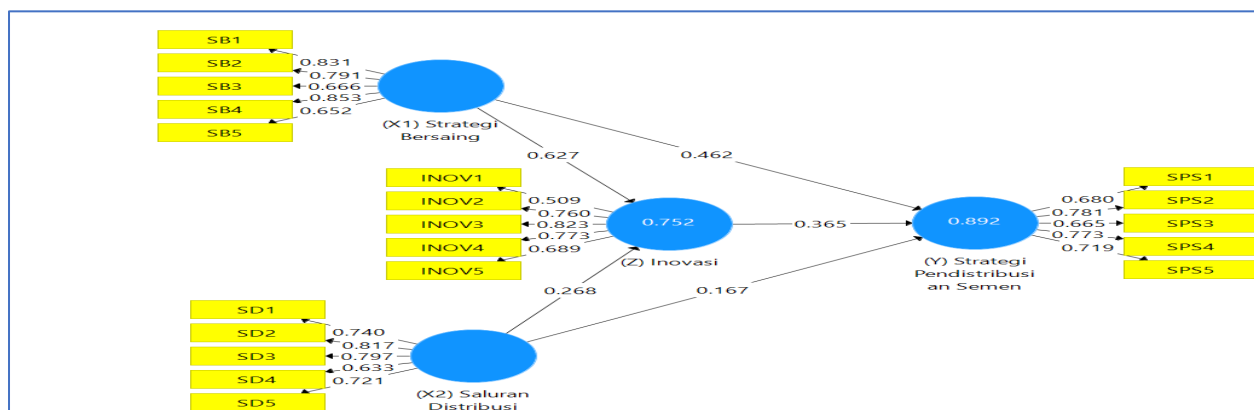
Collinearity Statistics (VIF)	
Outer VIF Values	
	VIF
INOV1	1,255
INOV2	1,902
INOV3	1,869
INOV4	1,914
INOV5	1,389
SB1	2,150
SB2	1,841
SB3	1,425
SB4	2,348
SB5	1,363
SD1	1,557
SD2	1,942
SD3	2,015
SD4	1,474
SD5	1,852
SPS1	1,613
SPS2	2,418
SPS3	2,103
SPS4	1,885
SPS5	1,470

Source : Research data processed 2024

On the table above show that the existing variables are valid and not each other related Good Competitive strategy, distribution channels, innovation and cement distribution

strategy. VIF value below 5 indicates No each other related between variable independent or independent variables .

Outer Model



Source: Image processed (2024)

Figure 4. 2.1

Outer Model

R- square

square evaluation must be carried out in measuring structural model research, still based on SmartPLS 3.0 software - PLS

Algorithm, output Rsquare can be seen for the Endogenous variable Sustainable Competitive Advantage and the Endogenous variable Technological Innovation, as in Table 7 below.

Table 7
R-Square

R Square	R Square	R Square Adjusted
(Y) Cement Distribution Strategy	0.892	0.886
(Z) Innovation	0.752	0.746

Source : Research data processed 2024

Table 7. above shows that the R- square value The adjusted variable (Y) for Cement Distribution Strategy is 0.886, meaning that the variable (Y) for Cement Distribution Strategy can be explained 88.60% by the Innovation variable, while the R- Square value adjusted

Innovation is 0.746, meaning that the innovation variable can be explained by 74.60% of the competitive strategy variables , distribution channels. The rest can be explained by variables outside the model.

Inner VIF Results

Correlation between independent variables to other independent variables should

not exist in a good regression model. The following is table 8 of the results of the inner VIF.

Table 8
Inner VIF

Inner VIF Values	(X1) Competitive Strategy	(X2) Distribution Channels	(Y) Cement Distribution Strategy	(Z) Innovation
(X1) Competitive Strategy			5,232	3,646
(X2) Distribution Channels			3,935	3,646
(Y) Cement Distribution Strategy				
(Z) Innovation			4,031	

Source: Research data processed 2024

Hypothesis

The hypothesis that has been given must be measured for its significance. This can be obtained by looking at the T-statistic > 1.65 (

one tailed) and P-value < 0.05 because this study uses a 95% confidence level. Here is table results testing hypothesis

Table 9
Total direct Effects

Path Coefficients	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Mean , STDEV, T- Values , P- Values					
(X1) Competitive Strategy -> (Y) Cement Distribution Strategy	0.476	0.470	0.092	5,156	0,000
(X1) Competitive Strategy -> (Z) Innovation	0.627	0.637	0.113	5,559	0,000
(X2) Distribution Channels -> (Y) Cement Distribution Strategy	0.169	0.179	0.073	2,326	0.010
(X2) Distribution Channels -> (Z) Innovation	0.268	0.262	0.124	2,164	0.015
(Z) Innovation -> (Y) Cement Distribution Strategy	0.352	0.349	0.100	3,535	0,000

Source : Research Data processed 2024

Based on table 9 above show that mark tStatistics (X1) Competitive Strategy -> (Y) Cement Distribution Strategy show value 5.156 with significance 0.000 means influential in a way positive significant , then (X2) Distribution Channels -> (Y) Cement Distribution Strategy worth statistic 2.326 with mark pValues 0.015 means influential in a way positive significant ,

then (X1) Competitive Strategy -> (Z) Innovation , has a value tStatistics 5,559 with pValues 0.000, meaning influential in a way positive significant , then (X2) Distribution Channels -> (Z) Innovation worth statistic 2.164 with pValues 0.015 is the same influential positive and significant , then variable (Z) Innovation -> (Y) Cement Distribution Strategy

worth statistics 3.535 , and pValues 0.000, this means influential in a way positive and significant ,

Table 10
Total indirect Effects

Specific Indirect Effects					
Mean , STDEV, T- Values , P- Values					
	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
(X1) Competitive Strategy -> (Z) Innovation -> (Y) Cement Distribution Strategy	0.221	0.222	0.074	2,976	0.002
(X2) Distribution Channels -> (Z) Innovation -> (Y) Cement Distribution Strategy	0.094	0.092	0.053	1,778	0.038

Source: Research Data processed 2024

X1) Competitive Strategy -> (Z) Innovation -> (Y) Cement Distribution Strategy has a t-statistic of 2.976 with a significance of 0.002, meaning that there is an indirect influence of (X1) Competitive Strategy -> (Z) Innovation -> (Y) Cement Distribution Strategy positively and significantly. (X2) Distribution

Channel -> (Z) Innovation -> (Y) Cement Distribution Strategy has a t-statistic of 1.778 with a significance of 0.038, meaning that there is an indirect influence of (X2) Distribution Channel on (Y) Cement Distribution Strategy through (Z) Innovation positively and significantly.

Table 11
Direct Effect Hypothesis Results

Hypothesis	Original Sample	T-statistic	Sig P-value	Hypothesis Analysis
H1 : There is influence Competitive strategy on distribution strategy cement	0.476	5,156	0.000	Accepted
H2 : There is influence channel distribution on distribution strategy cement	0.169	2,326	0.010	Accepted
H3 : There is influence Competitive strategy to Innovation	0.627	5,559	0.000	Accepted
H4 : There is influence channel distribution to Innovation	0.268	2,164	0.015	Accepted
H5 : There is influence innovation on distribution strategy cement	0.352	3,535	0.000	Accepted

Source : Processed data (2023)

From table 11 it shows that mark count Influence of competitive strategy to the cement distribution strategy by 5,156 more big from 1.65 with significant 0.000 means more small from 0.05, so H1 is accepted . The calculated t value channel distribution to the cement distribution strategy by 2,326 more big from 1.65 with significant 0.010 means more small

from 0.05, so H2 is accepted . T- value Competitive strategy to Innovation by 5,559 more big from 1.65 with significant 0.000 means more small from 0.05, so H3 is accepted . The calculated t value Influence channel distribution to Innovation by 2,164 more big from 1.65 with significant 0.015 means more small from 0.05, so H4 is accepted . The

calculated t value Influence innovation to the cement distribution strategy of 3,535 more big

from 1.65 with significant 0.000 means more small from 0.05, so H5 is accepted .

Table 12
Results of Indirect Effect Hypothesis

Hypothesis	Original Sample	T-statistic	Sig P-value	Hypothesis Analysis
: There is influence No direct Competitive strategy on distribution strategy cement through innovation	0.221	2,976	0.002	Accepted
: There is influenceno direct channel distribution on the cement distribution strategy through innovation	0.094	1,778	0.038	Accepted

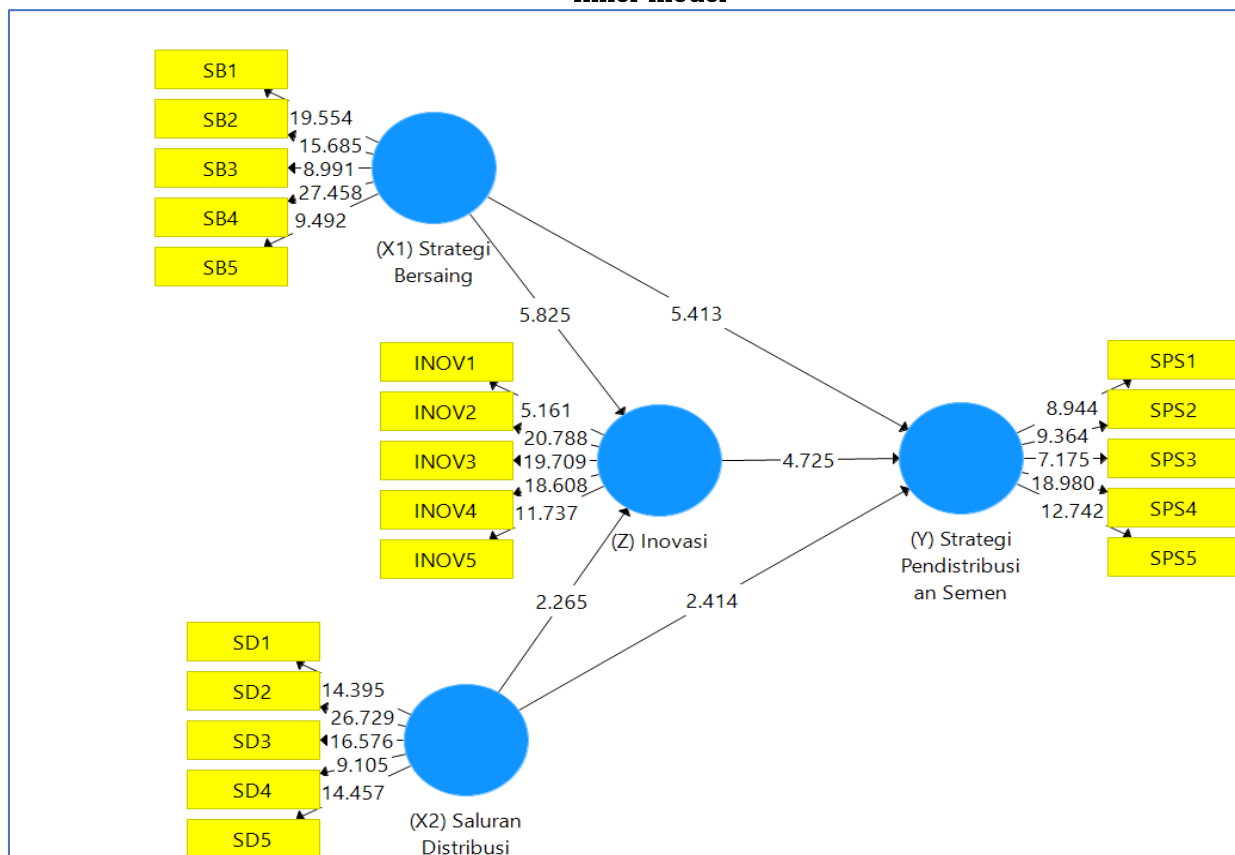
Source : Processed data (2023)

From table 12 Hypothesis influence No direct show that there is mark count influence No direct Competitive Strategy Behavior on the cement distribution strategy through innovation by 2,976 more big from 1.65 with significant 0.002 more small from 0.05 so that

H6 is accepted . The calculated t value influenceno direct channel distribution on the cement distribution strategy through innovation by 1,778 more big from 1.65 with significant 0.038 more small of 0.05 so H7 is accepted .

As seen on picture below is the inner model

Inner model



Hypothesis Testing

H1: There is an influence of competitive strategy on cement distribution strategy.

The competitive strategy has a significant effect on the cement distribution strategy, as indicated by a p-value of 0.000, implying a direct impact of competitive strategy on the cement

distribution strategy. This means that the higher the competitive strategy value, the higher the value of the cement distribution strategy. This study successfully confirms the findings of previous research by Adam (2023) and Yossi (2023), which found a positive influence of competitive strategy on cement distribution strategy. Hypothesis accepted.

H2: There is an influence of channel distribution on cement distribution strategy.

Channel distribution significantly influences the cement distribution strategy, with a p-value of 0.010. This implies a direct effect of channel distribution on the cement distribution strategy, meaning that the more robust the channel distribution, the higher the value of the cement distribution strategy. This study confirms the findings of previous studies by Septia (2023) and Simanjuntak (2021), which also observed a positive influence of channel distribution on cement distribution strategy. Hypothesis accepted.

H3: There is an influence of competitive strategy on innovation.

Competitive strategy positively and significantly influences innovation, with a p-value of 0.000, indicating a direct effect. This means that as the competitive strategy value increases, so does the level of innovation. This study successfully supports previous research by Darma et al. (2022) and Fatimah & Tyas (2020), which found a positive influence of competitive strategy on innovation. Hypothesis accepted.

H4: There is an influence of channel distribution on innovation.

Channel distribution positively and significantly influences innovation, with a p-value of 0.015, implying a direct effect. The higher the value of channel distribution, the higher the level of innovation. This study confirms the findings of previous studies by Aswan et al. (2023) and Firnando et al. (2021), which also found a

positive impact of channel distribution on innovation. Hypothesis accepted.

H5: There is an influence of innovation on cement distribution strategy.

Innovation positively and significantly influences the cement distribution strategy, as shown by a p-value of 0.000, indicating a direct effect. This means that the higher the level of innovation, the higher the value of the cement distribution strategy. This study successfully supports previous research by Bari et al. (2022) and Rahman et al. (2022), which found a positive impact of innovation on cement distribution strategy. Hypothesis accepted.

H6: There is no direct influence of competitive strategy on the cement distribution strategy through innovation.

Competitive strategy has no direct influence on the cement distribution strategy through innovation, with a p-value of 0.000, indicating that innovation can mediate the relationship between competitive strategy and cement distribution strategy. This study supports previous research by Nasir (2022) and Galih & Sukmadewi (2024), which confirmed that innovation can intervene in the effect of competitive strategy on cement distribution strategy. Hypothesis accepted.

H7: There is no direct influence of channel distribution on the cement distribution strategy through innovation.

Channel distribution has no direct influence on the cement distribution strategy through innovation, with a p-value of 0.038. This indicates that innovation can mediate the effect of channel distribution on the cement distribution strategy. This study confirms the findings of Yuana (2022), which found that innovation plays an intervening role in the influence of channel distribution on the cement distribution strategy. Hypothesis accepted.

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