“Value creation potential of intellectual capital in the digital content industry”

AUTHORS	Hsing-Hwa Hsiung Juo-Lien Wang

ARTICLE INFO	Hsing-Hwa Hsiung and Juo-Lien Wang (2012). Value creation potential of intellectual capital in the digital content industry. *Investment Management and Financial Innovations*, *9*(2)
RELEASED ON	Thursday, 07 June 2012
JOURNAL	"Investment Management and Financial Innovations"
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
0	**0**	**0**

© The author(s) 2024. This publication is an open access article.

BUSINESS PERSPECTIVES

businessperspectives.org

Hsing-Hwa Hsiung (Taiwan), Juo-Lien Wang (Taiwan)

Value creation potential of intellectual capital in the digital content industry

Abstract

This study calculated the value of intangible assets in Taiwan's digital content industry using the classification method of Sveiby (2010), based on five valuation models for intangible assets (the market capitalization methods of MV/BV and Tobin's q, and the return on assets methods of CIV, EVA, and VAIC^{TM}), and also conducted comparative analysis of the various valuation methods. This study reached the following research conclusions: (1) There is a high correlation between market capitalization type valuation methods, but low correlation between the return on asset type methods. Therefore, when valuating intangible assets, the objectives must be very clear and the valuation method must be chosen carefully. An appropriate method must be chosen from the perspective of suitability to prevent false estimation of the company's real value. (2) The four dimensions of financial assets and intellectual capitals (structural, human, and relationship capitals) are not individually related to the company's value creation, and they have mutual contribution, advancement, and growth. The greater the synergy produced by their interaction, the greater the contribution they make to the value of the company.

Keywords: intellectual capital, digital content industry, valuation.
JEL Classification: M49.

Introduction

With the arrival of the era of the knowledge-based economy, companies in many emerging industries emphasize knowledge intensity and innovation as the tools of industry competition. In contrast to companies in traditional industries, these knowledge-based industries no longer rely on familiar factors of production to create benefit, but create company profit through the creation of intangible assets such as R&D capacity and results. In practice, the value of intangible assets and knowledge creation, such as brand value, copyrights, and trademarks, is the key to the company's success. In academia, after about a decade of practical application and development, the theoretical framework related to intangible assets has gone further than simply that of a performance measurement tool, and its application has gradually expanded to the overall sphere of strategy management and execution, establishing a relationship between intangible asset management and strategic management (Itami and Roehl, 1987; Kaplan and Norton, 2004; Parr, 1991).

Intangible asset management is not only related to an organization's value but also an important key to company growth. However, when a company wants to make intangible assets into an even greater tool for use in competition, they must face certain questions of valuation. Although the traditional mode of financial reporting can accurately express the cost-benefit analysis for a certain year, it is biased toward short-term tangible measurement, and has the shortcoming of not being able to clearly calculate the real value of intangible assets (Osborne, 1998; Chu, Hsiung, Huang and Yang, 2008). Therefore, if the significance of intangible assets can be deeply understood, and if the basic modules of strategic themes and intangible assets can be specifically applied by connecting and integrating strategies and objectives through causality, then intangible assets can be used to illustrate the changing competitive advantages and courses of organizations and industries, and can become a management tool for strategic planning and operations (Hall, 1992; Kaplan and Norton, 2004).

Because knowledge management is so critical today, companies must understand what their intangible assets are worth, how they are being valued, and from where in the company that value is being derived. This paper intends to use the valuation of intangible assets and confirm the determinants thereof to understand how the digital content industry − which has the unique features of a high degree of specialization, continual innovation, high added value, a high degree of knowledge concentration, and heavy reliance on intellectual capital − creates its competitive advantages. The research findings of this paper can be used as a guide by knowledge-based industries for strategic management, and by administrative units for science and technology policy.

Numerous scholars have presented many different methods for evaluating intangible assets, but each method has its own limitations in actual implementation. Based on the framework of Luthy (1998) and Williams (2001), Sveiby (2010) thoroughly organized 28 methods for measuring intangible asset value and summarized these into four main models. However, a set of universally applicable criteria is still lacking, especially in the areas of indicator selection and valuation models with quantitative val-

© Hsing-Hwa Hsiung, Juo-Lien Wang, 2012.

ues; and there are still many divergent viewpoints and room for discussion (Chu et al., 2008). Whereas there is no dearth of literature that discusses measurement methods and value determinants. Furthermore, most empirical studies rely on a single methodology instead of discussing comparative results. The first purpose of this study employs five evaluation models to compute the intangible value of digital content industry in Taiwan. Through hypothesis testing to understand the difference between the evaluation methods. It can be used as a reference implementation of evaluation by high intangible assets companies.

In addition, in the process of searching for methods to evaluate the intangible assets and intangible production procedures of companies, intellectual capital can provide a new model for observing a company's value. Roos (1998) suggested that the concept of intellectual capital can be used for more than just understanding, assessing, and graphically depicting a company's latent value. It can be taken further to convert its results into new value. Therefore, the development of intellectual capital should be regarded as the best tool for creating future intangible value for a company. The company model proposed by Sullivan (2000) used ordinary assets as a foundation and intellectual or intangible assets as distinct assets, and the findings of that study showed that a company can only create value by combining these two types of assets to produce differentiated assets. In a study of the biochemical industry of Finland, Hernams and Kauranen (2005) confirmed that the three types of intellectual capital − when assessed individually − are mostly unrelated to company revenue. However, their interaction indeed possesses a decisive influence on future company revenue. Therefore, our second objective in this study is to explore the correlation of financial and intellectual capital with a company's value creation.

The paper is organized as follows. Section 1 presents the five valuation methods and 26 metrics according to a review of the existing literature. Section 2 presents the research methodology. Section 3 discusses the statistical results of this study. Finally, this paper discusses the implications and suggests a direction for subsequent research.

1. Literature review and hypothesis construction

1.1. Digital content industry[1]. No globally recognized consistent classifications currently exist for the digital content industry, but the scope of discourse is generally consistent, with only minor differences. The areas of digital gaming, computer animation, digital recording, mobile content, online learning, and network information have been the foci of attention by studies from various countries. According to the annual analysis of the global entertainment and media market by PricewaterhouseCoopers, the scale of the global entertainment and media market in 2006 was US$1.43 trillion, and it was estimated that it could reach US$1.96 trillion in 2011, which is a compounded annual growth rate of 6.4 %.

According to statistics from E&M, the United States is the world's largest market, with a market scale of US$582.4 billion in 2006, which was 40.7% of the global market share. It was estimated that this would reach US$754.2 billion in 2011, for a compounded annual growth rate of 5.6%. It is estimated that in the next several years, Internet services will be the area with the fastest growth in the US market. Europe, Middle East, and Africa (EMEA) is the second largest market, with a market scale of US$473 billion in 2006, or 33% of the global market share. It was estimated that this would reach US$616.9 billion in 2011, for a compounded annual growth rate of 5.5%. The fastest growing segments of this market are anticipated to be the Internet, digital television, and digital gaming.

The Asia Pacific region is the world's third largest market, and it is the market with the fastest continual growth rate, especially the two regions of China and India. The Asia Pacific region had a market scale of US$297 billion in 2006, or 20.7% of the global market share. It was estimated that it would reach US$470.4 billion in 2011, for a compounded annual growth rate of 9.6%, making it the fastest growing region in the world. Latin America had a market scale of US$44.2 billion in 2006, and it was estimated that it would reach US$66.7 billion in 2011, for a compounded annual growth rate of 8.9%. Canada had a market scale of US$35.7 billion in 2006, and it was estimated that it would reach US$46.8 billion in 2011, for a compounded annual growth rate of 5.6 %,

1.2. Valuation of intangible assets. This study uses five different methods: market return methods MV/BV and Approximate Tobin q, and asset return methods CIV, VAIC^{TM}, and EVA. These methods are applied to twenty digital content companies each from Taiwan to compute the values of their intangible assets. There are three advantages to employing both market and asset return approaches. First, they are useful in merger & acquisition situations and for stock market valuations. Second, they can be used for comparisons between companies within the same industry. Third, they help quantify goals and directions for CEOs. The formula of five evaluation methods are as follows:

[1] Source: *Annual Review of the Digital Content Industry in Taiwan*, 2007.

1. Market Value/Book Value (MV/BV):

$$\frac{MV}{BV} = \frac{Market\ Share\ Price \times Number\ of\ Common\ Shares\ Outstanding}{Total\ Assets - Total\ Liabilities}.$$

2. Approximate Tobin *q*:

Approximate Tobin q = (*MV* + *PS* + *Debt*)/ *Total Asset Book Value*,

where *MV* = *MVE* = share price × number of common shares outstanding; *PS* = liquidating value of firm's outstanding preferred stock; *Debt* = (short-term liabilities – short-term assets) + book value of LT debt.

3. Calculated Intangible Value (CIV):

$$CIV = \frac{(1 - Tax\ Rate) \times (Excess\ Return)}{Appropiate\ Discount\ Rate} = \frac{(1 - Tax\ Rate) \times EBT - (Industry\ ROA\ Avg \times Tangible\ Assets\ Value)}{Appropiate\ Discount\ Rate}.$$

Tangible Assets Values are based on 3-year average. Appropriate discount rate estimated by WACC in 2003.

4. Value Added Intellectual Coefficient (VAIC^{TM}):

$$VA = Depreciation + Dividends + Taxes + Retained\ Earnings + Wages,$$

$$VAIC^{TM} = Capital\ efficiency\ index + human\ efficienct\ index + structural\ efficiency\ index =$$

$$= \frac{VA}{Book\ Equity} + \frac{VA}{Wages} + \frac{VA - Wages}{VA}.$$

5. Economic Value Added (EVA):

EVA = (*Return on Invested Capital* − *WACC*) × *Capital Employed.*

1.3. Hypothesis construction. *1.3.1. Intangible asset value and valuation method.* The two valuation methods of MV/BV and Approximate Tobin *q* are market capitalization methods. Edvinsson and Malone (1997) stated that intellectual capital represents the hidden difference between market value and financial capital, and argued that the difference between market value and book value is none other than the intellectual capital of a company. However, to make the difference between market value and book value more reliable for use, the proportion of market value to book value should be examined. This is what we call the market value/book value ratio (MV/BV). When the ratio is higher, it means that the intangible assets owned by the company are higher in value (Stewart, 1997). The Approximate Tobin *q* value is the ratio of a company's market value and replacement cost. The Approximate Tobin *q* ratio is mainly used to predict the company's investment decisions without consideration of economic factors. Both of these indicators have a high correlation with market value, and market value is an objective measurement. Therefore, we can propose hypothesis H_{1a}.

Hypothesis H_{1a}: There is a high correlation between the market capitalization type valuation methods (MV/BV and Approximate Tobin q).

Although Sveiby (2010) categorized the three valuation methods of CIV, EVA, and VAIC^{TM} as return on assets methods, the rise or fall of the CIV value represents whether a company is invested too heavily or not sufficiently in intangible assets. The CIV value can indicate the comparison of a company's profitability ratio with the rest of the industry. VAIC^{TM} can explain the combined benefit of a company's intellectual capital and capital utilization. When the VAIC^{TM} is higher, it means the company can create a higher value. EVA was developed based on the concepts of surplus profit (economic profits) and internal rate of return.

These three indicators have different economic implications, so even though they are all classified as return on assets methods, there is a low correlation between their valuation formulas. We therefore propose hypothesis H_{1b}. In addition, because return on assets type valuation methods are highly sensitive to changes in the discount rate, the variability coefficient of the valuation indicators will be higher than those of the market capitalization methods, which leads to hypothesis H_{1c}.

Hypothesis H_{1b}: There is a low correlation between return on assets type valuation methods (CIV, EVA, and VAIC^{TM}).

Hypothesis H_{1c}: The variation of market capitalization type valuation methods is lower than that of return on assets type valuation methods.

1.3.2. Intellectual capital and intangible asset value. The intangible assets of key technologies and innovation capital possessed by companies in the digital content industry are more difficult for outsiders to measure than tangible assets are. Recently, only a few scholars have studied the correlative factors that influence value in the digital content industry. Chang, Hung and Huang (2011) constructed an efficiency evaluation model for the Taiwanese digital content industry based on the perspective of IC. The empirical results suggest that the scale of the digital content companies does play an important role in influencing the operating efficiency. The firms that have a small amount of capital can still attain optimal efficiency, from the perspective of IC. In addition, human resource capital and customer capital are the most significant influential factors that deserve digital content firms' attention. Yong and So (2008) explored the customer relationship management of the South Korean digital content industry through constructing an equation model, and their findings showed that the most important factors related to customer satisfaction were service content efficiency, response speed, and stability. Therefore, companies that produce digital content should pay attention to service quality; meaning that they should focus on managing customer capital.

Scholars used an interactive model of three types of intellectual capital to clearly show the mutual contribution, advancement, and growth between the three types of intellectual capital. The greater the synergy produced by their interaction, the greater the contribution they make to the value of the company. For companies with intellectual capital as their core, knowledge can be repeatedly input without it disappearing, so value can be accumulated and multiplied. The model proposed by Sullivan (2000) also showed that if companies simultaneously use ordinary capital as a foundation and intellectual capital or intangible assets as distinct assets, value can only be created for the company when the two combine to produce differentiated assets. The study of the biochemical industry of Finland by Hernams and Kauranen (2005) verified that when the three types of intellectual capital are valuated individually, they are largely unrelated to company revenue. However, their interaction indeed possesses a decisive influence on future company revenue. Therefore, we propose hypothesis H_2.

Hypothesis H_2: The interaction of financial capital and the three dimensions of intellectual capital exert a positive influence on company value.

2. Methodology

2.1. Hypothesis: H_{1a}, H_{1b}. This study used Pearson's correlation coefficient to examine the Hypotheses H_{1a} and H_{1b}. Pearson's correlation coefficient (r) is a measure of the strength of the association between the two variables. Positive correlation indicates that both variables increase or decrease together, whereas negative correlation indicates that as one variable increases, so the other decreases, and vice versa. The t-test is used to establish if the correlation coefficient is significantly different from zero, and, hence that there is evidence of an association between the two variables. The formula for Pearson's correlation coefficient is shown below:

$$r = \frac{\sum xy - \frac{\sum x \sum y}{N}}{\sqrt{(\sum x^2 - \frac{(\sum x)^2}{N})(\sum y^2 - \frac{(\sum y)^2}{N})}}. \quad (1)$$

2.2. Hypothesis: H_{1c}. This study used coefficient of variation (CV) to examine the Hypothesis H_{1c}. The standard deviations of two variables, while both measure dispersion in their respective variables, cannot be compared to each other in a meaningful way to determine which variable has greater dispersion because they may vary greatly in their units and the means about which they occur. The standard deviation and mean of a variable are expressed in the same units, so taking the ratio of these two allows the units to cancel. This ratio can then be compared to other such ratios in a meaningful way: between two variables, the variable with the smaller CV is less dispersed than the variable with the larger CV. The coefficient of variation is defined as the ratio of the standard deviation σ to the mean u. The formula for coefficient of variation is shown below:

$$CV = \frac{\sigma}{u}. \quad (2)$$

2.3. Hypothesis: H_2. This part of research referred to Hernams and Kauranen (2005) research pattern, carries on by two steps:

Step 1. Factor analysis is used to identify the financial and IC factors and produce factor score for each company. The factor scores are used as variables in the regression model. We group the 26 variables into sets through a process of elimination. There are two main reasons to use factor analysis in this study. First, in order to avoid collinearity issues related to regression analysis, second, by the variable deletion of the procedures for to identify the original 26 variables behind the common factors. It is these sets which will be evaluated by regression analysis as to how they contribute to the value of digital content firms' intangible assets. These attribute sets will also facilitate discussing the interaction of intellectual capitals.

Step 2. Regression analysis is used to explain the companies' intangible assets. In the regression model, the independent variables are the attributes extracted form factor analysis. The dependent variables are the values generated by the five valuation methods discussed in section 1.2 section. The regression's purpose is to quantify how various attributes of a firm's financial and intellectual capital structure affect intangible asset value.

$$Y_i = \beta_0 + \beta_1 F_{i1} + \beta_2 F_{i2} + \ldots + \beta_{p-1} F_{i,p-1} + \varepsilon_i ,$$

$$\varepsilon_i \sim n(0, \sigma^2). \quad (3)$$

3. Data and variables

3.1. Sample construction. The valuation subjects are the digital content companies which are listed on the Taiwan Stock Exchange and GreTai Securities Market. This paper deduct material incomplete sample during research period, altogether collection 20 company's material. Financial data was gathered from the *Taiwan Economic Journal* and company annual reports. Patent information was obtained from the Intellectual Property Office, Ministry of Economic Affairs, R.O.C. The Taiwan Central Bank's annual average interest rate was used. The data period was 2001 through 2006 with each year containing 120 data points.

3.2. Financial and intellectual capital measures. Based on the related literatures and Edvinsson and Malone (1997), 26 variables were selected and their values calculated as a starting point for the next analysis. Table 1 to Table 4 below shows the mean values and standard deviations for the twenty digital content companies.

Financial indicators are economic indicators that communicate financial information, explain financial activities, and reflect a company's operating processes and results. As shown by the financial dimensions in Table 1, the average earnings per share of companies in the Taiwanese digital content industry is US$0.09. The current and liquidity ratios are both over 250%, indicating very short-term solvency for these companies. In addition, the long-term capital adequacy and net debt-to-equity ratio are both rather high, indicating that there is long-term capital adequacy.

Table 1. Description of the financial capital variables

Variable name	N	Min	Max	Mean	Std. dev.
Earnings Per Share (USD)	120	-0.179	0.72	0.09	0.13
Return on Assets (%)	120	-20.41	55.99	12.82	12.91
Return on Equity (%)	120	-57.84	60.53	11.60	16.53
Current Ratio (%)	120	36.07	1249.96	300.64	259.34
Quick Ratio (%)	120	11.11	1244.64	256.25	265.51
(L-T Liab.+ SE)/FA %	120	89.22	11977	1107	1659
Debt to Equity Ratio (%)	120	0.48	13.93	3.40	2.95

Note: Non-percentage items are in thousands USD (except for EPS); conversions are made at 30:1 ratio.

Structural capital displays its benefit through the organizational infrastructure. Edvinsson and Malone (1997), Stewart (1997), and Sveiby (2010) showed that organizations with a longer operating history are more stable than more recently established organizations, and that they have better external and organizational relationships.

Table 2 shows nine structural asset variables that we selected for this study: R&D Expenses/Total Assets was 3.27%, R&D Expenses/Sales was 4.37%, and R&D Expenses/OPEX average was nearly 30%, indicating that R&D expenses made up almost 1/3 of operating expenses. This shows that companies in the digital content industry place a great deal of importance on R&D input. The average total asset turnover rate was 0.98, and higher total asset turnover rates signified higher asset utilization efficiency. The fixed asset turnover rate reached 20.66, indicating a low level of fixed assets, which is a characteristic unique to the digital content industry.

Table 2. Description of the structural capital variables

Variable name	N	Min	Max	Mean	Std. dev.
R&D Exp./Net Income (%)	120	-922.44	4969.74	53.98	474.77
R&D Expenses/Total Assets (%)	120	0.00	12.69	3.27	3.30
R&D Expenses/OPEX (%)	120	0.00	263.65	27.55	34.94
R&D Expenses/Sales (%)	120	0.00	27.35	4.37	4.76
Operating Profit Margin (%)	120	-45.40	47.99	12.56	15.18
Total Assets Turnover (times)	120	0.23	4.00	0.98	0.83

Table 2 (cont.). Description of the structural capital variables

Variable name	N	Min	Max	Mean	Std. dev.
Fixed Assets Turnover (times)	120	43.00	52.25	20.66	56.13
Patent Count	120	0.00	119.00	9.82	22.59
Accumulated Patent Count	120	0.00	572.00	32.18	85.99

Note: Non-percentage items are in thousands USD (except for EPS); conversions are made at 30:1 ratio.

The greatest objectives of human capital are to educate employees and maximize the intangible capabilities of knowledge, skills, and experience to create company value and increase performance. Table 3 shows the seven human capital variables selected for this study. The average number of employees for companies in the digital content industry in Taiwan was 1,910; but the smallest company had 55 employees and the largest had 31,421, indicating great variability in terms of size. The average salary was US$13,470, but the average revenue generated was US$315,770, with a net profit of US$25,680, which highlights the particularly high productivity of employees in this industry.

Table 3. Description of the human capital variables

Variable name	N	Min	Max	Mean	Std. dev.
OPEX/Employee (In $K US)	120	6.35	162.60	39.80	26.40
Wages per Employee (In $K US)	120	2.92	37.56	13.47	7.02
Fixed Assets per Employee (In $K US)	120	36.16	1168.34	346.04	238.26
Employee Count	120	55.00	31421	1910.22	6182.92
Revenue per Employee (In $K US)	120	46.90	3744.63	315.77	461.66
Assets per Employee (In $K US)	120	1.04	582.97	81.88	130.70
Net Income/Empolyee (In $K US)	120	-73.27	141.33	25.68	38.16

Note: Non-percentage items are in thousands USD (except for EPS); conversions are made at 30:1 ratio.

Relationship capital includes relationships with customers and suppliers. The source of company value is tied to the establishment and maintenance of customer relationships, so companies should understand that customers − like other assets − should be evaluated and appropriately managed and utilized. It should be emphasized that "relationships" are also valuable assets. Table 4 shows three relationship asset variables selected for this study. The average company's market share was 0.72%, and the growth rates for business revenue and profit were mostly positive, showing that this industry still in a period of high growth.

Table 4. Description of the relational capital variables

Variable name	N	Min	Max	Mean	Std. dev.
Market Share (per 2003 sales) (%)	120	0.02	13.23	0.72	2.20
Sales Growth (%)	120	-81.95	194.43	18.82	37.44
Gross Margin Growth (%)	120	-103.93	4137.35	51.45	378.74

4. Empirical results

4.1. Hypotheses H_{1a} and H_{1b}. Table 5 shows the Pearson correlation coefficient of the five intangible asset valuation methods calculated for the digital content industry in this study. The research findings showed that the market capitalization methods (MV/BV and Approximate Tobin *q*) had a high Pearson correlation, with a correlation coefficient of 0.889, which was statistically significant. The correlation coefficient for each pair of return on assets methods (CIV, EVA, and VAIC™) showed a low correlation and was not statistically significant. There was only a low level of significance in the correlation between the CIV and the EVA methods, with a coefficient of -0.26. Therefore, the research findings supported both H_{1a} and H_{1b}: that there is a high correlation between the market capitalization type valuation methods (MV/BV and Approximate Tobin *q*), and that there is a low correlation between return on assets type valuation methods (CIV, EVA, VAIC™).

Table 5. Pearson correlation coefficient among 5 intangible valuation methods

	MV/BV	Tobin *q*	CIV	VAIC™	EVA
MV/BV	1				
Approximate Tobin *q*	.889** (0)	1			
CIV	-0.067 (0.464)	-0.002 (0.983)	1		
VAIC™	.184* (0.045)	.384** (0)	0.011 (0.908)	1	
EVA	0.086 (0.35)	-0.098 (0.289)	-.260** (0.004)	-0.122 (0.183)	1

Note: ** *p*-value < 0.01, * *p*-value < 0.05.

4.2. Hypotheses H_{1c}. Table 6 shows the variability coefficients for the five intangible asset valuation methods calculated for the digital content industry in this study. Variability coefficients are also called dispersion coefficients, standard deviation rates, or per-unit risk, and they can determine the degree of dispersion of two series of values. The research findings showed that the variability coefficients of the market capitalization methods (MV/BV and Approximate Tobin *q*) were 0.64 and 1.02, respectively, which were both much lower than those of the return on assets methods (CIV, VAIC™, and EVA) of 25.98, 1.08, and 3.97, respectively. This indicates that the degree of dispersion of the values for the market capitalization type valuation methods was lower than that of the return on assets type valuation methods. Therefore, the research findings supported hypothesis H_{1c}; that the variability of the market capitalization type valuation methods is lower than that of return on assets type valuation methods.

Table 6. Standard deviation and CV among 5 intangible valuation methods

	N	Std. dev.	Coefficient of variation (CV)
MV/BV	120	0.84	0.64
Tobin-*q*	120	0.64	1.02
CIV	120	15252784	25.98
VAIC™	120	9.24	1.08
EVA	120	106876800	3.97

4.3. Hypotheses H_2. *4.2.1. Factor analysis of financial and intellectual capital items.* This next section groups the 26 variables into sets through a process of elimination. It is the sets, or attributes, which will be evaluated by regression as to how they contribute to the value of digital content firms' intangible assets. We used the standard rules for Principal Component Analysis and conducted orthogonal rotation with Varimax. Only those variables with eigenvalues greater than one as generated by SPSS software were retained, resulting in seven attribute groupings. We performed the KMO test to verify that the original data was suitable for a factor analysis, as shown in Table 7 below.

Table 7. KMO test results

Kaiser-Meyer-Olkin measure of sampling adequacy	0.613
Bartlett test of sphericity	3788.381
Degree of freedom	325
Sig. value	0.000

Each attribute was grouped in accordance to the factor loadings of the variables it contained – those variables with higher factor loadings were given more weight in its attribute. The accumulated variance of these seven attributes was 82.623% percent for the Taiwan digital content firms. The results of the factor analysis are shown in Table 8 below. Based on the establishment procedure of the dimensional validity of factor analysis, we could clearly observe that the content composition of the first three major factors was not formed simply by the financial or intellectual capital dimensions, indicating that there are interactions among financial capital and three dimensions of intellectual capital. Factor 1 includes structural, human, and relationship capital; Factor 2 includes financial, structural, and human capital; and Factor 3 includes financial, structural, and human capital, the same as Factor 2.

Table 8. Summary of factor analysis on digital content companies

Factor	Variables		Factor loading	Attribute name	Eigenvalue	Percent of variance (%)
Factor 1	S + H + R	Employee Count (H)	0.949	4.154	15.977	15.977
		Market Share (R)	0.916			
		Patent Count (S)	0.904			
		Accumulated Patent Count (S)	0.884			
		Fixed Assets per Employee (R)	0.672			
Factor 2	F + S + H	Return on Equity (F)	0.942	3.838	14.760	30.737
		Return on Assets (F)	0.938			
		EPS (F)	0.907			
		Operating Profit Margin (S)	0.715			
		Net Income/Empolyee (H)	0.646			
Factor 3	F + S + H	Total Assets Turnover(S)	0.939	3.220	12.383	43.120
		Revenue per Employee (H)	0.857			
		(L-T Liab.+ SE)/FA (F)	0.801			
		Total Assets Turnover (S)	0.646			
		Wages per Employee (H)	0.475			
Factor 4	F	Quick Ratio (F)	0.952	3.141	12.082	55.202
		Current Ratio (F)	0.951			
		Debt to Equity Ratio (F)	0.897			

Table 8 (cont.). Summary of factor analysis on digital content companies

Factor	Variables	Factor loading	Attribute name	Eigenvalue	Percent of variance (%)	Factor
Factor 5	S	R&D Expenses/OPEX (S)	0.880	2.831	10.888	66.090
		R&D Expenses/Total Assets (S)	0.858			
		R&D Expenses/Sales (S)	0.727			
		R&D Exp./Net Income (S)	0.556			
Factor 6	H	OPEX/Employee (H)	0.881	2.648	10.183	76.273
		Assets per Employee (H)	0.786			
Factor 7	R	Sales Growth (R)	0.818	1.651	6.350	82.623
		Gross Margin Growth (R)	0.766			

Note: S is the structual capital; H is the human capital; R is the relational capital; F is the financial capital.

4.2.2. Regression of determinants of intangible asset value. Table 9 shows the seven factors formed by the extraction of financial or intellectual capital using factor analysis as the independent variables. The intangible asset values calculated using the five intangible asset valuation models were the dependent variables. We can clearly observe from the results of regression analysis that among the 35 explanatory variables in the five regression equations, only 14 coefficients displayed statistical significance. Factor 1 and Factor 2 appear three times each, and Factor 3 appears once. The components included in these three factors were not formed by simple financial or intellectual dimensions. These research findings confirmed the viewpoint proposed by this study: that financial and intellectual capital are not individually related to business value creation, but instead have cooperative contribution, advancement, and growth. The greater the synergy produced by their interaction, the greater the contribution they make to the value of the company.

Examined from another perspective, no matter which valuation method is used as the dependent variable in the five regression equations, there is always an integration factor in the formula. With the MV/BV method, the regression analysis showed that the explanatory factors were Factor 2 (F + S + H) and Factor 5 (S). With the Approximate Tobin *q* method, they were Factor 2 (F + S + H), Factor 4 (F), and Factor 5 (S). With the CIV method, it was Factor 1 (S + H + R). With VAIC^{TM}, they were Factor 1 (S + H + R), Factor 2 (F + S + H), Factor 3 (F + S + H), Factor 4 (F), Factor 6 (H), and Factor 7 (R). For the EVA method, they were Factor 1 (S+H+R) and Factor 5 (R). This indicated that the interaction between the dimensions was related to the intangible asset value.

In addition, when the company asset value was calculated using the market capitalization methods (MV/BV and Approximate Tobin *q*), "Factor 2" was shown as the most important factor influencing capital market valuation, emphasizing the interaction of financial capital with structural capital. When using asset value (CIV, VAIC^{TM}, and EVA) to measure intangible asset value, it was indicated that "Factor 1" was the main factor influencing intangible asset valuation, emphasizing the interaction of human resources, structure, and customers, without a clear interactive relationship with financial capital.

Finally, by looking at the explanatory power (Adjusted R^2) of the overall regression model, the explanatory power for the driving factors of intangible asset value listed in this study was the highest for the EVA valuation method, at 75.2%. This was followed by VAIC^{TM} at 56%; CIV had the lowest explanatory power of only 3%. Perhaps the factors extracted in this study were not the primary factors influencing CIV, which would reduce its explanatory power.

Table 9. Results of regression

	MV/BV	Tobin's *q*	CIV	VAIC™	EVA
Intercept	1.423*** (0.081)	0.697*** (0.056)	-2016200 (1665204)	8.532*** (0.561)	-18244273*** (5899404)
Factor 1 (S + H + R)	-0.093 (0.071)	0.048 (0.048)	3632097*** (1436602)	1.689*** (0.563)	-82065745*** (5089524)
Factor 2 (F + S + H)	0.444*** (0.1)	0.442*** (0.068)	-2738130 (2016344)	4.845*** (0.563)	-6706859 (7143406)
Factor 3 (F + S + H)	0.015 (0.072)	-0.004998 (1463906)	32545 (1463906)	-1.41*** (0.563)	3691475 (5186255)
Factor 4 (F)	-0.075 (0.075)	-0.092*** (0.052)	-46720 (1537315)	2.198*** (0.563)	2456496 (5446326)
Factor 5 (S)	0.34*** (0.085)	0.229*** (0.058)	-1681986 (1719473)	0.369 (0.563)	22096061*** (6091668)

Table 9 (cont.). Results of regression

	MV/BV	Tobin's *q*	CIV	VAIC™	EVA
Factor 6 (H)	-0.06 (0.074)	-0.023 (0.051)	1933910 (1584903)	3.77*** (0.563)	1170570 (5614919)
Factor 7 (R)	0.056 (0.092)	-0.065 (0.063)	-2164730 (1863307)	-1.621** (0.563)	2650098 (6601236)
R^2	0.267	0.402	0.104	0.586	0.771
Adjusted R^2	0.208	0.353	0.03	0.56	0.752
F	4.544***	8.358***	1.418	1.418***	40.908***

Note: ** *p*-value < 0.01, * *p*-value <0.05.

Discussion

Numerous scholars have previously presented a variety of different methods for evaluating intangible assets, but each method has its own limitations in actual implementation; and, especially in the areas of indicator selection and valuation models with quantitative values, there are still many divergent views and much room for discussion. Most empirical findings determined intangible asset valuation through singular methods, and there was a lack of empirical comparison of the various types of methods (Chu et al., 2008). This study can make up for some of these research shortcomings.

First, the empirical findings show that there is a high correlation among the market capitalization type valuation methods, indicating that there is a consistent standard for calculating intangible asset value from a market value perspective; thus, there is high homogeneity between these valuation methods. Meanwhile, there was a low correlation between the return on assets type valuation methods. The concepts of these methods originate from the calculation of a company's excess return on assets while giving weight to the concept of the average cost of capital discount, so there is greater variation among values, resulting in a lower correlation between the different valuation methods. Therefore, when performing a valuation of intangible assets, there must be a very clear purpose, and the valuation method must be selected carefully. An appropriate method must be chosen from the perspective of suitability to prevent incorrect estimation of the company's actual value.

The second purpose of this paper is to investigate the composition of intangible assets in the Taiwanese digital content industry by examining possible elements, which were determined from the different aspects of the relationship between intangible determinates and intangible value. We constructed 26 items from the aspects of financial and intellectual capital. The research findings show that financial and intellectual capital are not individually related to business value creation, but instead have mutual contribution, advancement, and growth. The greater the synergy produced by their interaction, the greater the contribution they make to the value of the company.

Because these empirical findings are limited by the difficulty of obtaining information other than that contained in financial statements, future research can be directed toward a more in-depth study of the intangible asset value in the parts of the Taiwanese digital content industry that the independent variables (explanatory variables) chosen by this study were not able to explain. Future research can also go further in depth to select other dimensional variables for the understanding of the drivers of intangible asset value and creation processes, and to benefit the understanding of the determinants of intangible assets in different capital market formation models. This is a research topic with a broad potential for application.

References

1. Chang, C.C., S.W. Hung and S.Y. Huang (2011). Evaluating the operational performance of knowledge-based industries: the perspective of intellectual capital, *Quality & Quantity*, published online.
2. Chu, P.Y., H.H. Hsiung, C.H. Huang and C.Y. Yang (2008). Determinants of the valuation of intangible assets – a contrast between Taiwanese and American IC design houses, *International Journal of Technology Management*, Vol. 41, No. 3, pp. 336-358.
3. Edvinsson, L. and M.S. Malone (1997). *Intellectual capital: realizing your company's true value by finding its hidden roots*, New York: Harper Collins Publishers.
4. Edvinsson, L. and M.S. Malone (1997). *Intellectual capital – the proven way to establish your company's real value by measuring its hidden brainpower*, Judy Piatkus.
5. Hall, R. (1992). The Strategic Analysis of Intangible Resources, *Strategic Management Journal*, Vol. 13, No. 2, pp. 135-144.
6. Hernams, R. and I. Kauranen (2005). Value creation potential of intellectual capital in biotechnology-empirical evidence from Finland, *R&D Management*, Vol. 35, No. 2, pp. 171-185.
7. Itami, H. and T.W. Roehl (1987). *Mobilizing invisible assets*, Harvard University Press, Cambridge, MA.

8. Kaplan, R.S. and D.P. Norton (2004). Measuring The Strategic Readiness of Intangible Assets, *Harvard Business Review*, Vol. 82, No. 2, pp. 52.
9. Luthy, D.H. (1998). Intellectual Capital and Its Measurement. Asian-Pacific Interdisciplinary Research in Accounting Conference 98 in OSAKA, http://www3.bus.osaka-cu.ac.jp/apira98/archives/htmls/25.htm.
10. Osborne, A. (1991). Measuring Intellectual Capital: The Real Value of Companies, *The Ohin CPA Journal*, pp. 37-38.
11. Parr, R.L. (1991). *Investing in Intangible Assets − Finding and Profiting From Hidden Corporate Value*, New York: John Wiley & Sons, Inc.
12. Roos, J. (1997). Exploring the concept of intellectual capital (IC), *Long Range Planning*, Vol. 31, No. 2, No. 150-153.
13. Stewart, T.A. (1997). *Intellectual capital: the new wealth of organizations*, Dell Publishing Group, Inc.
14. Sullivan, P. (2000). *Value-driven intellectual capital: how to convert intangible corporate assets into market value*, New York: John Wiley & Sons, Inc.
15. Sveiby, K.E. (2010). *Methods for measuring intangible assets*, updated 27 April.
16. Williams M. (2001). Is a company's intellectual capital performance and intellectual capital disclosure practices related? Evidence from publicly listed companies from the FTSE 100. Paper presented at McMasters Intellectual Capital Conference, Toronto.
17. Yong, G.J. and Y.S. So (2008). Structural equation model for effective CRM of digital content Iindustry, *Expert Systems with Applications*, Vol. 34, pp. 63-71.