THE UNIVERSITY OF HULL

The Market Valuation of Intellectual Capital: A Study of the Relationship Between IC and the Market to Book Ratios of 20 Companies of the Tourism and Leisure Sector of the LSE.

being a Dissertation submitted in partial fulfilment of

the requirements for the Degree of

MSc FINANCIAL MANAGEMENT

in the University of Hull

by

Audrey Delannoy, B.B.A.

Abstract:

Through the growing interest on Intellectual capital the last ten years, this work explores relationship between IC and market valuation. This dissertation highlights the Value Added by Intellectual Capital in market prices of 20 companies of the Travel and Leisure sector of the London Stock Exchange from 2005 to 2013. The relation of IC, its components and Market to Book ratios of firms is studied through the VAIC method. Results support the hypothesis than IC is valued by investors despite its non-recognition by accounting standards. Results support recommendations of more disclosure practices and improvement of IC theoretical frameworks.

Table of Contents

ABSTRACT: **2**

TABLE OF CONTENTS **3**

LIST OF FIGURES **4**

ACKNOWLEDGEMENTS: **5**

CHAPTER 1: INTRODUCTION **6**

CHAPTER 2: LITERATURE REVIEW **11**

A. ECONOMIC, AND STRATEGIC PERSPECTIVES: 13
I. Economic Perspective: *13*
II. Strategic perspective *14*
B. ACCOUNTING AND FINANCIAL PERSPECTIVES: 17
I. Increased of the difference between book and market value: recognition of hiding value. *18*
II. Disclosure practices: *32*
C. DEFINITION AND CLASSIFICATION 35
I. Definitions *35*
II. Classification of IC *40*
D. METHODS USED TO EVALUATE IC 48
I. Presentation of methods: *50*
a. Static methods 50
b. Dynamics methods (resources based) 71

CHAPTER 3: METHODOLOGY **74**

A. RESEARCH METHODS 75
I. Research hypotheses *75*
II. Selection of methods used : *76*
III. Regression models. *78*
IV. Définitions of variables : *79*
A. JUSTIFICATION OF THE DATASET 81
B. COLLECTION OF DATA 83

CHAPTER 4: RESULTS AND FINDINGS **85**

A. MODEL 1: 85
B. MODEL 2 86
C. MODEL 3 87

CHAPTER 5: DISCUSSION AND RECOMMENDATIONS **91**

A. ANALYSE OF THE RESULTS 91
B. LIMITS AND EXPANSION 100
C. RECOMMENDATIONS: 103

CHAPTER 6: CONCLUSIONS, CRITIQUE, AND LESSONS LEARNED **106**

BIBLIOGRAPHY **109**

LIST OF REFERENCES **113**

List of Figures

Figure 1: Theoretical framework of Chen, Cheng and Hwang (2005) research hypotheses. 21
Figure 2: The Skandia value scheme (Edvinsson, 1997, p.369).....42
Figure 4: Classification schema of IC (Huang, Luther and Tayles, 2007, p. 388) 43
Figure 5: Human Capital Components (Huang, Luther and Tayles, 2007, p. 390) 45
Figure 6: Costumer Capital Components (Huang, Luther and Tayles, 2007, p. 390) 45
Figure 7: Structural capital components (Huang, Luther and Tayles, 2007, p. 390) 46
Figure 8: Decision tree of method used in the dissertation. 52
Figure 9: The Skandia navigator (Edvinsson, 1997, p.371).....54
Figure 10: Construction of the VAIC coefficient (Stahle, Stahle and Aho, 2011).....61
Figure 11: Intellectual capital transformation sheme (Molodchik, Shakina and Bykova (2012) 64
Figure 12: Theoretical framework 76
Figure 13: Final dataset. 82
Figure 14: Regression - Model 1. Test of H1. 85
Figure 15: Regression - Model 2. Test of H2. 86
Figure 16: Regression – Model 3. Test of H1.....89
Figure 17: Regression - Model 3. Test of H1 with CE variable. 89
Figure 18: Regression - Model 3b. Test of H2 90
Figure 19: M/B ratio evolution (2006-2013, Companies 1 to 10).....94
Figure 20. M/B ratio evolution (2006-2013, Companies 11 to 18) ...94
Figure 21: Regression - Model 2. Control of variable "Crisis".....95
Figure 22: Regression VAHUexp – Huexp. 96
Figure 23: Regression MB – Hu expenses. 97
Figure 24: Evolution of VA (2006-2013).....98
Figure 25: All companies at 31 July 2014 119
Figure 26: Filter - Country of incorporation = "GB".....119
Figure 27: Filter - List Date = "Before 2005" 120
Figure 28: Filter Market capitalisation = "different of 0" 120
Figure 29: Filter - Market = "Main market".....121
Figure 30: Filter - Sector = "Travel and leisure".....122

Acknowledgements:

I would like to thank Dr. Alcino Azevedo for his support and guidance. Also, I would like to thank University of Hull for the great organisation and atmosphere it provided. I would like to thank Mohammed Khalil for his teaching which improved my understanding of corporate financial analysis.

I wish to thank Mohammed Al Darwish for his emotional and linguistic support, and my family for their emotional and financial support throughout my studies.

Chapter 1: Introduction

The last two centuries had transformed the economic world in a high competitive and performance oriented world.

First, the modification of the structure of the economy created new field in business focus. In the 18-19th century, the industrial revolution brought a new economic system and the corporate organisation became one of the main core of study. Then, the 20th century led to the development of the service sector: the model of value creation change from tangibles inputs-outputs to a mix of intangible and tangible inputs creating intangible outputs. In this new economy, the focus is still on the satisfaction of the customers, but the quality of the final product is now in the Human resources hands. The contact between the internal structure of the company with its customers increased, creating new challenge in management field.

On the other Hand, the multiplication of actors and globalisation have increased the number of competitors in the market and the complexity of over-performing it. The velocity of information makes all the stakeholders able to assess and compare the companies and choose the best for their own goals.

The customers can compare through media and internet and choose the company which will give them the best quality for the best prices.

The suppliers and creditors can choose the most trustable company able to give them the most advantageous long term relationship.

The government and community can assess the ethics and social behaviours of the companies, their contribution to the economic and

social world, and penalise quickly the failings related to corporates social responsibilities.
The talented employees can compare the offers in terms of training, salary, benefits, career plan, and choose the company in which they want to perform.

Both evolutions led to new challenges: the satisfaction of the costumers is nowadays related to more factors where the company has to give a qualitative product or service while respecting its internal and external environment. The human resources of the companies have to be efficient and answer the needs of the costumers, and ask for better work conditions, opportunities and recognition. As the new valuable resource is humans and their knowledge rather than material and industrial resources, loyal and talented human resources are one of the factor making a company performing better than its competitors.

Another factor of this performance is the capacity of the company to collect, create and circulate the information. Moreover, the most valuable resource of the companies is now the exchange of information (external information obtained about the customers, suppliers, competitors; the internal information about departments' performance and human resources knowledge). As Augier and Teece (2005, p.3) recognised "the traditional factors of production - land, labour and capital - have not disappeared. But they have become secondary. Knowledge is becoming the only meaningful resource".

Building talents and knowledge, creating strong relationship with stakeholders, adopting the most efficient internal process for

value creation are the new goal of the companies if they want to perform and remain powerful. The current literature describes these challenges and models better practices. Companies over performing the market are recognized as talented, often presented as companies with good internal structure, skilled managers, strong costumer's loyalty, or better financial management. These same companies present often market values greatly superior to their book values because their book value does not recognise their capacity to perform better than the competitors. In the financial field, literature analysing the state of markets suggests that a new asset, the "Intellectual Capital" is the reason of these gaps. This asset gathers performance of Human Resources, Intern (structural) Resources and Relational Resources.

An interesting issue is in the relationship between the Intellectual Capital and the market prices. Do the market really recognize and give more value to companies with greater intellectual capital? Is each component of Intellectual Capital identically valued by the market? Through the research question "How an investment on IC is evaluated by the market?" this dissertation highlights the relationship between IC, its components and the Market to Book ratio. Our first objective is to highlight that IC is integrated in market prices even if it is not recognized in classical financial statements. Secondary objectives are to highlight that different components of IC add more value than others. These findings will support academic works of disclosure practices recommendations and similar empirical works.

Our initial feelings on the topic are that companies with greater Structural, Relational and Human Capital have market values constantly superior to their book value; and that these components bring different values. A first feeling is that Human Capital, regarding to its nature could be more valuated than the other components.

To answer these objectives, our first step is to select measurement methods relevant with our research question and our time constraint.

Chapter 2 presents the actual state of literature on Intellectual Capital mainly in accounting and financial focus. The first section introduces the concept and the relevance of our research through economic and strategic perspectives. The second section focuses on both accounting and financial perspectives to present the subject from the creation of the Intellectual Capital concept to its measurement practices. The actual empirical findings and the recommendations addressed to manager and accounting standards will be presented in this section. The third section of the chapter focuses on the definitions and classifications of the different components of IC and the fourth presents the main methods used to measure IC through comparison, classification and criticism.

Chapter 3 presents the methodology used in this dissertation: the justification of the use of the VAIC method, our hypothesis and regression models. The justification of our dataset and the issues relative to our data collection will be presented in the second section of the chapter.

Chapter 4 presents our empirical findings through two models and the analysis of the results through a third model.

Chapter 5 is dedicated to a discussion on the subject. It presents our interpretation of the result and concludes the findings and the research with their limitation and expansion. It as well presents the main issues of the process of data collection and gives recommendation based of literature and our own findings about further research.

Chapter 6 concludes the research process presenting the criticism of the work and the main lesson learned during the process.

Chapter 2: Literature Review

Ways to address intellectual capital issues are many: in business area, disciplinary and interdisciplinary views can be recognised. As Suggested by Marr (2005), ten main disciplinary perspectives on IC can be emphasised. This dissertation is based on accounting and financial perspectives: accounting literature addresses measurement issues to assess IC, financial literature presents the relation between IC and market performance of companies, and frameworks to IC management. Both fields are needed to address our research questions: the first one helps us to choose the most relevant methods to measure IC and the second one gives us the basis for analysing our results. However, other perspectives as economic and strategic should be addressed to better understand the dimensions of the topic.

The main purpose of the companies is to create value for their shareholders. From economic perspective, it is through creating value for stakeholders, from strategic perspective, it is through using internal resources to respond to external opportunities (strategic perspective) (Marr and Roos, 2005). From a financial point of view, this creation of value occurs when the ROIC is higher than the WACC. Once this condition is achieved, the company growth adds a leverage effect. The ROIC comprises profit margin and capital efficiency: a higher ROIC than the competitors shows a better performance of the company because the company uses lesser resources to produce more value. Strategic point of view claims that in long term, this over

performance is created by a strong competitive advantage. From all perspectives, literature argues that Intellectual Capital is the key to obtain this competitive advantage (Augier and Teece, 2005: Marr and Roos, 2005; Lev, Cañibano, Marr, 2005; Wernerfelt, 1984; Boisot 1998; Carlos, 2003). However, from an accounting point of view, this intellectual capital is not recognised in the fundamental value of the companies. If all the accounting authors agree about the need of recognition of this "hidden value" (Edvinsson, 1997), they disagree on the measure to use for capturing the IC fair value.

A chronological approach of the literature in accounting and financial area shows that the consideration of the concept of intellectual capital is done by different "stages" representing different approaches of the topic: first strongly theoretical through definitions and segmentations, then through models and measurements, and empirical, through the application of these models (Pew, Plownam and Hancock, 2008).
In order to prove the relevance of creating strong IC financial statements, many empirical works explore the relationship between IC, market value and firm performance.

The first section of this chapter focuses on economic and strategic perspectives to present the relevance of the topic for all the business field. The second section addresses accounting and financial issues through the recognition of traditional accounting gaps, the presentation of empirical results and the recommendations of academic literature. The research method of this dissertation is based on the ones used in these empirical studies. The third section defines IC and presents

the existing framework related to the classification of its components. It permits to understand what we are measuring when we evaluate IC and how it is different from the actual accounting standards. The focus on actual accounting standards improves our understanding about the book value of the companies studied. The last section presents the methods and frameworks for IC accounting and measurement, focusing on the methods relevant to this dissertation. It gives justification of the method used and assess its validity.

A. Economic, and strategic perspectives:

I. Economic Perspective:

Economic perspective, from a macroeconomic point of view, recognises that knowledge and intellectual capital are the main value creator in the economy (Augier and Teece, 2005; Chen *et al*., 2005; Maditinos *et al*., 2011): Solow (1957) puts this assumption in numbers calculating that 87.5% of the USA growth between 1909 and 1949 was due to technological innovation (Augier and Teece, 2005). Through a study of economic literature focusing on intellectual capital (including authors as Shumpeter, Smith, Arrow or Solow), Augier and Teece give a picture of the actual perspective on intellectual capital. The main focus is on the effect of innovation on competition (Shumpeter, 1943), on the relationship between learning and knowledge in economic growth (Smith, 1776), and on the external effect of knowledge creation on the other companies production (Romer, 1986).

From a microeconomic point of view, literature focuses on the spill-overs, externalities, how the intellectual capital circulate between the

companies and between the departments of the companies, and "on issues relating to create and maintain competitive advantage at the firm level" (Augier and Teece, 2005, p. 11). Augier and Teece explain that creating value through intangible capital lead to more risk than from physical capital, highlighting the value of "complementary assets": the intellectual capital takes value in the interrelation with the assets in place and the organisation of the company. In other words, with the physical and intellectual capital already created and used by the company. The risk can as well be highlighted from a real option theory perspective: in a wrong investment in tangible capital, the cost can be decreased by selling the residual tangible, which cannot be done with intangible: the cost of the option to abandon is higher in intellectual capital. The main findings in economy of intellectual capital are that even if investment in IC are more risky, it is nowadays the main driver of economies growth and business performance. This gives justification to focus on the concept and studying its relationship with financial value creation. From a strategic perspective, managing this IC can lead to more value creation, then permit to find the capital needed to answer markets opportunities.

II. Strategic perspective

Strategy perspective recognises IC "as essential value driver in firms increased" (Marr and Roos, 2005, p.28). Seeing strategy as a group of decision using as a tool the exploitation of internal resources to respond to market opportunities, Marr and Roos argue that IC is the key to these resources.

The evolution of strategic focus in IC can be viewed from a market-based to a resource-based paradigm: it is in this second one that intellectual capital comes into its own (Marr and Ross, 2005). In a market-based paradigm, the strategy of organisation has to focus on the analysis of competitive forces in the industry (Porter, 1980). From a resource based point of view, this identification of competitive forces is not enough: companies have to identify the internal resources which make them unique (Nelson and Winter, 1982) and how these resources can respond to opportunities (Penrose, 1959). However, Marr and Roos, based on Prahalad and Hamel (1990) and Penrose (1959) work argue that "resources themselves never create value, instead, value is created from the services these resources can render. It is, therefore, beneficial for the companies to be able to apply their strategic assets to a wide range of products, services and activities" (Marr and Roos, 2005, p.30). Following Itami (1987), Marr and Roos argue that *invisible assets* (i.e. technology, costumer trust, brand image, corporate culture and management skills) are the only ones which can be used simultaneously in several areas, therefore they are the most valuable resources according to Prahalad and Hamel statement.

Considering these literature developments, authors of strategic area started to focus on intellectual capital and the importance of its management from a static and a dynamic point of view. Static point of view can be seen as accounting related: it gives the inventory of the resources of the company, it gives relevance to accounting models and static valuation methods, which are assessing IC from its fair value or its cost creation. Arguing that this static point of view

cannot reveal the real value of IC because it is ignoring the value of the interaction between resources, most of the authors adopt a dynamic point of view. It gives relevance to financial models and dynamic valuation models, which are assessing the value of IC regarding its performance or value creation. In this second point of view, many management and strategic models are created. Kaplan and Norton (1996) created the *balanced score-card,* later adapted by Skandia group to create the *business* navigator. Sveiby (1997) suggests the *intangible assets monitor* method. Roos et al. (1997) propose the *IC index*. And Brooking (1998) recommends the *technology broker* approach. The main limits of these strategic methods in valuation process is that they have to be adapted for each company which used them, preventing any benchmark and investment decision use (Rodov and Leliaert, 2002; Axtle Ortiz, 2006).

This strategic perspective allows to understand the important magnitude of intellectual capital in actual organisation as well as the challenge of managing it well. However, this management can be done uniquely if measures are available to know precisely where and how much to invest. As noted in this section, strategic point of view leads to both accounting and financial perspectives.

B. Accounting and financial perspectives:

The interest for intellectual capital started with the observation of accounting inefficiency to capture the total value of the companies. As we will detail in the definitions paragraph, accounting standards do not consider all the intellectual capital in the intangible assets recognition; given this fact, accounting literature had developed number of theoretical articles, frameworks and empirical studies to give recommendations in IC accounting and disclosure. Assessing accounting articles and methods, financial literature focuses on empirical studies especially connecting IC value with market prices and firms' performance, and theoretical articles suggesting alternative methods to assess IC and investment in intangibles through dynamic point of view.

In the two first paragraphs of this section, we will present the main consideration of accounting literature from the recognition of lack in traditional financial statement to recommendations in disclosure practices. We will define and classify in the third paragraph intellectual capital and its components, as well as key concepts in this subject. Throughout these paragraphs we will introduce the main methods used to evaluate IC and the different academic points of view in this process (detailed discussion about the main methods will be done in the next section).

I. *Increased of the difference between book and market value: recognition of hiding value.*

Lev, Cañibano and Marr (2005, p.43) highlight that "cost focused reporting tools cannot provide the adequate information on firm performance". According to Lev *et al*. most intangible assets relevant for company performance are not recognized by the standards, and not accounted in the fundamental value of the companies. Noting the increasing difference between book and market values, Edvinsson (1997) evokes the concept of *Hidden value* going further than Brainard and Tobin (1968) who had already highlighted this difference in their work on markets interdependences without allocating it to IC (i.e. the main recognised contribution of this work is the Tobin's Q ratio, used to highlight the relevance of studying difference between market and fundamental value). He based his findings on an analysis of the Sweden stock market arguing that the biggest companies of the stock exchange entice their shareholders with their knowledge rather than with their physical capital. Edvinsson notes that growth companies are under valuated by their fundamental value (rather than over valuated by the market). He used a second study to strengthen this idea: a workshop estimates that the companies studied were valuated up to 9 times their book value in United-States between 1981 and 1993 (SEC, 1996). Edvinsson recognises in this gap the presence of intellectual capital.

After this first observation, many authors started to take interest on the difference between market to book value from an IC point of view: for Nakumura (1999) this gap is explained by the beginning of the recognition of investment in IC as a potential source of profit by the investors, for Lev and Sougiannis (1999) IC is "a fundamental

variable underlying the market-to-book value effect" (Lev, Cañibano and Marr, 2005, p.43).

This difference between market and fundamental value as measure of IC has to be taken with precaution: in the hypothesis of efficient markets, the fundamental value should equal the market value of a company. In this context, the difference between both will give a fair value of IC. However, in an efficient market, the information should be available to investor: as we will see in the paragraph II, disclosing information about IC is not compulsory, and the hypotheses of efficient market has to be challenged.

In complement to this idea, from a financial point of view, IC can explain inefficiency of markets. Sudarsanam, Sorwar and Marr quote Krugman (2000) to explain the volatility of stock prices, setting that the firm's capital is nowadays mainly intangible, which makes the assessment of companies' worth difficult. An example given is the internet crisis in 2000, explained by Krugman as an overvaluation of the real knowledge-wealth of these companies. another argument to set this inefficiency is the "bonus" always calculated when firms operate mergers and acquisitions: if markets were efficient, the prices should be correctly valuated, instead of that, analysts have to measure a new price, most often composed of "goodwill" in an extend meaning (brands, talent, organisational capital…). This goodwill can be an approximation of the intellectual capital of the firm.

This recognition gives legitimacy to recommendations about disclosure practices and frameworks in IC accounting that we will detail in the following paragraphs. It marked as well the beginning of considerations between IC and market relationship in a series of articles.

a. Chen, Cheng and Hwang models (Taiwan Stock Exchange study).

Chen, Cheng and Hwang (2005), Cheng *et al*. (2010) and Maditinos *et al*, (2011) study the impact of IC in market values and firms performance.

Chen, Cheng and Hwang use the Value Added Intellectual Coefficient developed by Pulic (2000) to investigate the relation between IC, market value and financial performance of 4254 companies of Taiwan Stock Exchange. They developed 4 main hypothesis in their theoretical framework:

- H1: Companies with greater intellectual capital tend to have higher ratios of market-to-book value (*Ceteris paribus*)

- H2: Companies with - greater physical capital efficiency (H2-1) / Human capital efficiency (H2-2) / proportions of structural capital in the creation of value added (H2-3) – tend to have higher market-to-book value ratio (*Ceteris paribus*)

- H3: After controlling for the structural capital efficiency of VAIC, company with greater – R&D expenditure (H3-1) / advertising expenditure (H3-2) – tend to have higher market to book value ratios (*Ceteris paribus)*

- H4: Companies with greater IC tend to have better financial performance – contemporaneously (H4-1) / in the following years (H4-2) -.

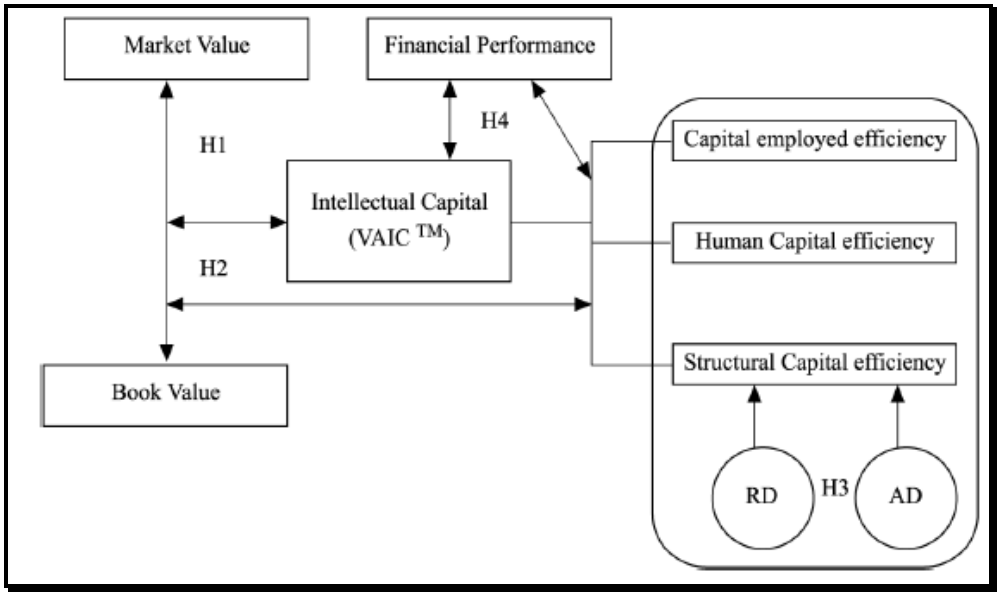

Figure 1: Theoretical framework of Chen, Cheng and Hwang (2005) research hypotheses.

Their regression model[1] measures the relationship between the market to book value and the Intellectual Capital. They take the VAIC method as measure of IC (1th equation). The VAIC measure is divided into three components, measuring the relationship between M/B ratios and each of them (2nd equation). And they add variables of R&D and advertising expenditures to increase the explanatory ability of M/B (3rd equation).

$$M/B_{it} = \alpha_0 + \alpha_1 \mathrm{VAIC}_{it} + \varepsilon_{it}$$

$$M/B_{it} = \alpha_0 + \alpha_1 \mathrm{VACA}_{it} + \alpha_2 \mathrm{VAHU}_{it} + \alpha_3 \mathrm{STVA}_{it} + \varepsilon_{it}$$

$$M/B_{it} = \alpha_0 + \alpha_1 \mathrm{VACA}_{it} + \alpha_2 \mathrm{VAHU}_{it} + \alpha_3 \mathrm{STVA}_{it} + \alpha_4 \mathrm{RD}_{it} + \alpha_5 \mathrm{AD}_{it} + \varepsilon_{it}.$$

Equation 1: Regression models of Chen, Cheng and Hwang (2005, p. 164)

[1] See annexe A for the definitions of dependent variables and VAIC method (section IV, paragraph a) for the independent variables (i.e: VAIC, VACA, VAHU, STVA).

Their findings are that around fifty per cent of the 4254 firms market value studying are not well represent by their fundamental value (M/B mean is 1.96) and that M/B is positively related to VAIC value and its components (Value Added efficiency of Capital employed – *VACA* – Value Added efficiency of Human capital – *VAHU* – and Value Vdded efficiency of Structural Capital – *STVA* -). They fail to relate M/B with advertising expenses but found a relationship between M/B and R&D expenditure, enforcing their hypothesis that it captures additional information on firm's innovative capital (i.e. component of STVA).

Variable	VAIC	VACA	VAHU	STVA	RD	AD	M/B
VAIC	1.000						
VACA	0.584*	1.000					
VAHU	0.997*	0.591*	1.000				
STVA	0.073*	−0.164*	−0.001	1.000			
RD	0.056*	0.214*	0.052*	0.022	1.000		
AD	−0.129*	0.084*	−0.124*	−0.100*	0.046*	1.000	
M/B	0.329*	0.497*	0.327*	−0.021	0.301*	0.023	1.000

Note: * Indicates correlation is significant at the 0.01 level in the two-tailed test

Table 1: Correlation analysis of variables, Chen, Cheng and Hwang model (2005, p.168)

They succeed to support H1, H2, H3-1, H4 and fail to support H3-2. According to the R^2 values, the three models explain between 10 to 30% of the difference between markets to book ratio: the third model, including R&D and advertising expenditures is the most explanative, with an R^2 of 0.2916 for similar significance.

According to their regression, investors value more the company with greater IC (H1), and they value differently the three components of IC (valuing more the efficiency of capital employed) (H2). Investors

value as well variables which are not included in VAIC as the R&D expenditure (H3-1).

Model 1: $M/B_{it} = \alpha_0 + \alpha_1 VAIC_{it} + \varepsilon_{it}$		
Independent variable	Coefficient	t-statistic
Intercept	1.605	61.59*
VAIC	0.065	22.68*

Notes: * Indicates significant at $\alpha = 0.05$ level; Adjusted $R^2 = 0.1077$; F-value = 514.16 (p-value < 0.0001)

Model 2: $M/B_{it} = \alpha_0 + \alpha_1 VACA_{it} + \alpha_2 VAHU_{it} + \alpha_3 STVA_{it} + \varepsilon_{it}$		
Independent variable	Coefficient	t-statistic
Intercept	1.142	28.30*
VACA	8.242	28.64*
VAHU	0.009	2.62*
STVA	0.151	4.30*

Notes: * Indicates significant at $\alpha = 0.05$ level; Adjusted $R^2 = 0.2515$; F-value = 477.29 (p-value < 0.0001)

Model 3: $M/B_{it} = \alpha_0 + \alpha_1 VACA_{it} + \alpha_2 VAHU_{it} + \alpha_3 STVA_{it} + \alpha_4 RD_{it} + \alpha_5 AD_{it} + \varepsilon_{it}$		
Independent variable	Coefficient	t-statistic
Intercept	1.053	25.82*
VACA	7.221	24.69*
VAHU	0.013	4.02*
STVA	0.112	3.25*
RD/BV	11.781	15.57*
AD/BV	−0.823	−0.70

Notes: * Indicates significant at $\alpha = 0.05$ level; Adjusted $R^2 = 0.2916$; F-value = 351.13 (p-value < 0.0001)

Table 2 : Regression results of the three models developing by Chen, Chang and Hwang (2005, p. 169)

Their findings about relationship between IC and firms performance[2] support H4: firms with greater IC have better financial performance contemporaneously and in the following years. R&D expenditure captures additional information and is positively related

[2] See annexe B for regression table.

contemporaneously to ROA and revenues growth, and to future ROE, ROA revenue growth (one and two year results) and future employee productivity (three year results).

In this study, they provide the empirical evidence of hypothesis advancing by theoretical literature: As Lev and Sougiannis (1999) and Nakamura (1999) assert "innovative capital is a fundamental variable underlying the market to book value effect" (Lev, Cañibano and Marr, 2005, p.43): findings of Chen *et al*. support this statement. The difference between market and fundamental values can be explained by intellectual assets not recognised by financial statements: the investors recognise *hidden value*. Furthermore, investors, unknowing in detail the true value of items of IC (disclosure practices been rare), associate different values to each of these items.

This empirical study gives, first, support for the "extend intangible assets recognition" recommendations to accounting standards, offering an evidence of the relevance to open the debate and create new categories of assets. It gives in second hand framework for similar projects, as the expansion to other stock exchange is possible. It gives finally support to strategic literature to analyse the value creation process through IC investment, thus giving path to further research about IC management.

b. Maditinos, Chatzoudes, Tsairidis and Theriou models (Athens Stock Exchange)

Following Chen *et al.* models, Maditinos *et al.* (2010) study the Athens Stock Exchange with the following hypothesis:

- H1: Companies with greater – IC (H1) / Capital employed efficiency (H1a) / Human Capital efficiency (H1b) / Structural Capital efficiency (H1c) – have higher ratios of market to book value.
- H2: Companies with better - IC (H2) / Capital employed efficiency (H2a) / Human Capital efficiency (H2b) / Structural Capital efficiency (H2c) have better financial performance.

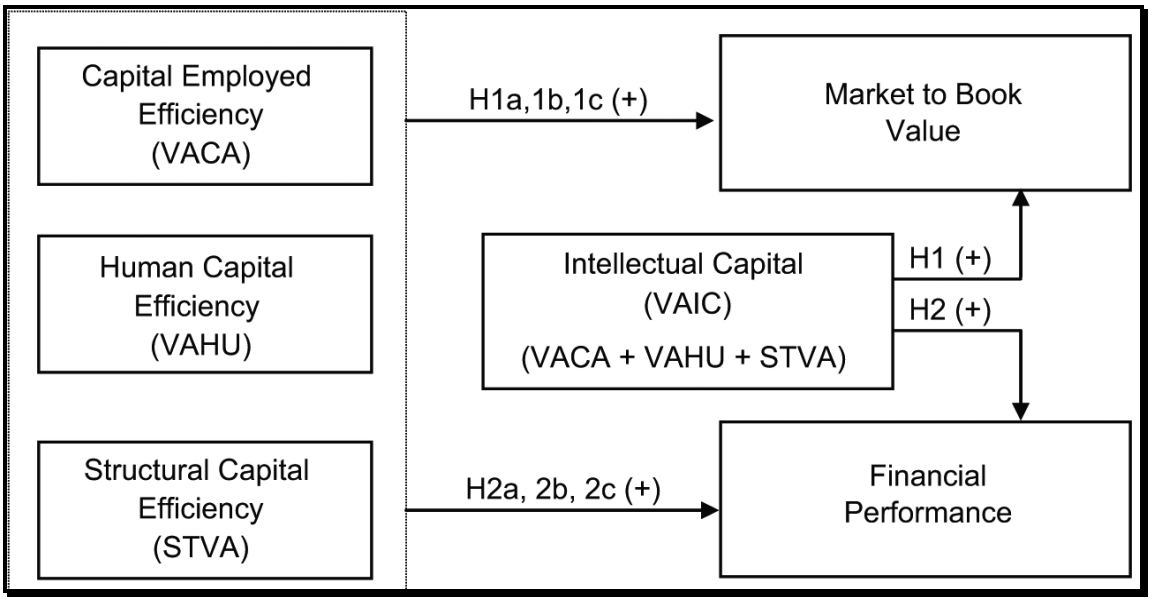

Table 3: Theoritical framework of Maditinos and all (2010, pp.138) research hypothesis.

Their regression model[3] measure as Chen *et al.* models the relationship between the market to book value and the Intellectual capital taking VAIC as measure of IC (1th equation - H1) and divided it by its components (2nd equation - H1a-b-c).

$$H1: \mathrm{M/B} = \mathrm{a}_0 + \mathrm{a}_1\mathrm{VAIC} + \mathrm{e}$$

$$H1a,\ H1b \text{ and } H1c: \mathrm{M/B} = \mathrm{a}_0 + \mathrm{a}_1\mathrm{VACA} + \mathrm{a}_2\mathrm{VAHU} + \mathrm{a}_3\mathrm{STVA} + \mathrm{e}.$$

Equation 2: Maditinos and All. models for M/B (2010, p.141)

[3] See Chen Cheng and Hwang models for the definitions of variables.

They create as well modelling for relationship between financial performance measure (ROE, ROA, and Revenue Growth) and VAIC (three first equations) and its components (three last equations).

$$H2: \text{ROE} = a_0 + a_1\text{VAIC} + e$$

$$H2: \text{ROA} = b_0 + b_1\text{VAIC} + e$$

$$H2: \text{GR} = c_0 + c_1\text{VAIC} + e$$

$$H2a,\ H2b \text{ and } H2c: \text{ROE} = a_0 + a_1\text{VACA} + a_2\text{VAHU} + a_3\text{STVA} + e$$

$$H2a,\ H2b \text{ and } H2c: \text{ROA} = b_0 + b_1\text{VACA} + b_2\text{VAHU} + b_3\text{STVA} + e$$

$$H2a,\ H2b \text{ and } H2c: \text{GR} = c_0 + c_1\text{VACA} + c_2\text{VAHU} + c_3\text{STVA} + e.$$

Equation 3: Maditinos and All. models for financial performance (2005, p.141)

Their findings are interesting if we compare them to Chen *et al.* findings: models failed to support hypothesis, correlation is found between value added by human capital and market to book ratio and ROE[4], but the other hypotheses are not supported. It seems to support that different international markets do not work similarly witch gives relevance to a similar analysis in the UK markets. We were unable to find recent studies which focus on regression between

[4] See annexe C for Maditinos and all regression tables.

IC and market values in UK: the most relevant work found is the empirical study of Toivanen, Stoneman and Bosworth (2002) analysing the impact of R&D on productivity and market values[5].

To improve the analysis, attention has to be given to the market characteristics, Maditinos *et al.* explain that their results can be explained with the contemporaneous market situation: the public sector represents 40% of GDP, foreign direct investments level is low, the capital market does not work efficiently, most of the companies being studied are small, and there is little focus on modern management practices. Knowing that, their study can be a support for further recommendations: they argue that "policy makers should intensify their initiatives in order to encourage greater acceptance and understanding of the concept of IC and the development of its related assets." (Maditinos and all, 2010, pp. 145-146). The finding that human capital is the unique component of IC recognised by the market gives path to further strategic research in the management of human resources. The relevance of the dissertation comes with the lack of empirical studies.

[5] See paragraph (c.).

c. Toivanen, Stoneman and Bosworth models (UK quoted companies of 4 sectors)

In their work, Toivanen Stoneman and Bosworth (2002) study the impact of R&D on productivity and market value of 877 UK companies of Mineral extraction, general manufacturing, consumer goods and utilities sectors over 6 years (between 1989 and 1995). They build an explanatory models based on equations and findings of Hall (1992, 1993, 2000); Griliches (1991); Stoneman and Bosworth (1994); Blundell *et al*. (1999); and Green *et al*. (1996).

Their final model accounts four categories of explanatory variables:

- Referring to Tobin Q ratio determinants:
  - Industry and companies specific effect($\sum \alpha_k I_k$)
  - Firms debt to equity ratio ($\gamma_1 \mathrm{DEBTE\ Q_i}$)
  - Changes in Log of sales ($\gamma_2 \mathrm{d \log S_I}$)
  - Market shares value ($\gamma_3 \mathrm{MS_i}$)
- Referring to the level and composition of book value of assets
  - Log of book value of assets ($\beta_1 \log \mathrm{A_i}$)
  - Financial assets to total assets ratio ($\beta_2 (\mathrm{FIN/A})_i$)
  - Cash flow to assets ratio ($\beta_3 (\mathrm{CF/A})_i$)
- Referring to innovative assets
  - R&D to assets ratio ($\tau_1 (\mathrm{RD/A})_i$)
  - Patent to assets ratio ($\tau_2 (\mathrm{PAT/A})_i$)
  - Change in tangible fixed asset to asset ratio ($\tau_3 (\mathrm{dTFA/A})_i$)
- Cross product term between market share and R&D ($\delta \mathrm{MSRD_i}$)

The final equation modelling the market value is the following:

$$\log MV_i = \sum \alpha_k I_k + \beta_1 \log A_i + \beta_2 (FIN/A)_i + \beta_3 (CF/A)_i + \gamma_1 DEBTE\ Q_{i,-1} + \gamma_2 d \log S_I + \gamma_3 MS_i + \tau_1 (RD/A)_i + \tau_2 (PAT/A)_i + \tau_3 (dTFA/A)_i + \delta MSRD_i + \varepsilon_i$$

Equation 4: Toivanen and all. Model (2002, p.44)

Their findings support the previous argument advance in literature that R&D is valued by the UK market, but they fail to prove relationship between R&D disclosure practices and market value (companies which disclose R&D do not have more market value than others), however, a relationship can be found between new announcers in R&D and variation of market value (incorporation of "new information" is valued by the market and led upward revaluation). This supports the argument of the relevance of disclosure practices: disclosing R&D first has a numerical effect on the fundamental value (increasing the value of assets), the market takes this into account to revaluate the value of the firm. As the value of asset is one of the explicative variable of the model, it permits to set that influence of disclosure on market value is not only for the increase on fundamental value (dependence of variables is eliminated in the model by the interaction term MSDR): first disclosure practice permits to increase the market value more than proportional (potential growth is recognised by the market).

Despite the brief time interval and the outdated period (1989-1995), their findings support the idea that the UK market reacts to intangibles assets expenditures. This gives relevance to further and

more recent study about intangibles and IC market valuation in UK. Similar methods of Chen *et al.* could be used to improve focus on IC, since the use of the market to book ratio as dependent variable can avoid to put in the model explicative variables of the market value.

As we discuss in this paragraph, the difference between market and fundamental values pointed out by the literature is questioning the relevance of traditional accounting methods and standards. An important discussion in that respect is the relevance of news disclosure practices including intellectual capital, and, once recommendations establish, the concern about which method to use to disclose IC value. From a financial point of view, it creates discussion about IC management and leads to a series of framework concerned to assess and manage IC investment. These two points of view (i.e. accounting and financial) lead to dual division in methods used: static and dynamic. We will discuss both categories in the paragraph III of this section, and address the disclosure concern in the following paragraph.

II. Disclosure practices:

The importance of this paragraph comes from it causality in our research question: if, as discussed before, market and fundamental values are increasingly different, is in part due to the lack of traditional accounting. An important accounting paradox has to be highlighted: increasing IC (i.e. making an investment in one of its components) is considered as an output in the incomes statements, without repercussions in the balance sheet, it has the effect to reduce the value of the company instead of increasing it.

The actual literature agrees on the necessity to publish more information about intellectual capital. However, once this recommendation is agreed on, different points of view can be highlighted in the accounting method to use. Pro traditional accounting authors advance framework resolving this valuation through traditional accounting tools (respecting the balance equality *liability* = *asset*) and more favourable to recognise the cost value of IC, pro modern accounting authors on the other hand argue that new methods have to be created and discuss the recognition methods (cost or revenues based methods). Different points of view are also set in recommendation on disclosure: one part of the literature orientates the discussion about IC inclusion in traditional statements, others recommend new statements to disclose as complement of traditional ones: "We have become convinced of the value of encouraging intellectual capital to provide its own accounts rather than to remain imprisoned within the accounts devised by those

whose task it is to ensure that they are managed effectively" (Roslender and Fincham, 2001).

Some empirical and theoretical studies try to find a relationship between disclosure practices and market value. Toivanen *et al*, 2002 were not able to find evidence in this sense, arguing that they cannot affirm that firms' decision to report their IC value is leaded to expected reaction of the market. Nonetheless, their findings support that the market reacts to the first disclosure of a firm, revaluation the market value with the new information available. However a study of the Australian practices argues that without obligation, Australian firms already disclose their IC value as a strategic choice to increase their market value (Wyatt, 2002).

As we shall see in the definitions section, international accounting standards do not recognise all the intangible assets. For Bukh (2003) these standards have to be updated, but it is not the only issue. Bukh notes that it is more an "understanding" gap than a real "information" gap which is in the markets: the information is available but not well presented to make it useful for investors. The ICTEM (Molodchik, Shakina and Bykova, 2012) IC valuation methods presented below (Section C, paragraph I) support this idea: the method is complex in terms of collection of data, but all the data used are available in financial statement.

Academics argue that more recognition of IC value in accounting standards terms, and systematic readable frameworks to present the information. This can resolve a part of the gap between book and

market value. The difficulties to create these frameworks are explained by the following section as a general definition does not exist about IC

In addition, as we shall see in the following section, classical accounting methods do not capture all the value of IC, the accounting area should accept to include more uncertainty to its accounts if they want to reduce the gap significantly (Kossovsky, 2002).

The first two parts of this literature review had permitted to assess the relevance of studying IC from four different perspectives (economic, strategic, accounting and financial), to present the main discussions around the concept to date, and to introduce some methodology and methods used to evaluate IC The second part of this chapter presents the different classification and definition of Intellectual capital, as they appear in the literature, details the methods used by both the accounting and financial fields to evaluate IC, it also gives a critical assessment of these methods and present a classification according to their context of use, their objectives, and their feasibility in order to determinate the most relevant ones to use in this dissertation.

C. Definition and classification

I. Definitions

The difficulty of building generalizable accounting and measures of IC comes in the fact that there is not a recognized definition of intellectual capital. The meaning of the concept as well as the concept itself differ from perspectives and authors. In many works, concepts as *knowledge assets/capital*, *innovative assets/capital*, *intellectual assets/capital*, *invisible assets/capital,* are taken as synonyms and used interchangeably. Accounting literature prefers the use of the term "asset", whereas financial literature are more likely to use the term of "capital". Strategic and economic points of view are more likely to use generic terminology as knowledge, innovation or research and development. In this section, we will try to present and classify the different concepts of IC in order to define what we are really assessing. First, presenting the different terminology to denominate IC will permit a better understanding of the literature. Second, detailing components of IC will give the base of the interpretation of the results presented in paragraph 4.

a. Intellectual capital and interchangeable concepts

From a strategic point of view, the consideration of *invisible assets* (information-based assets) (Itami, 1987) is in many works since the 1980s. Formally called *intellectual assets* or *intangible assets* (Hall, 1989, 1992), they are "those assets whose essence is an idea or knowledge and whose nature can be defined and recorded in some way" (Marr and Roos, 2005, p. 30).

From an economic point of view, knowledge and intellectual capital are part of intangible assets (Augier and Teece, 2005).

In order to distinguish these interchangeable concepts, it is necessary to clearly define what Knowledge and Human Capital mean from a financial and corporate point of view. Knowledge is relevant in Intellectual Capital focus because it is the base of its component. Maditinos *et al*. (2005, p134) quote Sullivan (2000, p17) to set that IC is the "knowledge that can be converted into profits". This differs from the previous definition delimiting it in a financial purpose. As we will detail in the second section, knowledge is not part of IC by itself. It is the use of the knowledge by the company and the Human Capital which transforms it in valuable resources. This use can be summarised by the value chain of knowledge given by De Pablos Heredero, C. *et al*.:

Creation and location → transformation and storage → diffusion → usage

Each part of this chain can be divided in order to classify it in different IC components. Creation, location, transformation and storage are part of the organisational process of the company, diffusion and usage are related to the skills of the Human resources.
This is a good example of the kind of interrelation which makes investment in intellectual capital difficult to measure in a systematic way. Knowledge capital is part of intellectual capital, as human, innovative and process capital. Increasing the efficiency of the process can help the Human resources to perform better, and consequently, increasing the value of Human Capital.

As we shall see in the next paragraph, one important part of intellectual capital is the human capital. Some valuation methods even take the human capital value as approximation of IC value arguing that human capital is the main component of IC (this is valuable argument in specific services industry). Since the 90's, the emphasis in management area has been on the human recourses as valuable capital to create value and competitive advantage. In fact, the focus on this field have been the starting point of IC concern. The fact that the companies cannot owned human capital (Edvinsson, 1997) have highlight target of loyalty creation needed to ensure that the investments in training are not lost. Several articles highlight the importance of human capital as a component of IC (Prahalad and Hamel, 1990; Hudson 1993; Edvinsson, 1997; Pulic, 2000; Lev, 2001). Accounting literature focuses on measuring the true value of H.C. and gives recommendations in order to disclose it (Andrade and Sotomayor, 2011) arguing that it is valuable information for investors decisions process. Financial and managerial literature focus on measuring the value that H.C adds to the company in order to create better practices regarding management and investment (Stewart 1997; DCTU, 1999; Skandia navigator, 1997).

b. Intangible asset and intellectual capital:

As we argued before: "From an economic point of view, knowledge and intellectual capital are part of intangible assets" (Augier and Teece, 2005). However, from an accounting perspective, intangible assets and intellectual capital are different as an intangible asset is recognized in the fundamental value of the company, whereas IC is not.

The international accounting standards define an intangible asset as:

"An identifiable (and recognisable) non-monetary asset without physical substance" (IAS 38, 2012).

According to the identification criteria the resource has to be:

- "separate or capable to be separate or divided from the entity and sold, transferred, licensed, rented or exchanged, either individually or together with a related contract, identifiable asset or liability."
- "Arises from contractual or other legal rights, regardless of whether those rights are transferable or separable from the entity or from other rights and obligations."

The asset should be recognized:

- "only if it is probable that the expected future economic benefits that are attributable to the asset will flow to the entity"
- "the cost of the asset can be measured reliably".

The IFRS adds that the internally generated goodwill is not recognised as intangible assets. Despite these restrictions in accounting standards, in accounting literature, *Intangible Assets* concept is often used as synonym of Intellectual Capital and does not correspond to the IAS definition (Lev, Cañibano and Marr, 2005).

The term *intellectual capital* came from financial/strategic literature to substitute the accounting term *intangible asset* (Jashapara, 2011). Intangible assets, used as synonym of intellectual capital (Edvinsson and Malone, 1997) fail to determine with precision the nature of the "hidden value" recognized by Edvinsson. He first defined IC as "the possession of knowledge, applied experience, organisational technology, customer relationships, professional skills that provides a competitive edge in the market" (Edvinsson, 1997, p.368).

This definition shows that intellectual capital is, for Edvinsson, a competitive advantage: if the components described do not increase the over performance ahead of the market, they are not considered as intellectual capital (they can be considered as potential future intellectual capital). This point of view is denied by more modern definition showing the intellectual capital as potential of earnings (arguing that the traditional accounting measure fails to capture this potential, and advising "dynamic or value oriented measurement methods"). Completing this definition Sudarsanam, Sorwar and Marr take a financial point of view to argue that IC (or *Intellectual Assets*) are a kind of asset "with no immediate measurable payoffs […] where outcomes are subject to much uncertainty" (2005, p57). The introduction of this notion of uncertainty is important in both accounting and financial field. For an accounting field, this gives an argument against formal statements as they argue that the true value of the company has to be risk free; for financial field, this permits to orientate the valuation method of investments towards specifics measure taking risk as focal point.

The issues created by the lack of generally recognized definition can be in part resolved by adopting the point of view of one or several authors giving different classifications of IC these different classifications as well as their associated methods to measure IC are presented in the following paragraph.

II. Classification of IC

With the first definition in financial area given by Edvinsson, came the first categorisations of the components of IC and their measurement models. From accounting point of view, these classifications take importance as they are needed to create precise accounting. From strategic and managerial points of view, they permit to precisely assess the IC present inside the company and improve the possibility to manage it. We will in this paragraph present in detail the classification used for this dissertation and highlight the main others one.

a. First classifications:

The foundation of the actual understanding of what is intellectual capital had been built in the 1990's by authors as Edvinsson, Roos, Sveiby, Brooking, Lynn and Pulic (Roos, Ballow and Thomas, 2005). Whith their works came detailed definitions and classifications supporting many of recent articles.

The classification of Edvinsson of Malone (1997) is interesting because of the important activity of Edvinsson and Skandia in the IC field. Skandia is the first firm to create an intellectual capital department, appointing Edvinsson as a director. In parallel of intern

measurement and management, Skandia makes public its research and results and gives recommendation to other companies.
Edvinson and Malone divide and define the different component of IC as:

- Human capital (H.C) - (employee's knowledge, skills and innovation, company's value, culture and philosophy)
- Structural capital (S.C) - (Hardware, Software, Databases, organisational structure, patents and trademarks).

The Skandia Classification (1997) is the one followed by the majority of scholars (as: Pulic, 2000; Bontis, 1998; Holton and Yamkovenko, 2008; Mavridis and Kyrmizoglou, 2005[(6)]). It adds one more category:

- Customer capital (C.C)
- Innovation capital (IC)
- Process capital (P.C)

The two classifications can fit in the general scheme given by Edvinsson (1997):

[6] References collected by Maditinos *et al*. (2011, p. 134)

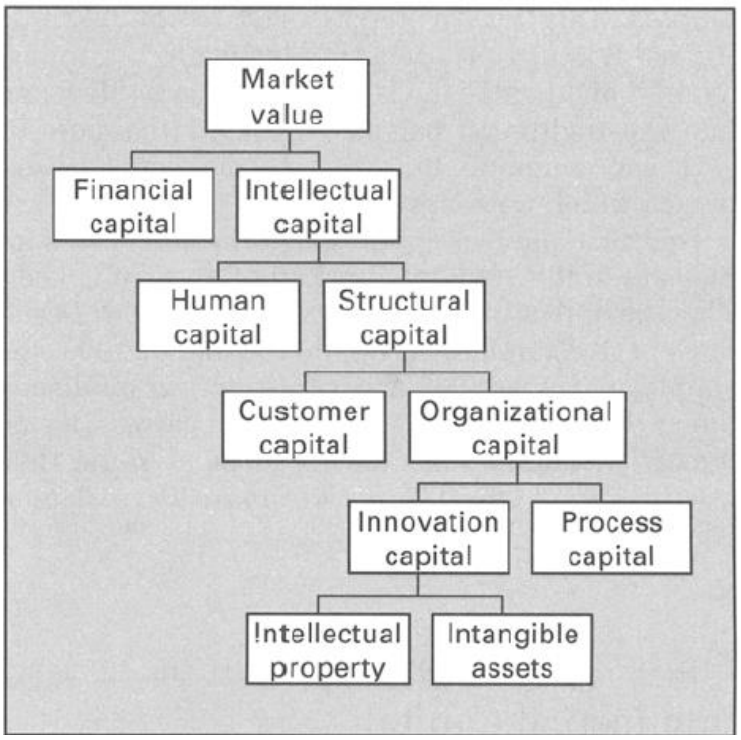

Figure 2: The Skandia value scheme (Edvinsson, 1997, p.369)

The associated valuation method (The Skandia Navigator) and associated valuation methods based on this classification (VAIC) are presented in section D.

b. Others classifications

Contemporaneous authors to Edvinsson build others classification in parallel of valuation frameworks and methods, these classifications are presented in figure 4. From an accounting point of view, Brooking (1996) divides IC into infrastructure assets, human centred assets, intellectual property and market asset, and she creates the *Technology broker* (TB) method. Roos *et al*. (1997) divide structural and human capital and create the *IC-index* method, Stewart (1997) adds client capital and creates the *Economic Value Added* method

(EVA) and the *CIV* based on *ROA*. Sveiby (1997) uses the concept of external and internal structure and employee's competence and creates the *Intangible Asset Monitors* and the *Invisible Balance Sheet*. Lynn (1998) categorizes Human capital, relational capital and structural capital. The difference between the classifications came in the aggregation of the concept, as well as a higher recognition of interrelation for some of them.

Developed by (year)	Framework (country)	Classification
Edvinsson and Malone (1997)	Skandia Value Scheme (Sweden)	Human capital Structural capital
Bontis (1998)	Canada	Human capital Structural capital Customer capital
Stewart (1997)	USA	Human capital Structural capital Customer capital
Saint-Onge (1996)	Canadian Imperial Bank of Commerce (Canada)	Human capital Structural capital Relational capital
Sveiby (1997)	Intangible Assets Monitor (Australia)	Employee competence Internal structure External structure
Van Buren (1999)	American Society for Training and Development (USA)	Human capital Innovation capital Process capital Customer capital
Roos *et al.* (1998)	UK	Human capital Structural capital Relational capital
O'Donnell and O'Regan (2000)	Ireland	People Internal structure External structure

Source: Tseng and Goo (2005)

Figure 3: Classification schema of IC (Huang, Luther and Tayles, 2007, p. 388)

The number of classifications and definitions makes the understanding of the concepts difficult. Each article presents different aggregation and the results cannot be analysed without prior understanding of the aggregation used. This issue is a barrier to academics' works on IC. Without widely recognised definition and classification, each work is independent of the others, and general conclusions about IC cannot be built. In order to resolve this issue and build a first general classification recognized by academic and empirical world, Huang, Luther and Tayles classify 45 items of IC in 3 groups. They based their work on empirical research to find out how the different items of IC can be classified in relation with the real world. The result is a list of items more comprehensively aggregated, and robust with the reality of the companies. In order to detail each component of IC, the tables 5-6-7 give a detailed list of each item. Human capital components are related both to intangible and financial value of employees, as well as their satisfaction. It assesses the talent of Human resources and the talent of the companies to manage them.

Code	Element
Human capital (HC)	
HC1	Employees' know-how/expertise
HC2	Employees' level of education/vocational qualification
HC3	Employees' work-related competence
HC4	Employees' creativity/innovativeness
HC5	Employees' work-related knowledge
HC6	Employees' job satisfaction
HC7	Key employee turnover
HC8	Leadership qualities of managers
HC9	Employees' training
HC10	Employees' profitability (e.g. revenue per employee, etc.)
HC11	Incentive programme/compensation scheme
HC12	Employees' previous job experiences
HC13	Employees' motivation
HC14	Employees' loyalty
HC15	Employee recruitment costs

Figure 4: Human Capital Components (Huang, Luther and Tayles, 2007, p. 390)

Customer capital (CC)	
CC1	Market demands for products/services
CC2	Customers' loyalty to your company/product e.g. repeat sales
CC3	Company's distribution channels allowing customers access to products/services
CC4	Opportunities for business alliances/partnerships/ collaborations
CC5	Opportunities for licensing/franchising agreements
CC6	Favourable contracts obtained due to company's unique position
CC7	Customers' satisfaction (e.g. via survey) with company/product
CC8	Timeliness of product/service delivery
CC9	Customer complaints and responses to complaints
CC10	Customer acquisitions (new customers)
CC11	Customer profitability
CC12	Market share
CC13	Growth in business or service volume
CC14	Dependence on key customers
CC15	Updated customer list/profile

Figure 5: Costumer Capital Components (Huang, Luther and Tayles, 2007, p. 390)

Huang *et al.* model assesses the value of all the relation of the company as well as strategic components as the demand for the products or the growth in business. It permits to give delimitation to

the item "strategy" incorporated in Structural Capital component of other classifications.

Structural capital (SC)	
SC1	Exploitation and management of patents, copyrights and trademarks
SC2	Organisational culture in written form
SC3	IT systems and their usage in your company
SC4	Networking systems with customers, suppliers, databases, etc.
SC5	Management (including financial) control system
SC6	Internal communication system
SC7	Documentation of knowledge in manuals, databases, etc.
SC8	Data systems providing access to relevant information
SC9	Execution of corporate strategies
SC10	Effectiveness of expenditure on R&D
SC11	Development of new ideas/products/services
SC12	Implementations of new ideas/products/services
SC13	Length of time for product design/product development
SC14	Quality of product/service supplied
SC15	Life-cycles of products
SC16	Society's image of the company

Figure 6: Structural capital components (Huang, Luther and Tayles, 2007, p. 390)

The structural capital permits to group the different items present in the classification of "organisational" and "structural". The advantage of this classification is that each component of IC is well defined and delimited. HC measures the employees and the company's ability, CC measures feelings of the market over the company, and Structural Capital measures the internal position of the company to create these feelings.

This classification is the most detailed and advanced of the current literature. It permits to create an interrelation between accounting, managerial and financial perspectives. They are managerially recognized as they come from empirical study. The delimitation

permits the basis to create strong frameworks as it prevents mistakes of mixing elements of the three categories.

As we introduced, definitions and classifications varied with the framework which used them.
The classification presented is the most detailed to understand the IC concept, however we will use less complicated one. The collection of data needed to use a method related to this classification is not feasible in our timescale.
In the following paragraph, we detail the main accounting and financial methods by dividing them into two categories: static methods (using past and present data to valuate IC), and dynamic methods (valuating IC according to its potential return).

D. Methods used to evaluate IC

As we saw, if the accounting regulations do not recognise intellectual capital, the accounting literature is conscious that these intangibles assets have to be expend. In 1964, Hermanson first tried to measure the value of the human capital using classical accounting tools and created the *human asset accounting* field. One of the challenges of assessing IC is that for most of its components, there is not a market with enough supplies and demands to fix a price, the measurement of its value has to be assessed by the company.

The importance of measurement can be summarised by the quotation used by Tan, Plowman and Hancock (2008):

"When you can measure what you are speaking about and express it in numbers, you know something about it, but when you cannot measure, when you cannot express in numbers, your knowledge is of a meagre and unsatisfactory kind. It may be the beginnings of knowledge, but you have scarcely, in your thoughts, advanced to the stage of a science." (Liebowits and Ching, 2000).

The importance of IC measurement is relevant in all the areas of a business: in microeconomic area, measuring the intellectual capital permits to compare the situation of the company with the competitors, measure the over or underperformance of the company, and know which company has the best practice in terms of IC management. In strategic and managerial areas, IC measurement permit to know the performance of each department of the company,

and is necessary information to take decisions of investments (as Augier and Teece point out, it is complicated to manage an asset without precise knowledge of its value). From accounting point of view, these measurements permit to capture the true value of the company, and, as we saw in the first part of the literature review, to give an answer to the problem of hidden value. However, this leads to measurement issues, Augier and Teece stated "if intangibles are not measured correctly, an organisation might appear to be doing poorly when in fact it is simply investing in intangibles". To provide an example, on 27 July 2014, the market value of Apple was more than the double of its fundamental value, when for Samsung, the same relation was 1.25. The same day, LG and Nokia were seen the inverse relation (The fundamental value of LG was 2.98 times its market value, and the same relation for Nokia was 1.10. As we discussed on the second section of this dissertation, the debate in literature sets that these companies are not over/under valued by the market, but that this difference of value is due to a "hidden value" non-recognised by classical financial statements. An additional issue after recognising this hidden value is to know how to measure the intellectual capital, with witch method, and with witch criteria?

In order to give an overview of the methods developed, we will present in detail some of the methods, taking as selection criteria the occurrence of citation in the literature adopting a critical point of view in order to assess their validity and relevance for this dissertation.

I. Presentation of methods:

In the paragraph (II) of the section C, we introduced some methods associated with the classifications used by Sudarsanam, Sorwar and Marr (2005). In this paragraph, we will present this methods dividing them in two categories: statics and dynamics methods.

a. Static methods

In order to make easier the reading and understanding of this paragraph, we present at the beginning the classification of the methods that we use:

Methods	**Valuation method**	**Author (s)**	**Benchmark**	**Unit**	**Data**
Balance scorecard	Scorecard	Kaplan and Norton (1996)	No	Non-Monetary	Qualitative-interns
CIV	ROA	Stewart (1997)	Yes	Monetary	Quantitative available in financial statements
Direct IC methods	(Direct IC method)	Various	Yes	Monetary	Qualitative and quantitative – intern and extern
EVA	ROA	Stewart (1996)	No	Monetary	Quantitative external
FIMIAM	Market capitalisation	Rodov and Leliaert (2002)	Yes	Monetary	Quantitative Intern and external
IC index	Scorecard	Ross *et al*. (1997)	Yes inside of industry	Non-monetary	Quantitative intern and extern

Intangible Asset Monitor	Scorecard	Sveiby (1997)	No	Non-monetary	Qualitative intern
Market to book value	Market capitalisation	Edvinsson (1997)	Yes	monetary	Quantitative extern
Meritium project	Scorecard	Cañibano and al. (2002)	No	Non-monetary	intern
Residual incomes	ROA	Lev (2001)	Yes	Monetary	Quantitative extern
Skandia navigator	Scorecard	Edvinsson and Malone (1997)	No	Non-monetary	Quantitative and qualitative intern
Technology Broker	Direct intellectual capital	Brooking (1998)	Yes inside of industry	Mixed	Quantitative intern
Tobin Q	Market capitalisation	Tobin (1968)	Yes	Monetary	Quantitative extern
Transformation evaluation model	Mixed	Molodchik, Shakina and Bykova (2012)	Yes	Monetary	Quantitative and qualitative extern
VAIC	ROA	Pulic (2000)	Yes	Monetary	Quantitative extern

Table 4: Classification of Static IC valuation methods[7].

Sudarsanam, Sorwar and Marr define *static methods* as the ones which do not take into consideration the time or the differences between different categories of intangibles. These models value an

[7] Prepared by the author on the basis of the works of: Kothare, Mehta and Sharma (2013); Agnė Ramanauskaitė and Kristina Rudžionienė (2013); Sudarsanam, Sorwar and Marr (2005); Rodov and Leliaert (2002).

"aggregate value of intellectual assets at a point in time or the value of the accumulated intellectual asset". These methods are the ones most often used from an accounting point of view, as they are similar to their actual practices in term of valuation.

Regarding the literature, we highlighted 15 static methods. They can be classified with different criteria (See table 4). Our decision tree to used/detailed methods is based on these classification criteria.

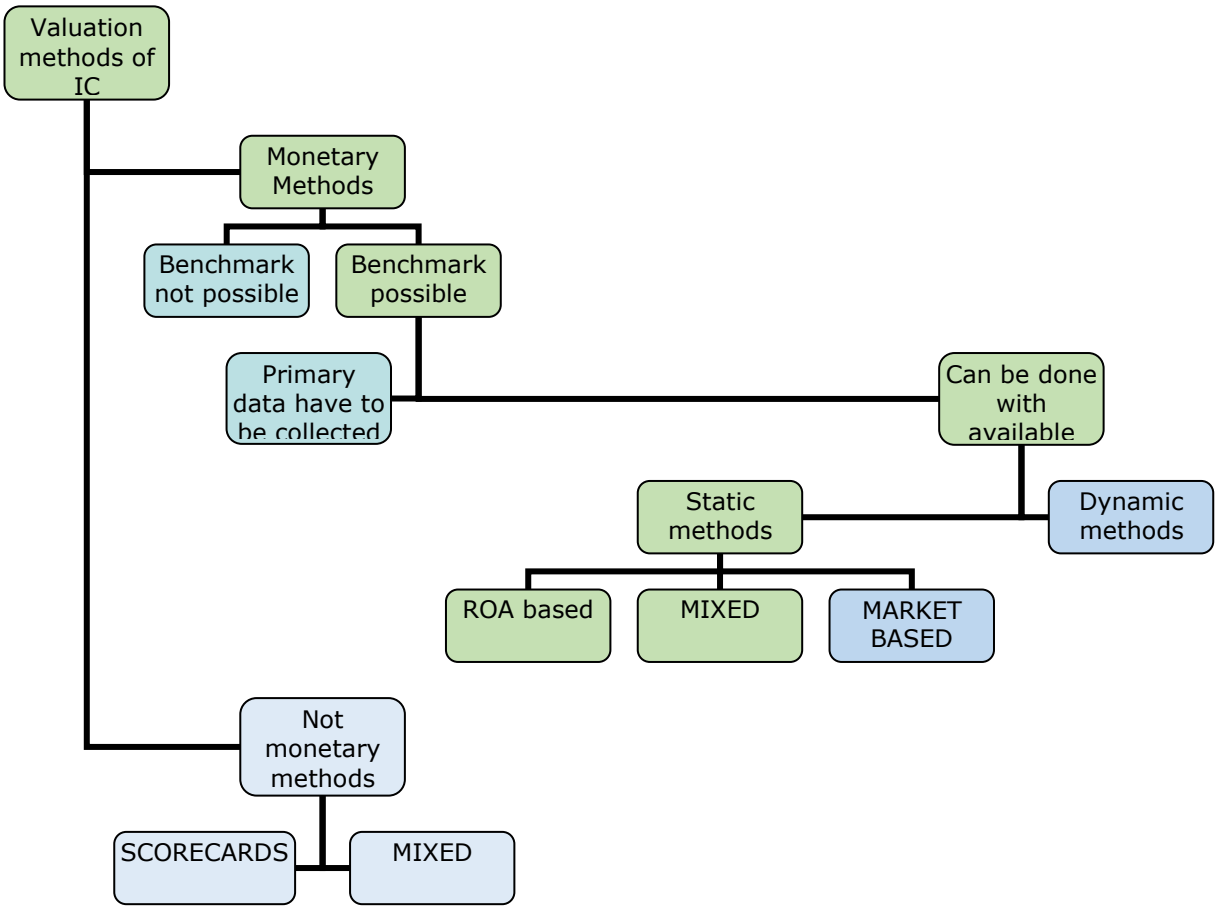

Figure 7: Decision tree of method used in the dissertation.

The green highlights in the schema figure show the way that we follow to choose methods. We will briefly present the others categories and detail the 6 static methods selected in this paragraph. The paragraph (b) will be dedicated to dynamics methods.

In table 4, we highlight the main methods and frameworks in IC valuation field up to date. We highlight in the second and third columns the valuation method in which they are based, and the author(s) founder. The three last columns can be seen conjointly with the Figure 4 and present our criteria of decision to use or not the method: the fact that a benchmark can be perform, the unit of measure of the method and the nature of data needed.

Some of these methods as scorecards (Balance scorecard, IC index, Intangible asset monitor, Meritium Project and Skandia navigator) and Technology Broker (Brooking, 1998) do not give monetary value of IC They build models to follow to manage it, or measure of performance in indices, most often oriented until internal use. Their principal limits are that they are difficult to use for an external agent, and do not give precise value, making difficult the application of the recommendations given by absence of measurement to assess their performance. They are as well, for the majority of them, poorly generalizable and they do not allow benchmark, which make their managerial use less helpful as they cannot compare their IC management practices with their competitors. However, they had the advantage to educate managers in IC issues and increase the relevance of IC valuation in the business world. They also give convenient mapping to analyse the interrelations between different IC

components and their repercussion on the company's performance. One instance of their framework is the Skandia navigator, recognised to be one of the first used by a company (Skandia).

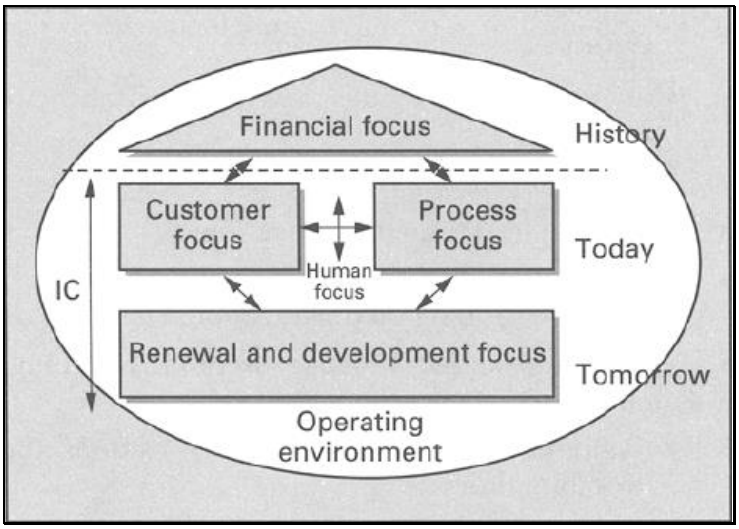

Figure 8: The Skandia navigator (Edvinsson, 1997, p.371)

The navigator is useful in strategic area, presenting IC as a multi-faceted focus. It gives a series of indications to improve the management of the customer, process and development capital as key items to assess them, for example, they advise to measure the customers' focus of the company with the number of accounts, brokers and lost customers Rodov and Leliaert (2002).

Other methods have not been selected in this dissertation as they do not allow benchmark (EVA) or because the nature of data needed do not match our time constraints (Direct IC and FIMIAM) as they need internal information and from a methodology point of view, primary data to be collected through interview. However, from an accounting point of view these two last methods are the ones which most

accurate of the accumulate value of IC as they assess in detail each one of their components.

After eliminating these 9 methods, 8 are remaining: they match our criteria as they are:

- Monetary methods
- Which permit benchmark
- Based on data available (Secondary)

They can be classified in Static or dynamic, defining what they are measuring from a time scale point of view (past-present or future discount value). Static methods in this paragraph are mainly following three "school of measure": based on ROA method, based on Market value or mixed methods. We present them as alternatives to the method used to address our research objective.

- <u>ROA based method: CIV.</u>

The CIV method, developed by Stewart (1997), measures an average excess earning of a firm over the industry. It is based on the hypothesis advanced by Edvinsson that the difference between market and fundamental values reflects IC and that IC is the value of knowledge assets providing an over performance over the market.

The method follow four step:

(1) Calculation of ROA as:

$$\boxed{\text{EARNINGS / TANGIBLE ASSETS}}$$

To eliminate exceptional results, Stewart recommend to use values of average pre-tax earnings over 3 or 5 years and average tangible assets over the same period.

(2) Comparison with the industry average:

$$ROA_{FIRM} - ROA_{IND.}$$

A positive result supports the idea that the firm possesses IC, if the result is negative, we assume that IC is null.

(3) Calculation of Average annual excess earning as:

$$(ROA_{FIRM} - ROA_{IND}) * \text{AVERAGE TANGIBLE ASSETS.}$$

(4) Estimation of IC value as:

$$\text{AVERAGE ANNUAL EXCESS EARNINGS / COST OF CAPITAL}$$

Advantages of this method are that it is easy to use and allows comparison between firms (Rodov and Leliaert, 2002). Moreover, it permits to increase the understanding and interest for IC
However, according to Aho, Stahle and Stahle (2011) it is a week indicator of IC as it is connected to all types of capital assets. It is as well irrelevant in small industry as the average ROA needs a significant number of firms to be accurate. Two more issues related

to the measurement are that CIV is based on past values and does not give an actual picture of the company's situation. This makes it less relevant for managerial focus, and that, from an accounting point of view it is illogical, as, based on ROA, a consequence of an increase in IC (i.e. an investment in employee training for example) is to decrease the annual earnings, then the ROA and CIV estimated value of IC (Aho, Stahle and Stahle, 2011; Rodov and Leliaert, 2002). Finally, the fact that the model assigns the same rate of return for all types of assets does not reflect the reality of the markets (Tan, Plowman and Hancock, 2008). Financial literature recommending Dynamic methods makes the same criticism about most of the static methods: not allowing the different part of IC to be measured and discounted or capitalised separately which make these methods less useful and less accurate (Sudarsanam, Sorwar and Marr, 2005).

To conclude, Aho Stahle and Stahle state that CIV only measures the firm ability to outperform the market, but not the IC value. However, we can contrast this idea with the definition of IC given by Edvinsson presented above: if IC is the value of knowledge assets providing an over performance over the market, the measure of the firm ability to outperform the market is a component of Intellectual Capital. In this dissertation, we will see if this component is linked to markets values.

- <u>ROA based method: Residual incomes.</u>

Another model developed by Lev (2001) based on ROA permits to improve the CIV method and get around its limits. It considers future earnings, assigns different rate of return for each kind of asset, subtracts the financial assets making the valuation more focus of the

knowledge capital, and is not related to average in market, making the method useful even in small industry.

Basing the model on considering the economic performance as a production function, they build the following relationship:

$$\text{Economic Performance} = \alpha(\text{Physical Assets}) + \beta(\text{Financial Assets}) + \delta(\text{Intangible Assets})$$

Equation 5: Lev (2001) residual income Model. (Tan, Plowman and Hancock, 2008)

α β and δ are the relative contribution of physical, financial and intangible assets to the enterprise performance. Lev found a 0.11, 0.29 and 0.53 correlation.

The measuring model derivate of this equation follow 5 steps:

(1) Measuring normalised earnings: as the average earning of the company over 3/5 past year and 3/5 forecasting year (following the consensus forecasts of analysts)

Part Earnings + Future Earnings = NORMALISED EARNINGS

(2) Calculating the expected after tax return on financial assets (ROFA): it is estimated as 4.5[8]% of the total value of the

[8] See annexe C. Note in: Sudarsanam, Sorwar and Marr (2005, pp.60).

asset (See note in: Sudarsanam, Sorwar and Marr, 2005, pp.60).

ROFA = FINANCIAL ASSETS * 4.5%

(3) Calculation the expected after tax return on physical assets (ROPA): it is estimated as 7% of the total value of the asset.

ROPA = PHYSICAL ASSETS * 7%

(4) Calculating the knowledge capital earnings:

Knowledge capital earnings = Normalised Earnings – ROFA – ROPA

(5) Capitalising intangible assets: the knowledge capital earnings are estimated as 10.5% of the total value of the asset.

INTANGIBLE ASSETS = Knowledge capital earnings / 10.5%

The main limit to the model is that it is based on forecasts which are not always available or accurate (Tan, Plowman and Hancock, 2008). It also does not identify individually the components of IC which give few indications for managers. The model does not explain how IC creates value for the company (Sudarsanam, Sorwar and Marr, 2005) which does not allow the computation of interrelation values. However, the method, permits the benchmark and gives a numerical value of IC, which makes it useful for regression analysis.

- ROA based method: VAIC.

To avoid the difficulties of measuring a fair value of IC, Pulic (2000) builds a method assessing the efficiency of IC rather than its direct value. It also resolves the limits highlighted in the CIV method as it is not based on forecast, and it measures individually the different component of IC (Human capital and Structural capital). Our interest for this valuation method comes from the fact that academic literature uses it to address the same research questions as us (Riahi-Belkaoui, 2003; Chen, Cheng and Hwang, 2005; Maditinos *et al*. 2011).

Pulic focuses his researches on the connection between IC and economic performance. The VAIC model is supposed to measure the value added by IC efficiency (Stahle, Stahle and Aho, 2011). To better understand the methods, the following diagram summarises the calculation presented below.

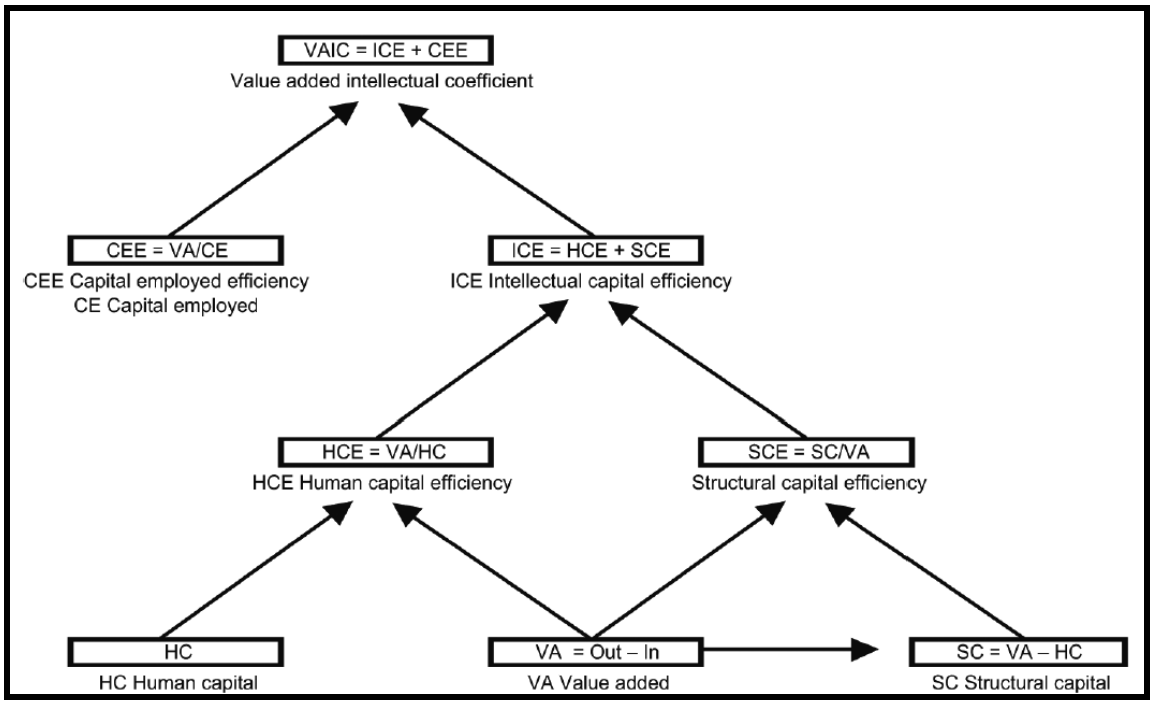

Figure 9: Construction of the VAIC coefficient (Stahle, Stahle and Aho, 2011)

Three stages can be highlighted:

(1) Calculation of Value Added (VA): the method used by empirical research literature (Maditinos *et al*., 2011; And Chen, Cheng and Hwang, 2005) is the one used by Riahi-Belkaoui (2003). It express VA as:

$$VA = S - B - DP = W + I + DD + T + R$$

Where:

- S = sales revenues
- B = bought in material and services (i.e.: cost of goods sold)
- DP = depreciation
- W = Wage (Salaries)
- I = interest
- DD = dividends
- T = taxes
- R = changes in retained earnings

Chen, Cheng and Hwang simplify the equation with net income, expressing after tax income as NI = DD+R:

$$VA = S - B - DP = W + I + T + NI$$

(2) Calculation of capital employed (CE), human capital (HU[9]) and structural capital (SC) as:

$$CE = \text{Total assets} - \text{Intangible assets}$$

$$HU = \text{Total expenditure on employees}$$

$$SC = VA - HU$$

(3) Calculation of VAIC and its three component (VACA, VAHU, STVA[10]) as:

$$VAIC = VACA + VAHU + STVA$$

$$VACA = VA / CE$$

$$VAHU = VA / HU$$

$$STVA = SC / VA$$

[9] We adopt the terminology of Chen. Cheng and Hwang (2005), HU is designated as HC in the model of Pulic (2000).
[10] Idem as note (9), VACA, VAHU and STVA are respectively designated as CEE, HCE and SCE in Pulic model (2000).

Stahle, Stahle and Aho (2011) measure the validity of the VAIC model and conclude that it does not assess Intellectual capital efficiency but the efficiency of labour and capital invested. However, as in CIV method, this efficiency can be part of IC. According to Stahle *et al.,* components of VAIC as STVA do not really assess IC but the financial performance of the company and STVA is dependent of VAHU as it is calculated as the difference between value added and Human Capital. Nevertheless, this financial performance can be seen as a managerial capacity to create value through assets. In this perspective, STVA should be seen, according to definitions, as Human Capital (performance of employee) or Structural Capital (performance of the organisation). Another criticism presented by *Stahle et al.* is that the value used to measure IC does not really measure Intellectual Capital as it is based on financial and disclosed information where IC is not recognised in financial statement. However, the model shows that the components of VAIC are valued by investors. If these components do not give the real value of IC, they are related to it and are able to assess to which of them market gives more value. Despite its criticism, this method is relatively simple to use in our time constraint, for this reason, and because we believe that it gives a good estimation of what we want to measure, we will use it in our methodology.

We will assess in this dissertation the relation between VAIC and market value.

- Mixed method: ICTEM

An interesting framework developed by Molodchik, Shakina and Bykova (2012) permits avoiding the main limits highlighted in classical valuation methods. It is based on both past and future value of IC, permits benchmark, puts valuable qualitative information in equation and needs only the traditional information disclosed in financial statements, and assesses each component of IC separately (the classification used is: human capital, structural capital and relationship capital). It is based on an intersection between value based and resources based method (ROA and Market based).

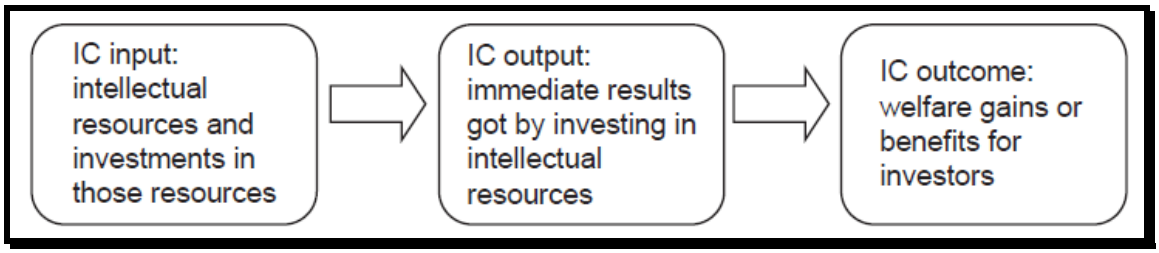

Figure 10: Intellectual capital transformation sheme (Molodchik, Shakina and Bykova (2012)

The model shows that an accumulated value of actual IC is measured as well as the current and potential return of the IC

They present in equation a number of variables related to the three components of IC: Human Capital, Structural Capital, Relational Capital. Molodchik, Shakina and Bykova model the IC outcomes as following:

$$\mathrm{Perf}_{it} = \alpha + (\beta_1, \ldots, \beta_n)\mathrm{HC}_{it} + (\delta_1, \ldots, \delta_n)\mathrm{SC}_{it} + (\varphi_1, \ldots, \varphi_n)\mathrm{RC}_{it} + (\lambda_1, \ldots, \lambda_n)\mathrm{TF}_{it} + \varepsilon_{it}$$

Equation 6: ICTEM model (Molodchik, Shakina and Bykova, 2012, pp. 450)

With HC, SC and RC vectors of variables responsible for their component (see Table 6), TF vector of transformational factors and ε a vector of errors.

Perf_{it} been an indicator of IC outcomes as EVA, MVA of FGV where EVA indicates immediate return on IC, MVA measures the intrinsic value of IC and FGV the potential growth value with the following corresponding formula:

IC outcomes	ICTEM indicators	Information source and estimation algorithm
Immediate (short term) return on IC	Economic value added (EVA)	$\mathrm{EVA}_t = \mathrm{CE}_{t-1} \times (\mathrm{ROIC}_t - \mathrm{WACC}_t)$, $\mathrm{CE}_{t-1} = \mathrm{D}_t + \mathrm{E}_t$: capital employed D_t: book value of debt E_t: book value of equity $\mathrm{ROIC}_t = \mathrm{NOPAT}_t/\mathrm{CE}_{t-1}$: return on invested capital $\mathrm{NOPAT}_t = \mathrm{EBIT}_t(1-T)$: net operation profit after taxes $\mathrm{WACC}_t = \mathrm{D}_t/(\mathrm{D}_t + \mathrm{E}_t) \times \mathrm{kd}(1-T) + \mathrm{E}_t/(\mathrm{D}_t + \mathrm{E}_t) \times \mathrm{ke}$: weighted average cost of capital kd = krf + default spread of the company + default spread of the country: cost of debt ke = krf + β × (km − krf): cost of equity krf: risk-free rate – return on the treasury bonds of US Government β: bottom-up build beta (adjusted by Hamada's equation) km: historical return on the market portfolio (market index) T: effective tax rate
Potential (long term) return on IC	Market value added (MVA)	$\mathrm{MVA}_t = \text{Market capitalization}_t + \text{Long-term debts}_t - \mathrm{CE}_t$
	Future growth value (FGV)	$\mathrm{FGV}_t = \mathrm{MVA}_t - \text{Capitalized EVA}_t$

Table 5: Proxy indicators of IC outcomes (Idem, pp.454)

The computed values of the vectors HC, SC and RC are measured summing the components detailed in the following table:

Components	ICTEM input indicators	Information source and estimation algorithm
Human capital	Share of wages in costs	Company's Annual Report,[a] section "Financial data" Employee costs divided to total costs
	Cost of employee	Company's Annual Report,[a] section "Financial data" Employee costs divided to total costs
	Earnings per employee	Company's Annual Report, sections "Common information" and "Financial data" EBIT divided to number of employees
	Board of directors' qualification	Company's Annual Report, section "Directors' information" If more than one-third of directors have postgraduate level qualifications and more than five years experience – 2 points If more than one-third of directors have postgraduate level qualifications or more than five years experience – 1 point Otherwise – 0 points
	Corporate university	Search on company's web site using the words as "corporate university" If company has information about the above – 1 point, otherwise – 0 points
Structure capital	R&D investments	Company's Annual Report, section "Financial data"
	Intangible assets	Company's Annual Report, section "Financial data"
	Patents, licenses, trade marks	Search on company's name and number of patents on the web site QPAT: http://library.hse.ru/e-resources/e-resources.htm
	ERP systems implementation	Search on company's location on their web site using the following words as "ERP", "Oracle", "NAVISION", "NAV", "SQL", "SAP" If company has news about these as listed above – 1 point, otherwise – 0 points Important to put "1" or "0" in the year of implementation
	Strategy implementation	Search on company's location on their web site using the following words as "strategy", "strategy implementation" If company has news about these as listed above – 1 point, otherwise – 0 points Important to put "1" or "0" in the year of implementation
	Stable turnover growth	Company's Annual Report, section "Financial data" Standard deviation of the total revenue sum from previous and current divided to average of this sum
	Presence of subsidiaries	Company's Annual Report, section "Subsidiary name" If company has <100 subsidiaries put the total number, otherwise use the following vector "First 100 out of *Y* subsidiaries"

(Continued)

Components	ICTEM input indicators	Information source and estimation algorithm
Relational capital	Well-known brand	Search on company's name on the web site: www.justmeans.com/top-global-1000-companies If it has a rank – 1 point, otherwise – 0 points
	Commercial expenses share	Company's Annual Report, section "Financial data" Commercial expenditures divided to difference between total revenue and EBIT
	Foreign capital employed	Company's Annual Report, section "Shareholder name", vertical vector "country" If company has foreign investors it gains 1 point and otherwise 0 points
	Citations in search engines	Search on company's name and its score on the web site: www.prchecker.info/check_page_rank.php
	The integral index of the web site quality	Search on company's web site and estimate site quality according to the following criteria: availability of information for investors (special section or page); multi-lingual information (with English language); amount of information (more than ten pages); and design (using flash animation) For each criterion company gains 1 point. The integral index is the sum of points
	Participation in business associations	Company's Annual Report, section "Common information" For those who involved in business associations it is given 1 point and otherwise 0 points
	Owner/director ratio	Company's Annual Report,[a] sections "Shareholder name" and "Directors' information"

Table 6: Proxy indicators of IC inputs (Idem, pp.451)

The vector of transformational factors is measured by summing the components detailed in the following table:

Transformational factors	ICTEM indicators	Information source and estimation algorithm
Internal factors	Company age	Company's Annual Report, section "Common information", foundation year
	Company size	Company's Annual Report, section "Common information", number of employees
	Global market orientation	Company's Annual Report, section "Financial data" If company has earnings from export – 1 point, otherwise – 0 points.
External factors	Industry	Company's Annual Report, section "Common information" Location of the company's headquarters
	Country	Company's Annual Report, section "Common information", Location of the company's headquarters
	Developed market	Company's Annual Report, section "Common information", foundation year If company is located in developed countries – 1 point, otherwise – 0 points
	Sub-indexes (or pillars) of Knowledge Economy Index (KEI)	Search on company's location on the web site: http://data.worldbank.org/data-catalog/KEI Put the score in the following pillars: vEconomic Incentive and Institutional Regime (EIR); veducation; vinnovation; and vinformation and communications technologies (ICT)
	Location in the state (or region) capital	Search on company's location on their web site, see the status of the city location in Wikipedia If it is the capital of the state (or region) – 1 point, otherwise – 0 points
	Location in a megalopolis	Search on company's location on their web site, see the population of the city location in Wikipedia If the number of inhabitants is more than one million people – 1 point, otherwise – 0 points

Table 7: Transformational factors' proxies (Idem, p.453)

The huge number of data put in equation makes this method the most detailed of the ones using secondary data. However, as no critical assessment of the validity of the method has been done, the measurement has to be taken with precaution. The authors advise that because they are built on proxy indicators, the hypothesis should

be tested before drawing conclusions. The limit advanced by literature advising dynamic methods are that it does not take into account the present value of the future investments made possible by the actual IC We can also add that the method is more complex to use than the classical ones and does not allowed direct calculation for potential investors willing to know the IC statement of the company.

- Market based methods: M/B and Tobin Q.

We present the following methods because of their recurrence in academic literature. However, as our research question is oriented to support the hypothesis of a relationship between IC value and market values, we will not take them as measurement of intellectual capital (as they are market based, the relationship will be systematic). In exchange, we will use them as dependent variables and test their regression with IC value as presented in the model of Chen, Cheng and Hwang (2005).

The market to book methods are simply the difference between the market value of a firm and the net value of its assets as:

M/B = (Number of shares outstanding*market value of a share) / net value of assets

They are used by number of academics (Stewart, 1997; Edvinsson and Malone, 1997;Lev and Feng, 2001; Guthrie, 2001) The main assumption done in the 1990's is that:

IC = Market value – Book value

The assumption done in this method about the efficiency of the market received considerable criticism. In the methods, the value of IC is subjected to market imperfections and fluctuations, which can increase the IC value without any internal change in the company (Tan, Plowman and Hancock, 2008). Since all the methods based on market prices, it can be a weak estimator of IC, as such prices could be highly influenced by market sentiments (Roslender and Fincham, 2001; Maditinos and all, 2005; Aho, Stahle and Stahle, 2011; Molodchik, Shakina and Bykova, 2012). Actions as change in accounting standards or currency, internal decisions about depreciation methods, internal revaluation or assets, fluctuate intellectual capital value without any change in its components. Other criticism is that the methods do not assess any separate items inside IC, which makes it useful only to increase the interest of the academic and empirical world to intellectual capital, but do not allow any managerial decision regarding potential investments.

Tobin Q method is similar to the Market to Book method as it is based on market values. It is calculating as:

$$\boxed{\text{Q ratio} = \text{Market value / book value of its tangible assets}}$$

Because it is based on the same items in nature, it has the same criticism related to the measurement validity. Nevertheless, the two methods have the advantage to be easy to calculate, which explains the generalisation of their use by empirical studies and investors in their decision process.

These 6 methods are presented by Sudarsanam, Sorwar and Marr (2005) as "traditional methods". They are easy to measure and use, but do not assess all the potential of IC, which makes them less accurate. The main criticisms highlighted in the above paragraph are that most of these methods (Market based, CIV and Residual Income) do not measure the different components of IC separately, and none of them takes into account the value related to the potential future investments permitted by the actual intellectual capital. Under uncertainty, the value of these future investments can be difficult to assess with classical methods, as the future expense can be implemented, delayed or abandoned regarding the decisions taken by managers. A method trying to resolve these issues and modelling these different "options" is the real option method that we present in the following paragraph.

b. Dynamics methods (resources based)

According to Sudarsanam, Sorwar and Marr (2005) from a generic financial point of view,

Firm value = value of assets in place + value of future growth opportunities from assets in place + value of future growth opportunities from new assets

The incorporation of the variable "future growth opportunities" makes the statics accounting methods of IC obsolete as they consider intellectual capital from an accounting point of view, recognising the

past value (cost based) or present value (value based). Sudarsanam, Sorwar and Marr point out that both second and third component of this equation take their value in the firm's accumulation of resources and past investments. This in turn gives an additional value to the IC traditionally calculated by the methods already shown.

Methods developed in order to recognize potential future growth are most often static, using past value and the value of future growth opportunities from assets in place. They do not differentiate between the value of IC in terms of temporal differences (Sudarsanam, Sorwar and Marr). Methods resolving this issue are seen as "dynamics methods". The discount cash flow model is one of these. However, it does not resolve all the limits as it does not account the options available to managers. There are few frameworks focusing on IC which used DCF model and is more relevant in internal decision making process than in external assessment. Methods recognizing future options of a potential investment are scarcer. An interesting development in this subject is the adaptation of the real option methodology to valuate IC In this paragraph we will first present the current state of real option literature to introduce ROM and then present the actual academic focus in the intersection between real option and IC literature.

- Real option method

The application of real option theory in IC measurement take its legitimacy in the significant uncertainty involved in investment in intellectual capital. Research and development, advertising, training

in human resources never present certain return. Furthermore, depending on their results, number of other investments can be done or abandon.

According to Sudarsanam, Sorwar and Marr "investments in activities to generate future growth opportunities may lead to subsequent investments in intangibles as well as the tangible assets necessary to exploit the growth opportunities" (2005, p.58). Research and development fall in this category: the investment does not directly give incomes, but leads to a future decision to continue to invest or not, which gives the firm an option. Sudarsanam, Sorwar and Marr maintain that by investing in R&D, the firm buys an option.

The method is based on the Black-Scholes option pricing model used to measure the value of a financial options in derivatives markets. As in derivatives market, a real option to buy is an investment done in a project giving the opportunity but not an obligation to make further investments (in derivatives market, it is a call option, option to buy the subjacent). This method permits to assess IC investments under uncertainty. It takes its relevance in the nature intangible of the Intellectual Capital. Some components of IC as patents, advertising or Human resources practices have uncertain return. Furthermore, this method is the only one able to measure the interrelation on the IC items.

However, this method is used to evaluate specific investments. It does not give a general value of IC. In this dissertation, we test the relation between IC and market prices, however, this method is an internal tool to managerial decisions and cannot measure the global value of IC.

Chapter 3: Methodology

The process of literature review highlights various methods relevant to respond to our research question. The dynamic methods have the advantage to be theoretically more accurate as they offer better evaluation of interrelation, but statics measures are based on available data which make them easier to measure. Furthermore, our research question is based on how markets value IC. Markets use information available to make valuation. It seems then more relevant to use methods based on available information. Methods based on ROA as CIV, Residual Income and VAIC permit to measure the profitability created by IC. The Transformation Evaluation model permits to assess the value that market gives to qualitative information present in the financial reports. Our research question highlights different issues in the research method used. It should not be based on market value, since we try to highlight a relationship with the markets, and should assess separately the different parts of IC.

Because of their use in similar empirical studies, VAIC and Transformation Evaluating model (ICTEM) caught our attention. They have the advantage to be based on available information and to be enough detailed to permit the assessment of the different parts of IC.

A. Research methods

I. Research hypotheses

In order to assess "how Intellectual Capital is evaluated by financial market?", we developed a theoretical framework, based on the works of Chen *et al*., Maditinos *et al.* and Toivanen *et al.* As highlighted in literature review, an increasing gap exists between market and book values. This gap is explained by many authors by the presence of IC. To support this affirmation, our first hypothesis is:

- H1: Companies with greater Intellectual Capital have higher Market to Book ratios.

Our research objectives are to support the idea that the different components of IC are valued differently by investors. In order to answer these objectives, we have set three hypotheses:

H2: The market gives different value to each component of IC.

- H2-1 Companies with grater Human Capital efficiency have higher Market to Book ratios.
- H2-2 Companies with greater Structural Capital efficiency have higher Market to Book ratios.
- H2-3 Companies with greater Physical capital efficiency have higher Market to book ratios.

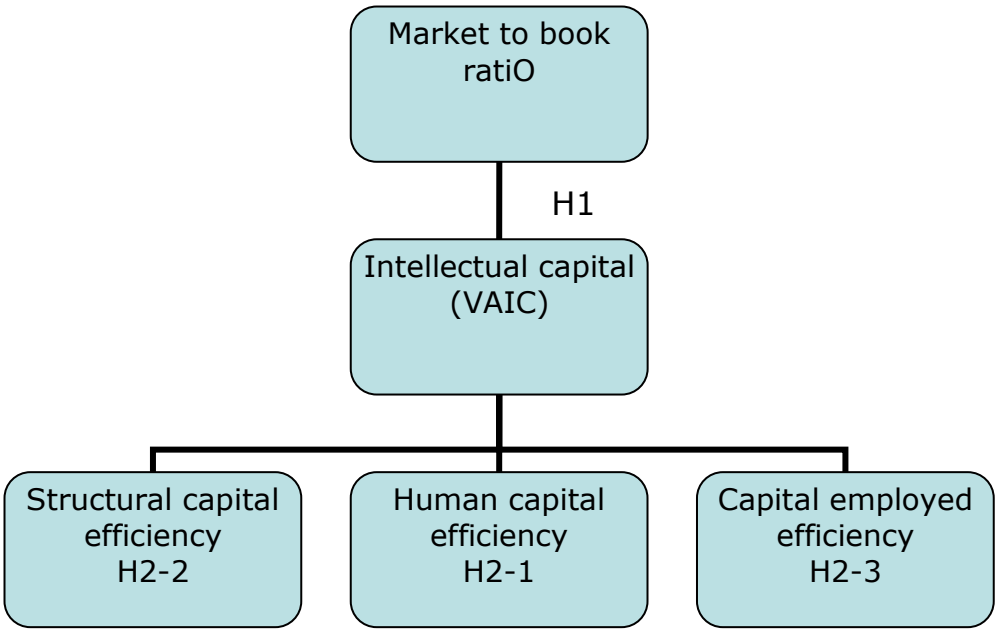

Figure 11: Theoretical framework

II. *Selection of methods used :*

The first part of the research has been dedicated to select IC measurement relevant for this question through an analysis of the current literature. As presented in the section D of chapter 2 the methods more relevant according to our question and our time constraints are VAIC and ICTEM.

VAIC presents the advantage to have well defined frameworks. However, as presented in literature review, it gives little consideration to qualitative information. ICTEM fill this gap with variables theoretically available in financial statements presenting qualitative information susceptible to be valued by investors. It gives as well better estimation of IC components as it used a summative methods (items of components of IC are summed) rather than VAIC which used subtractive methods (each component of IC is measured deducting it from a general equation of VA).

The second part of the research has been dedicated to collect data to follow the two methods. However, data available for the ITCEM methods were too irregular and unequal to use. As we saw in disclosure practices, companies are not obligated to disclose the number of intangible assets. They aggregate often intangibles and goodwill, making the differentiation between structural and costumer capital difficult. Variables as "board of director's qualification" depend of the company willingness to disclose the educational background of directors. Nine important variables were biased by the information available:

- Related to the Human Capital, the board of director qualification, the Corporate University, and the cost of employee (in terms of training) were incompletely disclosed. Director educational background was evoked only when they were from prestigious university. Corporate university was equivocal, as some companies have "graduate programs", others "graduate opportunities", but aggregate these different items under "corporate university" nominal variable was irrelevant. Training costs or investment in HC were aggregates with wages and salaries of administrative expenses.
- Related to Structural capital: R&D expenses were not disclosed, strategy implementation measure as the model presents it[11] was ambiguous as all companies had information about strategy, ERP information and associative

[11] "If the company has news in their web site about strategy – 1 points, otherwise – 0 point." (Molodchik, Shakina and Bykova, 2012, p. 451)

business pertinence was not evoked, except for one company.

- Related to Relational capital: the commercial expenses were not disclosed.

These issues are mainly due to the size of the company of the dataset. Most of them focus on strategic and financial management of the firm and their subsidiaries manage marketing, R&D and other related expenses. These issues confirm the findings of Striukova, Unerman and Guthrie (2008) and Bozzolan *et al.* (2006) who measure that less than 25% of the companies present in the FTSE disclosed about their Human and Structural Capital.

For the regression analysis, only the VAIC method had been used, missing data for the ICTEM support the recommendation given by disclosure practices literature presented in paragraph II of the section B of chapter 2.

III. Regression models.

The models related to our hypotheses are:

Model 1:

$$\boxed{M/B_{it} = \varphi_0 + \varphi_1 \, VAIC + \varepsilon_{it}}$$

Where M/B_{it} represents the market to book ratio of the company $_i$ for the time $_t$. VAIC represents the intellectual capital efficiency as proxy of IC value. The model tests the hypothesis H1.

Model 2:

$$M/B_{it} = \varphi_0 + \varphi_1 \, VAHUexp + \varphi_2 \, VACA + \varphi_3 \, STVA + \varepsilon_{it}$$

VAHU, VACA and STVA are measure of Human capital, Capital Employed and Structural capital efficiency. The model tests the hypotheses H2-(1-2-3)b.

Model 3:

$$M/B_{it} = \varphi_0 + \varphi_1 \, HUexp + \varphi_2 \, CE + \varphi_3 \, SC + \varepsilon_{it}$$

HU is the investment in human capital (Cost of employees expenses variation), CE and SC are the measure of the accumulate value of structural and physical capital. The model tests the hypotheses H2-(1-2-3)a.

IV. Définitions of variables :

As detailed in the presentation of VAIC method, it is based on the value added equation (inputs-outputs).

In first instance, we calculate VA as:

$$VA = S_t - B_t - DP_t$$

Where:

- S = sales revenues
- B = cost of goods sold
- DP = depreciation

Second, we estimate capital employed (CE), human capital (HU) and structural capital (SC) as:

$$CE = \text{Total assets}_t - \text{Intangible assets}_t$$

$$HU = \text{Employee cost}_t$$

$$SC = VA - HU$$

$$Huexp = \text{Employee cost}_{t} - \text{Employee cost}_{t-1}$$

The use of HUexp permits to assess if investor values the global expenses on employee or the new investment on HU.

Third, we measure the value of VAIC and its three component (VACA, VAHU, STVA) as:

$$VAIC = VACA + VAHU + STVA$$

$$VACA = VA / CE$$

$$VAHU = VA / HU$$

$$STVA = SC / VA$$

A. Justification of the Dataset.

As highlighted when presenting the models of Chen *et al*. and Maditinos *et al.* there are few researches in the relationship between intellectual capital and market value in UK. The difference of findings highlighted in their research makes relevant a similar study in the UK market.

As detailed, financial data are needed to use VAIC and ICTEM, we took as dataset companies present in the London Stock Exchange[12]:

- At 31 July 2014: 2469 companies[13].
- Filter – Country of incorporation "GB": 1635 companies.
- Filter – List date "Before 2005": 963 companies.
- Filter – Market capitalisation "different of 0": 769 companies.
- Filter – Market "main market": 533 companies.
- Filter – Sector "travel and leisure": 20 companies.

The filter "list date" and "main market" permit us to select companies constrained to disclose their statements on their website as regulated by the LSE, and with financial data available from 2005 to 2013. The market capitalisation different of 0 is mandatory to study the relation between IC and market value. To avoid bias due to industry specification we chose to analyse the companies of one unique sector. We chose to remove the bank and financial sectors from the possibilities as they present particularities in their financial statements. Most of the remaining sectors counted less than 10

[12] London Stock Exchange. (2014). *List of all companies at 31 jul 2014.* Available: http://www.londonstockexchange.com/statistics/companies-and-issuers/companies-and-issuers.htm. Last accessed 04 Sep 2014.
[13] Screenshots of the selection process are presented in annexe D.

companies for the criteria selected. We chose the travel and leisure sector because they add a reasonable number of companies. The final dataset is presented in the figure below.

All Companies on the London Stock Exchange At 31 Jul 2014

Number of Companies	Market Value (m)
20	£36,926

List Date	Company	Sector	Country of Incorporation	Market	Mkt Cap £m
23/11/1995	AIR PARTNER PLC	Travel & Leisure	GB	Main Market	
27/05/2002	PUNCH TAVERNS	Travel & Leisure	GB	Main Market	60.7768
27/08/1996	FULLER SMITH & TURNE	Travel & Leisure	GB	Main Market	292.407
06/11/1995	ENTERPRISE INNS	Travel & Leisure	GB	Main Market	633.484
07/10/1996	RANK GROUP	Travel & Leisure	GB	Main Market	637.872
23/05/1947	MARSTON'S PLC	Travel & Leisure	GB	Main Market	819.557
30/10/1992	WETHERSPOON(J.D.)	Travel & Leisure	GB	Main Market	915.509
09/05/1994	GO-AHEAD GROUP	Travel & Leisure	GB	Main Market	940.054
20/01/1969	RESTAURANT GROUP PL	Travel & Leisure	GB	Main Market	1233.55
20/09/1967	LADBROKES PLC	Travel & Leisure	GB	Main Market	1235.5
26/04/1995	NATIONAL EXPRESS GR	Travel & Leisure	GB	Main Market	1334.35
16/06/1995	FIRSTGROUP	Travel & Leisure	GB	Main Market	1524.03
15/04/2003	MITCHELLS & BUTLERS	Travel & Leisure	GB	Main Market	1532.72
04/02/1955	GREENE KING	Travel & Leisure	GB	Main Market	1796.15
25/04/1996	MILLENNIUM & COPTH	Travel & Leisure	GB	Main Market	1902.41
19/10/1998	STAGECOACH GROUP	Travel & Leisure	GB	Main Market	2043.26
20/06/2002	WILLIAM HILL PLC	Travel & Leisure	GB	Main Market	2499.73
23/10/2000	CARNIVAL	Travel & Leisure	GB	Main Market	4646.82
22/11/2000	EASYJET	Travel & Leisure	GB	Main Market	5120.91
09/07/1948	WHITBREAD	Travel & Leisure	GB	Main Market	7757.04

Figure 12: Final dataset.

The travel and leisure sector is interesting to studies: the performance of the companies are related to services given by human resources. The quality and performance of the Human Capital should have direct relationship with the performance of the company. As well as the Structural Capital (the way the company is organised to give this service) and the Customer Capital should take more importance than in sector which based their revenue in goods production.

B. Collection of data

The data of the 20 companies had been collected through their consolidated financial statements for the period 2005-2013.

The market value of the companies have been estimated through the company disclosure of "weighted average share price during the period" multiplied by the share outstanding at the end of the period to avoid bias caused by market prices.

Assets, and book value of the companies have been collected in the balance sheet of the companies. The intangible assets represent the value of goodwill and other intangibles.
Employee cost includes tax and benefits expenditure.

The data of restarted years have been included. When the accounting period was changing, a prorata-temporis have been calculated (Value for the year= (value*52/number of weeks in the period).

Data related to ITCEM method have been collected, some of the regression was significant. However important missing data are not allowed to build conclusions.

The years presenting negative book value have been eliminated from the final database. The year 2005 have been used to calculate evolution of employee cost and have been eliminated from the final database.

140 lines “Companies/Years” remained at the end of the selection.

Chapter 4: Results and findings

A. Model 1:

Source	SS	df	MS
Model	4.57083674	1	4.57083674
Residual	107.311904	103	1.04186315
Total	111.882741	104	1.07579558

Number of obs =	105
F(1, 103) =	4.39
Prob > F =	0.0387
R-squared =	0.0409
Adj R-squared =	0.0315
Root MSE =	1.0207

logMB	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logVAIC	-.3560435	.169985	-2.09	0.039	-.6931686	-.0189184
_cons	1.098891	.2484099	4.42	0.000	.6062284	1.591553

Figure 13: Regression - Model 1. Test of H1.

Figure 14 presents the Regression model for the hypothesis 1. The model explains 3.15% of the variation of M/B ratios for the companies of tourism and leisure sector in UK between 2006 and 2013. A variation of 1% of VAIC leads to a diminution of 0.35% of the M/B ratios.

The model does not support H1[14]. The followings two models can give information about how to interpret these findings, the analysis is presented in chapter 5.

[14] H1: Companies with greater Intellectual Capital have higher Market to Book ratios.

B. Model 2

Source	SS	df	MS
Model	32.8942235	3	10.9647412
Residual	28.445063	65	.437616353
Total	61.3392865	68	.902048331

Number of obs =	69
F(3, 65) =	25.06
Prob > F =	0.0000
R-squared =	0.5363
Adj R-squared =	0.5149
Root MSE =	.66153

logMB	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logVAHUexp	-.2433324	.0765818	-3.18	0.002	-.3962768	-.090388
logVACA	.6272199	.0839861	7.47	0.000	.4594881	.7949516
logSTVA	-.1796492	.2018983	-0.89	0.377	-.582868	.2235696
_cons	1.893815	.3644443	5.20	0.000	1.16597	2.621661

Figure 14: Regression - Model 2. Test of H2.

Model 2 includes the different components of IC with their efficiency value. It supports the hypothesis H2 that markets give different values to each component of IC as the adjusted R-squared improved significantly in model 2 (51.49% of MB variation can be explained by variation of IC components). The coefficient of VAHUexp and STVA which represent the value added by human Capital and Structural capital are negative. The hypothesis H2-2b is supported by the model, companies with greater capital invested efficiency (physical and financial) tend to have higher market to book ratio. However, H(1-2)b are not supported. Higher Human Capital efficiency leads to less M/B. The variable STVA is not explicative in this model as the t-stat is not included in [-1.96, +1.96]. This does not confirm the findings of Maditinos *et al.* who found a negative relationship between STVA and M/B ratios but a positive relation between VAHU and M/B ratios. Chen *et al.* found a positive relation in both variables.

The interpretation of the findings discussed in the next chapter led us to create a new model to test the validity of our explanations. This model and its findings are presented in the following section. The interpretations of the findings and the way they justify our analysis of the results of the two first models are presented in the discussion of chapter 5.

C. Model 3

Regarding the analysis of the results of model 2 and the specificity of our dataset (the value added is stable) we suggest a model assessing the hypothesis of the beginning based on the accumulated value of IC components. H1 remains equal, but IC value is measured by aggregated HU investments and SC:

$$\boxed{IC = HUexpenses + SC}$$

The adaptation of H2 hypothesis is the following:

H2: The market gives different value to each component of IC.

- H2-1 Companies with grater Human Capital expenses have higher Market to Book ratios.
- H2-2 Companies with greater Structural Capital have higher Market to Book ratios.

Because physical capital is fully recognized in book value, the accumulate value of CE do not assess IC, we expect the relation between CE and M/B to be negative. The adaptation of H2-3 is:

- H2-3 Companies with greater Physical capital have lower Market to book ratios.

The models resulting of these hypothesis are:

Model 3a:

$$M/B_{it} = \varphi_0 + \varphi_1 IC + \varepsilon_{it}$$

Model 3b:

$$M/B_{it} = \varphi_0 + \varphi_1 HUexp + \varphi_2 CE + \varphi_3 SC + \varepsilon_{it}$$

Where HU is the investment in human capital (Variation in cost of employees expenses), CE and SC are measures of the accumulate value of structural and physical capital. In this model, the value of IC is measure by the variables HU and SC.

The following figure presents the regression between the new IC value and B/M ratios:

```
. reg logMB logICmodel3

      Source |       SS       df       MS              Number of obs =      86
-------------+------------------------------           F(  1,    84) =    0.61
       Model |  .549509759     1  .549509759           Prob > F      =  0.4385
    Residual |  76.1629385    84  .906701648           R-squared     =  0.0072
-------------+------------------------------           Adj R-squared = -0.0047
       Total |  76.7124482    85  .902499391           Root MSE      =  .95221

------------------------------------------------------------------------------
       logMB |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 logICmodel3 |  -.0496895   .0638277    -0.78   0.438    -.1766178    .0772388
       _cons |   1.474559   1.248967     1.18   0.241     -1.00915    3.958267
------------------------------------------------------------------------------
```

Figure 15: Regression – Model 3. Test of H1

IC alone fails to explain M/B ratios. The explanation can be that M/B ratios are more explained by the information provided by VACA. To assess this hypothesis, we add Capital employed in the model.

```
reg logMB logICmodel3 logCE

      Source |       SS       df       MS              Number of obs =      86
-------------+------------------------------           F(  2,    83) =   20.03
       Model |  24.9751614     2  12.4875807           Prob > F      =  0.0000
    Residual |  51.7372868    83  .623340804           R-squared     =  0.3256
-------------+------------------------------           Adj R-squared =  0.3093
       Total |  76.7124482    85  .902499391           Root MSE      =  .78952

------------------------------------------------------------------------------
       logMB |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 logICmodel3 |   .2327929   .0695498     3.35   0.001     .0944612    .3711247
       logCE |  -.5227538   .0835097    -6.26   0.000    -.6888512   -.3566563
       _cons |   6.949542   1.355503     5.13   0.000     4.253502    9.645582
------------------------------------------------------------------------------
```

Figure 16: Regression - Model 3. Test of H1 with CE variable.

This model explains 30% of the variation of M/B ratios, both IC and CE variations are significant to explain M/B ratios variation. An increase in IC increases M/B ratios when an increase in CE decreases M/B ratios. The discussion chapter will explain and assess these findings.

```
. reg logMB logHUEXP logCE logSC

      Source |       SS       df       MS              Number of obs =      70
-------------+------------------------------           F(  3,    66) =   23.37
       Model |  33.5822927     3  11.1940976           Prob > F      =  0.0000
    Residual |  31.6156309    66   .47902471           R-squared     =  0.5151
-------------+------------------------------           Adj R-squared =  0.4930
       Total |  65.1979235    69  .944897442           Root MSE      =  .69212

------------------------------------------------------------------------------
       logMB |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    logHUEXP |   .1307231   .0365701     3.57   0.001     .0577086    .2037377
       logCE |  -.6210641   .0890318    -6.98   0.000    -.7988218   -.4433064
       logSC |    .303338   .0860405     3.53   0.001     .1315526    .4751234
       _cons |    5.52752   1.338121     4.13   0.000     2.855875    8.199164
------------------------------------------------------------------------------
```

Figure 17: Regression - Model 3b. Test of H2

The model 3b includes the different components of IC in their accumulate value. The model is less explicative than the model 2 but the amelioration of the T-stat make it interesting. The model supports H2(1-2)a. Higher investment in HU and higher SC lead to higher M/B ratio. As in the model 2b, higher CE leads to less M/B value. The model supports our second hypothesis: markets give different value to the different components of IC.

In the following chapter, four main explanations will be discussed to assess our results. First one is related with the particularity of our dataset, second one is related to the VAIC method and its measurement, thirds will discuss the probability of other factors independent of IC creating gap between M/B ratios, and the last one will be oriented to the effect that different disclosure practices could have in our results.

Chapter 5: Discussion and Recommendations

A. Analyse of the results

Results show that markets react to IC and its components, however, the reaction finding with the model 1 and 2 do not support our initial analysis and do not support literature findings. The model 3, created a-posteriori of the two first model have an explanatory nature.

Model 1 shows a negative relationship which can be interpreted as a negative effect of IC value on the market to book ratios: however, the following hypotheses seem more plausible:

- The particularity of our dataset makes the VAIC method less effective (the financial crisis had decreased markets values and the value added remain stable on the period of analysis which makes analysis based on value added valuation less relevant)
- Arithmetic issues in VAIC methods make the coefficient of the components of IC negatives or the VAIC value is poor measure of IC.
- The explanation of the gap between market and book value in Tourism and Leisure sector in UK between 2006 and 2013 cannot be attributed to the only presence of IC.
- An evolution of the disclosure practices make intangible assets of the companies more accurate.

These hypotheses will be tested and described in the following paragraphs. The results of the regression of model 2 give us more information to explain the result of model 1. Model 3 tests the validity of the explanation of our results.

This first finding has no correspondence with actual academic empirical results. The model is based on both works of Maditinos *et al.* (2011) and Chen *et al.* (2006).

Maditinos *et al.* fail to support H1 with an adjusted R^2 of 0.00 for this first model studying 96 Greek companies over 2006-2008, and Chen *et al.* support H1 with a level of signification of 10.77% and a positive coefficient of 0.065 for the 4254 firms studied over 1992-2002. However, in our analysis, we use the logarithms of raw value, which increase the level of signification, the use of raw value will lead to the same findings of Maditinos *et al.* These differences can be explained mainly by a difference of size of dataset, and by the period of the research. Analysing one sector over 8 years as we did is more dependent of markets variations and sector specificities.

Model 2 adds information to discuss our first findings, the coefficient of VAHU and STVA are negative, which explains that the aggregate value of VAHU, STVA and VACA is negatively related with M/B ratios. Once again this can be explained with the difference of size of our dataset, and the specificity of our data. Before to conclude to an inverse relationship between IC and M/B ratios, contradicting the actual empirical findings and our initial thoughts, we tested the following hypothesis: the negative signs are due to the effect of the crisis in our data or the VAIC does not measure the IC value.

A first possible explanation of these coefficients is that the crisis affected the data. To explore this explanation, we first generated diagrams presenting the evolution of M/B of each companies during the period studying: based on created variables "$logMBC_i$ = logMB if Company = "i" in the Y axe and variable "Year" in X axe. We divided the companies in two groups for better reading of the diagrams.

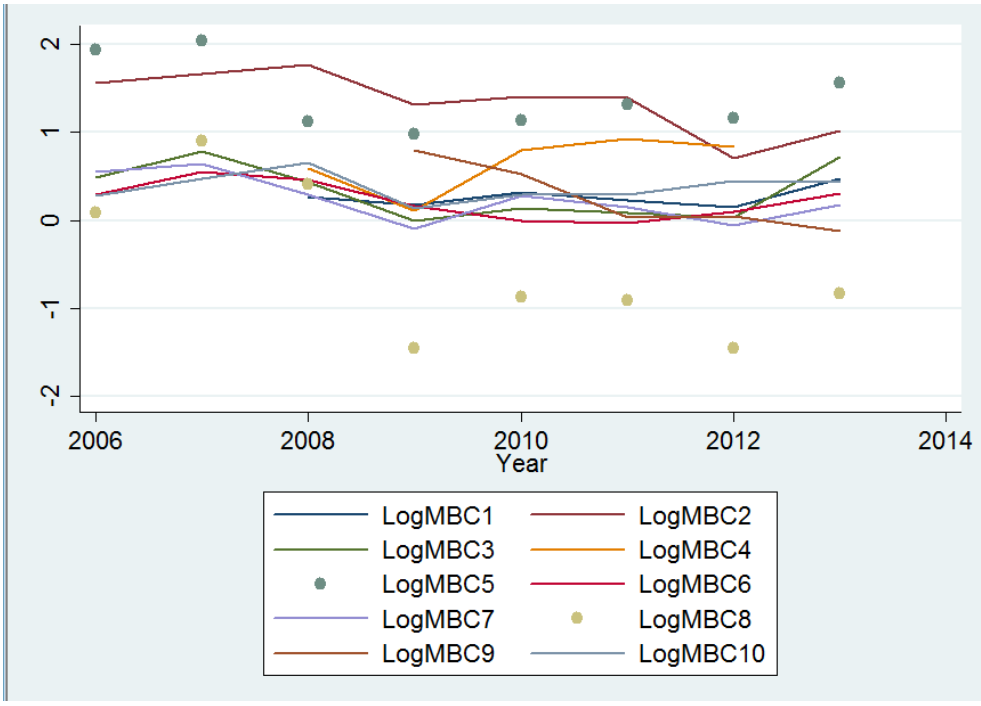

Figure 18: M/B ratio evolution (2006-2013, Companies 1 to 10)

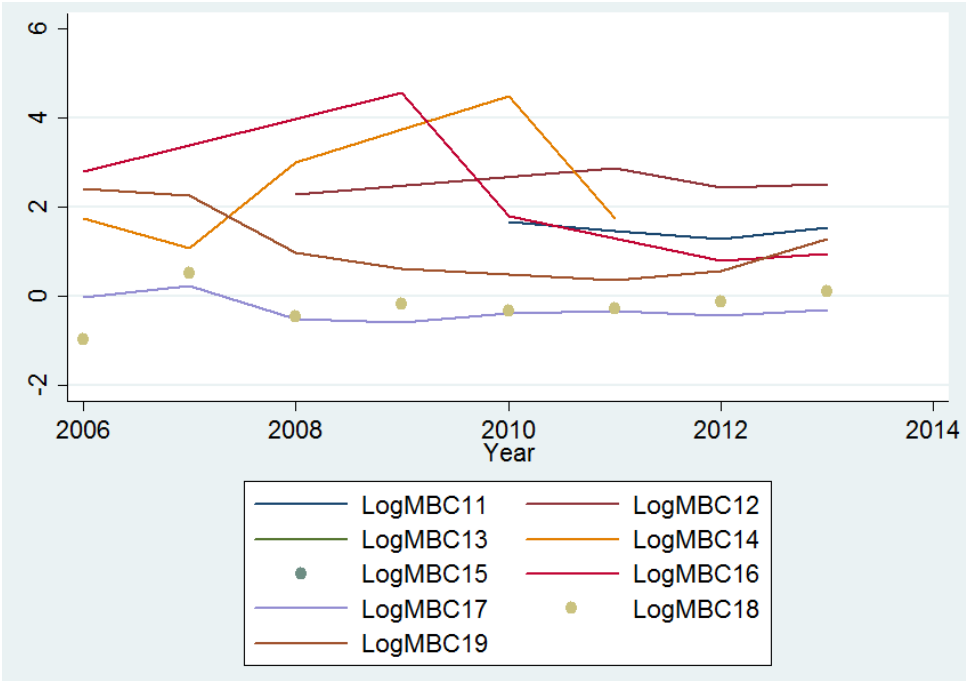

Figure 19. M/B ratio evolution (2006-2013, Companies 11 to 18)

Regarding the diagrams, the M/B ratio decreased between 2007 and 2010. To support the idea that negatives coefficients are due to market variations independent of IC component variations we generated a new regression model for the year 2006, and 2010 to 2013.

Source	SS	df	MS
Model	25.1852486	3	8.39508288
Residual	19.0001757	43	.441864551
Total	44.1854243	46	.960552703

Number of obs =	47
F(3, 43) =	19.00
Prob > F =	0.0000
R-squared =	0.5700
Adj R-squared =	0.5400
Root MSE =	.66473

logMB	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logVAHUexp	-.2435893	.1037867	-2.35	0.024	-.4528952	-.0342834
logVACA	.6244663	.0999814	6.25	0.000	.4228346	.826098
logSTVA	-.1836654	.2278274	-0.81	0.425	-.6431231	.2757924
_cons	1.831236	.5003763	3.66	0.001	.8221313	2.840341

Figure 20: Regression - Model 2. Control of variable "Crisis"

The new regression fails to explain the negative coefficient, but the R-squared had improved, showing that the crisis had negative effect on the nature explicative of our model. The first hypothesis advanced to justify our results is not verified by its new regression. Another hypothesis is inherent to the measurement model used.

The other explanation is in the arithmetic calculation of VAHU and STVA: the explanation of VAHU coefficient can be explained by a relationship between HU and M/B ratio and the explanation of SCVA by its dependence of SC to HU.

First, VAHU represents the efficiency of Human Capital. As advanced by IC literature, HC is a component of IC valuated by the

market: more HC adds market value, therefore, increasing the M/B value. In the VAHU, HC is placed as denominator, which have the effect to decrease VAHU when HC increases. If an increase in HC has the effect to increase the M/B value, the decrease of VAHU will have the effect to increase the M/B if the VA remains equal. To prove this argument, we first tested the effect of HU expenses variation over VAHU:

```
. reg logVAHUexp logHUEXP

      Source |       SS       df       MS              Number of obs =      78
-------------+------------------------------           F(  1,    76) =   26.39
       Model |  32.0981295     1  32.0981295           Prob > F      =  0.0000
    Residual |   92.424629    76  1.21611354           R-squared     =  0.2578
-------------+------------------------------           Adj R-squared =  0.2480
       Total |  124.522758    77  1.61717868           Root MSE      =  1.1028

------------------------------------------------------------------------------
  logVAHUexp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    logHUEXP |  -.4350866   .0846882    -5.14   0.000    -.6037578   -.2664154
       _cons |    10.6946   1.378222     7.76   0.000     7.949635    13.43957
------------------------------------------------------------------------------
```

Figure 21: Regression VAHUexp – Huexp.

The t-stat and R-squared of the regression permit us to argue that for the companies and period studied, an increase in HC investement decrease the VAHU variable. To test if this explains the negative coefficient of VAHU in the model 2, we tested the relation between HUexpenses and M/B ratio:

```
. reg logMB logHUEXP

      Source |       SS       df       MS              Number of obs =      79
-------------+------------------------------           F(  1,    77) =   10.60
       Model |  8.62942317     1  8.62942317           Prob > F      =  0.0017
    Residual |  62.7139747    77  .814467204           R-squared     =  0.1210
-------------+------------------------------           Adj R-squared =  0.1095
       Total |  71.3433979    78  .914658947           Root MSE      =  .90248

------------------------------------------------------------------------------
       logMB |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    logHUEXP |   .1418432   .0435767     3.26   0.002     .0550709    .2286156
       _cons |  -1.678836   .7046678    -2.38   0.020    -3.082009   -.2756629
------------------------------------------------------------------------------
```

Figure 22: Regression MB – Hu expenses.

The relation permits to support the hypotesis that the negative coefficient of VAHU in model 2 does not have to be interpreted as an inverse relationship between HC and M/B. It is due to the value given by investor to expense in Human Capital. Regarding the evolution of our variables, The VAHU value does not permit to assess the value given by investors to HC efficiency. To assess it, the expenses in HU should remain stable, then the VAHU could assess the added value given by investors to an increase in HC efficiency.

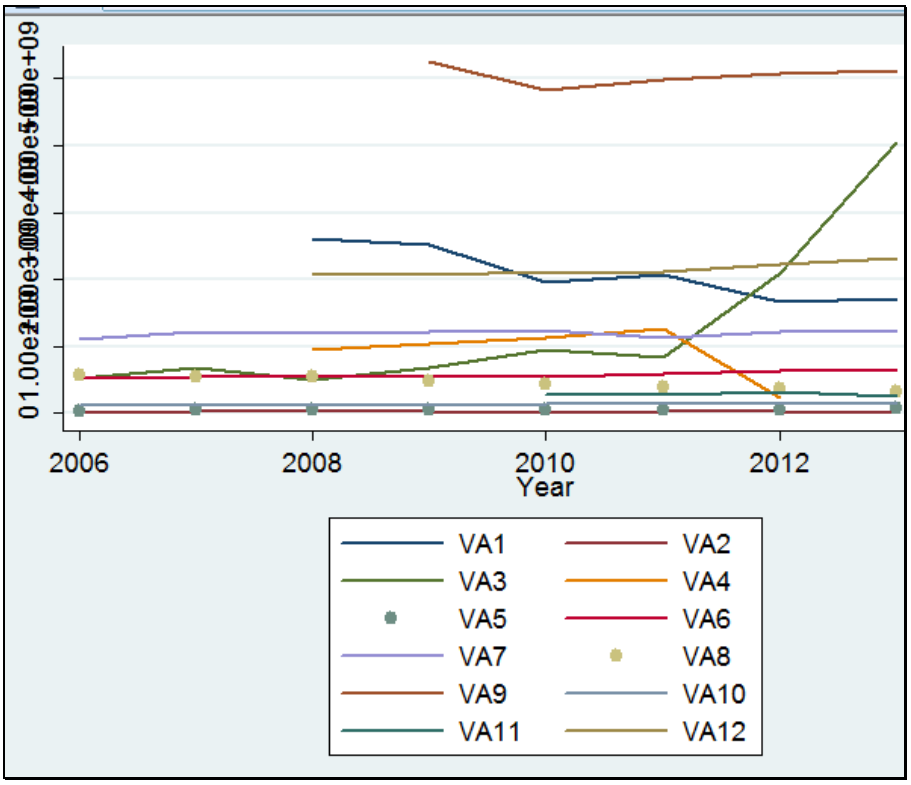

Figure 23: Evolution of VA (2006-2013)

Second, the coefficient of Structural Capital efficiency can be explained by the relation between HU and SC highlighted by *Stahle et al*. (2011, p.536): SC is calculated as VA less HU, if VA remains stable (figure 17 shows that it is stable during the period 2006-2011) an increase in HU leads to a decrease in SC due to the relation: SC = VA-HU. The ratio SCVA, calculated as SC divided by VA, decreases with the diminution of SC. For a period with stable Value Added, HU and SC have to show the same coefficients.

This analysis led to think that VAIC does not permit to give conclusions on the relationship between IC and markets values. The investors seem to react to the VAIC components, important issues of its calculation makes the interpretation of the results difficult.

This leads us to model 3 presented in the previous chapter. The analysis of our dataset and results makes us suggest a model testing the explanation arguing in the discussion: the first model test the hypothesis 1 taking as aggregated value of IC he sum of the Human Capital expenses and the Structural capital. The first draft of the model resulting is not significant. But the information added by CE in the second draft explains better the variation of M/B ratios. Companies with greater IC tend to have better market to book ratio, when companies with greater CE tend to have less market to book ratio, this is explained well by the fact that companies with greater CE have greater book value as CE is fully recognised in financial statements of companies. The model permits to test one of the possible explanation advanced to explain our first result: it suggests that IC is not the only explicative variable of market to book ratios.

Model 3b tests H2 trough the regression of M/B ratios HU expenses values, SC and CE. The findings are that increasing investment in HU and SC leads to better M/B values. In the travel and leisure sector, the structural capital seems to be more valuated than the human capital. However as explained, in the VAIC method, HU and SC are correlated. We will see in the limits of the study that, as argued by Stahle *et al.* SC poorly represents structural capital but is more comparable to operating results (2011, p. 535).
Because model 3 is not based on actual literature, it does not permit to build general conclusion of relationship between IC and market values, however, it permits to test the explanation advanced in the analysis of the results of the model 1 and 2. The negative coefficients

are mainly due to issues in the VAIC method, and not to a real negative relationship between IC and the markets value.

B. Limits and expansion

As presented across the analysis of the results, two main limits can be addressed: the first is related to the dataset, and the second to the method used.

First, results have to be taken with consideration of the low number of companies in the dataset. 20 companies from one unique sector do not permit to build conclusion over the general effect of Intellectual capital on market value. The company's studied have different size and structure which can involve bias in the results. The specificity of the tourism and leisure sector can lead to false conclusion. The companies of the sector have organizational differences due to their sub-sector specificities: restaurant companies are mainly group of subsidiaries with many competitors where airlines companies are unique companies with few competitors. This can lead to misunderstanding of the results, specifically in the weight attributed to each component of IC.

The period of study involves as well potential bias: we tried to control the effect of the financial crisis through dummy variable, however, the repercussion of the markets collapse can impact the financial performance of the company's nowadays. A deep analysis of the travel and leisure sector and its components could add explicative reasoning supporting this assumption.

The Value Added in our dataset remains stable over the period studied, this led to the inefficiency of the VAIC method as it is based on the market valuation of value added by IC component. If this value remains stable, the variation of the markets cannot be explained by the VAIC measure.
Model 3 had been built a-posteriori of the research methodology design to resolve this issue. However, as it has not been assessed by the academic world and is not based on existing framework, this model has to be analyzed with caution. The use of the value of HU, CA and SC rather than their value added efficiency could lead to a diminution of the significance of the model to assess IC relation with M/B. For example, CA does not assess any component of IC as it is merely based on financial and physical assets value. These data based limits can explain the contradiction of our findings with the actual academic findings.

The second limit is in the VAIC method itself. It was explained in chapters 2 and 3 why this method had been chosen despite its criticisms: the availability of the data in financial statements and the detailed frameworks existing make it easier to use. However, the initial methodology was designed in order to use a second method and compare them, which could give better robustness to our results. The unavailability of most of the data needed to use the ICTEM method supports the recommendations presented in the first section of chapter 2 for better disclosure practices.
As Stahle *et al.* assess in their critical analysis of the VAIC method, it does not purely measure the IC efficiency. Some major issues regarding its calculation method make it invalid to measure

intellectual capital value. HU measures the use of Human Capital, not its value. This becomes clearer when the value undertaking is compared with the table of Human Capital components created by Huang, Luther and Tayles (2007). The cost of Human Resources is not a component of Human capital. The skills and satisfaction of the employees are not assessed in the VAIC method. The value that we took (variation of expenses in employees cost) can be more accurate as it could express the consideration of the company in investing in Human Capital. However, this is true if the investment is done in order to improve Human Capital efficiency or satisfaction (in training or benefits for instance). Once again, the actual disclosure practices of the companies do not permit to accede this information. The main limit of VAIC method in its validity to measure IC is that it is not considering the relational capital, aggregating it in a non-explicit "structural capital".

Expansion of the method used (VAIC) can be done in order to include more companies and sectors in the dataset. It could improve the robustness of the results and may represent better the actual empirical findings. The period of analysis can be increased in order to eliminate bias due to market variations. A variable representing the relational capital has to be created to increase the accuracy of the method. The use of an alternative method as the ICTEM is an expansion permitting to resolve the VAIC issues. This can be done if the data needed are available. Interviews with companies can be conducted in order to resolve the problems due to disclosure practices. However, this can decrease the possibility of assessing the IC value of a sufficient number of companies.

C. Recommendations:

In this section, we overview the dissertation research process to build recommendations classified in three parts: the first is related to the problems faced in our research process. Second is oriented to academic world. The third category leads to recommendation for further research and work.

The first recommendation is about the method use. With more time, the methodology limits met in the ICTEM method can be overcome using qualitative data collection through questionnaires. We believe that this method better measures the IC value and can permit building strongest conclusion than the VAIC. This first recommendation leads to recommendation on disclosure practices: if the firms was disclosing relevant information about their IC, the ICTEM could be used without using this research method, the number of companies in this study should be increased by this change, and as a result increasing the robustness of the data.

Following the recommendation of the accounting literature on disclosure practices: we believe as Roslender and Fincham (2001) that the impact of IC on company's market values is a strong argument to create IC financial statements. We support the idea of a need of evolution in accounting standards as suggested by Bukh (2003). However, we disagree with his statement that the information needed is already available in the financial statement and corporate website in a qualitative way. The fail to assess firms IC of our database with the ICTEM methods proves that an important gap in the information disclosed prevents the efficient valuation of the

companies by investors. This leads to an inefficiency of the markets: if the information is not available, the markets cannot measure the true values of the firms; on the other hand, this lack of information leads to an imperfect valuation by the investors more tempted to use their "feelings".

On the other hand, we believe that this increase in accounting recognition and disclosure practices have to be backed by strong empirical studies on the impact of IC over firms values. Empirical studies are isolated over the time period, the geographic area and the sector studied. Ambitious international project addressing our research question could be a great influence of standards recognition and companies behaviour.

However, this project needs a defining measurement method and classification. This argument leads to our third recommendation: the IC literature needs agreed definitions and classifications. Studying a concept and its effect without delimitating its meaning and components creates an incoherence on IC literature. Articles and empirical studies on the same concept (i.e. IC) measure different items, where works about different concept are often assessing the same element. Besides, this will lead to a needed agreement on the best method to use for assessing the market value of IC and its component.

Final recommendation is on further idea to examine carefully. The managerial challenges on IC can be highlighted through research and framework of the real option methods adapted to IC. These framework will have to measure the interrelations emerging through the different IC component, as well to integrate both monopolistic

and competition models. Component of IC as the organisational behaviour is not constrained by competitive game, however, many others as the Human Capital depend of the capacity of the company to attract the best talent.

To conclude this chapter there is no doubt for us that IC measurement and management is the new challenge of academic and corporate world. If the findings do not clearly prove the relationship between IC and M/B ratios, they support the hypothesis that investors value IC components and Human Capital. The academic world has to improve its theoretical work about IC where the corporate world has to be conscientious of its great *hidden value* and the importance of its management.

Chapter 6: Conclusions, Critique, and Lessons Learned

As presented in this dissertation, there are many ways to address IC research. Its multidisciplinary nature permits to highlight issues in different field, and as it is a relatively new field, a number of gaps in the literature can create good research questions.

The repercussion of IC on economic world makes of its measurement and control a great objective for internationals studies. Human Capital management, corporate Structural organisation and Relational Capital had already been well addressed in the literature. Nevertheless, gathering them in one concept permits an interesting interdisciplinary brainstorming about the economic, strategic and financial repercussions of these concepts.

In this context, choosing a relevant research question for financial dissertation purpose as well as the selection of the information available in the literature was our first challenge. The link of our research question with accounting issues permitted us to use a cross disciplinary analysis adding relevance of our study. Each new article read was bringing new information than we would like to address in this work, and at the beginning, it had been difficult to keep the focus on our objectives.

The subject had been chosen by a personal interest which had made the months of the dissertation research really interesting and informative. However, gaps in theoretical literature specifically in the lack of agreed definition and classification have added a level of difficulties as a long part of the reading had been dedicated to the classification and segmentation of IC concepts in order to select the

most relevant ones to address our objectives. Each classification was related to specific method of measurement. Another challenge had been to isolate our own beliefs on the topic to accept and follow a method feasible with our time constraint. The classification that we feel closer to the real business world is the detailed one of Huang, Luther and Tayles. However, methods studied was using other aggregation of the concept, and created a theoretical framework using this classification and assessing it with empirical data was not feasible for this research.

The dissertation process had permitted to put in practices the *Research and Methods* module of the first semester in the University of Hull, and highlighted the advices and theories teaching in this module with the lessons learned from our own mistakes. Issues as bias due to the researcher feelings, or difficulties to focus on the research objectives have been experimented. A lot of time has not been effectively used, specifically in two first month of the dissertation because of irrelevant readings for the topic or focus in detail, losing the point of the research.

Until the last weeks of the research, uncertainty about the way to clearly address IC concern had made us studying thoroughly some aspects of our topic irrelevant to this dissertation. The lessons learned during dissertation process had mainly be related to keeping the focus on our research objectives: in our readings and in our analysis. The support of our supervisor had permitted us in the last week of the research to avoid mistakes of adding too much information and details irrelevant to our research question

Another lesson had been learned from the methodology design process. The mistake of trying to prove our initial beliefs and

hypothesis, when the results were contradicting them, made us lose time in redesigning a method. Once again, the support of our supervisor was that a research process is not addressed to prove our point but to study empirical facts, and that contradictory results can be more interesting to analyse than result supporting actual literature.

The dissertation process had permitted us to learn a lot about intellectual capital in many disciplinary perspectives. We learned the self-learning process through research and reading of articles. We developed a critical point of view comparing academic works and perspectives. We improved our analysing skills through a classification and selection of the works to use, and the justification of our results.

Bibliography

Aho, S. Stahle, S. Stahle, P. (2011). A critical assessment of Stewart's CIV method. *Measuring Business Excellence*. 15 (4), pp.27-35.

Alcaniz, L. Gomez-Bezares, F. Roslender, R.. (2011). Theorical perspectives on intellectual capital: a backward look and proposal for going foward. *Accounting Forum*. 35, pp.104-117. Publ. Elsevier.

Apple (2014), Quarterly report pursuant to section 13 or 15(d) of the securities exchange act of 1934 [on line] Available at: http://files.shareholder.com/downloads/AAPL/3358475571x0x770499/d8f7def2-7dd5-44c3-be7d-ee66ff33f947/Q3_2014_Form_10-Q_as_filed_.PDF [Accessed 27 July 2014].

Augier, M. and Teece, D.J. (2005). An Economics Perspective on Intellectual Capital. In: Marr, B. *Perspectives on intellectual capital*. Burlington, USA: Elsevier Butterworth-Heinemann. pp. 3-27.

Bloomberg (2014), Apple Inc [on line] Available at: http://www.bloomberg.com/quote/AAPL:US [Accessed 27 July 2014].

Bloomberg (2014), LG Electronics Inc [on line] Available at: http://www.bloomberg.com/quote/066570:KS [Accessed 27 July 2014].

Bloomberg (2014), Nokia OYJ [on line] Available at: http://www.bloomberg.com/quote/NOK1V:FH [Accessed 27 July 2014].

Brainard, W. and Tobin, J. (1968). Pitfalls in financial model building. *The American Economic Review.* 58 (2), pp. 99-122.

Bukh, P.N. (2003). The relevance of intellectual capital disclosure: a paradox?. *Accounting, Auditing and accountability Journal*. 16 (1), pp.49-56.

Burgman, R.J. Roos, G. Ballow, J.J. Thomas, R.J. (2005). No longer "out of sight, out of mind". Intellectual capital approach in

Chareonsuk, C. and Chansa-ngavej, C. (2010). Intangible asset management framework: an empirical evidence. *Industrial management and data systems*. 110 (7), pp.1094-1112.

Chen, M.C. Cheng, S.J. Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of Intellectual Capital*. 6 (2), pp.159-176.

Chang, M.Y. Lin, J.Y. Hsiao, T.Y. Lin, T.W. (2010). Invested resources, competitive intellectual capital, and corporate performance. *Journal of Intellectual Capital*. 11 (4), pp.433-450.

Edvinsson, L. (1997). Developing Intellectual Capital at Skandia. *Long Range Planning*. 30 (3), pp.366-373.

Green, A. (2006). The transformation of business knowledge into intangible assets. *VINE: The journal of information and knowledge management systems*. 36 (1), pp.27-34.

Huang, C. Luther, R. and Tayles, M. (2007). An evidence based taxonomy of Intellectual Capital. *Journal of Intellectual Capital*. 8 (3), pp. 386-408.

International Accounting standards board (2012) *IAS 38: Intangible assets* [on line]. Available at: http://www.ifrs.org/IFRSs/IFRS-technical-summaries/Documents/IAS38-English.pdf (Accessed 27 July 2014).

Jashapara, A. (2011). Chapter 3: Intellectual Capital. In: Pearson Custom *Management: An integrated Approach.*. 2nd ed. Harlow: Pearson Education Limited, pp.63-86.

Kannan, G. Aulbur, W.G. (2004). Intellectual capital Measurement effectiveness. *Journal of Intellectual Capital*. 5 (3), pp.389-413.

Koller, T., Goedhart, M. H. & Wessels, D. (2010) Valuation : measuring and managing the value of companies. 5th ed. Hoboken, N.J., John Wiley.

Kothari, M. Mehta (Ranka), N. Sharma, L. (2013). Intangible assets: a study of valuation models. *Research journal of management Sciences*. 2 (2), pp.9-13.

Lev, B. Cañibano, L. And Marr, B. (2005). An Accounting Perspective on Intellectual Capital. In: Marr, B. *Perspectives on intellectual capital*. Burlington, USA: Elsevier Butterworth-Heinemann. pp. 42-55.

LG Electronics Inc. (2014), *Interim Consolidated Financial Statements March 31, 2014 and 2013* [on line] Available at: http://www.lg.com/global/investor-relations/reports/financial-statements [Accessed 27 July 2014].

Maditinos, D. Chatzoudes D. Tsairidis, C. Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. *Journal of Intellectual Capital*. 12 (1), pp.132-151.

Marr, B. (ed.) (2005). *Perspectives on Intellectual Capital, Multidisciplinary insights into management, measurement, and reporting*. Burlington, U.S.A: Elsevier Butterworth-Heinemann.

Marr, B. and Roos, G. (2005). A Strategy Perspective on Intellectual Capital. In: Marr, B. *Perspectives on intellectual capital*. Burlington, USA: Elsevier Butterworth-Heinemann. pp. 28-41.

Molodchik, M. Shakina, E. Bykova, A. (2012). Intellectual capital transformation evaluating model. *Journal of Intellectual Capital*. 13 (4), pp.444-461.

Moon, Y, J. Kym, H.G. (2006). A model for the value of intellectual Capital. *Canadian Journal of Administrative Sciences*. 23 (3), pp.253-269.

Nokia (2013), *Annual report* [on line] Available at: http://company.nokia.com/sites/default/files/download/investors/nokia_in_2013.pdf [Accessed 27 July 2014]

Pew tan, H. Plownam, D. Hancock, P. (2008). The evolving research on intellectual capital. *Journal of Intellectual Capital*. 9 (4), pp.585-608.

Ramanauskaitė, A. and Rudžionienė, K. (2013). Intellectual Capital valuation: Methods and Their Classification. *EKONOMIKA*. 92 (2), pp. 79-92.

Riahi-Belkaoui, A. (2003). Intellectual capital and firm performance of US multinational firms: a study of the resource-based and stakeholder views. *Journal of Intellectual Capital*. 4 (2), pp.215-226.

Rodov, I. and Leliaert, P. (2002). FiMIAM: financial method of intangible assets measurement. *Journal of intellectual Capital*. 3 (3), pp.323-336.

Roslender, R and Fincham, R. (2001). Thinking critically about intellectual capital accounting. *Accounting, Auditing and Accountability Journal*. 14 (4), pp.383-398.

Stahle, P. Stahle, S. Aho, S. (2011). Value added intellectual coefficient (VAIC): a critical analysis. *Journal of Intellectual Capital*. 12 (4), pp. 531-551.

Striukova, L. Unerman, J. Guthrie, J. (2008). Corporate reporting of intellectual capital: Evidence from UK companies. *The British Accounting Review*. 40 (0), pp.297-313.

Sudarsanam, S. Sorwar, G. Marr, B.. (2005). A Finance Perspective on Intellectual Capital. In: Marr, B. *Perspectives on Intellectual Capital*. Burlington, USA: Elsevier Butterworth-Heinemann. pp. 56-68.

Sudarsanam, S. Sorwar, G. Marr, B. (2006). Real options and the impact of intellectual capital on corporate value. *Journal of Intellectual Capital*. 7 (3), pp.291-308.

Toivanen, O. Stoneman, P. Bosworth, D.. (2002). Innovation and the market value of UK. *Oxford Bulleting of Economics and Statistics*. 64 (39), pp.39-61.

Wyatt, A. (2002). Towards financial reporting framework for intangibles. *Journal of intellectual capital*. 3 (1), pp.71-86.

Youndt, M.A. Subramaniam, M. Snell, S.A. (2004). Intellectual Capital Profiles: An Examination of Investments and Returns. *Journal of Management studies*. 4 (1:2), pp.335-361.

List of references

Appendix A: Definitions of dependent variables in Chen, Cheng and Hwang regression models. (Chen, Cheng and Hwang (2005), pp. 164-165).

Variable definitions
Dependent variables:

(1) *Market-to-book value ratios of equity (M/B)*. M/B is measured by the market value divided by the book value of common stock:

Market value of common stock = number of shares outstanding × stock price at end of the year.

Book value of common stocks = book value of stockholders' equity − paid − in capital of preferred stocks.

(2) *Financial performance*. The four financial performance variables are defined as follows:

- Return on equity (ROE) = pre − tax income ÷ average stockholders' equity.
  ROE represents returns to shareholders of common stocks, and is generally considered an important financial indicator for investors.

- Return on total assets (ROA) = pre − tax income ÷ average total assets.
  ROA reflects firms' efficiency in utilising total assets, holding constant firms' financing policy.
- Growth in revenues (GR) = (current year's revenues ÷ last year's revenues) − 1) × 100%.
  GR measures the changes in firms' revenues. Increases in revenues usually signal firms' opportunities for growth.
- Employee productivity (EP) = pre − tax income ÷ number of employees.
  EP is a measure for the net value added per employee, reflecting employees' productivity.

Appendix B: Regression results of Chen, Cheng and Hwang models (2005, pp.172-173). Contemporaneous and future financial performance.

Independent variables	Dependent variables: ROE *n*	ROE *t*-statistic	ROA *n*	ROA *t*-statistic	GR *n*	GR *t*-statistic	NP *n*	NP *t*-statistic
Panel A: model 1								
Intercept	−0.863	−13.73*	−0.078	−2.61*	3.151	5.81*	−1,402	−17.89*
VAIC	0.396	57.73*	0.199	61.23*	1.360	22.97*	308	36.00*
Adjusted R^2	0.439		0.468		0.110		0.233	
F-value	3,332*		3,749*		527*		1,295*	
Panel B: model 2								
Intercept	−2.187	−29.58*	−0.953	−34.70*	−0.118	−0.13	−1,362	−10.37*
VACA	34.309	65.07*	19.335	98.73*	68.600	10.36*	6,736	7.19*
VAHU	0.169	28.04*	0.070	31.36*	0.904	12.27*	267	24.98*
STVA	−0.027	−0.42	0.129	5.39*	1.367	1.74	−153	−1.34
Adjusted R^2	0.729		0.842		0.133		0.247	
F-value	3,807*		7,574*		218*		466*	
Panel C: model 3								
Intercept	−2.036	−26.72*	−0.905	−32.32*	−1.291	−1.38	−1,344	−9.85*
VACA	35.210	64.41*	19.473	96.87*	56.151	8.38*	6,932	7.08*
VAHU	0.158	25.74*	0.066	29.31*	0.968	12.88*	266	24.23*
STVA	−0.057	−0.88	0.103	4.35*	0.965	1.23	−147	−1.28
RD/BV	−1.255	−0.89	2.885	5.55*	132.811	7.67*	−2,096	−0.83
AD/BV	−17.931	−8.20*	−9.016	−11.21*	11.922	0.45	−170	−0.04
Adjusted R^2	0.733		0.848		0.144		0.247	
F-value	2,334*		4,739*		144*		279*	

Note: * Indicates significant at $\alpha = 0.05$ level

Independent variables	Lagged one-year results ($n = 3{,}626$)				Lagged two-year results ($n = 3{,}028$)				Lagged three-year results ($n = 2{,}491$)			
	ROE	ROA	GR	NP	ROE	ROA	GR	NP	ROE	ROA	GR	NP
Intercept	−0.31*	0.18*	8.35*	−429*	0.63*	0.18*	6.86*	−406*	0.72*	0.15*	3.81*	−338*
VAIC	0.23*	0.12*	0.14*	129*	0.09*	0.09*	0.21*	100*	0.08*	0.06*	0.49*	63*
Adjusted R^2	0.13	0.16	0.01	0.14	0.02	0.07	0.01	0.06	0.01	0.03	0.01	0.02
F-value	561*	671*	4.37*	577*	75.6*	232*	6.96*	196*	34.74*	80.08*	26.87*	41.37*
Intercept	−1.64*	−0.60*	5.71*	−632*	−0.22	0.64*	4.83*	−799*	−0.03	−0.51*	1.47	−725*
VACA	27.1*	14.9*	38.0*	5,717*	15.3*	13.4*	27.6*	7,331*	15.45*	12.13*	29.13*	8,474*
VAHU	0.06*	0.02*	−0.11	94*	0.01	0.01	0.04	57*	−0.01	−0.01	0.32*	18
STVA	0.15	0.13*	1.07	17	0.09	0.18*	0.87	79	−0.16	−0.02	1.38	−103
Adjusted R^2	0.30	0.39	0.01	0.16	0.09	0.25	0.01	0.10	0.08	0.17	0.01	0.05
F-value	529*	765*	10.66*	235*	101*	330*	6.48*	105*	77.48*	171*	12.51*	47.39*
Intercept	−1.61*	−0.59*	5.41*	−611*	−0.23	−0.63*	4.66*	−757*	−0.03	−0.54*	0.83	−721*
VACA	26.9*	14.7*	28.4*	5,806*	14.3*	13.0*	17.40*	7,375*	14.66*	11.13*	15.91	8,058*
VAHU	0.05*	0.02*	−0.10	92*	0.01	0.01	0.05	54*	−0.01	0.01	0.40*	19
STVA	0.11	0.10*	0.39	9.02	0.01	0.14*	0.14	53	−0.22	−0.08	0.86	−136
RD/BV	8.06*	6.52*	153*	545	15.1*	8.33*	149.3*	2,740	11.52*	11.74*	135*	6,052*
AD/BV	−10.68*	−6.44*	−96.55*	−3,083	−8.24*	−6.58*	−72.7*	−6,314*	−7.00	−3.19	−1.92	−3,627
Adjusted R^2	0.31	0.40	0.03	0.16	0.10	0.26	0.02	0.10	0.09	0.18	0.02	0.06
F-value	322*	474*	19.82*	142*	66.24*	209*	13.23*	64.55*	49.34*	113*	12.96*	29.69*

Note: * Indicates significant at $\alpha = 0.05$ level

Appendix C: Maditinos and all. (2010, pp. 142-143) Regression tables.

Table I. Descriptive statistics for all study variables

Variable	Mean	Standard deviation	Minimum	Maximum
M/B	1.694	1.862	0.123	7.365
VAIC	4.052	2.555	−15.631	25.148
VACA	0.069	0.042	−0.092	0.236
VAHU	3.364	2.364	−16.369	24.342
STVA	0.619	0.341	−0.837	2.496
ROE	1.211	3.148	−15.689	9.361
ROA	1.123	2.333	−4.361	5.314
GR	8.311	37.318	−36.145	269.329

Table II. Correlation analysis for selected study variables

Variable	M/B	VAIC	VACA	VAHU	STVA
M/B	1.000				
VAIC	0.136	1.000			
VACA	0.369	0.514*	1.000		
VAHU	0.269*	0.789*	0.369*	1.000	
STVA	0.029	−0.013*	−0.129	−0.236	1.000

Note: *Correlation significant at the 0.01 level (two-tailed)

Table III. Regression results – Model 1: M/B and VAIC

Independent variable	Coefficient	*t*-statistic	Significance
Constant	−1,971.535	−0.495	0.622
VAIC	−0.021	−0.164	0.870

Notes: Adjusted $R^2 = 0.000$; F-value $= 99.36$ (p-value > 0.05)

Independent variables	Coefficient	t-statistic	Significance
Constant	−3,457.817	−0.706	0.483
VACA	0.003	0.025	0.369
VAHU	0.126	0.325	0.032
STVA	−0.022	−0.165	0.645

Notes: Adjusted $R^2 = 0.114$; F-value $= 63.14$ (p-value > 0.05)

Table IV. Regression results – Model 2: M/B and VAICs components

	Dependent variables					
	ROE		ROA		GR	
Independent variable	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Constant	1,907.369	2,948*	2,253.304	2.423*	7,124.459	1.005
VAIC	0.095	0.743	0.062	0.498	0.019	0.153
Adjusted R^2	0.095		0.004		0.000	
F-value	2.653		3.698		34.652	

Note: *Significant at the 0.05 level

Table V. Regression results – Model 3: financial performance and VAIC

	Dependent variables					
	ROE		ROA		GR	
Independent variables	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Constant	3,392.369	4.689*	2,555.276	2.276*	6,881.598	0.890
VACA	0.009	0.077	0.056	0.439	0.021	0.161
VAHU	0.432	3.627*	0.054	0.416	−0.025	−0.190
STVA	0.085	0.726	0.041	0.322	0.022	0.171
Adjusted R^2	0.189		0.009		0.002	
F-value	4.698*		21.448		9.367	

Note: *Significant at the 0.05 level

Table VI. Regression results – Model 4: Financial Performance and VAICs components

Annexe C: Note on Lev's residual income Model (Sudarsanam, Sorwar and Marr, 2005, pp.60)

Note: To calculate the intellectual asset discount rate Lev looked at whether cash flow, traditional earnings, or knowledge earnings correlates most with return on equity. He found just a 0.11 correlation between strong returns on equity and cash flows, a 0.29 correlation with traditional earnings, and a strong 0.53 correlation with knowledge earnings. This, therefore, would seem to justify a rate of 10.5% that compares with 4.5% for financial assets and 7% for physical assets.

Annexe D: Dataset selection process

All Companies on the London Stock Exchange At 31 Jul 2014

Number of Companies	Market Value (m)
2,469	£4,114,983

List Date	Company	Sector	Country of Incorporation	Market	Mkt Cap £m
	CAMBRIDGE WATER	Debentures & Loan	GB	Main Market	0
04-Nov-10	ABU DHABI ISLAMIC BA	Company Bonds	AE	Main Market	0
02-Nov-95	ACER INC	Technology Hardwa	TW	PSM	0
27-Jul-38	AECI	Preference	ZA	Main Market	0
15-Dec-04	AIR CHINA	Travel & Leisure	CN	Main Market	0

Figure 24: All companies at 31 July 2014

All Companies on the London Stock Exchange At 31 Jul 2014

Number of Companies	Market Value (m)
1,635	£2,112,738

List Date	Company	Sector	Country of Incorporation	Market	Mkt Cap £m
	CAMBRIDGE WATER	Debentures & Loan	GB	Main Market	0
16-Sep-92	NEWCASTLE BUILDING S	Preference	GB	Main Market	0
05-Mar-98	BAA LYNTON LTD	Debentures & Loan	GB	Main Market	0
22-May-95	L.G.S.INVESTMENTS	Debentures & Loan	GB	Main Market	0
26-Jul-96	PLASMON	Technology Hardwa	GB	Main Market	0
11-Feb-10	TP10 VCT PLC	Equity Investment	GB	Main Market	0

Figure 25: Filter - Country of incorporation = "GB"

All Companies on the London Stock Exchange At 31 Jul 2014

Number of Companies	Market Value (m)
863	£1,663,961

List Date	Company	Sector	Country of Incorporation	Market	Mkt Cap £m
	CAMBRIDGE WATER	Debentures & Loan	GB	Main Market	0
16-Sep-92	NEWCASTLE BUILDING S	Preference	GB	Main Market	0
05-Mar-98	BAA LYNTON LTD	Debentures & Loan	GB	Main Market	0
22-May-95	L.G.S.INVESTMENTS	Debentures & Loan	GB	Main Market	0
26-Jul-96	PLASMON	Technology Hardwa	GB	Main Market	0

Figure 26: Filter - List Date = "Before 2005"

All Companies on the London Stock Exchange At 31 Jul 2014

Number of Companies	Market Value (m)
769	£1,663,961

List Date	Company	Sector	Country of Incorporation	Market	Mkt Cap £m
24-Dec-02	TALENT GROUP	Media	GB	AIM	0.2196
04-Dec-01	GALLEON HOLDINGS PL	Media	GB	AIM	0.39064
25-Sep-02	COBURG GROUP	Beverages	GB	AIM	0.56413
25-Oct-04	FITBUG HLDGS PLC	Leisure Goods	GB	AIM	0.84257
16-Apr-48	HIDONG ESTATE	Food Producers	GB	Main Market	0.85667

Figure 27: Filter Market capitalisation = "different of 0"

All Companies on the London Stock Exchange At 31 Jul 2014

Number of Companies	Market Value (m)
533	£1,647,933

List Date	Company	Sector	Country of Incorporation	Market	Mkt Cap £m
16-Apr-48	HIDONG ESTATE	Food Producers	GB	Main Market	0.85667
05-Apr-00	OXFORD TECHNOLOGY	Equity Investment	GB	Main Market	1.02746
20-Mar-95	HIGHWAY CAPITAL PLC	General Financial	GB	Main Market	1.39113
21-Mar-96	TRIAD GROUP	Software & Compu	GB	Main Market	1.51496
25-Mar-73	ROSS GROUP	Electronic & Electri	GB	Main Market	1.79479

Figure 28: Filter - Market = "Main market"

All Companies on the London Stock Exchange At 31 Jul 2014

Number of Companies	Market Value (m)
20	£36,926

List Date	Company	Sector	Country of Incorporation	Market	Mkt Cap £m
23/11/1995	AIR PARTNER PLC	Travel & Leisure	GB	Main Market	
27/05/2002	PUNCH TAVERNS	Travel & Leisure	GB	Main Market	60.7768
27/08/1996	FULLER SMITH & TURNE	Travel & Leisure	GB	Main Market	292.407
06/11/1995	ENTERPRISE INNS	Travel & Leisure	GB	Main Market	633.484
07/10/1996	RANK GROUP	Travel & Leisure	GB	Main Market	637.872
23/05/1947	MARSTON'S PLC	Travel & Leisure	GB	Main Market	819.557
30/10/1992	WETHERSPOON(J.D.)	Travel & Leisure	GB	Main Market	915.509
09/05/1994	GO-AHEAD GROUP	Travel & Leisure	GB	Main Market	940.054
20/01/1969	RESTAURANT GROUP PI	Travel & Leisure	GB	Main Market	1233.55
20/09/1967	LADBROKES PLC	Travel & Leisure	GB	Main Market	1235.5
26/04/1995	NATIONAL EXPRESS GR	Travel & Leisure	GB	Main Market	1334.35
16/06/1995	FIRSTGROUP	Travel & Leisure	GB	Main Market	1524.03
15/04/2003	MITCHELLS & BUTLERS	Travel & Leisure	GB	Main Market	1532.72
04/02/1955	GREENE KING	Travel & Leisure	GB	Main Market	1796.15
25/04/1996	MILLENNIUM & COPTH	Travel & Leisure	GB	Main Market	1902.41
19/10/1998	STAGECOACH GROUP	Travel & Leisure	GB	Main Market	2043.26
20/06/2002	WILLIAM HILL PLC	Travel & Leisure	GB	Main Market	2499.73
23/10/2000	CARNIVAL	Travel & Leisure	GB	Main Market	4646.82
22/11/2000	EASYJET	Travel & Leisure	GB	Main Market	5120.91
09/07/1948	WHITBREAD	Travel & Leisure	GB	Main Market	7757.04

Figure 29: Filter - Sector = "Travel and leisure"

Annexe E: Proforma for research project:

UNIVERSITY OF Hull

Business School

A PROFORMA FOR

STAFF AND STUDENTS BEGINNING A RESEARCH PROJECT

This proforma should be completed by all staff and research students undertaking any research project and by taught students undertaking a research project as part of a taught module.

Part A (compulsory)

Research Proposer(s): Audrey Delannoy

Student number (if applicable): 201310428

University of Hull email address: A.Delannoy@2013.hull.ac.uk

Programme of Study: MSc Financial Management (Bordeaux)

Research (Working Dissertation/Thesis)
Title: The market value of Intellectual Capital in the tourism and leisure sector in UK.

Research (brief):

Research on the relationship between Intellectual capital, its components (Human Capital, Structural Capital and Relational Capital) and the market to book ratios of 20 companies of the Tourism and Leisure sector in UK, between 2005 and 2013 through the VAIC and the ICTEM methods.
Proforma Completion Date: 6/09/2014

Tick and sign by one of the following statements:

☐ 1) I confirm that *human participants are not involved in my research and in addition no other ethical considerations are envisaged.*

Signature of researcher.....

☐ 2) Human participants are involved in my research and/or there are other ethical considerations in my research.

Signature of researcher.....

If statement 1 is ticked and signed, there is no need to proceed further with this proforma, and research may proceed now.

If statement 2 is ticked and signed the researcher should complete part B of this proforma.