







“Competitiveness and technological capital as determining factors of exports in small and medium-sized companies”

AUTHORS	Gladys Rueda-Barrios   Gladys Mireya Valero Cordoba  Jairo Gonzalez-Bueno  
ARTICLE INFO	Gladys Rueda-Barrios, Gladys Mireya Valero Cordoba and Jairo Gonzalez-Bueno (2023). Competitiveness and technological capital as determining factors of exports in small and medium-sized companies. <i>Problems and Perspectives in Management</i> , 21(4), 63-83. doi: 10.21511/ppm.21(4).2023.06
DOI	http://dx.doi.org/10.21511/ppm.21(4).2023.06
RELEASED ON	Tuesday, 17 October 2023
RECEIVED ON	Thursday, 04 May 2023
ACCEPTED ON	Tuesday, 12 September 2023
LICENSE	 This work is licensed under a Creative Commons Attribution 4.0 International License
JOURNAL	"Problems and Perspectives in Management"
ISSN PRINT	1727-7051
ISSN ONLINE	1810-5467
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”



NUMBER OF REFERENCES

61



NUMBER OF FIGURES

3



NUMBER OF TABLES

6

© The author(s) 2024. This publication is an open access article.



BUSINESS PERSPECTIVES



LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine
www.businessperspectives.org

Received on: 4th of May, 2023

Accepted on: 12th of September, 2023

Published on: 17th of October, 2023

© Gladys Rueda-Barrios, Gladys
Mireya Valero Cordoba, Jairo
González-Bueno, 2023

Gladys Rueda-Barrios, Ph.D., Associate
Professor, Faculty of Business
Administration, Pontifical Bolivarian
University, Colombia. (Corresponding
author)

Gladys Mireya Valero Cordoba,
Ph.D., Associate Professor, Faculty of
International Business Administration,
Pontifical Bolivarian University,
Colombia.

Jairo Gonzalez-Bueno, Ph.D.,
Full Professor, Public Accounting
Program, Autonomous University of
Bucaramanga, Colombia.



This is an Open Access article,
distributed under the terms of the
[Creative Commons Attribution 4.0
International license](https://creativecommons.org/licenses/by/4.0/), which permits
unrestricted re-use, distribution, and
reproduction in any medium, provided
the original work is properly cited.

Conflict of interest statement:

Author(s) reported no conflict of interest

Gladys Rueda-Barrios (Colombia), Gladys Mireya Valero Cordoba (Colombia),
Jairo González-Bueno (Colombia)

COMPETITIVENESS AND TECHNOLOGICAL CAPITAL AS DETERMINING FACTORS OF EXPORTS IN SMALL AND MEDIUM-SIZED COMPANIES

Abstract

This study explores international business integration, focusing on Colombian small and medium-sized enterprises (SMEs). It delves into the crucial aspects of competitiveness and technological capital influencing the export models of these SMEs. Using a questionnaire, responses were gathered from 63 Colombian SMEs exporting to 74 countries with 333 tariff positions. This analysis examines competitiveness factors like innovation, productivity, and business structure, as well as technological capital components such as R&D management, technological processes, and equipment, all tailored to the context of Colombian SMEs. The findings establish a comprehensive model elucidating direct and indirect relationships among these variables. They underscore the importance of strengthening competitiveness elements, particularly the infusion of technology into process and product innovation, alongside productivity and business structure rooted in the value derived from information technologies. Simultaneously, the study highlights the importance of nurturing employees' physical, financial, and language skills within Colombian SMEs. This study accentuates the pivotal role of investment in technological capital aspects, including research and development management, personnel, and leveraging information technology, especially within Colombian SMEs. These investments are instrumental in augmenting performance and ensuring success in the international business arena. The paper contributes to both theoretical understanding and practical applications in enhancing the international competitiveness of Colombian SMEs.

Keywords

competitiveness, technological capital, exports,
innovation, productivity, technologies, processes

JEL Classification

M11, M15, M16

INTRODUCTION

Competing effectively in the international market poses a significant challenge for Latin American countries, particularly for small businesses. According to the Latin American and Caribbean Economic System, these small enterprises constitute 99.5% of the region's business landscape and generate 61% of its employment opportunities. Surprisingly, only 10% of these small businesses partake in international trade. Aside from the macroeconomic factors and the specific regional contexts, internal factors within these companies significantly hinder their integration into the global economy and subsequently influence the performance of SME exports.

Essential components of structural competitiveness, such as the alignment of a company's internal functions with its core mission and purpose, the capacity to innovate – where technological innovation is a focal point – efficient data management through systems that facilitate informed decision-making, productive capacity to meet high-quality

standards, organizational learning, knowledge of international markets, and language proficiency, must be scrutinized within the framework of export growth and sustainability.

Identifying competitiveness factors, technological capital, and their correlation with export performance is crucial. Export performance encompasses export orientation, the types of products exported, and export capacity. Competitiveness encompasses business structure (financial, physical, and human capacity), productivity (units produced and sold, labor and inputs), and innovation (product, process, organizational, and marketing). The technological capital encompasses R&D management (collaboration networks and IT), technological endowment (machinery, equipment, information systems, and operators), and technological processes.

1. LITERATURE REVIEW AND HYPOTHESES

Competitiveness, a multifaceted concept, has been extensively studied in various domains. Porter (1985) initially defined a nation's competitiveness as its industries' ability to innovate and improve market positions. Later, Porter (2002) linked competitive advantage to a nation's overall market performance, emphasizing that the inefficiency of competitiveness often results from businesses failing to incorporate competitive advantages into their strategies. He also introduced the value chain concept, which covers all company activities to satisfy customer needs. Competitive strategies are categorized into cost leadership, differentiation, or focus, with technology playing a pivotal role.

Krugman (1994) posited that competitiveness matters less nationally, as leading countries usually do not compete directly. Modern literature views competitiveness from diverse angles. Rock (2010) highlighted that accessing competitive advantages hinges on foreign suppliers, investments, research and development (R&D), and foreign studies. Saldívar (2012) examined competitiveness from two contexts: external, linked to macroeconomics, and internal, tied to microeconomics and company management. Sosa Rodriguez and Reyes (2014) underscored that the competitiveness of export-oriented SMEs in Colima State hinges on efficient quality systems, international competitiveness, innovation, and effective marketing. SMEs often face barriers, like unfamiliarity with government policies for international market entry.

Bueno (2011) defines that technological capital encompasses intangible assets crucial for an organization's technical system. It directly influences

product attributes, efficient production processes, and knowledge accumulation for future innovations. This capital is pivotal in a firm's competitive ability to enter international markets. Several economic theories shed light on the relationship between technological capital and international trade. The Heckscher-Ohlin theory (Heckscher, 1919; Ohlin, 1933) suggests that a country's characteristics determine whether its products are labor-intensive (indicating low technological levels) or capital-intensive (indicating high technological levels). Vernon's (1966) product life cycle theory explains how the US market's size and wealth drive innovative product development, facilitated by high labor costs that encourage efficient processes. The neotechnology theory (Borkakoti, 1998) emphasizes technological disparities between countries as sources of comparative advantage in international trade. Based on these considerations, technological capital is critical to a firm's competitiveness in international markets. Economic theories provide valuable insights into the dynamic relationship between technological capital and international trade, highlighting the importance of innovation, efficiency, and knowledge accumulation for success on the global stage.

Exporting is a gradual process for companies, involving several factors. It is influenced by motivations for internationalization, internal corporate elements, the role of change agents, and a company's ability to overcome internationalization barriers (Czinkota & Ronkainen, 2002). Exportation refers to selling products or services from one country to residents of another (Hill, 2001). Companies considering internationalization must decide whether to do so through exportation, importation, or foreign investment. International operations require alignment of a company's mission,

objectives, and strategy (Daniels & Radebaugh, 2000). Four primary objectives guide internationalization: increasing sales, acquiring resources, diversifying sales and supply sources, and minimizing competitive risk. External influences related to policies, geography, values, and economic conditions affect a company's internationalizing decision. Companies must also assess the competitive landscape to gain pricing, differentiation, and capabilities advantages. This leads to a typical internationalization pattern, known as the "general pattern focused on minimizing risk" (Daniels & Radebaugh, 2000), which progresses from passive to active opportunity-seeking, external-to-internal operation management, and limited or extensive operation modes. Ultimately, a company's internationalization decision depends on its strategic vision and capacity to integrate international business into its core operations.

In light of the abovementioned considerations, contemporary companies are actively pursuing successful expansion into the international market through exports, imports, and foreign investments. Consequently, they continually assess the standards that must be incorporated to facilitate internationalization. In this sense, different organizations worldwide have carried out studies that identify critical factors of competitiveness and its relationship with the internationalization processes of companies (CONPES, 2006; Comisión Regional de Competitividad, 2016; Departamento Nacional de Planeación, 2018; Schwab, 2017). Similarly, the development of information and communications technology and other elements of the technological capital (Internet and other emerging technologies) has impacted the level of internationalization of companies, not only by the scope of these technologies in the visibility and marketing process but for optimization and development of effective internal processes to make decisions and increase the achievement of optimal results in the international market.

For the Colombian economy, internationalization and opening markets are two issues of special importance since 1991, when Colombia inserted itself into the world economy more aggressively. The internationalization process driven by the government toward world markets has become evident in the development plans Colombia has generated.

This has favored a growing foreign projection of the business sector that has focused on generating better productivity levels as a driving factor for the growth of exports. Moreover, it brought the diversification of goods and services other than the mining and energy sector, improving sanitary conditions so that products such as those from the agricultural sector have acceptance in the international market.

In 2010, as a continuation of the policy of insertion of companies in the world economy, a structural tariff reform (STR) was implemented to reduce production costs and tariff dispersion and minimize negative protections. With this measure, the average tariff fell from 12.2% in 2010 to 7.1% in 2017. The conditions of access to markets for exports were also increased through 8 new trade agreements: European Free Trade Association: Iceland, Liechtenstein, Norway, Switzerland, and Canada (2011); United States and Venezuela (2012); European Union (2013); South Korea, Costa Rica, and the Pacific Alliance (2016). Colombia had 16 current trade agreements with 62 countries in 2018. Trade agreements guarantee the permanence of preferences with these countries and stimulate foreign direct investment thanks to the legal certainty generated by these (Ministerio de Comercio, Industria y Turismo, 2018). Between 2005 and 2018, Colombian exports grew at an average annual rate of 5.4% in value and 3.9% in volume. Total imports grew at an annual average rate of 7.2% in value and 5.9% in commercial volume. The non-extractive foreign direct investment grew 5.68%, from USD 1,512 million in 2010 to USD 10,107 million in 2017. The value of exports of non-mining-energy goods and services closed at USD 23,268 million, a growth of 26.7%, compared to USD 18,360 million in 2010. Additionally, the positive trend of services exports was consolidated, which increased by 8.5% between 2016 and 2017. In 2010, 19.7% of exports were made to countries with FTAs; in 2017, it covered 67.3%. With trade agreements, the access went from a market of 490 million people to one close to 1,500 million people (Ministerio de Comercio, Industria y Turismo, 2018).

The strategies implemented so far seek to improve productivity, human capital formation, trade promotion, regulatory aspects, bilingualism, trade statistics, the use of quality certifications for each

sector, and facilitate access to foreign markets. Among these, the creation of the following programs stands out:

- 1) Productive Transformation Program, which, between 2017 and 2018, implemented actions to promote productive development in the manufacturing, services, and agro-industrial sectors, in conjunction with the public sector, the private sector, and the academy;
- 2) Colombia Productive Program, which provides comprehensive assistance to SMEs and involves 265 companies, all with the support of the World Bank, to improve their productivity, optimize energy consumption, reduce time and production costs, implement quality standards, improve sales strategies and the management of human talent;
- 3) Rural Businesses Productivity Program, which is being implemented with 380 production units from the tourism, fruit, coffee and cocoa sectors;
- 4) We Live Peacefully Program, so that businessmen from the fashion industry who were victims of the armed conflict create attractive products of quality and at a reasonable price;
- 5) Colombia Transforms Fashion Program, so that 250 companies producing and/or marketing textiles and clothing in 6 regions of the country rediscover their business model and improve their productivity, processes, quality, and design to increase their sales;
- 6) Promotion cooperation program, to strengthen the quality and productivity of the auto parts and vehicle chain;
- 7) Safe + cooperation program, to strengthen the national quality infrastructure, increase and improve the productive capacity of the cosmetic sector, with an emphasis on natural ingredients;
- 8) Strategic intelligence and institutional strengthening program, aimed at developing institutional analytical capacities in three specialty coffee sectors: cocoa and chocolate and textiles and clothing (Ministerio de Comercio, Industria y Turismo, 2018).

As is evident through these strategies, Colombia is joining forces to advance in the internationalization of companies, and the international aspect has become a relevant part of the companies' strategy and development plans for the country's regions. However, although the number of Colombian companies in the world markets for goods and services has increased progressively, it continues to be low compared to other Latin American countries; the Colombian presence abroad is still below its potential capacity. Therefore, it is a priority in the coming years to expand the export base and consolidate the international perspective in business strategy and management.

While Colombia has an internationalization coefficient of 8.3%, one of its regions, Santander, reaches 1.1%, which reflects the low commercial performance. Exports from this region are concentrated in 76.7% in the hydrocarbon sector (oil and its derivatives since the main petroleum refinery of the country is located there, as well as oil wells managed by multinational companies), 12.3% in the agricultural sector (cocoa, pineapple, poultry, coffee, among others), 8.7% in the manufacturing sector (leather, footwear, clothing), 5% in tourism and health, and 2.3% in food and beverages. Regarding constant sales, 81.4% are mainly to South and Central America and 17% to North America; 53.6% were made by medium-sized companies and 19.6% by large companies; 20.4% have been constant for the past nine years, considering important the maturity that companies reach in terms of strategy, financial capacity, and vision. In terms of intermittent sales, 48.8% are made to South and Central America and 28.8% to North America; they are performed in 56% by micro-enterprises and 38.8% by medium-sized companies. The total number of exporting companies from Santander in 2019 was 380, destined to 70 countries and 631 tariff lines, of which 317 work with products different from oil and its derivatives, and of these, only 130 have export consistency, representing 0.14% of the business sector of the region. Another highlight is that in the region during 2019, 19.3% of companies made exports for the first time, while the majority, 60.2%, entered and left the global market (Observatorio de Competitividad de Santander, 2019).

To strengthen exports in Santander, the Regional Competitiveness Commission presented the

2018–2032 Regional Competitiveness Plan, which establishes six strategic axes: productivity for internationalization, territorial development, institutions, science, technology and innovation, infrastructure and human capital. The fundamental goals are to increase exports from 224 billion USD to 1,440 billion USD, improve the national positioning of the amount of exports going from the 18th position to the 10th as a minimum, and finally increase participation in exports from Colombia from 0.96% to 4%. In addition to these regional policies aligned to national, the creation of GPS was proposed (Santander internationalization strategy), which aims, through aggressive campaigns, to create an export culture in the region and the training school for internationalization with training for exporting entrepreneurs with export potential (Comisión Regional de Competitividad, 2017).

Based on the context of the region, national studies, and scientific literature, a research model is proposed to determine the elements of competitiveness (innovation, productivity, and business structure) and technological capital (R&D management, technological endowment, technological processes) that influence export processes (export orientation, skills for the international market, export capacity) as part of the internationalization of companies.

For the Santander department, it is of great importance to work on the international insertion of companies in the region, to identify the fundamental parameters generated by the level of competitiveness and technological capital in the internationalization process immersed in the region. The results of the study support and back up proposals and programs from state entities, universities, and organizations for business development that strengthen local, regional, and national companies in the insertion into the international market solidly and competitively.

As defined by Schwab (2017), competitiveness encompasses the array of institutions, policies, and factors shaping a country's productivity level. This notion is underpinned by the Global Competitiveness Index (GCI), which assesses economies based on their factor endowment, efficiency, and innovation elements. The National

System of Competitiveness, Science, Technology, and Innovation adopts the definition of competitiveness from CONPES 3439 (2006), viewing it as the country's ability to produce goods and services that can thrive in global markets while enhancing living standards. Porter (2002) delves into corporate competitiveness, where a multitude of factors within the value chain interplay, influencing performance. These factors span primary activities (inbound and outbound logistics, operations, marketing, services) and support activities (infrastructure, human resources, finance, technologies), coupled with macro and micro-environmental aspects like competition, institutions, technology, suppliers, and clients.

As Bueno (2011) elucidates, technological capital encompasses intangible assets directly intertwined with an organization's technical system. This system, pivotal for achieving products with specific attributes and efficient production processes, also bolsters the knowledge bedrock essential for future innovations. In their pursuit of competitiveness, enterprises harness information technology for informed decision-making, robust technological systems for process automation, specialized IT personnel, research and development for product and service enhancement, knowledge protection, and technological vigilance. A key driver for market entry is a company's technological capability. Daniels and Radebaugh's (2000) specific factors model asserts that the nature of goods or services produced by countries hinges on their characteristics, rendering them either labor-intensive (low technological level) or capital-intensive (high technological level). Vernon's technological gap theory and product life cycle elucidate international market behavior, considering product lifespan and the technological level. Notably, the nanotechnology theory highlights the significance of technological disparities between countries in determining comparative advantage. Porter (2002) underscores technology's role in a company's value chain, designating it as technology development, crucial for a competitive edge. In this context, factors of R&D management, technological processes, and technological endowment are pivotal components of technological capital (Bueno, 2011; Guerola-Navarro et al., 2020; Villa-Espinosa et al., 2018; Rueda-Barrios & Rodenes Adam, 2016; Lee & Kwon, 2023).

In the corporate realm, the interdependence of competitiveness and technological capital is underscored, evident in various literature reviews (Jano et al., 2014; Özaydın & Çelik, 2022; Seo et al., 2022; Jano et al., 2015; Ahuja Sánchez et al., 2020). Edvinsson and Stenfelt (1999) emphasize the divergent factors shaping regional growth, particularly in terms of technological structure. This, in turn, underscores the role of technological capital in explaining regional development levels, thus influencing the Gross Domestic Product (GDP). Ahumada Tello and Perusquia Velasco (2016) assert that knowledge, environment, innovation, and business intelligence contribute to expanding business intelligence as a competitiveness cornerstone. Di Caprio and Santos Arteaga (2016) underscore the impact of technological development discrepancies between nations on innovation incentives. Hazarika et al. (2016) emphasize the necessity of technological development for cost and product quality competitiveness, highlighting the significance of a favorable political framework for credit access, market entry, and technology adoption.

In light of this, this study aims to pinpoint pivotal competitiveness drivers, encompassing innovation (products/services, processes, marketing), productivity (international sales, sales per employee, language-proficient staff), and business structure (regulations, physical assets, financial capacity) (Sanchez & Acosta, 2001; Fajinzylber, 2006; CONPES, 2006; Miranda & Toirac, 2010; Arge et al., 2006; Zapata & Hernández, 2014; Klaus,

2016; Tung & Binh, 2022; Comisión regional de Competitividad, 2016; Schwab, 2017).

The research model encompasses three hypotheses that establish connections between the core variables of competitiveness, technological capital, and exports. The measurement of each variable under scrutiny incorporates various constituent elements, as depicted in Figure 1.

The model of study is considered as a form of internationalization, exports, which is defined as the exit of goods from the national customs territory to another country or an industrial free zone of goods and services (Procolombia, 2013). The Ministry of Commerce, Industry and Tourism measures exports from a country and business sectors. The study considered export orientation (number of products and/or services with export profile and export promotion and commercialization), exported products (units exported, exported products catalogue), and export capacity (operational management, strategic management) (Park & Lee, 2015; M. Ruzzier & M. K. Ruzzier, 2015; Procolombia, 2018; Comisión Regional de Competitividad, 2016).

After an extensive review of the existing literature, the study proceeds to expound upon the subsequent hypotheses:

H1: Competitiveness, based on innovation, productivity and business structure, influences the exports of companies.

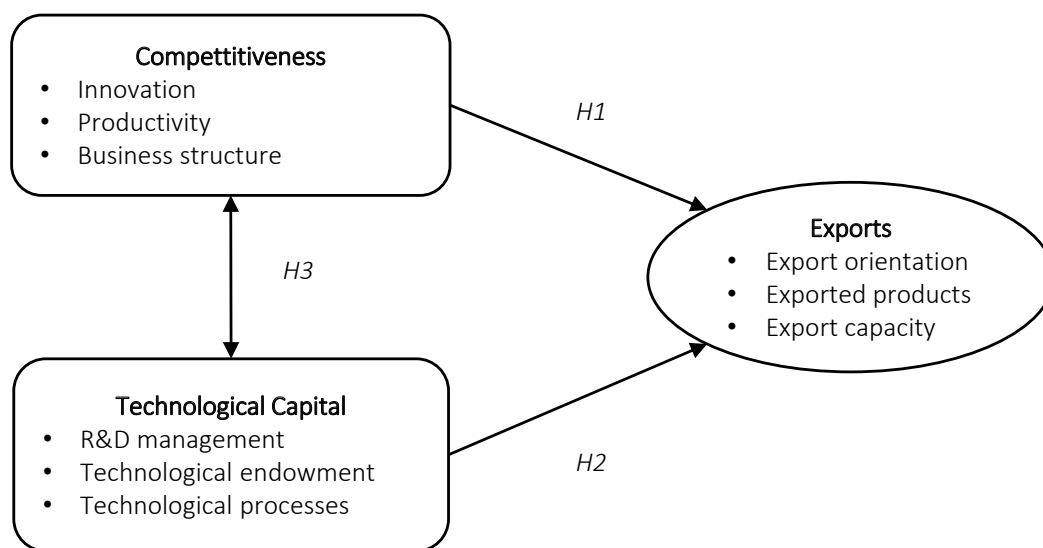


Figure 1. Study model

H2: *Technological capital, based on R&D management, technological processes and technological equipment, influences the exports of companies.*

H3: *Competitiveness, based on innovation, productivity, and business structure, is positively related to technological capital, based on R&D management, technological processes, and the technological endowment of companies.*

a workshop for exporting businessmen. The data treatment was done in the SPSS version 25 program with the statistical analysis techniques summarized in Table 1.

The research model proposed competitiveness and technological capital as independent variables, and exports as a dependent variable, presents the items that make up each variable and the indicators (Appendix A).

2. METHOD

The research design is based on a quantitative approach with a descriptive, correlational, and explanatory scope based on the deductive method. It identifies theoretical variables and empirically verifies them in the reality of companies in the region. This study defined 161 companies from the Santander region in Colombia as the target population, which exported to 74 countries with 333 tariff positions and are registered in the first quarterly report of 2018 issued by the Bucaramanga Chamber of Commerce. The response rate was 39%, corresponding to 63 companies classified mainly in the service, construction, commerce, transportation, agricultural, and industrial sectors.

The survey comprises 49 statements with a Likert scale (1-5) and was initially applied to a pilot group of 20% of the sample to validate the instrument. The instrument was created and completed on an online platform controlled by the Bucaramanga Sectional Pontifical Bolivarian University and shared during

3. RESULTS

The results of the descriptive analysis show that 50% of the exporting companies have more than 13 years of creation. The size of the physical infrastructure of the companies in terms of area per square meter (production plant and administrative area) is small, on average 500 m². The number of units produced for the national market is, on average, 82% compared to sales in the international market at 17%, a similar behavior in the three periods measured. On organizational innovation, the promotion of the company stands out to encourage teamwork and generate new ideas, motivating to achieve new innovations; innovation in marketing stands out for the positioning of the product, considered strategic, to consolidate the product and favor the recording of the brand. The improvement in innovation in services over the last three years is low (0.37), which demonstrates a process of differentiation of companies that is not very dynamic and effective, as well as who develops said processes. The low use of the resources the government grants to the export sector is also evident, many due to ignorance of their existence (0.76).

Table 1. Statistical techniques of the study

Statistical technique	Results	Measurements
Descriptive statistics	Company characterization	Frequency, mean, standard deviation, variance
Factorial analysis	Grouping of final variables: - Competitiveness (innovation, productivity and business structure) - Technological Capital (R&D management, technological endowment, technological processes) - Exports (export orientation, exported products, export capacity)	Bartlett's sphericity test KMO measure ≥ 0.5 Explained variance ≥ 0.6 Varimax rotated components Factor load ≥ 0.5 Cronbach's alpha ≥ 0.6
Bivariate correlation analysis	The first hypothesis test to find preliminary correlations between the indicators of competitiveness and technological capital with exports	Pearson correlation ≥ 0.3
Multiple regression analysis Path Analysis	The second hypothesis test to establish the final correlations of the proposed model with the indicators of competitiveness and technological capital, and its relationship with exports	Anti-image matrix (greater than 0.5) Coefficient of determination R ² Beta β coefficient Multicollinearity (tolerance – VIF)

Regarding the technological endowment, it is evident that they have machinery, equipment, and information systems; these are not sufficient for the international operation of the business. They rely on different communication networks, such as the internet, webpages, and others. In expanding their products and services, managers continually seek new export markets, reflecting their interest in international scenarios. Managers recognize the

importance of investing in education and training for the international market and in strengthening language skills to establish negotiation and marketing processes.

The correlation analysis is presented in Table 2. It shows the positive relationship between the components of competitiveness, technological capital, and their relationship of influence in improving the ex-

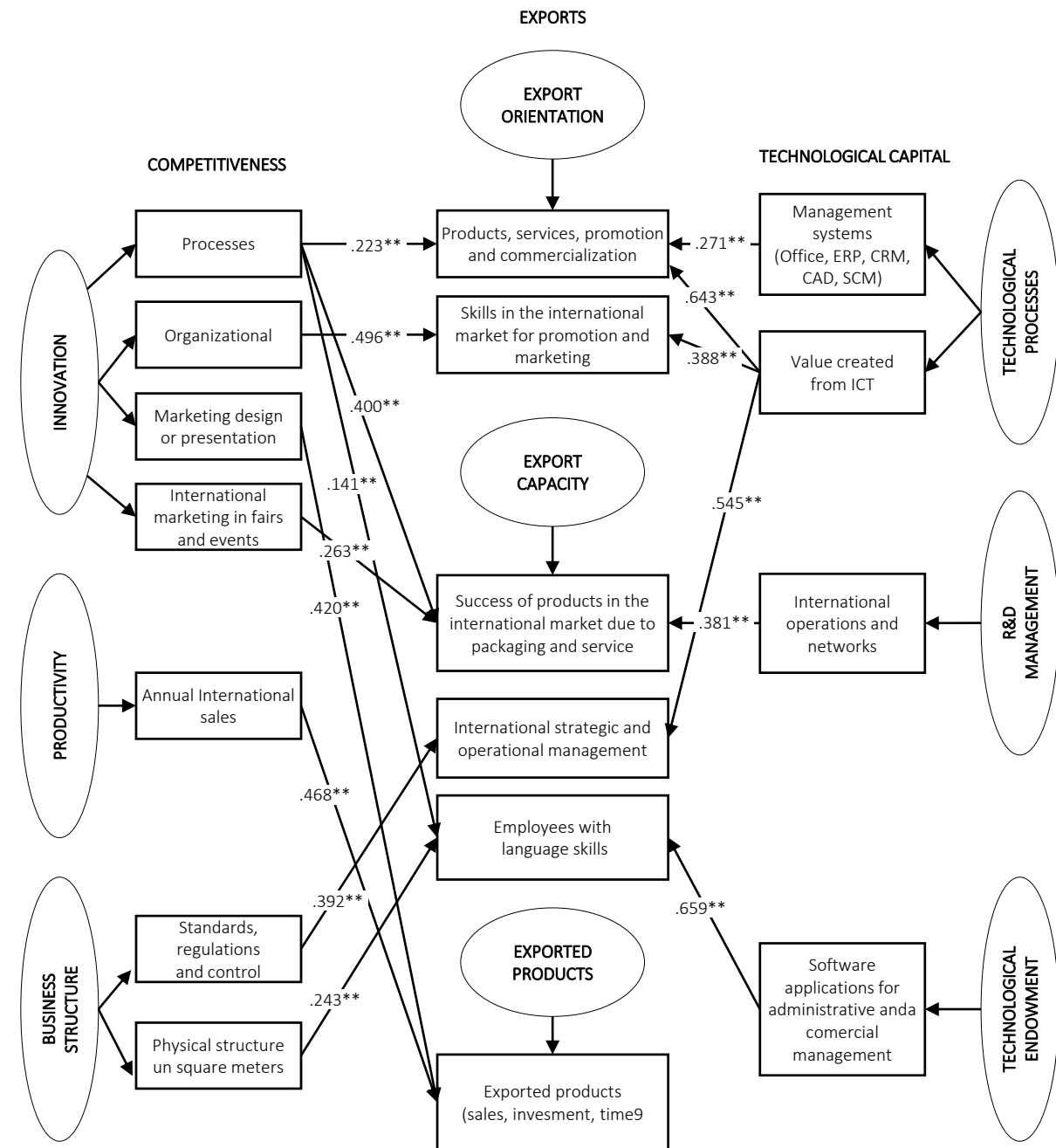
Table 2. Linear regression models for H1 and H2

Independent variables competitiveness and technological capital	Dependent variable: Exports					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Export orientation		Exported products		Export capacity	
	Products, services, promotion and commercialization	Skills in the international market for promotion and marketing	Exported products (sales, investment and time)	Success of the products in the international market due to packaging and service	International strategic and operational management	Employees with language skills
Innovation						
Process innovation	0.223 **			0.400 **		0.141 *
Organizational innovation		0.496 **				
Innovation in design or presentation			0.420 **			
Innovation in international marketing at fairs and events				0.263 *		
Productivity						
International annual sales			0.468 **			
Business structure						
Standards, regulations, and control at work					0.392 **	
Physical structure in square meters						0.243 **
R&D management						
International operations and networks				0.381 **		
Technological equipment						
Software applications for administrative and commercial management						0.659 **
Technological processes						
Value created from ICT	0.643 **	0.388 **			0.545 **	
Management systems (OFFICE, ERP, CAD, CRM, SCM)	0.271 **					
$\Delta R^2 > 0.10$	0.728	0.627	0.552	0.338	0.653	0.734

Note: R²: Determination coefficient that explains the relationship between the variables of a model and hypotheses verification. ** P < 0.01; * P < 0.05.

port performance of companies. Model 1 shows the relationship between innovation processes, the value created from ICT, and the information systems for administrative and commercial management, compared to exports measured by products, services, promotion, and marketing in the international market. Model 2 presents the relationship between organizational innovation and the value created from ICT, with exports represented by skills in the

international market for promotion and marketing. Model 3 presents the relationship between marketing innovation for design or presentation and productivity measured from international sales and exported products (sales, investment, and time). Model 4 proposes the relationship between innovation in processes and innovation in international marketing at fairs and events and international operations and networks, with the success of products



Note: ** P < 0.01.

Figure 2. Direct relationship model between the study variables

Table 3. Linear regression models for H3

Independent variable technological capital	Dependent variable: Competitiveness							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	Innovation			Productivity			Business structure	
	Innovation in products and services	Process innovation	Organizational innovation	Administrative employees	Total employees and company size	Total sales per employee	Standards, regulations, and control at work	Physical structure in square meters
Technological equipment								
IT staff		0.424 **		0.844 **	0.609 **			0.504 **
Operators and computers						0.474 **		0.279 *
Machinery and specialized equipment for internationalization	0.677 **							
Organizational supplies and technological changes			0.424 **				0.388 **	
Technological processes								
Value created from ICT			0.376 **				0.306 *	
Information systems for commercial and administrative management					0.347 **			
$\Delta R^2 > 0.16$	0.45	0.166	0.484	0.708	0.753	0.296	0.337	0.489

Note: ** P < 0.01; * P < 0.05.

in the international market due to packaging and service. Model 5 shows the relationship between the business structure represented in standards, regulations, control at work, and technological processes based on the value created from ICT, with international strategic and operational management. Model 6 presents the relationship between process innovation and the business structure measured by the physical structure in square meters, against employees with language skills.

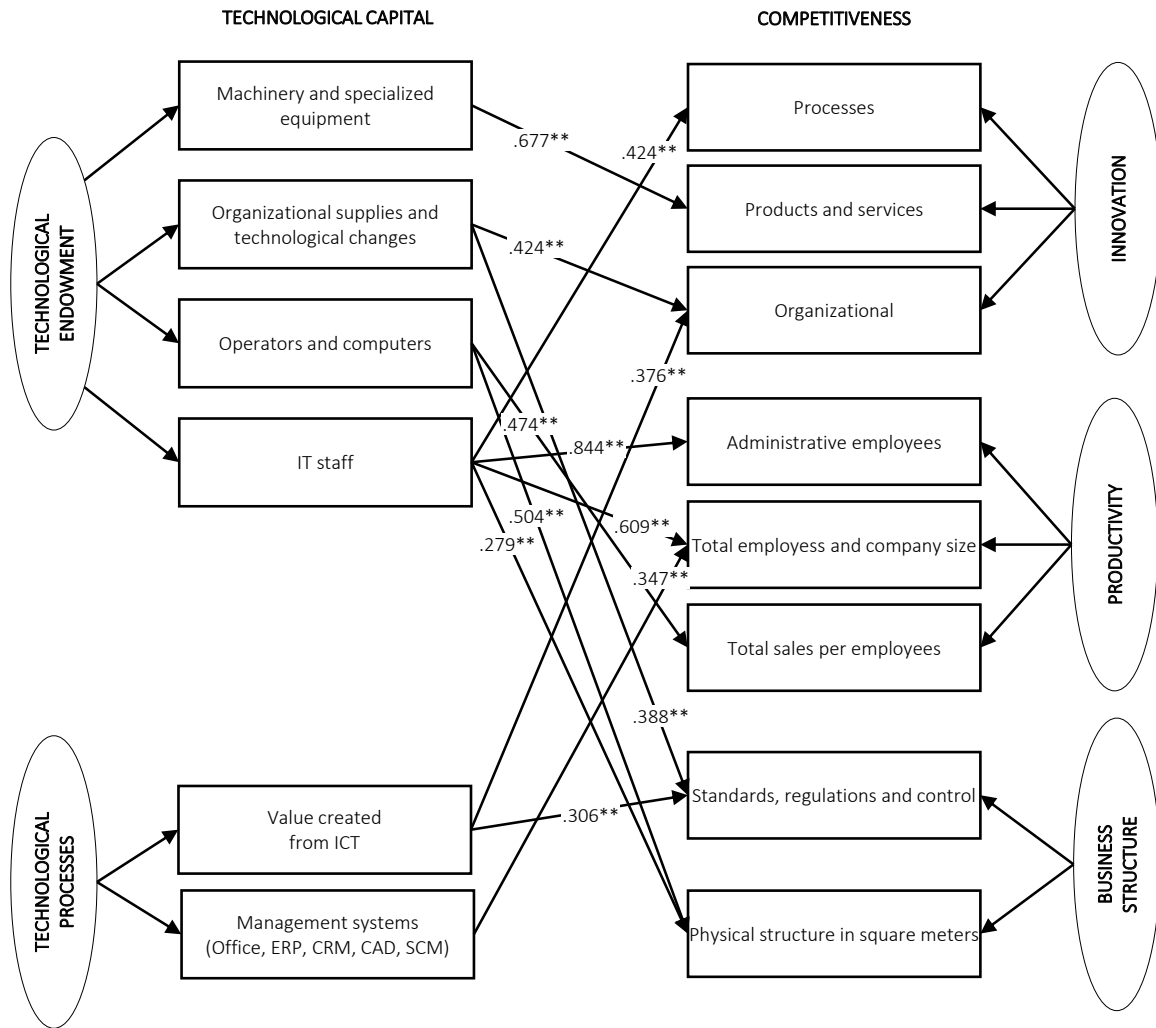
Considering the results of the linear regression analysis, Figure 2 shows the direct relationships between the variables of competitiveness and technological capital against exports.

H3 presents the relationships between competitiveness and technological capital, understanding that technological capital can be a factor of competitiveness for companies. This analysis identified eight models with positive correlations according to Beta (β) coefficients and coefficients of determination (R^2) shown in Table 3.

The results show that the greater the endowment and technological processes, the greater the results in innovation, productivity and business structure. In addition, the findings indicate a strong relationship between information technology (IT) staff and language skills, a relationship between IT staff and systems for administrative and commercial management, the total number of employees and the size of the company, a relationship between IT staff operators and computers and physical structure in square meters, a relationship between the value created from ICT, supplies and technological changes, and organizational innovation.

The path analysis found relationships between competitiveness and technological capital, as shown in Figure 3.

The resulting model reveals the correlation between the variables being investigated. The relationship between competitiveness and exports in the study population was evidenced by 3 elements: innovation, productivity, and business structure.



Note: **P < 0.01; * P < 0.05.

Figure 3. H3 relationships final model

Innovation as the first element of competitiveness is positively related to exports through:

- a) innovation in processes with products, services, promotion, and commercialization ($\beta = 0.223$ **, $R^2 = 0.728$); exported products (sales, promotion, and time) ($\beta = 0.420$ **, $R^2 = 0.552$); and employees with language skills ($\beta = 0.141$ **, $R^2 = 0.734$);
- b) the organizational innovation in exports through skills in the international market for promotion and marketing ($\beta = 0.495$ **, $R^2 = 0.627$);
- c) innovation of the marketing design or presentation of the exported products (sales, promotion, and time) ($\beta = 0.420$ **, $R^2 = 0.552$);

- d) innovation of international marketing in fairs and events in relation to exports in the success of products in the international market due to packaging and service ($\beta = 0.203$ **, $R^2 = 0.338$).

Productivity as the second element of competitiveness is positively related to exports through:

- a) international annual sales with exported products (sales, promotion, and time) ($\beta = 0.468$ **, $R^2 = 0.552$).

The business structure, as the third element of competitiveness, is positively related to exports through:

- a) standards, regulations, and control at work with international strategic and operational management ($\beta = 0.292$ **, $R^2 = 0.653$);

- b) the physical structure with employees with language skills ($\beta = 0.243^{**}$; $R^2 = 0.734$).

The relationship between technological capital and exports in the study population has become clear from 3 items: R&D management, technological equipment, and technological processes. R&D management as the first element of technological capital is positively related to exports through:

- a) international operations and networks with the success of products in the international market due to packaging and services ($\beta = 0.381^{**}$; $R^2 = 0.338$);

The technological endowment as the second element of technological capital is positively related to exports through:

- a) software for administrative and commercial management with employees with language skills ($\beta = 0.243^{**}$; $R^2 = 0.734$).

Technological processes and innovation as the third element of technological capital are positively related to exports through:

- a) the value created from the ICT related to exports through products, services, promotion, and commercialization ($\beta = 0.543^{**}$; $R^2 = 0.728$); skills in the international market for promotion and marketing ($\beta = 0.388^{**}$; $R^2 = 0.627$); and the international strategic and operational management ($\beta = 0.545^{**}$; $R^2 = 0.653$);
- b) systems for administrative and commercial management (Office, ERP, CRM, CAD, SCM) with products, services, promotion, and commercialization ($\beta = 0.271^{**}$; $R^2 = 0.728$).

Finally, technological capital and competitiveness are related to each other according to the path analysis as follows:

- a) technological endowment in machinery and specialized equipment for internationalization is positively related to innovation in products and services ($\beta = 0.667^{**}$; $R^2 = 0.45$);
- b) IT staff is positively related to process innovation ($\beta = 0.424^{**}$; $R^2 = 0.166$);

- c) the value created from IT ($\beta = 0.376^{**}$) and organizational supplies and technological changes ($\beta = 0.424^{**}$) are positively related to organizational innovation ($R^2 = 0.484$);

- d) IT staff with productivity according to the number of administrative employees ($\beta = 0.844^{**}$; $R^2 = 0.708$);

- e) IT staff ($\beta = 0.609^{**}$) and the technological endowment of software and applications to administrative and commercial management ($\beta = 0.347^{**}$) influence the productivity regarding total employees and company size ($R^2 = 0.753$);

- f) supplies and technological changes ($\beta = 0.388^{**}$) and technological processes and innovation regarding the value created from IT and IT services ($\beta = 0.306^{**}$) influence the structure of standards, regulations, and control at work ($R^2 = 0.337$); the technological capital-technological endowment regarding IT staff ($\beta = 0.504^{**}$);

- g) the technological endowment of operators and computers ($\beta = 0.279^*$) influences the physical structure in square meters (size) ($R^2 = 0.489$);

- h) the technological equipment of operators and computers ($\beta = -0.474^{**}$) and the financial capacity ($\beta = .298^*$) influence positively and negatively the productivity regarding total international sales per employee ($R^2 = 0.296$).

4. DISCUSSION

As fundamental axes that prepare and consolidate businesses competitively for the challenges of the international market, innovation is a permanently present element to enter products, services, promotion, and marketing in a differentiated way. To achieve this, one needs to consider innovation as creating or improving a new product or service. It is also necessary to make innovation in production processes involved in transforming raw materials for products or services, in the design or presentation of these, in the administrative and operational management of the organization for

export processes, and in the new visibility strategies and commercialization of products or services internationally. This discovery is based on the 12 pillars proposed to measure the competitiveness index proposed by Schwab (2017), which includes basic requirements such as business infrastructure, improving process efficiency, and increasing the level of innovation and sophistication in companies. Hill et al. (2017) consider that the fundamental objective of every company, in addition to growing and generating profits, is to create and deliver added value to its clients. A company adds value when it improves the quality of a product or service, adapts the product to the needs and requirements of the client, and adapts internal processes to the needs of the environment. Arge et al. (n.d.) maintain that international competitiveness is defined as the ability to sustain and increase participation in these markets, starting from the structural characteristics that determine the performance and the ability to respond to that market. Porter (2002) considers that the inefficiency of competitiveness lies in the inability of companies to identify this competitive advantage and translate it into each company's strategy.

These results are consistent with other studies made in different countries and contexts that support innovation in products, processes, organizational, and marketing as an element of competitiveness of companies in the international market (Rock, 2010; Sosa Rodrigues & Reyes, 2014; Avella Camarero & Garcia, 2010; Miranda & Toirac, 2010; Czinkota & Ronkainen, 2002; Hill, 2001; Daniels & Radebaugh, 2000; Jaramillo et al., 2001; OCDE-EUROSTAT, 2005; Fajinzylber, 2006; Consejo Privado de Competitividad, 2019).

The second element that establishes competitiveness in the international market is productivity, measured by the supplies used, the units produced and sold, the size of the company, and the number of administrative and total employees. To achieve productivity, optimization of production, supplies, processes, and resources is required; and this is where the third element appears, the corporate structure, which is based on the financial capacity, administrative capacity, geographic location, and physical infrastructure, which determines the potential and organizational capacity for the international market (Ficker, 2004; Yi, 2015).

Parallel to the elements of competitiveness, this study showed that technological capital, determined by IT staff and R&D management, the endowment of machinery and specialized equipment, information system for administrative and operational management, resources and process technology based on the added value generated by information and communication technologies, help to achieve greater success in companies in inserting themselves into the international market adapting to organizational changes and environmental requirements (Bueno, 2011; Rueda-Barrios & Rodenes-Adam, 2016; RICYT, 2009).

This study shows that the elements above are related positively with exports of companies measured by three aspects. The first is export orientation, which is characterized by the capabilities and characteristics of each company depending on its social object and its facility for internationalization. The second is international insertion, referred to how exporting companies enter the global market regarding the type of product, success entering the foreign market regarding issues such as design, technology, quality, price, packaging, services, and raw material used. The third is the export capacity, which is supported in aspects such as the strategic and operational management capability to define said export with the approach of the insertion strategy and the trained staff with language skills for such insertion.

The results are related to those obtained in studies carried out in different countries and contexts that consider innovation in products, processes, organizational and marketing, as factors that favor the achievement of competitiveness (Jaramillo et al., 2001; OCDE-EUROSTAT, 2005; Fajinzylber, 2006; Consejo Privado de Competitividad, 2019). Likewise, it states that productivity is one major axis in internationalization processes, considering results in products/services, quantity of supplies used to obtain them, and sold units of such products and/or services in the international market (Consejo Privado de Competitividad, 2019; Arge et al., n.d.; Miranda & Toirac, 2010). Finally, it states that R&D management, the provision of technology, considered by the number and types of information technologies on companies, as the technology itself and networks, constitute fundamental aspects of supporting exporting companies (Bueno, 2011; Rueda-Barrios & Rodenes-Adam, 2012; RICYT, 2009).

CONCLUSION

In a rapidly evolving global landscape, businesses are navigating an ever-expanding international marketplace. To thrive in this dynamic environment, this analysis reveals that three pivotal factors – innovation, productivity, and structural adaptability – have become the linchpins of competitiveness for companies venturing into the international arena. These elements demand a continuous, strategic reassessment, as they hold the key to a differentiated approach in the pursuit of successful internationalization.

The findings underscore that innovation, hand in hand with streamlined productivity, plays a central role in this transformative journey. For companies, this entails optimizing production processes, efficiently managing supply chains, refining financial structures, fostering administrative agility, and bolstering infrastructure – a holistic approach that equips them to confront and conquer the multifaceted challenges presented by the global market. Moreover, the analysis shines a spotlight on the indispensable significance of technological capital. This encompasses dimensions such as R&D management, technological provision, processes, and innovation – elements that are instrumental in empowering exporting companies. Among these, R&D management emerges as the vanguard, propelling firms toward higher echelons of internationalization. However, this ascent is contingent on robust technological underpinnings, spanning everything from internet capabilities to export-oriented operational systems. These technological investments not only refine production, marketing, and innovation processes but also enhance overall value creation and management systems.

The triumphant navigation of international markets hinges on a three-tiered approach. Export orientation tailors strategies to the unique corporate mission and internationalization capabilities. International insertion deftly chooses product types and market entry strategies. And export capacity is underpinned by robust strategic and operational management, and a proficient human resource pool.

To wrap up these findings, this study illuminates the pathway to international success: an unwavering evaluation of competitiveness and technological capital, seamlessly integrated into internal strategies. These elements not only align with broader macroeconomic objectives but also significantly contribute to the growth and enduring global presence of individual businesses. Looking ahead, this study points to promising directions for future exploration. These may encompass a deeper dive into the intricacies of innovation strategies, a thorough analysis of the impact of specific technological investments, and an investigation into the role of government policies in fostering internationalization.

AUTHOR CONTRIBUTIONS

Conceptualization: Gladys Mireya Valero Cordoba.

Data curation: Gladys Rueda-Barrios, Gladys Mireya Valero Cordoba, Jairo González-Bueno.

Formal analysis: Gladys Rueda-Barrios, Jairo González-Bueno.

Funding acquisition: Gladys Mireya Valero Cordoba.

Investigation: Gladys Mireya Valero Cordoba.

Methodology: Gladys Rueda-Barrios, Gladys Mireya Valero Cordoba, Jairo González-Bueno.

Project administration: Gladys Mireya Valero Cordoba.

Resources: Gladys Mireya Valero Cordoba.

Software: Gladys Rueda-Barrios, Gladys Mireya Valero Cordoba.

Supervision: Gladys Rueda-Barrios.

Validation: Gladys Mireya Valero Cordoba, Jairo González-Bueno.

Visualization: Gladys Mireya Valero Cordoba, Jairo González-Bueno.

Writing – original draft: Gladys Rueda-Barrios, Gladys Mireya Valero Cordoba.

Writing – review & editing: Jairo González-Bueno.

REFERENCES

1. Ahuja Sánchez, L., Yépez Ríos, N. B., & Pedroza Zapata, Á. R. (2020). Relationship between total quality management (TQM) and technology R&D management (TM/R&D) in manufacturing companies in Mexico. *Contaduría y Administración*, 65(1). Retrieved from https://www.scielo.org.mx/scielo.php?pid=S0186-10422020000100102&script=sci_arttext&tlng=en
2. Ahumada Tello, E., & Perusquia Velasco, J. (2016). Business intelligence: Strategy for competitiveness development in technology-based firms. *Contaduría y Administración*, 61(1), 127-158. <https://doi.org/10.1016/j.cya.2015.09.006>
3. Arge, G., Dajer Plata, R., & Alvarez, D. (2006). Diseño e implementación de un mapa de ordenamiento competitivo regional soportado en tecnología internet para asistir procesos de inversión en el departamento de Cordoba-Colombia [Design and implementation of a regional competitive map supported by internet technology to assist investment processes in the department of Cordoba-Colombia]. In *Conferencia Nacional ASCOLFA* (pp.183-225). (In Spanish).
4. Avella Camarero, L., & Garcia, F.P. (2010). La actividad exportadora: ¿Causa o efecto de la competitividad de las pymes manufactureras españolas? [Export activity: Cause or effect of the competitiveness of Spanish manufacturing SMEs?]. *GCG: Revista de Globalización, Competitividad & Gobernabilidad*, 4(1), 80-88. (In Spanish). Retrieved from <https://www.redalyc.org/pdf/5118/511851323004.pdf>
5. Benzaquen, J., del Carpio, L. A., Zegarra, L. A., & Valdivia, C. A. (2010). Un índice regional de competitividad para un país [A regional competitiveness index for a country]. *Revista CEPAL*, 69-86. (In Spanish). Retrieved from <https://ideas.repec.org/a/ecr/col070/11417.html>
6. Borkakoti, J. (1998). *The neotechnology theory of international trade*. Palgrave.
7. Bueno, E. (2011). *Modelo intelectual de medición, gestión e información del capital intelectual (New actualized version) [Intellectual capital measurement, management and reporting model (New actualized version)]*. Madrid: CIC-IADE. (In Spanish). Retrieved from <https://goo.su/Rpohn>
8. Chandra, A., Paul, J., & Chavan, M. (2020). Internationalization barriers of SMEs from developing countries: A review and research agenda. *International Journal of Entrepreneurial Behavior & Research*, 26(6), 1281-1310. <https://doi.org/10.1108/IJE-BR-03-2020-0167>
9. Comisión Regional de Competitividad. (2016). *Santander competitivo [Competitive Santander]*. (In Spanish). Retrieved from <http://santandercompetitivo.org/secciones-14-s/quienes-somos.htm>
10. Comisión Regional de Competitividad. (2017). *Plan Regional de Competitividad de Santander (2018-2032) [Santander Regional Competitiveness Plan (2018-2032)]*. (In Spanish). Retrieved from <http://santandercompetitivo.org/media/43e1c8feba0feb9ef87203b6eb2a1a7d35dd261e.pdf>
11. Consejo Nacional de Política Económica y Social (CONPES). (2006). *Institucionalidad y principios rectores de política para la competitividad y productividad [Institutionality and guiding policy principles for competitiveness and productivity]*. Bogotá: Alta Consejería Presidencial para la Competitividad y la Productividad, Ministerio de Comercio, Industria y Turismo. (In Spanish). Retrieved from <https://colaboracion.dnp.gov.co/CDT/Conpes/Econ%C3%B3micos/3439.pdf>
12. Consejo Privado de Competitividad. (2019). *Informe Nacional de Competitividad 2018-2019 [National Competitiveness Report 2018-2019]*. (In Spanish). Retrieved from <https://compite.com.co/informe/informe-nacional-de-competitividad-2018-2019/>
13. Cuestas Rodriguez, L. F. (1999). Comercio internacional [International trade]. In L. F. Cuestas Rodriguez (Ed.), *Gestión Empresarial Comercio Internacional* (pp. 36-43). Bucaramanga: Insed-UIS. (In Spanish).
14. Czinkota, M. R., & Ronkainen, I. A. (2002). *Marketing internacional [International marketing]*. Mexico: Prentice Hall. (In Spanish).
15. Daniels, J. D., & Radebaugh, L. H. (2000). *Negocios internacionales [International business]*. Mexico: Pearson. (In Spanish).
16. Departamento Nacional de Planeación. (2018). *Anuario Mundial de Competitividad 2018 [World Competitiveness Yearbook 2018]*. Obtenido de. (In Spanish). Retrieved from <https://colaboracion.dnp.gov.co/CDT/Prensa/Anuario%20Mundial%20de%20Competitividad.pdf>
17. Di Caprio, D., & Santos Arteaga, F. (2016). On the evolution of technological knowledge and the structural economic consequences derived from its assimilation. *International Journal of Innovation and Learning*, 19(1), 85-108. Retrieved from <https://ideas.repec.org/a/ids/ijilea/v19y-2016i1p85-108.html>
18. Edvinsson, L., & Stenfelt, C. (1999). Intellectual capital of nations for future wealth creation. *Journal of Human Resource Costing and Accounting*, 4(1), 21-33. <https://doi.org/10.1108/eb029051>
19. Fajnzylber, F. (2006). *Una visión renovadora del desarrollo de América Latina [A renewed vision of Latin America's development]*. Chile: CEPAL. (In Spanish).
20. Ficker, S. K. (2004). The export boom of the Mexican revolution: Characteristics and contributing factors. *Journal of Latin American Studies*, 36(2), 267-296. <https://doi.org/10.1017/S0022216X04007436>
21. Guerola-Navarro, V., Oltra-Badenes, R., & Gil-Gomez, H.

- (2020). Análisis de la relación entre el grado de introducción de CRM y los beneficios de la empresa a través del Desempeño Organizacional y la Innovación Empresarial [Analysis of the relationship between the degree of CRM introduction and company benefits through Organizational Performance and Business Innovation.]. *3C Empresa. Investigación y Pensamiento Crítico*, 9(1), 67-87. (In Spanish). <http://doi.org/10.17993/3cemp.2020.090141.67-87>
22. Hazarika, B., Bezbauah, M., & Goswami, K. (2016). Adoption of modern weaving technology in the handloom micro-enterprises in Assam: A Double Hurdle approach. *Technological Forecasting and Social Chang*, 102, 344-356. <https://doi.org/10.1016/j.techfore.2015.08.009>
 23. Heckscher, E. F. (1919). Utrikshandelns verkan pa inkomstfoerdelningen [The effect of foreign trade on the distribution of income]. In H. S. Ellis & L. A. Metzler (Eds.), *Readings in the Theory of International Trade* (pp. 272-300). Philadelphia: Blakiston. (In Swedish).
 24. Hill, C. (2001). *Negocios internacionales [International business]* (3rd ed.). Washington: McGraw-Hill. (In Spanish).
 25. Hill, Ch. W. L., Hult, T. M., & Mehtani, R. (2017). *International business: Competing in the global marketplace* (11th ed.). New York: McGraw-Hill Education.
 26. Ipsmiller, E., & Dikova, D. (2021). Internationalization from Central and Eastern Europe: A systematic literature review. *Journal of International Management*, 27(4), 100862. <https://doi.org/10.1016/j.intman.2021.100862>
 27. Jano, Z., Janor, H., Mohd. Nor, M. J. B., Ahmad, R., & Shaaban, A. (2014). A qualitative content analysis of e-strategies for research, innovation and commercialization: A case of global bodies, Malaysian ministries and research university. In L. Anthopoulos & C. Reddick (Eds.), *Government e-Strategic Planning and Management: Practices, Patterns and Roadmaps* (pp. 305-321). Springer. https://doi.org/10.1007/978-1-4614-8462-2_16
 28. Jano, Z., Saad, M. S. M., Yahya, A., Khamis, N., & Ahmad, R. (2015). National e-strategies for research and development. *Jurnal Teknologi*, 75(3). <http://dx.doi.org/10.11113/jt.v75.5055>
 29. Jaramillo, H., Lugones, G., & Salazar, M. (2001). *Manual de Bogotá: Normalización de Indicadores de Innovación Tecnológica en América Latina y el Caribe [Bogota Manual: Standardization of Technological Innovation Indicators in Latin America and the Caribbean]*. Publisher. (In Spanish). Retrieved from <https://oei.int/publicaciones/manual-de-bogota-normalizacion-de-indicadores-de-innovacion-tecnologica-en-america-larina-y-el-caribe>
 30. Klaus, S. (2016). *The Fourth Industrial Revolution*. Foro Económico Mundial.
 31. Krugman, P. (1994). Competitiveness: A dangerous obsession. *Foreign Affairs*. Retrieved from <https://heinonline.org/HOL/LandingPage?handle=hein.journals/fora73&div=31&id=&page=>
 32. Lee, J., & Kwon, H. B. (2023). Synergistic effect of R&D and exports on performance in US manufacturing industries: High-tech vs low-tech. *Journal of Modelling in Management*, 18(2), 343-371. <https://doi.org/10.1108/JM2-03-2021-0057>
 33. Ministerio de Comercio Industria y Turismo. (2016). *Procolombia [Procolombia]*. (In Spanish). Retrieved from <http://www.procolombia.co/>
 34. Ministerio de Comercio, Industria y Turismo. (2018). *Informe al Congreso 2018: Sector comercio, industria y turismo [Report to Congress 2018: Trade, industry and tourism sector.]*. Bogotá: Gobierno de Colombia. (In Spanish). Retrieved from <http://www.mincit.gov.co/CMSPages/GetFile.aspx?guid=9af5501e-94ba-4fc4-8d36-4fa9d89a7347>
 35. Miranda, J., & Toirac, L. (2010). Indicadores de productividad para la industria dominicana [Productivity indicators for Dominican industry]. *Ciencia y Sociedad*, 235-290. Retrieved from <https://www.redalyc.org/pdf/870/87014563005.pdf>
 36. Observatorio de Ciencia, Tecnología y Sociedad del Centro de Altos Estudios Universitarios (OEI) y Ministerio da educación de Portugal (RICYT). (2009). *Manual de Lisboa: Pautas para la interpretación de datos estadísticos disponibles y la construcción de indicadores, referidos a la transición de Iberoamérica hacia la sociedad de la información [Lisbon Manual: Guidelines for the interpretation of available statistical data and the construction of indicators related to the transition of Ibero-America towards the information society]*. Red Internacional de Ciencia y Tecnología. (In Spanish). Retrieved from <https://oei.int/publicaciones/manual-de-lisboa-pautas-para-la-interpretacion-de-los-datos-estadisticos-disponibles-y-la-construccion-de-indicadores-referidos-a-la-transicion-de-iberoamerica-hacia-la-sociedad-de-la-informacion>
 37. Observatorio de Competitividad de Santander. (2019). *Perfil de las empresas exportadoras Santander 2019 [Profile of Santander exporting companies 2019]*. Santander, Bucaramanga: Cámara de Comercio de Bucaramanga. (In Spanish). Retrieved from https://www.camaradirecta.com/temas/documentos%20pdf/Santander_exporta/exporta2019/Perfil%20exportadoras%20en%20Santander.pdf
 38. OCDE-EUROSTAT. (2005). *Manual de Oslo [Oslo Manual]*. (In Spanish). Retrieved from <https://www.madrid.org/bvirtual/BVCM001708.pdf>
 39. Ohlin, B. (1933). *Interregional and international trade*. Cambridge, Mass.; Harvard University Press.
 40. Organización para la Cooperación y Desarrollo Económico. (2002). *Manual de Frascati [Frascati Manual]*. Fundación Española

- de Ciencia y Tecnología FECYT. Retrieved from <https://www.fecyt.es/es/publicacion/manual-de-frascati-2002>
41. Organización para la Cooperación y Desarrollo Económico. (2009). *Medición del capital [Capital measurement]*. OECD. Retrieved from <https://unstats.un.org/unsd/nationalaccount/docs/OECD-Capital-s.pdf>
 42. Özyaydın, G., & Çelik, Y. (2022). A research of affecting factors on R&D management in food industry. *Selcuk Journal of Agriculture and Food Sciences*, 36(1), 13-19. <http://dx.doi.org/10.15316/SJAFS.2022.003>
 43. Park, K.-S., & Lee, H.-Y. (2015). An empirical study on the effect of the selection factors of 3PL on the switching costs, long-term relationship orientation, and export performance. *Korea Logistics Review*, 25(4), 25-39. <http://dx.doi.org/10.17825/klr.2015.25.4.25>
 44. Porter, M. E. (1985). *La riqueza de las naciones [The wealth of nations]*. Mexico: Compañía Editorial Continental. (In Spanish).
 45. Porter, M. E. (2002). *Estrategia competitiva técnicas para el análisis de sectores industriales y de la Competencia [Competitive strategy techniques for the analysis of industrial sectors and competition]*. México: Compañía Editorial Continental. (In Spanish).
 46. Procolombia. (2013). *Proceso de exportación de artesanías [Export process of handicrafts]*. Bogota: Procolombia. (In Spanish). Retrieved from <https://procolombia.co/memorias/proceso-de-exportacion-artesantias-2013>
 47. Procolombia. (2018). *Guía práctica para exportaciones de bienes y servicios [Practical guide for exports of goods and services]*. (In Spanish). Retrieved from <https://procolombia.co/publicaciones/guia-practica-para-conocer-el-proceso-de-exportacion-de-bienes>
 48. Rock, J. A. (2010). Exporting success factors: The case of Chilean firms. *Panorama Socioeconómico*, 28(41), 44-159. Retrieved from <https://www.redalyc.org/pdf/399/39920230007.pdf>
 49. Rueda-Barrios, G., & Rodenes-Adam, M. (2016). Factores determinantes en la producción científica de los grupos de investigación en Colombia [Determining factors in scientific production of research groups in Colombia]. *Revista Española de Documentación Científica*, 39(1), e118. <http://dx.doi.org/10.3989/redc.2016.1.1198>
 50. Ruzzier, M., & Ruzzier, M. K. (2015). On the relationship between firm size, resources, age at entry and internationalization: The case of Slovenian SMEs. *Journal of Business Economics and Management*, 16(1), 52-73. <https://doi.org/10.3846/16111699.2012.745812>
 51. Saldívar. (2012). Competitiveness and management of SMES. *Global Conference on Business & Finance Proceedings* (pp. 1152-1156).
 52. Sanchez, F., & Acosta, P. (2001). *Proyecto andino de competitividad: Proyecto indicadores de competitividad [Andean Competitiveness project: Competitiveness indicators project Colombia]*. Bogota: CEDE Universidad de los Andes
 53. Schwab, K. (2017). *The Global Competitiveness Report 2017-2018*. World Economic Forum. Retrieved from <http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf>
 54. Seo, R., Edler, J., & Massini, S. (2022). Can entrepreneurial orientation improve R&D alliance performance? An absorptive capacity perspective. *R&D Management*, 52(1), 50-66. <https://doi.org/10.1111/radm.12473>
 55. Sosa Rodriguez, J. O., & Reyes, O. B. (2014). Competitividad de las pymes exportadoras del estado de Colima [Competitiveness of exporting SMEs in the state of Colima]. *Global Conference on Business and Finance Proceedings*. (In Spanish). Retrieved from https://www.researchgate.net/publication/342365321_Competitividad_de_las_PYMES_exportadoras_del_estado_de_Colima
 56. Thomas, D. (2015). The analysis on the determinations factors of container port competitiveness. *Journal of Fisheries and Marine Sciences Education*, 27, 262-272.
 57. Tung, L. T., & Binh, Q. M. Q. (2022). The impact of R&D expenditure on firm performance in emerging markets: Evidence from the Vietnamese listed companies. *Asian Journal of Technology Innovation*, 30(2), 447-465. <https://doi.org/10.1080/19761597.2021.1897470>
 58. Vernon, R. (1966). International investment and international trade in the product life cycle. *The Quarterly Journal of Economics*, 80(2), 190-207. <https://doi.org/10.2307/1880689>
 59. Villa-Espinosa, D. M., González-Ladrón-de-Guevara, F., & Miñana Terol, J. L. (2018). Relationship between Information and Communication Technology and competitiveness in the tourism industry: A mapping review. *Revista Iberoamericana de Turismo- RITUR*, 8(2), 143-173. Retrieved from <http://www.seer.ufal.br/index.php/ritur>
 60. Yi, S. G. (2015). An analysis of an influencing factor in the export performance of ICT company. *Journal of Service Research and Studies*, 5(2), 1-13. <http://dx.doi.org/10.18807/jsrs.2015.5.2.1>
 61. Zapata, G., & Hernández, A. (2014). Origen de los Recursos y ventajas competitivas de las organizaciones: Reflexiones teóricas [Resources origin and competitive advantages of organizations: Theoretical reflections]. *Revista Venezolana de Gerencia*, 19(68), 735-759. (In Spanish). Retrieved from <https://www.redalyc.org/pdf/290/29032819007.pdf>

APPENDIX A

Table A1. Model variables and indicators: Competitiveness

Competitiveness	
Variable	Business structure
Items	Indicator
Physical infrastructure	Number of mt2 of storage that the company has
	Number of mt2 of production plant that the company has
	Number of mt2 of administrative activities that the company has
Company size and norms	Company size according to number of employees
	In the structure of the company there are numerous norms and rules that describe the work procedures
	In the structure of the company there are considerable resources and efforts to ensure that employees follow the work rules
Financial capability	In the structure of the company there are constant controls on the employees to see if they comply with the rules
	Total Assets
	Total Liabilities
	Heritage
	Operating Income
	Net profit
	Percentage growth of indebtedness 2017
	Percentage growth of indebtedness 2018
	Rotation growth 2017
	Rotation growth 2018
Variable	Productivity
	Indicator
Sales	Number of units produced for the national market (2016)
	Number of units produced for the national market (2017)
	Number of units produced for the national market (2018)
	Number of units produced for the international market (2016)
	Number of units produced for the international market (2017)
	Number of units produced for the international market (2018)
Labor	Number of administrative employees (2016)
	Number of administrative employees (2017)
	Number of administrative employees (2018)
	Total number of employees (2016)
	Total number of employees (2017)
Resources	Total number of employees (2018)
	Own resources (2016)
	Own resources (2017)
	Own resources (2018)
	Average resources from supplier companies in the last three years
	Supplier company resources (2016)
	Supplier company resources (2017)
	Supplier company resources (2018)
	Bank resources in the last three years
	Bank resources (2016)
	Bank resources (2017)
	Bank resources (2018)
	Average government resources in the last three years
	Government resources (2016)
	Government resources (2017)
	Government resources (2018)
	National sales in the last three years (%)
	Domestic Sales (2016)
	Domestic Sales (2017)
	Domestic Sales (2018)
International Sales in the last three years (%)	
International Sales (2016)	
International Sales (2017)	
International Sales (2018)	
Places where they export	

Table A1 (cont.). Model variables and indicators: Competitiveness

Variable	Innovation
Items	Indicator
Product/service innovation	Number of new improved products in the last three years Number of new service-enhanced innovations in the past three years With whom does the company develop innovation? Percentage of revenue from sales of improved new products or services in the last three years
Process innovation	Number of innovations implemented in production processes in the last three years processes Who has developed the innovations in the production processes? Total percentage of cost savings from the implementation of new or improved
Organizational innovation	The company is ISO9000 certified The company is ISO14000 certified The company is ISO27001 certified The company is ISO22000 certified The company is BASC certified (other) The application of formal procedures to assess risk in innovative projects The company supports employees in specialized training The company encourages teamwork to generate new ideas The company encourages creative thinking to generate innovative projects The company carries out multidisciplinary projects The company rewards staff for innovating The people selection process ensures the hiring of employees with new knowledge, skills and ideas for the company The company regularly benchmarks the competition The company has an intranet to share knowledge The company uses ICTs to manage internal and external knowledge
Marketing innovation	The percentage distribution of the marketing innovation (price) The distribution percentage of the innovation in marketing (promotion) The percentage distribution of the marketing innovation (product positioning) Percentage of sales in the last year of products or services with significant improvements in their design or presentation Percentage of sales in the last year of products or services with significant improvements in their design or presentation Percentage assigned to stands at international fairs Percentage assigned to promotions and discounts Percentage assigned to advertising in foreign media Percentage Allocated to Catalogs Percentage assigned to mailings Percentage assigned to telemarketing Percentage assigned to web page Percentage assigned to other activities

Table A2. Model variables and indicators: Technological capital

Technological capital	
Variable	Management in research and development (R&D)
Items	Indicator
Technology of the information and communication	With the ICT that the company has (Internet) With the ICT that the company has (Intranet) With the ICT that the company has (Extranet) With the ICT that the company has (Web Page) Situation of the company, personnel assigned in the company for research and development, for the internationalization process Situation of the company, influence of ICT in the diffusion of knowledge between teams and departments Situation of the company, impact of ICT for the interpretation and analysis of internal and external information Situation of the company, usefulness and ease of retrieval of the information, stored in the databases and file systems for decision making and evaluation of problems
Technology	Management of the company in international operations (Internet) Management of the company in international operations (Intranet) Management of the company in international operations (Extranet) Management of the company in international operations (Web Page) It has a computer system and/or specific module for the export department The company has a blog to share company information abroad

Table A2 (cont). Model variables and indicators: Technological capital

Technological capital	
Variable	Management in research and development (R&D)
Items	Indicator
Network	Company personnel are registered in specialized social networks that favor potential international business The company's staff manages its network of professional contacts The company is aware of the ICT support programs of the public administration or industrial support institutions The company has social media contact management software
Variable	Technological equipment
Items	Indicator
Machinery and equipment	Number of laboratories Number of measuring equipment Number of specialized machines
Software	The company has its own software The company has purchased software Number of software R&D design applications Number of inbound logistics R&D software applications Number of software applications R&D production Number of outbound logistics R&D software applications Number of commercial R&D software applications Number of R&D Admin Software applications. Number of computer R&D software applications
Computers and operators	The company has IT/telecommunications operators Total number of computers that the company has for management and operation
Technological processes	
Variable	Indicator
Items	Indicator
Inputs or raw material for technology and innovation	Level of technological and organizational changes introduced by the company in the last three years in relation to information technology for the improvement of management and operation Level of technological and organizational changes introduced by the company in the last three years in relation to R&D to improve management and operation Level of technological and organizational changes introduced by the company in the last three years in relation to the incorporation of qualified personnel to improve management and operation Level of technological and organizational changes introduced by the company in the last three years in relation to training courses to improve the qualification of the personnel involved in management and operation Number of people that make up the technology department Computer-savvy employees
Technological processes and innovation	The company has one or some of the office systems with management software The company has one or some of the systems for integrated management system The company owns one or some of the systems for computer aided design The company has one or some of the systems for supply chain management system The company has one or some of the systems for customer relationship management system The company has other management systems Services contracted for the company, which favor technological processes, management and maintenance of the computer park Services contracted for the company, which favor technological processes, computer consulting Services contracted for the company, which favor technological processes, training Services contracted for the company, which favor technological processes, software development
Output-value created	Benefits generated in the company, by the use of technological processes, reduce costs Benefits generated in the company, by the use of technological processes, improve quality Benefits generated in the company, by the use of technological processes, reduce the processing time of transactions Benefits generated in the company, by the use of technological processes, improve the relationship with customers and offer a better service Benefits generated in the company, by the use of technological processes, improve relations with our suppliers Benefits generated in the company, by the use of technological processes, improve the supply process Benefits generated in the company, by the use of technological processes, configuration of new products or services that improve our position in the market

Table A3. Model variables and indicators: Exports

Exports	
Variable	Export orientation
Items	Indicator
Products/services	<p>Investment objectives of the company are focused mainly on international customer satisfaction</p> <p>Constant monitoring of the level of commitment to the needs of the international client</p> <p>The strategy is based on understanding the needs of the international client</p> <p>Customer satisfaction frequently and consistently</p> <p>The objectives of the company are focused mainly on the satisfaction of the international client in terms of the benefits obtained in the purchase of the product</p> <p>The management communicates to all employees the information about the commercial result with the foreign clients</p> <p>The company's management believes that all employees can contribute to creating value for foreign customers</p>
International promotion and marketing	<p>They respond quickly to competitive actions that threaten international markets</p> <p>Managers continually seek new export markets</p> <p>Process of planning, execution and evaluation of marketing strategies</p> <p>Ability to reach different frameworks and target segments</p> <p>Ability to use marketing tools to differentiate products from main competitors</p> <p>Knowledge of customers and competitors</p> <p>Development and adaptation of products to customers and markets</p> <p>Company image</p> <p>Ability to respond quickly to development opportunities</p>
Variable	Exported products (international insertion)
Items	Indicator
Product units sold	Proportion of export sales in relation to the company's total sales in the last year
Exports	<p>Percentage of investment in promotion and advertising abroad in relation to the total investment in promotion and advertising</p> <p>Percentage of time worked dedicated to export activity in relation to the total time worked in the last year</p> <p>The success of the products in international markets is due to: Raw materials</p> <p>The success of the products in international markets is due to: Technology</p> <p>The success of the products in international markets is due to: Design</p> <p>The success of the products in international markets is due to: Quality</p> <p>The success of the products in international markets is due to: Packaging</p> <p>The success of the products in international markets is due to: Price</p> <p>The success of the products in international markets is due to: Service</p> <p>The success of the products in international markets is due to: Service</p>
Variable	Export capacity-management
Items	Indicator
Strategic management	<p>The different export strategies. Which one does your company use?</p> <p>Managers actively seek contact with suppliers or customers in international markets</p> <p>Managers have regularly attended domestic or foreign trade fairs</p> <p>Managers always encourage new product ideas for international markets</p> <p>Managers believe that an opportunity in international markets is greater than one in domestic markets</p> <p>Of the total number of employees, what number of employees have language skills to serve international markets?</p>
Infrastructure operational management	<p>Management information system can quickly determine the profitability of sales territories</p> <p>Management information system can quickly determine the profitability of product lines</p> <p>Generally, in the company, export and international business executives can make their own decisions without consulting someone else.</p> <p>In the company, management sees training and training in international markets as a significant investment</p>