



The 6th International Symposium on Emerging Information, Communication and Networks
(EICN 2019)
November 4-7, 2019, Coimbra, Portugal

Factorial Analysis in the Intellectual capital's dimensions on micro, small, and medium-sized export enterprises

Adalberto Escobar Castillo^{a*}, Gabriel Velandia Pacheco^b, Lissette Hernández-Fernández^c, Evaristo Navarro Manotas^d, Tito Crissien Borrero^e, Jesus Silva^f

^{a, b, c, d, e} Universidad de la Costa (CUC), Barranquilla 080003, Colombia
^f Universidad Peruana de Ciencias Aplicadas, Lima, Peru.

Abstract

The objective of this paper is to analyze the intellectual capital in the industrial export MSMEs of the Atlántico Department. A research was conducted through a quantitative approach with a field, non-experimental design, and a descriptive study. A Likert-type questionnaire was used as an instrument with reliability index of 0,944 on 82 statements, which was applied to 40 micro, small, and medium-sized export enterprises in the industrial sector. The measurements of central tendency, dispersion, and factorial analysis were used as statistical tools. The results show the presence of strategies that enhance the relational, structural, and human dimensions of the intellectual capital. Results allowed to conclude that attitudes and capabilities of human resources are relevant for these organizations, as well as the internal processes, and the relationships with customers.

© 2019 The Authors. Published by Elsevier B.V.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)
Peer-review under responsibility of the Conference Program Chairs.

Keywords: Human capital; relational capital; structural capital; intellectual capital, micro, small, and medium-sized enterprises.

1. Introduction

The dynamics of economic systems in the society during the last century has led to an evolution of the financial situation of the organizations, since intangible assets have acquired special relevance in the commercial operations. This statement is based on the changes faced by the economic structures which were supported in an 83% by land,

* Corresponding author. Tel: +57-301-478-3827
E-mail address: aescobar2@cuc.edu.co

buildings, and large machinery, and came to be supported in an 80% by intangible resources, leading to a new social order called the knowledge society (Torres, 2014) [1]. In this sense, Bueno (1998) [2] expresses that the differential factor of the new economy lies in the fact that intellectual capital serves as a productive factor capable of generating competitive advantages in the organizations. For this reason, managers of institutions involved in the post-industrial era should devise mechanisms that allow management to make strategic decisions based on the generated knowledge flows.

Under this premise, it can be said that the markets in post-industrial era are characterized by being unpredictable, unstable, and highly competitive, due to the increasing presence of intangible assets arising from the constant information and knowledge flows in the environment. In fact, business success is driven to the implementation of strategies for the management of learning capabilities of human capital, the efficiency of control and information systems, and the optimization of those relationships that may be established with stakeholders (Molodchik & Jardon, 2017) [3]. Accordingly, the intellectual capital has been established as the cornerstone in the success of organizations that consider the organizational knowledge as the assets of greater representation during the development of the operational cycle. Similarly, the use of mechanisms to assess the organizational capabilities to make decisions based on the transformation of tacit into explicit knowledge will guarantee the sustainability of economic units over time, their market presence, and the value generation (Castello, 2002) [4]; (Hernández-Fernández, 2003) [5]. For this reason, the objective of this article is to analyze the intellectual capital in the industrial export Micro, Small, and Medium-sized Enterprises (MSMEs) of the Atlántico Department.

2. The intellectual capital in the knowledge economy

In the framework of the dynamic characteristic of current markets, intellectual capital is shown as a set of assets of intangible nature that derive from the knowledge inside the organizations. For this reason, López et al. (2005) [6] claim that, through strategies related to the planning, organization, direction, and control of organizational learning, business capabilities can be developed to generate competitive advantages. For its part, Bradley (1997) [7] considers that the intellectual capital refers to those assets of intangible nature arising from the knowledge generated by the capabilities and mental models of the human resource. From this class of resources, the strategies used by the high management allow to efficiently manage the productive factors of immaterial nature.

In summary, the various theoretical references have identified the intellectual capital as an integration of intangible assets that support the generation of competitive advantages, from the development of strategies aimed at the economic use of the knowledge derived from the processes, human resources, and relations with the external sector. For this reason, Saint-Onge (1996) [8]; Stewart (1997) [9]; Sveiby (1997) [10]; Edvinsson and Malone (1997) [11], and Roos et al. (2001) [12] state that the human, structural, and relational dimensions integrate the intellectual capital of a company. With regard to the intellectual capital in its human dimension, Edvinsson and Malone (1997) [11], Roos et al. (2001) [12], Marzo (2016) [13], Molodchik and Jardon (2017) [3] and Agostini et al. (2017) [14], express that, through the intellectual capital, the capabilities and skills of the people in the organization can be assessed to generate knowledge from individual learning. This process will provide value to the extent that it constitutes an important factor for the strengthening of internal procedures.

On the other hand, Sánchez et al. (2007) [15] and Khalique and Bontis (2015) [16] argue that the structural dimension of intellectual capital refers to all that knowledge that the organization has been able to make explicit through the implementation of procedures aimed at the management of all intangible assets arising from Know What, Know How, and Know Why. In the perspective assumed by the cited authors, the definition of strategies promoting the internalization of human resource skills through culture, information systems, and databases acquires a great value. Finally, Hernández (2010) [17] expressed that due to the fact that the decision-making process is permanently influenced by external factors, it is of great importance to assess the organization capabilities to develop distinctive competencies from the relations established with customers, suppliers, shareholders, human resource, creditors, State, and with society in general. These considerations are referred to as relational capital.

3. Methodology

The research assumed a quantitative approach, given that the intellectual capital in the industrial export MSMEs of the Atlántico Department is analyzed using statistical techniques (Hernández et al., 2014) [18]. This feature allowed the researchers to establish guidelines and generate empirical evidence for contrasting theories concerning the administration of the intangible assets arising from organizational knowledge, as a permanent source for the development of competitive advantages. For Hernández et al. (2014) [18] the definition of the approach is important in the research process since it leads the strategies used by the researcher for defining the techniques in the analysis of the information collected through the instrument. In this sense, the authors believe that the quantitative studies provide an exploratory, descriptive, correlational, and explanatory scope. The depth of the research depends on the researcher knowledge with respect to the issue addressed and the researcher's point of view. Given the objective of the research, its scope is framed at a descriptive level. The research design used is field, non-experimental type since the dimensions studied included the intellectual capital in export MSMEs of the Atlántico Department, without deliberate manipulation in its natural context. This process was carried out through the data collecting in a single period, what means that the study is cross-sectional (Hernández et al., 2014) [18].

On the other hand, the sample was composed of forty (40) micro, small and medium-sized businesses that perform export activities in the industrial sector of the Atlántico Department. The companies were selected following a simple random probability sampling, and completed a questionnaire with a Likert ordinal scale, whose reliability index is 0,944 on 82 statements (Hernández et al, 2014) [18]. The statistical tools used to analyze the intellectual capital in each of the dimensions in the industrial export MSMEs of the Atlántico Department are the central tendency measures, and the multivalent tests like the factorial analysis. The primary information collected was processed through the statistical program called Statistical Package for the Social Sciences (SPSS) version 18. The central tendency measures helped to identify points of reference for interpreting the values obtained from the application of the questionnaire. On the other hand, factor analysis is a multivariate statistical test used with the aim of reducing the dimensions that explain the behavior of a variable. To apply this technique, it is necessary to use a series of sampling adequacy measures, which serve as the basis for developing the model to estimate the intellectual capital in the industrial export MSMEs of the Atlántico Department (Montoya, 2007) [19]; (Ferrando & Anguiano, 2010) [20] and (Hernandez et al., 2014) [18].

4. Analysis and discussion of the results

4.1. Practices that enhance the intellectual capital in the export MSMEs of the Atlántico Department

The Table 1 shows arithmetic averages of more than four (4) (agree) for the assessment of managers, respecting to the importance of technical qualification processes in human resources, the staff motivation to confront the problems with full confidence in their capabilities, and the development of entrepreneurial orientation. The range of answers to the human capital dimension ranged from 3 to 5. In effect, the data obtained determined that the four (4) (agree) is the common denominator in the ratings of the respondents. These results complement the studies carried out by Marzo (2016) [13], Molodchik, and Jardon (2017) [3] and Agostini et al. (2017) [14] who determined that, in the context of MSMEs, the human resource is a key factor in the success of the acquisition, production, and transformation of intellectual capital through strategies to strengthen the knowledge, capabilities, and skills acquired by the staff.

Table 1. Practices of human capital in the export MSMEs of the Atlántico Department

Practice	Mode	Median	Mean	Standard Deviation	Maximum	Minimum
Entrepreneurial orientation	4	4	4,03	0,423	5	3
Human resource confidence to face difficult situations	4	4	4,1	0,304	5	4
Technical qualification	4	4	4,1	0,304	5	4
Measures of central tendency of the human capital indicator	4	4	4,08	0,344		

About the structural capital, it is observed that the formal systems in the MSMEs guarantee the generation, transmission, and communication of knowledge. In addition to the above, the authors determined the existence of informal practices that favor the structuring of strategic alliances with the interest groups as a mechanism to strengthen

the skills to generate value. However, patents and other types of certifications are not used to support the presence of knowledge. The above was justified in the results obtained, since the mode indicates the option four (4) (agree) as the most frequent value in the responses of the managers. In this case, the median establishes that the 50% of the sample indicates that MSMEs develop activities that strengthen the structural capital through policies that ensure synergies with stakeholders and the implementation of formal systems for the transformation from tacit to explicit knowledge. However, an arithmetic average of response of 3.5 with a dispersion degree of 1.06 permits to infer that these institutions are not interested in the creation of patents and other types of certificates (Table 2).

Table 2. Practices of structural capital in export MSMEs of the Atlántico Department

Practice	Mode	Median	Mean	Standard Deviation	Maximum	Minimum
Strategic alliances with groups of interest	4	4	3,6	0,67	4	2
Creation of patents and other certifications	4	4	3,5	1,06	5	3
Formal systems for transmitting knowledge	4	4	3,8	0,58	5	1
Measures of central tendency of the structural capital indicator	4	4	3,7	0,77		

The studied MSMEs have policies to assess market trends through the ongoing relationship with customers, for the purposes of permanent improvement processes. In addition to the above, meetings are the basis for the generation of innovating ideas. On the contrary, expert directories and the horizontal integration with suppliers do not constitute administrative tools to identify the causes of problems and the knowledge required to solve them. Finally, there are no strategies to analyze the information about the competitors. In this sense, weaknesses are observed with respect to the corporate capabilities to generate value from the relationships established with the stakeholders. This assertion has empirical support in the data collected, because an average response located in 3.5 with an average dispersion of 1.01 indicates that, in these institutions, the expert directories, the continuous relationship with suppliers, and the analysis of information from competitors are not considered tools for the generation of value (Table 3).

Table 3. Relational capital practices in export MSMEs of the Atlántico Department

Practice	Mode	Median	Mean	Standard Deviation	Maximum	Minimum
Expert directories as a tool to solve problems	4	4	3,1	1,138	4	1
Meetings as innovation mechanisms	4	4	3,6	0,917	4	1
Continuous relation with suppliers	4	4	3,5	0,96	5	1
Continuous relation with clients	4	4	3,8	1,104	4	1
Strategies to analyze information of the competitors	4	4	3,5	0,933	4	1
Strategies for market research	4	4	3,6	1,006	4	1
Measures of central tendency of the relational capital indicator	4	4	3,5	1,01		

4.2. Intellectual capital in export MSMEs of the Atlántico Department: Factorial Analysis

First, the existence of correlations between the different indicators used must be determined. When analyzing the data shown in Table 4, there is a considerable degree of direct correlation between the different dimensions that make up the practices that enhance the intellectual capital of export MSMEs in the Atlántico Department. This result constitutes empirical evidence to validate the theoretical contribution outlined by Garzón (2006) [21], who indicates that the ability of the organization managers to manage intangible assets will allow the generation of value.

Table 4. Correlation matrix

		Human capital	Structural capital	Relational capital
Correlation	Human capital	1,000	0,844	0,785
	Structural capital	0,844	1,000	0,928
	Relational capital	0,785	0,928	1,000
Sig. (Unilateral)	Human capital	Does not apply	0,000	0,000
	Structural capital	0,000	Does not apply	0,000
	Relational capital	0,000	0,000	Does not apply

a. Determinant = 0.040

Once the analysis of the existing correlations between the dimensions that integrate the intellectual capital in export MSMEs of the Atlántico Department, Bartlett's Test, and the Kaiser, Meyer, and Olkin (KMO) analysis must be applied for determining the existence of significant interrelations between the studied factors (Ferrando & Anguiano, 2010) [20]. According to the data recorded in Table 5, it can be considered that the relationships between the variables studied are adequate for performing the factorial analysis.

Table 5. KMO and Bartlett's test

Kaiser-Meyer-Olkin sample adaptation measure.	Bartlett's sphericity test	
0,711	Approximate Chi-square	119,752
	Gl	3
	Sig.	0.000

Because the KMO and Bartlett tests determine that the factor analysis is the most relevant method to establish the interrelationships between human, relational, and structural capital, it is important to verify the importance of each of them based on the use of the statistical method called "Main Components Analysis". In this sense, the data in Table 6 allows to infer that structural capital is the main factor for explaining the variance of intellectual capital in the context of export MSMEs.

Table 6. Commonalities

	Initial	Extraction
Human capital	1,000	0,848
Structural capital	1,000	0,949
Relational capital	1,000	0,909

Extraction Method: Main Components Analysis

According to Montoya (2007) [19], in the "Main Components Analysis", a component represents a combination of variables that seeks to determine the total variance of the study object. In the case of intellectual capital in export MSMEs, the following table shows that the first component is sufficient to explain 90.2% of the variance (see Table 7).

Table 7. Total Variance explained

Component	Auto initial values			Sums of saturations to the square of the extraction	
	Total	% of variance	% accumulated	Total	
1	2,706	90,204	90,204	2,706	
2	0,230	7,657	97,862		
3	0,064	2,138	100,000		

Extraction Method: Main Components Analysis

Based on the above, the first factor is chosen as the main element for an explanation of the variance of the intellectual capital in export MSMEs of the Atlántico Department. This component is made up of human capital with a factor loading of 0,921, the structural capital with a participation of 0,974, and relational capital with 0,954. In this type of business institutions, intellectual capital is subject to the efficiency and effectiveness of internal processes (see Table 8). These results support the theoretical assumptions of Sánchez et al. (2007) [15] confirming the importance of managing all those intangible assets arising from Know What, Know How, and Know Why.

Table 8. Components Matrix

Dimensions	Component 1
Human capital	0,921
Structural capital	0,974
Relational capital	0,954

Extraction Method: Main Component Analysis.

5. Conclusions

Based on the results, it is concluded that the alliances with the stakeholders, the formal systems to transmit knowledge, the meetings, the continuous relationship with the clients, and the market research constitute practices that enhance the structural and relational dimension of the intellectual capital of the MSMEs, developing strategies that allow the acquisition of a competitive position in a market in which organizations are measured through variables that transcend the financial field. However, these institutions do not consider the development of strategies that lead to the creation of patents and other types of certifications as a source of competitive advantages, based on the use of tools such as expert directories, the continuous relationship with suppliers, and the analysis of the information coming from the competitors.

Another conclusive element refers to the direct relationships that appear in the human, relational, and structural dimensions of intellectual capital, a situation that highlights the characteristics of the economic application of knowledge that has been generated within MSMEs or acquired from external sources, because in most cases, this process responds to a set of systematized steps. In coherence with the results obtained, the influence exerted by internal processes, management systems, and technological tools in the transformation of implicit knowledge in intangible assets capable of generating value is highlighted. These results are consistent with the theoretical assumptions outlined by Sveiby (1997) [10] and Roos et al. (2001) [12]. Finally, the results of the research are empirical evidence related to the study of intellectual capital, as primary information was generated to support future research related to the management of intangible assets derived from internal learning capabilities, constituting this way, a basic input for the strengthening of research lines related to the management of organizations [22] [23].

References

- [1] Torres, L. (2014) “La importancia de los activos intangibles en la sociedad del conocimiento”. *Revista la propiedad inmaterial*, **(18)**: 5-34.
- [2] Bueno, E. (1998) “El capital intangible como clave estratégica en la competencia actual”. *Boletín de Estudios Económicos*, **53(164)**, 205-229.
- [3] Molodchik, M., & Jardon, C. (2017) “Intellectual capital as enhancer of product novelty: An empirical study of Russian manufacturing SMEs”. *Journal of Intellectual Capital*, **18(2)**: 419-436.
- [4] Castello, E. (2002) “Los activos intangibles en la era del conocimiento”. *Boletín de estudios económicos*, **57(176)**: 197-226.
- [5] Hernández-Fernández, L. (2003) “Conocimiento, cambio y transformación organizacional”. **9(1)**: *Omnia*, 9(1).
- [6] López, M., Cabrales, G., & Schmal, R. (2005) “Gestión del conocimiento: una revisión teórica y sus asociación con la universidad”. *Panorama Socioeconómico*, **(30)**: 0.
- [7] Bradley, K. (1997) “Intellectual capital and the new wealth of nations”. *Business Strategy Review*, **8(1)**: 53-62.
- [8] Saint-Onge, H. (1996) “Tacit knowledge: The key to the strategic alignment of intellectual capital”. *Strategy and leadership*, **24(2)**: 10-14.
- [9] Stewart, T. (1997) “*Intellectual capital: the new wealth of organizations*. Doubleday Currency”. New York: Doubleday Dell publishing group.
- [10] Sveiby, K. (1997). “*The new organizational wealth*”. United States of America (USA): Berrett-Koehler Publishers, Inc.
- [11] Edvinsson, L., & Malone, M. (1997) “*Intellectual Capital: Realizing yours Companys true Value by finding its hidden brainpower*”. New York: Harper Collins.
- [12] Roos, G., Bainbridge, A., & Jacobsen, K. (2001) “Intellectual Capital as a Strategic Tool”. *Strategic & Leadership*, **29(4)**: 21-26.
- [13] Marzo, G. (2016). Exploring intellectual capital management in SMEs: an in-depth Italian case study. *Journal of Intellectual Capital*, **17(1)**, 27-51
- [14] Agostini, L., Nosella, A., & Filippini, R. (2017) “Does intellectual capital allow improving innovation performance? A quantitative analysis in the SME context”. *Journal of Intellectual Capital*, **18(2)**: 400-418.
- [15] Sánchez, A., Melián, A., & Hormiga, E. (2007) “El concepto del capital intelectual y sus dimensiones”. *Investigaciones Europeas de Dirección y Economía de la Empresa*, **13(2)**: 97-111.
- [16] Khaliq, M., & Bontis, N. (2015) “Intellectual capital in small and medium enterprises in Pakistan”. *Journal of Intellectual Capital*, **16(1)**: 224-238.
- [17] Hernández, M. (2010) “Propuesta del modelo de gestión del conocimiento para la gerencia de gestión documental y centros de servicios compartidos del grupo bancolombia en Medellín”. *Tesis de especialización*. Medellín: Universidad de Antioquia.
- [18] Hernández, R., Fernández, C., & Baptista, P. (2014) “*Metodología de la investigación*”. México D.F: Mc Graw Hill.
- [19] Montoya, O. (2007) “Aplicación del Análisis Factorial a la Investigación de Mercados”. *Scientia et Technica*, **13(35)**: 281-286.
- [20] Ferrando, J., & Anguiano, C. (2010) “El análisis factorial como técnica de investigación en psicología”. *Papeles del Psicólogo*, **31(1)**: 18-33.
- [21] Garzón, M. (2006) “Aproximaciones a la gestión del conocimiento en empresas colombianas”. *Universidad empresa*, **5(10)**: 232-256.
- [22] Amelec, V., & Carmen, V. (2015). Validation of a model for productivity evaluation for microfinance institutions. *Advanced Science Letters*, **21(5)**, 1610-1614.
- [23] Amelec, V. (2015). Increased efficiency in a company of development of technological solutions in the areas commercial and of consultancy. *Advanced Science Letters*, **21(5)**, 1406-1408.