

The Effects of Managing Innovation and Technological Adoption on Business Performance through Differentiation Strategy in Indonesia's Construction Industry

Siddik Siregar^{a*}, Harjanto Prabowo^b, Mohammad Hamsal^c, Eddy Irsan Siregar^d, ^{a,b,c}Bina Nusantara University, Jakarta, ^dMuhammadiyah Jakarta University, Jakarta, Email: ^{a*}siregarsiddik@yahoo.com

The construction industry has an important role in improving a country's economy. In Indonesia, the construction industry has contributed more than ten percent of GDP during the last five years, which is greater than Indonesia's economic growth that only constitutes around 5% annually. However, large-scale construction companies are still producing low performance. The purpose of this study is to find out the effect of managing innovation and technological adoption on business performance through the strategy of differentiation in Indonesia's construction industry. The research methods include a descriptive method through scoring analysis and verification method by quantitative analysis. Focus Group Discussion was also conducted for validation of the questionnaire responses. The observation process used time horizon that has cross section/one shot nature in 2019. The research respondents were large-scale construction companies domicile in six provinces in Java Island, including DKI Jakarta, East Java, Central Java, Banten, West Java and DI Yogyakarta, which were determined by proportional sampling of 90 companies. The order of sampling was taken from the largest company turnover in each province. Data was analysed by Partial Least Square (PLS) software. The result shows that managing innovation and technological adoption contribute to improving business performance through differentiation strategy.

Keywords: *Construction Industry, Business Performance, Technological Adoption, Managing Innovation, Differentiation Strategy.*

Introduction

Research Background

In order to be successful in the highly competitive and rapidly changing global economy, competition is no longer limited to the efficiency of raw material management, service standards and technological development. The ability to focus on the power of innovation and seize every opportunity by offering products and services, which are produced creatively, and advance ideas will be the most successful (Brockmann,, Brezinski, and Erbe, , 2016). Construction companies are also demanded to be able to increase their abilities to reach continuous competitive advantage (Brockmann, et al, 2016; Budayan, et al, 2015). Construction industry is one of the most dynamic industries compared to other industries due to dynamic market conditions , a relatively short construction period and fluctuation of material prices that is very difficult to predict, and need reliable managerial skills and good knowledge to overcome such conditions. However, the construction industry is one of the main pillars to support the economic growth of a country (Tan, 2008, et. al.).

Like other manufacturing industries, the construction industry is also affected by the evolution of technology. Currently, the Industrial Revolution is quite advanced and already categorised as the 4th generation of the Industrial Revolution. The 4th generation of industry is an acronym for a revival of the industrial era. In this 4th era of industrial revolution, fusion occurs regarding various technological advances. Innovation moves fast and everything is connected.

Port & Happelman (2014) wrote in their journal that in the 4th generation of industrial revolution, the roles of information technology and cloud data storage are growing rapidly creating sophisticated and efficient product fabrications, including smart manufacturing, which is controlled by automation, thereby reducing the need for manpower. This will affect the development and change of managing innovation as well as resources in construction industries.

According to previous research, there have been no studies regarding managing innovation in large-scale construction companies. Technological adoption is rapidly changing, characterised by the use of robots, drones, GPS, BIM (Building Information Modelling) and large amounts of data. Thus, it is necessary to research whether construction services have utilised such technology.

Government expenditure for the construction sector also has a significant effect, which is marked by the correlation between government expenditure and the increase of infrastructure projects. Growth between 2013 and 2014 was 12.15%, which is the largest, growth between 2014 and 2015 was 11.38% so that the average growth during the last three years was 12.28%.

These are significant numbers. If compared to Indonesia's average economic growth of 4%-5% annually, then the construction industry is a very influential industry, which makes a great contribution to Indonesia's economy. Even though the market and growth of the construction industry are big enough, the ROA (Return of Asset) of most construction companies from 2010 until 2015 were below 6% (annual report of Construction Services Development Board of Indonesia). On average, construction companies have a profitability of 2.53%. If compared to the ROA obtained by PT Telekomunikasi Indonesia Tbk, one of the healthiest companies in Indonesia, which has a ROA of 25.84% (data from 2010 until 2015), ROA obtained by construction industry is very low. The ideal ROA of a company is between 6%-10% (Pat Dorsey, 2004).

Research Objectives

The objectives of this study include:

- (1) To find out the conditions of Managing Innovation, Technological Adoption, Differentiation Strategy and Business Performance.
- (2) To find out the role of Managing Innovation in influencing Business Performance through Differentiation Strategy.
- (3) To find out the role of Technological Adoption on Business Performance through Differentiation Strategy.

Literature Review

Strategic Management

In general, the definition of company strategy is a way to achieve long-term goals. The method used can be in the form of geographical expansion, diversification, acquisition, product development, market penetration, employee rationalisation, divestment, liquidation and even mergers by David P (2014). Strategy excellence is an attempt to find a position in the industry by Porter (1990, 1996), a process for good defence and resistance by Walker (2001). Long-term competitive strategy allows the company able to find a market position, protect that position and resist competitors.

Business Performance

According to Best (2009), the concept of Business Performance is the output or results of the application of all activities related to business activities.



Best (2009) also states that, to complement business financial performance, companies need a series of parallel measurements to follow marketing performance. In the marketing performance report, there is information about market growth, market share, customer retention, new and dissatisfied customers, relative product quality, relative service quality and relative new product sales. Best (2009) calls these dimensions of non-financial business performance, which is proxied through sales growth.

Differentiation Strategy

Since the financial crisis in 2008, particularly for developing countries, many global companies have shifted their competitive strategy from low cost strategy based on price competition to differentiation strategy. In addition, the sole focus on cost leadership strategy is no longer suitable to accommodate diverse customer needs (Gehani, 2013).

Construction companies perform differentiation strategy by executing project activities using the EPC (Engineering, Procurement and Construction) strategy, then developing overseas market share, and finally creating the project by investing in their own projects.

Managing Innovation

In general, managing innovation is a process which allows companies to create sustainable competitive advantage for the company.

In Table 1 below, the views expressed by well-known writers are explained to convey their views on managing innovation.

Table 1: Comparison of Managing innovation Variable Dimensions

No.	Schilling (2009) concludes that there are only 2 dimensions of managing innovation :	Grant (2011:298) concludes that there are only 2 dimensions of managing innovation:	Tidd and Bessant (2013) conclude that there are only 4 dimensions of managing innovation :	This Research Construct concludes that there are 4 dimensions of managing innovation :
1.	Product Innovation	Product Innovation	Product Innovation	Product Innovation
2.	Process Innovation	Process Innovation	Process Innovation	Process Innovation
3.	-	-	Position Innovation	Position Innovation
4.	-	-	Paradigm Innovation	Marketing Innovation
5.	-	-	-	-
6.	-	-	-	-
7.	-	-	-	-

Source: Processed from various references

Technological Adoption

Technology can be defined as an entity, object or non-object (e.g. program) that is created in an integrated manner through actions and thoughts to achieve a value.

Adoption of technological advances is defined as the acceptance or use of an idea, tool (machine) or new technology by the adopter delivered by the technology carrier. It has been generally recognised that technology can help Organisations improve performance and subsequently achieve competitive advantage (Adam, 2009; Ellitan, 2003). The positive role of technology in moderating business strategies and business performance results in an increase in business competitiveness. The diffusion theory of technological innovation or According to the Diffusion of Innovation Technology (DOI) put forward by (Rogers, 2003), technological adoption is a theoretical framework used to understand the evaluation, adoption and implementation of technology and identify factors that both hinder and encourage these processes .

Methodology

The research method is carried out by using descriptive and explanatory survey with the unit of analysis as the Organisation, that is Indonesian construction companies. The observation unit consists of construction companies represented by Directors and General or Division Managers who are considered to have a strategic role in the continuation of sample companies. Descriptive survey is conducted with the purpose of collecting explanations from research

objects, while explanatory survey aims to determine the characteristics of variables by studying samples.

The observation process in this study uses a time horizon that is cross section/one shot, meaning that the information or data obtained is through the results of research conducted at one particular time, in this case during 2019.

The summary of the method used is explained in Table 2 as follows.

Table 2: Methodology Used

Research Purposes	Research Design				
	Research Type	Method Used	Analysis Unit	Observation Unit	Time Horizon
RP-1	Descriptive	Descriptive survey	Construction Company	Manager	Cross-Sectional
RP-2	Verification	Verification Survey	Construction Company	Manager	Cross-Sectional
RP-3	Verification	Verification Survey	Construction Company	Manager	Cross-Sectional

Source: processed by Authors (2018)

Remark: RP 1 to RP 3 are the research purposes

RP-1 To find out the conditions of Managing Innovation, Differentiation Strategy, Technological Adoption, and Business Performance

RP-2 To find out the role of Managing Innovation in influencing Business Performance through Differentiation Strategy

RP-3 To find out the role of Technological Adoption on Business Performance through Differentiation Strategy

Operational Variables

In this study, there are 2 exogenous variables, including Managing Innovation, Technological Adoption and 2 endogenous variables: Differentiation Strategy and Business Performance.

In Table 3 the concepts, dimensions, indicators, units, and sizes of each variable are explained.

Table 3: Operational Research Variables

Research Variable: Managing Innovation (X₁)			
Concept: The process of managing innovation in a company in order to be useful for the creation of business performance			
Dimension	Indicator	Unit of Measurement	Measuring Scale
Product Innovation	Development of a new product or service	Level of ability to develop new products or services	Ordinal
	Product or service improvements	Level of ability to improve products or services	Ordinal
Dimension	Indicator	Unit of Measurement	Measuring Scale
Process Innovation	Development of new production/service process	Level of ability to develop new production/service process	Ordinal
	Production/service process improvements	Level of ability to improve the production/service process	Ordinal
Dimension	Indicator	Unit of Measurement	Measuring Scale
Position Innovation	Launching new products to overcome stagnant products	Level of ability to launch new products to overcome stagnant products	Ordinal
	Repositioning existing products / services	Level of ability to reposition existing products or services.	Ordinal
Marketing Innovation	Improvements in ways to find new projects and contracts	Level of ability to make improvements in ways to find new projects and contracts	Ordinal
	Open an overseas marketing representative office	Level of ability to open offices and/or representatives abroad	Ordinal
Variable: Technological Adoption towards Differentiation Strategy			
Concept: The act of adopting technology that will improve the performance of differentiation strategy			
Dimension	Indicator	Unit of Measurement	Measuring Scale
Robotic Adoption	Robotics has been adopted for work execution	Usage Level	Ordinal
Drone Adoption	Drone has been adopted for work execution	Usage Level	Ordinal
GPS Adoption	GPS has been adopted for work execution	Usage Level	Ordinal
BIM Adoption	BIM Software has been used to simulate construction models before the tender	Usage Level	Ordinal

Big Data Adoption	Big Data Processing has been used for simulating data capabilities of competitor contractors	Usage Level	Ordinal
Research Variable: Differentiation Strategy			
Concept: In the long-term, the company aims to achieve its business goals. In order to have a competitive advantage, it needs to conduct business differently from its competitors			
Dimension	Indicator	Unit of Measurement	Measuring Scale
EPC Project	Capital readiness towards budget	Level of ability to find funds	Ordinal
	Value Engineering Application for efficiency	Level of ability of engineering team to create a better but more economical design	Ordinal
	Execution plan according to plan	The ability of the project manager in project management	Ordinal
	Quality standard and warranty time	The final product is in accordance with quality standards	Ordinal
Dimension	Indicator	Unit of Measurement	Measuring Scale
Overseas Expansion	Establishment of overseas branches	Level of ability to cooperate with local companies and set up branches	Ordinal
	Creation of innovative services	Level of ability to create innovative services	Ordinal
	Creation of relationship with customers	Level of ability to create relationship with customers	Ordinal
	Having a better product capability compared to existing contractors	Level of ability to create better product capability compared to existing contractors	Ordinal
Dimension	Indicator	Unit of Measurement	Measuring Scale
Own Project Investment	Predictive ability for future customer needs	Level of speed to anticipate consumer behaviour Level of speed to anticipate market demands	Ordinal
	Large capital availability	Level of ability to work with capital owners	Ordinal

	Ability to work with technology owners	Level of ability to work with technology owners	Ordinal
Variable: Business Performance (Z)			
Concept: The results of a company's management activity			
Dimension	Indicator	Unit of Measurement	Measuring Scale
Stock Performance	Stock value growth	Annual growth rate of stock value	Interval
	Number of stock transactions	Annual growth rate of stock transactions	Interval
Sales Growth	Sales growth	Annual sales growth rate	Interval
	Number of sales transactions	Annual growth rate of sales transactions	Interval
Profit Performance	Company Return On Assets (ROA) Calculation	Annual average growth rate of ROA calculation	Interval
	Company Return On Equity (ROE) Calculation	Annual average growth rate of ROE calculation	Interval
	Company Return On Investment (ROI) Calculation	Annual average growth rate of ROI calculation	Interval

Source: Processed by Authors (2018)

Sources and Methods of Data/Information Determination

Types and Sources of Data

The type of data collected is quantitative. In this study, types and sources of data are collected from 2 (two) sources, primary and secondary data. Primary data is collected from Indonesian construction companies located on the Java Island that have implemented Managing innovation in Indonesian construction companies, while secondary data is collected from the Indonesian Central Bureau of Statistics, websites and other relevant sources.

Sources and Methods of Sample Determination

The study population consists of large scale construction companies in Java of 849 units (Construction Statistics, Central Bureau of Statistics, 2016).

Table 4: Population of Large Scale Construction Companies in Java

No.	Province	Amount (unit)
1	DKI Jakarta	688
2	West Java	61
3	Central Java	31
4	DI Yogyakarta	3
5	East Java	58
6	Banten	8
	Total	849

Source: Construction Statistics Book, Central Bureau of Statistics 2016
Sampling is carried out by using the Slovin formula as follows:

$$n = \frac{N}{(Nd^2 + 1)}$$

Keterangan:

n = sample size

N = population size

d = error

d = take 10%

$$n = 849 : [(849 \times 0,1^2) + 1]$$

$$= 849 : [(8,49) + 1]$$

$$= 849 : 9,49$$

$$= 89,5 \approx 90$$

Sample Determination

Sample determination is based on proportional respondents in the table as follows:

Table 5: Determination of Proportional Respondents

No.	Location	Number of Companies	Sample	Sub Total
1	DKI Jakarta	688	81.03 x 90	73
2	West Java	61	7.18 x 90	6
3	Central Java	31	3.65 x 90	3
4	DI Yogyakarta	3	0.35 x 90	1
5	East Java	58	6.83 x 90	6
6	Banten	8	0.94 x 90	1
	Total	849 units		90

Source: Data processed (2018)

Data Collection Technique

Data collection technique consists of the complete data collection for both primary and secondary data carried out on the management of large-scale construction companies in

Indonesia through survey activities. The data needed from the two types of data is collected by the following techniques:

Table 6: Data Collection Technique

No.	Data Collection Techniques	Purpose	Media Used
1	Interview	Obtain an overview of Managing Innovation, Technological Adoption and strategy in construction companies	Off-line with Mr. Destiawan Soewardjono as one of the core managements of Indonesian Contractor Association of DKI Jakarta, he is an expert in the construction industry
2	Observation	Obtain additional information about the construction service industry and the usage level of Managing Innovation and Technological Adoption in the company	On-line, website and email with large-scale construction companies
3	Questionnaire	Obtain information about the conditions of managing innovation, strategies, technological adoption, and business performance	Off-line with managers at construction companies, each company is represented by one or two managers or directors
4	Focus Group Discussion	To check the validity of the questionnaire results and to discuss matters directly related to the handling of the main problems faced by construction companies by selecting 5 to 6 people from all samples to discuss in the form of Focus Group Discussion	Discussions mediated by construction management experts

Source: Processed by Authors (2018)

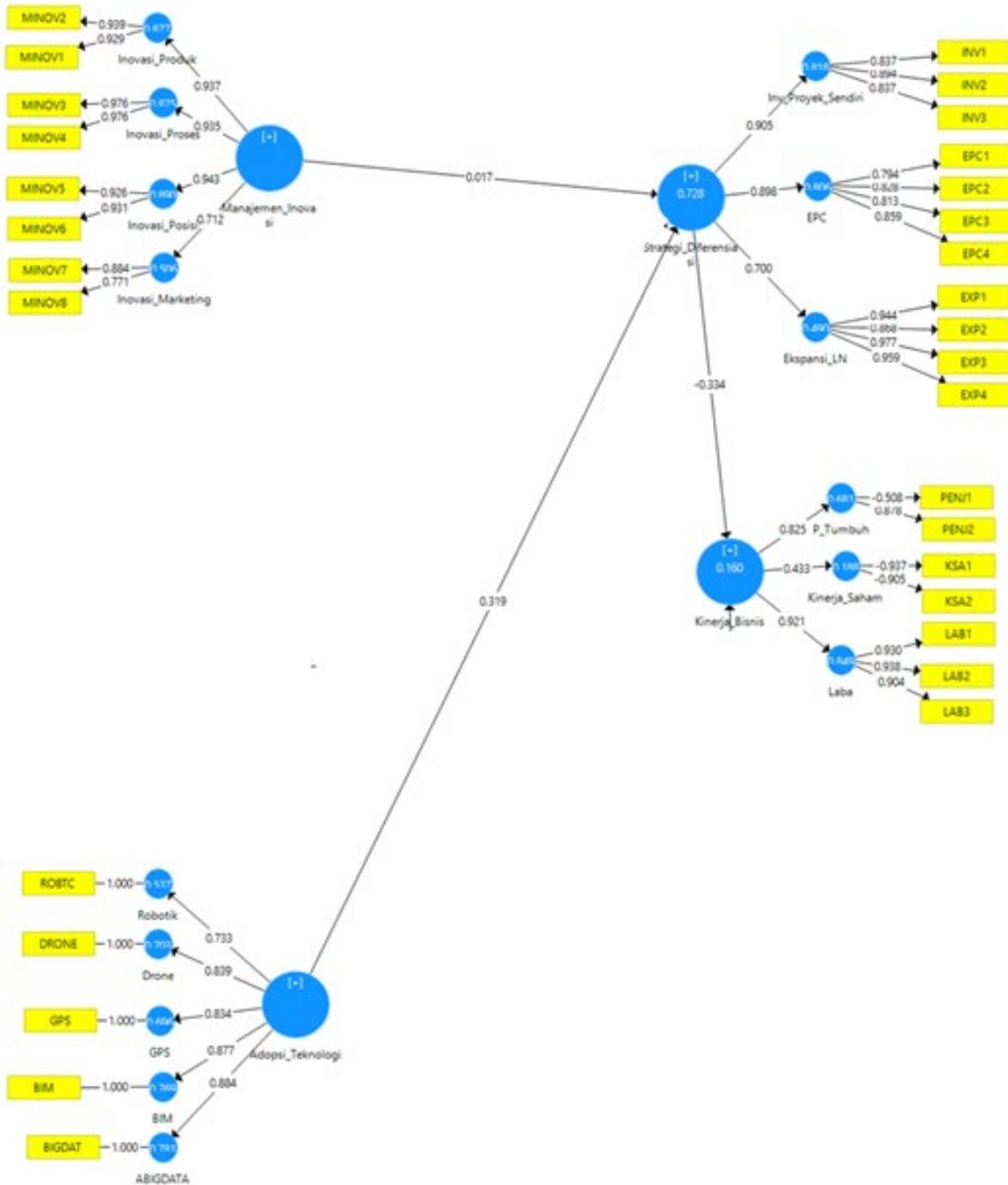
The analysis method used for RP-1 is descriptive analysis. Descriptive analysis is a method of organising, summarising, and presenting data in an informative way (Lind et al., 2012). The data is arranged using analysis class. The questionnaire uses a Likert scale with a scale of 5, with a total class of 5. Class interval is the maximum value minus the minimum value divided by the number of classes, which is 0.8. Thus, describing the conditions of each variable in the study using class boundary is achieved as follows.

- a. 1.00 - 1.80 = very low
- b. 1.80 - 2.60 = low
- c. 2.60 - 3.40 = neutral
- d. 3.40 - 4.20 = high
- e. 4.20 - 5.00 = very high

The analysis method for RP-2 and RP-3 is Path analysis.

Path analysis is a technique for analysing cause and effect relationships that occur in multiple regression if the independent variable affects the dependent variable either directly or indirectly (Robert D. Retherford, 1993).

Figure 1. Research Path Diagram



Source: Research Result (2019)

In this study, latent construct is multidimensional, followed by a second order of confirmatory analysis which reflects on the first order while the second order is performed as illustrated in Table 7.

Table 7: Constructs and Indicators of First and Second Order

Second Order Construct	First Order Construct	Indicator	Code
Managing Innovation	Product Innovation	Development of a new product/service	MINOV 1
		Development of improved product/service	MINOV 2
	Process Innovation	Development of new product/service process	MINOV 3
		Improvement of product/service processing	MINOV 4
	Position Innovation	Launching new products to overcome stagnant products	MINOV 5
		Repositioning existing products or services	MINOV 6
	Marketing Innovation	Improvements in ways to find new projects and contracts	MINOV 7
		Open an overseas marketing representative office	MINOV 8
Technological Adoption	Robotics1 Adoption	Robotics has been adopted for work execution	ROB1
	Robotics2 Adoption	Still renting a Robotic system for work execution	ROB2
	Drone1 Adoption	Drone has been adopted for work execution	DRO1
	Drone2 Adoption	Still renting a Drone system for work execution	DRO2
	GPS1 Adoption	GPS has been adopted for work execution	GPS1
	GPS2 Adoption	Still renting a GPS system for work execution	GPS2
	BIM1 Adoption	Already used BIM Software to simulate construction models before the tender	BIM1
	BIM2 Adoption	Still renting BIM Software to simulate construction models before the tender	BIM2
	Big Data1 Adoption	Already using Big Data Processing to simulate data capabilities of competitor contractors	BIG1
	Big Data2 Adoption	Still renting Big Data Processing to simulate data capabilities of competitor contractors	BIG2

Second Order Construct	First Order Construct	Indicator	Code
Differentiation Strategy	EPC Project	Capital readiness towards budget	EPC1
		Value Engineering application for efficiency	EPC2
		Execution time according to plan	EPC3
		Quality standard and warranty time	EPC4
	Overseas Expansion	Establishment of overseas branches	EXP1
		Creation of innovative services	EXP2
		Creation of relationship with customers	EXP3
		Having a better product capability compared to existing contractors	EXP4
	Own Project Investment	Predictive ability for future customer needs	INV1
		Large capital availability	INV2
Ability to work with technology owners		INV3	
Business Performance	Share Performance	Stock value growth	PENJ1
		Number of stock transactions	PENJ2
	Sales Growth	Sales growth	KSA1
		Number of sales transactions	KSA2
	Profit Performance	Company Return On Assets (ROA) Calculation	SAFE1
		Company Return On Equity (ROE) Calculation	SAFE2
Company Return On Investment (ROI) Calculation		SAFE3	

Source: Research Result (2019)

Validity Evaluation

The validity of each indicator in the variable is obtained from SmartPLS results. According to Chin in Ghozali (2012), a variable is said to have good validity towards latent construct if: (1) Load loading factor (λ) ≥ 0.5 , (2) T-Statistics Value > 1.96 (greater than critical value). The evaluation results show that each indicator and dimension used in this study is valid because they meet the requirements.

Reliability Evaluation

The reliability of each research variable is obtained from the results of SmartPLS, including Cronbach's Alpha, Composite Reliability. The evaluation results show that each indicator and dimension used in this study is reliable because they meet the requirements.

Hypotheses Test Design

Hypothesis 1 Test:

Managing Innovation contributes to Business Performance through Differentiation Strategy.
Test Criteria:

Ho : $(\beta_{21}\eta_1 + \zeta_2)(\gamma_{11}\xi_1 + \zeta_1) = 0$ Managing Innovation does not contribute to Business Performance through Differentiation Strategy.

Ha : $(\beta_{21}\eta_1 + \zeta_2)(\gamma_{11}\xi_1 + \zeta_1) \neq 0$ Managing Innovation contributes to Business Performance through Differentiation Strategy.

Hypothesis 2 Test:

Technological Adoption contributes to Business Performance through Differentiation Strategy.

Test Criteria:

Ho : $(\beta_{21}\eta_1 + \zeta_2)(\gamma_{13}\xi_1 + \zeta_1) = 0$ Technological Adoption does not contribute to Business Performance through Differentiation Strategy.

Ha : $(\beta_{21}\eta_1 + \zeta_2)(\gamma_{13}\xi_1 + \zeta_1) \neq 0$ Technological Adoption contributes to Business Performance through Differentiation Strategy.

Results and Findings

Research Results

From 90 samples of construction companies, it is found that amongst the companies running all three dimensions of the differentiation strategy, including EPC, own project investment and overseas expansion, there are only 7 companies or 8%. The activities of dimensions performed by companies are described in Table 8 below.

Table 8: Number and Percentage of Companies which Performed the Differentiation Strategy Dimension

Description of the Strategy Dimension	Number of Companies	Percentage
Perform EPC Strategy	31	34%
Perform Overseas Expansion	7	8%
Perform Own Project Investment Strategy	57	63%
EPC and Investment Strategy	28	31%
EPC, Investment and Expansion (all three dimensions)	7	8%

Source: Research Result (2019)

Table 9 summarises all the dimensional conditions of this study:

Table 9: Summary of Descriptive Research Results of All Variables

Variable	Dimension	Average	Scale
Managing Innovation	Product Innovation	3.350	Moderate
	Process Innovation	3.556	High
	Position Innovation	3.294	Moderate
	Marketing Innovation	2.628	Moderate
Technological Adoption	GPS	2.822	Moderate
	BIM	2.567	Low
	Drone	2.567	Low
	Big Data	2.456	Low
	Robotic	1.911	Low
Differentiation Strategy	EPC	3.369	Low
	Own Project Inv.	3.056	Moderate
	Overseas Expansion	1.886	Low
Business Performance	Sales Growth	3.745	High
	Profit	3.741	High
	Stock Performance	2.244	Low

Source: Research Results (2019)

Test Results of Hypotheses

Overall, the test results of the hypotheses are described in Table 10 as follows.

Table 10: Test Result of Hypotheses

Hypotheses	Path Coefficient	T Statistics	P Values	Result
H1 MI->SDIF->KBI	0.017	2.951	0.016	Accepted
H2 AT > SDIF ->KBI	0.319	2.305	0.000	Accepted
H3 AT -> KBI	0.104	31.682	0.529	Accepted

Source: Research Results (2019)

Evaluation of Research Results

The above test results for the hypotheses can be linked to previous theories and research that underlie this study. The following are the studies for each hypothesis test result obtained.

Managing innovation contributes to Business Performance through Differentiation Strategy. Hypothesis test result indicates that managing innovation contributes to business performance through differentiation strategy. This is consistent with previous research which found that managing innovation is an important factor in the success of differentiation strategy

implementation. In their book “Management Innovation” Tidd and Bessant, (2013), concluded that managing innovation has a major influence on differentiation strategy.

Technological Adoption contributes to Business Performance through Differentiation Strategy.

Hypothesis test result indicates that technological adoption has a role in business performance through the performance of differentiation strategy. This is consistent with previous research which found that technological adoption is important as a success factor in the implementation of differentiation strategy to improve business performance, which is consistent with a paper released by McKinsey Global Institute (2017) titled A Future That Works: Automation, Employment, and Productivity about the effects of automation technology that has an impact on changes in management systems and future implementation .

Conclusion

Based on the results of quantitative research through the distribution of questionnaires and surveys to management (directors and managers) of the Indonesian construction service industry as the 2018/19 respondents , several conclusions can be drawn :

- (1) The study findings indicate that in general, for those construction companies that use a differentiation strategy in Indonesia:
 - a. The application of managing innovation towards process innovation, product innovation, position innovation and marketing innovation in construction service management is still in a low level category. Although innovation occurs frequently, it lacks planning and control.
 - b. The use of technological adoption, including robots and big data processing, has not been used optimally, but drones and BIM software are being used by most Indonesian construction companies that perform differentiation strategy.
 - c. All construction companies have carried out the EPC strategy, but only 7 companies (8%) have expanded overseas and 57 companies (63%) have invested to create their own projects. As a result, there are only 7 companies (8%) that simultaneously perform those three strategies.
- (2) Managing innovation contributes to business performance through differentiation strategy. Construction companies really need innovations that will improve business performance, because if there is no innovation, construction output will run in place, or even experience a setback in performance. Although it contributes to business performance, at present, managing innovation only has a very small role.
- (3) Technological Adoption contributes to business performance through differentiation strategy. Only the use of robotics and big data processing are still not used optimally, but the use of drones and BIM software is being included by almost all construction companies.



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