STRUCTURAL EQUATION MODELLING OF DIGITAL ENTREPRENEURSHIP, LOGISTICS INNOVATION, AND DIGITAL TRANSFORMATION INFLUENCE ON LOGISTICS PERFORMANCE OF LOGISTICS ENTREPRENEURS IN THAILAND

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Abstract

This study explored the development of digital entrepreneurship construct measures in logistics entrepreneurs, analyzing a model of the casual relationships among digital entrepreneurship, logistics innovation, digital transformation, and logistics performance. The population consisted of 1,012 logistics business companies in Thailand. Data were collected using questionnaires completed by one entrepreneur, executive chairman, or executive from each company. A final sample of 322 responses was deemed usable for the analyses. The sample was split into 2 sub-samples: sample 1 (n=100) was used in the exploratory factor analysis for digital entrepreneurship, while sample 2 (n=222) was used in the confirmatory factor analysis and structural equation modelling. The results of the exploratory factor analysis identified four dimensions of digital entrepreneurship, namely digital venturing, digital proactive competition, digital existence autonomy, and digital research and development. These four new dimensions were used to describe digital entrepreneurship as the ability to create and operate a business, forming a new model to explain business transformation using advancements in digital technology. Digital entrepreneurship, logistics innovation, and digital transformation have positive influences on logistics performance at the 0.05 significance level. The results can assist: 1) the development of best practice for entrepreneurial logistics innovation; 2) the development of an organizational digital transformation strategy to develop logistics activities which meet customer needs in accordance with advancements in innovation and

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digital technology; and 3) strengthening of international competitiveness through improvements in logistics performance.

Keywords: Logistics Innovation, Logistics Performance, Digital Entrepreneurship, Digital Transformation, Structural Equation Modelling

1. INTRODUCTION

Logistics shipping activity is at the heart of every part of the production and service industry. Logistics plays a role in distributing goods to both domestic and foreign markets, with logistics service providers moving goods in each step of the supply chain. Originally, a logistics service provider referred to the logistics service provided by an external company that offered to handle a customer's shipping activities, with the external company hired to partially or entirely conduct the company's management and distribution activities. As time passed, ideas about logistics service providers developed to involve more complicated services by combining many aspects of logistics services (Leuschner, Rogers, and Charvet, 2014).

The situation for logistics business is always moving in the same direction as the amount of goods being supplied to customers; this in turn grows according to changes in the domestic economy which reflect the demand on businesses regarding their operation outcomes, meaning that there is a high potential for logistics work to lead to higher average incomes. Logistics activities relate to trading capital worth more than 18% of the GDP of developing countries and 8–10% of the GDP in developed countries (Arvis et al., 2014). Thus, the operational outcome in a logistics business is to successfully develop logistics performance, increasing income and profit in a highly competitive environment. Research in the past decade indicates that logistics business is quickly expanding worldwide in response to the increasing demands of a highly competitive business world (Wang, Jie and Abareshi, 2015).

Logistics business expansion has led to a high level of competition, putting pressure on Thai entrepreneurs who mostly run small businesses (93.7% of registered entrepreneurs in Thailand) with a limited customer base and often small investment in technology and personnel. Some have short supply pipelines and encounter cash flow problems which are disadvantageous to middle and large entrepreneurs, both in terms of their competitive ability and bargaining power in the market (Sathapongpakdee, 2018). Large foreign logistics entrepreneurs use technology and innovation as tools in logistics service competition. The increasing fuel price and decreasing availability of natural gas

have required logistics businesses in Thailand to adapt, such that they are able to handle frequent and unpredictable change. In recent years, logistics business has become more challenging as new forms of business have developed with digital technology. Changing the business process using digital technology has become a key competitive component in various industries (Hofmann and Osterwalder, 2017).

When there is more logistics competition in the market, entrepreneurs must seek excellence in their operations, developing superior logistics performance to increase market share and gain advantages over their competitors. Consequently, an entrepreneur in the digital age must create new logistics innovations along with changes in the organization's operation to use more digital technology in response to the changing needs of the consumer. This involves using resources and capital efficiently and effectively. Hence, the purpose of this study was to explore the development of digital entrepreneurship construct measures for logistics entrepreneurs and to analyze a model of the casual relationships among digital entrepreneurship, logistics innovation, digital transformation, and logistics performance. The results can be used in developing logistics performance outcomes for logistics entrepreneurs in Thailand, helping such entrepreneurs to become strong international competitors.

2. LITERATURE REVIEW

2.1 Digital Entrepreneurship (DE)

Regarding digital entrepreneurship, recent research has indicated that the content on digital technology is quite narrow and there have not been many studies of the entrepreneurial characteristics needed for successfully carrying out new forms of business following the development of digital technology. Digital leadership refers to the adjustment of strategic ideas throughout an organization in relation to digital technologies (Roger, 2016). Consequently, this research included the construction of a digital entrepreneurship indicator model from 2 main ideas of entrepreneurship, namely Entrepreneurship Orientation and Corporate Entrepreneurship, developing indicators of digital technology-related contexts to group the new components of Digital Entrepreneurship. Both ideas can be considered from the establishment of a business up to the level of maintaining the business, along with decision making patterns, processes, and organizational behavior. Regarding entering a new market with new products or services, Lumpkin and Dess (1996) state that studies of entrepreneurship with many dimensions and components do not necessarily need to be conducted at the same time. The dimensions of Entrepreneurship Orientation and Corporate Entrepreneurship in this study are detailed below.

Pro-activeness refers to the seeking of opportunities; predicting behavior for presenting new products, services, or technological capabilities; being farsighted or outstanding by presenting new products before competitors; and the ability to predict the future needs of customers (Lumpkin and Dess, 1996). These actions are related to the methods that an organization uses to intuitively seek market opportunities and their process of developing new products (Mapalala, 2017).

Risk taking refers to the level at which the manager is willing to accept obligations regarding resources with a high risk of failure (Miller and Friesen, 1982). Mapalala (2017) explained risks as the deeds of an organization when entering an unknown market and the action of allocating a large amount of resources to run a business in an uncertain environment. Without risk taking, a company tends to encounter deceleration when new innovative products are presented in the market.

Competitive aggressiveness refers to the characteristics demonstrated in response to a competitor's challenge and face-to-face encounters that might reflect competitive willingness by using exotic methods and step-by-step operations to strictly achieve a goal by allocating more resources than competitors, particularly in the fields of marketing, product development, production technology, and production capacity. As a result, advantages in competition are quickly created by hastening the product cycle to achieve faster development of new products for the market.

Autonomy occurs when members of the organization have freedom in their performance and decision-making for searching, supporting, and presenting concepts or visions regarding operations to achieve the organization's goals (Lumpkin and Dess, 1996). In the context of the organization, it can hasten creation through centralization in a small company. On the other hand, a large company may support freedom by giving authority to operational units. When an operational unit has more authority in decision making, it can access the correct information in time to solve any problems. Delegating authority also boosts motivation of team members, giving them a feeling of ownership and enhancing determination in achieving project goals (Shan et al., 2015).

New business ventures refers to opportunities for the organization to enter a new business field, via new products, entering a new market (Antonic and Hisrich, 2001), or investing in a new business within the same organization (Stopford and Baden-Fuller, 1994). For all organizations regardless of size, investing in a new business refers to investing in a new business within the organization regardless of the decision process. A company running business at a high level tends to actively predict events, taking advantage of in-depth information of the marketing environment and of the competition, which helps in making better decisions regarding product

investment or entering new markets (Chen et al., 2015).

Self-renewal refers to adjusting key concepts in running the business, adjusting the operating strategy, and changing the organization by adjusting the organization's structure and changing the whole system to create innovation (Muzyka et al., 1995). A company with proper structure adjustment will benefit from advantages which help the entrepreneur to seek new opportunities while also helping the organization in seeking and implementing new marketing strategies (Garcia-Morales et al., 2014). Adjusting the organization covers acceptance and trialing of new resources which may be used to adjust the process of product innovation or to adjust the results of innovation (Chen et al., 2015).

Most of the related literature on Digital Entrepreneurship focuses on a narrow scope of content related to using digital technology. Most research omits studying the characteristics of entrepreneurs used in conducting new forms of business which have been led by progress in digital technology. Leading an organization in changing to digital technologies not only involves using digital technology, but also involves improving strategic concepts in the organization (Roger, 2016). Consequently, the current study developed a digital entrepreneurship indicator model using all 6 dimensions of both concepts applied to the logistics business (Tuan, 2017), then applying the model in a related digital technology context, identifying new dimensions of digital entrepreneurship using Exploratory Factor Analysis.

2.2 Logistics Innovation (LIN)

Logistics Innovation involves new technologies, new services, new processes, and new concepts, which are used to adjust logistics performance (Grawe et al., 2009; Wang *et al*., 2016). From previous literature reviews, patterns of logistics innovation studies can be divided by processes or services with limitations in design innovation which affect implementation in different problem contexts. Consequently, the current study covered 3 components of logistics innovation:

Logistics Capability Innovation (LCIN), which refers to the capability of using logistics innovation in solving problems, or in development for adjusting to match the changing business environment, and using innovation as a tool to maintain an advantage with regard to the competition (Wang et al., 2015).

Logistics Process Innovation (LPIN), which refers to the implementation of new steps in operating logistics activities and new logistics activities structures, which benefit production by gaining a better result (Grawe et al., 2011).

Logistics Service Innovation (LSIN), which refers to the development of a new logistics service or adjusting a logistics service which benefits customers (Chu et al., 2018).

Previous studies of logistics innovation have identified patterns, dividing logistics activities into new innovative solutions, and presenting abstract aspects. Within the context of applications in different logistics innovation component issues, scholars have studied each logistics innovation separately (Grawe et al., 2011; Cui et al., 2012; Grawe et al., 2015). Therefore, in studying logistics innovations to cover the logistics business aspect, 3 logistics innovations were used as the dimensions of logistics innovation, which is an important factor that affected logistics in the current study.

2.3 Digital Transformation (DT)

Digital Transformation refers to sustainable company-level change through revised or newly created businesses and successfully running the business through digitally achieved added value (Chu et al., 2018). As a strategy in changing a company's information technology architecture, the important adjustment is in the strategic thinking of the company by the leader or entrepreneur, with a digital focus. This requires the capability to review and present new forms of business in all dimensions of strategic planning including customers, competition, data, innovation, and value (Rogers, 2016). The current research studies Digital Transformation, including The Internet of Things (Yu, Nguyen and Chen, 2016), Big Data (Sganzerla et al., 2016), and the Platform Business Model (Silva et al., 2014).

Big Data (DTBD) refers to the capability to collect, sort, and analyze a huge amount of data, used in achieving a company's strategic and performance goals.

The Internet of Things (DTIoT) refers to an organization's internal performance system in which everything is connected to the internet; this includes staff, command and control of tool use through the internet, and customers being able to ask for services and to track and check products and services through the internet.

Platform Business Model (DTPB) refers to how a business creates value by facilitating directly in response between 2 or more types of customers, acting as a connecting medium using technology such as a website or mobile application, as the management system.

In the past decade, there have been a limited number of imperative results from studying the digitalization of management and organization management. The aspects of the studies, and dimensions of change regarding digital factors are different depending on the industry used in the study. All 3 dimensions considered in this study are important factors in the logistics industry. Imperative results on each aspect show that all 3 dimensions affect logistics progress. Moreover, Nwankpa and Roumani (2016) presented the concept of incorporating Big Data into organization management for digitalization within an organization. Meanwhile, Sganzerla (2016) presented the

concept of Big Data, which comes from the progression of the Internet of Things, as an important factor of digitalization affected by technology and innovation development (Yu, Nguyen and Chen, 2016). Especially regarding the Platforms Business Model for competition, which comes from the development of a model for conducting business with digital technology, imperative results have found that logistics platforms do affect the ability to conduct logistics (Zhang, et al. 2019).

2.4 Logistic Performance (LP)

Logistics performance capability involves effectively performing logistics activities regarding the cost dimension while maintaining quality and flexibility in products and services, and providing fast delivery matching customer demand. The current research studied the logistics performance of logistics companies according to Schönsleben's concept (2016) which consists of 4 dimensions.

Logistics Quality (LPQ) refers to a logistics company's performance regarding its ability to safely deliver parcels and products without damage. In recent years, many researchers have used it as a shipping and logistics performance indicator (Schafer, 2015).

Logistics Cost (LPC) includes all costs at the company level provision of logistics services (Othman et al., 2016). Production in logistics activities contains 3 steps: (1) supply, (2) production, and (3) distribution. Thus, logistics cost is a result of the process that starts with procurement and ends with delivering products to the main logistics performance-related customer (Wang and Cheng, 2009).

Delivery (LPD) is an important logistics performance indicator, as the speed of delivery can affect other performance indicators, such as cost efficiency, flexibility, and expansion of the quality range (Leuschner et al., 2013).

Flexibility (LPF) when referring to logistics flexibility is an organization's capability to provide a quick response to a customer's needs, regarding delivery, support, and services (Zhang et al., 2002). It involves adjustment of delivery routes and timetables and the ability to import goods in good condition. A higher level of logistics flexibility helps improve the company's ability to provide better logistics services (Yu, Cadeaux and Song, 2016).

These 4 dimensions have been used individually by most researchers studying logistics performance in the supply chain. However, past research my not have studied all the 4 dimensions together, depending on the sample industry groups. This research is a study of logistics performance among logistics business companies which conforms with Schönsleben's (2016) logistics performance result concept; this concept examines logistics performance results in relation to logistics entrepreneurship objectives. It can be seen that there has been development of the components or aspects of logistics performance in the results of prior studies of logistics

companies, from their imperative results which have individually studied each dimension.

2.5 Hypotheses

From the literature review, six hypotheses were identified and used to develop a conceptual model of the research framework. The constructs of digital entrepreneurship, logistics innovation, digital transformation, and logistics performance, and the hypothesized influences between them are explained in Figure 1.

H1: Digital entrepreneurship has a positive influence on logistics innovation.

H2: Digital entrepreneurship has a positive influence on digital transformation.

H3: Digital entrepreneurship has a positive influence on logistics performance.

H4: Logistics innovation has a positive influence on digital transformation.

H5: Logistics innovation has a positive influence on logistics performance.

H6: Digital transformation has a positive influence on logistics performance.

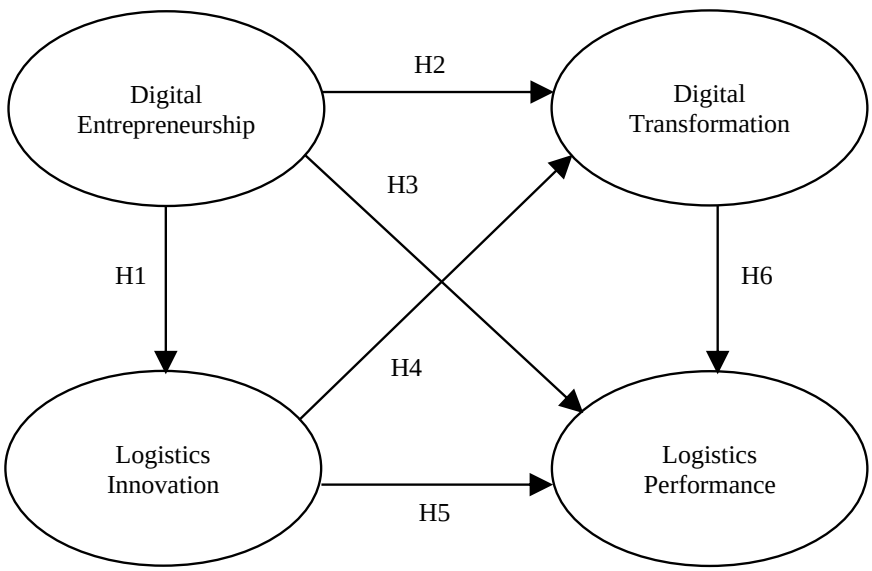


Figure 1 Research framework

3. RESEARCH METHODOLOGY

3.1 Population and sample

The population used in this research encompasses the 1,012 logistics business companies which use innovation and digital technology, registered in Thailand, including 512 Thai logistics business companies holding ISO 9001 certification for logistics quality management, 336 foreign logistics business companies doing business in Thailand and certified as maintaining international logistics service standards, and 164 logistics business companies that are members of the Department of International Trade Promotion, Ministry of Commerce, and are certified according to the Malcolm Baldrige National Quality Award.

Data were collected via questionnaires sent out to the total population of 1,012 logistics business companies, each addressed to an entrepreneur, executive chairman, executive or other representative acknowledging logistics performance as the representative for each company. Surveys were distributed via e-mail with an e-Questionnaire link attachment, and as hard copies distributed and returned via the Thai postal service, with a 5 months data collection period from February to June 2020. In total, 332 questionnaires were returned, of which 322 were considered usable after checking for completeness. Data analysis required the sample to be divided into 2 parts.

Sample 1 (n=100) was used for the exploratory factor analysis. This sample size was considered to be sufficient for providing reliable results (Kline, 2005).

Sample 2 (n=222) was used in the confirmatory factor analysis and to test the structural equation model. This sample size was also considered satisfactory for providing reliable results (Hair *et al*, 2014).

3.2 Research Instruments

The survey instrument used for data collection was a questionnaire compiled based on prior studies of the current concepts, theories, and other related research. The questionnaire was divided into 4 parts with opinion-based questions utilizing a seven-point Likert scale. While the questionnaires were originally developed in English, they were subsequently translated into Thai and developed for use in a digital context to facilitate respondents' understanding. The instrument was developed as follows:

Digital Entrepreneurship was measured by items adapted from Karimi and Walter (2015), Mapalala (2017), Shan et al. (2016), Chen et al. (2015), and Garcia-Morales et al. (2014).

Logistics Innovation was measured by items adapted from Wang et al. (2015), Grawe et al. (2015), and Chu et al. (2018).

Digital Transformation was measured by items adapted from de Vass et al. (2018), Lin, (2016), and Cenamor et al. (2019).

Logistics Performance was measured by items adapted from Yu, Cadeaux and Song (2016), Wang (2016), Othman et al. (2016), and Gligor (2014).

Scoring and interpretation of the variables used a seven-point Likert scale opinion indicator. This research used Structural Equation Model (SEM) analysis with a maximum likelihood method involving a high number of variables in the analysis in order to obtain a model that conformed to the empirical data. The 7 scores ranged from strongly disagree (1), to neutral (4), to strongly agree (7). Means were calculated, providing a level of opinion and score range to facilitate interpretation and understanding for each variable. Opinion scores were assigned to one of 5 levels, with the width of each level set using the formula: class interval width = range/number of classes = (7-1)/5 = 1.20. Thus, the value ranges were interpreted as excellent (5.81–7.00), very good (4.61–5.80), good (3.41–4.6), fair (2.21–3.40), and poor (1.00–2.20).

The content validity was verified by analyzing the index of item objective congruence (IOC) based on evaluation by 4 experts (the questionnaire was sent to 5 experts, of which 4 responded). The range was between 0.5 and 1.00, which was greater than or equal to the recommended level for the IOC (Rowinelli and Hambleton, 1977). These results showed that the question responses could be measured according to the content and were consistent with the assessment purpose.

Testing of the reliability of the questionnaires was done using 30 pre-test respondents who almost qualified for the main sample, and who were selected based on convenience sampling. The test reliability of the questionnaire was consequently calculated according to the Cronbach's Alpha coefficient (Cronbach, 1951) for each variable, with the range found to be between 0.717 and 0.962, which is greater than the minimum of 0.700 recommended for an acceptable level of reliability (Nunnally and Bernstein, 1994).

3.3 Methods of analysis

SEM was applied to estimate the conceptual model. For data analysis the sample was split into 2 sub-samples: Sample 1 (n=100) and Sample 2 (n=222).

Exploratory Factor Analysis (EFA) was used to identify underlying factors; these were generated from the items of digital entrepreneurship based on sample 1 (n=100) data using SPSS 22. After identifying the dimensions through exploratory factor analysis, the next stage confirmed the acceptability of the digital entrepreneurship measurement model and was used to perform the confirmatory factor analysis based on the sample 2 (n=222) data using AMOS 22. Confirmatory factor analysis revealed that the digital entrepreneurship measurement items were in accordance with the pattern

revealed in the exploratory factor analysis.

A data reduction process was conducted before analyzing the structural model based on the recommendation of Prajogo and Sohal (2003) "…to reduce the number of variables and parameters in the research model to a manageable number in terms of the ratio between sample size and parameters estimated in the SEM." A data reduction process was conducted in this study in order to collapse the 14 dimensions (constructs)—each consisting of 3–6 manifested variables—into composite variables. There were 4 dimensions (Digital Venturing, Digital Existence Autonomy, Digital Proactive Competition, and Digital Research and Development) for the Digital Entrepreneurship latent variable, 3 dimensions (Logistics Capability Innovation, Logistics Process Innovation, and Logistics Service Innovation) for the Logistics Innovation latent variable, 3 dimensions (the Internet of Things, Big Data, and Platform Business Model) for the Digital Transformation latent variable, and 4 dimensions (Logistics Quality, Logistics Cost, Delivery, and Flexibility) for the Logistics Performance latent variable. The composite measure of each dimension was found by calculating the mean values of the manifested variables (Hair et al., 2014); the results are shown in Table 4.

SEM based on AMOS 22 was used to perform the confirmatory factor analysis (CFA), to confirm the measurement model of the theoretical constructs of digital entrepreneurship, logistics innovation, digital transformation, and logistics performance, based on the sample 2 (n=222) data. SEM was also used to test the model fit, reliability, and validity (Hair et al., 2014). The structural model fit was then tested, and the structural path model was used to test the hypotheses based on the path coefficients, total effect, direct effect, and indirect effect.

The fit indices for the measurement model and structural model indicated a good fit of the model to the data: $\chi^2/df < 5.0$. The goodness of fit index (GFI), comparative fit index (CFI), normed fit index (NFI), incremental fit index (IFI), and the Tucker Lewis index (TLI) were all higher than the suggested cut-off value of 0.90 (Hair et al., 2014), while the root mean square error of approximation (RMSEA) was below the suggested cut-off level of <0.08 (Hu and Bentler, 1999).

4. RESULTS

4.1 Exploratory Factor Analysis of Digital Entrepreneurship

Exploratory factor analysis was conducted to produce factors that could adequately explain the set of variables in the dataset. The variables were grouped together based on the factor loading criteria, when shown to measure the same underlying constructed latent variable (Hair et al., 2014). The factor analysis technique of Henson and Roberts (2006) was

used to identify the factors embedded in the data. The principal axis method, based on the oblique (Promax) method, was used to explore the factors (Hair et al., 2014). This oblique rotation method is particularly useful for small samples which have a possibility for correlation between factors.

The current study was based on various dimensions of the digital entrepreneurship model. Hence, it was logical to expect correlations between the dimensions in the digital entrepreneurship model. Therefore, the oblique (Promax) rotation method was justified for use in this study.

To identify the factors, a minimum eigenvalue of 1 was chosen as the condition for factor extraction. In addition, items were allocated in a factor if their primary loading was greater than 0.5 without any overlaps between factors and their communality was >0.4.

The results for the Kaiser-Meyer-Olkin measure of sampling adequacy calculated for all dimension levels in the construct-level factor analysis had a value of 0.908, which can be considered outstanding. Barlett's test of sphericity was significant (χ^2 = 1,611.818, $p < 0.01$) indicating that correlations existed among the digital entrepreneurship categories. The total variance can be used to explain the presence of 18 items yielding four factors or dimensions, with eigenvalues greater than one and an adequate percentage of variance for each of the four identified dimensions. The total variance percentage can be used to indicate how well a particular factor accounts for what all the variables together represent. Factor analysis showed that approximately 71% of the total variance was represented by the information contained in the factor matrix, and thus the factors could accurately represent all the digital entrepreneurship attributes (Hair et al., 2014).

Table 1 shows the final rotated solution with the remaining 18 items. This shows the item loadings on the four dimensions (factors) with a factor loading greater than 0.5 extracted as a conservative criterion based on Hair et al. (2014). Based on the categorization, the dimensions and their characteristics are provided below.

Dimension 1: Digital Venturing (DEV) had 6 items loaded on Component 1, namely DE14, DE15, DE16, DE17, DE18, and DE13. This factor seemed to capture the Digital Venturing dimension of digital entrepreneurship.

Dimension 2: Digital Existence Autonomy (DEA) had 4 items loaded on Component 2, namely DE10, DE11, DE9, and DE12. This factor seemed to capture the Digital Existence Autonomy dimension of digital entrepreneurship.

Dimension 3: Digital Proactive Competition (DEC) had 4 items loaded on Component 3, namely DE2, DE3, DE7, and DE8. This factor seemed to capture. the Digital Proactive Competition dimension of digital entrepreneurship.

Dimension 4: Digital Research and Development (DER) had 2 items

Table 1 Pattern matrix with oblique (Promax) rotation for the four factors and Cronbach's Alpha

Item	Factor				Cronbach's
	1	2	3	4	Alpha
(DE14) New business venture 2	0.980				0.945
(DE15) New business venture 3	0.940				
(DE16) Self-renewal 1	0.915				
(DE17) Self-renewal 2	0.747				
(DE18) Self-renewal 3	0.676				
(De13) New business venture 1	0.530				
(DE6) Risk-taking 3					
(DE10) Autonomy 1		0.838			0.893
(DE11) Autonomy 2		0.765			
(DE9) Competitive aggressiveness 3		0.673			
(DE12) Autonomy 3		0.635			
(DE2) Pro-activeness 2			0.959		0.877
(DE3) Pro-activeness 3			0.924		
(DE7) Competitive aggressiveness 1			0.556		
(DE8) Competitive aggressiveness 2			0.520		
(DE1) Pro-activeness 1				0.918	0.820
(DE4) Risk-taking 1				0.626	
(DE5) Risk-taking 2					

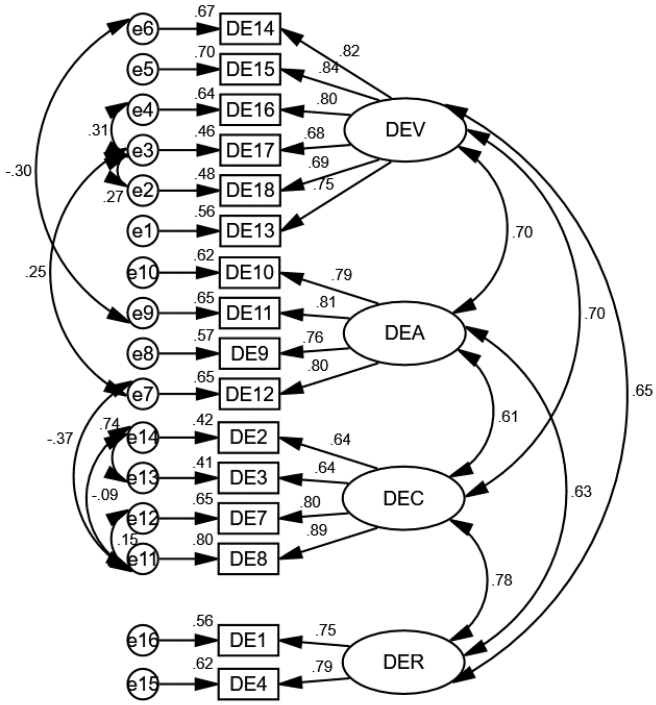
Extraction Method: Principal Axis Factoring
Rotation Method: Promax with Kaiser Normalization

loaded on Component 4; these were DE1 and DE4. This factor seemed to capture the Digital Research and Development dimension of digital entrepreneurship.

4.2 Confirmatory Factor Analysis of the Digital Entrepreneurship Measurement Model

After identifying the four dimensions of digital entrepreneurship through the exploratory factor analysis, the next stage confirmed the digital entrepreneurship measurement model. An SEM analysis was applied using AMOS 22 for the confirmatory factor analysis.

Figure 2 shows that the digital entrepreneurship measurement model provided a satisfactory model fit of the data: χ^2/df = 2.372; RMSEA = 0.079; GFI = 0.900; CFI = 0.946; NFI = 0.912; IFI = 0.947; and TLI = 0.928. In addition, all indicators loaded



Chi-square = 213.472, df = 90, P-value = 0.000, RMSEA = 0.079, GFI = 0.900
Figure 2 Digital entrepreneurship measurement model

Table 2 Results of Digital Entrepreneurship Measurement Model With Reliability and Validity

Di-Mension	Item	Mean (SD)	Factor Loading	t value	Sig	R^2	AVE	CR	Cronbach's Alpha
DEV		5.43 (1.000)					0.585	0.893	0.945
	DE14	5.48 (1.208)	0.817	12.112	0.000***	0.668			
	DE15	5.34 (1.328)	0.839	12.711	0.000***	0.704			
	DE16	5.53 (1.094)	0.803	11.640	0.000***	0.645			
	DE17	5.36 (1.160)	0.676	9.773	0.000***	0.457			
	DE18	5.65 (1.066)	0.691	10.160	0.000***	0.477			
	DE13	5.21 (1.238)	0.746			0.556			
DEA		5.71 (0.913)					0.623	0.869	0.877
	DE10	5.81 (1.073)	0.791	12.641	0.000***	0.625			
	DE11	5.55 (1.168)	0.805	13.000	0.000***	0.649			
	DE9	5.80 (1.059)	0.756	11.854	0.000***	0.572			
	DE12	5.69 (0.997)	0.805			0.648			
DEC		5.04 (1.137)					0.566	0.836	0.893
	DE2	4.69 (1.471)	0.644	8.480	0.000***	0.415			
	DE3	4.70 (1.335)	0.639	9.033	0.000***	0.408			
	DE7	5.48 (1.228)	0.803	14.610	0.000***	0.645			
	DE8	5.28 (1.262)	0.893			0.797			
DER		5.56 (0.981)					0.589	0.742	0.820
	DE1	5.75 (1.055)	0.747	9.731	0.000***	0.559			
	DE4	5.54 (1.147)	0.788			0.620			

significantly on the digital entrepreneurship latent construct. The values of the fit indices indicated a reasonable fit of the measurement model with the data (Hu and Bentler, 1999; Hair et al., 2014). The measurement model confirmed the four-dimension structure of the digital entrepreneurship instrument.

The reliability of the constructs was assessed using the Cronbach's alpha coefficient and composite reliability. The Cronbach's alpha coefficients for all constructs showed satisfactory levels with alpha values > 0.70 and ranging from 0.820 to 0.945, all of which were acceptable and showed that the instrument was reliable (Nunnally and Bernstein, 1994). The composite reliability (CR) of all the constructs was greater than 0.70 and ranged from 0.742 to 0.893; these results confirmed that the constructs all had satisfactory reliability (Carmines and Zeller, 1988).

Convergent validity was used to assess the degree to which measures of the same concepts were correlated (Hair et al., 2014). Table 2 shows that all indicators had significant ($p < 0.001$) factor loadings greater than 0.60 and ranging from 0.639 to 0.893 under their respective constructs (Hair et al., 2014). Similarly, the t-values for all the items were >2, providing strong evidence of convergent validity (Anderson and Gerbing, 1988). The average variance extracted (AVE) for all constructs was ≥ 0.5 and ranged from 0.566 to 0.623 which is acceptable (Fornell and Larcker, 1981) and suggests the constructs had sufficient convergent validity.

Conclusions regarding the dimensions and meanings revealed in the analysis of the digital entrepreneurship measurement model development are summarized below.

Digital Entrepreneurship (DE) describes the capability of the entrepreneur in creating and finding new business opportunities, changing performance strategies, and having the ability to make decisions freely in operations to achieve required goals. DE involves conforming to the current context of digital technology progression in developing new products and services and being able to effectively enter competitive markets to maintain the business in the current environment which is constantly changing due to digital technology progression. It includes 4 dimensions:

Digital venturing (DEV) involves the adjustment of business running concepts in line with digital technology and adjusting the organization's structure, along with changing the performance strategy in order to seek new opportunities to enter the market with the development of new products or services according to the customer needs which are constantly changing due to digital technology progression. This may require splitting into business sub-units or investing in a new business within the same organization.

Digital Existence Autonomy (DEA) describes the deeds of individuals or teams which are carried out freely using digital technology which improves the team's ability to

present concepts or visions. This dimension also encompasses the freedom to act or make decisions toward the achievement of goals by dedicating resources necessary for the development of digital technological products and services. Such autonomy can help a company to survive in a highly competitive market.

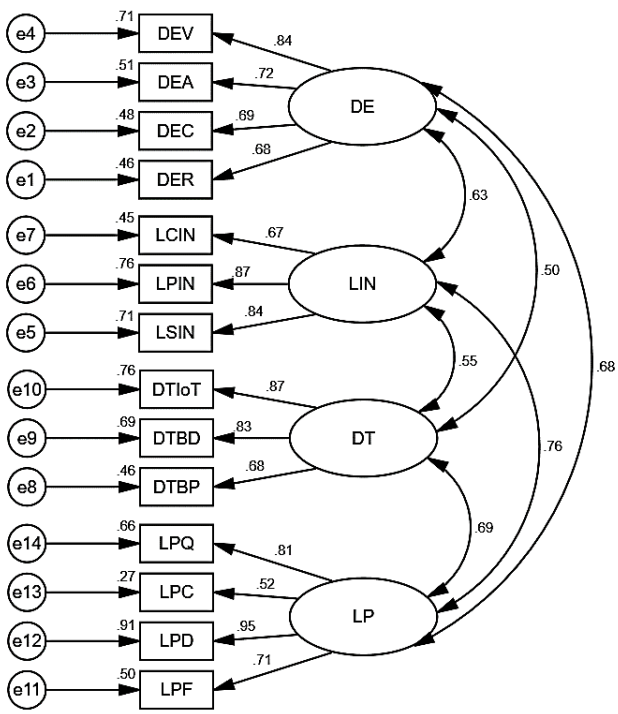
Digital Proactive Competition (DEC) refers to the initiation of management or operations, making the organization the first to successfully present new products or services, entering the market before competitors in a highly competitive business environment through the use of digital technology.

Digital Research and Development (DER) is the development of products and services according to new customer needs arising from digital technology progression; it is based on the support of concepts and use of research results in the development of digital technological products or services.

4.3 Structural Path Model and Hypotheses Testing

4.3.1 Measurement Model

SEM was applied to estimate the conceptual model based on sample 2



Chi-square = 169.776, df = 71, P-value = 0.000, RMSEA = 0.079, GFI = 0.905

Figure 3 Measurement model

Table 3 CFA Results Including Reliability and Validity of the Measurement Model

Cons-truct	Dimen-sion	Mean (SD)	Factor Load-ing	t value	Sig	R^2	AVE	CR	Cron-bach's Alpha
DE		5.43 (0.836)					0.543	0.825	0.926
	DEV	5.43 (1.000)	0.843	9.841	0.000***	0.711			
	DEC	5.04 (1.137)	0.695	9.234	0.000***	0.482			
	DEA	5.71 (0.913)	0.715	9.177	0.000***	0.512			
	DER	5.56 (0.981)	0.684		0.000***	0.465			
LIN		5.50 (0.827)					0.640	0.840	0.901
	LCIN	5.45 (0.932)	0.673	10.376	0.000***	0.454			
	LPIN	5.55 (0.924)	0.871	14.662	0.000***	0.759			
	LSIN	5.49 (0.955)	0.841		0.000***	0.707			
DT		5.02 (0.932)					0.637	0.839	0.895
	DTIoT	5.02 (0.977)	0.869	10.432	0.000***	0.756			
	DTBD	4.98 (1.084)	0.833	10.452	0.000***	0.695			
	DTBP	5.06 (1.201)	0.680		0.000***	0.463			
LP		5.34 (0.750)					0.584	0.843	0.896
	LPQ	5.48 (0.990)	0.834	11.469	0.000***	0.663			
	LPC	5.01(1.075)	0.517	7.372	0.000***	0.267			
	LPD	5.48 (0.849)	0.926	13.102	0.000***	0.906			
	LPF	5.36 (0.981)	0.752			0.500			

(n=222), first to test the measurement model, and then the structural path model. The measurement models of the four constructs—Digital Entrepreneurship (DE), Logistics Innovation (LIN), Digital Transformation (DT), and Logistics Performance (LP)—were assessed through confirmatory factor analysis (CFA). Figure 3 shows that the CFA confirmed the measurement model of the theoretical constructs with the final model fit indices being: χ^2/df = 2.391, RMSEA = 0.079, GFI = 0.905, CFI = 0.942, NFI = 0.905, IFI = 0.942, and TLI = 0.925. The details of the factor loadings and t-values from the CFA are presented in Table 3.

The reliability of the constructs was assessed using a Cronbach's Alpha coefficient and composite reliability analysis. The Cronbach's Alpha for all the constructs showed satisfactory levels (>0.70 and ranging from 0.895 to 0.926) showing that the instrument was reliable (Nunnally and Bernstein, 1994). The CR of all constructs was >0.70 and ranged from 0.825 to 0.877; these results confirmed that all constructs had satisfactory reliability (Carmines and Zeller, 1988).

Convergent validity assesses the degree to which measures of the same concepts are correlated (Hair et al., 2014). Table 3 shows that all indicators had significant ($p < 0.001$) factor loadings greater than 0.50 (ranging from 0.517 to 0.952) under their respective constructs (Hair et al., 2014). Similarly, the t-values for all items were >2, providing strong evidence of convergent validity (Anderson and Gerbing, 1988). The AVE of all constructs was ≥ 0.5 and ranged from 0.543 to 0.640 which is

known to be acceptable (Fornell and Larcker, 1981) and suggests the constructs have sufficient convergent validity.

Discriminant validity was estimated to show the extent to which each construct was truly distinct from the other constructs (Hair et al., 2014). Table 4 shows the results for discriminant validity, assessed by ensuring that the square root of each AVE value was greater than the absolute correlation value between that construct and other constructs; this procedure established that discriminant validity existed for each of the four constructs according to the work of Fornell and Larcker (1981).

4.3.2 Structural Path Model

SEM was performed to test the study hypotheses. Figure 4 indicates that the structural model resulted in an overall acceptable fit with χ^2/df = 2.391, RMSEA = 0.079, GFI = 0.905, CFI = 0.942, NFI = 0.905, IFI = 0.942, and TLI = 0.925. All the goodness-of-fit indices were above the recommended cut-off points. The results of hypotheses testing is shown in Table 5.

4.3.3 Hypotheses Testing

Examination of the standardized parameter estimates (Table 5 and Figure 4) showed that digital entrepreneurship (DE) has a significant positive influence on logistics innovation (LIN) ($\gamma = 0.635$, $p < 0.01$), digital transformation (DT) ($\gamma = 0.252$, $p < 0.05$), and logistics performance (LP) ($\gamma = 0.244$, $p < 0.01$). Therefore, hypotheses H1, H2, and H3 are supported. The results also reveal that digital entrepreneurship (DE) has an indirect effect on digital transformation through logistics innovation (IE = 0.250, $p < 0.05$) and an indirect effect on logistics performance through logistics innovation and digital transformation (IE = 0.433, $p < 0.01$). Logistics innovation (LIN) is positively and significantly related to both digital transformation (DT) ($\beta = 0.394$, $p < 0.01$) and logistics performance (LP) ($\beta = 0.418$, $p < 0.001$). Therefore, hypotheses H4 and H5 are supported. The results also show an indirect effect of logistics innovation on logistics performance through digital transformation (IE = 0.132, $p < 0.5$). Finally, digital transformation (DT) had a significant positive influence on logistics performance (LP) ($\beta = 0.335$, $p < 0.001$). Therefore, hypothesis H6 is also supported. Globally, the model explains logistics innovation and digital transformation well (R^2 = 0.403 and R^2 = 0.345 respectively), while logistics performance is explained very well (R^2 = 0.713).

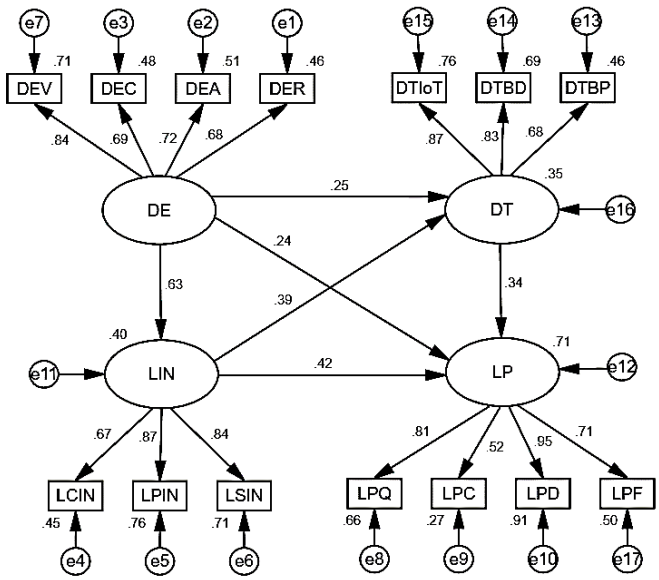
Table 4 Discriminant Validity

Constructs	CR	AVE	DE	LIN	DT	LP
DE	0.825	0.543	0.737			
LIN	0.840	0.640	0.637	0.800		
DT	0.839	0.639	0.502	0.554	0.798	
LP	0.843	0.584	0.677	0.758	0.689	0.764

Table 5 Results of The Structural Path Model (direct, indirect, and total effects)

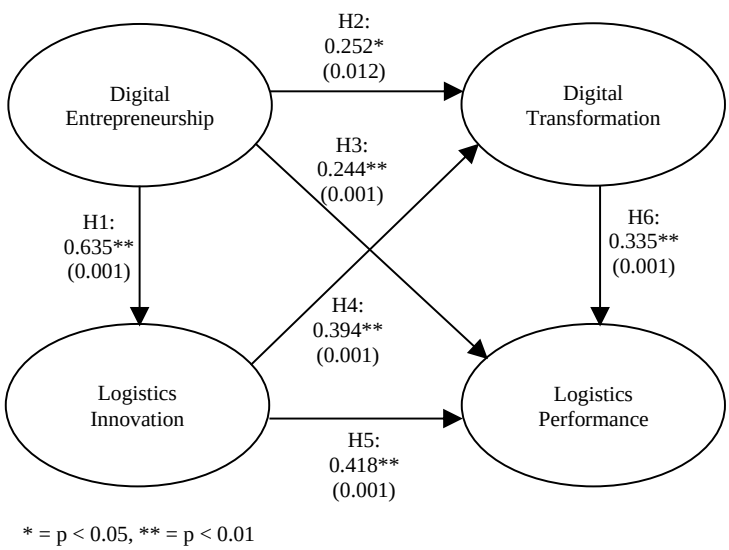
	DE			LIN			DT			R^2
	DE	IE	TE	DE	IE	TE	DE	IE	TE	
LIN	0.635**	-	0.635**							0.403
DT	0.252*	0.250*	0.502**	0.394**	-	0.394**				0.345
LP	0.244**	0.433**	0.677**	0.418**	0.132*	0.550**	0.335**	-	0.335**	0.713

Note: * = p < 0.05, ** = p < 0.01



Chi-square = 169.776, df = 71, P-value = 0.000, RMSEA = 0.079, GFI = 0.905

Figure 4 Structural model with path coefficient estimates



* = p < 0.05, ** = p < 0.01

Figure 5 Hypotheses Testing

Table 6 Results of Hypotheses Testing

	Hypothesis path	Std. path coefficients	t value	p value	Result
H1	Digital Entrepreneurship → Logistics Innovation	0.635**	6.535	0.001	Accepted
H2	Digital Entrepreneurship → Digital Transformation	0.252*	2.523	0.012	Accepted
H3	Digital Entrepreneurship → Logistics Performance	0.244**	3.311	0.001	Accepted
H4	Logistics innovation → Digital Transformation	0.394**	3.791	0.001	Accepted
H5	Logistics innovation → Logistics Performance	0.418**	5.199	0.001	Accepted
H6	Digital Transformation → Logistics Performance	0.335**	4.868	0.001	Accepted

* = $p < 0.05$, ** = $p < 0.01$

5. CONCLUSION

The development of the Digital Entrepreneurship variable indicator model using an Exploratory Factor Analysis identified 4 new Digital Entrepreneurship dimensions: (1) Digital Venturing (2) Digital Proactive Competition (3) Digital Existence Autonomy, and (4) Digital Research and Development. This differed from other studies of Digital Entrepreneurship which explain the phenomenon through technological assets, such as the internet, information technology, and communication (Le Dinh et al., 2018). The current study presented Digital Entrepreneurship as characteristics of a business, from the capabilities of the business establishment, through to maintaining the business via digital technology progression, as well as through being a leader in changing to digital technology with a strategic concept to invest in new business models. A logistics business entrepreneur must confront the situation of a changing business model, in order to implement and respond to digital technology progression.

Hypothesis H1: The research found that Digital Entrepreneurship has a significant positive influence on Logistics Innovation at the 0.01 confidence level. This shows that Digital Entrepreneurship has a crucial role in logistics activities, conforming to the results reported by Cui et al., (2012). Entrepreneurs are the creators of new innovations, both through designing new products, and in providing new logistics services to customers. Furthermore, entrepreneurs are able to create competitive advantages, for example by marketing new equipment from company research and development, reducing material loss in the production process, and reducing the ready-made material ratio (Tuan, 2017). Digital Entrepreneurs also demonstrate offensive performance in

developing product innovations and supporting logistics process innovations (Tuan, 2017).

Hypothesis H2: The results showed that Digital Entrepreneurship has a significant positive influence on Digital Transformation (DT) at the 0.05 confidence level. Because entrepreneurs are important components in creating a Digital Ecosystem, they should analyze changes in conducting business to have a more digital focus which leads to serious change in the company (Hu et al., 2016). Now, the logistics entrepreneur can implement technological change in the digital age, as the original form of logistics business transportation is now being threatened by new forms of transportation such as autonomous vehicles, drones, and robots (Hofmann and Osterwalder, 2017). Thus, a Digital Entrepreneur is able to respond to the digital environment and the digital technology that plays a crucial role in products and services, along with logistics business-related processes and activities. These are important factors in developing products and services, setting activity patterns, and conducting business, which include using important technological components in establishing and implementing a company's digital transformation strategies. Entrepreneurship has a positive influence on Big Data (Lin, 2016).

Hypothesis H3: The study found that Digital Entrepreneurship has a significant direct positive influence on logistics processing at the 0.01 confidence level. The entrepreneur is the leader in changing and setting operational strategies such as reducing the amount of "disposable" goods in active operation to gain advantages in periodic purchasing (the gap between P/O and its delivery), or in forecasting the oscillation of demand forms to increase flexibility in purchases and adjust for specific customers regarding sizes, components, regulations, or delivery times. This leads to an improved ability in responding to customer needs. Furthermore, such entrepreneurial decisions lead to greater efficiency in logistics services and the ability to increase the benefits of logistics outcomes (Tuan, 2017). This supports the concept of Cui et al., (2012) that Entrepreneurial Orientation elevates an organization's general and logistical outcomes.

Hypothesis H4: The study found that Logistics Innovation has a significant direct positive influence on Digital Transformation at the 0.01 confidence level. Logistics innovations and the improvement of logistics processes and activities lead to new machinery, packaging, and the use of algorithms to improve systems or processes. As the logistics ecology becomes more complex, this is an important factor in the information technology system as part of the digital technology infrastructure that plays a crucial role in accessing, analyzing, and processing data to support decisions (Gomez et al., 2015). Digital technology progression comes from the improvement of innovations used in improving the

logistics process (Grawe et al., 2009; Wang et al., 2016). In this digital age, it is necessary for logistics businesses to fortify potential logistics innovation through digital transformation.

Hypothesis H5: The study found that logistics innovation has a significant direct positive influence on Logistics Performance at the 0.01 confidence level. Logistics innovation is an important factor that affects logistics performance through creating competitive advantages and in responding to changing customer needs which occur due to technological progression (Chu et al., 2018). Innovation is necessary for producing better logistics services (Pedrosa et al., 2015) and a swift response using modern technology to increase customer satisfaction. Logistics innovation has great potential to fortify a company's outcomes and is most important in developing new channels to prepare the response to logistics activities development which can increase the effectiveness of logistics performance (Grawe et al., 2015).

Hypothesis H6: The study found that Digital Transformation has a significant direct positive influence on Logistics Performance at the 0.01 confidence level. Digital transformation includes "The Internet of Things" which is important in improving logistics performance. Important technological developments include (1) global positioning system technology, (2) sensors, and (3) artificial intelligence. Digital transformation can adjust processes so that decision making can be done automatically, with other smart equipment having the ability to capture images and share information online via the internet, helping to increase an organization's efficiency (De Vass et al., 2018). Internet of Things technology leads to large amounts of data being readily available; this is the so-called "Big Data". In the context of logistics activities, Big Data is used for analyzing data to plan logistics activities. Deep analysis of this data leads to more effective management. Big Data has a positive influence on supply chain performance (Lin, 2016), including the "Platform Business Model" researched by Cenamor et al., (2019) which found that SMEs could improve their performance through digital platforms. Not only does this change the industrial model but also the resources and potential of organizations.

6. SUGGESTIONS

1. This research developed knowledge in Digital Entrepreneurship based on Exploratory Factor Analysis. The results identified 4 new dimensions which are appropriate indicators of Digital Entrepreneurship: (1) Digital Venturing (2) Digital Proactive Competition (3) Digital Existence Autonomy, and (4) Digital Research and Development. This shows that Digital Entrepreneurship is involved in many processes, from business establishment through to maintaining a business through continuous

technological change. These 4 dimensions of Digital Entrepreneurship can be used in studies of other industries where digital technology plays a role. Studies of developing Digital Entrepreneurship using these 4 dimensions can increase a company's ability to compete in the digital age. This involves authorizing strategic and tactical level staff members with freedom to increase active organizational strategy when the market mechanism and customer needs change (Mintzberg and Waters, 1985) according to digital technology progression. Entrepreneurial skill is a human resource and creates organizational culture that can drive a company to use innovation to create new value in logistics (Witkowski, 2017), by dedicating resources to the research and development of new products and services for the market, in order to meet the changing needs of customers in the digital economy age.

2. The components and indicator models of this study were developed from the literature review. The data collection and analysis of the results conformed to the empirical data collected from logistics businesses. This information should be compared to other industries where logistics performance is an important factor for the organization in terms of creating a competitive advantage. Specific industries that are driving Thailand's economic development include agriculture, food, and tourism.

3. Logistics entrepreneurs should continuously support and develop logistics innovation. A company should support its personnel to participate in communication and logistics innovation-developing activities with colleagues, suppliers, customers, and related service providers. This includes coordinating and gathering knowledge and suggestions and using newly gained knowledge alongside prior knowledge to improve the process of logistics service provision and to develop logistics innovation. In fact, most companies have no research and innovation development department or even an authorized person for developing new methods in logistics activities. Suggested performance evaluation includes setting guidelines for innovations in operation and participation, or opinion gathering. Employee suggestions regarding what has and has not produced good results can be collected through workload evaluations in various positions, such as salespeople, logistics, and distribution staff (Grawe et al., 2011). Improving and developing methods to create logistics innovation in the organization can also be done (Witkowski, 2017) as follows:

3.1 Continuously controlling the quality of activities and prioritizing performance verification to continuously improve by having an innovation working team with genuine responsibility for the job.

3.2 Prioritizing the team's performance using successful practice guidelines and sharing those values with other teams or personnel in the organization.

3.3 Reinforcing new and better methods for seeking activities in

logistics performance.

3.4 Creating satisfaction by working honestly with customers and discarding old habits that obstructed transformation in logistics activities.

4. The results also suggest that logistics entrepreneurs should urgently plan strategies for digital transformation of their organizations. The results of this research showed that digital transformation is an influential factor in logistics performance. This includes adjusting a company's strategic thinking in planning every dimension of their digital transformation strategic plan, covering customers, competition, data, innovation, and digital-focused value (Schallmo and Williams, 2018), with this plan created on the basis of digital technology (Nwankpa and Roumani, 2016).

REFERENCES

Arvis, J. F., Saslavsky, D., Ojala, L., Shepherd, B., Busch, C., and Raj, A. (2014). Connecting to compete 2014. In: Trade Logistics in the Global Economy: The Logistics Performance Index and Its Indicators. *The World Bank 2014*. Retrieved from http://www.worldbank.org/content/dam/Worldbank/document/Trade/LPI2014.pdf, November 2nd, 2018.

Carmines, E. G. and Zeller, R. A. (1980). *Reliability and Validity Assessment*. London: SAGE Publications.

Cenamor, J., Parida, V., and Wincent, J. (2019). How Entrepreneurial SMEs Compete Through Digital Platforms: The Roles of Digital Platform Capability, Network Capability and Ambidexterity. *Journal of Business Research*, 100, 196-206. https://doi.org/10.1016/j.jbusres.2019.03.035

Chen, Y., et al. (2015). IT Capabilities and Product Innovation Performance: The Roles of Corporate Entrepreneurship and Competitive Intensity. *Information & Management*, 52, 643-657. http://dx.doi.org/10.1016/j.im.2015.05.003.

Chu, Z., et al. (2018). Logistics Service Innovation by Third Party Logistics Providers in China: Aligning Guanxi and Organization Structure. *Transportation Research Part E*, 118, 291-307. https://doi.org/10.1016/j.tre.2018.08.007.

Cui, L., Su, S. I. I., and Hertz, S. (2012). Logistics innovation in China. *Transportation Journal*, 51 (1), 98-117.

De Vass, T., Shee, H., and Miah, S. (2018). The Effect of Internet of Things on Supply Chain Integration and Performance: An Organisational Capability Perspective. *Australasian Journal of Information System*, 22, 1-29.

Fornell, C. and D. F. Larcker. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39-50.

Garcia-Morales, V. J., et al. (2014). Technological Variables and Absorptive Capacity's Influence on Performance Through Corporate Entrepreneurship. *Journal of Business Research*, 67, 1468-1477; http://dx.doi.org/10.1016/j.jbusres.2013.07.019.

Gligor, D. M. (2014). A Cross-Disciplinary Examination of Firm Orientations' Performance Outcomes: The Role of Supply Chain Flexibility. Journal of Business Logistics: *Strategic Supply Chain Research*, 34(4), 281-298. DOI: 10.1111/jbl.12071.

Gomez, M., Grand, S., and Grivas, S.G. (2015). Digitalisation in Logistics and The Role of Cloud Computing: How Cloud Computing Will Change The Game. *Logistics Innovation Technologies*, 2, 4-7.

Grawe, S. J. (2009). Logistics Innovation: A Conceptual-Based Framework. *The International Journal of Logistics Management*, 20(3), 360–377.

Grawe, S. J., Daugherty, P. J., and Roath, A. S. (2011). Knowledge Synthesis and Innovative Logistics Processes: Enhancing Operational Flexibility and Performance. *Journal of Business Logistics*, 32(1), 69-80.

Grawe, S. J., Daugherty, P. J., and Ralston, P. M. (2015). Enhancing Dyadic Performance Through Boundary Spanners and Innovation:An Assessment of Service Provider Customer Relationship. *Journal of Business Logistics*, 36(1), 88-101.

Hair, J. F., Jr., Black, W. C., Babin, B. J.,and Anderson, R. E. (2014). *Multivariate data analysis*. (7th ed). Harlow: Pearson Education.

Henson, R. K. and Roberts, J. K. (2006). Use of exploratory factor analysis in published research common errors and some comment on improved practice. *Educational and Psychological Measurement*, 66, 393-416.

Hofmann E. and Osterwalder F. (2017). Third-Party Logistics Providers in the Digital Age: Towards a New Competitive Arena? *Mdpi Open Access Journal Logistics*, 2017, 1-9. doi:10.3390/logistics1020009.

Hooper, D., Coughlan, J. and Mullen, M. R. (2008). Structural Equation Modelling: Guidelines for Determining Model Fit. *Journal of Business Research Methods*, 6(1), 53-60.

Hu, L. and Bentler, P. M. (1999). Cut Off Criteria for Fit Indices in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modeling*, 6(1), 1055.

Karimi, J. and Walter, Z. (2016). Corporate Entrepreneurship, Disruptive Business Model Innovation Adoption, and Its Performance: The Case of the Newspaper Industry. *Long Range Planning*, 49, 342-360.

Kline, R. B. (2005). *Principles and Practice of Structural Equation Modeling*. (2nd ed). New York: The Guilford Press.

Le Dinh, T., Vu, M. C. and Ayayi, A. (2018). Towards a Living Lab for Promoting the Digital Entrepreneurship Process. *International Journal of Entrepreneurship*, 22 (1), 1-17.

Leuschner, R., Rogers, D. S., and Charvet, F. F. (2014). A Meta-Analysis of Supply Chain Integration and Firm Performance. *Journal Supply Chain Management*, 49, 34-57. http://dx.doi.org/10.1111/jscm.12013.

Lin, C. (2016). *Exploring Big Data Capability: Drivers and Impact on Supply Chain Performance*. (Doctor of Philosophy Dissertation). Manufacturing and Technology Management, The University of Toledo, USA.

Lumpkin, G. T., and Dess, G. G. (1996). Clarifying the Entrepreneurial Orientation Construct and Linking It to Performance. *Academy of Management Review*, 21(1), 135-172.

Mapalala, M. J. (2017). Examining the Relationship Between Entrepreneurial Orientation and Organization Performance: The Moderating Role of Organizational Learning. (Doctor of Philosophy Dissertation). *Organizational Leadership*, Regent University, USA.

Mintzberg, H. and Waters, J.A. (1985). Of strategies, deliberate, and emergent. *Strategic Management Journal*, 6(3), 257-272.

Nunnally, J. C. and Bernstein, I. H. (1994). *Psychometric Theory*. (3rd ed.). New York: McGraw-Hill.

Nwankpa, J. K., and Roumani, Y. (2016). IT Capability and Digital Transformation: A Firm Performance Perspective. *Thirty Seventh International Conference on Information System*, Dublin.

Othman, A. A., et al. (2016). The Relationship between Supply Chain Integration, Just-In-Time and Logistics Performance: A Supplier's Perspective on The Automotive Industry in Malaysia. *International Journal Supply Chain Management*, 5(1), 44-51.

Prajogo, D. I. and Sohal, A. S. (2003). The Relationship Between TQM Practices, Quality Performance and Innovation Performance: An empirical Examination. *International Journal of Quality & Reliability Management*, 20(8), 901-918. DOI: 10.1108/02656710310493625.

Rogers, D. L. (2016). *The Digital Transformation Playbook: Rethink Your Business for The Digital Age*. New York: Columbia University Press.

Rowinelli, R. J., and Hambleton, R. K. (1977). On the Use of Content Specialists in the Assessment of Criterion-Referenced Test Item Validity. *Dutch Journal for Educational Research*, 2.

Sathapongpakdee, P. (2018). Thailand Industry Outlook 2018-20: Road Freight Transportation Service. *Krungsri research*. Retrieved from https://www.krungsri.com/bank/getmedia/1c9317f7-4e4d-4e81-a2e8-abaa2f66a24d/IO_

Road_Freight_180705_EN_EX.aspx, November 2nd, 2018.

Schallmo, D. R. A., and Williams, C. A. (2018). *Digital Transformation Now! Guiding the Successful Digitalization of Your Business Model*. Switzerland: Springer.

Schönsleben, P. (2016). *Integral Logistics Management: Operations and Supply Chain Management Whithin and Across Companies*. (5th ed.). New York: CRC Press.

Shan, P., Song, M., and Ju, X. (2015). Entrepreneurial Orientation and Performance: Is Innovation Speed a Missing Link? *Journal of Business Research*, 69(1), 683-690. http://dx.doi.org/10.1016/j.jbusres.2015.08.032.

Sganzerla, C., Seixas, C., and Conti, A. (2016). Disruptive Innovation in Digital Mining. *SYMPHOS 2015 3rd International Symposium on Innovation and Technology in the Phosphate Industry*.

Silva, T.F.G et al. (2014). Logistics Cost Management: Insights on Tools and Operations. *International Journal Logistics Systems and Management*, 19(3), 329-346.

Tuan, L. T. (2017). Under Entrepreneurial Orientation, How Does Logistics Performance Active Customer Value Co-Creation Behavior? *The International Journal of Logistics Management*, 28 (2), 600-633. DOI 10.1108/IJLM-12-2015-0242.

Wang, G., et al. (2016). Big Data Analytic in Logistics and Supply Chain Management: Certain Investigations for Research and Applications. *International Journal Production Economics*, 176(2016), 98-110. http://dx.doi.org/10.1016/j.ijpe.2016.03.014.

Wang, M., Jie, F., and Abareshi, A. (2015). Evaluating Logistics Capability for Mitigation of Supply Chain Uncertainty and Risk in the Australian Courier Firms. *Asia Pacific Journal of Marketing and Logistics*, 27(3), 486-498. DOI: 10.1108/APJML-11-2014-0157

Williams, L. and E.R. O'Boyle Jr. (2008). Measurement Models for Linking Latent Variables and Indicators: A Review of Human Resource Management Research Using Parcels. *Human Resource Management Review*, 18, 233-242.

Witkowski, K. (2017). Internet of Things, Big Data, Industry 4.0 – Innovation Solutions in Logistics and Supply Chains Management. *Procedia Engineer*, 182(2017), 763-769. doi: 10.1016/j.proeng.2017.03.197

Yu, K., Cadeaux, J., and Song, H. (2016). Flexibility and Quality in Logistics and Relationship. *Industrial Marketing Management*, 62, 211-225. http://dx.doi.org/10.1016/j.indmarman.2016.09.004.

Yu, X., Nguyen B., and Chen Y. (2016). Internet of Things Capability and Alliance:

Entrepreneurial Orientation, Market Orientation and Product and Process Innovation. *Internet Research*, 25 (2), 402-434. DOI: 10.1108/IntR-10-2014-0265

Zhang, M. et al. (2019). Crowd Logistics Platform's Informative Support to Logistics Performance: Scale Development and Empirical Examination. *Sustainability 2019*, 11(2), 451. https://doi.org/10.3390/su11020451.