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ANALYSIS OF FACTORS AFFECTING THE INNOVATION ACTIVITIES OF ENTERPRISES IN BAC NINH INDUSTRIAL ZONE

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ABSTRACT: In the context of globalization and the ongoing Fourth Industrial Revolution (Industry 4.0), innovation has become crucial for the development of enterprises, particularly in the industrial zones of Bac Ninh, a key industrial hub in Vietnam. Bac Ninh is not only geographically advantageous but also hosts a concentration of high-tech companies and leading manufacturing plants. However, to fully leverage the opportunities presented by globalization and Industry 4.0, a deep understanding of the factors influencing innovation activities is essential. This paper aims to analyze the factors affecting innovation activities of enterprises in the Bac Ninh industrial zone, highlighting a critical period of transformation influenced by global trends and technological advancements. The study focuses on identifying and analyzing both internal and external factors that impact the innovation process, proposing strategies to optimize creative capabilities and enhance competitiveness. This includes exploring elements such as corporate culture, human resources, knowledge management, and process innovation. The analysis not only provides a comprehensive overview of the state of enterprise innovation in Bac Ninh but also suggests practical solutions to foster sustainable development and establish a competitive edge in the new era.

Keywords: Innovation, Bac Ninh industrial zone, Innovation activities

I. INTRODUTION

In the context of globalization and the rapidly unfolding Fourth Industrial Revolution (Industry 4.0), innovation has become a crucial element for enterprise development. This is especially critical in the industrial zones of Bac Ninh province, a key industrial center in Vietnam. Bac Ninh is not only known for its strategic geographical location but also as a hub for high-tech enterprises and leading manufacturing plants. However, to fully capitalize on the opportunities brought by globalization and Industry 4.0, a deep understanding of the factors affecting the innovation activities of enterprises in this area is essential.

This article aims to analyze the factors influencing the innovation activities of enterprises in the Bac Ninh industrial zone at present, a period marking a significant transformation of the region in response to the impacts of globalization and Industry 4.0. Specifically, it will focus on identifying and analyzing both internal and external factors that influence the innovation process, thereby proposing solutions and strategies to optimize creative capabilities, enhance innovation, and boost competitiveness for enterprises in the area.

The article will explore factors such as corporate culture, human resources, knowledge management, and process innovation. Through this analysis, the article not only provides a comprehensive overview of the innovation landscape at enterprises in the Bac Ninh industrial zone but also suggests practical solutions that contribute to sustainable development and establish a competitive advantage in the new era.

II. RESEARCH MODEL AND METHODOLOGY

In this study, the authors conducted a survey through a questionnaire to collect primary data. In addition, the author hasresearched a number of published scientific articles to serve the research process. For primary data collection, the author used a
questionnaire paper and conducted a random survey in Bac Ninh with the number of questionnaires distributed being480, the number of valid answers collected being 464. According to Hair et al (2014), the

minimum sample size to use EFA is 50,preferably 100 or more. The ratio of the number of samples to one analytic variable is at least 5:1, with the number of variables inthe factor analysis model of this study being 24 variables, the number of samples needs to be at least 120, so with a sample of 464is perfectly suitable for the analysis according to the EFA model.

Observations are included in the questionnaire on a 5-point Likert scale, in which, "1" is "strongly disagree"; "2" means"disagree", "3" means "no opinion", "4" means "agree" and "5" means "strongly agree". The proposed research model includes 7 factors and uses the Likert scale to consider the rating. For the selection of factors, the author uses the expert method, in which theexperts have many studies in the fields of economics. The research model is shown in Figure 1 below.

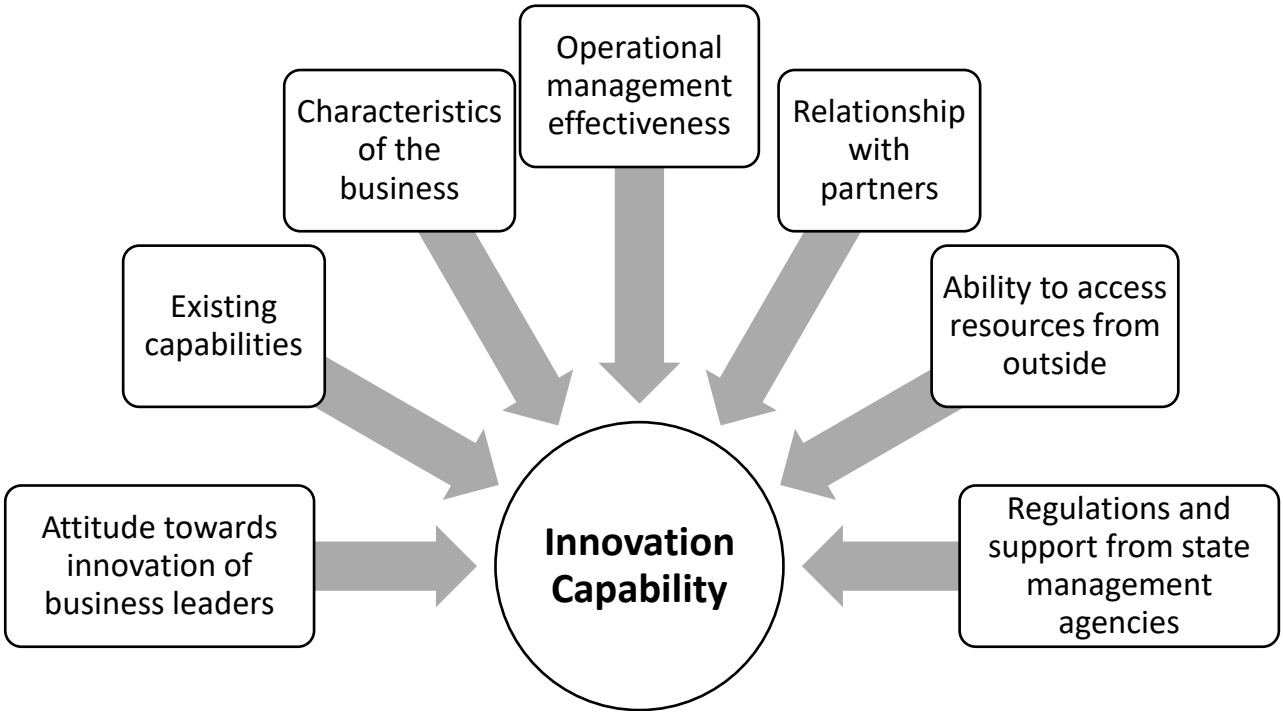

Figure 1. Model of factors affecting the innovation capability of the enterprise

The dependent variable of the model is "Innovation Capability" which is measured by 04 indicators, The independent variables of the model include:Attitude towards innovation of business leaders, Existing capabilities, Characteristics of the business, Operational management effectiveness, Relationship with partners, Ability to access resources from outside, Regulations and support from state management agencies,all of which are measured by 3 indicators each.

III. TESTING THE RELIABILITY OF A MEASURE USING CRONBACH'S ALPHA COEFFICIENT

The Cronbach's Alpha test is a reliability test used to analyze and assess the consistency of a measurement instrument. The purpose of this test is to determine whether the observed variables measure the same concept or not. The contribution of each variable is analyzed through the item-total correlation coefficient (Corrected Item - Total Correlation), which allows for the exclusion of variables that do not fit within the research model.

The evaluation criterion is that observed variables with an item-total correlation coefficient (Item - Total Correlation) less than 0.3 will be eliminated, and the standard for selecting the measurement is when Cronbach's Alpha is greater than 0.6 (Hoang Trong & Chu Nguyen Mong Ngoc, 2000). The results of the Cronbach's Alpha analysis for the factors are summarized in the following table:

Table 1: Reliability Testing Using Cronbach's Alpha

Variable	Scale	Item-Total Correlation	Cronbach's Alpha
Attitude towards innovation of business leaders	THAIDO_01	0.613	0.713
	THAIDO_02	0.418	
	THAIDO_03	0.587	
Existing capabilities	NLHIENHUU_01	0.673	0.814

	NLHIENHUU_02	0.676	
	NLHIENHUU_03	0.649	
Characteristics of the business	DACTRUNG_01	0.454	0.648
	DACTRUNG_02	0.423	
	DACTRUNG_03	0.523	
Operational management effectiveness	HIEUQUA_01	0.494	0.661
	HIEUQUA_02	0.536	
	HIEUQUA_03	0.625	
Relationship with partners	MQH_01	0.826	0.904
	MQH_02	0.752	
	MQH_03	0.758	
Ability to access resources from outside	TIEPCAN_01	0.614	0.761
	TIEPCAN_02	0.815	
	TIEPCAN_03	0.681	
Regulations and support from statemanagement agencies	QUIDINH_01	0.753	0.817
	QUIDINH_02	0.690	
	QUIDINH_03	0.625	
Innovation Capability	NLDMST_01	0.761	0.892
	NLDMST_02	0.820	
	NLDMST_03	0.799	
	NLDMST_04	0.674	

Nguồn: Nhóm nghiên cứu tổng hợp từ kết quả điều tra

The reliability test results for the proposed factors show that most factors have good reliability, with all Cronbach's Alpha values greater than 0.6. All variables have an item-total correlation coefficient (Item - Total Correlation) greater than 0.3, therefore, all variables are retained.

IV. EXPLORATORY FACTOR ANALYSIS (EFA) FOR INDEPENDENT VARIABLES

The results of the Exploratory Factor Analysis (EFA) show that the Kaiser-Meyer-Olkin (KMO) coefficient is 0.896, which is greater than 0.5, indicating that this dataset is suitable for factor analysis (Kaiser, 1974). Bartlett's Test of Sphericity was used to examine if the observed variables within the factor are correlated, achieving significance with a Sig. value of 0.000, less than 0.5. Therefore, the observed variables are related and meet the conditions for conducting EFA.

Table 2: Results of the KMO and Bartlett's Test

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.896
Bartlett's Test of Sphericity	Approx. Chi-Square	4012.696
	df	136
	Sig.	.000

Source: Results from the data analysis

5 factors were extracted with initial Eigenvalues of 1.212, which is greater than 1, and the total variance explained is 59.520%, greater than 50%. This indicates that the 5 factors extracted in the EFA account for 59.52% of the variance of all measures included in the model.

Table 3: Summary of Exploratory Factor Analysis Results for Independent Variables

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
Business research and development activities	.789				
Reward mechanisms for applied innovations in practice	.767				
Frequency of innovation proposals	.744				
Criteria and procedures for evaluating and categorizing innovative ideas/projects of the business	.709				
Employee confidence in proposing new innovations			.694		
Quality of the workforce			.672		
Support policies and provision of technology transfer consultancy services				.648	
Links with scientific research institutions				.629	
Regulations and support for the establishment, operation, and dissolution of businesses from regulatory bodies		.699			
Leadership readiness to accept risks and failures		.726			
Company's history of establishment		.789			
Leadership experience in management		.747			
Business leaders' education in relevant fields		.615			
Industry type		.578			
Pressure from suppliers					.877
Pressure from customers					.858
Ability to mobilize financial resources from credit institutions					.549

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Source: Results from the data analysis

Reviewing the rotated matrix with the Varimax rotation and only displaying factor loadings greater than 0.3, all observed variables with loadings greater than 0.5 are considered to have practical significance (Hair et al., 1998). Therefore, all these observed variables are retained for further analysis. The final results of the exploratory factor analysis for the independent variables include 17 observed variables loaded onto 5 factors. The order and names of the factors have been modified from the initial setup and are summarized in the table below.

Table 4: Summary of Influencing Factors

No.	Factor Name	Symbol	Number of indicators
1	Motivation for innovation	DLDM	4
2	Internal factors of the enterprise	NLDN	6
3	Scientific research	NCKH	2
4	Human resources in innovation	NLDM	6

5	Impact from partners	DTDM	3
	Total		**17**

Source: Results from the data analysis

V. EXPLORATORY FACTOR ANALYSIS (EFA) FOR THE DEPENDENT VARIABLE

The results of the Exploratory Factor Analysis (EFA) for the dependent variable indicate that the dependent variables converge into one factor. The Kaiser-Meyer-Olkin (KMO) measure is 0.830, which is greater than 0.5, indicating that the dataset is suitable for factor analysis. (Kaiser, 1974).

Table 5: Results of KMO and Bartlett's Test for the NLDMST variable

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.830
Bartlett's Test of Sphericity	Approx. Chi-Square	1119.379
	df	6
	Sig.	.000

Source: Results from the data analysis

The Initial Eigenvalue coefficient of 3.030 > 1 indicates that the extracted factor in the table represents a significant portion of the variance. The total variance extracted is 75.761% > 50%, indicating that the factors extracted in the EFA reflect 75.761% of the variation in all the measures included in the model.

Table 6: Results of Exploratory Factor Analysis for the dependent variable

Component Matrix[a]

	Component
	1
The method of organizing work always changing is better.	.908
The business production method is always being improved	.894
The operational efficiency of the business is always enhanced	.870
The products and services of the enterprise are always innovated to meet market demands	.806

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Source: Results from the data analysis

The synthesis of the reliability test results (Cronbach's Alpha) and exploratory factor analysis (EFA) has identified the factors, variables, and measures that can be used to evaluate the factors influencing the effectiveness of innovation in businesses within industrial zones in Bac Ninh province.

VI. REGRESSION ANALYSIS OF THE INFLUENCING FACTORS.

To test the research hypotheses, the authors conducted multiple linear regression for the 5 proposed variables in the adjusted model after qualitative research. The method chosen was "Enter," yielding the following regression results:

Table 7: Coefficients of the Regression Model

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.776[a]	.602	.597	.39718	1.775

a. Predictors: (Constant), DTDM, NLDM, NCKH, NLDN, DLDM

b. Dependent Variable: NLDMST

Source: Results from the data analysis

The result of the coefficient summary of the regression model in Table 7, with an Adjusted R Square of 0.776, indicates that, with a sample size of 464, 77.6% of the variation in the dependent variable is explained by the influence of the 5 variables included in the research model. The remaining 32.4% is attributed to other factors outside the research model. The Durbin-Watson statistic value of 1.775 < 3 indicates that the model does not exhibit autocorrelation, thus suggesting good regression quality.

Table 8: Variance coefficients

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	109.109	5	21.822	138.328	.000[b]
	Residual	72.251	458	.158		
	Total	181.360	463			

a. Dependent Variable: NLDMST

b. Predictors: (Constant), DTDM, NLDM, NCKH, NLDN, DLDM

Source: Results from the data analysis

The table of variance coefficients for the F-test result shows F = 138.328 and Sig = 0.000, indicating that the proposed research model is appropriate for the surveyed dataset.

Table 9: Results of Multiple Linear Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.968	.133		7.267	.000		
	DLDM	.261	.043	.278	6.008	.000	.406	2.464
	NLDN	.224	.045	.215	4.990	.000	.467	2.139
	NCKH	.241	.035	.310	6.978	.000	.440	2.275
	NLDM	.051	.038	.164	1.340	.021	.384	2.606
	DTDM	.040	.026	.155	1.503	.033	.659	1.518

a. Dependent Variable: NLDMST

Source: Results from the data analysis

The research results in the table above show that the acceptance coefficients (Tolerance) range from 0.384 to 0.659, while the Variance Inflation Factor (VIF) values are low (ranging from 1.518 to 2.606, less than 10). Therefore, it can be concluded that the relationships between these independent variables are not significant, indicating no multicollinearity phenomenon in the model.

From these results, we can derive the standardized multiple linear regression equation representing the relationship between the factors influencing innovation capability in businesses within the industrial zones of Bac Ninh province as follows:

*NLDMST = 0,310*NCKH + 0,278*DLDM + 0,215*NLDN + 0,164*NLDM + 0,155*DTDM*

With a sample size of 464, the regression results indicate that all the factor groups included in the study have an impact on the innovation capability in businesses within the industrial zones of Bac Ninh province. The level of influence, in descending order, is as follows: Scientific research; Motivation for innovation; Internal capacity of the enterprise; Human resources in innovation; Impact from partners.

VII. CONCLUSION

"The analysis of factors influencing the innovation activities of businesses in Bac Ninh Industrial Parks in the context of globalization and the Fourth Industrial Revolution has provided a comprehensive insight into

how these factors affect the innovation capability of enterprises. Through the analysis and evaluation of factors affecting innovation activities of businesses in Bac Ninh Industrial Parks, five main factors strongly influencing innovation capability have been identified. These factors include Scientific Research, Motivation for Innovation, Internal Strength of the Enterprise, Human Resources in Innovation, and Impact from Partners.

Based on these analyses, it can be affirmed that promoting innovation in enterprises in Bac Ninh Industrial Parks requires a combination and coordinated alignment of internal factors within the enterprise and support from the external environment, including policies from the government and cooperation from business partners.

Ultimately, identifying the factors influencing innovation activities will help businesses and managers in Bac Ninh to develop appropriate strategies to capitalize on opportunities in the era of globalization and the Fourth Industrial Revolution, thereby contributing to the sustainable development and success of enterprises."

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