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DIGITAL COMPETITIVENESS AND OPERATIONAL EFFICIENCY OF ENTERPRISES IN THE DIGITAL ERA: THE CASE OF VIETNAMESE ENTERPRISES

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Abstract

In the business activities of enterprises, the problem of competition to survive is inevitable and a matter of survival. This problem is also essential for developing the business in the current digitization context. This paper uses The Digital Economy and Society Index (DESI) of the European Commission (2019) to consider the digital competitiveness factor in the performance of Vietnamese enterprises to have effective solutions to improve the digital competitiveness of those firms. Through a survey of 289 senior leaders of enterprises and using the SPSS 27 and JASP analysis program version 0.17.3.0, digital competitiveness is influenced by the following factors: (1) Connectivity; (2) Digital Public Services; (3) Integration of Digital Technology; (4) Human Capital and (5) Use of the Internet. The study also shows that Vietnamese businesses need to improve their current market access by upgrading broadband infrastructure, enhancing skills in using technology, and using the internet of the staff in the industry. In addition, the government also needs to change the institutional environment by digitizing public services, reducing administrative processing time, and supporting the quick and accurate operation of businesses.

Keywords: *Digital competitiveness; Performance; Vietnam*

1. Introduction

In the business process of enterprises, to survive and develop in the digital era, businesses must create new competitive advantages for themselves. For Vietnamese enterprises, one of the competitive advantages is the "behind advantage" of other countries in economic development. Therefore, SMEs need to build a competitive strategy for their products based on the experience of enterprises in other countries. Competition is to position their products and win the choice of customers. Businesses must consider new ideas, resources, market share, finance, creativity, green products, and corporate social responsibility. After all, competition is a race for creativity and innovation. The core of competition is the need to position enterprises' products to win the choice customers concerning similar consequences of competitors.

Businesses must develop and execute their strategy using their competitive advantage (Vasin et al., 2021) to gain a competitive advantage. It is necessary to be lean in the management apparatus, combined with digital technology, to create competitive advantages, especially for manufacturing enterprises (Valamede & Akkari, 2020). To explore the factors of competitiveness, author Decyk (2020) shows that innovation, quality, marketing, and logistics activities have increased the company's competitiveness compared to other companies. Other companies in the same industry are knowledge- and digital-based. Santoso et al. (2020) demonstrate the importance of digital literacy in regulating the relationship between innovation in work behavior and increased business performance.

In Vietnam, along with the Government's economic recovery policies, the economy showed signs of recovery; more than 100,000 enterprises registered for a new establishment, besides the number of enterprises temporarily suspended business increased. Relatively high, with over 50,000 enterprises, with an increase of 38% over the same period last year. In this context, companies must increase their competitiveness to survive. The competitiveness of enterprises reflects in two aspects, namely productivity and products/services of enterprises, which in both parts best meet customer satisfaction to ensure customer satisfaction and ensure profitable production and business activities. Productivity in the digital age remains core to competitiveness (Aiginger et al., 2013; IMD, 2018; Radman and Belin, 2017; WEF, 2018). Therefore, in this context, increasing the competitiveness of businesses is more necessary than ever in the current digital technology landscape. The rest of the paper is presented as follows; Part 2 presents the theoretical basis related to digital competitiveness and the relationship between digital competitiveness to the performance of enterprises, part 3 presents the research methodology, part 4 is the research results, and the last part is the conclusion and recommendations.

2. Digital competitiveness and operational efficiency of enterprises

Competition in the direction of digitalization in the digital age is currently a hot topic, especially in the search for business methods to increase the competitiveness of enterprises. (Schwab, 2016; Morrar và Arman, 2017; WEF, 2018; OECD, 2019; Laitsou, E., Kargas, A., & Varoutas, D., 2020).

According to Porter (2008, 2014), "The only meaningful concept of competitiveness at the national level is productivity… A nation's standard of living depends on the capacity of its companies to achieve high levels of productivity and to increase productivity over time". The essence of this definition refers to the bidirectional relationship between competitiveness and innovation (Grossman and Helpman 1990; Uchida and Cook, 2005; Chiappini 2014).

Under the Industry 4.0 concept, competitiveness is also described/explained with emphasis put on quality (quality competitiveness) or technology (technological competitiveness) (Aiginger & Vogel, 2015). In the case of technological competitiveness, the whole concept can be related to (i) Innovative ability and adaptive capacity (Fagerberg, 1996); (ii) Ability to develop new technologies, economically exploitable (Aschhoff et al., 2010); (iii) Technological innovation or increased productivity (Hemais et al., 2005; Weresa, 2010; Radman và Belin, 2017).

There are many studies on digital competitiveness and the relationship between digital competitiveness and business performance. Most of these studies agree on the positive relationship between digital competitiveness and business performance. Digital competitiveness is also used in the European Union's competitiveness ranking (EC, 2018; IMD, 2018; WEF, 2018) (Figure 1)

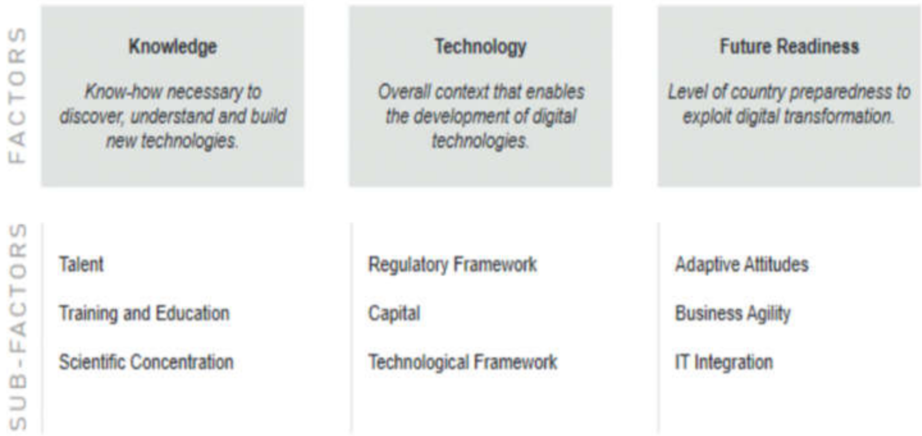


Figure 1: IMD World Digital Competitiveness Ranking main factors.

(Source: IMD World Digital Competitiveness Rankings, 2021)

Nagy (2017) shows a link between the high growth rate of digital technologies such as the Internet, tablets, and smartphones that will contribute to the economic development of Hungary and Ukraine. Moroz (Moroz, 2017) studied the development of the e-economy in Poland to compare it with some European countries to assess the level of development of the digital economy in Poland compared to some European countries.

From a more methodological perspective, Kotarba (2017) analyzes the various indicators used to measure digitalization activities. Five key levels were analyzed: digital economy, society, industry, business, and customer metrics. This study draws on commercial and public metrics to gauge digital progress.

The importance of digitalization and new technologies in the research of Pini et al. (2018) shows that the growth of exports and the increase in exports correlates with more advanced digital technologies, which are partly rooted in the digitization of the organization's business processes. Organization, thereby bringing competitive advantages to exporting companies.

Rossato and Castellani (2020) show that companies that implement digitalization in their business processes contribute to: "(1) improve business process efficiency, (2) improve customer experience understanding customers, (3) assist with career guidance and impart knowledge in their field of business, (4) raise awareness of the company's cultural values, and (5) enable the development of design skills advanced across different digital platforms and devices.

Research by the authors Moldabekova et al. (2021) also show technological innovation for companies operating in the logistics sector. The results indicate that investment in innovation and technological progress affects the logistics performance of countries where capital is the main prerequisite for promoting logistics 4.0.

3. Methodology

The research method in this article is approached according to the point of view and methodology of the European Commission (European Commission, 2019) and the study of Macchi et al. (2015) to measure digital competitiveness through the index—the Digital Economy and Society Index (DESI). Such aspects and many others related to digital competitiveness have been used in competitiveness rankings (IMD, 2018; WEF, 2018) and the formation of the Digital Transformation Scoreboard developed by the European Union (EC, 2018).

The methodological structure of the Digital Economy and Society Index includes the:

- Connectivity (The deployment of broadband infrastructure and its quality. Access to fast broadband-enabled services is a necessary condition for competitiveness (Macchi et al., 2015)

- Human Capital (Internet user skills; Advanced skills and development) (EC, 2018).

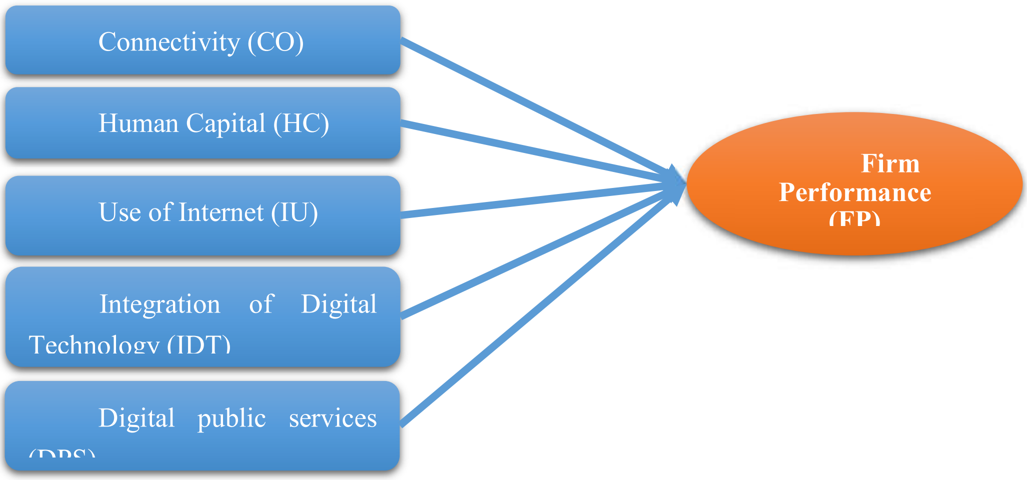
- Use of the Internet (Business use of digital technologies and activities to execute essential business functions (Macchi et al., 2015))

- Integration of Digital Technology (Making markets (Macchi et al., 2015); Sourcing inputs (Macchi et al., 2015))

- Digital public services (Changes in institutional and socioeconomic environments to facilitate digitalization-(Macchi et al., 2015))

The article approaches the research of (Liang & Gao, 2020) through factors such as Customer Satisfaction, market share, and Sales to measure the performance of the business. The research model is as follows:

Figure 2: Proposed research model



(Source: Authors)

In this study, in addition to secondary data, the authors use questionnaires and proceed through two main steps: (1) Preliminary research; and (2) Formal study to collect primary data. The official survey was conducted from March to May 2023. The survey subjects are managers, heads/deputies of departments/departments, and senior management staff in Vietnamese enterprises. A total of 267 printed questionnaires and 534 emails with links to the online survey were sent to the survey. As a result, 184 printed ballots were obtained (68.91%), and 105 online observations were collected (19.66%). After filtering the data, 285 valid observations remained. The article uses data analysis methods: scale reliability testing, exploratory factor analysis, and Bayesian Neural network analysis to process models in quantitative research. The contents of the observed variables are presented in Table 1.

Table 1: Variables

Variables	***Contents of the scale***	
Connectivity(CO)	Technology infrastructure to meet the company's digitization needs	CO1
	The quality of my company's broadband infrastructure is good	CO2
	Customers can easily access the company's broadband services	CO3
	The company's support services are performed very quickly when using broadband	CO4

Human Capital (HC)	Employees in my company have the technology skills to meet the company's digital transformation needs	HC1
	Employees' ability to absorb is very fast when the company operates new management technologies in production and management.	HC2
	Employees in the company have the ability to quickly adapt to the change of production processes applying high digital technology.	HC3
	Employees have creative thinking when using new technologies	HC4
	The internet skills of employees in the company are good.	HC5
Use of Internet (UI)	The company always uses management software applications by the internet	UI1
	The use of management by the internet greatly supports the company in the business planning process	UI2
	Business decisions are made faster with the help of the Internet	UI3
	The company's production / service operation process is faster when using BPM (Business Process Management).	IU4
	The company's digital transformation technologies help increase interaction between customers	IU5
Integration of Digital Technology (IDT)	Digitizing businesses helps companies share information more quickly	IDT1
	The company's communication activities reach partners quickly	IDT2
	Company information reaches partners promptly when integrating digital technology	IDT3
	Corporate management data is gathered into big data that is easier to manage	IDT4
	The operating processes in the company are integrated with digital technology	IDT5
	Digital technology is integrated and deployed in most parts of the company	IDT6
Digital public services (DPS)	Reports to state management agencies are all done online	DPS1
	The report forms are integrated in the management software of state agencies	DPS2
	State regulations are published online and regularly updated	DPS3
	Report forms are available in state management software	DPS4
Firm Performance (FP)	Company sales increase when businesses implement digital transformation	FP1
	Revenue increased as the company increased the digitization of existing markets	FP2
	Cross-border online sales increase	FP3
	Minimizing management costs when the company applies digital transformation	FP4
	The number of customers increases as the company digitizes operations	FP5

(Source: Authors)

4. Results

4.1 Scale test results

It is common for researchers to use Cronbanch's Alpha coefficient to test the reliability of the scale. However, recent studies show many limitations, such as Cronbach's alpha coefficient (α), depending on assumptions, and they are rarely met. Cronbach's alpha coefficient (α) is an estimated score that does not demonstrate variation in the estimation process (Ravinder & Saraswathi, 2020). In comparison, Mcdonald's Omega coefficient has more reliable characteristics.

Table 2: Mcdonald's Omega Integration of factors

Factor	Corrected Item-Total Correlation	McDonald's Omega if Item Deleted	Mcdonald's Omega
CO1	0.915	0.887	0.943
CO2	0.922	0.902	
CO3	0.859	0.925	
CO4	0.647	0.971	
UI1	0.640	0.837	0.861
UI2	0.512	0.866	
UI3	0.774	0.817	
UI4	0.775	0.810	
HC1	0.824	0.866	0.875
HC2	0.820	0.868	
HC3	0.738	0.929	
HC4	0.760	0.924	
DPS1	0.682	0.793	0.834
DPS2	0.645	0.808	
DPS3	0.719	0.773	
DPS4	0.613	0.814	
DPS1	0.682	0.793	0.834
DPS2	0.645	0.808	
DPS3	0.719	0.773	
DPS4	0.613	0.814	
IDT1	0.762	0.871	0.858
IDT2	0.743	0.872	
IDT3	0.748	0.891	
IDT4	0.759	0.885	

(Source: Results from data processing software SPSS 27)

The results show that McDonald's coefficient ω for all variables is > 0.8, and the correlation coefficient between the remaining items is more significant than 0.3 (Table 4). From here, the author has a basis to conclude that the scales are suitable for the analysis in the following steps.

4.2 Exploratory Factor Analysis (Efa)

4.2.1. Exploratory factor analysis of independent varieties scales

After testing the reliability of the scales, the required observed variables were included in the EFA exploratory factor analysis for the following results:

Table 3 : KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.784
Bartlett's Test of Sphericity	Approx. Chi-Square	5563.123
	df	190
	Sig.	0.000

(Source: Results from data processing software SPSS 27)

Table 3 shows that the p-value of Bartlett's test is less than 0.001, so there is a basis to conclude that there is a statistically significant relationship between the variables. Overall MSA coefficient of the KMO test = 0.784 > 0.5 shows that the significance level of the data set included in factor analysis is satisfactory, proving that the factor analysis model is appropriate. The results of factor extraction showed that five factors (Table 4) were extracted from the original variables.

Table 4: Results of factor extraction

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.384	31.920	31.920	3.347	16.735	16.735
2	3.165	15.825	47.745	3.127	15.634	32.369
3	2.420	12.100	59.845	2.873	14.364	46.733
4	1.691	8.454	68.299	2.818	14.091	60.824
5	1.281	6.406	74.705	2.776	13.881	74.705
6	0.849	4.247	78.952			

(Source: Results from data processing software SPSS 27)

The total variance extracted is 74.7% ≥ 50% (Table 4), showing the suitable EFA model. The factor rotation model keeps 74.7% of the variance of the factors. The factor rotation results show that the independent variables should be divided into five scales (Table 5). The composition of these scales remains the same as the original design. Therefore, the author kept the original scale and named it the same as Connectivity (CO), Human Capital (HC), Use of Internet (UI), Integration of Digital Technology (IDT), Digital public services (DPS) scales, and Firm Performance (FP).

Table 5: Rotated Component Matrix

Rotated Component Matrix[a]	Component				
	1	2	3	4	5
CO2	0.902				
CO1	0.899				
CO3	0.869				
CO4	0.722				
HC1		0.897			
HC2		0.896			
HC4		0.871			
HC3		0.856			
IDT4			0.827		
IDT2			0.801		
IDT3			0.771		
IDT1			0.757		
DPS3				0.808	
DPS4				0.785	

Rotated Component Matrix[a]					
	Component				
	1	2	3	4	5
DPS1				0.771	
DPS2				0.748	
UI4					0.852
UI3					0.828
UI1					0.760
UI2					0.690

(Source: Results from data processing software SPSS 27)

4.2.2. Exploratory Factor Analysis Of Dependent Varieties Scale

After testing the reliability of the scales, the observed variables of the required dependent boundary were included in the EFA exploratory factor analysis for the following results:

Table 6: KMO and Bartlett's Test of dependent varieties scale

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.789
Bartlett's Test of Sphericity	Approx. Chi-Square	472.596
	df	6
	Sig.	0.000

(Source: Results from data processing software SPSS 27)

Table 6 shows that the p-value of Bartlett's test is less than 0.001, so there is a basis for concluding a statistically significant relationship between the variables. Overall MSA coefficient of the KMO test = 0.789 > 0.5 shows that the significance level of the data set included in factor analysis is satisfactory, proving that the factor analysis model is appropriate. Because there is one factor, the Chi-squared test results are not displayed. The results of factor extraction showed that one factor (Table 7) was extracted from the original variables.

Table 7: Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.714	67.843	67.843	2.714	67.843	67.843
2	0.596	14.903	82.746			

(Source: Results from data processing software SPSS 27)

The total variance extracted is 67.84% ≥ 50% (Table 8), showing the suitable EFA model. The factor rotation model keeps 67.84% of the variance of the factors. The factor rotation results suggest that the independent variables should be divided into one scale (Table 8). The composition of these scales remains the same as the original design. Therefore, the author kept the original scale and named it the Firm Performance (FP) scale.

Table 8: Component matrix of the dependent variable factor

Component Matrix	
	Component
	1
FB1	0,855
FB2	0,844
FB4	0,842
FB3	0,749

(Source: Results from data processing software SPSS 27)

4.3. Analysis Bayesian network

This study assesses the link between variables using the Bayesian network analysis approach. Bayesian network analysis is a potent method for modeling uncertain and dependent variables. This tool is essential in various domains because it can capture intricate probabilistic correlations. The Bayesian network offers more precise predictions and improved decision-making in complicated systems to present a formal framework for debating on and comprehending uncertainty. For this analysis, we utilized the JASP analysis program version 0.17.3.0, and made the following settings:

Sampling option: Burn in = 5000, interactions = 10000

Prior: Prior egde inclution (g prio) = 0.5, Innitial configuaration prior egde inclution (g start) = emplty, Degree of freedom of G-Wishart prior (df prior) = 3.

The study uses the Bayesian Network Analysis with specific research model as follows:

$FB = \beta_1 CO + \beta_2 HC + \beta_3 IDT + +\beta_4 DPS + \beta_5 UI + \varepsilon$ *(1)*

Where:

FB: Variable representing the Firm Performance;

CO: Variable representing the Connectivity;

HC: Variable representing the Human Capital;

UI: Variable representing the Use of Internet;

IDT: Variable representing the Integration of Digital Technology;

β: Regression coefficient of the model;

ε: Residuals.

The network comprises six nodes, as indicated in Figure 3. According to Table 5, the weighted interaction intensity among the six nodes is more significant than zero. Among the CO and the FB display the strongest correlation (0.584), followed by the DPS and the FB (0.551), and next the IDT and the FB (0.548), and then the HC and the FB (0.530), and lastly, the UI and the FB (0.523).

Table 9: Weights matrix

	Network					
Variable	FB	CO	HC	IDT	DPS	UI
FB	0.000	0.584	0.530	0.548	0.551	0.523
CO	0.584	0.000	-0.310	-0.321	-0.323	-0.306
HC	0.530	-0.310	0.000	-0.290	-0.291	-0.277
IDT	0.548	-0.321	-0.290	0.000	-0.301	-0.287
DPS	0.551	-0.323	-0.291	-0.301	0.000	-0.288
UI	0.523	-0.306	-0.277	-0.287	-0.288	0.000

(Source: Results from data processing software JASP 0.17.3.0)

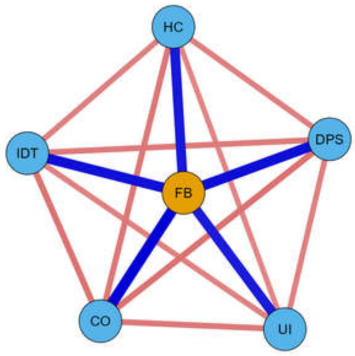


Figure 3: Network

(Source: Results from data processing software JASP 0.17.3.0)

The potential significance of nodes in a network is estimated using centrality indices (Hevey, 2018). Nodes with low centrality are located on the network's edges, whereas nodes with high centrality locate in the center. The betweenness, proximity, and degree (vital) indexes use in the current work. The betweenness centrality metric highlights a node's importance in the network's connection to other nodes. The distance between two nodes is measured quantitatively by "closeness." When compared to a node with lesser closeness, a node with higher closeness has a shorter pathway to all other nodes (Bringmann et al., 2019). According to account Robinaugh et al. (2016), the degree is the number of edges connecting a node to other edges while accounting for those linkages' importance.

The standardized centrality indices are present in Table 9 and Fig.3. Based on the results, the most Strength nodes were: FB, CO, DPS, DIT, HC, and UI.

Table 10: Centrality measures per variable

	Network			
Variable	Betweenness	Closeness	Strength	Expected influence
FB	0.000	2.028	2.022	2.041
CO	0.000	-0.207	-0.164	-0.426
HC	0.000	-0.501	-0.521	-0.399
IDT	0.000	-0.402	-0.398	-0.409
DPS	0.000	-0.387	-0.379	-0.410
UI	0.000	-0.531	-0.559	-0.397

(Source: Results from data processing software JASP 0.17.3.0)

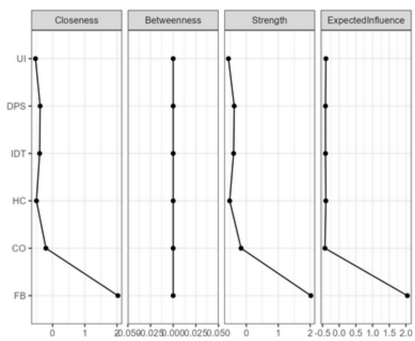


Figure 4. Centrality Plot

(Source: Results from data processing software JASP 0.17.3.0)

5. Conclusion and recommendations

5.1. Conclusion

Research results have shown the importance of improving competitiveness in the current digitalization context of Vietnamese enterprises. The conclusions of the article show that there are 05 factors affecting competitiveness ranked in descending order of influence as follows: (1) Connectivity; (2) Digital public services; (3) Integration of Digital Technology; (4) Human Capital, and (5) Use of the Internet. This result shows that digital transformation to improve competitiveness for SMEs must originate from upgrading broadband infrastructure to integrate faster and more accurate processing functions.

5.2. Recommendations

Improve the integration of Digital Technologies to be proactive in finding input materials and create output markets for products to increase the competitiveness of enterprises. Besides, the human factor is equally important. Employees in the digital era must be knowledgeable about technologies and operate them to bring about the best efficiency and productivity and to reduce operating costs for businesses. In addition to the investment in the technology foundation of the enterprises themselves, there should be a synchronous innovation in the management and provision of online public services to ensure the smooth operation of enterprises. Quickly increase the ability to capture the market and increase the competitiveness of businesses in the digital era.

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