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# The impact of intellectual capital on financial performance in Argentina, Chile and Peru

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Intellectual capital research is a topic that has stood out in recent decades and has allowed us to recognize other types of strategic non-accounting resources that allow organizations to increase their financial performance. Despite the importance of the subject, the evidence for emerging economies, especially in Latin America is scarce and outdated with inconclusive results. This motivates this research. The objective of this work is to determine and quantify the impact of intellectual capital and its components, human capital, relational capital, and structural capital on the financial performance of the electricity industry in Argentina, Chile, and Peru. The estimates are considered using a panel analysis and the generalized methods of moments and fixed effects are used. The results are not conclusive when estimating a contemporary relationship between human capital, relational capital, and structural capital and financial performance. However, a significant positive relationship is observed when lagged measures are used for each proposed measure of intellectual capital.

Key words: Intellectual capital, firms' performance, electricity industry, emerging markets.

#### INTRODUCTION

The research into intellectual capital, as an intangible asset, has been highlighted in recent decades and has allowed the recognition of another type of strategic non-accounting resources that permit organisations to generate better performance (Pirogova et al., 2020; Xu et al., 2020; Xu and Li, 2019; Xu and Liu, 2020; Xu and

Wang, 2018). In the context of the knowledge economy, investments in intangible assets have grown significantly in recent decades, overtaking investment in tangible assets (Oppong and Pattanayak, 2019; Pirogova et al., 2020), which has generated a challenge in recognizing and measuring this type of investment in the financial

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Author(s) agree that this article remain permanently open access under the terms of the <u>Creative Commons Attribution</u> License 4.0 International License states of companies, making the correct valuation of companies and organisations difficult (Fengli and Xu, 2020).

In accordance with resource-based theory, the competitive advantage of an organization is explained by having valuable, heterogeneous, non-transferable, and expensive resources to reproduce, that is, investments in intangible assets. Intellectual capital, in particular, has become a key resource. Examples of these resources are organizational processes, brands, staff skills and capacity, work methodologies, relationships with interest groups, information, and knowledge of organizational, production or other capacities, the purpose of which is to achieve higher levels of efficiency and sustainable effectiveness competition (Nadeem et al., 2017).

As a consequence of the positive relationship between investment in intellectual capital and organisations' performance, there has been increasing interest in measuring intellectual capital and its effects (Pedro et al., 2018). In spite of the importance of the topic, the evidence from emerging economies, especially from Latin American economies, is scarce, out of date and with inconclusive results (Fernandez-Jardon and Martos, 2016), which is what motivates this present research (Li et al., 2021). Thus, this study contributes by providing an updated and detailed analysis related to intellectual capital and its effects, revealing its importance in companies that operate in emerging economies, and in particular, in electricity companies due to the relationship that exists between economic growth and energy consumption and also between economic growth and organisations' performance (Dalmazzo-Bermejo et al., 2016). For this, a data set from Latin American countries and a methodology of panel data have been utilized.

This paper is arranged in five sections. The introduction is in section one, the review of related literature is in section two, the data and methods are displayed in section three, the results and discussion are shown in section four, while the paper is concluded in section five.

# LITERATURE REVIEW AND PROPOSAL OF HYPOTHESES

During the industrial era, the investment in tangible assets was considered the only source of riches. However, currently knowledge has been transformed into a strategic resource, revealing an increasing investment in intangible assets (Ozkan et al., 2017). The literature has understood that intellectual capital is an intangible asset utilised for creating value in a set of other assets or transforming it into other resources. However, we will understand intellectual capital as a set of resources or abilities of a strategic nature that are difficult to imitate and that affect the development of the unique capabilities of a company in search of competitive advantage (Evans et al., 2017; Geissdoerfer et al., 2018; Li et al., 2021).

There exists agreement in understanding intellectual capital as a dynamic resource in constant movement Wulf et al. (2017) that can be explained through three concepts: human capital (HC), structural capital (SC), and relational capital (RC) (Smriti and Das, 2018; Urban and Joubert, 2017; Xu and Li, 2019; Xu and Wang 2019).

For Meles et al. (2016) and Sardo et al. (2018), human capital can be defined as knowledge acquired by a person that increases his or her productivity and the value of his or her contribution to the company. Likewise, for Ahmed et al. (2019), human capital is recognized as the skills and knowledge of employees, which can be enhanced with adequate training. Structural capital is formed of all the intangible resources capable of generating values that reside in an organisation, that is to say, that which is inside an organisation when the employees have left (Ahmed et al., 2019). For Arash et al. (2018) it is all the knowledge that is property of the organisation and is independent of the people (culture, organisational processes, and information systems). This is supported by the management of all types of databases of the company, reports generated, manuals of processes and functions and any instrument that has value for the organisation and that value is higher than its material value.

Pedro et al. (2018) define relational capital as the ability of the company to interact positively with the business community and all its surroundings. The elements that make this up are mainly strategic alliances, brand value, relationships with the community, analysis of the reputation consumer trust, competition, of the organisation, relationships with providers, financial relationships, rate of client retention, client satisfaction, distribution of contracts with providers, distribution channels and agreements, franchising agreements, and social networks, among others (Xu and Wang, 2018).

Jordão (2017) find a positive relationship between intellectual capital and company performance when the measure is EBITDA (Earnings before interest, taxes, depreciation, and amortization) for a data set of Brazilian companies. Similar results were obtained by Xu and Wang (2019), but they highlight the contributing effect of structural capital when the performance measure is EBIT (Earnings before interests and taxes). Bontis et al. (2015) find that structural and human capital positively affects company performance when the measure of performance is return on assets (ROA) for a data set of 34 Serbian hotels. Similar results are found by Nimtrakoon (2015) for whom intellectual capital is positively associated with return on assets (ROA) for data from companies from the Association of Southeast Asian Nations (ASEAN). Xu and Wang (2018) find similar results when the performance measure is the margin of gross profit and the margin of

net benefit.

Haris et al. (2019) find specifically that human capital positively affects companies' performance when the measure used is the margin of gross profit but observes a negative relationship of structural capital for data of Pakistani banks. However, Nabi et al. (2020) do not find a significant relationship when the performance measure used is earnings per share (EPS) for a data set of banks from Bangladesh. Arash et al. (2018) find similar results. An explanation for these inconclusive results is the lack of consensus with respect to the definition and composition of intellectual capital and to the identification of non-observable dimensions that could improve the quality of the estimations (Matos et al., 2020).

Despite the importance of this issue, few studies have researched the relationship between intellectual capital and company performance (Ge and Xu, 2020). This work proposes the following hypotheses:

H1: Human capital positively affects financial performance in companies in the electricity industry.

H2: Structural capital positively affects financial performance in companies in the electricity industry.

H3: Relational capital positively affects financial performance in companies in the electricity industry.

H4: The interactions between the components of intellectual capital positively affect the financial performance of companies in the electricity industry.

#### DATA AND METHODOLOGY

#### Data base, variables, and methodology

The sample for the current study was obtained from Thomson Reuters Eikon that contains information of non-financial companies from which Argentine, Chilean and Peruvian companies were selected for this research. The period under study considers the years 2013 to 2018. The data collected correspond to consolidated financial statements for these companies and years, respectively. The data were entered into and tabulated through the STATA 14 statistical software. The empirical analysis was divided into two stages. First a descriptive analysis was done to show the main characteristics of our sample and the basic relationships between the variables and, following that, the proposed hypotheses were evaluated. To test the coherence of our results, we executed various models with different variables and methods of estimation.

We controlled the dynamic endogeneity introducing the term lagged for the dependent variable and the simultaneity, estimating our regressions using estimations of the generalised moments method (GMM) in which we introduced several explicative lagged variables as instruments and therefore an estimator of the GMM system is proposed, as it deals efficiently with problems of endogeneity (Le and Phan, 2017). As indicated, to estimate the relationship between the company's performance and the intellectual capital, specifically human capital, HCAP, structural capital, SCAP and relational capital, RCAP and its effect on performance and their interactions, panel data methodology was used. The specification test of Hausman confirmed that is preferable to utilize the model of fixed effects over the model of random effects (Bell et al., 2019). To test the validity of the instruments, the Hansen test of over-identification of restrictions is used, checking the absence of correlation between the instruments and the end of error and thus, verifying the validity of the chosen instruments. To validate our research hypotheses, we considered the research done by Mardones and Cuneo (2020) who used panel data to estimate the relationships proposed in this research.

To validate the hypotheses of this research and the relationship between intellectual capital and its components, human capital, structural capital and relational capital, with financial performance, we follow Sardo et al. (2018), Soewarno and Tjahjadi (2020) and Xu and Wang (2019), who propose the existence of linear relationships between the components of intellectual capital and financial performance. Thus, (1) is proposed.

$$ROA_{i,t} = \alpha_0 + \beta_1 ROA_{i,t-1} + \beta_2 Hcap_{i,t} + \beta_3 Scap_{i,t} + \beta_4 Rcap_{i,t} + \beta_5 Hcap_{i,t-1} + \beta_6 Rcap_{i,t-1} + \beta_7 Rcap_{i,t-1} + \beta_8 LEV_{i,t} + \varepsilon_{i,t}$$
(1)

Following Sardo et al. (2018), the relevance of the components of intellectual capital on financial performance does not only refer to the individual contribution of each component, but also to the interaction between them. Thus, for the effect of these possible interactions of the components of intellectual capital, we have proposed (2).

 $\begin{aligned} ROA_{i,t} &= \alpha_0 + \beta_1 ROA_{i,t-1} + \beta_2 Hcap_{i,t} + \beta_3 Scap_{i,t} + \beta_4 Rcap_{i,t} + \\ \beta_5 Hcap_{i,t} * Scap_{i,t} + \beta_6 Hcap_{i,t} * Rcap_{i,t} + \beta_7 Scap_{i,t} * Rcap_{i,t} + \\ \beta_8 LEV_{i,t} + \varepsilon_{i,t} \end{aligned}$  (2)

#### Measurement of variables and descriptive statistics

To reduce bias in the estimation between the components of intellectual capital and company's performance, we propose to use leverage as a control variable following Guney et al. (2020), Jara et al. (2019), Li et al. (2020). Table 1 presents the details of all the variables.

#### **RESULTS AND DESCRIPTIVE STATISTICS**

The summary of the descriptive statistics of all of the variables (Table 2) shows an average profitability measured through ROA of 0.078362 with a standard deviation of 0.0659319; it shows a low volatility in this performance measure due to the fact that the electricity industry is a highly regulated business. It is observed that the companies show an average leverage of 1.253551 (LEV) which reveals the importance of the use of sources of external financing and the kind of business model. Thus, we can reveal the magnitude and importance of this investment for the operations of the companies. The average values of the components of intellectual capital suggest a greater level of human capital (HCAP) than structural capital (SCAP) or relational capital (RCAP).

Continuing with the descriptive analysis (Table 3), a significant and positive correlation can be observed

Table 1. Definition of variables.

Variable	Abbreviation	Detail
Return on assets	ROA	Operating income to total assets
Control variables		
Leverage	LEV	Total debt to total assets
Intellectual capital dimensions		
Human capital	HCAP	Natural logarithm of staff cost
Structural capital	SCAP	Working capital turnover
Relational capital	RCAP	Revenue growth

Source: Own elaboration.

 Table 2. Descriptive statistics.

Variable	Mean	Standard deviation	Minimum	Maximum
ROA	0.078362	0.065932	-0.0374	0.3362
HCAP	11.723690	4.449208	0	19.5926
SCAP	0.576256	10.471000	-81.5962	132.9421
RCAP	0.060281	0.398268	-1.6749	-1.6749
LEV	1.253551	2.689439	8.1909	26.6291

Source: Own computation using STATA 14 software.

#### Table 3. Correlation matrix.

Variable	ROA	HCAP	SCAP	RCAP	LEV
ROA	1.0000				
HCAP	-0.5386 (0,0000)	1.0000			
SCAP	-0.0589 (0.2925)	0.0659 (0.2396)	1.0000		
RCAP	0.0004 (0.9939)	-0.0122 (0.8305)	0.0057 (0.9213)	1.0000	
LEV	0.2866 (0.0000)	0.0999 (0.0749)	-0.0042 (0.4557)	0.1932(0.0007)	1.0000

Source: Own computation using STATA 14 software. Level of significance is shown in parentheses.

between debt, LEV, and the performance variable, return on assets, ROA, which is in accord with that found by Forte and Tavares (2019). In terms of the variables that explain intellectual capital, mixed results are observed. We observe a significant and positive correlation between relational capital, RCAP, and the performance variable. However, for human capital, HCAP, a significant and negative correlation is observed with the performance measure, ROA and finally, the structural capital, SCAP, shows a negative and non-significant correlation of 0.0589.

In Table 4, the Arellano and Bond tests for AR(1) and AR (2) are shown; it is observed that for AR(2) there is no serial correlation of the errors as its p-value is 0.272 and 0.203 respectively for the models (1) and (2). Thus, we understand that the problems of endogeneity have been

adequately dealt with. To identify possible multicollinearity problems between the variables, the correlation matrix was estimated, as well as the inflation variation factor (VIF). The results do not show the presence of these problems.

The results for (1) and (2), estimated using the generalised moments model (GMM), show that financial performance in the electricity industry measured by return on assets, ROA, shows a positive and significant relationship with the return of the previous period  $ROA_{(t-1)}$ , 0.843313 and 0.700033. This is in accord with that found by Pastusiak et al. (2016); Utami et al. (2020); Sardo et al. (2018) who find that financial performance shows persistence in companies from the hotel industry (Table 3). Additionally, it is observed that human capital, HCAP, which represents knowledge, aptitudes, skills, and

Variable	Model (1) coefficient	Variable	Model (2) coefficient
L1. ROA	0.843313(0.0378) ***	L1. ROA	0.700033(0.0502) ***
HCAP	-0.003235(0.0014) ***	HCAP	-0.002729(0.0010) ***
SCAP	0.000239(0.0026) *	SCAP	0.008583(0.0023) ***
RCAP	0.003588(0.0051) *	RCAP	-0.011494(0.0129)
L1.HCAP	0.001770(0.0015)) *	HCAP * SCAP	0.000000(0.0001) ***
L1.SCAP	-0.000414(0.0002)	HCAP * RCAP	0.001298(0.0010) *
L1.RCAP	0.006266(0.0049) *	SACP * RCAP	-0.000034(0.0011) ***
LEV	0.003146(0.0007) ***	LEV	0.003827(0.0008)
CONS	0.025477(0.084) ***	CONS	0.051440(0.0144) ***
p-value AR(1)	0.184	p-value AR(1)	0.077
p-value AR(2)	0.272	p-value AR(2)	0.203
Lag	1	Lag	1
Observations	272	Observations	289
Groups	27	Groups	27
Obs. per group	8	Obs. per group	9

Table 4. Estimation relationship between intellectual capital and financial performance with GMM estimators.

Standard deviation in parentheses. \*p < 0.1; \*\* p < 0.05; \*\*\* p < 0.01. Source: Own computation using STATA 14 software.

abilities possessed by individuals that belong to an organisation, shows a negative and significant relationship, -0.003236 and -0.00229 when (1) and (2) are estimated.

For its part, structural capital, which is formed of all the intangible resources capable of generating value such as the knowledge stock that is property of the company and independent of the people, SCAP, shows a positive and non-significant relationship, 0.000239 when (1) is estimated, and 0.008583 when (2) is estimated. Therefore, H1 is rejected for (1) and (2) and H2 is accepted when we have measured a contemporaneous relationship between the components of intellectual capital and financial performance. These results are coherent with those obtained by Buallay et al. (2019); Chowdhury et al. (2019) and Tran et al. (2020).

In terms of relational capital, RCAP, which considers the company's ability to interact and considers resources such as strategic alliances, companies' image, brand value, etc., it shows mixed and significant results. When (1) is estimated the results show a positive and nonsignificant relationship, 0.003588, and, when (2) is estimated, a non-significant relationship is observed too. In accordance with these results, H3 is rejected inasmuch as a positive relationship between relational capital, RCAP, and companies' performance, ROA, is not observed. These results are coherent with those obtained by Andreeva and Garanina (2016) and Xu and Li (2019).

When (1) is estimated, using lagged variables, for the relationship between the components of intellectual capital and financial performance, it is observed that

human capital, L1.HCAP, shows a positive and significant relationship of 0.001770, as when estimating the effects of relational capital, L1.RCAP, 0.006267. This result is coherent with having a strategic resource available beforehand to obtain a better performance over time. In accordance with this, the hypotheses H1 and H3 are accepted. On the other hand, structural capital, L1.SCAP, shows a non-significant relationship and thus, H3 is rejected. Finally, we observed a positive and significant relationship between leverage (LEV), 0.003146 and 0.003827, respectively, when (1) and (2) are estimated (Table 4).

When estimating the possible interactions between the different types of intellectual capital (2), mixed results are observed. For the relationship between HCAP \* RCAP, a synergistic effect between human capital and relational capital is observed, since we observe a null and significant relationship, 0.0000. This improves the capacities of human capital to develop and offer solutions to the needs of clients and thus, increase the satisfaction of those clients. On the other hand, it is observed that relational capital improves human capital competencies, strengthening its contribution to financial performance, 0.001298 since a positive and significant relationship is observed (Meles et al., 2016; Bontis et al., 2015; Sardo et al., 2018).

However, the interactions proposed between structural capital and relational capital, SCAP\*RCAP, do not show a significant effect on the performance of the organisation. In accordance with these results, Hypothesis 4, the interactions between the components

Variable	Model (1) coefficient	Variable	Model (2) coefficient
L1. ROA	0.848286(0.0034) ***	L1. ROA	0.846913(0.0313) ***
HCAP	-0.002864(0.0012) **	HCAP	-0.001804(0.0004)
SCAP	0.000254(0.0002)	SCAP	0.001332(0.0008)
RCAP	0.003150(0.0041)	RCAP	-0.011231(0.0079)
L1.HCAP	0.001524(0.0013) *	HCAP SCAP	-0.00009(0.0001)
L1.SCAP	-0.000404(0.0002) **	HCAP *RCAP	0.001509(0.0007) *
L1.RCAP	0.006330(0.0050) *	SCAP * RCAP	0.000836(0.0009)
LEV	0.003152(0.0008) ***	LEV	0.003086(0.0006)***
CONS	0.023683(0.010) ***	CONS	0.033949(0.0134) ***
Fixed effects		Fixed effects	
Firm	Yes	Firm	Yes
Year	Yes	Year	Yes
Observations	272	Observations	303
Adj. R-squared	0.8545	Adj. R-squared	0.8415

Table 5. Estimation relationship between intellectual capital and financial performance with fixed effects.

Standard deviation in parentheses. \*p < 0.1; \*\* p < 0.05; \*\*\* p < 0.01. Source: Own computation using STATA 14 software.

of intellectual capital positively affect the financial performance of companies in the electricity industry, is partially accepted as a positive relationship, observed only when analysing the effects of human capital and relational capital.

To control those characteristics of the company those are non-observable and unchanging over time, (1) and (2) are estimated and the results are shown in Table 5. By using the fixed effects method, it is observed that the effect of the performance of the previous period,  $ROA_{(t-1)}$ continues to show a positive and significant relationship 0.848286 and 0.846913 when estimating (1) and (2). On estimating the effects of intellectual capital, it is observed that the effect of human capital, HCAP, continues being negative and significant.

Structural capital shows a positive and significant relationship, 0.000239 when (1) is estimated, and 0.008583 when (2) is estimated. Therefore, H1 is rejected for (1) and (2) and H2 is accepted when we have measured a contemporaneous relationship between the components of intellectual capital and financial performance. These results are coherent with those obtained by Buallay et al. (2019); Chowdhury et al. (2019); Tran et al. (2020). Continuing with the contemporary analysis of relational capital and its effect on the financial performance of the company, a positive and non-significant relationship is observed when we have estimated (1) and (2). In accordance with these results, H3 is rejected inasmuch as a positive relationship between relational capital. RCAP, and company performance, ROA, is not observed.

With respect to the results obtained for (1) with the use of lagged variables, similar results are observed to those obtained with GMM, as for human capital, L1.HCAP, -0.002864 when (1) is estimated and relational capital, L1.RCAP, which shows a positive and significant relationship, 0.006330 with performance . In accordance with this, hypotheses H1 and H2 are accepted. On the other hand, structural capital, L1.SCAP, shows a significant negative relationship -0.000404 when (1) is estimated, however, it shows a positive and significant relationship, 0.001509 when we estimated (2). Therefore, we accept H3 when using (2). Finally, by observing the results of the possible interactions between the different types of intellectual capital and the financial performance of the company (2), we only observe a positive and significant relationship between human capital and relational capital, HCAP \* RCAP, 0.001509. Thus, we can partially accept H4.

#### Conclusion

Different studies have demonstrated the importance of knowing and considering the effect that intellectual capital generates on financial performance, together with an efficient management of its components by companies as they can be a source of value creation that produces competitive advantages that are sustainable over time. The evidence shows the existence of mixed results between intellectual capital and companies' financial performance, which allows us to suppose that the results found in developed economies cannot be extrapolated to emerging economies.

In detail, a positive and significant relationship is observed for structural capital, SCAP, and relational capital, RCAP with financial performance, ROA. It is also worth noting that the use of the lagged variables for human capital, HCAP and relational capital, RCAP, allowed us to suppose that companies must first develop and invest in these strategic resources to obtain a better performance.

We also observe mixed results on examining the interaction between human capital, structural capital, and relational capital. However, the synergy between human capital and relational capital, HCAP \* RCAP is noteworthy due to the positive and significant nature of this relationship with the performance of the company. We also observe positive and significant results when examining the interaction between human capital and structural capital, since this synergy, HCAP \* RCAP stands out for the positive and significant nature of this relationship with the performance of the company, since, when estimating its individual effects, it does not have a positive and significant effect. Consequently, if companies of the electricity industrial sector invest in human capital, they could reach higher levels of performance as, by investing in this resource, they could make the most of the abilities, knowledge, and aptitudes of the personnel that form the organisation, favouring the relationships between the interested parties.

Some of the main limitations of this research are the lack of variables of a strategic nature and the corporate policy system that favours environments that promote competitive advantage. For future research, we propose the identification of strategic variables and corporate governance that contribute to increasing our estimation for Latin American countries' companies.

#### **CONFLICT OF INTERESTS**

The authors have not declared any conflict of interests.

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