MEASURING INTELLECTUAL CAPITAL EFFICIENCY: A CASE OF FOOTBALL CLUBS IN THE UEFA CHAMPION LEAGUE

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Abstract

The purpose of this study is to examine the intellectual capital efficiency of football clubs in the UEFA Champion League between 2010 and 2019. We measure the intellectual capital efficiency of each football club through Value Added Intellectual Coefficient (VAIC) method developed by Pulic (1998, 2004), Ghosh and Mondal (2009), Yalama (2013), Ozkan, Cakan, and Kayacan (2017). Using a sample of 10 football clubs from 7 countries, we find that almost all clubs use their intellectual capital efficiently with great coefficients. We also document that human capital, as the core of intellectual capital, has a positive impact on structural capital. Our finding is significant for sports managers to make strategic management of intellectual sources to create value in the football industry. It suggests that football clubs should pay more attention to intellectual capital like fan loyalty and talented players. Meanwhile, it helps the sports industry to play a great role of human capital in intellectual capital and to increase the competitive advantage of the enterprise.

Keywords: Sports Industry, Intellectual Capital, VAIC Model, Human Capital, Structural Capital

Authors' individual contribution: Conceptualization – M.J.R.; Methodology – M.J.R.; Software – S.D.; Validation – S.D.; Formal Analysis – S.D.; Investigation – S.D.; Resources – S.D.; Data Curation – S.D.; Writing – M.J.R. and S.D.; Supervision – M.J.R.

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1. INTRODUCTION

Intellectual capital (IC) has played a great role in business activities with the development of enterprise in the information industry. It is the "packaged useful knowledge" (Andriessen, 2004). In management theory, a company's competitiveness relies more on the strategic management of intangibles in today's world. Intellectual capital, as a kind of intangible asset has become a key element for the financial success of an enterprise. Therefore, researchers realize the value of knowledge assets cannot be ignored and initiate the measurement of it (Edvinsson, 1997; Kaplan & Norton, 1996; Roos, Roos, Dragonetti, & Edvinsson, 1997; Steward, 1991; Sveiby, 1997). To measure the intellectual capital, most of the recent studies use the value added intellectual coefficient (VAIC) model developed by Pulic (1998), Pulic (2004), Chen, Cheng, and

Hwang (2005), Joshi, Cahill, Sidhu, and Kansal (2013), Mondal and Ghosh (2012), and Yalama (2013). According to Firer and Williams (2003), VAIC is an easily applicable and effective model to measure firms' intellectual capital performance and make comparisons between firms. Nawaz and Haniffa (2017) found a significant positive relationship between VAIC and accounting performance based on return on assets (ROA).

For measurement of intellectual capital in the football industry, Gürel, Dagli Ekmekci, and Küçükkaplan (2012), by adopting VAIC method, have found that intellectual capital of Turkish football clubs has great efficiency especially for human capital efficiency. Ricci, Scafarto, Celenza, and Gilvari (2015) have also explored the impact of intellectual capital efficiency (ICE) on twelve football firms in the top-flight division of Italian football. However, both of these two studies select data from

the source in one country with a quantitative approach. In order to increase the reliability and credibility of the study, researching the whole European football clubs is a better way to examine ICE with annual reports of top teams. Besides, Ricci et al. (2015) developed a quantitative analysis of some dimensions in ICE and demonstrated that human capital efficiency and relational capital efficiency can increase the value of enterprise but the relationships among intellectual capital components have not yet been illustrated. It is significant to demonstrate the effect of human capital which is the core intellectual capital on structural capital and relational capital.

In previous studies, most researchers choose to concentrate on one place not randomly in several ones. It is unable to examine the IC of different firms in more than two countries. For example, Riahi-Belkaoui (2003) discovered a positive impact of IC on the financial performance of US-based multinational firms. Chen et al. (2005) used the VAIC method for measuring IC of Taiwanese listed companies in their financing activity. Therefore, determining research objects from different countries is a new and valuable approach to examine IC. Gürel et al. (2012) also suggest their study could be expanded by applying the VAIC method for the clubs taking place in European leagues. The analysis of football clubs in the European area can make a great comparison between various countries. This study fills these gaps by measuring IC of 10 European football clubs in the UEFA Champion League.

The purpose of this study is to examine the intellectual capital efficiency of football clubs in the UEFA Champion League between 2010 and 2019. We measure the intellectual capital efficiency of each football club through value added intellectual coefficient (VAIC) method developed by Pulic (1998, 2004), Ghosh and Mondal (2009), and Yalama (2013). Using a sample of 10 football clubs from 7 countries, we find that 8 of the top UEFA football clubs use its intellectual capital efficiently especially for Barcelona and Benfica club. Compared with structural capital and relational capital, human capital is often stable and efficient with a great coefficient of efficiency.

We further investigate the relationship between human capital and structural capital. According to Edvinsson and Malone (1997), the concept of IC consists of three components including human capital, structural capital, and relational capital. Among three types of intellectual capital, human capital is the core capital to play a great role in financial performance. For the structural capital, it could be an organization's database or infrastructure to function human capital. Therefore, the correlation between human capital and structural capital ought to exist. This paper uses a regression model for investigating human capital's effect on structural capital. The regression result demonstrates that human capital, as the core of intellectual capital, has a positive impact on structural capital.

Our study contributes to the literature in the following manner. First of all, to the best of our knowledge, this is the first research that examines the intellectual capital efficiency of football clubs in the UEFA Champion League. We use a sample of 10

football clubs from the whole of Europe. Europe, as the continent where football prevails, is very suitable for research on the intellectual capital efficiency of the football industry. Second, we further investigate the relationship between human capital and structural capital. We prove that human capital, as the core of intellectual capital, has a positive impact on structural capital. What's more, Namvar, Fathian, Gholamin, and Akhavan (2010) made a study of the internal relationship of intellectual dimensions in the e-business industry. This study is a further and specific research to concentrate on the football industry to explore human capital's effect on other dimensions. Finally, our finding is significant for sports managers to make strategic management of intellectual sources to create value in the football industry. It suggests that football clubs should pay more attention to intellectual capital like fan loyalty and talented players.

The remainder of this paper is organized as follows. Section 2 consists of a literature review and key elements of intellectual capital. In Section 3, the paper introduced the data source and research methodology. In Section 4, the main results were explained. In Section 5, the paper discussed the results, theoretical contribution, and reliability and validity of this study, and Section 6 concludes the paper.

2. LITERATURE REVIEW

2.1. Intellectual capital as a kind of intangible assets

Intellectual capital can be defined as intangible assets that are not reported explicitly on a firm's financial statements. However, it has a relationship between employees, ideas, and information, thereby positively impact firm performance (Edvinsson, 1997). It is widely believed that a firm prepare a balance sheet for reporting purpose instead to provide information on the actual value of the firm. Besides, the relationship between financial statements data and the value of the firm has weakened. Moreover, the conventional accounting systems fail to display intangible assets creating value in enterprises (Cañibao, Garcia-Ayuso, & Sanchez, 2000; Lhaopadchan, 2010). Therefore, the realism of the accounting data has been diminishing (Lev & Zarowin, 1999). In the modern world, enterprises not only include the value and wealth of economic resources to their product manufactured but also their intellectual capital as a kind of intangible assets (Chen et al., 2005; Goldfinger, 1997).

According to Powell (2003), intellectual capital plays a superior role in creating firm value. Intellectual capital is treated as one of the important production factors in the knowledge-based socio-economic period and the measurement of firm performance may not be possible with conventional accounting practices any longer. Consequently, it is requiring building up new methods taking account of the intellectual capital as well (Berzkalne & Zelgalve, 2014; Gan & Saleh, 2008). Nadeem, Gan, and Nguyen (2017) found that intellectual capital efficiency is significantly associated with return on assets and return on equity.

It has been acknowledged that intellectual capital is highly related to the enterprise's

competitiveness, profitability, market share, and even customer satisfaction in recent twenty years. There is an increasing focus on the importance of intellectual capital applied to real business for employers in a knowledge society. Initially the concept of intellectual capital (IC) was vaguely mentioned but they realized these intangible assets should be disclosed (Roos et al., 1997). Therefore, a large number of researchers started to figure out the concept of IC, although there is no generally accepted definition for IC. For example, according to Chu, Lin, Hsiung, and Liu (2006), intellectual capital is the sum of knowledge asset to create the value of a company. Martínez-Torres (2006) demonstrates intellectual capital is an intangible asset of an organization which not traditionally recorded in the financial statement but contains more than 80% of market value. Similarly, Peng, Pike, and Roos (2007) claim that intellectual capital is the sum of a hidden asset without recording in the balance sheet completely. It is a strong resource to strengthen sustainable competitive advantages in an organization. According to Edvinsson and Malone (1997), intellectual capital can be divided into human capital, structural capital, and relational capital with three main components.

2.2. Human capital

Edvinsson and Malone (1997), define human capital as the core assets in intellectual capital such as individual skills, knowledge, talent, and experience. It mainly comprises the human ability to solve the company's problem and how efficiently a company uses the human resource to accumulate its knowledge and innovation. For example, in an organization, employees have individual knowledge, skills, experience, and intelligence. These are the resources to strongly create the value of the company.

However, the company cannot own human capital personally because it belongs to an employee naturally. When employees are absent from the company such as annual leave, sick leave, or holidays, the value of human capital will decrease. The company could increase intensive training to increase human capital.

2.3. Structural capital

Structural capital is described as all values supported by human capital. In other words, Structural capital consists of the company's brand image, the company's information system, and the company's database. It can facilitate the formation of organizational policies, culture, relations, and so on. Compared to human capital, structural capital can remain to be preserved when an employee leaves. In other words, it is owned by the company, not people (Edvinsson & Malone, 1997).

There are three main types of structural capital: organizational capital, process capital, and innovation capital (Roos et al., 1997). Organizational capital is the culture and system of the company. Process capital is the process for employees to apply their knowledge into production through a program or project. Innovation capital is other intangible assets except for philosophy and the process of the organization like patent, goodwill, and copyright.

2.4. Relational capital

Relational capital is also regarded as customer capital. According to Edvinsson and Malone (1997), customer capital is the total value of the relationship between the enterprise and its customers especially for the long-term relationship with customer loyalty. The strong relationship with customers can positively influence the promotion of client capital compared to both human capital and structural capital. For relational capital, it involves more than the value created by customers, but also that of relations with other firms, suppliers, and related industries.

In the sports industry, each component of intellectual capital shows significant values of intangible assets in the enterprise. As an example of a football club, talented players, one kind of human capital, fully reinforced the team. Strategies of successful management of the team, important structural capital, are well-implemented for the use of the human resource. Fan loyalty, one basic type of relational capital, is able to both improve the performance of players and establish a strong brand. Therefore, the benefits from these intangible assets ought to be ignored especially for the core part, human capital.

3. METHODOLOGY

3.1. Data collection

The sample of the study is 10 top football clubs from 7 different countries playing in the UEFA Champion League over the period from 2010 to 2019. These clubs have a great reputation and popularities in different countries like Spain, the United Kingdom, and France. The Table 1 shows the clubs included in this study. The data is collected on the financial annual report of the club's official website severally and from Bloomberg Terminal.

Table 1. Clubs included in the study

Club	Country
Real Madrid	Spain
FC Barcelona	Spain
Liverpool FC	England
Manchester United	England
AS Roma	Italy
Juventus	Italy
Dortmund	Germany
Galatasaray AŞ	Turkey
SL Benfica	Portugal
Olympique Lyonnais	France
Celtic	Scotland

3.2. Measuring intellectual capital

In order to examine the existing intellectual capital, researchers find two approaches: measuring IC separately or as a whole. Choosing to combine these approaches is more logical. There are three general methods for measurements of intellectual capital including *market-to-book ratio, Tobin's Q ratio,* and *calculated intangible value* (İşeri & Kayakutlu, 2003).

Market-to-book ratio is calculated by market value – market price per share of common stock multiplied by the number of outstanding shares – divided by the book value shown on the company's

balance sheet. It indicates how a company evaluates its current value related to book value. In other words, it compares a company's net asset available in relation to the sales price of the stock. It is a simple way to measure IC but limited by external factors that may influence the stock price. The stock price is most likely to be changed by the economic environment. On the other hand, depreciated historical costs are flexible and result in underestimating the actual value of book value (Gürel et al., 2012). The equation for the market-to-book ratio is as follows:

$$M/B = Market\ Capitalization/Total\ book\ value \tag{1}$$

Another method for measurement of intellectual capital is Tobin's Q ratio. It can be used for measuring IC both separately and as a whole. Compared to the market-to-book ratio, the Q ratio replaces the book value of tangible assets with a replacement cost of tangible assets (Gürel et al., 2012). The replacement cost is the cost of producing a new product to replace the essential asset. If Tobin's Q ratio is higher than 1, it indicates the company has a high value of intellectual capital with great profits. The function is displayed as:

$$Intellectual\ Capital = Market\ Value/Asset\ Replacement\ Cost \tag{2}$$

The final method, calculated intangible value (CIV), describes as recording the fixed value of an intangible asset such as goodwill and copyright, which is not affected by the market value of an enterprise. Generally, the value of the intangible asset is determined by the market value of tangible assets subtracting the book value of tangible assets. However, the variability of market value cannot be ignored. CIV method takes additional factors into consideration like pretax earnings and returns on asset. Especially for ROAs, CIV compares the industrial average of ROA with the company-specific ROA (Aho, Ståhle, & Ståhle, 2011).

3.3. Value added intellectual coefficient (VAIC) method

In this paper, the intellectual capital efficiency of each football club is calculated with the VAIC method, which was developed by Pulic (1998, 2004), Ghosh and Mondal (2009), and Yalama (2013). This method intends to measure how efficient the company uses intellectual capital based on value-added assets of the enterprise. There are three components showing in Figure 1. Each of the intellectual capital efficiency is calculated by individual equation.

Figure 1. Value added intellectual coefficient (VAIC) model
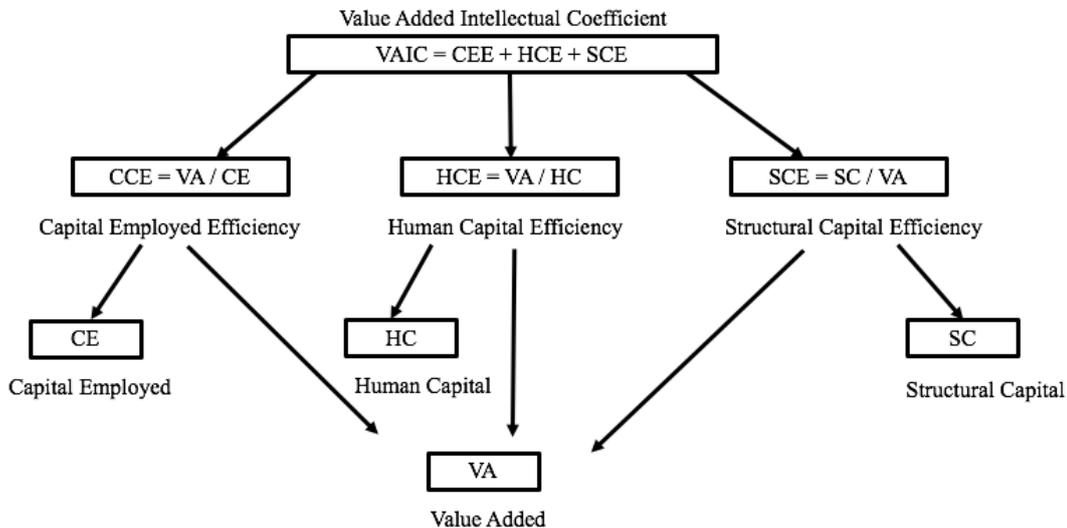
VAIC is calculated as follows (Ghosh & Mondal, 2009; Pulic, 1998, 2004; Yalama, 2013; Ozkan et al., 2017):

$$VAIC_i = CEE_i + HCE_i + SCE_i \tag{3}$$

In equation (3), $VAIC_i$ refers to the value added intellectual coefficient of the football club *i; CEE_i* refers to the capital employed efficiency coefficient of the football club *i; HCE_i* refers to the human capital efficiency coefficient of the football club *i;* and SCE_i refers to the structural capital efficiency coefficient of the football club *i*. In order to calculate these variables, the total value added *(VA_i)* created by the football club needs to be calculated. Total VA_i is calculated as follows (Al-Musali & Ismail, 2014; Alipour, 2012; Chu, Chan, & Wu, 2011; Pulic, 2004):

$$VA_i = OP_i + C_i + D_i + A_i \tag{4}$$

In equation (4), VA_i refers to the total value added created by the football club *i; OP_i* refers to the operating profit of the football club *i; C_i* refers to the total salary and wage costs of the football club *i,* and A_i refers to the amortization and depreciation of the football club *i*.

Following the calculation of the total VA_i, the components of $VAIC_i$ (CEE_i, HCE_i and SCE_i) are calculated. CEE_i, the first component of $VAIC_i$, is calculated as follows:

$$CEE_i = VA_i/CE_i \qquad (5)$$

In equation (5), CE_i refers to the capital employed (book value of assets) of the football club i; in other words, the equity value of the football club i. HCE_i and SCE_i are calculated as follows:

$$HCE_i = VA_i/HC_i \qquad (6)$$

$$SC_i = VA_i - HC_i \qquad (7)$$

$$SCE_i = SC_i/VA_i \qquad (8)$$

In equations (6), (7), and (8), HCE_i refers to the human capital efficiency coefficient of the football club i. HC_i refers to the personnel expenses of the football club i, and SC_i refers to the difference between VA_i and HC_i. VA_i refers to total value added of the football club i, and HC_i refers to total salary and wage costs for football club i.

4. RESULTS

4.1. Capital employed efficiency coefficient

Table 2 indicates the calculation of capital employed efficiency coefficient in 10 UEFA Champion League clubs. The value added of the football team is calculated by the function mentioned in equation (4) in the methodology section. The capital employed of each club is interpreted as the book value of an enterprise, which is the net asset of a club. For calculation of total value added and capital employed, we took the average of ten-year data from 2010 to 2019 for each club. It can be observed that the coefficient of Barcelona ranked first at 9.714. It suggests that investing 1 capital employed can create 9.714 additional value, showing great efficiency. Following Barcelona, both Juventus and Benfica also have great capital employed efficiency close to 5. On the contrary, the coefficients of Roma and Galatasaray for capital employed are negative with inefficiency due to negative capital employed collected in these clubs' financial statements. Compared to eight other clubs, Roma and Galatasaray are unable to create extra value from capital employed.

Table 2. Capital employed efficiency coefficients of clubs

Club	VA	CE	CEE
Machester United	328.25	434.55	0.755
AS Roma	147.04	(79.80)	(1.843)
Juventus	276.19	53.63	5.150
Dortmund	195.78	211.35	0.926
Galatasaray	52.63	(43.99)	(1.196)
SL Benfica	129.54	25.57	5.066
Olympique Lyonnais	105.68	153.52	0.688
Celtic	61.01	62.06	0.983
Liverpool FC	168.01	45.23	3.715
FC Barcelona	447.12	46.03	9.714

4.2. Human capital efficiency coefficients

Human capital efficiency is the coefficient for measuring the efficiency of human resource applied to creating the company's value. Human capital can be regarded as employee expense (Ilkka et al., 2011). We collected total salary and wage costs in the reported income statement of each club as human resource investment. For some clubs without the total salary and wage costs account, human capital for them is interpreted as personnel expense, which is similar to employee benefit expense. Table 3 demonstrates human capital efficiency coefficients of UEFA clubs, showing how the efficient company creates additional value invested in human resources. The highest human capital efficiency coefficient belongs to the Benfica club. Overall, all clubs got efficient human capital, each of which is close to or higher than 1. The value "1" presents that total value added has been affirmatively transferred into human resource costs, showing the efficiency of human capital as the part of intellectual capital.

Table 3. Human capital efficiency coefficients of clubs

Club	VA	HC	HCE
Machester United	328.25	216.82	1.514
AS Roma	147.04	129.21	1.138
Juventus	276.19	204.40	1.351
Dortmund	195.78	123.14	1.590
Galatasaray	52.63	61.67	0.853
SL Benfica	129.54	60.28	2.149
Olympique Lyonnais	105.68	99.81	1.059
Celtic	61.01	49.12	1.242
Liverpool FC	168.01	147.09	1.142
FC Barcelona	447.12	336.46	1.329

4.3. Structural capital efficiency coefficients

In the VAIC model, structural capital is the difference between the produced value added and human capital (Pulic, 1998, 2004; Ilkka et al., 2011; Fijałkowska, 2014). It is recorded as a traditional accounting and financial variable rather than a specific class as structural capital (Ilkka et al., 2011). Structural capital is the value for human capital to function. If the total value added is smaller than human capital, the value of structural capital will be

negative like SC of Galatasary club in Table 4. Therefore, CEE for Galatasary is also negative. Except for this club, other clubs have positive value but each of them is smaller than 1. Among ten clubs, the highest structural capital efficiency belongs to Benfica. This result is also similar to human capital efficiency in Table 3. It shows the Benfica club creates about 0.535 units of capital for the enterprise through structural capital. Compared to Benfica, the Olympique Lyonnais club achieves less efficient capital for enterprise with CEE at 0.506.

Table 4. Structural capital efficiency coefficients of clubs

Club	SC	VA	SCE
Machester United	111.43	328.25	0.339
AS Roma	17.83	147.04	0.121
Juventus	71.79	276.19	0.260
Dortmund	72.65	195.78	0.371
Galatasaray	(9.04)	52.63	(0.172)
SL Benfica	69.26	129.54	0.535
Olympique Lyonnais	5.88	105.68	0.056
Celtic	11.89	61.01	0.195
Liverpool FC	20.92	168.01	0.125
FC Barcelona	110.66	447.12	0.247

4.4. Intellectual capital efficiency

In order to measure the intellectual capital efficiency of each club as a whole, three types of intellectual capital efficiency are summed up to analyze. We make a comparison between clubs and identify the potential of the club's value creation. Table 5 illustrates the total intellectual capital efficiency coefficient of each club with ten-year average data. The main result is that except for Roma and Galatasary, eight other clubs have great intellectual capital efficiency with more than "1" value. The higher the coefficient, the greater the ability and efficiency for the club to create value and make resources utilization (Fijałkowska, 2014). Barcelona, one of the top football clubs in Spain, ranked the first in UEFA clubs with the total VAIC at 11.29, which is much higher than any other clubs. It means Barcelona has the greatest labor productivity and the most efficiency of creating capital among ten clubs. Following Barcelona, Benfica whose coefficient is 7.75 also used its intellectual capital efficiently. On the contrary, the intellectual capital efficiency coefficients for both Roma and Galatasary are negative, presenting inefficiency. VAIC model cannot apply to negative book value or negative profit for the enterprise. It suggests incorrect productivity through creating value by intellectual resources (Fijałkowska, 2014).

Table 5. Intellectual capital efficiency of UEFA clubs in average 2010-2019

Club	VAIC (ICE)
Machester United	2.609
AS Roma	(0.583)
Juventus	6.761
Dortmund	2.887
Galatasaray	(0.515)
SL Benfica	7.750
Olympique Lyonnais	1.803
Celtic	2.420
Liverpool FC	4.981
FC Barcelona	11.290

Note: VAIC coefficient means total intellectual capital efficiency (ICE).

In order to make a panel data analysis between 10 clubs, Figure 2 was created to display each component of intellectual capital efficiency for an individual club. Each type of bar stands for specific intellectual capital efficiency respectively. The yellow line represents the VAIC of clubs, also meaning the total coefficient of intellectual capital efficiency (ICE). Human capital, as the core of intellectual capital, is often stable and efficient among UEFA clubs. In these orange bars, the coefficients for human capital is almost higher than 1. Compare to human capital efficiency (HCE), capital employed efficiency (CEE) in blue bars fluctuate among clubs based on their book value of the enterprise. Sometimes it could be negative due to equity loss like the Roman and Galatasasry club. Structural capital, as the difference between total value added and human capital, is a small proportion of intellectual capital like these grey bars. Compared to human capital, all clubs create less capital through investing in structural capital and might also be negative if human capital is larger than the total value.

Besides, we also focus on average intellectual capital efficiency (ICE) of ten clubs between the periods from 2010 to 2019. Each year of VAIC is calculated by the average of total intellectual capital efficiency in ten clubs. Except for 2014, intellectual capital is usually efficient in UEFA Champion League for ten years. In 2010, football clubs have the highest average intellectual capital efficiency at 5.711. After 2010, it dropped to 2.153 in 2012 and then continued to fall at 1.393 in 2013. However, for 2014, it became negative and inefficient, which is unexpected results. In the recent four years, the value of average ICE has been stable between 3 to 4. It can be predicted that each club tends to use its intellectual capital efficiently to create capital and value.

Figure 2. Intellectual capital efficiency of UEFA clubs in average 2010-2019
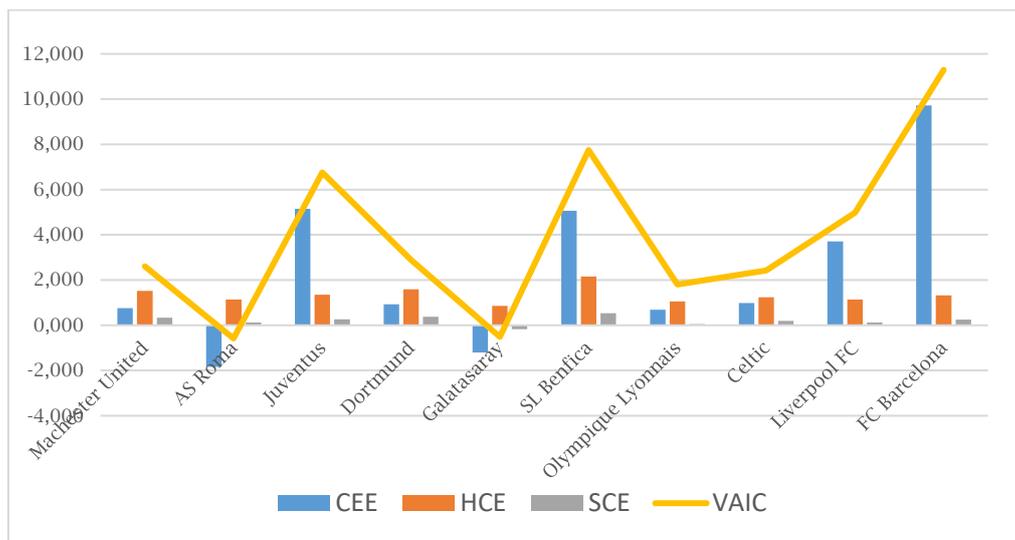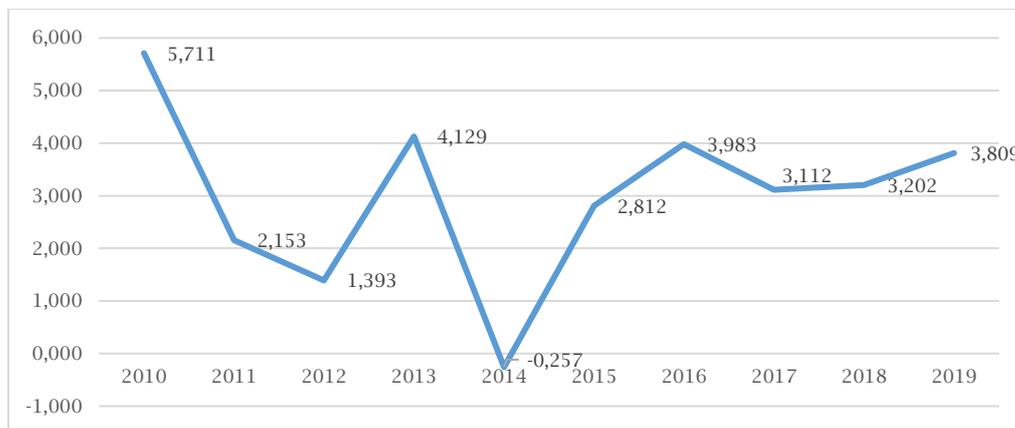

Figure 3. Average intellectual capital efficiency of UEFA clubs in 2010-2019

4.5. Additional test: Relationship between human capital and structural capital

This study also investigates the relationship between human capital and structural capital in intellectual capital dimensions. According to Edvinsson and Malone (1997), the concept of IC consists of three components including human capital, structural capital, and relational capital. Among three types of intellectual capital, human capital is the core capital to play a great role in financial performance. For the structural capital, it could be an organization's database or infrastructure to function human capital. Therefore, the correlation between human capital and structural capital ought to exist and be positive. Namvar et al. (2010) explore the effect of human capital on structural capital in the e-business industry in Iran. They adopted the regression model to analyze. Finally, they provided adequate evidence that three components of intellectual capital are correlated. It could show human capital has a great relationship with structural capital. Manzaneque, Ramírez, and Diéguez-Soto (2017) investigate the role played by both human and structural capital efficiency as determinants of achieving technological innovation outputs. Their finding suggests that

findings also suggest that family management increases the efficiency of human and structural capital to obtain technological innovation outcomes.

In order to explore the relationship between human capital and structural capital, this study adopts a regression analysis from Namvar et al. (2010). The regression equation is as follows:

$$SC_i = \beta_0 + \beta_1 HC_i + \beta_2 SCI_i + \beta_3 GDP + \beta_4 AGE + e_i \quad (9)$$

4.5.1. Dependent variable

In this study, one of the aims is to demonstrate the hypothesis that human capital (HC) has a positive impact on structural capital (SC) in the football industry. In the regression model, we regard structural capital as a dependent variable, which is affected by the change of human capital and certain control variables. When calculating intellectual capital efficiency (ICE) through the VAIC model, the structural capital is also calculated as the difference between total value added and human capital.

4.5.2. Independent variable

Similarly, we also calculate human capital with total salary and wage costs. In the main results, the value of human capital would stand out from all types of intellectual capital, which indicates human capital is the center of intellectual capital. Therefore, in the relationship between human capital and structural capital, human capital, as the independent variable, controls the hypothesis by changing its value to test structural capital efficiency. Meanwhile, another independent variable is the social capital index (SCI). Social capital involves the relationship between employees and companies and creates value and competitive advantage (Hitt & Duane, 2002). Therefore, it can also be a factor that affects structural capital. Social capital is measured by the social capital index (Lee, Jeong, & Chae, 2011).

4.5.3. Control variable

In this regression model, there are two control variables including GDP of each country and years for company publicly traded (AGE). GDP of each country from 2010 to 2018 is collected on the Trading Economic website. The AGE index is the natural logarithm of one plus the number of years a firm goes public. We collect data from Bloomberg Terminal. These control variables strongly influence regression results, although they are not the primary interest in the relationship between SC and HC.

We collect each variable for the regression model with 50 samples of publicly-traded clubs. Table 6 summarizes these variables efficiently. Structural capital, as the dependent variable, has a great standard deviation among observed objects, which is consistent with human capital. However, the mean of structural capital is close to 60, which is much smaller than that of human capital. For the SCI, it indicates that the sample from different countries with a similar score of social capital. In control variables, GDP has the mean at 15.88, and AGE has the mean at 2141.464 respectively. Among these clubs, Manchester United went public at the latest with seven years.

Table 6. Summary of variables in the regression model

Variable	Obs.	Mean	Std. Dev.	Min	Max
SC	50	59.6252	44.66376	0.49	217.82
HC	50	230.8774	72.74196	0.38	295.94
SCI	50	6.115	0.962141	3.97	7.05
GDP	50	2141.464	1160.161	199.42	3996.76
AGE	50	15.88	4.547437	7	21

Table 7 presents the correlation analysis among dependent and independent variables. For the main investigation between human capital and structural capital, the value "0.6964" demonstrates that structural capital and human capital are correlated tightly and positively. For SCI, it has a value of 0.1241 with structural capital, which shows little relevance to structural capital. However, it has a great positive correlation with GDP.

Table 7. Correlation analysis

	SC	HC	SCI	GDP	AGE
SC	1.0000				
HC	0.6964*	1.0000			
SCI	0.1241	0.3020	1.0000		
GDP	0.0704	0.3244	0.8947*	1.0000	
AGE	-0.4620**	-0.2985**	0.1532	0.3110	1.0000

*Notes: * The value between 0.5 and 1.0 means a great positive correlation between each other.*
*** The value under 0 means a negative correlation between each other.*

Table 8 shows the regression results in the STATA. It is noticeable that the p-value of human capital is 0.000, showing very significant. The coefficient for human capital is 0.3974751, which captures the relationship between human capital and structural capital. It indicates that the higher value of human capital impacts structural capital positively. On the contrary, the control variable, AGE, has negative coefficients at -2.284088. It demonstrates that the higher level of AGE impact structural capital negatively. However, the p-value of social capital is 0.602 which is higher than 0.1, suggesting insignificance. Compared to control variables, the significance of human capital and social capital is much more important. The F-value with "0.0000" also presents that the regression analysis is significant.

Table 8. Regression analysis

Dependent Variable: SC	Coef.	Std. Err.	t	P >	t		[95%Conf.	Interval]
HC	0.397***	0.0721	5.51	0.000	0.252	0.543
SCI	5.689	10.820	0.53	0.602	-16.104	27.484
GDP	-0.006***	0.009	-0.70	0.489	-0.026	0.013
AGE	-2.284	1.200	-1.90	0.064	-4.702	0.134
_cons	27.646	58.373	0.47	0.638	-89.922	145.216
Observations	50					
Prob > F	0.000					
R-squared	0.561					
Adj R-squared	0.522					

Notes: This table presents regression results from testing the relationship between human capital and structural capital. The dependent variable is Structural Capital (SC), which is calculated as the difference between total value added and human capital. Human Capital (HC) is the independent variable, which is calculated based on total salary and wage costs. In this regression model, there are two control variables including GDP of each country and years for company publicly traded (AGE). GDP of each country from 2010 to 2018 is collected on the Trading Economic website. The AGE index is the natural logarithm of one plus the number of years a firm goes public.

*** If p < 0.1, it shows the results with significance in the regression model. If the coefficient is positive, it shows a positive relationship, otherwise negative.

5. DISCUSSION

With the VAIC model, it can be concluded that almost all clubs have efficient intellectual capital except for Roman and Galatasary. These clubs achieve great ability to create value through intellectual resources. In addition, the highest intellectual capital efficiency belongs to the Barcelona club. Among the three components of intellectual capital, human capital usually takes a stable proportion with great efficiency but not for structural capital and relational capital. The latter two are easier to be affected by operating profit and book value. Another hand, based on regression results, the findings can demonstrate that human capital affects structural capital positively.

In Table 4, the total intellectual capital efficiency (ICE) of each club is partly significant. The negative value of both Roma and Galatasary is unexpected. Roma's negative ICE is attributed to equity loss, which leads to negative capital employed efficiency. Roma club was most likely to suffer from large accumulated loss and large dividend payments for ten years. Like Roma, Galatasary faced equity loss but also operating loss. It influences the calculation of total value added with a negative value, therefore resulting in negative structural capital. Similarly, in Figure 2, the average VAIC in 2014 was different at -0.257. The average value of ten clubs might also be affected by some club's both operating loss and equity loss. It suggests UEFA football clubs in 2014 could not create value more efficiently through investing in intellectual capital than those in any other year. In regression analysis, there is also an insignificant result of social capital's p-value at 0.602. The measurement of social capital is based on the social capital index (SCI) developed by Lee et al. (2011). It might not be updated to the latest index in 2019 by countries.

This study also has some limitations. Compared to other information industries, the sports industry especially for football has less organizations to be publicly traded. Therefore, when selecting a sample in UEFA Champion League, some popular and prevalent clubs are unable to collect data like Real Madrid. In the process of calculating total value added (VA), components might not be added correctly like write-downs (D). The component "D" should be calculated by write-downs of both current and long-term assets but there's not one account representing write-downs in the balance sheet. Some of the accounts lacked information when searching in Bloomberg Terminal. Therefore, calculation errors from these components exist when analyzing VAIC of each club. Meanwhile, the VAIC model remains some shortcomings and drawbacks. Since Pulic (1998, 2004) was the first to put forward the method, many researchers have applied the model into the regional and national analysis of individual company's performance on intellectual capital. However, it still cannot be a formal and conceptual method for measuring intellectual capital efficiency. For the human capital, the VAIC model defined it as total salary and wage costs simply but human capital is more complex and variable at labor costs, which probably underestimates the value. Another hand, if a company discloses a negative book value or negative profit, VAIC will be negative and cannot perform correctly on measuring intellectual capital as a whole (Fijałkowska, 2014).

For the reliability of research, this study follows previous research undertaken by Gürel et al. (2012) who examined the intellectual capital through the VAIC model. This model has been acknowledged by many previous researchers (Pulic, 1998, 2004; Ghosh & Mondal, 2009; Yalama, 2013). For the additional test, the author adopts a regression model to investigate the relationship between human capital and structural capital according to Namvar et al. (2010) who figure out the correlation between internal intellectual capital dimensions. These reliable analysis techniques are adopted by this study to measure IC of European football clubs with similar findings. For the validity of research, the sample of this study is top and prevalent football clubs in a large-scale European league. Although Liverpool and Barcelona are not publicly traded, the influence and publicity are also admitted by people around the world in the football industry. The ten-year average data from 2010 to 2019 is also significant and valid for regression and VAIC analysis.

Followed by Gürel et al. (2012), the study adopts the VAIC method into the calculation of the intellectual capital efficiency of football clubs from various countries in the UEFA Champion League. What's more, the calculation of the total value added of enterprise is also based on Gürel and her partners' equation (Gürel et al., 2012). Turkey, one country in Europe, merely occupies a small proportion of the football industry. Except for

Turkey, the author also investigates the football industry in six other countries in Europe like Spain, England, and so on. In the finding and analysis part, we also create a related line chart to compare each intellectual capital efficiency of clubs in different countries. It is significant to look through the impact of IC on the whole European football industry base on a prevalent European league. On the other hand, we initiate research on the internal relationship between human capital and structural capital. It can help future study to focus on the promotion of structural capital from human capital in an enterprise.

6. CONCLUSION

Due to the increasing importance of intellectual capital in the sports industry, this study makes its objective to measure the intellectual capital of each football club in UEFA Champion League and to demonstrate whether human capital has a positive impact on structural capital or not. We determine 10 top clubs from 7 various countries in the UEFA Champion League as the sample of this study. For the methodology, we adopt the VAIC model to measure the efficiency of intellectual capital in ten clubs. With panel data analysis, we find that 8 of football clubs used intellectual capital efficiently especially for Barcelona and Benfica clubs. Among intellectual capital, human capital usually obtains a stable and great efficiency coefficient but not for structural capital and relational capital. What's more, we undertake an additional analysis with the regression model. Through the regression results, it has affirmed that human capital influences structural capital positively.

With the VAIC model to measure intellectual capital, previous researchers have focused on national analysis for the overall efficiency of

companies. Gürel et al. (2012) have determined whether using intellectual capital can seek profit for sports enterprises by analyzing two Turkish football clubs. This study expands the sample in different countries from the Europe area. However, the sample cannot contain some top clubs which not publicly traded because they lack detailed and adequate financial information. What's more, the application of the VAIC model is unable to perform on clubs with negative operating profit and negative equity.

This study contributes to the existing literature. This study expanded research on the whole of Europe from various countries. Europe, as the continent where football prevails, is very suitable for research on the intellectual capital efficiency of the football industry. This study is further and specific research to concentrate on the football industry to explore human capital's effect on other dimensions. It brings more opportunities for the company to make strategic management of human capital in the sports industry.

The football industry is one kind of sports industry. For the development of sports enterprise, this study could continue to be undertaken for other sports industry such as basketball. It is significant for researchers to make a great comparison between different sports industry. Similarly, future studies for other industries could also adopt regional analysis in one continent with various countries. Besides, using more than two methods for measuring intellectual capital can decrease calculation error efficiently. One major suggestion is combining the VAIC model with the market-to-book ratio. Meanwhile, relationships between intellectual capital dimensions could also be researched specifically such as the effect of human capital on components of relational capital.

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