



Validity and reliability of a scale for measuring intellectual capital in SMEs

Validez y confiabilidad de una escala de medición del capital intelectual en PyMEs

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Abstract

This investigation had the purpose of doing the exploratory analysis of the intellectual capital (IC) construct and the reliability in small and medium enterprises (SME's) of Monterrey, Nuevo León, México. The sample used consisted of 233 SME's managers from Monterrey. A questioner with 16 statements was validated to measure IC in the SME's. The factorial analysis was made with two methods the principal components and structural equation modelling. It was observed that in the factorial analysis three factors got together (human capital, structural capital and relational capital) that were proposed by many authors. In the confirmatory analysis of the IC through structural equations, shows that all the criteria (X^2 , p, X^2/df , CFI, GFI, NFI, RMSEA) have a good fit

JEL Code: M12, O10, O15

Keywords: intellectual capital; human capital; structure capital; relational capital

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Resumen

Esta investigación tuvo el propósito de realizar el análisis exploratorio, así como su confiabilidad de la Escala de Capital Intelectual (ECI) en las pequeñas y medianas empresas (pymes) de Monterrey, Nuevo León, México. La muestra estuvo constituida por 233 directivos de Pymes de Monterrey. Se validó un instrumento con 16 declaraciones para medir la variable capital intelectual en las pymes. Se realizó un análisis factorial exploratorio usando dos métodos, el de componentes principales y modelo de ecuaciones estructurales. Al realizar el análisis exploratorio del constructo se observó que los ítems se agruparon en los tres factores (capital humano, capital estructural y capital relacional) propuestos por diversos autores. Al realizar la validez del constructo usando modelos de ecuaciones estructurales se observó que todos los criterios seleccionados (X^2 , p , X^2/gf , CFI, GFI, NFI, RMSEA) se cumplieron, obteniéndose una alta confiabilidad de la escala.

Código JEL: M12, O10, O15

Palabras clave: capital intelectual; capital humano; capital estructura; capital relacional

Introduction

Edvinsson and Malone (1999) mention that an organization is like a tree where there is a visible part (leaves, branches, and fruit) and a hidden part (roots). If only the visible part is taken care of and the roots are forgotten, the tree may die. This is also true for companies; if the focus is only on the financial results and the hidden values are ignored, the company will not survive in the long term. In a knowledge-based economy, intellectual capital (IC) is recognized as a source of growth, innovation, and competitive advantage (Lev, 2001). Moreover, much of the literature emphasizes the potential of IC to improve the competitiveness, position, and value creation of a company. The literature also suggests benefits for overcoming the weaknesses that small and medium-sized companies have (Berezinets, Garanina, & Ilina, 2016; Edvinsson & Malone, 1997; Firer, 2005; Jordão & Novas, 2017; Sullivan, 2000; Verbano & Crema, 2016). The topic of IC has gained relevance among academics, practitioners, and consultants. Companies compete by relying more on intangible resources such as technologies, process innovations, employee skills, creativity, relationships with external partners, and industry networks (Berezinets et al., 2016; Cordazzo, 2005; Keong, 2008; Kujansivu & Lönnqvist, 2007).

Several authors (Dumay, 2014; Galabova, 2014; Mouritsen, 2006) mention that although IC cannot be seen in an accounting report, articles with this point of view predominate and ignore important management processes and strategy in the organization. On the other hand, some scholars point out that SMEs do not seem to manage IC as large companies do and urge future researchers to study IC in SMEs (Durst & Edvardsson, 2012; Guthrie, Ricceri, & Dumay, 2012; Marzo & Scarpino, 2016).

This article aims to provide a validated measurement scale to measure IC.

This research is divided into the following sections: theoretical framework, methodology, analysis of results, discussion, conclusions, and references.

Theoretical framework

Definitions of intellectual capital

What is intellectual capital? Some authors define it as the intangible assets that an organization has, but that are not reflected in its financial statements, and that generate value or have the potential to generate value in the future (Euroforum, 1998; Lev, 2001; Ramírez & Constansa, 2009; Sagástegui, 2014).

According to Medina, Gonzalez, and Perez (2007), IC includes staff knowledge, ability to learn and adapt, relationships with customers and suppliers, brands, product names, internal processes, and innovation and development capacity. For Secundo, Dumay, Schiuma, and Passiante (2016), IC is a multidimensional concept of knowledge assets, experience, and practical capabilities to create value. Edvinsson and Malone (2003) mention that some authors include in their definition of IC factors such as leadership in technology, employee training, and aspects such as speed of response to customers. Cassol, Reis, Santos, and Lima (2016) state that for developing IC and absorptive and innovative capacity, constant training of employees, suggestion programs, assimilation of new technologies, application of know-how, and partnerships with innovation support agencies are needed.

Dimensions

Most authors (Alvarez & Gonzáles, 2013; Bontis, 2002; Bontis, Chua, & Richardson, 2000; Buenechea, 2017; Herremans, Isaac, Kline, & Nazari, 2011; Marzo & Scarpino, 2016; Matricano, 2016; Mention & Bontis, 2013; Ordóñez, 2003; Petty & Guthrie, 2000; Reyes, 2011; Roos, Roos, Dragonetti, & Edvinsson, 2001; Sagástegui, 2014; Viedma, 2001; Wee & Chua, 2016) agree that IC, since its inception, continues to be classified into the same three dimensions (a) human capital, (b) structural capital, and (c) relational capital.

Human capital

For Mertens (1996), managers of organizations are giving greater importance to the human factor. The European Union recognizes that innovations and the human factor can be seen as the main drivers of growth for countries, companies, and individuals (OECD, 2013). The human factor is present in every moment of the productive event since the participation of people is required to obtain results in organizational performance (Kemppilä & Lönnqvist, 2003; Saari & Judge, 2004).

On the other hand, Reyes (2011) mentions that human capital is the talent that people have and the main value of organizations. For Marimuthu, Arokiasamy, and Ismail (2009), human capital is one of the dimensions of IC known as the organization's largest and most important intangible asset. It includes processes associated with education, training, and other career plans to increase an employee's knowledge, skills, values, and social assets. Similarly, other authors point out that human capital is the source of knowledge, ideas, inspiration, and innovation in organizations (Gates & Langevin, 2010; Johanson, Mårtensson, & Skoog, 1999).

Several authors mention that human capital is the sum of knowledge, skills, competencies, innovations, commitment, and wisdom that belong to the employee and that the employee uses to perform their tasks and that they take with them when they leave the organization (Bontis, 1998; Edvinsson & Malone, 2003; Johnson, 1999; Morris, 2015).

Human capital is the set of competencies of an individual that makes it possible for said individual to generate value for the company. Human capital is composed of training, incentives, teamwork, public recognition, awards, promotions, goal achievement, employee turnover, and sufficient and accurate information (Roos et al., 2001; Sagástegui, 2014). Álvarez and González (2013) mention that human capital includes the emotional and operational parts: attitudes, feelings, motivation, loyalty, friendship, and behavior. Sagástegui (2014) points out that three components can be distinguished within the dimension dedicated to human capital (a) competencies, in the form of knowledge, skills, and talent and knowing how to do the task; (b) attitude, which translates into the conduct, motivation, performance, and ethics of people; and (c) intellectual agility, which generates value for the organization to the extent that new knowledge or discoveries are applied, making it possible for ideas to be transformed into products and services.

Structural capital

Structural capital is more specialized than the other components, as it can be seen as the basic structure of a company that enhances human capital. Furthermore, structural capital is considered the structure for

establishing and maintaining relationships in the organization. Structural capital also includes the most valuable strategic assets of the company, such as organizational and cultural capabilities, processes, patents, copyrights, trademarks, and databases (Bontis, 1998; Curado, Henriques, & Bontis, 2011; Denicolai, Ramusino, & Sotti, 2015; Hejazi, Ghanbari, & Alipour, 2016; Janosevic & Dzenopoljac, 2012; Johnson, 1999; Molodchik, Shakina, & Barajas, 2014; Schiuma & Lerro, 2008).

For Aramburu, Sáenz, and Blanco (2015), structural capital largely explains the effectiveness of generating new ideas and managing innovation projects because structural capital includes equipment, programs, databases, organizational structure, and everything concerning the organizational capacity. Thus, structural capital is everything that stays in the company when employees are not at work (Edvinsson & Malone, 2003).

Medina et al. (2007) mention that there are two schools of thought for measuring structural capital. The first comes from the legal protection that the organization exercises over assets with a special value. Among those assets are know-how, trade secrets, copyrights, patents, design rights, trademarks, and service marks. The second refers to assets that bring order, security, correctness, and quality to the organization, corporate culture, and methods for calculating risks or information databases.

On the other hand, Sagástegui (2014) mentions that structural capital refers to the formal and informal organizational structure and the company's leadership, management, and cultural systems. Structural capital has to do with structural design, coordination mechanisms, group behavior, organizational routines, corporate culture, planning and control systems, and industrial know-how.

Relational capital

Relational capital is the knowledge obtained through the development of external relationships. It comprises knowledge of employees, processes, innovation capacity, research projects, branding, and relationships (Bontis, Janosevic, & Dzenopoljac, 2015; Cabrita & Bontis, 2008; Johnson, 1999; Kweh, Lu, & Wang, 2014; Serenko & Bontis, 2004; Ting & Lean, 2009; Wang, Wang, & Liang, 2014; Youndt, Subramaniam, & Snell, 2004; Yu, Wang, & Chang, 2015).

For Edvinsson and Malone (1997), relational capital includes external relationships with customers, suppliers, shareholders, and other stakeholders such as the government and society in general. Sagástegui (2014) mentions that relational capital is composed of the company's relationships with its customers (price and quality control), distribution channels, suppliers, alliances, banks, shareholders, and trademarks. Therefore, this capital has to do with the relationships that the company has. Seen in another way, it is the perceived value of the company.

Álvarez and Gonzáles (2013) divide relational capital into external and internal agents. External agents are customers, suppliers, vendors, and public administrations. Internal agents have to do with good relations with shareholders, managers, employees, market (image and logo), reputation, ethics, and brand.

For Villena and Souto (2015), foreign trade-oriented relational capital, sustainable firm culture, quality certification, competitive improvement capability, and employee orientation positively impact firm performance.

Proposed questionnaire items, according to the authors

Table 1 presents the bibliographic basis for each item.

Table 1
 Reagents with a bibliographic basis

Items	Authors
1. The staff continually learns from others	(Bontis, 1998; Edvinsson & Malone, 2003; Johnson, 1999; Marimuthu et al., 2009; Morris, 2015)
2. Employees have the necessary competencies for the position	(Bontis, 1998; Edvinsson & Malone, 2003; Johnson, 1999; Marimuthu et al., 2009; Morris, 2015)
3. The employee participates in job enrichment and work flexibility programs	(Bontis, 1998; Edvinsson & Malone, 2003; Johnson, 1999; Marimuthu et al., 2009; Morris, 2015)
4. The employee is capable of developing new ideas and knowledge	(Gates & Langevin, 2010; Johanson et al., 1999)
5. The staff copes with difficulties efficiently	(Bontis, 1998; Johnson, 1999; Edvinsson & Malone, 2003; Morris, 2015)
6. The employee builds trust and is committed to the company	(Roos et al., 2001; Sagástegui, 2014)
7. Training programs are in place to develop and update the skills of employees on an ongoing basis	(Bontis, 1998; Edvinsson & Malone, 2003; Johnson, 1999; Marimuthu et al., 2009; Morris, 2015)
8. The company has recruitment and selection processes in place to hire the best candidates	(Bontis, 1998; Curado et al., 2011; Denicolai et al., 2015; Hejazi et al., 2016; Janosevic & Dzenopoljac, 2012; Johnson, 1999; Molodchik et al., 2014; Sagástegui, 2014; Schiuma & Lerro, 2008;)
9. The knowledge and experiences of employees are stored in manuals, systems, and processes	(Bontis 1998; Johnson, 1999; Curado et al., 2011; Denicolai et al., 2015; Hejazi et al., 2016; Janosevic & Dzenopoljac, 2012; Molodchik et al., 2014; Sagástegui, 2014; Schiuma & Lerro, 2008)
10. The company has documented procedures that help to execute routine actions	(Bontis 1998; Curado et al., 2011; Denicolai et al., 2015; Johnson, 1999; Hejazi et al., 2016; Janosevic & Dzenopoljac, 2012; Molodchik et al., 2014; Sagástegui, 2014; Schiuma & Lerro, 2008)

11. The company has the infrastructure in place for employees to access relevant information	(Bontis 1998; Curado et al., 2011; Denicolai et al., 2015; Janosevic & Dzenopoljac, 2012; Johnson, 1999; Molodchik et al., 2014; Sagástegui, 2014; Schiuma & Lerro, 2008)
12. The company formally assesses the reasons for the success or failure of the collaboration with strategic alliances	(Bontis 1998; Johnson, 1999; Schiuma & Lerro, 2008; Curado et al., 2011; Denicolai et al., 2015; Hejazi et al., 2016; Janosevic & Dzenopoljac, 2012; Molodchik et al., 2014; Sagástegui, 2014)
13. Employees have good relationships through networking with customers, suppliers, partners, and friends for the development of solutions	(Bontis et al., 2015; Cabrera & Bontis, 2008; Edvinsson & Malone, 1997; Johnson, 1999; Kweh et al., 2014; Sagástegui, 2014; Serenko & Bontis, 2004; Ting & Lean, 2009; Wang et al., 2014; Youndt et al., 2004; Yu et al., 2015)
14. The company learns from strategic alliances to improve its processes	(Bontis et al., 2015; Cabrera & Bontis, 2008; Edvinsson & Malone, 1997; Johnson, 1999; Kweh et al., 2014; Sagástegui, 2014; Serenko & Bontis, 2004; Ting & Lean, 2009; Wang et al., 2014; Youndt et al., 2004; Yu et al., 2015;)
15. Employees rely on suppliers to solve business and strategic needs (cost, quality, time, production, and others)	(Bontis et al., 2015; Cabrera & Bontis, 2008; Edvinsson & Malone, 1997; Johnson, 1999; Kweh et al., 2014; Sagástegui, 2014; Serenko & Bontis, 2004; Ting & Lean, 2009; Wang et al., 2014; Youndt et al., 2004; Yu et al., 2015;)
16. The staff is involved in managing long-term relationships with customers	(Bontis et al., 2015; Cabrera & Bontis, 2008; Edvinsson & Malone, 1997; Johnson, 1999; Kweh et al., 2014; Sagástegui, 2014; Serenko & Bontis, 2004; Ting & Lean, 2009; Wang et al., 2014; Youndt et al., 2004; Yu et al., 2015;)

Source: created by the author

Research on the measurement of the IC scale

Martínez (2006) conducted an exploratory study of an IC model using structural equations. The study was conducted at a university in the humanities and social sciences. The sample size was 59 subjects. The instrument consisted of 60 items which were classified into the concept maps. The IC construct was dimensioned in human, structural, and relational capital. The instrument's reliability for human capital was .81, for structural capital .72, and relational capital .82. Additionally, the following hypotheses were tested, (a) human capital predicts structural capital by 29%, (b) structural capital predicts relational capital by 50%, and (c) relational capital predicts human capital by 36%.

Cabrera and Bontis (2008) conducted an IC and performance study of the Portuguese banking industry. The study was conducted with 253 participants from 53 banking organizations. The IC instrument was dimensioned in human capital, relational capital, and structural capital. Besides, the study measured business performance and tested hypotheses through the PLS software. The reliability of the instruments was .93. A principal components analysis was performed with a VARIMAX rotation. The four factors were made up of 14 items for human capital, 14 for relational capital, 10 for structural capital,

and 10 to measure performance. Subsequently, a comparison was made with studies from Canada and Malaysia, where it was found that 15 items were repeated in the three studies.

Hernández, Moreno, and Arroyo (2010) conducted an exploratory analysis of the implementation and use of IC information systems in companies. The analysis carried out the data collection process through an instrument that they sent to the directors or management control department of the 1,911 companies in the Autonomous Community of Castilla y León. The response rate was 11%, and the sample was 211 companies. The following dimensions were used to measure IC: human capital, structural capital, and relational capital.

Chahal and Bakshi (2016) conducted research to measure IC in the banking sector. The instrument was distributed to 576 participants from 144 branches, of which 339 responded to the questionnaire. The reliability of the total IC instrument was .922; of human capital .913; of structural capital .820; and relational capital .908. In the exploratory analysis, the human capital dimension, with 31 items, was reduced to 13. In structural capital, 16 of 21 items were retained, and in relational capital, 7 of the 11 items were retained. They then performed a confirmatory analysis using the three factors (human capital, structural capital, and relational capital). These three factors were dimensioned as follows, (a) human capital: competencies, creativity, manager attitude, and employee attitude; (b) structural capital: innovation, information technologies, and culture; (c) relational capital: relationship with employees and relationship with customers. The model results were as follows: $\chi^2/df = 3.119$, RMSEA = .80, NFI = .914, IFI = .940, TLI = .912, and CFI = .939.

Mercado (2016) researched the validity of an intellectual capital measurement scale with a three-component model (human capital, structural capital, and relational capital). The validation was carried out with a sample of 742 academics, middle managers, and managers of Mexican universities. The exploratory factor analysis identified four factors (human capital, structural capital, relational capital, and technological capital) that explain 66.74 of the variance. The reliability extracted by Cronbach's alpha was greater than .85.

Methodology

This research used a population consisting of the managers of 2,500 SMEs registered in CAINTRA in Nuevo León, Mexico. For the sample collection process, authorization was requested from the director of the Tecnológico Nacional de México, Nuevo León campus, through an official letter signed by the head of the research project and the industrial engineering project liaison. This letter communicated the request for permission to the directors of the companies affiliated with CAINTRA. Subsequently, the students in a group doing their professional residencies in these companies were given ten surveys each, together with

the official document to be presented to the company managers to authorize their application. The survey was administered physically to the managers at their facilities in their free time. For others, appointments were scheduled so as not to obstruct the daily productive work of the companies.

This research used non-random, convenience sampling since the selected company managers in Monterrey, Nuevo Leon, Mexico, and its metropolitan area were willing to participate between September and December 2017. The sample consisted of 233 managers, representing 9.32% of the population, with the following characteristics: (a) divided by age, 20 to 30 years of age, 48.7%; 31 to 40 years of age, 29.3%; 41 to 50 years of age, 18.5%; and 51 to 60 years of age, 3.4%; (b) by gender, 79.3% are men and 20.7%, women; (c) by education level, 14.2% studied up to high school, 69.4% up to undergraduate degree and 16.4% up to postgraduate degree; (d) by performance area, 3.9% work in sales, 34.3% in production, 8.2% in purchases, 12.4% in administration, and 41.2% in other areas; (e) by position, 17% work at the operational level, 59.2% are supervisors, 22.9% work in management, and only .9% work at the director level; (f) by sector, 4.8% work in sales, 88.3% in manufacturing, and 6.9% in services.

Instrument creation procedure

Sanchez (2018) created an instrument with 16 Intellectual Capital Scale (ICS) statements that was made up of three dimensions, as suggested by the authors mentioned above (a) human capital (CI1 to CI7), (b) structural capital (CI8 to CI11), and (c) organization-related capital (CI12 to CI16). Concerning procedure, a list of items that could be used to form the construct was drawn up. Then, consultations and reviews were carried out with experts in the field, such as SME managers, to select the most relevant items, leaving a total of 16 items.

After the instrument was created, content validity was applied, where the clarity and relevance of each of the items were evaluated with the help of five experts in the field. The instrument was applied between September and December 2017. The scale used was as follows: 1, never; 2, almost never; 3, sometimes; 4, almost always; and 5, always.

Hair, Anderson, Tatham, and Black (2007) suggest having at least five respondents for each item. The ratio used in this research was 15 respondents for each item.

Results analysis

To determine construct validity, exploratory factor analysis was performed using SPSS software version 23. The reliability of the instrument was calculated, and descriptive statistics were presented. Structural equation modeling analysis was also performed using AMOS version 21 software.

Construct validity

The factor analysis procedure was used to assess the validity of the IC construct. In the correlation matrix analysis, the 16 statements were found to have a positive correlation coefficient greater than .3 or close to .3. The sample adequacy measure KMO resulted in a value close to the unit (KMO= .939). For Bartlett's test of sphericity, the results ($X^2= 2,538.301$, $gl= 120$, $p= .000$) were significant. When analyzing the anti-image covariance matrix, it was verified that the main diagonal values are significantly greater than zero (greater than .8).

For the principal component extraction statistic, it was found that the communality values (Commin = .555; Commax = .779) for the 16 items of the scale are higher than the extraction criterion (Com= .300). Concerning the total variance explained, a confirmatory analysis was performed with three factors explaining 69.143% of the total variance. This value was higher than the 60% established as a criterion.

As for the rotated factorial solution, orthogonal rotation was used. Table 2 presents information comparing the relative saturations of each item for the three IC factors.

The first factor (column 1 of Table 2) consisted of six items and was named "human capital." The indicators were as follows: "can develop new ideas and knowledge" (CI4), "copes with difficulties efficiently" (CI5), "fosters trust and is committed to the company" (CI6), "has the skills required for the position" (CI2), "continuously learns from others" (CI1), "can participate in job enrichment and job flexibility programs" (CI3), and "training programs are in place to constantly develop and update employee competencies" (CI7), [despite having a higher factor loading in factor three (structural capital) it was decided to leave it in this factor (human capital) since it has a significant loading in this factor and is the one in which it was initially included].

The second factor (column 2 of Table 2) consisted of five items and was assigned the name "organization-related capital." The indicators were as follows: "employees rely on suppliers in solving business and strategic needs, costs, quality, time, production, and others" (CI15), "learns from strategic alliances to improve their processes" (CI14), "employees have good relationships through networking with customers, suppliers, partners, and friends for the development of solutions" (CI13), "the staff is concerned with managing long-term relationships with customers" (CI16), item CI12 (formally assesses the reasons for success or failure in collaboration with strategic alliances) [despite having a higher factor loading in factor three (structural capital), it was decided to leave it in this factor (relational capital) since it has a significant loading in this factor. It is the one in which it was initially].

The third factor (column 3 of Table 2) consisted of five items and was assigned the name "structural capital." The indicators were as follows: "have documented procedures that help execute

routine actions” (CI10), “store employee knowledge and experiences in manuals, systems, and processes” (CI9), “have the infrastructure for employees to access relevant information” (CI11), and “have recruitment and selection processes to hire the best candidates” (CI8).

Table 2
 Distribution of items after orthogonal rotation

	Component		
	1	2	3
Is capable of developing new ideas and knowledge (CI4)	.831	.230	.191
Copes with difficulties efficiently (CI5)	.797	.054	.268
Fosters trust and is committed to the company (CI6)	.724	.284	.296
Has the skills required for the position (CI2)	.716	.302	.301
Continuously learns from others (CI1)	.670	.368	.223
Can participate in job enrichment and job flexibility programs (CI3)	.578	.474	.346
Employees rely on suppliers for the solution of business and strategic needs, costs, quality, time, production, and others (CI15)	.255	.789	.278
Learns from strategic alliances to improve their processes (CI14)	.144	.784	.377
Employees have good relationships through networking with customers, suppliers, partners, and friends for the development of solutions (CI13)	.282	.769	.218
The staff is involved in the management of long-term relationships with clients (CI16)	.377	.731	.183
Have documented procedures that help to execute routine actions (CI10)	.243	.250	.749
Store employee knowledge and experience in manuals, systems, and processes (CI9)	.365	.201	.726
Have the infrastructure in place for employees to access relevant information (CI11)	.245	.352	.678
Have recruitment and selection processes in place to hire the best candidates (CI8)	.424	.246	.648
Formally assesses the reasons for success or failure in collaboration with strategic alliances (CI12)	.139	.564	.570
Training programs are in place to constantly develop and update employee competencies (CI7)	.452	.368	.464

Source: created by the author

Instrument reliability

The analysis was carried out with the full scale and each of the proposed dimensions. The results are presented in Table 3 and illustrate acceptable reliability values. The value of human capital was ($\alpha = .906$), the highest value. In contrast, the structural capital factor ($\alpha = .841$) presented the lowest reliability, but it was above the threshold ($\alpha = .700$), while for relational capital it was ($\alpha = .892$). In general, the instrument is reliable ($\alpha = .945$).

Table 3
 Internal consistency values (Cronbach's alpha)

Scale	Cronbach's alpha
Complete	.945
Human Capital	.906
Structural Capital	.841
Relational Capital	.892

Source: created by the author

Table 4 presents the arithmetic means (M) and standard deviation (SD) of the IC construct. The highest means were as follows: "Have documented procedures that help execute routine actions" (4.25), "Fosters trust and is committed to the company" (4.18), and "Have the infrastructure for employees to access relevant information" (4.12). The lowest were the following: "The employee participates in job enrichment and job flexibility programs" (3.68), "Training programs are in place to develop and update employee competencies constantly" (3.69), and "Formally assesses the reasons for success or failure of the collaboration with strategic alliances" (3.77). The overall mean of the IC construct was 3.95.

Table 4
 Arithmetic means of the items

Items	M	SD
Have documented procedures that help execute routine actions (CI10)	4.25	.837
Fosters trust and is committed to the company (CI6)	4.18	.750
Have the infrastructure in place for employees to access relevant information (CI11)	4.12	.894
The staff continually learns from others (CI1)	4.06	.767
Workers have the competencies required for the position (CI2)	4.04	.791
Have recruitment and selection processes in place to hire the best candidates (CI8)	4.00	.986
The employee can develop new ideas and knowledge (CI4)	4.00	.807
The staff is involved in managing long-term relationships with clients (CI16)	3.97	.970
The staff copes with difficulties efficiently (CI5)	3.96	.766
Knowledge and experiences of employees are stored in manuals, systems, and processes (CI9)	3.88	1.02
Employees have good relationships through networking with customers, suppliers, partners, and friends for the development of solutions (CI13)	3.88	.886
Employees rely on suppliers to solve business and strategic needs (cost, quality, time, production, and others) (CI15)	3.87	1.00
Learning from strategic alliances to improve their processes (CI14)	3.81	.924
Formally assesses the reasons for success or failure of the collaboration with strategic alliances (CI12)	3.77	.932
Training programs are in place to constantly develop and update employee competencies (CI7)	3.69	1.07
The employee participates in job enrichment and work flexibility programs (CI3)	3.68	.996
Intellectual Capital	3.95	.630

Source: created by the author

Construct validity with structural equations

Structural equation modeling was also used to perform the ICS factor analysis. The SPSS software database had several missing data, and it is necessary not to have missing data to use structural equation models. The database was cleaned using the arithmetic mean in each of the items. A diagram of the model was constructed displaying the dimensions and items of the IC construct. The model established the relationships between the dimensions.

Hair *et al.* (2007) comment that goodness-of-fit indices can be used to evaluate the model (see Table 4). Some of the most commonly used criteria were selected from the list: chi-square (X^2), chi-square ratio/degrees of freedom (X^2/gl), comparative goodness-of-fit index (*CGFI*), goodness-of-fit index (*GFI*), and root mean square error (*RMSEA*).

Table 4
 Goodness-of-fit statistics

Statistic	Abbreviation	Criteria
Absolute fit		
Chi-square	X^2	Significance > .05
Chi-square ratio/degrees of Freedom	X^2/gl	Less than 3
Comparative adjustment Goodness-of-fit index		
Comparative Other	CFI	$\geq .95$
Goodness-of-fit index	GFI	$\geq .90$
Root of the mean square residual approximation	RMSEA	< .10

Source: created by the author

Figure 1 displays the proposed model for IC, consisting of 16 items. On resolving the model, no problems were detected since the variances corresponding to the items were positive and the standardized coefficients were less than one. In examining the regression coefficients, it was found that each of them was significant at p levels less than or equal to .001.

To start validating the IC construct, the normality of the construct was first checked using Mahalanobis distances. The data were reduced from 233 to 172. The standardized regression coefficients were reviewed and adjusted to 1. Subsequently, the residual moments and the fit of the indices were reviewed, resulting in a model with ten items. The ICS presented very acceptable goodness-of-fit indices, according to the indices selected as criteria ($X^2 = 41.977$, $p = .112$, $X^2/gl = 1.312$, *CGFI* = .990, *GFI* = .956, *NFI* = .959, *RMSEA* = .043).

It is observed that between the constructs, there is a correlation of .81 between human capital and structural capital. There is also a correlation between human capital and relational capital of .75, and between structural capital and relational capital, the correlation was .84 (see Figure 1).

Final item reliability

After performing the factor analysis, the instrument's reliability was calculated with the final items, obtaining a Cronbach's alpha of .912.

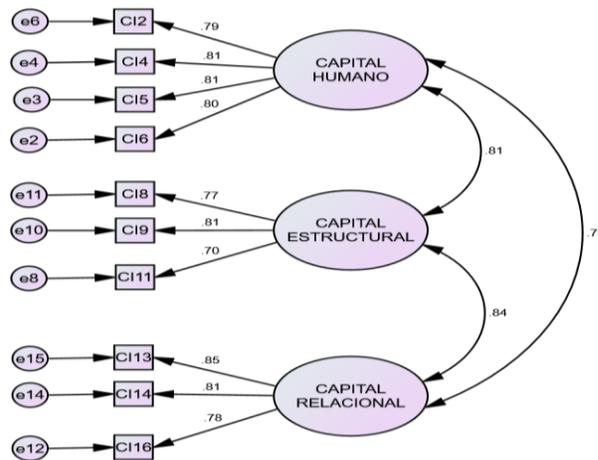


Figure 1. Standardized parameters for the intellectual capital model.
 Source: created by the authors.

Conclusions

The article presented the reliability and construct validity of IC for SMEs in Monterrey, Nuevo León, Mexico. The ICS was structured according to the theoretical underpinning of several authors (Álvarez & Gonzáles, 2013; Bontis, 2002; Bontis & Richardson, 2000; Buenechea, 2017; Herremans et al., 2011; Marzo & Scarpino, 2016; Matricano, 2016; Mention & Bontis, 2013; Ordóñez, 2003; Petty & Guthrie, 2000; Reyes, 2011; Roos et al. 2001; Sagástegui, 2014; Viedma, 2001; Wee & Chua, 2016) into the following dimensions: human capital, structural capital, and relational capital. The ICS consisted of 16 items. When the exploratory factor analysis was performed with SPSS, it revealed that all the established

criteria were met (KMO, Bartlett's sphericity test, anti-image covariance matrix, communalities, and total variance explained). Regarding the rotated factorial solution, 14 items were grouped in the corresponding factors, and two items presented higher loadings in another factor. Although CI7 had a higher factor loading in the structural capital factor, it was decided to leave it in the human capital factor since it has a similar loading in this factor and is the one in which it was initially grouped. Item CI12 had a higher factor loading in the structural capital factor. However, it was decided to leave it in the relational capital factor since it has a similar loading in this factor and is where it was initially. The final reliability for the ICS was .912 and was similar to other studies conducted on both the construct and the factors (Cabrita & Bontis, 2008; Chahal & Bakshi, 2016).

When performing the exploratory factor analysis with a structural equation model, the results of fit indices of the proposed model demonstrate the model's acceptance with three factors. The goodness of fit indices were the following: chi-square (X^2), chi-square ratio/degrees of freedom (X^2/df), comparative goodness of fit index (CGFI), goodness of fit index (GFI), and root mean squared residual (RMSEA). The results of the model fit indices were satisfactorily fulfilled ($X^2 = 41.977$, $p = .112$, $X^2/df = 1.312$, $CGFI = .990$, $GFI = .956$, $NFI = .959$, $RMSEA = .043$). These indices were better when compared to the results of Chahal and Bakshi (2016), although these authors performed the validation with a structural equation model using the factor dimensions.

In conclusion, the exploratory factor analysis demonstrated that the ICS in the SMEs of Monterrey, Nuevo Leon, Mexico could be dimensioned in the following three factors: human capital, structural capital, and relational capital. The structural equation model corroborated the construct validity of the ICS since all the selected goodness-of-fit indices were fulfilled.

This study has implications for the business sector, as it contributes to the validation of a scale to measure IC in SMEs. Some authors (Dumay, 2014; Durst & Edvardsson, 2012; Galabova, 2014; Guthrie et al., 2012; Marzo & Scarpino, 2016; Mouritsen, 2006;) recommend conducting studies of IC in SMEs from a non-accounting point of view.

For future research, the recommendation is to test the ICS in other Mexican states or countries to compare the results with this study.

Among the limitations of this study is that no discrimination and validation of the survey items were carried out, using several pilot tests with large samples.

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