Intellectual Capital and Business Performance: An Empirical study for the Greek Listed Companies

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Abstract

The aim of this study is to empirically examine the four elements of intellectual capital (human capital, customer capital, structural capital and innovation capital) and their relationship with business performance in the Athens Stock Exchange (ASE). This study was conducted based on a psychometrically validated questionnaire developed and launched by Bontis (1997) and Bontis *et al.* (2000). Confirmatory Factor Analysis and Structural Equation Model have been used as statistical methods to analyse the five hypotheses developed. Our results are designed to extend it to degrees consistent with those revealed by Bontis *et al.* (2000) for a Malaysian set of industries. In particularly, we found that: (a) human capital is important and positively associated to customer capital in both service and non-service industries; (b) customer capital has an influence in structural capital rather than in non-service industries; (c) innovation capital seems to have an important and positive relationship to structural capital, regardless of the industry type; and (d) structural capital has a positive relationship to business performance in both industry types, and especially in non-service industries.

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Key words: Intellectual Capital; human capital, customer capital, structural capital and innovation capital; business performance; Confirmatory Factor Analysis and Structural Equation Modelling.

1. Introduction

The global market is progressively moving towards knowledge and technological innovation, seeking methods to boost competitive advantage. For years intellectual capital (IC) has been synonymous with intangible assets and knowledge capital. In the last two decades, numerous scholars have contributed and analysed the role and the relevance of the IC to the performance and value creation capabilities of the companies (see: Edvinsson and Malone, 1997; Roos *et al.*, 1997; Sveiby, 1997 and 1998; Sullivan, 1998; and Teece, 2000).

A general notion of intangible value was detected, in early 1980s, where huge IC research movements started. In the mid 1980s the 'information age' took into consideration the gap between book value and market value expanding for several companies (see: Bontis, 2001). However, only in the late 1980s, specialists and professionals have constructed statements of IC measurement models. Moving towards the 1990s, several models were developed to evaluate and report the IC stock of a company to other parties, while, in the late 1990s, scholars have baptised IC into a popular subject and extensively discussed it in relevant conferences and other releases.

The importance of IC has been revealed and discussed by many scholars. Handy (1989) mentioned that intellectual assets are three or four times the tangible book value of a company. Van Burren (1999) suggested that intangible assets represent more than two-thirds of the corporate value, while, Osborne (1998) indicated that 80 per cent of a company's value is not tangible. Furthermore, traditional accounting measures are inadequate to determine the real value of the company, in the so-called "knowledge-based society" (see: Stewart, 1991). Thus, valuing IC is vital to enabling companies to appreciate their exact corporation value.

IC frameworks have been generated for understanding IC. These frameworks classify IC assets, and its elements are categorised and understood. A variety of classification schemes classify IC into four categories: (a) human capital; (b) external (customer-related) capital; (c) internal (structural) capital; and (d) innovation capital. Several studies have been conducted to identify and measure IC, as well as to relate IC with the company's performance (see: Bontis, 1996, 1998, 1999, 2000; Edvinsson, 1997, 2000, 2002; and Edvinsson and Malone, 1997).

Firms are likely to produce IC performance measures, due to the realisation of the importance of IC. The management, based on these measures, should be in place to provide motivations for employees to behave in a way that will increase the firm's IC value. Once companies identify particular items of IC, they can categorise and invest in human capital, customer capital, structural and innovation capital, to enhance corporate value. The main conclusion lay to the fact that if companies invest in the parameters that were discussed above, they would achieve a higher competitive advantage towards the antagonistic market. If IC steers in the right direction and

companies take advance of its elements, not separately and independently, but as topics linked to each other, they could succeed in business performance.

As for Greece, to our knowledge, no study has up to now examined the relationship between these four elements with business performance. This was one of the motivations to conduct this study in the Greek environment.

The rest of the paper is structured as follows: The theoretical background and the model development are presented in sections two, while methodology follows in section three. Section four presents the empirical results, followed by section five with the concluding remarks and suggestions for further research.

2. Theoretical Background

Productive scenarios, in the completive economy, state that conventional tangible resources and financial capital do not support the competitiveness of the company and its systems. On the other hand, sustainable and strong competitive results appear increasingly from the control and exploitation of knowledge resources (Stewart, 1997; Teece *et al.*, 1997, Teece, 2000). Theoretically, some new concepts have been introduced in the economic and management theory to analyse and assess the importance of knowledge resources. In particular, throughout the last decade, several scholars have contributed and analysed the role and the relevance of the IC into the performance and value creation of the organisations (Edvinsson and Malone, 1997; Sveiby, 1997; Roos *et al.*, 1997, 1998; Sullivan, 1998; Teece, 2000).

Moreover, the fact that tangible assets are losing control over IC has been revealed by the growing volume of business knowledge (O'Donnell *et al.*, 2000). In this context '*intellectual capital is emerging as a highly complex and dynamic fuzzy activity set, embracing language, experiences, history, culture, processes, understandings, interactions, interpretations, routines, information, data and knowledge*' (O'Donnell *et al.*, 2000, p. 187).

More recently, the literature suggests the value-creation capabilities of other organisational systems, national, regional, local production systems of companies and public organisations to be relevant of such resources (see: Edvinsson, 2002; Bontis, 2004; Tallman *et al.*, 2004; Bounfour and Edvinsson, 2005; Schiuma *et al.*, 2005). On the other hand, several theoretical contributions have underlined the strategic importance of intangible resources for the value creation capabilities in regional systems' level. That seems to materialise the need: (a) to build approaches and tools more oriented towards projects and management processes; and (b) to enhance with major empirical evidence the relationship between knowledge resources, value creation capabilities and competitiveness (see: Bontis, 2004; Bounfour and Edvinsson, 2005; Pulic, 2005).

2.1. The Conceptual Thinkers

In 1987, Itami and Roehl revealed the effect of invisible assets on the management of companies in Japan, while Sveiby (1986) addressed the dimension of human capital in IC. These studies resulted in a rich and exciting view for rating the company based

upon the experience and knowledge of its employees. However, according to Sullivan (2000), even though the idea of IC was widely used in literature, it did not become accepted until the late 1990s, since by the mid 1990s notably work was entirely descriptive without relating the generalised comments to an organisational background (Bontis, 1998).

Sveiby (1986) is the founder of the 'Swedish Movement' in knowledge management and IC. Sveiby acknowledged the need to measure human capital, and in 1989, he recommended a theory for measuring knowledge capital by dividing it into three categories: (a) customer capital; (b) individual capital; and (c) structural capital. Moreover, St. Onge (1996) is considered as the originator of the concept of customer capital in the field of learning and knowledge management. He was interested in both human and structural capital, and first identified that the first two capitals should focus on customer-related interests, into a new capital, named customer capital. The St. Onge model shows that joining human, structural, and customer capital in one essence creates long-term profits.

Research on the intangible assets has been reported in different directions (both theoretical and empirical). Lev and Sougiannis (1996) valued and calculated intangibles and then correlated those values with financial measures. Edvinsson (1997) identified the so called 'hidden values' of a company and developed an IC management model. He was inspired by Sveiby's (1994) concepts of reporting on external capital, and re-labelled these intangible assets as IC. The study of Bontis (1998) showed the association between IC and business performance, while that of Bontis *et al.* (2000) revealed that human, customer and structural capital have a positive relationship with business performance apart from industry type (service and non-service organisations). Chen *et al.* (2004) also observed that there is an important association between the four elements (customer, innovation, structural and human capital) of IC and the business performance. Furthermore, they proved that there is a remarkable relationship among the elements of IC. Finally, Tseng and Goo (2005) explored the relationship of IC with the value creation. They used three financial methods for value creation and they analysed the relationship between the four elements of IC (human, structural, customer and innovation) and corporate value. The empirical findings showed that a positive relationship exists between IC and corporate value.

2.2. Definitions of IC

The Organisation for Economic Co-operation and Development (OECD, 1999) categorised intangible assets into two categories: (a) organisational capital; and (b) human capital. Both comprise the IC which is a broad term considered synonymous with the corporation's intangible assets. Skandia explains IC as the knowledge, the skills and the technologies that create a competitive advantage and therefore, financial gains.

According to Tseng and Goo (2005) there is a common lack of a clear definition that would appropriately describe the term of IC. However, they seem to adopt Stewart's (1997) definition, also widely recognised, that IC has been formalised, captured, and enforced so as to generate an advanced value to the organisation. Moreover, Olve *et al.* (1998) regarded IC as a market premium, and Bontis (1998) considered it as the result of effective experience and knowledge against the company's data.

IC accounting started reflecting the true value of companies due to their 'disrespect' for intangible resources, including 'human capital', while, at the same time the traditional financial balance sheets were gradually seen more as inadequate (see: Edvinsson and Malone, 1997; Sveiby, 1997; Petty and Guthrie, 2000).

2.3. Components of IC

IC is not detached. Several scholars allocated IC into four categories: (a) human capital; (b) customer capital; (c) structural capital; and innovation capital (see: Edvinsson and Malone, 1997; Roos *et al.*, 1997; Stewart, 1997; Sveiby, 1997; Chen *et al.*, 2004 and Tseng and Goo, 2005).

Human capital (HC) represents the individual knowledge asset of a company's employees (Bontis *et al*., 2001). Roos *et al.* (1997) argued that employees generate IC throughout their competency, their attitude and their intellectual alertness. Even though employees are considered the most important corporate asset in a learning organisation, they are not owned by the organisation. Similarly, Hudson (1993) described HC as a combination of four factors: (a) culture; (b) experiences; (c) inheritance; and (d) attitude. Edvinsson and Richtner (1999) supported the view that HC is the skills, relationship ability and standards; the employee works on transforming an individual into a combined know-how and a more long-term organisational capital. In essence, HC is the brainpower of the employee inside the company.

Customer capital (CC) is the knowledge that is developed to the customer-supplier relationship when conducting business. Bontis (1999) represented customer capital as any potentials of the company regarding its customers. Supplementary explanation by Saint-Onge (1996) have included the 'relational capital', which covers the knowledge, surrounded by all relationships in an organisation from customers, competition, suppliers, associations or the government. Moreover, Edvinsson and Richtner (1999) showed that CC is the value of customer position, customer relationships and customer potential, and finally, Chen *et al.* (2004) argued that CC cannot be achieved without HC.

Structural capital (SC) contains '*all the non-human storehouses of knowledge in organisations, which include the databases, organisational charts, process manuals, strategies, routines and anything whose value to the company is higher than its material value*' (Bontis, 1999, pp. 92). Additionally, Roos *et al.* (1997) defined SC as the knowledge inside the company when employees stop working. In accordance with Bontis (1998), if organisations have inadequate procedures and systems, IC will not reach its peak of prospective. Another important feature of SC is its capacity to compose, allowing IC to be calculated and managed, in any stage of examination, (Bontis, 1998).

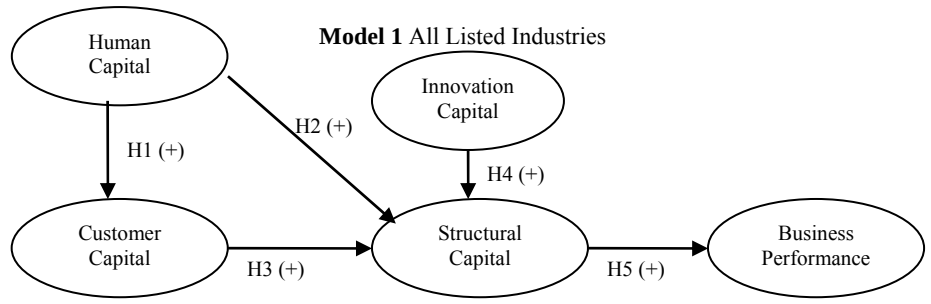
Innovation capital (InnC) is defined as the ability to build on previous knowledge and generate new knowledge. According to Tseng and Goo (2005) InnC includes the ability of a company to develop new products, as well as any innovative ideas. In order for a company to retain its competitive advantage, innovation should play a significant role for the company (Chen *et al.*, 2004). Innovation is achieved with a

mixture of employees, rational policies, culture and techniques. According to the OECD (1997), innovation is the implementation of a new resolution (for the enterprise, the industry or the world aiming at enhancing its competitive position, its performance, or its know-how. Innovation could be technological or organisational. In this direction, technological products (goods or services) or process innovation include new technologically products and processes, and significant technological improvements.

2.4. Research Model and Research Hypothesis

This study separates intellectual capital into four categories: (a) human capital; (b) customer capital; (c) innovation capital; and (d) structural capital. Based on Bontis *et al.* (2000) study develops and explores a conceptual model of the relationship between IC components and business performance (see Figure 1). The value added of this research model is the incorporation of InnC.

Figure 1 Research Model



Note (+): positive relationship

The scope of this research is to explore the inter-relationships among the independent variables: human capital, customer capital, structural capital, innovation capital and the depended variable which is the business performance, for both service and non-service industries, and to examine if the results are confirmed in the Greek context. The variables' definition and conceptualisation and the hypotheses development have been based on previous study conducted by Bontis *et al.* (2000).

Thus, the following hypotheses have been structured:

H1**:** Human Capital (HC) is positively associated with Customer Capital (CC).

H2**:** Human Capital (HC) is positively associated with Structural Capital (SC).

H3**:** Customer Capital (CC) is positively associated with Structural Capital (SC).

H4**:** Innovation Capital (InnC) is positively associated with Structural Capital (SC).

H5**:** Structural Capital (SC) is positively associated with business performance (PERF).

4. Empirical Research

4.1. Questionnaire Developing

Relevance and accuracy are the two crucial principles a questionnaire should meet. The questionnaire relevancy ensures that no unnecessary, wrong or irrelevant questions are asked. To avoid an irrelevant questionnaire, and for the purposes of the research, Bontis' (1997) questionnaire is the basic questionnaire structure in use. Accuracy assures that the information is reliable and valid. In order to avoid inaccuracy, simple, understandable and unbiased questions were designed to obtain accurate answers from respondents. In designing the questionnaire, as Andrews (1984) suggested, a 7-point Likert scale (strongly disagree to strongly agree) was used.

Overall, 67 items were shaped in the questionnaire, to satisfy the five constructs (four constructs relating to intellectual capital plus one construct for performance). The items included in the survey were first developed from Bontis (1997), in a past research, but because other concepts were also highlighted through the literature review of the study, items of the questionnaire were re-adjusted and interpolated. See Table 1 for a summary of these items.

Table 1 Summary of survey items

Human Capital			
HC1	Competence ideal level	HC11	Employees perform their best
HC2	Succession training programme	HC12	Recruitment programme comprehensive
HC3	Planners on schedule	HC13R	Big trouble if individuals left
HC4	Employees cooperate in teams	HC14R	Rarely think actions through
HC5	No internal relationships	HC15R	Act without thinking
HC6	Come up with new ideas	HC16	Individuals learn from others
HC7	Upgrade employee's skill	HC17	Employees express opinions
HC8	Employees are bright	HC18	Get the best out of employees
HC9	Employees are the finest in industry	HC19R	Bring down to other's level
HC10	Employees are satisfied	HC20	Employees give it their all
Customer Capital			
CC1	Customers generally satisfied	CC9	Firm is market-oriented
CC2	Reduce time to resolve problem	CC10	Meet with customers
CC3	Market share improvement	CC11	Customer info disseminated
CC4	Market share is highest	CC12	Understand target markets
CC5	Longevity of relationships	CC13	Capitalise on customer's wants
CC6	Value added service	CC14R	Launch what customers don't want
CC7	Customers are loyal	CC15	Confident of future with customer
CC8	Customers increasingly select us	CC16	Feedback with customer

Structural Capital			
SC1	Lowest cost per transaction	SC9	Engage more ideas in industry
SC2	Improving cost per revenue	SC10	Firm is efficient
SC3	Increase revenue per employee	SC11	Systems allow easy info access
SC4	Revenue per employee is best	SC12	Procedures support innovation
SC5	Transaction time decreasing	SC13R	Firm is bureaucratic nightmare
SC6	Transaction time is best	SC14	Not too far removed from each other
SC7	Implement new ideas	SC15	Atmosphere is supportive
SC8	Supports development of ideas	SC16R	Do not share knowledge
Innovation Capital			
IC1	Employees' average in innovation good	IC4	Management is supportive to innovation
IC2	Good average of sales of new products	IC5	Firm is incentive
IC3	Firm supports employees' innovation		
Performance			
PERF1	Industry leadership	PERF6	After-tax return on assets
PERF2	Future outlook	PERF7	After-tax return on sales
PERF3	Profit	PERF8	Overall response to competition
PERF4	Profit growth	PERF9	Success rate in new product launch
PERF5	Sales growth	PERF10	Overall business performance

Note R – reverse coded items

4.2. Data collection

A survey was designed to suit the intellectual capital concept as well as business performance within the Greek context. 319 firms took part in the research, including all section of industries. Given that the study focuses on specific levels of each company, every respondent was required to complete the questionnaire as a vivid employee.

A total of 119 complete questionnaire replies covering the 17 sections of the Athens Stock Exchange (ASE) including: Banks, Basic Resources, Chemicals, Construction and Materials, Financial Services and Technology, Food and Beverage, Health Care, Industrial Goods and Services, Insurance, Media, Oil and Gas, Personal and Household Goods, Retail, Telecommunications, Travel and Leisure, and Utilities. Most of the respondents are the leading firms in different segmentations.

Executives from 119 of the companies returned completed questionnaires. The response rate was 37.3 per cent. A description of the respondents is represented in Table 2. About 39.5 per cent of the respondents were from service industries (e.g. Health Care, Travel and Leisure, Banks, Financial services, etc.). The remaining 60.5

per cent were from non-service industries (e.g. Constructions and Material, Industrial Goods, Oil and Gas Chemicals, etc.). All the respondents were from the ASE.

Table 2 Description of respondents

	Observations	Percent (%)	Cumulative Percent (%)
Service			
Health Care	2	1.7	
Media	10	8.4	10.1
Travel and Leisure	6	5.0	15.1
Telecommunications	2	1.7	16.8
Utilities	6	5.0	21.8
Banks	4	3.4	25.2
Insurance	2	1.7	26.9
Financial Services	6	5.0	31.9
Technology	9	7.6	**39.5**
Sub-Total	**47**	**39.5**	
Non-Service			
Oil and Gas	1	0.8	
Chemicals	2	1.7	2.5
Basic Resources	11	9.2	11.7
Construction and Materials	12	10.1	21.8
Industrial Goods and Services	11	9.2	31.0
Food and Beverage	12	10.2	41.2
Personal and Household Goods	17	14.3	55.5
Retail	6	5.0	**60.5**
Sub-Total	**72**	**60.5**	
Total	**119**	**100.0**	
Gender			
Male	87	73.1	
Female	32	26.9	**100.0**
Total	**119**	**100.0**	
Age			

Below 30 years	33	27.7	
31 - 40 years	56	47.1	74.8
Above 40 years	28	25.2	**100.0**
Total	**119**	**100.0**	

Years of experience			
Below 5 years	53	44.5	
6-10 years	45	37.8	82.3
Above 11 years	21	17.7	**100.0**
Total	**119**	**100.0**	

4.3. Scale reliability and validity

The internal consistency of the questionnaire was assessed by examining the coefficient alpha scores. All Cronbach alpha values were high, in each of the constructs (human, structural, customer, innovation capital and performance), ranging (service and non-service) from 0.7521 and 0.7186 in human capital, 0.7948 and 0.8112 in structural capital, 0.8676 and 0.8269 in customer capital, 0.7340 and 0.7653 in innovation capital, and 0.9167 and 0.9374 in performance, respectively. Table 3 highlights each of the constructs tested for reliability and its loading values.

Table 3 Statistical Highlights

Human Capital (HC)				Structural Capital (SC)				Customer Capital (CC)				Innovation Capital (IC)				Performance (PERF)			
Service		Non-Service		Service		Non-Service		Service		Non-Service		Service		Non-Service		Service		Non-Service	
Cronbach's Alpha test for reliability																			
0.7521		0.7186		0.7948		0.8112		0.8676		0.8269		0.7340		0.7653		0.9167		0.9374	
Remaining Items with loading values > 0.7																			
HC3	0.7325	HC6	0.8411	SC7	0.7641	SC7	0.8531	CC5	0.8093	CC1	0.7855	IC1	0.7688	IC1	0.8010	PERF2	0.8620	PERF1	0.7962
HC8	0.7932	HC7	0.7402	SC9	0.7419	SC8	0.7120	CC6	0.7181	CC10	0.8651	IC2	0.7986	IC2	0.8364	PERF3	0.8697	PERF2	0.8244
HC10	0.7210	HC10	0.8160	SC10	0.7598	SC9	0.7789	CC7	0.7966	CC11	0.8894	IC3	0.8650	IC3	0.8476	PERF4	0.9174	PERF3	0.9049
HC11	0.7863	HC11	0.8421	SC11	0.8045	SC10	0.7089	CC10	0.7700	CC14	0.7652	IC4	0.8248	IC4	0.8749	PERF5	0.8652	PERF4	0.9247
HC20	0.7855	HC20	0.7238	SC12	0.8352	SC15	0.7331	CC11	0.7049			IC5	0.7422	IC5	0.7661	PERF6	0.8147	PERF5	0.8650
								CC14	0.7183							PERF7	0.8632	PERF6	0.8873
								CC16	0.8369							PERF8	0.8470	PERF7	0.9553
								CC17	0.8158							PERF9	0.8204	PERF8	0.8644
																PERF10	0.9066	PERF10	0.8594

4.4. Confirmatory Factor Analysis

To test the structure of the questionnaire, a Confirmatory Factor Analysis (CFA) was performed in order to allocate the quality of adjustment of the model to the data. CFA tests the hypotheses, about the data structure, that result from the literature review or are justified from earlier researches. CFA evaluates the overall model and the measurement model. The results from this analysis showed that the model fit the data reasonably well (Chi-square $X^2 = 110.98$; df $= 47$; Normed Chi-square $X^2/\text{df} = 2.36$; Root Mean Square Error of Approximation (RMSEA) $= 0.066$; Comparative Fit Index (CFI) $= 0.91$; Goodness of Fit Index (GFI) $= 0.88$, in service, and $X^2 = 136.08$; df $= 72$; $X^2/\text{df} = 1.89$; (RMSEA) $= 0.079$; CFI $= 0.86$; GFI $= 0.95$, in non-service industries). Both Joreskog and Sorbom (1993) and Kline (2005) state that good Comparative Fit Index and Goodness of Fit Index values should be considered greater than 0.9 (0 equals to a poor fit and 1 equal to a perfect fit). In this study the values in both service and non-service industries are around 0.9 but relatively close to the preferred values. Zikmund (2003), on the other hand, argues that values of CFI and GFI less than 0.9, do not necessarily mean that the model has a poor fit, because values are close to the preferred value (see Table 4).

Table 4 Overall Fit Measures

Measures of Fit	Service Industries	Non-Service Industries	Preferred Values
X^2	110.98	136.08	
df	47	72	
$p-$value	0.01	0.02	< 0.05 [a]
X^2/df	2.36	1.89	< 3 [b]
RMSEA	0.066	0.079	< 0.1 [c]
CFI	0.91	0.86	> 0.90 [d]
GFI	0.88	0.95	> 0.90 [d]

[a] Hair *et al.* (1995), [b] Bollen (1989); Carmines and Mclver (1981); Hair *et al.* (1995), [c] Charma and Smith (1996), [d] Joreskog and Sorbom (1993); Kline (2005).

For the evaluation of the model there is a test of the loadings with the use of t-values and the Construct Reliability and the Variance Extracted are calculated. According to Joreskog and Sorbom (2001), if all or some of the variances are ordinal it is false to estimate the variances or Pearson correlation and it is wrong to be analysed with the Maximum Likelihood or Generalised Least Squares methods. Consequently, as many researchers suggest (Bollen and Long (1993), Hair *et al.* (1995), Joreskog and Sorbom (2001)), for the Confirmatory Factor Analysis, Weighted Least Squares was used. For this study, Confirmatory Factor Analysis was tested for the validity and well

adjustment of data to each factor separately. The results of the Confirmatory Factor Analysis for testing the Construct Reliability and Variance Extracted, on each factor of the four constructs separately are presented in Table 5 below:

Table 5 Confirmatory Factor Analysis

	Factors	Human Capital	Structural Capital	Customer Capital	Innovation Capital	Performance
Service	**Construct Reliability > 0.70** [a]	0.8752	0.8870	0.9219	0.8993	0.9634
	Variance Extracted > 50% [a]	66.8%	68.9%	64.8%	71.3%	77.4%
Non-Service	**Construct Reliability > 0.70** [a]	0.8948	0.8712	0.8967	0.9147	0.9676
	Variance Extracted > 50% [a]	70.5%	66.2%	76.4%	72.1%	79.5%

[a] Hair *et al.* (1995)

According to Hair *et al.* (1995), the composite reliability is tested with two measurements, construct reliability and variance extracted. The preferred values for reliability is over 0.70, thus, according to Table 5, all values are accepted, because the values fluctuate from 0.8752 to 0.9634 for the service industries, and from 0.8712 to 0.9676 to non-service industries. The higher the values of variance extracted the more representative the price index. This norm is supplemental to the reliability of the model structure and the preferred value is over 50%. For that reason all values are acceptable, since they overcome the 50% rule (see Table 5).

4.5. Structural Equation Model

The Structural Equation Model (SEM) is a common and extremely powerful multivariate statistical analysis technique that includes specialised versions of a number of previous analysis methods as special cases. SEM is employed for building and more often testing statistical models. As in all multivariable techniques, the sample size plays a very important role for estimation and interpretation of the results, as it provides a basis for estimating the error sampling. Generally, it is accepted that the minimum size of the sample that provides the applicability of the use of the technique should overcome 100 units. In this survey the size is 119.

After the tests, the results showed the error variances on each construct, which are presented in Tables 6 and 7. In the same tables the overall formations of the model are presented, which will be evaluated according to the data that came out of the survey.

Table 6 Path diagram to Service Industries

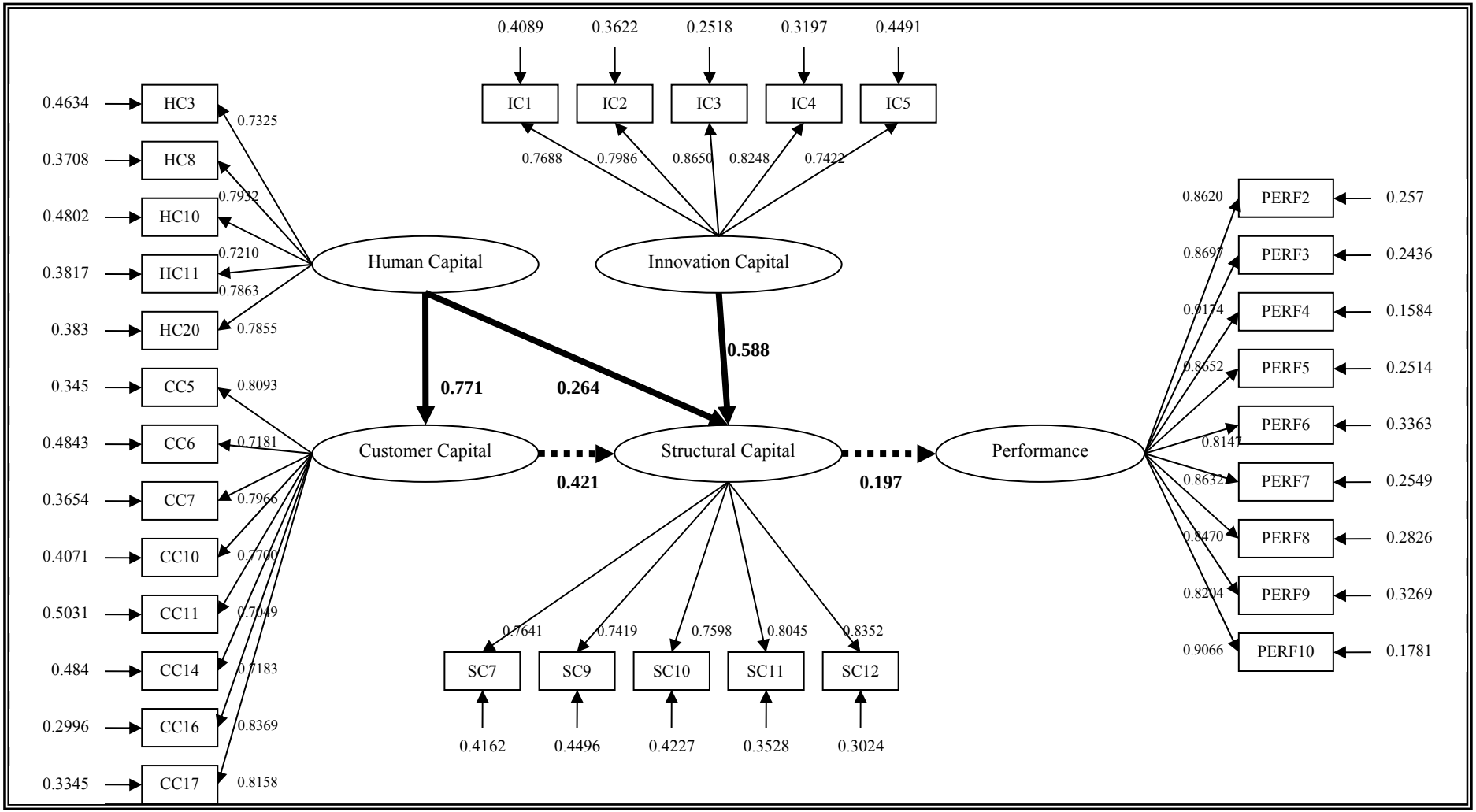
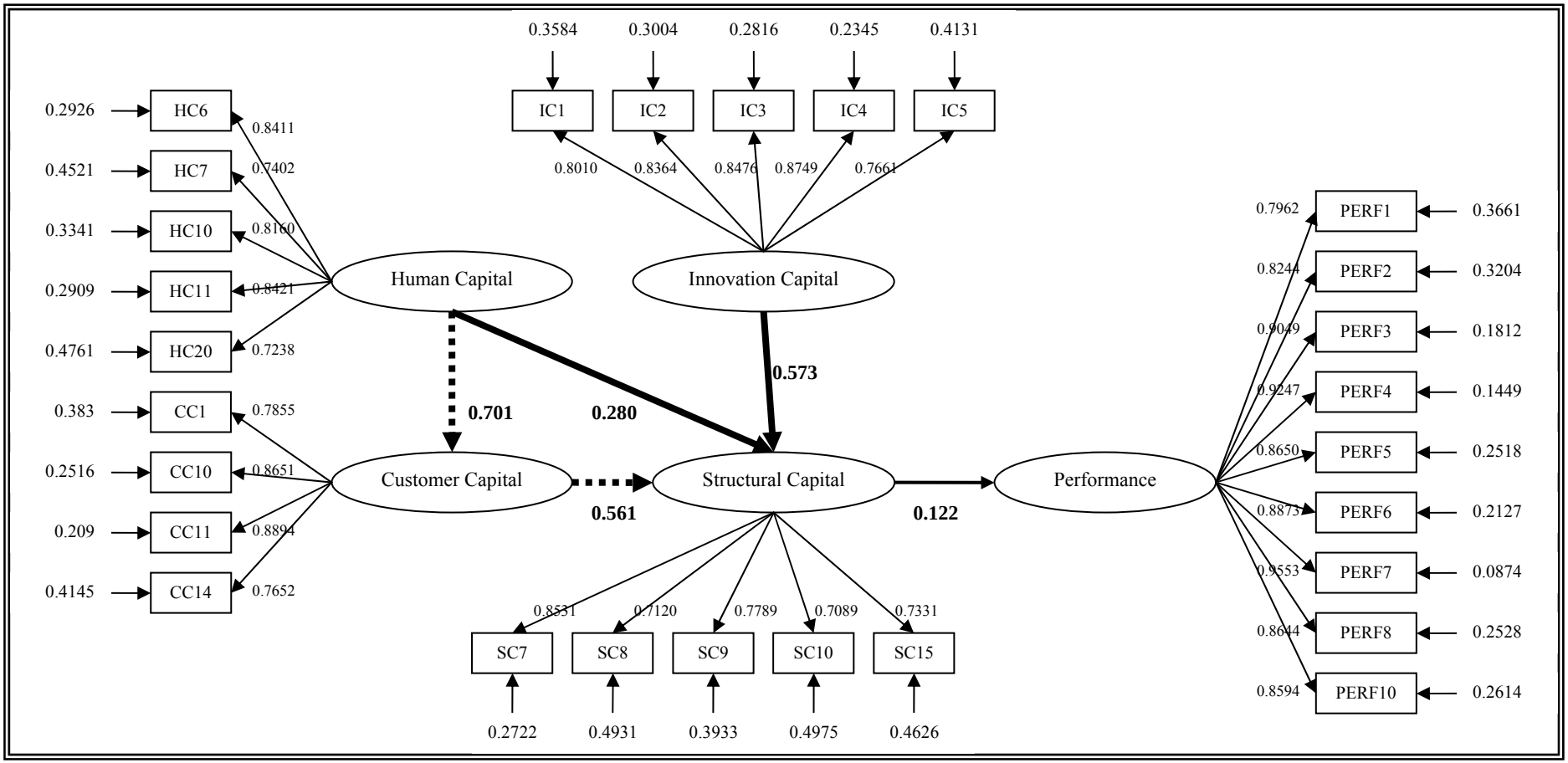


Table 7 Path diagram to Non-Service Industries



As the rationality and validity of the intellectual capital model has been verified through the research, a path analysis should be performed to indicate the real relationship between the intellectual capital constructs. Consequently, a path analysis was performed to calculate the statistical significance of the path coefficients, which are standardised betas. The results for both service and non-service industries are presented in Table 8.

Table 8 Structural Equation Model Results

Path from → to	Human Capital → Customer Capital (H1)	Human Capital → Structural Capital (H2)	Customer Capital → Structural Capital (H3)	Innovation Capital → Structural Capital (H4)	Structural Capital → Performance (H5)	Average R-Squared for Model
Model 1 Service Industries	0.771 (17.83) ***	0.264 (4.92) ***	0.421 (4.98) **	0.588 (7.91) ***	0.197 (5.66) **	46.35%
Model 2 Non-Service Industries	0.701 (21.86) **	0.280 (9.17) ***	0.561 (12.33) **	0.573 (12.87) ***	0.122 (11.35) *	40.98%
Comparison (see Figure 2)	Similar Values	Almost Identical Values	Service Industries Values Lower	Almost Identical Values	Non-Service Industries Values lower	Explanatory Power Lower to Non-Service industries

Notes
Top numbers is standardized beta coefficient
$t-$ statistic in brackets
*significant at $p < 0.10$; ** significant at $p < 0.05$; *** significant at $p < 0.01$

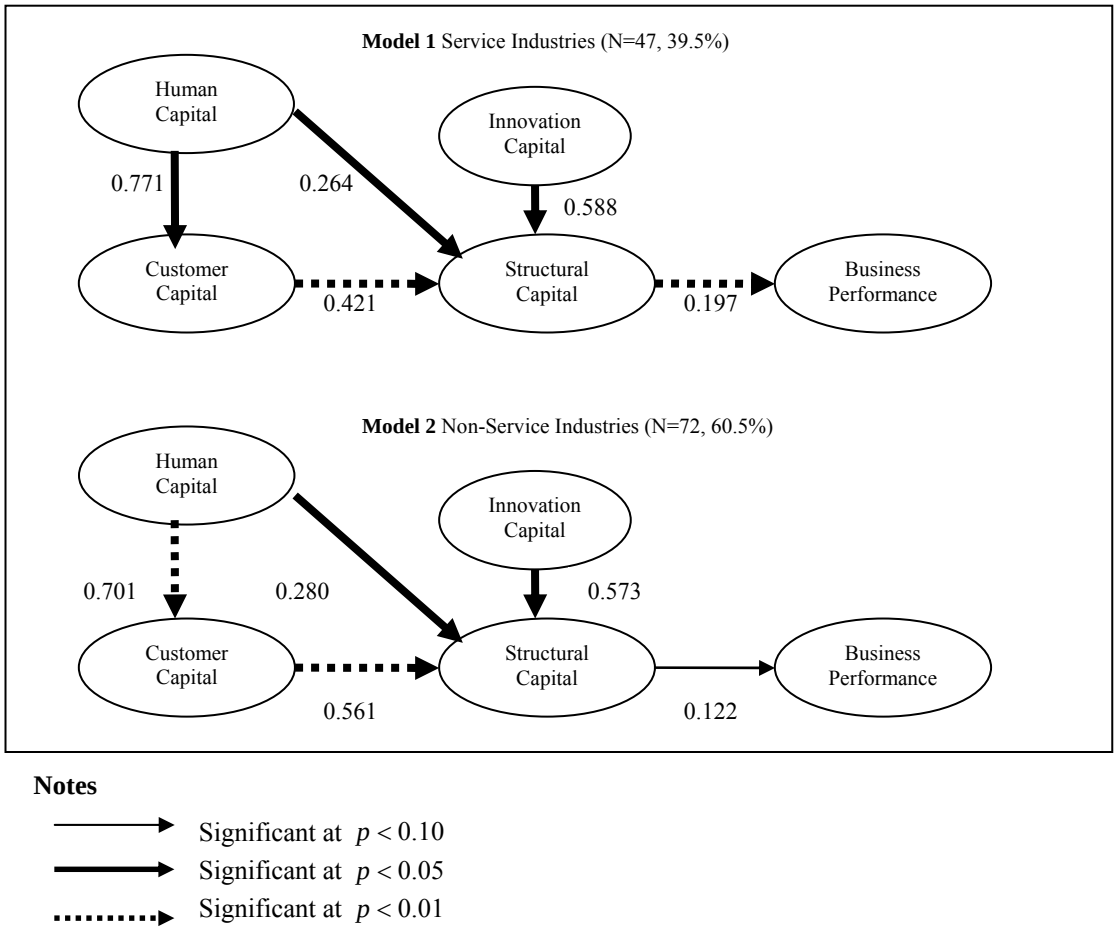
H1 tested the association connecting Human Capital and Customer Capital. The end results show a positive relationship, as the beta coefficient indicates a substantive, positive and significant relationship, 0.771 (at $p < 0.01$) for the service sample and 0.701 (at $p < 0.05$) for the non-service sample (similar prices) (see Table 8). Furthermore, *H2* tested the association between Human Capital and Structural Capital. Finally, the conclusions also illustrate a positive and significant beta coefficient, by 0.264 (at $p < 0.01$) for the service sample and 0.280 (at $p < 0.01$) for the non-service sample (almost identical prices).

Moving on, a positive significant beta coefficient for both service sample 0.421 (at $p < 0.05$) and non-service sample 0.561 (at $p < 0.05$) (value of service industries lower), confirmed the *H3* (Customer and Structural Capital relationship). *H4* tested the relationship between Innovation Capital and Structural Capital, and according to

the results in both samples there is a positive beta coefficient for the service industries 0.588 (at $p < 0.01$) and 0.573 (at $p < 0.01$) for the non-service industries (almost identical prices). Finally, *H5* tested the association between Structural Capital and Business Performance. The results show a positive coefficient of 0.197 (at $p < 0.05$) for the service sample and 0.122 (at $p < 0.10$) for the non-service sample (value of non-service industries lower) (see Table 8).

Furthermore, the explanatory power (R^2s) for both models was relatively strong at 46.35 per cent for the service sample and 40.98 per cent for the non-service sample. Figure 2 illustrates the finalised models, service and non-service industries.

Figure 2 Service and Non-Service models



Notes

Significant at $p < 0.10$

Significant at $p < 0.05$

Significant at $p < 0.01$

5. Conclusions

The results from this study are as expected and significantly supportive to the hypotheses developed. The first hypothesis proved that the relationship between HC and CC is positive and thereupon important to both service and non-service industries. This relationship is one of the strongest in the overall model as its value is over 0.7 to both industry types. This is an indicator, where senior managers understand the importance of HC, and realise that they should appreciate its dynamic. In other words, as long as companies have proficient and competitive staff, the more the employees

would understand the customer's needs. As Housel and Bell (2001) indicated employee IC gives a company the power and flexibility to rapidly position new knowledge and generate an ever-changing range of products and services. Therefore industries invest in developing a strong and loyal relationship, underlying a strong CC.

HC also proved a positive relationship with SC regardless of the industry type, with almost identical values. This implies that both service and non-service industries have the capability to transform individual employee knowledge into knowledge with structural roots. Paraphrasing, the IC in both industry types absorb the large capital expenditure. Both models indicate a significant path investing HC and SC, implying that the Greek context is allocating a lot of attention to the employees that contribute to the structure of any organisation. Explicitly, if HC is not effectively managed, it reduces other intellectual ability (Edvinsson and Malone, 1997).

The relationship between CC and SC is lower in service industries as opposed to non-service industries. The results show a positive and relatively significant relationship. These findings imply that non-service industries invest much more in becoming customer focused and market driven, and if companies invest more in this area, they would eventually '*create efficient organisational routines and processes that service their clientele well* (Bontis *et al.*, 2000, p. 98).

The results relating the InnC with SC show that there is a strong positive relationship. The values are exceeding 0.5, indicating that there is a strong relationship to both service and non-service industries. In addition there is a significant relationship, for both models. These findings reflect the fact that Greek companies underline the importance of InnC.

Finally, the results relating to the fifth hypothesis show that the relationship between SC and business performance is positive and relatively important to non-service industries. On the other hand, they prove to be less substantive in the service industries. These findings imply that if companies aggregate their efforts to unlock the organisational knowledge, finally they will gain a competitive lead. This competitive advantage transforms into higher business performance and corporate value.

The results of this study have similarities and contra-distinctions to previous studies of Bontis *et al.* (2000), Chen *et al.* (2004) and Tseng and Goo (2005). In general, though, the findings appear as cornerstones in the Greek context and more particularly in the listed companies. The main footings lay in the fact that if companies invest in the parameters that have been discussed above, they would achieve a higher competitive advantage towards the competitive market.

The results of this study are based on the reports and findings from the listed companies in the ASE. Nevertheless, the findings indicate that there are dissimilarities in the way companies cope with this vital issue. Diverse ideas that create competitive advantages to an organisation, and the creation of new ways for companies to evaluate their performance, with precise results, should drive organisations to take crucial activities to exploit and apply new and advanced business performance measurement methods. And all these are occasioned by a new factor accompanying these methods, the IC.

Issues that are presented below could allow new insights for further study: (a) where IC should be presented (i.e. annual reports, Balance Sheets, other accounting papers)?; (b) in what way IC should be measured?; (c) does high IC suggest higher business performance?; (d) who are the best representative of company's staff to measure and manage intellectual capital?

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