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

Diep Nguyen Thi Ngoc^{1}, Canh Quang Tran², Anh Bach Hoang Ngoc¹*

University of Economics and Law and Vietnam National University, Ho Chi Minh City

Ho Chi Minh City University of Economics and Finance

Yersin Da Lat University, Vietnam

diepntn@uel.edu.vn

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; Laitso, 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

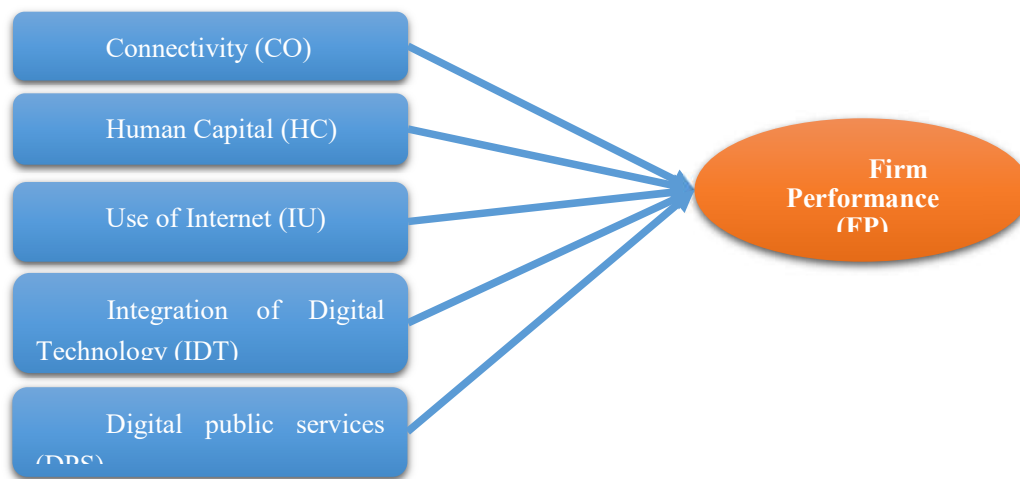
The research method in this article is approached according to the point of view and methodology of the European Commission (European Commission, 2019) and the study of Macchi et al. (2015) to measure digital competitiveness through the index—the Digital Economy and Society Index (DESI). Such aspects 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

| <i>Variables</i> | <i>Contents of the scale</i> | |
|------------------|--|-----|
| 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 Cronbach'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 $74.7\% \geq 50\%$ (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

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|-----------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|
| | 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 $67.84\% \geq 50\%$ (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 inclusion (g prio) = 0.5, Innitial configuration prior egde inclusion (g start) = empty, Degree of freedom of G-Wishart prior (df prior) = 3.

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

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

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

| Variable | Network | | | | | |
|----------|---------|--------|--------|--------|--------|--------|
| | 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)

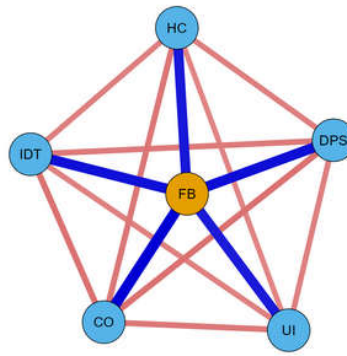


Figure 3: Network

(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

| Variable | Network | | | |
|----------|-------------|-----------|----------|--------------------|
| | 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)

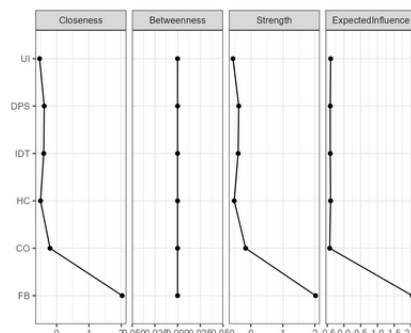


Figure 4. Centrality Plot

(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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HO CHI MINH CITY UNIVERSITY OF ECONOMICS AND FINANCE

141 - 145 Dien Bien Phu, Ward 15, Binh Thanh District, HCM City

Website: uef.edu.vn - Hotline: (028) 5422 6666 * (028) 5422 5555