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Examining the drivers of competitive advantage of the international logistics industry

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Abstract

Enhancing the competitive advantage of the international logistics industry is vital for a country. While most literature addresses the competitive advantage of individual organisations from the resource-based view, relatively few studies assess various governmental influences on providing a competitive advantage to the logistics industry. Drawing on the institutional theory and resource-based view, this study empirically identifies the critical drivers that affect competitive advantage in the international logistics industry. From the initial findings and a review of the relevant literature, this study identifies infrastructure, technology, integration, and regulation as the main drivers. Empirical data were collected from 149 international logistics firms or service providers in Taiwan. The study results show that the logistics industry in Taiwan is satisfied with technology and infrastructure. Using structural equation modelling (SEM), this study finds that *regulation* and *integration* have a positive impact on the *competitive advantage* of the international logistics industry, whereas *technology* has a positive impact on *integration*. In addition, based on the results of bootstrapping analysis, *integration* has a mediating effect on the relationship between *technology* and *competitive advantage* of the international logistics industry. Theoretical, managerial, and policy implications are discussed to reinforce the competitive advantage of the international logistics industry.

Keywords: International logistics industry, Competitive advantage, Institutional theory, Resource-based view

1. Introduction

Globalisation has increased competition and affected companies' operations worldwide (Arvis et al., 2007). Both international trade and economies rely largely on the development of transport logistics. Logistics cost is a key area in international business, and it enables the movement and flow of economic transactions; as a result, logistics can be considered as a key element facilitating the sale of products and services (Banomyong et al., 2008). International delivery is mainly operated by large logistics service providers with worldwide network coverage, and the ability to handle and coordinate delivery of goods across long distances.

An island country, Taiwan relies largely on the international logistics industry to boost its international trade. In 2018, Taiwan was ranked 27th on the Logistics Performance Index among 167 countries (World Bank, 2018). Based on a report by Taiwan's Directorate-General of Budget, Accounting, and Statistics

(2015), logistics cost represents around 9% of the country's GDP. The report also stated that with the development of transport technologies, the rate of logistics cost to national GDP is decreasing to less than 10% in most developed countries. Although the rate in Taiwan is less than 10%, this report shows a significant gap in Taiwan's logistics efficiency, lagging behind Hong Kong and Singapore. Therefore, improving Taiwan's logistics efficiency and further enhancing the logistics industry's competitive advantage is a challenge to the government and policymakers.

Many studies address industrial competitive advantage, applying the resource-based view (RBV) theory, which holds that companies can obtain and strengthen their competitive advantage by allocating resources efficiently (Wernerfelt, 1984; Hitt et al., 2016; Shibin et al., 2020). Several studies empirically investigated RBV theory in certain specific industries (Yang and Lirn, 2017; Wong and Yip, 2019; Shibin et al., 2020). In addition, prior studies have also demonstrated the role of a country's government in influencing the business activities and competitive advantage of multinational corporations (Panda and Reddy, 2016; Lorentz et al., 2018).

While most studies address the competitive advantage in the international logistics industry from the perspective of RBV theory (Tai, 2013; Yu et al., 2018; Chahal et al., 2020), only a few examine the impact of government initiatives in driving competitive advantage in the international logistics industry (Peng et al., 2009; Acciaro, 2015). For instance, Tai (2013) and Yu et al. (2018) investigated the influence of procurement management capabilities, supply chain capability, and information system on competitive advantage, yet both did not consider the impact of government initiatives or regulation on competitive advantage. Competitive advantage is commonly derived from resource-based elements; however, it is also impacted by elements related to policies, as well as the institutional and legal environment (Arvis et al., 2007; Banomyong et al., 2008; Chang and Lai, 2017). Arvis et al. (2007) showed that national infrastructure and the effectiveness of policies and institutions significantly affect logistics companies' ability and global networks. A research gap is thus generated as there are limited studies addressing both RBV and institutional theory in the global logistics industry. Thus, this study generates several questions. 1. What are the key government drivers that enhance competitive advantage for the international logistics industry? 2. What are the relationships between these drivers and the logistics industry's competitive advantage? To answer these questions and to fill the research gap, this study aims to assess the crucial drivers and their impact on the industry's competitive advantage from the perspective of an international logistics service provider by applying both RBV and institutional theory.

This study is structured into six sections. Section 2 presents a review of the relevant literature and provides the theoretical and empirical foundations of work based on the RBV and institutional theories for developing the research hypotheses. Section 3 discusses the study methodology, including the questionnaire design, sampling technique, and analysis methods. Section 4 presents the results of the data analysis. Section 5 discusses the implications of theory, policy, and management. Section 6 elaborates the conclusions with contributions and limitations for future research.

2. Literature review

2.1 Theory

2.1.1 Institutional theory

Institutions refer to 'regulative, normative, and cognitive structures and activities that provide stability and meaning to social behaviour' (Scott, 1995, p. 33). Institutions have a mix of attributes, including regulations, laws, rules, norms, cultures, and ethics (Peng et al., 2009). Many studies adopted the theory of institutions to examine firm performance or competitive advantage of an organisation. For instance, Chacar et al. (2010) investigated the degree to which institutional elements in the product, financial, and labour markets affect firm performance. In the logistics industry, Wong et al. (2009) investigated the impact of institutional pressure on a Chinese container terminal operator's IT management. Acciaro (2015) addressed corporate responsibility in the port industry and applied institutional theory to explain the diversity and dynamics of corporate responsibility. Santos et al. (2016) also applied institutional theory to analyse online sustainability communication in European ports. Shibin et al. (2020) applied both institutional and resource-based view theories to analyse the competitive advantage of the Indian auto components industry using variance-based structural equation modelling (SEM).

From a country perspective, several institutional drivers have been addressed in various studies across different industries (Lu et al., 2010; Khor et al., 2016; Wong and Yip, 2019). For instance, Lu et al. (2010) identified three institutional capital factors in entrepreneurial firms, including government policies to promote favourable exports and government support for international trade fairs in both local areas and across regions; Khor et al. (2016) theorised that regulatory and ownership pressure are two factors that create institutional pressure that affects reverse logistics product disposition towards business performance. Ab Talib et al. (2016) applied both theories in a review-based paper about the impact of halal certification on logistics performance. Their results found that institutions and transportation infrastructure have a positive impact on economic performance. Wong and Yip (2019) applied institutional theory in the context of the maritime sector and analysed the relationship between institutional attributes, transportation infrastructure, and economic performance. The authors identified three factors in the maritime industry with respect to talent (training and education), customs (legal and customs), and finance (fiscal and financial services).

2.1.2 Resource-based view

The resource-based view theory conceptualises that a firm's main task is to create and sustain a competitive advantage in its resources, and ensure that the uniqueness of such an advantage is not easily obtained by other relevant companies, either directly or indirectly (Wernerfelt, 1984). The RBV assumes that firms have various physical and intangible resources that can be transformed into unique competencies. These resources are not easily transferred and duplicated and are a source of a firm's long-term competitive advantage (Helfat and Peteraf, 2003). The RBV has been applied in many studies (e.g. Yang and Lirn, 2017; Yu et al., 2018; Chahal et al., 2020). In the logistics industry, Shang and Marlow (2005) analysed the interrelationships of logistics capabilities and financial performance and found that the most important element for manufacturing companies is information-based capability. Lu (2007) explored the crucial resources and capability of container shipping companies and found that a dedicated terminal (i.e. transport infrastructure) is among the top four important resource attributes. Hazen and Byrd (2012) concluded that logistics IT has a significant impact on efficiency, effectiveness, and resiliency performance. Lyu et al. (2019a) also found that logistics infrastructure has a significantly positive effect on operational performance. From the above studies, three dimensions under the RBV, namely integration, infrastructure, and technology are considered in this research and discussed in detail in the following sub-sections.

2.2 Drivers of competitive advantage

With reviewing literatures related to the institutional theory and RBV theory, four drivers of competitive advantage in the international logistics industry are summarised, that is, regulation (Khor et al., 2016; Wong and Yip, 2019) from the institutional theory, whereas infrastructure (Karia et al., 2015; Koh et al., 2018; Lyu et al., 2019b), technology (Lai et al., 2008; Karia et al., 2015; Vlachos, 2016), and integration (Song and Panayides, 2008; Lii and Kuo, 2016; Lyu et al., 2019a) from the RBV theory. The explanation of theories, definitions of the four drivers of competitive advantage in the international logistics industry, and the research hypotheses are elaborated as follows

2.2.1 Regulation

As the international logistics industry plays a key role in linking trade internationally, regulations are important to address various issues during international trade (Chang and Lai, 2017). Regulation is a crucial driver in the logistics industry from the perspective of institutional theory. Although regulation is important to the logistics industry, several studies have explored that overlapping or unnecessary regulations should be avoided to reduce cost and time consumption (Sadovaya and Thai, 2012; Chang and Thai, 2016). Procedures for customs clearance should be simplified to enhance procedural efficiency and further improve competitive advantage (Zhang, 2002).

2.2.2 Infrastructure

Infrastructure is an important driver that facilitates competitive advantage for the international logistics industry. Puertas et al. (2014) stated that the development of logistics infrastructure improves firm performance. Bensassi et al. (2015) studied the relationship between logistics infrastructure and trade through Spanish exports. They stated that the quality of logistics infrastructure, number and network of intermodal facilities, and number of logistics service providers are key factors that improve international competitive advantage. Several studies also identified logistics infrastructure as a logistics resource from the RBV theory (e. g. Karia et al., 2015; Koh et al., 2018; Lyu et al., 2019b). Specifically, infrastructure for international logistics consists of facilities such as airports and seaports.

2.2.3 Technology

Technology plays an important role in contemporary logistics operations. In this research, technology includes advanced machinery technology and IT that are applied in the logistics industry. Various technologies have been widely used in the logistics industry. For example, IT can transfer data and information in a more secure, efficient, and low-cost manner using tools such as a decision-support system (DSS), electronic data interchange (EDI), radio frequency identification (RFID), blockchain, and big data. Automated technology, such as autonomous vehicles, automated/smart ports, and drones can significantly reduce labour cost and the risk of human error (Sah et al., 2020; Chang et al., 2021). As the cost of using advanced technology decreases, logistics managers can manage information at a lower cost with increased coordination in logistics activities, and thus enhance service quality by offering real-time information, quicker responses, and better service to customers (Kubasáková et al., 2014). Several studies also explored technology from the RBV theory such as Lai et al. (2008) in third-party logistics providers, Karia et al. (2015) in Halal logistics, and Vlachos (2016) in the reverse logistics industry.

2.2.4 Integration

From a supply chain perspective, integration can be defined as 'the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organisation processes' (Flynn et al., 2010, p.59). Song and Panayides (2008) addressed the importance of integration between ports and terminals in a supply chain. Among the factors influencing port/terminal integration, 'relationship with a shipping line' had the highest mean, followed by 'use of technology', 'value added services', 'integration of transport modes', and 'channel integration practices and performance'. Lii and Kuo (2016) addressed the role of innovation-oriented supply chain integration, which includes supplier integration, internal integration, and customer integration. Lyu et al. (2019a) examined the relationship between two types of resources (i.e. platforms and locations) with logistics parks in China and found that platforms are tangible resources involving explicit knowledge. In addition to emphasising the importance of resource integration because resources should be well-allocated, they maximised resource function to improve the operational performance of logistics parks.

2.3 Competitive advantage

In the logistics industry, identifying a firm's competitive advantage is vital for the sustainable profitability and competitive advantage of logistics service providers (LSPs). Recently, some researchers attempted to identify competitive advantages from several perspectives. Liu et al. (2015) indicated that LSPs' competitive advantages include corporate capabilities, corporate resources, and dynamic mechanism. Among these three factors, corporate capabilities and corporate resources influence the development of competitive advantage much more. Karia and Wong (2013) revealed that LSPs achieve competitive advantage when they reconfigure and bundle their resources and capabilities with knowledge resources. However, not all LSPs manage to incorporate knowledge resources into their corporate strategy and perform financially well (Karia and Wong, 2010). Sandberg and Abrahamsson (2011) elaborated that sustainable competitive advantage is generated based on a combination of efficient and effective logistics operations and well-functioning, adjusted, in-house-developed IT systems.

In addition, some researchers discussed competitive advantage using a resource-based perspective, as mentioned earlier. However, the recent development of RBV into dynamic capabilities has so far received little attention in logistics literature (Esper et al., 2007); therefore, a more comprehensive perspective of how logistics capabilities are linked to sustainable competitive advantage is missing. In this research, institutional theory is applied to discuss the competitive advantages of LSPs with RBV.

2.4 Research hypotheses

Regulation is considered an important driver in the institutional theory, and infrastructure, technology, and integration are recognised as critical determinants of the logistics industry's competitive advantage based on the RBV theory. Therefore, this study further discusses the relationships between these four drivers and their impact on the logistics industry's competitive advantage.

2.4.1 Impact of regulation on the logistics industry's competitive advantage

Industrial regulation or policy has been widely recognised as a method for achieving and preserving international competitiveness across industries (Haar, 2014; Chang and Lai, 2017). Lall (2004) reviewed the role of government policy in developing countries for building industrial competitive advantage. For international trade, simplifying and automating the procedures for customs clearance can significantly enhance industrial competitiveness, as it brings several benefits to stockholders, such as cost and time saving and less number of errors. Many studies support this view (e.g. Libby, 2011; Ekici et al., 2016). Chang and Lai (2017) investigated logistics policy in Taiwan and the UK and found regulation as one of the important drivers of logistics policies. Therefore, this study proposes the following hypothesis:

- H_1: Regulation has a positive effect on competitive advantage in the transport logistics industry.

2.4.2 Impact of integration on the logistics industry's competitive advantage

Song and Panayides (2008) examined the importance of coordination between ports and terminals in a supply chain, as well as for achieving competitive advantage. Lii and Kuo (2016) addressed the impact of innovation-oriented supply chain integration on competitive advantage, and the results showed that all three supply chain integrations have a positive impact on combinative competitive capabilities. Lyu et al. (2019a) analysed the relationship between logistics platform, logistics location, resource integration, and operational performance. The result also showed that resource integration has a positive impact on operational performance, and this is supported by Chang and Lai (2017), Naway and Rahmat (2019) and Chahal et al. (2020). Therefore, this study proposes the following hypothesis under the attribute of integration as follows:

- H_2: Integration has a positive effect on competitive advantage in the transport logistics industry.

2.4.3 Impact of technology on the logistics industry's competitive advantage

Gunasekaran et al. (2017) conducted a comprehensive literature review based on 100 papers published during the last decade and proposed a model with three elements (adaptation, alignment, and agility) that emphasised the importance of IT to the competitive advantage of supply chains. Chang and Lai (2017) stated that by using IT, logistics companies can promptly respond to market changes and customer demand, and further enhance their competitive advantage. Oláh et al. (2018) addressed the influence of IT development on LSPs in Hungary and found that IT development yields a competitive advantage and better financial results. Several papers also premised that technology has a significantly positive impact on third-party logistics providers (Lai et al., 2008), web-based direct procurement systems (Tai, 2013), and the port sector (Saragiotis, 2019). Therefore, this study proposes the following hypothesis:

- H_3: Technology has a positive effect on competitive advantage in the transport logistics industry.

2.4.4 Impact of technology on integration

Technology, especially IT, enables logistics integration in supply chain management. For instance, Prajogo and Olhager (2012) stated that many logistics activities, such as inventory control, delivery status, and production planning and scheduling, can be integrated with an effective IT system. They also argued that IT improves the capabilities of forecasting and scheduling between companies and their supply chain partners, thus improving their inter-organisational coordination. Soliman and Youssef (2001) also articulated that IT can effectively and efficiently integrate supply chain partners. Omoruyi (2018) investigated the impact of IT on logistics integration and delivery reliability across small- and medium- enterprises in South Africa and found that IT has a positive and significant effect on logistics integration. This is also supported by Oláh et al. (2018). Therefore, this study proposes the following hypothesis:

- H_4: Technology has a positive effect on logistics integration.

2.4.5 Impact of infrastructure on competitive advantage

Porter (1990) stated that one of the key factors to enhance the competitive advantage of a country's industry is infrastructure. Cervero (2009) addressed transport infrastructure and global competitive advantage and states that 'transport infrastructure is critical to the competitive advantage of cities and regions in the global marketplace'. Palei (2015) assessed the influence of infrastructure, such as roads and railway, air transport, and electricity supply, on national competitive advantage. Palei also stated that national competitive advantage can be enhanced through effective infrastructure management. Ekici et al. (2016) investigated Turkey's logistics performance and argued that there is a close relationship between competitive advantage and logistics performance. Several studies have addressed the impact of infrastructure on competitive advantage in the maritime industry. For example, Aronietis et al. (2010) organised several studies and found that port infrastructure is one of the key factors that influences a shipper's port choice decision. Nguyen et al. (2016) analysed the impact of logistics infrastructure on the competitive advantage of terminals in Northern Vietnam. Parola et al. (2017) reviewed 20 years of studies related to port competitive advantage and argued that infrastructure is a key driver that has a positive impact on the competitive advantage of seaports. Wong and Yip (2019) also found that transport infrastructure has a positive effect on economic performance. Therefore, this study proposes the following hypothesis under the attribute of infrastructure as follows:

- H_5: Infrastructure has a positive effect on competitive advantage in the transport logistics industry.

2.4.6 Mediation effect of integration between technology and competitive advantage

As mentioned earlier, the extant literature shows that technological inputs have a positive influence on integration, such as interoperability of different modalities and platforms (Omoruyi, 2018; Oláh et al., 2018), whereas integration positively relates to competitive advantage (Song and Panayides, 2008; Naway and Rahmat, 2019). Prajogo and Olhager (2012) proposed a framework and evidenced that IT capabilities have a significant effect on logistics integration, which also has a positive impact in gaining a competitive advantage in logistics. Accordingly, this research posits that technology has a positive effect on integration which, in turn, affects competitive advantage positively. Therefore, this study proposes the following hypothesis:

- H_6: Integration has a positive mediation effect on the relationship between technology and competitive advantage.

Figure 1 presents the proposed conceptual framework based on the above six hypotheses.

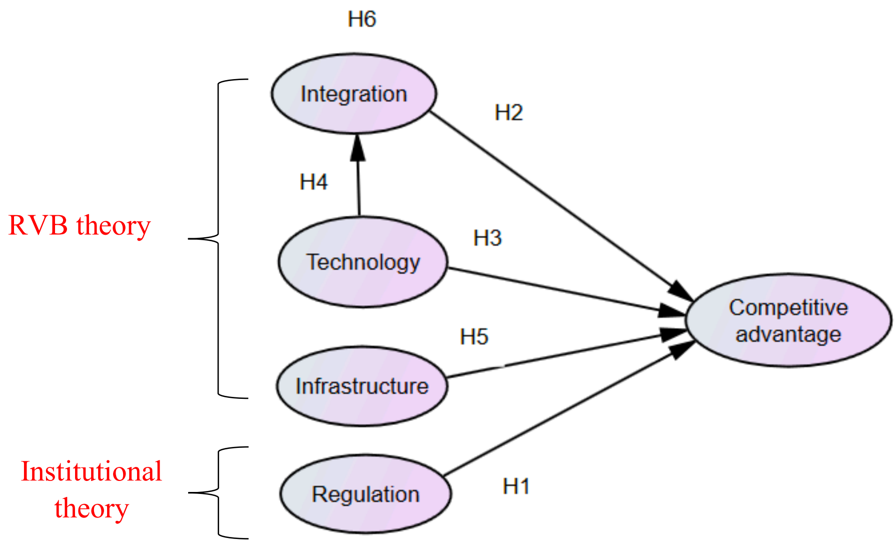

Figure 1. Conceptual framework

3. Methodology

3.1 Questionnaire development

In this study, four drivers or constructs are adopted to test the relationship with competitive advantage (dependent variable). The measurement items for each dimension are adapted mainly from existing studies (Banomyong et al., 2008; Lu et al., 2010; Lu and Lin, 2012). To ensure the questionnaire's content validity, this research conducts interviews with five logistics experts and six academic scholars pursuing logistics. A few minor modifications were made for improving the questionnaire. For example, the regulation item 'funding for research and development' was deleted because it is seldom provided to the international logistics industry, according to interviewees' comments. In addition, the infrastructure item 'rail network' was also removed from the questionnaire as Taiwan uses rail services mainly for transporting passengers. Based on the interviewees' suggestions, the final items for measuring the four drivers and competitive advantage are listed in Table 1.

The study questionnaire consists of three parts. The respondents were asked to provide their demographic information such as job position, work experience, type of business, and firm size. The second part of the questionnaire measures the four drivers of the international logistics industry in terms of satisfactory level. Competitive advantage was assessed in the final part using a five-point Likert scale from '1 = much worse' to '5 = excellent.'

3.2 Sampling

The target sample of this research comprises international LSPs based on the Association of Global Logistics in Taiwan. Specifically, the questionnaires targeted senior managers because they had more work experience in the logistics industry and can justify the four drivers and the extent of the industry's competitive advantage. The total number of international LSPs are 850 in Taiwan. This research conducted a population survey and posted 850 questionnaires. About 149 effective questionnaires were received, and the valid response rate was 17.5%. A comparison of the response rate with previous logistics related studies in Taiwan (Yang, 2012; Lin and Chang, 2018) shows that the response rate is acceptable.

3.3 Data analysis methods

This study aims to evaluate the relationship between the four dimensions and competitive advantage in Taiwan's logistics industry. To test the proposed hypotheses, the analysis was conducted using the SPSS 26 for Windows and Amos 26 statistical packages. The three main steps in the statistical analysis used in this research are described as follows:

(1) Descriptive analysis is used to summarise the respondents' background and the characteristics of the research variables with their mean and standard deviations.

(2) Confirmatory Factor Analysis (CFA) is conducted to test the reliability and validity of the proposed framework as well as the relationship between each latent dimension and the observed variables under each dimension. Several criteria are applied to investigate the goodness of the framework, including chi-square/df, goodness-of-fit (GFI), adjusted goodness-of-fit (AGFI), comparative fit index (CFI), normalised fit index (NFI), root mean residual (RMR), and root mean square error of approximation (RMSEA). These criteria have been commonly used in previous studies (e.g. Ali et al., 2020; Davis-Sramek et al., 2020). In addition, each item should have factor loading (λ) of more than 0.5, and each dimension should have composite reliability (CR) of more than 0.7 (Hair et al., 1998), and average variable extracted (AVE) of more than 0.5 (Fornell and Larcker, 1981). The equations of CR and AVE are listed in Eq (1) and Eq (2).

$$C.R. = \frac{(\sum_1^n \lambda)^2}{(\sum_1^n \lambda)^2 + \sum_1^n (1-\lambda^2)} \qquad (1)$$

$$AVE = \frac{\sum_1^n \lambda^2}{\sum_1^n \lambda^2 + \sum_1^n (1-\lambda^2)} \qquad (2)$$

where *n* is the number of items under each dimension.

(3) Structural equation modelling (SEM) is employed to verify the GFI of the research framework and describe the relationships between the construct variables. Structural equation modelling is a mature method that can assess the relationship between variables within the entire model using several linear regression equations (Lu, 2003). Compared to other relevant methods, SEM estimates 'a complete model incorporating both measurement and structural consideration' (Deng et al., 2013, p. 127).

4. Results

4.1 Background characteristics of respondents

Table 1 shows the distribution of respondents based on their background. The results of respondents' background from the descriptive analysis show that 83.9% of respondents are either managers/assistant managers or a higher level. A few respondents are directors (3.4%), clerks (6%), and sales representatives (2%). Broadly, managers make the final operational decisions; thus, the study shows reliable survey findings considering the high response rate from managers. Concerning work experience, more than 40% of the respondents have been working in the logistics industry for over 20 years, 35.6% for 11–20 years, and 24.2 % for less than 10 years. Regarding business type, 45% of respondents work in shipping agencies, followed by freight forwarders (21.5%), shipping companies (12.8%), logistics companies (9.4%), air transport/express delivery (4%), and others (7.4%). Regarding company size, 57.7% of them have fewer than 50 employees, while 30.2% and 12.1% have 51–500, and more than 501 employees, respectively.

Table 1. Distribution of respondents based on background characteristics.

	Type	Number	Per cent
Position	Vice president or above	59	39.6
	Manager/assistant manager	66	44.3
	Director	5	3.4
	Sales representative	3	2.0
	Clerk	9	6.0
	Others	7	4.7
Work experience	Less than 10 years	36	24.2
	11–20 years	53	35.6
	More than 20 years	60	40.3
Business type	Shipping agency	67	45.0
	Freight forwarders	32	21.5
	Shipping companies	19	12.8
	Logistics companies	14	9.4
	Air transport/express delivery	6	4.0
	Others	11	7.4
Company size	Fewer than 50 employees	86	57.7
	51–500 employees	45	30.2
	More than 501 employees	18	12.1

4.2 Perceptions of four dimensions and competitive advantage

Table 2 shows the results of the descriptive analysis of the characteristics of this research. According to the satisfaction level of the 12 items under the four dimensions (i.e. Integration, Technology, Infrastructure, and Regulation), the perceptions from the 149 respondents all range between neutral and high satisfaction. Among the four dimensions, the results show that Technology has the highest satisfaction (mean: 3.18), as perceived by the logistics industry in Taiwan, followed by Infrastructure (mean: 3.15), Integration (mean: 2.92), and Regulation (mean: 2.82).

Among the 12 items, the top items with mean of 3 or above include: *telecommunications* (TEC2, mean: 3.45)*, information technology system* (TEC1, mean: 3.35)*, ports and maritime transport* (INF1, mean: 3.16), and *air transport* (INF2, mean: 3.14), *Simplify the customs clearance procedures* (REG3, mean: 3.01), and *Encouragement of logistics professional qualification* (TEC4: mean: 3.00). Overall, respondents are satisfied with the technology and infrastructure in Taiwan, with the means of all items being more than 3, except *funding for logistics research and development* (TEC3, mean: 2.93), which is also very close to 3.

This apart, respondents indicate the lowest satisfaction in *avoidance of unnecessary regulation* (REG1) with a mean score of 2.67, followed by *policy to ensure efficient service operation and multiplicity of services* (REG2, mean: 2.78). Both items belong to the attribute of *Regulation;* this indicates that the logistics industry is not satisfied with the regulations and policies in Taiwan.

Regarding the level of competitive advantage in the respondents' logistics operations, the highest satisfaction attribute was *quality of service for transport users* (COM3, mean = 3.28), followed by *development of an efficient freight sector* (COM2, mean: 3.26), and *competitive advantage of your industry* (COM1, mean: 2.90). Overall, the competitive advantage in Taiwan's international logistics industry, as perceived by the respondents, is in good condition, with a mean of over 3.

Table 2. Satisfaction of respondents.

Items	Code	Mean	S.D.
Integration		2.92	
Participating in the international standardisation work of information exchange in logistics	INT1	2.95	0.76
Knowledge sharing through electronic platforms	INT2	2.91	0.76
Fostering smooth and fast integration and interoperability of different modalities	INT3	2.89	0.77
Technology		3.18	
Information technology	TEC1	3.35	0.73
Telecommunications	TEC2	3.45	0.75
Funding for logistics research and development	TEC3	2.93	0.88
Encouragement of logistics professional qualification	TEC4	3.00	0.84
Infrastructure		3.15	
Ports and maritime transport	INF1	3.16	0.81
Air transport	INF2	3.14	0.63

Regulation		2.82	
Avoidance of unnecessary regulation	REG1	2.67	0.88
Policy to ensure efficient service operation and multiplicity of services	REG2	2.78	0.92
Simplify all customs clearance procedures	REG3	3.01	0.90
Competitive advantage		3.15	
Competitive advantage of the industry	COM1	2.90	0.73
Development of an efficient freight sector	COM2	3.26	0.72
Quality of service for transport users	COM3	3.28	0.63

4.3 Reliability and validity tests

After conducting descriptive analysis, the second step is to perform CFA to confirm the structure summarised from the literature review (Figure 2). The abovementioned four dimensions and competitive advantage are listed in the proposed model and are inter-related using two-headed arrows. A total of 15 observed variables (squares in Figure 2) are loaded onto the four dimensions and competitive advantage, with three observed variables (INT1–INT3) under Integration, four (TEC1–TEC4) under Technology, two (INF1 and INF2) under infrastructure, three (REG1–REG3) under Regulation, and three (COM1–COM3) under Competitive advantage.

The results of the CFA model's goodness-of-fit show that all the indicators meet the recommended levels mentioned in Section 3.3, in which the Chi-square/df is 130.926/77 = 1.7 (less than 3), GFI is 0.910 (more than 0.9), AGFI is 0.860 (more than 0.8), NFI is 0.915 (more than 0.9), CFI is 0.962 (more than 0.9), RMR is 0.037 (less than 0.1), and RMSEA is 0.065 (less than 0.08). In addition, the model's reliability and validity are tested by CR (Eq 1) and AVE (Eq 2). Table 3 shows that all the criteria meet the recommended levels, with all CRs higher than 0.7 and all AVEs exceeding 0.5. This indicates that the structure passes the reliability and validity test. Furthermore, all the factor loadings are greater than 0.5, indicating that the relationships between each latent dimension and the observed variables under each latent dimension are all confirmed.

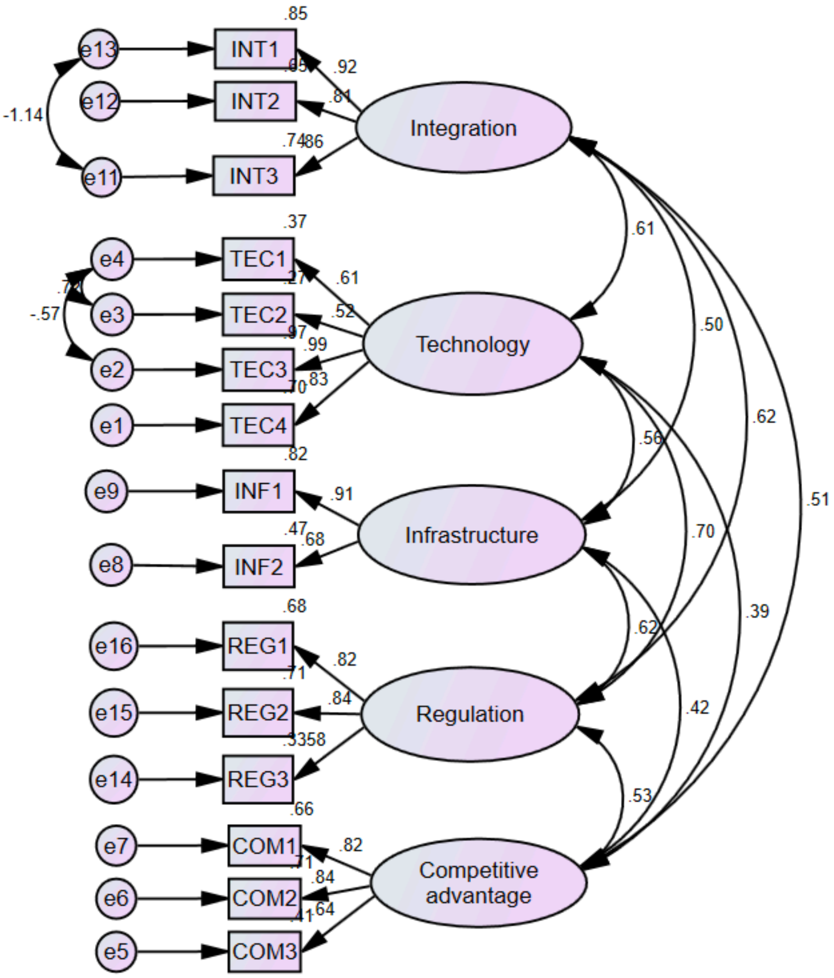

Figure 2. Confirmatory factor analysis with standardised estimates.

Table 3. Results of reliability and validity tests.

Research construct and research items	Factor loading	Composite reliability (CR)	Average variance extracted (AVE)
	Recommended level > 0.5	Recommended level > 0.7	Recommended level > 0.5
Integration		0.898	0.747
INT1	0.92		
INT2	0.81		
INT3	0.86		
Technology		0.838	0.578
TEC1	0.61		
TEC2	0.52		
TEC3	0.99		
TEC4	0.83		
Infrastructure		0.781	0.645
INF1	0.91		
INF2	0.68		

Regulation		0.796	0.571
REG1	0.82		
REG2	0.84		
REG3	0.58		
Competitive advantage		0.814	0.596
COM1	0.82		
COM2	0.84		
COM3	0.64		

4.4 Impact of the four dimensions on competitive advantage

After conducting the CFA to confirm goodness-of-fit of the structural model, the third step is to apply SEM to examine the relationship between the four dimensions and the competitive advantages in the logistics sector as well as to test the relationships proposed by the hypotheses. In the proposed model, the four dimensions are independent variables, whereas the logistics firms' competitive advantage is a dependent variable. The results of the SEM analysis are presented in Figure 3, and the fit indices of the model are presented in Table 4. All the fit indices meet the recommended levels, with the chi-square/df at 1.87, falling below the recommended level of 3.0; GFI is 0.901 and AGFI is 0.849. The rest of the indices (NFI = 0.904; CFI = 0.952; RMR = 0.047; RMSEA = 0.072) further confirmed that the model that has a good fit. The result also indicates that the proposed model can explain 88.5% of the variances and covariances.

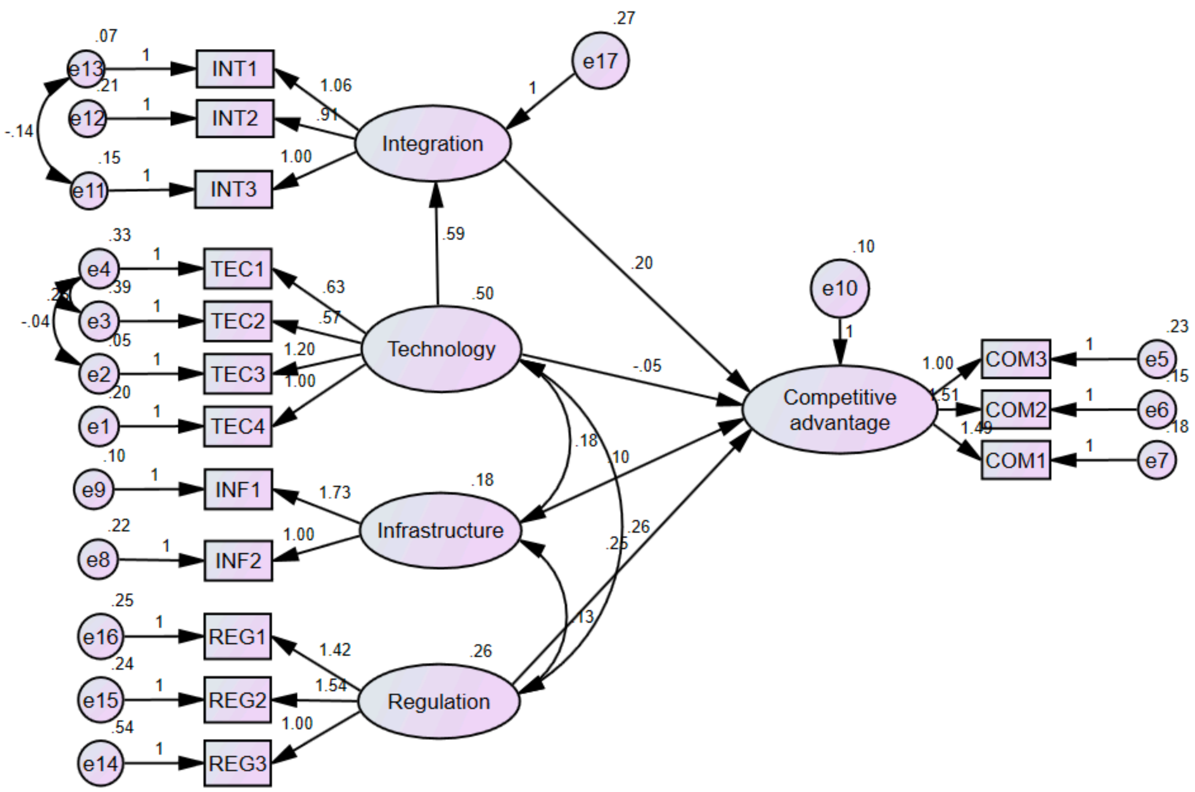

Figure 3. Results of the structural equation model.

Note: The results show unstandardised estimates based on a bootstrap analysis.

Table 4. Fit indices of the measurement model.

Measure	Recommend criteria	Structural model
Chi-square/df	≤3.0	148.015/79 = 1.87
Goodness-of-fit (GFI)	>0.9	0.901
Adjusted goodness-of-fit (AGFI)	>0.8	0.849
Normalised fit index (NFI)	>0.9	0.904
Comparative fit index (CFI)	>0.9	0.952
Root mean residual (RMR)	<0.1	0.047
Root mean square error of approximation (RMSEA)	<0.08	0.072

From Table 5, the results show that *competitive advantage* is significantly positively influenced by *Regulation* (supporting H1) and *Integration* (supporting H2), whereas *Technology* significantly positively affects *Integration* (supporting H4). However, it is interesting that *Technology* and *Infrastructure* do not have a significantly positive influence on *competitive advantage* (H3 and H5 are not supported).

Table 5. Results of structural equation modelling.

Variables/relations	Estimate	Critical ratios	P-value	Results
Competitive advantage <- Regulation	0.253	2.141	0.032**	Support H1
Competitive advantage <- Integration	0.196	3.141	0.002**	Support H2
Competitive advantage <- Technology	-0.049	-0.688	0.498	Not support H3
Integration <- Technology	0.586	8.051	***	Support H4
Competitive advantage <- Infrastructure	0.099	0.921	0.357	Not support H5

Note: Critical ratios are significant at p < 0.05 when the CR exceed 1.96.

A bootstrap analysis was conducted to investigate the mediation effect of *Integration* on *Technology* and *Competitive advantage*. The result of testing the indirect effect shows that the p-value of bias-corrected percentile method (BC) and percentile method (PC) are both less than 0.05, and the 95% confidence interval of BC and PC are both more than 0 (Table 6). This indicates that there is a significant and positive indirect effect of Integration (with an estimated value of 0.115) between Technology and Competitive advantage (supporting H6). In addition, the direct effect of Technology on Competitive advantage is not significant, with a p-value over 0.5 in both BC and PC, and the 95% confidence interval of BC and PC across 0. Consequently, the total effect on *Technology* and *Competitive advantage* is 0.115 (as direct effect is not significant), but the effect is not significant with a p-value of more than 0.05.

Table 6. Results of bootstrap analysis.

	Estimate	95%		
		BC/PC p-value	BC	PC
Indirect effect				
Technology – Integration – Competitive advantage	0.115	0.004/0.018**	0.048~0.235	0.022~0.211
Direct effect				
Technology – Competitive	-0.049	0.508/0.645	-0.255~0.126	-0.232~0.142

advantage				
Total effect				
Technology – Competitive advantage	0.115	0.536/0.488	-0.154~0.233	-0.129~0.242

Note: BC: bias-corrected percentile method. PC: percentile method.

5. Discussion

5.1 Implications

5.1.1 Theoretical implications

Institutions and resources have become crucial enablers to enhance firms' competitive advantage. The study results indicate the importance of the relationships between institutions, resources, and industrial competitive advantage in the logistics context, with several theoretical implications worthy of further discussion. Although institutional awareness has existed for many years, the importance of its contributions to industrial competitive advantage has only been addressed in recent years. This study identifies four crucial drivers from the RBV and institutional theories in the logistics sector and proposes a model investigating the relationship between the four drivers and industrial competitive advantage. Unlike Wong and Yip (2019), who use secondary data to investigate the relationship between transport infrastructure, institutions, and economic performance, this research conducts an empirical study in the logistics industry. Similar to their findings, this research finds that institutions also have a positive effect on competitive advantage in the logistics industry.

However, the study results do not support the direct impact of infrastructure and technology on the industry's competitive advantage. The results do not match previous studies such as Prajogo and Olhager (2012), Nguyen et al. (2016), Omoruyi (2018), Oláh et al. (2018), and Wong and Yip (2019). However, this does not indicate that these two drivers are not important in predicting the industry's competitive advantage. In fact, by analysing another SEM framework using only Technology, Infrastructure, and Competitive Advantage, the results showed that Technology and Infrastructure have positive and significant effects on Competitive advantage. This implies that suppression effects could occur leading to an insignificant influence of Technology and Infrastructure on Competitive advantage (Cheung and Lau, 2008).

5.1.2 Policy and managerial implications

The results of perceptions of drivers and competitive advantage show that the respondents are satisfied with logistics *Technology* and *Infrastructure* in Taiwan; telecommunications and IT systems obtained the highest and second highest satisfaction rating from the respondents, respectively. This indicates that Taiwan's government should use the advantages of these two drivers to develop its logistics industry. Meanwhile, there is still space for improvement, even in these two drivers, as they showed a mean of

3.18 and 3.15, respectively. In order to enhance the satisfaction in these two areas, it is suggested that the Taiwanese government provide some incentives to encourage logistics service providers to participate in developing these two areas. They are the actual beneficiaries of logistics *technology* and *infrastructure* in Taiwan, and they know what is needed in these two areas. Apart from this, *regulation* has the lowest satisfaction level, especially *avoidance of unnecessary regulation*. This indicates that Taiwan's government should make more effective and efficient regulations to enhance the competitive advantage of the logistics industry. This is consistent with the research findings of Sadovaya and Thai (2012) and Chang and Thai (2016).

In addition, based on the SEM analysis, the findings indicate that drivers such as *integration* and *regulation* have significantly positive effects on *competitive advantage*. This implies that policymakers should design and establish an integrated and efficient transparent legal system to improve and foster the competitive advantage of Taiwan's international logistics industry. In order to deal with the above issue, there are several potential solutions, such as simplifying and integrating procedures for customs clearance, proposing effective mechanisms for encouraging market competition to protect the market from monopolisation trends, developing the system of corporate governance to enhance transparency and security, and eradicating corruption. Despite the fact that the study findings do not support the impact of *infrastructure* and *technology* on *competitive advantage*, the results indicate that technology has an indirect effect on *competitive advantage* via *integration*. This reflects that technology, especially IT, has an impact on competitive advantage through integration. If the government can provide a platform that integrates all the information necessary for the logistics industry (known as information integration), it can perform to a better competitive advantage in today's fierce international business environment. This also supports the study of Lyu et al. (2019a).

5.2 Contribution

This study contributes in four ways to the literature on the institutional theory and RBV, and the competitive advantage of the international logistics industry. First, this research proposes that improving the resources and institutions of a country will increase the competitive advantage of the international logistics industry. Most prior research views resources and institutions as a means to increase a firm's performance, social responsibility, and increase competitive advantage by gaining access to specialised resources and institutional pressure (Wong et al., 2009; Chacar et al., 2010; Acciaro, 2015). However, the logistics industry is an international service provider. Government institutions and resource inputs are important drivers that facilitate the development of the international logistics industry.

Second, we emphasise that identifying the existing drivers of competitive advantage of the logistics industry will help to build institutions and resources for international logistics service providers. Thus, this research contributes to an emerging research stream to gain a better understanding of the critical drivers of competitive advantage. While a country has institutions and resources such as regulations, information technology (IT) systems, and infrastructure, which are theoretically grounded and empirically supported (Khor et al., 2016; Wong and Yip, 2019). However, whether this holds true with respect to competitive advantage for the logistics industry remains a question.

Third, this study differs from the previous studies on RBV and institutions, as it investigates how organisational resources, capabilities, and institutional factors affect performance or corporate responsibility (Wong et al., 2009; Acciaro, 2015). This research examines that a country's institutions and resources are positively related to the competitive advantage of the international logistics industry.

Finally, this research proposes that a country's technological system has an indirect influence on the logistics industry's competitive advantage via an integration mechanism. A growing number of studies have examined the influence of technology on firm performance (Wong et al., 2009; Hazen and Byrd, 2012; Gunasekaran et al., 2017). However, less attention has been paid to the mediating effect of integration on the relationships between technology and competitive advantage. As various types of international logistics service providers, they have encountered more technological and communication problems. We extend past institutional research by postulating the mediating role of integration to predict the impact of technology on competitive advantage.

6. Conclusions

6.1 Research findings

This study investigates the relationship of the crucial drivers from both RBV theory and institutional theory that impact the logistics industry's competitive advantage and provides suggestions for policymakers to improve competitive advantage in Taiwan's logistics industry. The literature review presents four crucial drivers from both theories: *technology*, *integration*, *regulation*, and *infrastructure*. The results from the descriptive analysis show that Taiwan's logistics industry is satisfied with drivers such as *technology* and *infrastructure* with an overall mean value of more than 3. The top satisfied items include *telecommunications* (TEC2), *information technology system* (TEC1), *ports and maritime transport* (INF1), *air transport* (INF2), *simplifies customs clearance procedures* (REG3), and *encouragement of logistics professional qualification* (TEC4).

The SEM results support several proposed hypotheses, including H1, H2, H4, and H6. Interestingly, H3 and H5 are not supported in this research, and the reasons are discussed in Section 5. Finally, some suggestions for policymakers to improve Taiwan's logistics industry's competitive advantage are also provided in Section 5.

6.2 Research limitations and suggestions for future research

There are several limitations in this study. First, this study addresses the four drivers (i.e. technology, integration, infrastructure, and regulation) from an RBV and institutional theory perspective in the logistics industry. This study proposes a conceptual framework applying both theories to investigate the link to competitive advantage in the logistics industry. Future research can consider other drivers that are also essential for the industrial competitive advantage to expand and refine the proposed framework. For instance, Peng et al. (2009) and Chacar et al. (2010) applied culture, currency stability, regional institutional impacts, ethical standards, and entrepreneurial profile from institutional theory in general market studies. Apart from that, some factors can also be considered when evaluating logistics competitive advantage such as risk management (Chu et al., 2017; Chang et al., 2019), logistics skills (Xu et al., 2012; Lin and Chang, 2018), and its impact on global economic regions (Youfang et al., 2014), etc. Second, the study's target sample focuses on Taiwan's logistics industry. As the logistics industry forms an important part of the global business, there can be various external factors from other countries that impact the proposed model, and thus generate a different and insightful discussion to address the research gaps in this area. For example, there are only two items in the driver Infrastructure, including airport and port and maritime transport. This is because Taiwan is an island country, and it would be inappropriate to include the country's railway and rail stations when addressing the international logistics industry. In fact, railway and rail stations should be considered when conducting research in continental countries. Finally, from a methodological perspective, a fuzzy analytic hierarchy process (AHP) can also be useful in evaluating the competitive advantage in the logistics industry (Singh and Sharma, 2014). In addition, this study conducts a static survey, which means the survey was conducted at one point in time. As mentioned previously, awareness regarding the importance of institutions has been increasing in recent years. A longitudinal study can further explain the changing perceptions of the institutional drivers about industrial competitive advantages over time.

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