

# Proposal of an Interrelation Model between the Components of Intellectual Capital in their Contribution to Value Creation

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## Abstract

The aim of this research is to shed light on the contradictions present in the literature regarding the relationship between the various components of intellectual capital (human, structural, relational) and value creation. Some authors argue that these contradictions are attributable to the failure of these studies to take account of the interrelationships between intellectual capital components. Yet this interrelationship is emphasized by several researchers as essential to value creation. Drawing on resource theory and socio-technical systems theory, we developed a conceptual model that takes this interrelationship into account. This model was then tested with 100 Moroccan companies. The results show that relational capital has a direct influence on value creation. Structural capital influences value creation through the mediation of relational capital. Finally, human capital influences value creation through the serial mediation of structural and relational capital.

## Keywords

Intellectual capital, Human, Structural, Relational, Financial performance, Value creation

## INTRODUCTION

The transition from the industrial to the information age has meant the end of the dominant role played by tangible production assets. The ability of intangible assets to create wealth in relation to physical assets is clear, as we move from physical capital-based businesses to knowledge-based businesses (Baker, 2006). Companies must develop their ability to cultivate and use their intangible capital in addition to their physical capital in order to meet consumer needs and achieve their financial objectives (Weston et al., 2007). The intangible, once considered less important, is now the element that guarantees the success of organizations in the 21st century (García-Merino et al., 2014). Intangible assets often represent up to 80% of a company's value (Petkovic, 2019). An organization is like a tree, whose trunk, leaves and fruit, which make up its visible part, only inform us about its present. The invisible part, corresponding to its roots, informs us about its future, and this is what represents intangible capital (Edvinsson et al., 1999). Appropriate use of intellectual capital can transform ordinary business organizations into industry leaders (Abdulaali, 2018). There is no unanimous definition of intellectual capital (Lee & Wong, 2019). It is considered to be the company's wealth that is not reflected in the financial statements (Fustec & Marois, 2006). Intellectual capital represents all the knowledge that a company mobilizes in order to generate a competitive advantage (Subramaniam & Youndt, 2005). The analytical models that have emerged in recent years break down a company's intellectual capital into three parts: human capital, structural capital and relational capital (Bounfour, 2011). This is the dominant classification. Human capital is the knowledge inherent in people; structural capital is the knowledge inherent in the organization and its systems; relational capital is the knowledge inherent in customers and other relationships external to the organization (Guthrie et al., 2012). Human capital is the skills, aptitudes and intellectual agility of employees (Peppard & Rylander, 2001). Other definitions go beyond competence alone, incorporating attitudes such as satisfaction (Moon & Kym, 2009), commitment (Yang & Lin, 2009) motivation (Djekic et al., 2017). Structural capital is defined as institutionalized knowledge, the codified experience found in databases, patents,

manuals, structures, systems and processes (Carmona-Lavado et al., 2010; Subramaniam & Youndt, 2005; Youndt et al., 2004). When this knowledge is protected by law, it is intellectual property (Chaminade & Johanson, 2003). Relational capital is defined as a company's ability to establish positive relationships with members of the business community in order to foster value creation (Johnson, 1999). From other perspectives, relational capital encompasses all the valuable relationships between a company, its customers, service providers and other interested parties (Peppard & Rylander, 2001). While there is a consensus that intellectual capital is the main driver of value creation, it must be acknowledged that not all empirical studies find significant relationships between intellectual capital components and value creation. As presented in the literature review, studies present contradictory results. According to some researchers, the divergent results found by researchers in relation to the influence of intellectual capital on financial performance may be attributable to: the diversity of indicators used to measure both intangible capital and financial performance, as well as the diversity of business sectors in which these studies are carried out (Currie et al., 2022; Ting et al., 2020). According to other authors, empirical studies underestimate the value created by asset combinations, because they are studied in isolation. Indeed, a significant amount of research has been carried out to demonstrate in isolation the influence of a specific component of intellectual capital on financial performance (Albertini & Berger-Remy, 2019). Perhaps due to the popularity of resource theory in the intangible capital literature, it is often the intangible resource itself that is the focus of analysis in models concerned with the relationship between intangible capital and value creation, rather than the way in which resources are deployed (Cuganesan, 2005). It is therefore this second avenue that we intend to explore in this research, in order to overcome the contradictions present in the literature, precisely by taking into account the interrelationships between the components of intellectual capital. Indeed, many authors stress the importance of interaction between the components of intellectual capital to ensure value creation. No single component can create value on its own, or the resulting value will be less than the value generated by the interaction of all the components; they are interrelated and complement each other (Lentjušenkova & Lapina, 2016). The components of intellectual capital are unlikely to create value in isolation, and we could even say that certain components only add value when combined with others (Albertini & Berger-Remy, 2019). The value of intangible components lies in their combined strength, not in their individual characteristics, so their interrelationships should have a positive influence on a company's financial performance (Z. Wang et al., 2014). It is the interaction between the three types of intellectual capital (human, structural, relational) that generates wealth-creating opportunities for your company (Baker, 2006). The three constituent elements of intellectual assets have a synergistic effect, in other words, they must be combined to achieve better results (Laallam et al., 2020). In view of the above, we intend to develop a conceptual model based on the resource-based view and socio-technical systems theory to study the relationship between intellectual capital components and financial performance. From a theoretical point of view, our aim in this research is to show that it is possible to overcome these contradictions in the relationship between the components of intellectual capital and value creation by taking into account the interrelationships between the three components of intellectual capital. In the following sections, we present a review of the literature, propose a theoretical framework from which we derive our research hypotheses, then present the empirical part of the investigation and end with a conclusion.

## LITERATURE REVIEW

Studies on the link between intellectual capital and financial performance are part of a plethora of literature on the impact of intellectual capital on organizational performance. The narrowest conception of organizational performance consists in measuring financial performance. The broadest conception includes the use of non-financial and operational indicators in addition to financial ones (Tsakalerou, 2015). Financial performance is the most widely used measure of organizational performance (Obeidat et al., 2017). In their meta-analysis, on the link between intellectual capital and financial performance, Albertini & Berger-Remy (2019) inform us that researchers generally use three categories of indicators to measure financial performance, stock market indicators, accounting indicators and customer metrics. The indicators used in the studies presented below are a mix of accounting indicators and customer metrics, "survey data and statistical quantitative methods". In 1998, the very first empirical research into the link between intellectual capital and performance was carried out by Nick Bontis (Ávila & Arias, 2016). Since then, a number of empirical studies have been carried out to explore this relationship. Some of these studies identified a significant link between intellectual capital and performance, while others found the opposite (Ting et al., 2020). The process by which intellectual capital affects performance is ambiguous (Lerro et al., 2014). Despite its invisibility, intangible capital can make a major contribution to financial performance (Edvinson & Malone, 1997). In the Table 1 below, we present a collection of works that have studied the link between the three components of intellectual capital and value creation. In the Table, "yes" indicates an impact of the intellectual capital component on value creation, and "no" indicates no impact.

**Table 1** Literature Review

Empirical survey	Value creation		
	Human capital	Structural capital	Relational capital
Bontis et al., 2000	YES via structural capital	YES	YES via structural capital
Cabrita & Bontis, 2008	....	YES	YES
Ru-Yan Hong et al., 2008	YES	YES	YES
Maditinos et al., 2010	....	YES	....

Table Continued...

Sharabati et al., 2010	YES	YES	YES
Adekunle Suraj & Bontis, 2012	YES	NO	...
Ling, 2013	YES	YES	YES
Mention & Bontis, 2013	YES	NO	NO
Z. Wang et al., 2014	YES	YES	YES
Abdullah et al., 2015	YES	YES	YES
Andreeva & Garanina, 2015	YES	YES	NO
Hashim et al., 2015	NO	NO	YES
Andreeva & Garanina, 2016	YES	NO	NO
Harlow, 2017	YES	YES	YES
Jain et al., 2017	YES	YES	YES
Obeidat et al., 2017	YES	YES	YES
Z. Wang et al., 2018	YES	YES	YES
McDowell et al., 2018	YES	YES	....
Ibarra Cisneros & Hernandez-Perlines, 2018	YES	YES	YES
Ary Adil & Kofand, 2018	YES	YES	YES
Ahmed et al., 2019	YES	YES	NO
Hermawan et al., 2020	YES via relational capital	YES via relational capital	YES
Hina et al., 2020	NO	YES	YES
Ibarra-Cisneros et al., 2020	YES	YES	YES
Lekić et al., 2021	YES	YES	YES
Muda et al., 2020	YES	YES	YES
Nagwan et al., 2021	YES	NO	YES
Aljuboori et al., 2021	YES	NO	NO
Daat et al., 2021	YES	NO	YES
Klimontowicz & Majewska, 2022	YES	YES	YES
Muftiasa et al., 2023	YES	YES	YES
Ishak & Omar, 2023	NO	NO	YES
Taha et al., 2023	NO	YES	YES

## THEORETICAL FRAMEWORK AND FORMULATION OF HYPOTHESES

The drivers of financial performance can be both tangible and intangible. Equipment and machinery can have an impact on a company's financial performance. As material goods become increasingly accessible to companies, the competitive advantages they can offer are less important than in the past. Differentiation based on material equipment is becoming increasingly difficult. The advent of the intangible economy is challenging traditional paradigms of competitiveness. When a company's competitive advantage is based on intangible assets, it is more difficult for competitors to imitate or reproduce them (Kessler, 2013). The competitive advantage provided by intangible capital is, according to resource theory, the reason for its contribution to value creation (Barney, 1991). A competitive advantage is a characteristic that enables a company to stand out from the competition. This competitive advantage persists over time, since an organization's intangible capital is formed in a unique historical process that is non-transferable from one organization to another. Indeed, the strong specificity of intellectual capital to the organization that develops it, makes it inoperative in another organization, helping to maintain a high level of competitiveness. This transfer is made more difficult by the intangibility of intellectual capital, unlike tangible goods, which can easily be imitated. It is the most valuable asset and the most formidable competitive weapon that organizations possess (W. Wang & Chang, 2005). The advantage offered by intellectual capital can be particularly high, generating higher margins (Guthrie et al., 2017). An organization's lasting success and the continued growth of its financial capital depend on its intangible capital (Pasher & Ronen, 2011). Intangible assets represent future profits (Lev, 2000). Management of intellectual capital began when managers, academics and consultants around the world realized that intellectual capital is the major determinant enabling companies to make a profit (Harrison & Sr, 2000). Long-term value creation is now closely linked to the intangible component of capital (Fustec, 2016). We therefore formulate the following hypotheses:

**H1:** human capital has an impact on financial performance

**H2:** structural capital has an impact on financial performance

**H3:** relational capital has an impact on financial performance

We still have a limited understanding of how the interrelationships between the constituent elements of intangible assets influence organizational performance (St-Pierre & Audet, 2011). "Individual employee knowledge, corporate structural arrangements and valuable relationships support each other. The dimensions of intangible capital considered individually may have no effect on improving company performance, but the strength of each increases the potential for such effects" (Inkinen, 2015). It is therefore unlikely that the components of intellectual capital can create value in isolation, even though they are all important for value creation. The value of intangible assets depends on their combination (synergy) rather than their individual characteristics (Jacobsen et al., 2005). The individuals within the organization, the technological infrastructure they utilize, and their interactions with external entities collectively constitute a intricate system that plays a crucial role in generating value. It is essential to gain a better understanding of how the various

components of the intangible combine and complement each other to create value for organizations. At present, this has not been clearly established by any study (Ávila & Arias, 2016). Investigations into the interrelationships between the constituent elements of the intangible and value creation represent an important area of research that has not received sufficient empirical attention (Cuganesan, 2005). The interaction between the constituent elements of intangible assets, and the consequences for performance, are the subject of controversy (Currie et al., 2022). In our literature review, we showed that the relationship between the three components of intellectual capital and value creation was not consistent. In the introduction we argued that these contradictions could be overcome by taking account of the interrelationships between the components of intellectual capital, which is precisely what the overwhelming majority of studies fail to do. Knowledge of the dynamics between the constituent elements of intellectual capital needs to be integrated into models for studying their relationship with value creation (Cuganesan, 2005). Albertini & Berger-Remy (2019) in their literature review on the impact of intellectual capital on financial performance, also highlight the fact that intellectual capital components are interrelated in their association with financial performance. They point to resource theory, which emphasizes the identification of a particular resource and its contribution to performance. This leads researchers generally adopting this theoretical framework to focus solely on the relationship between one component of intellectual capital and performance, while omitting the value created by the combination of different intangible assets. They put forward a new line of development in resource theory, namely resource orchestration, which argues that performance derives from the managerial ability to use resources jointly, rather than the resources themselves. It is therefore unlikely that the components of intangible capital can create value in isolation, even though they are all important for value creation. By exploiting the virtuous relationship between the components of intangible capital, managers can improve performance (Knight, 1999). Value creation cannot begin or continue without teams (Fustec, 2017). Human capital is the foundation on which the other two components of intangible capital are built (Johnson, 1999). Employees build and develop organizational capital by creating business processes and routines, as well as intellectual assets that belong to the organization (Al-Ali, 2003). Transforming human capital into organizational capital must be management's primary objective, as it can support the company's long-term development (Cohen & Kaimenakis, 2007). Indeed, employees' knowledge and skills contribute to company performance when used together through processes and procedures that structure the company, leading to the creation of value (Albertini & Berger-Remy, 2019). Organizational methods play a decisive role in performance (Bounfour, 2011). A company's ability to compete in a given market depends on the knowledge and skills of its staff (Ramauskaitė & Rudžionienė, 2013). In fact, if a company is well known in its market, if it has good relational capital, if it enjoys a good reputation, it's thanks to the marketing and sales teams (Fustec & Sappey-Marinière, 2011). Albertini & Berger-Remy (2019) suggest that the study of the various possible combinations between the components of intangible capital could be a fruitful area of research. We will therefore draw on socio-technical systems theory to provide a theoretical foundation for the relationships between the components of intellectual capital. According to socio-technical systems theory, "organizations are composed of individuals who interact as a social system, and they use tools, techniques and knowledge to create goods or services valued by customers" (Griffith & Dougherty, 2001). This theory teaches us that the organization is an open system interacting with the environment, composed mainly of two interacting subsystems (social and technical). Openness to the environment refers to the fact that organizations have permeable boundaries exposed to the environment, on which they depend for their survival. The social system encompasses the interactions, relationships and individual characteristics of people within the organization, such as their attitudes, values and skills. The technical system, on the other hand, encompasses operational processes, tasks and related knowledge (El Manzani, 2019). The environment is general and concerns everything external to the company. Given that we endorse this theory for the analysis of intellectual capital, the environment in our case corresponds to relational capital, which is the quality of the relationship between a company and its external partners. The social system is none other than human capital, and the technical system corresponds to structural capital. A number of studies have shown the influence of human capital on structural and relational capital (Adekunle Suraj & Bontis, 2012; Bontis, 1998; Cohen & Kaimenakis, 2007; Hsu & Fang, 2009; Huang & Hsueh, 2007; Kianto et al., 2010; Maditinos et al., 2010; Nuñez et al., 2017; S. H. Wu et al., 2007; W. Y. Wu & Tsai, 2005). Studies also find a positive impact of structural capital on relational capital (Bollen et al., 2005; Cabrita & Bontis, 2008; Chen et al., 2004; Jardon & Susana Martos, 2012; Martínez-Torres, 2006; Mention & Bontis, 2013; Tseng & Goo, 2005). The influence of the social system on the technical system can justify the effect of human capital on structural capital. The effect of the social and technical system on the environment can justify the impact of human and structural capital on relational capital.

Given the impact of the social system on the environment, we can formulate the following hypothesis:

**H4:** Relational capital plays a mediating role between human capital and financial performance

Given the impact of the technical system on the environment, we can formulate the following hypothesis:

**H5:** Relational capital plays a mediating role between structural capital and financial performance

Given the impact of the social system on the technical system and the impact of technical system on the environment, we can formulate the following hypothesis:

**H6:** Human capital has an effect on financial performance through the serial mediation of structural and relational capital

## EMPIRICAL STUDY

### Sampling and data collection

This research is part of a much larger study relating to Moroccan companies under ISO 9001 certification. The International Organization for Standardization estimates that there are approximately one thousand companies of this category operating within the country. Due to the relatively limited count compared to the overall Moroccan business landscape, we opted for convenience sampling. Essentially, this involved distributing our questionnaire among the accessible cases. We gathered the data through online channels by reaching out to individuals employed in ISO 9001 certified companies. Due to the lack of a comprehensive official registry of such companies, we initially gathered fragmented listings of ISO 9001-certified companies from multiple online sources. Subsequently, we amalgamated these listings to construct our own database. With the database in place, we leveraged the professional network of LinkedIn to connect with individuals employed in these companies. We extended study invitations to them and provided the questionnaire to those who expressed interest. Data collection occurred from May to October 2022. We reached out to roughly 2000 individuals and obtained 147 responses. The initial 47 responses were utilized for the questionnaire's pre-test, while the subsequent 100 responses constituted the final version of the questionnaire. Thus, we employed the data from the last 100 responses to assess the hypotheses.

### The measurement scales

We employed a 5-point Likert scale to gauge all variables. New measurement scales for human, structural, and relational capital were crafted from the cited sources, while a subset of items from an existing scale was chosen for evaluating value creation.

#### Human capital

The measurement scale for human capital consists of 10 items taken from the following studies (Bollen et al., 2005; Chen et al., 2004; Djekic et al., 2017; Kamukama et al., 2010; Kianto et al., 2010; Lekić et al., 2021).

#### Structural capital

The measurement scale for structural capital consists of 10 items taken from the following studies (Ataseven et al., 2014; Bontis, 2001; Chen et al., 2004; Hussinksi et al., 2017; Meyer et al., 2014; Reed et al., 2006; W.-Y. Wu et al., 2008).

#### Relational capital

The measurement scale for relational capital consists of 14 items taken from the following studies (Bontis, 1998; Bueno et al., 2014; Chen et al., 2004; Isaac et al., 2010; Kianto et al., 2010; Moon & Kym, 2009; Shih et al., 2010; Tseng & Goo, 2005).

### Financial performance

The measurement scale for value creation consists of 8 items taken from the following studies (Adekunle Suraj & Bontis, 2012; Ahmed et al., 2019; Bontis et al., 2000; Cabrita & Bontis, 2008; Ibarra-Cisneros et al., 2020; Maditinos et al., 2010; Mention & Bontis, 2013; Sharabati et al., 2010).

### Validation of the measurement model

The data analysis was conducted using SmartPLS 3.

### Reliability and convergent validity

The reliability of indicators refers to the "factor loading." It is recommended to be at least 0.7. In case results lower than this value are obtained, those between 0.4 and 0.7 should only be removed if their exclusion allows the composite reliability and average variance extracted to reach the minimum required, which are respectively 0.7 and 0.5. An item with a score below 0.4 must be systematically removed (Hair et al., 2021). In our present case, although some items of human and structural capital do not reach 0.7; the minimum required threshold for composite reliability and average variance extracted is achieved by considering all the indicators. However, we decided to delete a human capital item that had a factor loading of 0.469. The results of the reliability and validity analysis below are subsequent to the deletion of this item from the human capital scale. Tables 2, 3, 4, and 5 respectively present the reliability and convergent validity parameters of the measurement for human capital, structural capital, relational capital and financial performance.

**Table 2** Reliability and Validity of the Human Capital Measurement Scale

Scale of measurement of human capital (HC)	Loadings Reliability	Composite Reliability	AVE
Employees' knowledge and skills	0.757		
Good at problem handling	0.801		
Our employees are highly skilled in their tasks	0.776		
Competences of employees are in accordance with the requirements and responsibilities of the workplace	0.708		
The company encourages the upgrade and development of knowledge and skills of employees	0.733	0.922	0.568
Employees in the company, when performing work tasks, give their maximum	0.778		
Identification with corporate values	0.777		
Employees are overall satisfied in our company	0.704		
Employees are proud to work in the firm	0.743		

**Table 3** Reliability and Validity of the Measurement Scale of Structural Capital

Measurement scale of structural capital (SC)	Loadings Reliability	Composite Reliability	AVE
Our company has a great deal of useful information in documents and databases	0.522*		
Our organization embeds much of its knowledge and information in structures, systems, and processes.	0.567*		
Construction and utilization of company repository	0.708		
Features of our information systems capture the knowledge that exists in this organization	0.661*	0.910	0.506
Validity of enterprise controlling system	0.795		
The consistency of the way processes are performed	0.766		
The overall operation procedure is very efficient	0.816		
Business process period	0.746		
Systems allow easy info access	0.680*		
Availability of enterprise information	0.792		

**Table 4** Reliability and Validity of the Measurement Scale of Relational Capital

Measurement scale of relational capital (RC)	Loadings Reliability	Composite Reliability	AVE
Longevity of relationships	0.788		
Customers' loyalty	0.774		
Customers' satisfaction	0.824		
Customer complaint	0.725		
Customer feedback	0.858		
Brand and trademark reputation/ Corporate image/	0.864		
Negotiation power against partners	0.825		
Our business partner does not do anything that would harm our firm's goals and interests	0.859	0.968	0.683
Possibility of preserving relationships with partners	0.822		
Negotiations and cooperation with the business partner go smoothly, because we understand each other well and 'speak the same language' with each other	0.800		
Relationships with other external group	0.903		
We maintain appropriate communication with our stakeholders.	0.818		
Relationships with public administrations	0.875		
Corporate reputation	0.822		

**Table 5** Reliability and Validity of the Financial Performance Scale

The financial performance measurement scale	Loadings Reliability	Composite Reliability	AVE
Industry leadership	0.736		
Future outlook	0.818		
Profit	0.844		
Profit growth	0.898	0.953	0.718
Sales growth	0.864		
Overall response to competition	0.901		
Success rate in new product launch	0.870		
Overall business performance	0.838		

**Discriminant validity**

To establish discriminant validity, two parameters are used: the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT). To satisfy the Fornell-Larcker criterion, the square root of the average variance extracted from a construct must be greater than the correlations between that construct and all other constructs. The heterotrait-monotrait ratio (HTMT) should be less than 0.85 (Hair et al., 2021). Table 6 shows the satisfaction of the Fornell-Larcker criterion. The numbers on the upper diagonal represent the square root of the average extracted variances. They are all greater than the other numbers in their respective columns.

**Table 6** Establishing Discriminant Validity Between Constructs (FLC)

Fornell-Larcker criterion	FP	HC	RC	SC
FP	0.848			
HC	0.278	0.754		
RC	0.515	0.431	0.827	
SC	0.309	0.734	0.487	0.712

The heterotrait-monotrait ratio (HTMT) compares the variables of the model pairwise. The result obtained from these various comparisons should be less than 0.85 to establish that the different variables are indeed distinct from each other. It is possible to tolerate an HTMT ratio up to 0.90 if the concepts are closely related (Hair et al., 2021). In our current case, all HTMT values are below 0.85, as shown in Table 7 below. Discriminant validity is therefore established.

**Table 7** Establishing Discriminant Validity Between Constructs (HTMT)

HTMT	FP	HC	RC	SC
FP				
HC	0.289			
RC	0.524	0.457		
SC	0.332	0.810	0.516	

### Validation of the structural model

The Table 8 below presents the results of the hypothesis testing and the parameters associated with the structural model.

**Table 8** Results of Hypothesis Testing

Hypothesis	B	t-value	p-value	R <sup>2</sup>	f <sup>2</sup>	Is the hypothesis Supported?	95% Confidence interval
H1 : HC→FP	0.034	0.184	0.854		0.001	NO	-0.359 ; 0.370
H2 : SC→FP	0.053	0.335	0.738		0.002	NO	-0.251 ; 0.384
H3 : RC→FP	0.474	4.057	0.000	0.270	0.231	YES	0.247 ; 0.704
H4 : HC→RC→FP	0.076	0.931	0.352		0.016	NO	-0.051 ; 0.275
H5 : SC→RC→FP	0.175	2.208	0.027		0.084	YES	0.035 ; 0.344
H6 : HC→SC→RC→FP	0.129	2.167	0.030		1.168	YES	0.027 ; 0.261

HC\*human capital/ SC\*structural capital/ RC\*relational capital/FP\*financial performance ;  $-1 < \beta < 1$  ;  $t > 1.96$  ;  $p < 0.05$  ;  $R^2 (> = 0.67$  substantial ;  $> = 0.33$  moderate ;  $> = 0.19$  weak) ;  $f^2 (> = 0.02$  weak ;  $> = 0.15$  moderate ;  $> = 0.35$  substantial)

The hypothesis testing is performed using the Bootstrapping procedure, which allows evaluating the significance of path coefficients ( $\beta$ : path coefficient) to conclude whether the associated hypothesis is accepted or rejected. The resampling was done with 5000 iterations. We formulated six hypotheses regarding the influence of the three components of intellectual capital on financial performance. There is an interdependence between these different hypotheses, so their rigorous interpretation can only be carried out by combining them. These are direct relationship, simple mediation and serial mediation hypotheses. Among our hypotheses, only the direct influence of relational capital on financial performance is validated. The other two elements of intellectual capital, human capital and structural capital, only influence financial performance via relational capital. It is therefore logical to start with this hypothesis, as the others build on it. The third hypothesis, dealing with the impact of relational capital on financial performance, is accepted, as the beta path coefficient of 0.474 is significant (p-value 0.000). The  $f^2$  effect size of relational capital on financial performance is  $0.231 > = 0.15$ , reflecting a moderate effect. We postulated that the influence of structural capital on financial performance can be direct, just as it can pass through relational capital. Only the hypothesis including the mediation of relational capital is validated. Indeed, the direct influence of structural capital on financial performance, illustrated by hypothesis H2, is rejected, because the path coefficient of 0.053 is not significant (p-value 0.738  $> 0.05$ ). Total mediation is ensured by relational capital. This is evidenced by the validation of the fifth hypothesis. The trajectory coefficient of this mediation relationship which is 0.175 is significant. Hypothesis 5, which confers a mediating role on relational capital between structural capital and financial performance, is accepted (p-value 0.027  $< 0.05$ ). The size of the effect  $f^2$  of structural capital on relational capital is  $0.084 > = 0.02$  which reflects a weak effect. Finally, the influence of human capital on financial performance concerns three hypotheses: a direct influence of human capital on financial performance (H1), mediation through relational capital (H4) and serial mediation through structural and then relational capital (H6). In short, we postulated a partial mediation of the influence of human capital on financial performance via relational capital or structural then relational capital. The results showed a serial mediation passing through structural and then relational capital. In other words, hypothesis H1, which established a direct influence of human capital on financial performance, was rejected, as the beta path coefficient of 0.034 was not significant (p-value 0.854  $> 0.05$ ). Hypothesis 4, which attributes a mediating role to relational capital between human capital and financial performance, is also rejected (p-value 0.352  $> 0.05$ ), the beta path coefficient being 0.076. Only hypothesis H6 is validated. The path coefficient of this relationship, which is 0.129, is significant (p-value (0.030)  $< 0.05$ ). The overall index to evaluate the model's fit to the data is the Standardized Root Mean Square Residual (SRMR), which should be less than 0.08 (Hu & Bentler, 1999). The SRMR of our model is 0.08, indicating a good fit of our model to the data. The figure 1 below presents the conceptual model created using the software SmartPLS3.

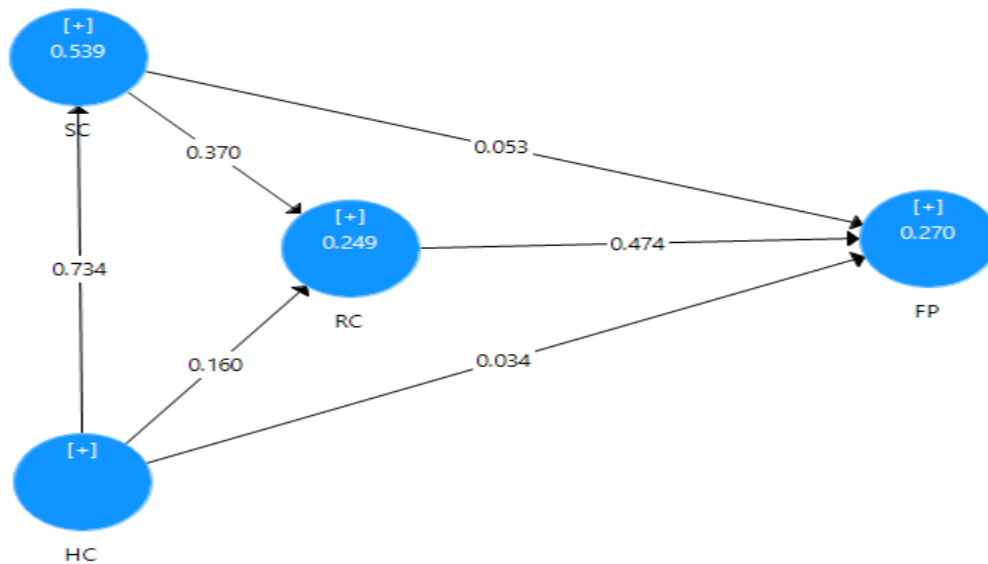


Fig. 1 Conceptual Model (SmartPLS 03)

## DISCUSSION AND CONCLUSION

The aim of this research was to study the relationship between intellectual capital and value creation, by proposing a model linking the components of intellectual capital. This study was justified by the contradictions present in the literature between intellectual capital and value creation. A contradiction that some authors attribute precisely to the failure to take into account the relationships between the components of intellectual capital. We adopted a deductive research method based on resource theory and socio-technical systems theory. Hypothesis H3 regarding the influence of relational capital on financial performance was validated. Two hypotheses were formulated regarding the influence of structural capital on financial performance. One hypothesis proposed a direct influence of structural capital on financial performance (H2), and the other suggested partial mediation through relational capital. However, the mediation turned out to be complete, meaning that the influence of structural capital on financial performance occurs exclusively through relational capital, thus validating hypothesis H5. As for the influence of human capital on financial performance, it is neither a direct influence (H1) nor an influence through relational capital (H4), but an influence through the serial mediation of structural and relational capitals, hence validating hypothesis H6.

### Theoretical implications

We formulated only one hypothesis (H3) regarding the relationship between relational capital and value creation. The studies in our literature review, which go in the same direction of validating this hypothesis are as follows (Ary Adil & Kofand, 2018; Cabrita & Bontis, 2008; Daat et al., 2021; Harlow, 2017; Hashim et al., 2015; Hina et al., 2020; Ibarra Cisneros & Hernandez-Perlines, 2018; Ibarra-Cisneros et al., 2020; Ishak & Omar, 2023; Jain et al., 2017; Klimontowicz & Majewska, 2022; Lekić et al., 2021; Ling, 2013; Muda et al., 2020; Muftiasa et al., 2023; Nagwan et al., 2021; Obeidat et al., 2017; Ru-Yan Hong et al., 2008; Sharabati et al., 2010; Taha et al., 2023; Z. Wang et al., 2014, 2018). However, there are a few studies for which this hypothesis is not validated (Aljuboori et al., 2021; Andreeva & Garanina, 2015, 2016; Mention & Bontis, 2013). As for the impact of structural capital on value creation, it encompasses two hypotheses: a direct relationship between these two variables, corresponding to hypothesis H2, and an indirect relationship via relational capital (H5). The mediation was complete, meaning that hypothesis H2 was rejected and hypothesis H5 was validated. Contrary to the result of the H2 hypothesis test, the following studies find a direct influence of structural capital on value creation (Ahmed et al., 2019; Andreeva & Garanina, 2015, 2016; Ary Adil & Kofand, 2018; Cabrita & Bontis, 2008; Harlow, 2017; Hina et al., 2020; Ibarra Cisneros & Hernandez-Perlines, 2018; Ibarra-Cisneros et al., 2020; Jain et al., 2017; Klimontowicz & Majewska, 2022; Lekić et al., 2021; Ling, 2013; Maditinos et al., 2010; McDowell et al., 2018; Muda et al., 2020; Muftiasa et al., 2023; Obeidat et al., 2017; Ru-Yan Hong et al., 2008; Sharabati et al., 2010; Taha et al., 2023; Z. Wang et al., 2014, 2018). However, the models do not give the other constituent elements of intellectual capital (human, relational) a mediating role between structural capital and value creation. While the following studies, in line with the rejection of the H2 hypothesis, find no direct influence of structural capital on value creation (Aljuboori et al., 2021; Daat et al., 2021; Hashim et al., 2015; Ishak & Omar, 2023; Mention & Bontis, 2013; Nagwan et al., 2021). However, these models also fail to assign a mediating role to human or relational capital between structural capital and value creation. The contradictory results regarding the impact of structural capital on value creation can therefore be explained by the failure to take into account the other components of intellectual capital when studying this relationship. By taking relational capital into account, we were able to establish a link between structural capital and value creation, as shown by hypothesis H5. The relationships between the components of intangible capital, as well as their relationship with value creation, are fragile and plural. Failure to take this into account can simplify conceptualizations of intellectual capital and marginalize complexity in the ongoing development of research and academic work (Cuganesan,



2005). It is therefore important in research and academic work to consider the relationships between the various components of intellectual capital, in order to better understand their impact on value creation. The relationship between structural capital and value creation may not always be straightforward. Three hypotheses were formulated regarding the influence of human capital on value creation. The direct relationship between these two variables was rejected (H1). Relational capital also does not play a mediating role between human capital and value creation (H4). The last hypothesis is validated (H6), human capital influences value creation through the serial mediation of structural and relational capital. Contrary to our hypothesis H1, the direct influence of human capital on value creation was shown by the following studies (Ahmed et al., 2019; Andreeva & Garanina, 2015, 2016; Ary Adil & Kofand, 2018; Harlow, 2017; Ibarra-Cisneros et al., 2020; Ishak & Omar, 2023; P. Jain et al., 2017; Ling, 2013; McDowell et al., 2018; Mention & Bontis, 2013; Muftiasa et al., 2023; Nagwan et al., 2021; Obeidat et al., 2017; Ru-Yan Hong et al., 2008; Sharabati et al., 2010; Z. Wang et al., 2014, 2014). However, they do not establish a relationship between human capital and the other components of intellectual capital (structural, relational). On the other hand, the following studies find no direct link between human capital and value creation (Hashim et al., 2015; Hina et al., 2020; Ishak & Omar, 2023; Taha et al., 2023), nor do they establish a relationship between human capital and the other components of intellectual capital (structural, relational). It is therefore possible to overcome these contradictions by integrating the other components of intellectual capital into this relationship, as shown by hypothesis H6. Among all the studies in our literature review, Hermawan et al., (2020) developed a conceptual model like ours. In line with our rejected hypotheses H1 and H2, the results of this study also reject the hypotheses of a direct relationship between human and structural capital and value creation. It finds a direct relationship between relational capital and value creation, in line with our hypothesis H3, which is confirmed. They also find that human capital influences value creation through the serial mediation of structural and then relational capital, in line with our hypothesis H6. The results also show an influence of structural capital on value creation through the mediation of relational capital, in line with our hypothesis H5. Finally, they find that human capital influences value creation through the mediation of relational capital. This is the only point of contradiction between the results of this study and our results. Indeed, this relationship, which corresponds to hypothesis H4 of our study, was rejected.

### **Managerial implications**

Given the impact of relational capital on financial performance, organizations need to ensure that the needs and expectations of their stakeholders are met, as well as the legal and regulatory requirements of the business. In this way, the organization will obtain financial resources from customers, receive the inputs it needs for its business at lower cost, and avoid unnecessary burdens due to non-compliance with the law. This means investing in building and maintaining positive relationships by implementing management policies focused on stakeholder satisfaction and loyalty. In this way, the organization will derive maximum benefit from its relational capital.

As for the impact of structural capital on financial performance, organizations need to build their structural capital by formalizing their knowledge and rigorously managing their processes and procedures. This will lead to greater operational efficiency, better decision-making and lower costs. Structural capital only influences financial performance through relational capital, so the role of structural capital in value creation will be to strengthen relational capital. The components of intellectual capital support each other in the creation of value. The company's organizational structures must be geared to satisfying and retaining external partners. To achieve this, processes and structures must integrate the requirements of these external entities, which is the prerequisite for positively influencing them and thus strengthening relational capital. So, on the basis of the information gathered on external entities, companies can adapt their processes to meet the specific needs of their external partners.

Regarding the impact of human capital on financial performance, we can say that organizations must take steps to improve their human capital (skill, motivation, satisfaction, commitment, retention). This impact of human capital on financial performance occurs through structural and relational capital, the competence and positive attitudes of employees are not enough. The role of human capital in value creation is the construction of structural capital in such a way as to strengthen relational capital which is the only capital contributing directly to profitability according to our results. More competent and capable people develop better structural capital for an organization. Improved human and structural capital helps create more productive external capital by providing high-quality products and services to high-value customers. The constituent elements of the intellectual combine to create better financial performance (Knight, 1999). In line with the complexity paradigm, effective management of intellectual capital requires a coordinated, holistic approach rather than a fragmented and reductionist one (Diop & Mokhlis, 2023). This means it is crucial to consider intellectual capital in its interconnections, avoiding fragmentation into isolated elements. Doing so enables the development of management strategies that take into account the synergies and interactions between different intangible assets. Thus, a coordinated approach implies a holistic and systemic vision, where value is created through the relationships and dynamics that develop between them.

### **Limitations and future studies**

Although this study offers a thorough analysis, it's important to acknowledge some limitations. The sample includes 100 companies, which may be viewed as relatively limited in scope, and the potential for selection bias cannot be completely dismissed, considering the convenience sampling method employed. The constrained sample size could impact the statistical power of the analyses performed. There are multiple determinants that can explain value creation. A multitude

of factors, both internal and external to the organization, can contribute to value creation. The introduction of control variables will make it possible to better isolate the effect of intellectual capital on value creation, thus strengthening the internal validity of future studies. Our study is also subject to the limitation that the variables are assessed through a questionnaire administered to individuals. Consequently, the levels of these variables are contingent on the perceptions of these individuals, rendering them subjective. The use of objective data to measure both the components of intellectual capital and value creation is an area for future research.

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## DECLARATION OF CONFLICT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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