

Relationship Between Strategic Innovation Orientation and Organizational Performance: The Mediating Role of Intellectual Capital*

Relación entre orientación estratégica a la innovación y desempeño organizacional: rol mediador del capital intelectual

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Abstract

Purpose: This study aimed to empirically analyze the relationship between strategic innovation orientation and organizational performance through the mediation of intellectual capital.

Design/Methodology: Using a cross-sectional design with an exploratory approach, this study employed quantitative techniques such as Baron and Kenny's product of coefficients method (1986) to examine said mediating effect. The sample comprised 1,765 companies in the manufacturing sector in Colombia, and data were sourced from Colombia's Survey on Development and Technological Innovation (EDIT for its acronym in Spanish) for the 2019–2020 period.

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Findings: According to the findings, there is a statistically significant relationship between strategic innovation orientation and organizational performance. In addition, intellectual capital was found to play a mediating role in this relationship.

Conclusions: It is concluded that intellectual capital is a key mechanism through which strategic innovation-oriented initiatives can lead to better organizational outcomes.

Originality: This study used observable indicators to operationalize the constructs under analysis, providing empirical evidence that aspects related to employees' knowledge and skills, enhanced organizational processes, and effective relationships with stakeholders can maximize the direct effect of strategic innovation orientation on organizational performance. Intellectual capital thus emerges as a new mediating mechanism that has not been extensively explored in the literature on strategic innovation orientation and its impact on organizational performance.

Keywords: organizational performance, intellectual capital, strategic innovation orientation, manufacturing industry.

JEL classification: O32, M10

Highlights

- Strategic innovation orientation enables companies to adapt to the demands of their environment and create competitive advantages.
- Implementing strategic innovation-oriented initiatives helps organizations to improve their performance.
- Intellectual capital serves as a mechanism through which strategic innovation-oriented initiatives can lead to better organizational outcomes.
- Company managers should prioritize strengthening intellectual capital so that strategic innovation orientation translates into better organizational performance.

Resumen

Objetivo: analizar empíricamente la relación entre la orientación estratégica a la innovación y el desempeño organizacional a través de la mediación del capital intelectual.

Diseño/metodología: el estudio siguió un diseño transversal con alcance exploratorio, usando técnicas cuantitativas, como el método de enfoque de productos de coeficientes de Baron y Kenny (1986), para analizar el efecto mediador. La muestra estuvo conformada por 1765 empresas del sector manufacturero en Colombia, obteniendo los datos a partir de la Encuesta de Desarrollo e Innovación Tecnológica (EDIT) de la industria manufacturera para el periodo 2019-2020.

Resultados: se evidenció la existencia de una relación estadísticamente significativa entre la orientación estratégica a la innovación y desempeño organizacional; además, se demostró que el capital intelectual ejerce un rol mediador en esta relación.

Conclusiones: se concluye que el capital intelectual es un mecanismo a través del cual las iniciativas estratégicas orientadas a la innovación se traducen en mejores resultados organizacionales.

Originalidad: el presente estudio utiliza indicadores observables para operacionalizar los constructos analizados, aportando evidencia empírica sobre la forma como los aspectos relacionados con conocimientos y habilidades del personal, mejora de los procesos organizacionales y relaciones efectivas con los grupos de interés, potencian el efecto directo de la orientación estratégica a la innovación en el desempeño organizacional. De esta forma, el capital intelectual representa un nuevo

mecanismo mediador que ha sido poco analizado en la literatura previa sobre orientación estratégica a la innovación y su impacto en el desempeño de las organizaciones.

Palabras clave: desempeño organizacional, capital intelectual, orientación estratégica a la innovación, industria manufacturera.

Clasificación JEL: O32, M10

Highlights

- La orientación estratégica a la innovación permite a las empresas adaptarse para responder a las demandas del entorno, generando ventajas competitivas.
- La implementación de una orientación estratégica a la innovación posibilita mejorar el desempeño de las organizaciones.
- El capital intelectual representa un mecanismo a través del cual, las iniciativas estratégicas orientadas a la innovación mejoran los resultados organizacionales.
- Los directivos deberían orientar los esfuerzos a fortalecer el capital intelectual con el fin de que la estrategia orientada a la innovación se traduzca en un mejor desempeño organizacional.

1. INTRODUCTION

Strategic Innovation Orientation (SIO) refers to an organization's capacity to develop and implement innovation-focused strategies. It encourages the adoption of a proactive and creative approach to enhance efficiency and productivity while participating effectively in a competitive market, thus transforming gaps into opportunities for business growth (Hernández-Betancur et al., 2022; Serafim & Veríssimo, 2021; Chatzopoulou et al., 2022; Kornelius et al., 2021). In recent years, SIO has gained prominence in both academic and practical contexts because it enables companies to adapt to the demands and needs of their environment, fostering competitive advantages that lead to improved organizational performance (Ganesh & Haslinda, 2023; Nugroho et al., 2022). In fact, recent studies confirm the direct impact of SIO on Organizational Performance (OP) by facilitating adaptation to change, improving efficiency and effectiveness, increasing added value for customers, and transforming human talent (Chatzopoulou et al., 2022; Kornelius et al., 2021; Dinu et al., 2023).

Literature in the field has provided theoretical and empirical evidence supporting the relationship between SIO and OP. It shows how organizations can convert internal weaknesses and external market threats into strengths and opportunities leading to organizational improvement and growth (Choi et al., 2021; Chatzopoulou et al., 2022; Schweiger et al., 2019). Additionally, it has allowed companies to evaluate and compare their performance, enabling the rethinking of objectives and strategies (Ayinaddis, 2023; Nürk, 2019). In particular, research has primarily focused on examining the direct relationship between SIO and OP, asserting that SIO enhances OP by fostering competitive advantages and reducing setbacks caused by a lack of environmental knowledge (Chatzopoulou et al., 2022; Nürk, 2019; Chmielewska et al., 2022). Moreover, some studies have identified mediating mechanisms in this relationship, such as: (i) organizational learning, which allows organizations to incorporate and apply new knowledge, yielding positive effects on their achievements and

performance (Mu & Di Benedetto, 2011); (ii) organizational culture, which enables companies to effectively adapt to and respond to market demands through dynamic organizational values (Grawe et al., 2009; Hakala, 2011), and (iii) strategic change management, which helps organizations obtain competitive advantages by enabling swift and efficient responses to changing environmental demands, thereby closing existing gaps (Setiadji & Ahmadi, 2020).

Despite significant advances in the literature, today's knowledge- and innovation-based society places importance on intangible resources when implementing strategies that positively impact organizational outcomes. Therefore, more empirical evidence is needed to understand how employees' skills and knowledge, organizational structure, and relationships with stakeholders can influence the relationship between SIO and OP. Intellectual Capital (IC), for instance, is an intangible resource (Nawaz & Haniffa, 2017) that encompasses the knowledge, skills, experience, information, and relationships individuals hold within an organization (Dang & Wang, 2022; Gómez-Valenzuela, 2022; Nazir et al., 2021). IC serves as a source of competitive differentiation that drives innovation and adaptation to change, improving efficiency and productivity (Ekaningrum, 2021; Handoyo et al., 2023; Hussein et al., 2023). It also provides a solid foundation for managing a company's intangible assets and positioning it in the market (Rehman et al., 2023; Bansal et al., 2023). Furthermore, empirical evidence supports the importance of IC dimensions in enhancing OP. When employees' knowledge, skills, and attitudes are strengthened, organizational processes improve, and relationships with stakeholders are solidified, contributing to better OP (Ekaningrum, 2021; Agostini et al., 2017; Dang & Wang, 2022). This suggests that IC may be a mechanism that enhances the relationship between SIO and OP.

In light of the above, the aim of this study is to empirically examine the relationship between SIO and OP through the mediation of IC. To that end, a cross-sectional and exploratory design was used, employing Baron and Kenny's (1986) product of coefficients method to analyze such mediating effect. This study makes two key contributions. First, it provides empirical evidence on how SIO directly impacts OP and demonstrates the mediating role of IC in this relationship. Second, the findings offer guidance for organizational managers in decision-making by emphasizing the importance of effectively allocating resources to enhance employees' skills, strengthen relationships with stakeholders, and consolidate organizational structure for improved performance.

This paper is divided into six sections, including the introduction. Section 2 presents the theoretical framework of the research. Section 3 outlines the methodology. Section 4 presents the results. Section 5 discusses the results. Finally, Section 6 details the main conclusions derived from the research.

2. THEORETICAL FRAMEWORK

Strategic Innovation Orientation (SIO)

SIO is one of the approaches of organizational strategic orientation, which focuses on introducing and enhancing goods and services, as well as optimizing production and organizational processes to gain competitive advantages (Chou & Yang, 2011; Denicolai et al., 2018; Dogan, 2017; Chatzopoulou et al., 2022; Hakala, 2011; Gatignon & Xuereb, 2006; Kumar et al., 2012; Naranjo-Valencia et al., 2011;

Yousaf et al., 2020; Mutlu & Sürer, 2016; Adams et al., 2019). Organizations that adopt this approach implement technology surveillance processes, allowing them to leverage practical knowledge to produce new technical solutions. This helps them meet customers' needs and requirements through new and improved products and services, fostering loyalty and attracting new customers (Do Hyung & Dedahanov, 2014; Yousaf et al., 2020; Mutlu & Sürer, 2016; Adams et al., 2019; Serafim & Veríssimo, 2021; Saqib et al., 2017; Lee et al., 2015; Hortinha et al., 2011; Kocak et al., 2017).

Intellectual Capital (IC)

IC is an intangible asset based on knowledge that creates value within organizations (Roos et al., 2001; Bontis, 1998; Umanto et al., 2018; Dang & Wang, 2022; Lo et al., 2020; Quintero-Quintero et al., 2021; Gómez-Bayona et al., 2020). It comprises a set of productive resources that boost a company's capabilities and competencies, enabling it to stand out within the industry and increase customer loyalty and performance (Morales Clark et al., 2020; Ibarra-Cisneros et al., 2020; Pedraza Melo & de la Gala Velásquez, 2022). Thus, the comparative advantages derived from IC are difficult to replicate, leading to a rise in intrinsic value for the company (Morales Clark et al., 2020; García Garnica & Taboada Ibarra, 2012).

According to the literature, IC includes three main components: (i) human capital, which involves employees' knowledge, skills, training, and application of this knowledge to benefit the organization; (ii) structural capital, which encompasses the organizational structure, processes, routines, and techniques that influence efficiency and effectiveness; and (iii) relational capital, which considers the quality and quantity of relationships with customers, partners, suppliers, the financial sector, allies, and other stakeholders (Zhang et al., 2019; Gómez-Valenzuela, 2022; Roos et al., 2001; Bontis, 1998; Nazir et al., 2021). Moreover, recent studies have proposed that IC can be operationalized through two dimensions: (i) internal IC, which includes aspects of human and structural capital developed internally and aligned with the company's strategic orientation, and (ii) external IC, which pertains to the organization's relationships with stakeholders, including suppliers, customers, and a country's science and technology system, all of which are related to strategy implementation (Restrepo-Ramírez, 2023).

Organizational Performance (OP)

OP refers to achieving strategic objectives to create value for stakeholders (Masa'deh et al., 2018; Chmielewska et al., 2022; Princy & Rebeka, 2019). Consequently, organizations focus their strategic actions on understanding, analyzing, and managing factors that positively impact their performance (Masa'deh et al., 2018; Ekaningrum, 2021). OP can be measured using different approaches, both financial and non-financial (Ekaningrum, 2021; Gunasekaran et al., 2015). Financial metrics include Return On Investment (ROI), profitability, return on sales, and return on invested capital (Mcgivern & Tvorik, 1998; Ekaningrum, 2021). Other indicators include Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) (Maxim, 2023) and Economic Value Added (EVA) (Tudose et al., 2022; Nagarajan, 2015). Non-financial measures encompass effective, efficient, and innovative performance (Rojas et al., 2018; Ekaningrum, 2021). By measuring performance, organizations can validate their competitive advantages and compare themselves with their environment, enabling them to reassess their strategy (Gehrisch & Süß, 2023; Odiri & Ideh, 2021).

Relationship between strategic innovation orientation and organizational performance

Organizations that adopt an SIO encourage employees to explore promising concepts for implementing new ideas, products, or processes, which makes it possible to achieve innovative impacts and contribute to long-term success (Deutscher et al., 2016). As a result, companies can increase productivity, thus fostering the creation of innovative goods and services, which in turn translates into improved OP (Pertuz & Pérez, 2020; Demuner Flores, 2021). SIO guides organizations to actively adopt new technologies for developing products, services, and processes, potentially enhancing their ability to thrive in competitive environments (Grinstein, 2008; Song & Jing, 2017; Walker et al., 2015).

To achieve superior performance, organizations often embrace an SIO to gain a competitive advantage and reduce the performance gap caused by environmental uncertainty (Azar & Ciabuschi, 2017). Therefore, it is possible to assert that SIO has a significant and positive impact on performance (Azar & Ciabuschi, 2017; Magnier-Watanabe & Benton, 2017; Walker et al., 2015). In fact, previous studies have shown a positive relationship between SIO and OP (Schweiger et al., 2019; Magnier-Watanabe & Benton, 2017; Walker et al., 2015; Suryantini et al., 2023). Nonetheless, although most of these studies demonstrate a strong conceptual and empirical association between the two (Schweiger et al., 2019; Demuner Flores, 2021; Ayinaddis, 2023), others have found no clear positive relationship, suggesting that SIO does not naturally result in improved OP (Mu et al., 2017; Chatzopoulou et al., 2022; Kornelius et al., 2021).

Furthermore, organizational leaders and scholars posit that innovative outcomes are beneficial for organizations, which is supported by empirical research showing that innovation strategies and activities positively influence performance (Magnier-Watanabe & Benton, 2017; Walker et al., 2015; Dinu et al., 2023). Given these considerations, the following hypothesis is proposed:

H₁: Strategic innovation orientation positively influences organizational performance.

Relationship between strategic innovation orientation and intellectual capital

The relationship between SIO and IC has not been widely studied in the literature. Most existing research has focused on specific components of SIO, such as technological innovation, process optimization, and product innovation (Bernal González et al., 2020). Hence, the need for a more comprehensive examination of the SIO–IC relationship by considering SIO as a whole. Despite limited research on this relationship, some studies have shown that the use of both tacit and explicit knowledge in SIO has a positive impact on IC (Magnier-Watanabe & Benton, 2017; Giménez, 2021). Additionally, the learning process involved in developing and designing products and services is essential for the activities stemming from SIO and IC (Lin & Chen, 2016; Coad et al., 2016). Furthermore, SIO allows companies to respond quickly and effectively to market demands by optimizing internal resources such as relationships with stakeholders, organizational structure, and employees' knowledge (Magnier-Watanabe & Benton, 2017; Dang & Wang, 2022).

In short, organizations should aim to develop a balanced portfolio of technological and organizational innovations to navigate changing environments and uncertainties and to strengthen knowledge, organizational structure, and relationships with stakeholders (Azar & Ciabuschi, 2017; Dang & Wang,

2022; Córdoba-Vega & Naranjo-Valencia, 2017; Thien & Hung, 2023). Based on this, the following hypothesis is put forward:

H₂: Strategic innovation orientation positively influences intellectual capital.

Relationship between intellectual capital and organizational performance

Previous research has provided empirical evidence of a positive relationship between IC and OP (Galeitzke et al., 2017; Masood et al., 2023). However, most studies have focused on a specific dimension of IC, i.e., human capital (Díez et al., 2010; Nguyen, 2020; Albertini & Berger-Remy, 2019), structural capital (Lin & Chen, 2016; Verbano & Crema, 2016; Ghlichlee & Goodarzi, 2023), or relational capital (Agostini & Nosella, 2017; Bontis, 1998; Edvinsson & Malone, 1998). This calls for a comprehensive assessment of the impact of IC on OP (Agostini et al., 2017). Also, IC has been studied as a mediating (Agostini et al., 2017; Magnier-Watanabe & Benton, 2017; Javed et al., 2023) or moderating factor (Adams et al., 2019; Schweiger et al., 2019; Agostini et al., 2017) in the relationship between OP and constructs such as dynamism, hostility, tacit and explicit knowledge, and technological innovation (Magnier-Watanabe & Benton, 2017; Schweiger et al., 2019; Agostini et al., 2017; Nguyen, 2020).

By directing resources towards enhancing employees' skills and knowledge—both individually and collectively—organizations can boost productivity (Ekaningrum, 2021; Agostini et al., 2017). Companies should also strengthen relationships with internal and external stakeholders, including employees, suppliers, and customers, to bridge communication gaps and gain a competitive edge in the market (Inkinen, 2015; Nguyen, 2020; Hussein et al., 2023; Ekaningrum, 2021). Additionally, it is important for companies to identify and manage their key production processes to differentiate themselves in the market and enhance productivity (Khan et al., 2019; Ibarra-Cisneros & Hernández-Perlines, 2019; Handoyo et al., 2023). Given this, the following hypothesis is proposed:

H₃: Intellectual capital positively influences organizational performance.

3. METHODOLOGY

Sample and data collection

Data for this study were sourced from the most recent version of Colombia's Survey on Development and Technological Innovation in the Manufacturing Industry (EDIT for its acronym in Spanish) for the 2019–2020 period. This survey was conducted by the National Administrative Department of Statistics (DANE, 2021), covering a population of 7,769 organizations. The analysis focused on companies classified by DANE into the "strict" or "broad" categories, representing companies that achieved innovative results during the study period in both domestic and international markets. Hence, the sample comprised 1,765 organizations falling under these two categories.

Variables and measurements

Indicators from the EDIT associated with each of the constructs under study were identified following Restrepo-Ramírez’s (2023) approach. This author developed a conceptual model using observable indicators from the EDIT linked to the constructs of SIO, IC, and OP and their respective dimensions. His approach comprises three main steps: (i) conducting a literature review to understand the theoretical content of the constructs; (ii) identifying possible indicators from the EDIT that reasonably represent the constructs under study; and (iii) validating content with experts.

Considering this, the measurement scales have already been validated in prior studies, including Restrepo-Ramírez’s work (2023), using the Kuder–Richardson test (Durán-Pérez & Lara-Abad, 2021) to assess reliability. This enabled their adoption in the present study.

Table 1 shows the number of indicators for each construct and dimension. Particularly, it outlines the distribution of the 88 indicators from the EDIT associated with each construct under study. Additionally, two example indicators are provided for each construct or dimension.

Table 1. Indicators associated with the constructs

Tabla 1. Indicadores asociados a los constructos

| Construct | Number of indicators | Examples |
|--------------|----------------------|---|
| SIO | 9 | <ul style="list-style-type: none"> • New goods or services in the international market • Introduction of new organizational methods in internal operations |
| Internal IC | 21 | <ul style="list-style-type: none"> • Trained personnel and master’s degree education • Average personnel involved in scientific, technological, and innovation activities |
| External IC | 38 | <ul style="list-style-type: none"> • Interns or research and development assistants • Competitors or other companies in the sector |
| OP | 20 | <ul style="list-style-type: none"> • Increased productivity • Invention patents |
| Total | 88 | |

Source. Own work.

Procedure

Descriptive statistics: Since dichotomous variables (1: presence of the attribute; 0: absence of the attribute) were employed, the frequency of each value (1 and 0) was counted for every variable, and the relative frequency was calculated based on the total to determine the importance of each variable in the behavior of the construct.

Mediation model: The proposed mediation model was tested using Baron and Kenny’s product of coefficients method (1986), which involves the following three sequential steps to verify the relationships between the dependent variable (X), the independent variable (Y), and the mediator (M) (Hayes, 2009; Zhao et al., 2010; Pardo & Román, 2013):

1) Estimating the regression coefficient for the direct relationship between the dependent and independent variables: This first step involves confirming that X and Y are related—i.e., the regression coefficient should be different from zero (Hayes, 2009; Zhao et al., 2010; Pardo & Román, 2013)—following the expected direction, as indicated in Equation 1.

$$Y = i_1 + cX + e_1 \quad (1)$$

Here, i_1 is the intercept, c is the regression coefficient relating X to Y , and e_1 are the random errors (i.e., the portion of Y not explained by X). These errors are assumed to be normally distributed with constant variance and independent from one another.

2) Determining whether the independent variable has a significant effect on the mediating variable: This second step involves checking if the coefficient estimated by the linear regression between X and M (represented by a) is different from zero (Hayes, 2009; Zhao et al., 2010; Pardo & Román, 2013), as shown in Equation 2.

$$M = i_2 + aX + e_2 \quad (2)$$

3) Testing the relationship between the variable of interest and the mediator to estimate the total direct and indirect effects of the model: This third step involves examining whether M and Y are related after controlling for the effect of X . This means that coefficient b should be different from zero (Hayes, 2009; Zhao et al., 2010; Pardo & Román, 2013). This condition is verified by performing a linear regression analysis of Y explained by X and M , as indicated in Equation 3.

$$Y = i_3 + aX + bM + e_3 \quad (3)$$

As a result, the relationship between X and Y should significantly decrease when controlling for the effect of M . In other words, the estimated coefficient c from Equation 1 should decrease when testing the entire mediation model (Equation 3) (Hayes, 2009; Zhao et al., 2010; Pardo & Román, 2013).

Moreover, Baron and Kenny's (1986) method recommends using the Sobel test (Preacher & Leonardelli, 2001) to estimate the indirect effect of the mediation model between a and b , as shown in Equation 4. Here, a is the estimated effect between X and M from Equation 2, b is the regression coefficient between M and Y from Equation 3, and s_a and s_b are their respective standard deviations (Zhao et al., 2010).

$$z = \frac{a \times b}{\sqrt{b^2 s_a^2 + a^2 s_b^2}} \quad (4)$$

Where:

z : statistical significance value

a : estimated effect of SIO on IC

b : estimated effect of IC on OP

s_a and s_b : standard errors of the respective estimated effects

The entire procedure was conducted using the *mediation* package in RStudio, performing bootstrapping with 500 estimates. This involves simulating the model multiple times with randomly sampled subsets from the dataset to ensure results within confidence intervals. Bootstrapping allows for the estimation of the impact of one variable on another, as well as its level of significance. The level of significance should be less than 0.05 to reject the null hypothesis that the estimated parameters are equal to zero, concluding that there is a significant relationship between the variables under analysis (Rivas-Ruiz et al., 2013).

4. RESULTS

Descriptive statistics

Table 2 presents the descriptive statistics of the *strategic innovation orientation* construct.

Table 2. Descriptive statistics of strategic innovation orientation

Tabla 2. Estadística descriptiva OEI

| SIO | | |
|---|-------|------------|
| Indicator | No. 1 | Percentage |
| New services or goods (company only) | 599 | 33.93% |
| Significantly improved services or goods (company only) | 547 | 30.99% |
| New goods or services in the international market | 7 | 0.39% |
| Significantly improved goods or services in the domestic market | 34 | 1.93% |
| Significantly improved goods or services in the international market. | 7 | 0.004% |
| Introduced new or significantly improved production, distribution, delivery, and logistics methods within the company | 832 | 47.14% |
| Introduced new organizational methods for the internal operations of the company | 445 | 25.21% |
| Total investment in scientific, technological, and innovation activities | 1,476 | 83.63% |
| Introduced new marketing techniques within the company | 575 | 32.58% |

Source: Own work.

As observed, a vast majority (84%) of manufacturing companies in Colombia invested in scientific and technological activities, demonstrating an interest in focusing their strategy on innovation. Furthermore, a significant percentage of companies directed their strategy towards internal innovation: 47% focused on improving production, distribution, and logistics methods; 25% developed or enhanced organizational methods; and 33% concentrated on improving and introducing new marketing techniques. In addition, 34% and 31% of the companies developed new or significantly improved services or goods for the company, respectively. Moreover, there was limited intention to pursue outward innovation, as evidenced by the higher focus on creating new goods on a national scale (31%) rather than in the international market (0.4%).

Table 3 reports the descriptive statistics of the *internal intellectual capital* construct. Particularly, it provides information about the internal IC of manufacturing companies, including the internal personnel assigned to the different areas (based on their education and training) who participate in scientific, technological, and innovation activities, as well as the internal sources of innovative ideas.

Table 3. Descriptive statistics of internal intellectual capital

Tabla 3. Estadística descriptiva CI interno

| Internal IC | | |
|--|-------|------------|
| Indicator | No. 1 | Percentage |
| Personnel: total number of men and women who participated in scientific, technological, and innovation activities, by company area | | |
| General management | 673 | 38.13% |
| Administration | 682 | 38.64% |
| Marketing and sales | 561 | 31.78% |
| Production | 860 | 48.73% |
| Accounting and finance | 302 | 17.11% |
| Research and development technicians | 315 | 17.85% |
| Total average employed personnel who participated in scientific, technological, and innovation activities | 1303 | 73.82% |
| Personnel: total average number of men and women with higher education who participated in scientific, technological, and innovation activities | | |
| Exact sciences (chemistry, physics, mathematics, and statistics) | 646 | 36.6% |
| Health sciences | 89 | 5.04% |
| Engineering, architecture, urban planning, and related fields | 996 | 56.43% |
| Social sciences | 415 | 23.51% |
| Humanities and fine arts | 160 | 9.07% |
| Total average number of trained personnel who participated in scientific, technological, and innovation activities | 1315 | 74.5% |
| Trained personnel with master's degree | 37 | 2.09% |
| Trained personnel with graduate diploma | 50 | 2.83% |
| Trained personnel with at least 40 hours of education and training | 295 | 16.71% |
| Personnel trained and/or financed. Trained people in 2019 | 317 | 17.96% |
| Sources of innovative ideas: internal company departments | 1765 | 100% |
| Sources of innovative ideas: suppliers | 747 | 42.32% |
| Did your company hire external consultants to carry out scientific, technological, and innovation activities? | 294 | 16.66% |
| Number of consultants providing services outside the company | 311 | 17.62% |

Source: Own work.

As can be seen, 74% of the companies allocated personnel for scientific, technological, and innovation activities. Additionally, in 75% of the companies, personnel with higher education

participated in these activities. Regarding sources of innovative ideas, all companies primarily resorted to their internal departments.

Table 4 shows the descriptive statistics of the *external intellectual capital* construct. Specifically, it outlines the components of external IC, including external personnel by area dedicated to scientific, technological, and innovation activities, as well as external sources of innovative ideas and the relationships with actors in the science, technology, and innovation system.

Table 4. Descriptive statistics of external intellectual capital

Tabla 4. Estadística descriptiva CI externo

| External IC | | |
|---|-------|------------|
| Indicator | No. 1 | Percentage |
| Personnel: total number of men and women who participated in scientific, technological, and innovation activities, by company area | | |
| Researchers | 498 | 28.22% |
| Interns or research and development assistants | 154 | 8.73% |
| Natural sciences | 95 | 5.38% |
| Trained personnel with doctoral qualifications | 12 | 0.67% |
| Sources of innovative ideas | | |
| Other related companies | 163 | 9.24% |
| Research and development department (other company) | 139 | 7.88% |
| Competitors or other companies in the sector | 172 | 9.75% |
| Companies from other sectors | 213 | 12.06% |
| Sector associations and/or organizations | 170 | 9.63% |
| Chambers of commerce | 246 | 13.94% |
| Technology development centers | 81 | 4.59% |
| Autonomous research centers | 61 | 3.46% |
| Business incubators for technology-based companies | 13 | 0.74% |
| Technology parks | 21 | 1.19% |
| Regional productivity centers | 43 | 2.43% |
| Universities | 231 | 13.08% |
| Training centers and/or technoparks | 38 | 2.12% |
| Consultants or experts | 311 | 17.62% |
| Fairs and exhibitions | 442 | 25.04% |
| Seminars and conferences | 389 | 22.03% |
| Books, magazines, or catalogs | 469 | 26.57% |
| Industrial property information systems | 112 | 6.35% |
| Copyright information systems | 52 | 2.95% |
| Internet | 970 | 54.96% |
| Scientific and technological databases | 313 | 17.73% |
| Standards and technical regulations | 565 | 32.01% |
| Public institutions | 195 | 11.05% |

| | | |
|--|-----|--------|
| Number of relationships with actors in Colombia’s Science, Technology, and Innovation System (SNCTI for its acronym in Spanish) | 163 | 9.25% |
| Cooperation to conduct scientific, technological, and innovation activities: | | |
| Customers | 272 | 15.41% |
| Competitors | 31 | 1.76% |
| Consultants | 174 | 9.86% |
| Universities | 175 | 9.92% |
| Technology development centers | 35 | 1.98% |
| Autonomous research centers | 32 | 1.81% |
| Technology parks | 13 | 0.74% |
| Regional productivity centers | 18 | 1.02% |
| Non-governmental organizations | 38 | 2.15% |
| Government | 74 | 4.19% |

Source: Own work.

As observed, 28% of the companies had researchers involved in scientific, technological, and innovation activities. Additionally, approximately 1% of the companies under analysis had personnel with doctoral qualifications dedicated to these activities. Regarding the most significant external sources of innovative ideas, 55% of the companies relied on the internet, 25% used fairs and exhibitions, and 32% resorted to standards and technical regulations. The most common actors with whom the companies cooperated were customers (15%), universities (10%), and consultants (10%).

Table 5 presents the descriptive statistics of the *organizational performance* construct. It highlights aspects of organizational performance such as efficiency, effectiveness, and innovative performance.

Table 5. Descriptive statistics of organizational performance

Tabla 5. Estadística descriptiva DO

| OP | | |
|---|-------|------------|
| Indicator | No. 1 | Percentage |
| Efficiency and effectiveness | | |
| Increased productivity | 1312 | 74.33% |
| Reduction in labor costs | 915 | 51.84% |
| Reduction in the use of raw materials | 796 | 45.09% |
| Reduction in energy consumption | 770 | 43.63% |
| Reduction in water consumption | 637 | 36.09% |
| Reduction in communication costs | 600 | 33.99% |
| Reduction in transportation costs | 624 | 35.35% |
| Reduction in maintenance and repair costs | 751 | 42.55% |
| Use of manufacturing waste | 938 | 53.14% |
| Improvement in quality of goods or services | 1341 | 75.98% |
| Expansion of the range of goods or services | 1262 | 71.5% |
| Has maintained its participation in its geographic market | 1454 | 82.38% |

| | | |
|--|------|--------|
| Entered a new geographic market | 956 | 54.16% |
| Improved compliance with regulations, standards, and technical standards | 1021 | 57.85% |
| Decrease in tax payments | 496 | 28.1% |
| Invention patents | 76 | 4.31% |
| Utility model patents | 43 | 2.44% |
| Copyright | 18 | 1.02% |
| Software registrations | 30 | 1.69% |
| Registration of industrial designs | 101 | 5.72% |

Source: Own work.

Regarding efficiency, 74% of the companies reported an increase in productivity, and 52% reduced labor costs thanks to scientific, technological, and innovation activities. As for effectiveness, 76% of companies reported improvements in the quality of goods and services, while 82% maintained their participation in the market. Innovative performance, for its part, showed poor results, as, for example, only 6% of the companies registered industrial designs.

Mediation model

Table 6 shows the results of the mediation model.

Table 6. Mediation model
Tabla 6. Modelo con mediación

| Step 1: Direct relationship | | |
|---|----------|--------------------------|
| Relationship | Estimate | P-value or significance* |
| SIO-OP | 1.0009 | 0*** |
| Step 2: introduction of the mediating variable | | |
| Relationship | Estimate | P-value or significance |
| SIO-IC | 2.8404 | 0*** |
| Step 3: Mediation model | | |
| Relationship | Estimate | P-value or significance |
| SIO-OP | 0.70766 | 0*** |
| IC-OP | 0.1033 | 0*** |
| SIO-IC-OP | 0.293 | 0*** |

* Note: p-value: * < 0.05; ** < 0.01; *** < 0.001.

Source: Own work using RStudio.

Based on the significance value of the direct relationship ($p < 0.05$), there is a positive and significant relationship between SIO and OP, which confirms hypothesis 1. After introducing the mediating variable, the relationship between the independent variable (SIO) and the mediator (IC) was tested. This analysis rejected the null hypothesis that the estimated parameters are zero ($p < 0.05$), confirming that SIO positively influences IC and thus confirming hypothesis 2. Then, the mediation model was analyzed, showing that IC has a positive impact on OP, confirming hypothesis 3. Importantly, the mediating effect was examined by considering IC as a whole, rather than focusing on the mediation of each dimension of the construct.

Thus, according to the results of the mediation model, there is a total, positive, and significant indirect effect as a result of the multiplication of the coefficients of the SIO–IC–OP relationship. In other words, IC absorbs a portion of the effect that SIO has on OP, indicating partial mediation.

Table 7 reports the estimated direct and indirect effects based on the coefficients calculated in the linear regression analysis.

Table 7. Direct and indirect effects**

Tabla 7. Efectos directos e indirectos

| Effects | Estimate | Lower bound of the 95% confidence interval | Upper bound of the 95% confidence interval | P-value* |
|---------------------------------|----------|--|--|----------|
| ACME (SIO–IC–OP) | 0.293 | 0.204 | 0.40 | 0.00*** |
| ADE (SIO–OP) | 0.708 | 0.554 | 0.86 | 0.00*** |
| Total effect (ACME+ ADE) | 1.001 | 0.865 | 1.13 | 0.00*** |

*Note: p-value: * < 0.05; ** < 0.01; *** < 0.001.

**Bootstrapping with 500 simulations

Source: Own work using RStudio.

As can be seen, the Average Causal Mediation Effect (ACME) of 0.293 indicates the indirect effect of SIO on OP mediated through IC. This effect ranged from 0.204 to 0.40 within a 95% confidence interval. Based on the p-value ($p < 0.05$), IC significantly explains the relationship between SIO and OP. The Average Direct Effect (ADE) of 0.708, for its part, represents the direct effect of SIO on OP without mediation through IC. This effect ranged from 0.554 to 0.86 within a 95% confidence interval.

The total effect (ACME + ADE) reflects the direct effect of SIO on OP and its indirect effect through IC mediation. Note that the estimated value of the direct relationship before including mediation (1.0009, see Table 6) decreased significantly when IC was introduced as the mediating variable in the model (0.708). This highlights the importance of IC as a mediating mechanism in explaining the relationship between the two constructs. Furthermore, ADE (SIO–OP) was greater than ACME (SIO–IC–OP), which was calculated using the Sobel test (Preacher & Leonardelli, 2001), as shown in Table 8.

Table 8. Indirect effect

Tabla 8. Efecto indirecto

| Unstandardized coefficients | | | |
|-----------------------------|-----------|---------|----------------|
| a | b | C | Indirect (a.b) |
| 2.84*** | 0.1033*** | 0.71*** | 0.293*** |

Note: p-value: * < 0.05; ** < 0.01; *** < 0.001.

Source: Own work.

Figure 1 illustrates the research model with the estimated results. As shown in this figure, introducing mediation into the model reduced the direct effect of SIO on OP to an estimated coefficient of 0.70, which is statistically significant. This suggests that IC partially mediates the relationship between SIO and OP.

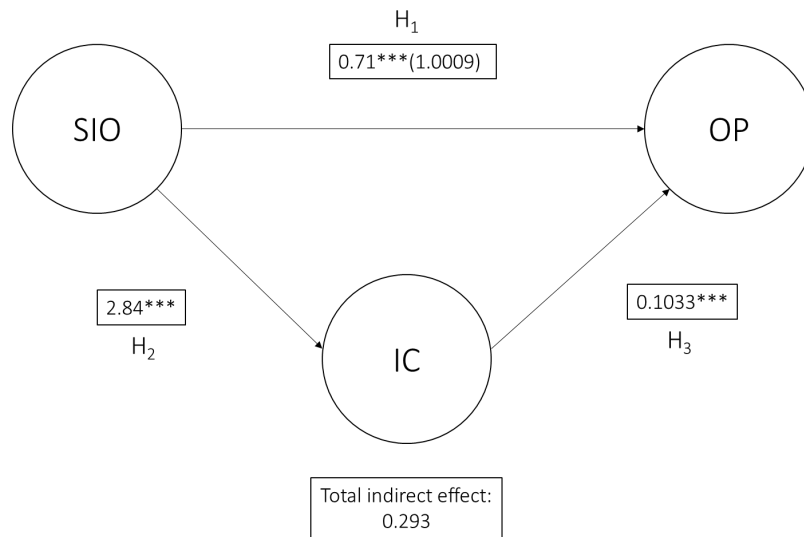


Figure 1. Research model
 Figura 1. Modelo de investigación
 Source: Own work.

Figure 2 depicts the scatter plot of the mediated relationship. As observed, the model exhibits partial mediation, as the indirect effect explains part of the relationship between SIO and OP but not entirely. Nonetheless, including IC as a mediating variable is crucial because it helps explain what the direct relationship does not fully capture. Note the difference between the model without mediation (black line) and the model after introducing the mediating variable (blue line), indicating partial mediation.

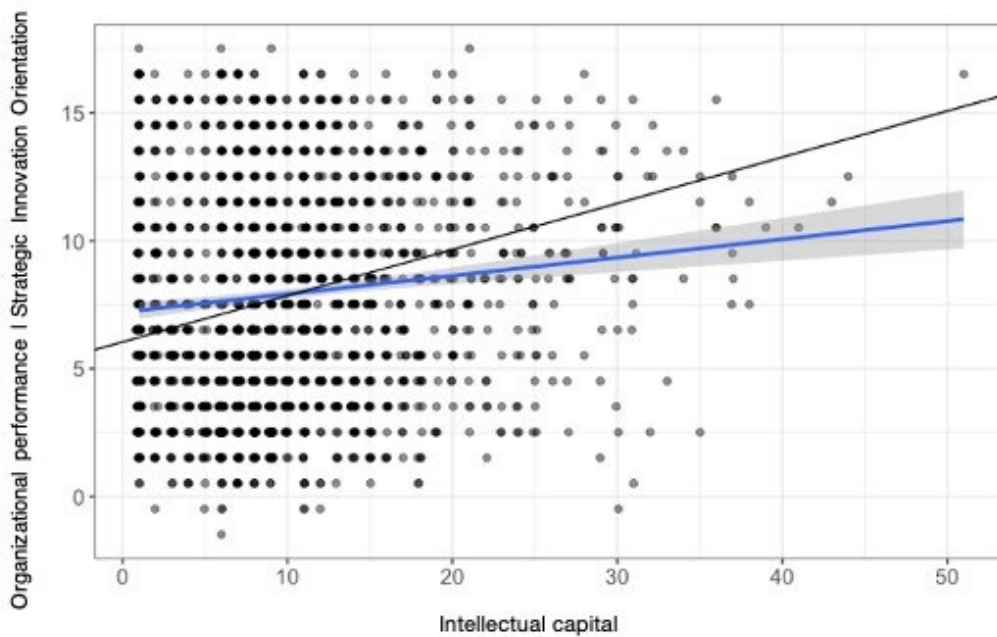


Figure 2. Scatter plot of the mediated relationship
 Figura 2. Diagrama de dispersión de la relación mediada
 Source: Own work using RStudio.

5. DISCUSSION

In recent years, SIO has gained significance both theoretically and practically due to its potential impact on the success and sustainability of organizations in highly competitive and dynamic markets (Setiadji & Ahmadi, 2020; Pertuz & Perez, 2020; Demuner Flores, 2021; Bansal et al., 2023). In addition, SIO enhances IC by fostering creative thinking, enabling the acquisition, generation, and transfer of knowledge within organizations (Chen & Lin, 2021; Dang & Wang, 2022; Bernal González et al., 2020; Ayinaddis, 2023; Rehman et al., 2023). Understanding market demands and addressing them with innovative strategies has allowed organizations to achieve high returns. This, in turn, helps them identify new opportunities to expand their range of goods and services, thereby creating differentiation and competitive advantages (Chatzopoulou et al., 2022; Dinu et al., 2023; Hussein et al., 2023).

The results of this study are consistent with those of previous research, providing empirical evidence that supports the positive relationship between innovative strategies and organizational performance (Chatzopoulou et al., 2022; Demuner Flores, 2021; Dinu et al., 2023; Purnomo et al., 2022; Ayinaddis, 2023). Furthermore, this research demonstrated that intellectual capital serves as a new mediating mechanism—an area previously underexplored in the relationship between strategic orientation and organizational performance. These findings are also in line with earlier studies showing the impact of knowledge-based intangible resources such as intellectual capital on organizational performance and market growth (Nguyen, 2020; Gehrisch & Süß, 2023; Handoyo et al., 2023; Hussein et al., 2023).

Moreover, in line with the results of this study, authors such as Nugroho et al. (2022), Dang and Wang (2022), and Bernal González et al. (2020) have emphasized the importance of directing company resources and capabilities towards key areas of knowledge and innovation to achieve better organizational outcomes.

Finally, this study also provides empirical evidence from manufacturing companies in Colombia, highlighting intellectual capital as a new mediating mechanism in the relationship between strategic innovation orientation and organizational performance. By using observable indicators to operationalize the constructs under study, this research contributes an original perspective to the existing body of literature.

6. CONCLUSIONS

This study empirically analyzed the relationship between Strategic Innovation Orientation (SIO) and Organizational Performance (OP) both directly and through the mediation of Intellectual Capital (IC). According to the results, there was a partial mediation of IC in this relationship, indicating that IC is a mechanism through which SIO can enhance OP.

The study makes two significant contributions. First, it provides empirical evidence of both the direct and indirect relationship between SIO and OP. It also emphasizes the importance of strengthening IC within organizations to achieve better performance outcomes through SIO. Second, the results suggest that organizational managers should focus on adopting an SIO to adapt to changing market

conditions and develop competitive advantages that boost performance. This includes enhancing intangible resources such as IC to maximize positive impacts on performance.

This study, however, also has limitations. First, it used a cross-sectional design, which does not allow for the analysis of changes in variables over time. To overcome this, future research could consider using a longitudinal approach. Second, IC was analyzed as a whole without considering its individual dimensions; hence, future studies could conduct analyses considering each dimension separately. Finally, the research focused on manufacturing companies in Colombia, so future work could explore other sectors and contexts to validate the generalizability of the results.

CONFLICTS OF INTEREST

The authors declare no conflict of financial, professional, or personal interests that may inappropriately influence the results that were obtained or the interpretations that are proposed here.

AUTHORS' CONTRIBUTIONS

Carlos Gilberto Restrepo-Ramírez: Principal investigator of the research project. He contributed to the conception and design of the study, the preparation of the database, data processing and analysis, the literature review, the writing of the manuscript, and the responses to the reviewers' and editors' comments.

Claudia Inés Sepúlveda-Rivillas: Co-investigator of the research project. She contributed to the conception and design of the study, data processing and analysis, the literature review, the writing of the manuscript, and the responses to the reviewers' and editors' comments.

Mariana Gómez-Montoya: Research assistant. She contributed to data processing and analysis, the literature review, the writing of the manuscript, and the responses to the reviewers' and editors' comments.

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