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# CREATING VALUE FROM INTELLECTUAL CAPITAL: AN APPROACH BASED ON THE SPECIFICATION OF MODELS

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**Abstract**

Organizations are facing new competitive paradigms associated with the ability to create, use, combine, and manage intellectual assets. Intellectual capital is the primary driver in an innovation economy as it "processes" and leverages organizational value and improves creativeness. The purpose of this study is to examine the interrelationships among intellectual capital components within the Portuguese banking context and to identify the paths to a superior performance through the specification of models. These models are assessed using a PLS (Partial Least Squares) approach, because it is able to treat complex models and it requires less stringent assumptions. Empirical findings from this study support the proposition that intellectual capital is an important driver of organizational value. Moreover, intellectual capital is a phenomenon of interrelationships among human capital, structural capital and relational capital.

**Key-words:** intellectual capital; human capital; structural capital; organizational value; Partial Least Squares (PLS).

## 1. INTRODUCTION

The determinants of organizations' prosperity and growth are reliant upon their effectiveness and efficiency in gathering and utilising knowledge to solve problems and exploit opportunities (OCDE, 1996). It is now largely accepted that the fundamental building material and engine of modern corporations' wealth

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is the creation and utilization of knowledge. The real challenge in the Information Age is to access how to accelerate the conversion of knowledge into money through understanding how to drive and measure knowledge assets.

It is now largely accepted that intangible assets such as knowledge, brands, relationships, organizational culture, and intellectual property are primary drivers of competitiveness in today's global economy. However, intangible assets seldom affect performance directly. Instead, they work indirectly through relationships of cause and effect (Kaplan and Norton, 2004). It is essential to recognise that intangibles are not *per se* sufficient for organization's successful performance. These key elements must be combined to generate value.

As yet there is no universal definition for intellectual capital as the nature of intellectual capital is still unknown and hard to capture in explicit terms (Seetharaman *et al.*, 2002). Intellectual capital can be described as all factors (resources, capabilities and competences) that are critical to the organization's future success. This means that intellectual capital drives organizational performance and value creation (Roos and Roos, 1997; Bontis, 1998; Bontis *et al.*, 2000). Therefore, intellectual capital is a phenomenon of interactions, connections and complementarities (Cabrita, 2005; Cabrita and Landeiro Vaz, 2005) as a resource's productivity may improve through investment in other kinds of resources. The inter-relationships between the different components of intellectual capital and how these inter-relationships enable (or impinge upon) value creation lack more detailed and empirically grounded research. There are few attempts to investigate these issues empirically (e.g., Bontis, 1998; Bontis *et al.*, 2000; Skoog, 2003; Marr *et al.,* 2004)

## 2. INTELLECTUAL CAPITAL AND VALUE CREATION

The debate about the intellectual capital concept has been active in recent years, though there is still no common consensus over its conceptualization (Sullivan, 2000) and its dimensions. Literature offers a number of definitions of intellectual capital (Petty and Guthrie, 2000). Viedma (2004) considers the term "intellectual capital" as equivalent to "core competencies" and "core capabilities". Sullivan (2000) defines intellectual capital as knowledge that can be converted into profits or knowledge that produces value. Andriessen (2001) refers to intellectual capital as a unique bundle of intangible assets that are the basis of the definite, sustainable, competitive advantage. According to Andriessen (2004, p. 3) the intangible perspective is a resource-based perspective that looks at the economy or at an individual company as a combination of stocks, flows and transformations of resources. These resources can be tangible or intangible. The intangible perspective focuses on resources that are not material, and highlights

the growing importance of this hidden wealth in the economy and in companies. Lev (2001) states that intangibles are frequently embedded in physical assets (e.g. knowledge contained in technology) and in labour (e.g. tacit knowledge), leading to considerable interactions between tangible and intangible assets in the creation of value. Other authors use the concept of intangibles and intellectual capital interchangeably (Marr, 2005), which can be seen associated with the scope of several methods to measure intellectual capital like Skandia Navigator's or Intellectual Capital –Index or Intellectual Capital dynamic value, Andriessen (2005).

The multidimensional nature of Intellectual Capital, with different disciplinary views, has produced several methods for valuation and measurement of its impact on corporate performance. Andriessen (2004), has chosen twenty five methods with different approaches and models, like the balanced scorecard (Kaplan et Norton, 1992), Lev´s Value Chain Scoreboard (2001), and Sullivan's model, to access the market value of a company (2000).

Bontis (1998) and Ross Dawson (2000, p.43), identified the three most common components in the intellectual capital concept: human capital, structural capital and relational capital. This perspective has inspired the conceptual structure adopted in this paper, emphasizing the interactions among these three components. Intellectual capital is seen as the main driver of value-creation and competitive advantage (Prahalad and Hamel, 1990). This suggests causal relationships between intellectual capital and organizational value creation (Marr and Roos, 2005).

## 2.1. Human Capital

Human capital is the set of intangible resources that are embedded in anorganization's members' minds. Ulrich (1998) conceptualizes intellectual capital as a multiplicative function of competence and commitment. Competencies are the ultimate creator of intellectual capital and as such, they are a necessary but not sufficient condition for wealth creation. Firm competencies must be established with the incorporation of a strong commitment to convert competencies into a superior performance.

It is generally accepted that knowledge is a vital organizational resource that leverages markets and fuels innovation and competitiveness. However, organizations cannot create knowledge on their own without the initiative of their employees. The human being is the source of knowledge creation and knowledge sharing. It is through the individual - from its desire to innovate and its search for new answers - that knowledge is created. Therefore, managers should recognize intangible activities as creation and knowledge sharing that can neither be forced

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out of people, nor supervised. They happen only when people cooperate volun-tarily (Kim and Mauborgne, 1997). Therefore, human capital should include not only human competencies (like skills, experience and know-how) but also human attitudes (including willingness to work for the company).

More important is the fact that employees clearly influence the values of others within the relationship network. Knowledge creation is a process of value addition to previous knowledge through innovation, which implies that the more knowledge we already possess the more we will be in a position to create and transfer to others (Narayanan, 2001).

Employees' productivity depends on a complex combination of factors: mo-tivation, reward, skill levels, experience, health and even emotional factors. Mint-zberg (1996) holds that there is no substitute for human dedication and an orga-nization without human commitment is like a person without a soul.

## 2.2. Structural Capital

While the concept of human capital is well established in the literature, the concept of structural capital is less obvious and requires more careful specifica-tion in the scope of intellectual capital (Carson et al., 2004). There are two dif-ferent approaches to knowledge: the individual and the organizational dimension. While the individual dimension considers that knowledge is located in people, the organizational dimension argures that much of the organizational knowledge is socially constructed. Without the firm's supporting structure, individuals have no ability to do anything with their ideas. Consequently, structural capital should be designed to maximize the potential value derived from its intellectual capital.

Structural capital represents the organization's capabilities to meet the mar-ket's demand. Scructural Capital includes infrastructures, information systems, routines, procedures, culture and so fourth. It is the skeleton and the glue of an organization as it provides the tools (management philosophy, processes, culture) for retaining, packaging and moving knowledge. IT includes all intellectual assets that can be assigned to the company and remain within the organization even after people leave.

## 2.3. Relational Capital

Relational capital is the knowledge embedded in relationships with stake-holders. The literature argues that relationships with stakeholders are the neces-sary condition to build, maintain and renew resources, structures and processes over time. In a recent work, Prahalad and Ramaswamy (2000) have suggested

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that customers have become a new source of competence for the organizations as they renew the overall competence of the organization and rejuvenate the knowledge base, preventing it from  obsolescence in a turbulent environment (Gibbert *et al.,* 2001).

While relational capital can be measured as a function of longevity (Bontis, 1998), marketing relationship literature argues that: *(i)* long lasting relationships are a source of competitive advantage (Håkansson and Snehota, 1995) and; *(ii)* marketing is embedded in the whole management process (Gummesson, 2002). Bontis (1998) also argues that the concept of relational capital emerges from the "market orientation" works (Kohli and Jaworski, 1990; Narver and Slater, 1990). Despite little consensus on the definition of "market orientation", the literature generally identifies it as organization-wide generation, dissemination and responsiveness to market intelligence. Market intelligence is a broad concept that includes customers' verbalized needs and preferences, and analysis of exogenous elements that influence those needs and preferences. Although moderated by internal and external variables, evidence exists of a positive relationship between market orientation and: *(i)* business performance (Dawes, 2000); *(ii)* new product performance (Ramaseshan et *al.,* 2002); *iii)* innovation (Gatignon, and Xuereb, 1997); or *iv)* learning organization (Slater and Narver, 1995). Market orientation is also a necessary condition for knowledge management orientation (Darroch and McNaughton, 2002). Recent works on "market orientation" emphasize the importance of including other stakeholder groups to better understand this concept (Greenley and Foxall, 1997). It is difficult, for example, for a client orientation to exclude the competitors because they directly or indirectly affect client preferences (Day and Wensley, 1988; Dawes, 2000). Moreover, Greenley and Foxall (1997) demonstrate that different types of stakeholder orientation affect each other impacting on organizational performance; shareholder emphasis may disturb customer orientation, or board self interest may conflict with shareholders' or employees' interests, affecting organizational performance. There must be an equilibrium among different stakeholders' interests, internal or external and organizational performance.

## 3. RESEARCH DESIGN AND METHODOLOGY

The author's choice for causal modelling  commenced at the conceptual level. Hulland (1999) elects three issues that play a crucial role in causal modelling research: *(i)* conceptual model specification; *(ii)* construct dimensionality; and *(iii)* distinction between constructs and measures. Hulland encourages researchers to make use of alternative models to underpin a particular piece of research in the early stages of theory refinement because comparisons often play a critical role.

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The dimensionality of constructs was conducted by a thorough review of literature and experts' opinion (Bontis, 1998; Darroch and McNaughton, 2002h). Component factor analysis helped us to confirm the dimensions defined *a priori*. Intellectual capital is a multidimensional construct, whose components emerge from the theories of other disciplines such as marketing, human resources, or information systems. Therefore, we have employed multi-item scales from other disciplines that "substantially increase the probability of a validation study" (Peter, 1991: 138).

The nature of the links between constructs and measures - referred to as epistemic relationships or "rules of correspondence" - is an important issue (Chin, 1998; Hulland, 1999) for testing the model's nomological validity and choosing the analytical technique.

## 3.1. Measurement Instrument

We applied a questionnaire that had already been administered in Canada (Bontis, 1998) and Malaysia (Bontis *et al.*, 2000) with eight extra items including various stakeholder groups. A copy of the questionnaire is available upon request to the author. Following Churchill's (1979) recommendations, the 63 original items were validated again. Independent assessment of validity enhances the quality of measures. New items were included after being submitted to the recommendation of the author's original questionnaire. Content validity was attempted through the depth of literature search and expert opinions (Bontis, 1998; Darroch and McNaughton, 2002; Chin, 1998). Totalling 71 items, the questionnaire was pre-tested through personal interviews with 8 banking managers in order to: *(i)* correct weaknesses in the questionnaire; *(ii)* identify the most knowledgeable people about the subject; and *(iii)* grasp the sector dynamics.

## 3.2. Data Collection

Data were collected from a sample of 53 banks, out of a population of 62 banks actually operating in Portugal. These 53 banks are all affiliated members of the Portuguese Bankers Association. Intellectual capital is a complex concept, and given its strategic nature, a convenience sample of 178 members (including first, second, third and fourth-level executives) was chosen to participate in the pilot test. From the 178 members, only 151 returned the questionnaires, which were collected personally. The remaining members argued that they did not have enough information to answer the questions properly. Further, for our empirical findings, we decided to apply the final test only to the chief executives and to the

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first and second-levels executives, following the literature on "strategic aware-ness" (Hambrick, 1981).

An analytical sample resulting in a response rate of at least 150 (as rec-ommended by Chin) was sought to ensure sufficient statistical power. To attain a sample of 150 observations, 430 executives (chief, first and second levels) were drawn from a list of 1081. Total answers (253), after 8 weeks, represent a response rate of 58,8%. Answers were returned by mail (176) or personally col-lected (77).

## 3.3 PLS Overview

Our model was estimated using Partial Least Squares (PLS), specifically PLSGRAPH v.3.00. PLS is a non-parametric analytical alternative to Structural Equation Modelling (SEM) techniques. Conceptually, PLS is an iterative combi-nation of principal components analysis relating measures to constructs (outer relations), and path analysis allowing a causal chain system of constructs (inner relations). PLS estimation does not require assumptions of metric data, multi-normality (which our data do not satisfy) or independence of observations. Be-sides, it works well with small samples and is ideally suited to the early stages of theory building and testing. Frequently labelled as "soft modelling" (Wold, 1982), PLS approach has been used as a research tool in a variety of settings such as business disciplines, cooperative ventures, global strategy, risk-return outcomes, geographic scope, and in intellectual capital research.

Although PLS estimates parameters for both the links between measures and constructs (i.e., loadings) and the links between the constructs in the model (i.e., path coefficients), at the same time, PLS proceeds in two stages. The first stage is to access the measurement model i.e., the relationships between the con-structs and the indicators used to measure them. The second stage requires the evaluation of the structural model i.e., to assess the explanatory power of inde-pendent variables and examine the size and the significance of path coefficients. The measurement model is accessed by examining:

*(i)* Individual items reliabilities i.e., the loadings or simple correlations of the measures with their correspondent constructs. A rule of thumb is to accept measures with standardized loadings of 0.707 or more. However, "loadings of 0.5 or 0.6 may still be acceptable if there exist additional indicators in the block for comparison basis" (Chin, 1998:325); *(ii)* Internal consistency and discrimina-tive validity.

(i) The structural model is assessed by examining: Estimation of path coef-ficients;

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    (ii) R-squares analysis;

    (iii) Statistical significance of structural paths.

Two types of epistemic relationships are considered relevant to causal modelling: reflective indicators and formative indicators. In the first case, indicators are viewed as reflecting the unobserved construct, with the construct "causing" the observed variables. In contrast, formative indicators define or "cause" the construct. In our case, all indicators were specified as "reflective" indicators, implying that our variables "reflect" or are manifestations of the constructs. The "rule of thumb" for sample size requirements suggests that it be equal to the larger of the following: 1) 10 times the scale with the largest number of formative indicators (scales with reflective indicators can be ignored); or 2) 10 times the largest number of antecedent constructs leading to an endogenous construct. In our study we applied the second requirement as all indicators are reflective. The largest number of antecedent constructs leading to our dependent variable (OP) is 6. Therefore, a minimum of $6*10 = 60$ would be required. However, according to Chin's recommendation, our sample size should be ideally 100 or 150 observations. Our sample size is 253.

## 4. DATA ANALYSIS

Following the pilot test, we inspected the reliability of measures using Cronbach's alpha. The reliabilities for each of the four constructs were validated, since the alpha values are greater than 0.93, exceeding the level of 0.7, which is considered good for exploratory research (Nunnally, 1978). Further, we used the principal component analysis for choosing the items that loaded at least 0.50 in its corresponding construct. Hair *et al*. (1992) considers loadings of 0.50 or greater, very significant. Given that one of our purposes is to attain reliable measures, we confirmed our factor findings using PLS to assess individual item reliabilities. We found that results are very similar in the two approaches. Thus, we retained 48 items that simultaneously loaded: *(i)* 0.50 in its corresponding construct by the principal component analysis; and *(ii)* 0.50 in the individual item reliabilities by the PLS analysis, as recommended by Chin (1998) for early stages of research. We proceeded with the final test, assessing first the measurement model and then the structural model.
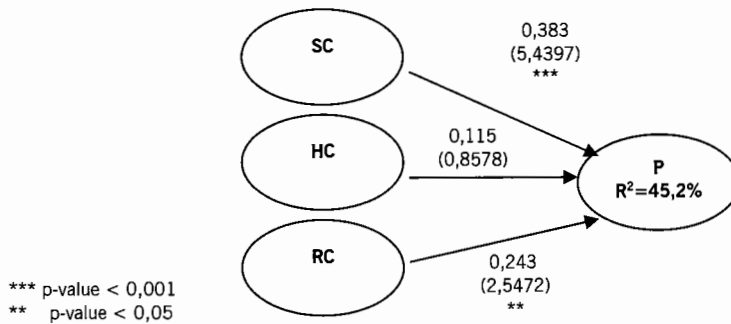
Given that PLS considers all path coefficients simultaneously (thus allowing analysis of direct, indirect, and spurious relationships) and estimates multiple individual item loadings in the context of a theoretically specified model rather than in isolation, it allows the researcher to avoid biased and inconsistent parameter estimates for these equations.

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PLS has as its primary objective the minimization of error (in other words the maximization of variance explained) in all endogenous constructs. The degree to which any particular PLS model accomplishes this objective can be determined by examining the $R^2$ values for the dependent (endogenous) constructs. One of the attractive features of PLS is that it can be used to quickly generate and test a variety of different theoretical models.
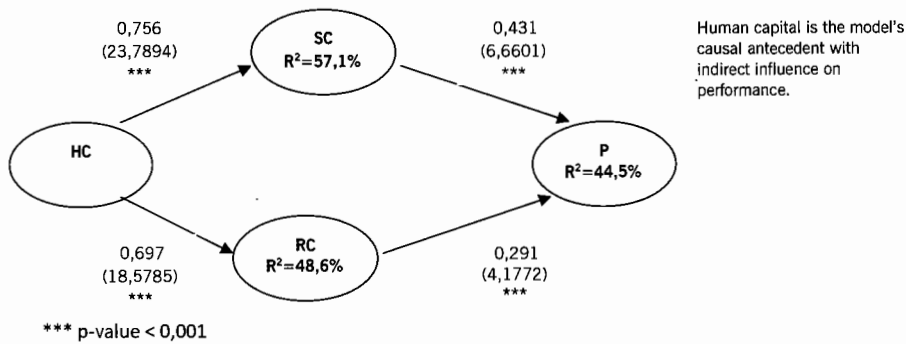
## 5. DISCUSSION

The purpose of this study is to test models that represent different combinations of intellectual capital components that are supposed to drive organizational performance. The model choice will be based on its explanatory power (i.e., $R^2$) and on the  significance of path coefficients, as depicted in table 1.
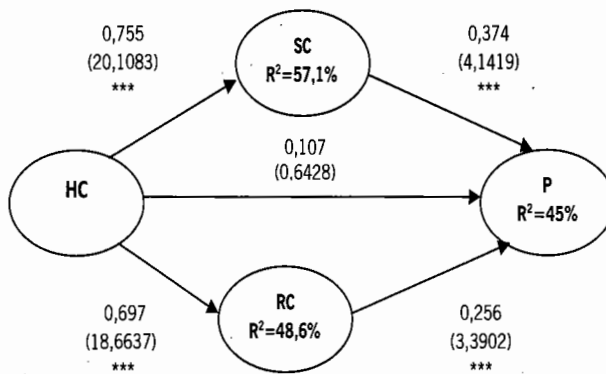
### Model A



*** p-value < 0,001
**    p-value < 0,05

### Model B



Human capital is the model's causal antecedent with indirect influence on performance.

*** p-value < 0,001

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## Model C



0,755
(20,1083)
***

SC
R²=57,1%

0,374
(4,1419)
***

Human capital is the model's causal
antecedent with direct influence on
performance.

HC

0,107
(0.6428)

P
R²=45%

0,697
(18,6637)
***

RC
R²=48,6%

0,256
(3,3902)
***

*** p-value < 0,001

The comparative analysis of the three models demonstrates that, although the highest $R^2$ is achieved by model A, the relationship between human capital and business performance is not significant, although positive. As far as model B is concerned, the $R^2$ explains 44.5% of the relationships between intellectual capital components and business performance, and all paths are substantive and significant (p-value < 0.001). In model C we added the direct relationship between human capital and business performance and, again, it proves not significant, although $R^2$ slightly increases in comparison with model B. In models B and C, human capital is the causal antecedent.

The comparative analysis concludes that the direct effect of human capital in business performance is not significant in two of the three models in which this relationship is proposed. This proves that human capital has a positive influence in business performance; however, this relationship is substantive and significant when it inter-relates with the two other components of intellectual capital.

Model B is the best model specification (diamond model) since $R^2$ reflects a high degree of explanatory power and path coefficients are all substantive and significant.

## 6. CONCLUSIONS, LIMITATIONS AND IMPLICATIONS

The aim of this paper is to gain further insight into the inter-relationships between intellectual capital components and business performance. These results confirm that intellectual capital has a positive and substantive impact on business performance.

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TABLE 1

**Model's comparative analysis**

| Paths | Significance | Direct effects | Indirect effects | Total effects | $R^2$ |
|---|---|---|---|---|---|
| Model A | | | | | |
| SC→P | p-value<0.001 | 0.383 | - | 0.383 | |
| HC→P | n.s. | 0.115 | - | 0.115 | |
| RC→P | p-value<0.05 | 0.243 | - | 0,243 | 45.2% |
| Model B | | | | | |
| HC→SC | p-value<0.001 | 0.756 | - | 0.756 | |
| HC→RC | p-value<0.001 | 0.697 | - | 0.697 | |
| RC→P | p-value<0.001 | 0.291 | - | 0.291 | 44.5% |
| SC→P | p-value<0.001 | 0.431 | - | 0.431 | |
| Model C | | | | | |
| HC→SC | p-value<0.001 | 0.755 | - | 0.755 | |
| HC→RC | p-value<0.001 | 0.697 | - | 0.697 | |
| RC→P | p-value<0.001 | 0.256 | - | 0.256 | 45.0% |
| SC→P | p-value<0.001 | 0.374 | - | 0.374 | |
| HC→P | n.s. | 0.107 | (0.755*0.374) + (0.697*0.256) = 0.460 | 0.567 | |

Another important finding is that intellectual capital is a phenomenon of interrelationships, among human capital, structural capital and relational capital. Moreover human capital is practically useless without the supportive structure of structural capital. This may account for the insignificant paths from human capital to business performance in the models tested. These findings support the idea that human capital and structural capital are interdependent and mutual enhancing factors. They "go together" in the creation of intellectual capital. This is what Edvinsson (2002) calls the multiplier effect. This is further supported by strong correlations between human capital and structural capital in models B and C.

Another point that emerges from the study is the importance of human capital as the model's causal antecedent. Human capital represents the mind, the hands and the heart of the organization and thereby it is the foundation of intellectual capital, a primary element to perform intellectual capital's functions. A company with strong structural capital will be likely to create favourable conditions to utilize human capital and allow human capital to realize its fullest potential. Through their structural capital, organizations can facilitate human and relational capital conversion into value.. Relational capital provides the organization with the meaning and purpose that foster the collaboration and trust needed to develop relationships and share knowledge, thereby building intellectual capital.

What the different models' specifications signalize is that there must exist a constant interplay among human, structural and relational capital to leverage the organization's knowledge base. As mentioned by Bontis (1998), isolated stocks of knowledge that reside in employees' minds that are never retained into organizational knowledge will never positively affect business performance.

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Finally, our empirical study emphasizes that intellectual capital elements interact with each other in order to impact the overall organizational value. So, the individual competencies and personal characteristics that make up human capital are evidenced through structural capital since the collective knowledge that makes up structural capital is manifested through a complex relationship network that makes cooperative actions possible.

The principal limitation of this study is that it focuses only in one country, and one sector and one point in time. Thus, the ability to generalize its conclusions is limited to the Portuguese banking industry.

Other limitations come from insufficient research modeling, even cross sectional; only with further and intense work in the area can different solutions be proposed and improvements made (Petty and Guthrie, 2000; Marr et al., 2004; Skoog, 2003; Mouritsen, 2004).

There are several ways in which future research could be directed. Some recommendations for future research include replicating the study in other sectors and exploring alternative measures of intellectual capital for more generalisations to be made.

Because previous research showed that the benefit of intellectual capital has a lagged effect, longitudinal data may help us to understand the comprehensive framework of relationships between intellectual capital and value creation.

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**Resumo**

As organizações encontram hoje novos paradigmas competitivos associados à capacidade de criar, utilizar, combinar e gerir activos intelectuais. O Capital Intelectual é o propulsor da economia da inovação porque processa e alavanca o valor organizacional e melhora a criatividade. O objectivo deste estudo é o de examinar as interrelações entre os componentes do capital intelectual, no contexto da banca Portuguesa e identificar as vias que conduzem a resultados superiores, através da especificação de modelos. Os modelos são avaliados utilizando uma abordagem PLS (Partial Least Squares), dadas as vantagens de tratar com modelos complexos requerendo menos rigidez nos pressupostos. Os resultados empíricos deste estudo suportam a proposição de que o capital intelectual é um propulsor do valor organizacional. Além disso o capital intelectual é um fenómeno de interrelações, entre o capital humano, o capital estrutural e o capital relacional.

**Palavras-chave:** capital intelectual, capital humano, capital estrutural, valor organizacional.

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