

An Investigation of Intellectual Capital Changes during Company's Life Cycle: Evidence from Tehran Stock Exchange

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Abstract

The main objective of the study is to investigate intellectual capital changes during the life cycle of the listed companies on the Tehran Stock Exchange. In this research Pulic method is used for measuring intellectual capital. More ever, we used Anthony and Ramesh (1992) and Black (1998) method to classify the different stages of the firms life cycle. Intellectual capital consists of three components (employed capital efficiency, human capital efficiency and structural capital efficiency) in the Pulic method. In this study, the different stages of the life cycle are considered as the independent variable and intellectual capital is considered as the dependent variable. The sample size includes 80 observations for 10 years during 2002 to 2011. The results showed that there is a significant difference in intellectual capital amount during life cycle (growth, maturity and decline) and the type of their relationship is consistent with organizational life cycle theory. Thus, the rate of intellectual capital increases in the growth period and reaches to its maximum level maturity period and decreases in decline period slowly. Other results showed that there is a significant difference in capital employed efficiency amount during growth and decline period. More ever, there is a significant difference in human capital efficiency and structural capital efficiency amount in three periods and is consistent with life cycle curve.

Keywords: Intellectual capital, Tehran Stock Exchange, Human capital, Structural capital, Life cycle

1. Introduction

In today's world, the industrial economy left behind and knowledge-based economy is highlighted. Economy in which the production and utilization of knowledge, plays a major role in the process of wealth creation (Chen Goh, 2005). Massive investment in human capital and information and communication technology are Characteristics of the knowledge-based economy, and due to the human capacity for knowledge generation, in knowledge-based economy, resources are infinite. The emergence of a knowledge-based economy Causes to the increasing importance of intellectual capital as an intangible asset and an important source of competitive advantage for a firm (Ross and Ross, 1997).

Intellectual capital is trying to effective use of knowledge (final product) versus data (raw material). From the Ross & al' perspective, intellectual capital is consists of all processes and assets that normally are not shown on the balance sheet, and so, includes all intangible assets (such as trademarks, patents and the exploitation and trade names) that are considered in modern approach. In other words, intellectual capital is total of its members' knowledge and the application of them (Huang and wang, 2008).

Organisms follow the life cycle curve or life cycle. They have Specific behavioral patterns in order to overcome the problems associated with the transition in during periods. Sometimes new cases arise and they can't overcome the problems. In these situations they need external factors for solving the problems (Adizes, 1989).

It is a fundamental trust that every organization, like a living organism, has a natural life cycle, and that is goes through predictable and repetitive pattern of behavior as it grow and develops. At each new stage of

development the organization faces a unique set of challenges. How well or poorly management addresses these challenges, and lead a healthy transition from one stage to the next, has a significant impact on the success and failure of that organization (Adizes, 1989).

According to above matters it is expected that the firm's intellectual capital is differently during its life cycle. Thus as a company grows this amount increases, and in maturity period reaches its highest level. Then in decline period it will also reduce.

2. Theoretical Basis

2.1. Intellectual Capital

Intellectual capital can be considered as knowledge assets of a company (IFAC, 1998). Although there is general consensus on the components of intellectual capital, but there is not a common accepted definition for it (Pew tan et al, 2007). According to the definition of Mar & Schiuma, intellectual capital is group of knowledge assets of an organization that by adding a value for key stakeholders involved in improving the competitive position of an organization.

According to the definition of the Organization for Economic Cooperation and Development (OECD), it is Synonymous with economic value of two categories of intangible assets of the organization (structural capital (SC) and human capital (HC)). Based on this, structural capital refers to the suitable software systems, distribution networks, and... . More ever, human capital resources consist of human resources within the organization and outside the organization, such as customers, partners and suppliers.

2.2. Intellectual Capital Components

Human Capital: Human capital is defined as individual knowledge, skills, abilities and experiences of employees in an organization to create value and solve business problems (Norma, 2005). More human capital theorists considered it at the individual level and have seen it a combination of knowledge, skill, and talent. For example according to definition of Penning et al, HC in professional services firm is expert's knowledge and skills that use them for professional services (swart.2006).

Structural Capital: Structural capital (SC) is defined as Existing structures and processes within an organization that employees through the use of their knowledge and skills use them (Vergauwen et al, 2005). In reality the capital structure is created for the company by employees. However, the company is the sole owner (Boisot, 2002; Pablos, 2004 and walsh & ungson, 1991).

Relational Capital

Relational capital is defined as all resources linked to the external relationships of the firm with customers, suppliers or partners in research and development. This type of communication created from different paths. For example, Knowledge acquisition connection to family or other personal contacts, the inter-company transfers, joint ventures and partnership agreements can be named.

2.3. Life cycle:

Like living organisms, the growth and aging of the entities are showed on the basis of control ability and flexibility. In Youth period (growth period) organizations are more flexible, but are often uncontrollable. With the increase of life, relationships may vary: controls increased and flexibility decreases. Finally, by aging (during Decline) control capability will be reduced. When an entity is able to control and flexible, it is stated that both the young and old can benefit. The condition known as developmental stage (Maturity Stage) is known (Adizes, 1989). A review of recent literature on the economic and management shows corporate life cycle disclosed four common stages: **birth, growth, maturity, and decline** and for it some models are presented. In the framework of these models, institutions and companies pursue specific policy at every stage of their economic life. This policy is reflected in corporate accounting information (Ghorbani, 2006).

2.4. Classification of the life cycle stages

Start-Up Stage:

Usually at this stage the amount of assets (firm size) is at the low level, Cash flow from operating activities and profitability was low and Companies need to high liquidity for finance and realize growth opportunities. Rate on dividends in these companies is usually zero or the maximum rate 10%. And return on investment or return on adjusted investment relative to the weighted rate financing is often poor (Adizes, 1989).

Growth Stage

At this stage, the size of the companies is more than emergence stage companies and growth in sales and earnings is higher than the emergence stage. Financial resources are more invested in productive assets, and the company has more flexibility in liquidity index. Companies' dividend ratio often fluctuates in the

range of between 10 % to 50 %. Return on investment or return on adjusted investment is often higher than funding costs weighted rate (Adizes, 1989).

Maturity Stage

At this stage, corporate experience has stability in sales and the need for cash in most cases is supplied from domestic sources. The size of the company's assets is greater than the size of the assets of the company in growth stage. Dividend ratio of the companies often fluctuates in the range of between 50 % to 100%. Due to excess liquidity and reduce dependence on outside funding policy, Return on investment or return on adjusted investment are often equal or more than funding costs weighted rate (Adizes, 1989).

Decline Stage

At this stage, there is very little opportunity for growth, Indicators of profitability, liquidity and obligations have decreasing trend. The company has been very intensive and competitive conditions. Moreover, costs of financing from external sources are high, So that in most cases the adjusted investment returns and investment returns are lower than the rate financing.

3. Review of literature

Some recent studies in the field of intellectual capital and the life cycle will be provided:

3.1. The study related to intellectual capital:

Clarke et al (2011) has investigated relationship between intellectual capital and Australian firm performance in during of 2004 to 2008. They used pulic method for measuring intellectual capital. The result showed that there was a direct relationship between intellectual capital and firm performance. More ever a positive relationship between intellectual capital in during of before and current year was found.

Nazari (2011) investigated relationship between intellectual capital components and firms' financial performance in during of 1996 to 2006. The results presented that HC and SC predict firms' ROE positively but about ROA only HC can predict it positively.

Longo and Mura (2011) investigated the effect of intellectual capital on employees' satisfaction and retention in Italian food industry. The result of testing hypotheses showed that intellectual capital effects on employees' Job attitude positively, although there are some differences between intellectual capital components. Specifically, HC and RC have not direct effect on employees' satisfaction and retention while SC has this. In addition to, the result of this study identified two methods for measuring management human resource and causes to get better employees' satisfaction.

Maditinos et al (2011) conducted a study entitled "The impact of intellectual capital on firms' market value and financial performance" during of 2006 to 2008. They got Experimental data from 96 Greek companies listed in the Athens Stock Exchange. The result of testing hypotheses showed that there is a significant relationship between Productivity of human capital and financial performance. More ever, as regards that intellectual capital is identified as an important strategic asset, this result causes different argument.

Hemati and Zamani (2011) investigated relationship between intellectual capital, value added and Cumulative abnormal returns. The results of testing hypotheses showed significant and positive relationship between intellectual capital and firm' value added and negative relationship between intellectual capital and Cumulative abnormal returns. In the other words, with the increase in intellectual capital, value added is reduced and Cumulative abnormal returns decreases.

Banimahd and Ghanbari (2011) investigated relationship between intellectual capital, firm size, profitability and capital structure on Tehran stock exchange. The results presented that there is a positive relationship between intellectual capital and capital structure. More ever there is a negative relationship between firms' profitability index and capital structure index and there is a positive relationship between firm size and capital structure index.

Ghorbani et al (2010) investigated the impact of intellectual capital on financial performance in Iranian pharmaceutical Industry. The results showed that the optimal and efficient use of material and intellectual corporate resources influences on the profitability index. Also efficiency of human capital have a negative effect on productivity and and structural capital efficiency has a positive impact on equity. Finally, no evidence that the changes in the market value of corporate can be attributed by intellectual capital performance, not found. It looks that Iranian pharmaceutical market still appears sensitive to be more physical assets to intellectual capital.

3.2. The study related to life cycle:

Stepanyan (2011) investigated how to distribution of cash between the shareholders (dividends, redemption of shares or a combination of both) during the life cycle of companies. He came to the conclusion that the payments during the companies' life cycle (birth, growth and maturity) are different.

Thanatawee (2011) investigated free cash flow and life cycle theory assumptions about the Thai companies' dividend policy. Results showed that large companies are much more likely to pay dividends. Financial leverage is also positively associated with interest payments, this finding may suggest that Thai companies are borrowings to pay dividends.

osta and Qytasy (2012) were examined the effect of business life cycle on discretionary accruals. They finally concluded that the use of discretionary accruals is different at different stages of the life cycle; this means that use of discretionary accruals in the growth stage is more than maturity and decline stage and the use of this item in growth stage is less than decline stage.

Rahmani et al (2011) examined the relationship between profitability and return according to life cycle and firm size about listed company on the Tehran Stock Exchange in during of 2004 to 2008. The results suggest that firm size and life cycle are factors that affect on the relationship between profitability and return and cause to increase in adjusted coefficient of determination.

Karami and Omrani (2010) were examined the effect of the firms' lifecycle on relevance of risk and performance measures during 1380 to 1386. The results show that relevance of risk and performance measures) are significantly different from each other in the different stages of the life cycle (growth, maturity, decline). The results of Woong test show that the incremental explanatory power of the risk criteria has the highest value at growth stage and has the lowest value at maturity stage.

Note that so far no research has been done on the relationship between intellectual capital and life-cycle n in and out of the country.

4. Research hypotheses:

According to the research these hypotheses arise:

- **H1: there is a significant difference in company's intellectual capital during growth and maturity periods.**
- **H2: there is a significant difference in company's intellectual capital during growth and decline periods.**
- **H3: there is a significant difference in company's intellectual capital during maturity and decline periods.**

5. Research methodology:

The research is a descriptive - analytical study and in nature is an applied research. After describing the data, we analyzed it by the central index of comparative tests carried out over two independent societies. At first we categorized the sample, using three variables: sales growth, capital expenditure changes and company's age, in three sections: in growing, maturity and decline .After that, the level of intellectual capital were compared in the three periods and the research hypotheses are tested.

5.1. How to Separation of corporate in life cycle stages

In this research we classified company using Anthony and Ramesh (1992) and Black (1998)'s classification method in life cycle stages. In these methods, to avoid biased results, the life cycle can be divided into three stages using multivariate classification methods. It means that at first, we used some variables (sales growth, capital expenditure changes and company's age) as classification index. Then, we ranked the sales growth rate and capital expenditures from highest to lowest value and companies' age from lowest to highest.

$$SG_t = ((SALES_t - SALES_{t-1}) / (SALES_{t-1})) * 100$$

SG :Sales growth

SALES_t :Sales in year t

$$CEV_t = (CE_t / VALUE_t) * 100$$

CEV :Capital Expenditure Changes

CE_t :Capital expenditures in year t, that obtain from the change in fixed assets between years t and t-1.

VALUE_t :Market value of equity plus book value of long-term debt in year t

AGE = CYEAR – FYEAR

AGE: company's age

CYEAR_t :the current year

FYEAR_t :Year of Establishment

At first, the values of these three variables were calculated for each year. These values were divided in three categories: low, medium and high, based on statistical quartiles. Then, according to following table, the companies were categorized. We assigned score of 3 to growing companies and score of 2 to mature companies and score of 1 to declining companies. Then, combined scores are obtained for each company. The companies has arranged based on the combined scores.

Life cycle	Sales growth	capital expenditure changes	Company age
growth	high	high	young
Maturity	average	average	mature
decline	low	low	old

5.2. How to calculate intellectual capital

Pulic method used to calculate intellectual capital; this model has five stages as follows:

1. Determine the added value

$$VA = OP + C + D + A$$

VA Value-Added firm

OP: Operating profit

C: Employees costs (including wages and other employees' social costs)

D : Depreciation

A: Amortization of intangible assets

2. Determine the Capital Employed Efficiency

$$CEE = VA / CE$$

CE :Capital employed that is equal to the book value of the company's total assets minus intangible assets

CEE :Capital Employed Efficiency

3. Determine human capital Efficiency

$$HCE = VA / HC$$

HC: Human capital that is the total cost of the company's

HCE: Human Capital Efficiency

4. Determine human capital Efficiency

$$SC = VA - HC$$

$$SCE = SC / VA$$

SC : Structural Capital

SCE: Structural capital Efficiency

Intellectual capital Efficiency can now be calculated according to the following equation:

$$ICE = HCE + SCE$$

ICE: Intellectual Capital Efficiency

5. Determine the Value Added Intellectual Coefficient

$$VAIC = ICE + CEE$$

VAIC: This ratio indicates efficiency create value or a company's intellectual ability. The higher ratio, management of the company has been using more the better the potential (Namazi and Ebrahimi, 2009).

6. Community and sample:

Statistical community of the study includes listed companies on Tehran Stock Exchange during 2002-2011 with following conditions:

- Company should be listed on Tehran Stock Exchange from the beginning of financial year of 2002.
- Sample companies have not been stopped during 2002 to 2011 permanently.
- At least they would have provided information and initial data for calculating research variables.
- Sample companies have not been changed their financial year during 2002 to 2011.
- Sample companies would not be among financial (banks) and investment companies.

The minimum required sample size for this study (80 companies) is determined according to previous research (Hadavi, 2011) and using the statistical software (NCSS & PASS). (error of 5% and power of 80% for comparing two or more groups).

7. Research results

7.1. Descriptive Statistics of research variables

Tables 1 and table 2 show descriptive statistics of the main variables in calculating intellectual capital and its components in the three stages of growth, maturity and decline.

Table1: Descriptive statistics for intellectual capital, human capital efficiency, structural capital efficiency and Capital Employed Efficiency

period	Statistical measures	HCE	SCE	CEE	VAIK
Growth stage	mean	3.98	0.62	0.33	4.93
	median	3.02	0.67	0.31	4.03
	Standard deviation	4.41	0.23	0.14	4.54
	min	0.54	-0.87	0.01	-0.20
	max	43.31	0.98	0.80	44.52
Maturity stage	mean	4.09	0.83	0.31	5.23
	median	2.59	0.62	0.29	3.56
	Standard deviation	5.76	4.58	0.15	7.33
	min	-0.06	-2.22	-0.01	-1.85
	max	51.19	89.04	0.80	89.03
Decline stage	mean	2.63	0.52	0.29	3.44
	median	2.11	0.53	0.28	3.05
	Standard deviation	2.37	0.83	0.17	2.63
	min	-0.3	-2.94	-0.05	-2.65
	max	21.28	6.18	0.75	22.74

Table 1 shows human capital efficiency is equal to 3/98 (in growth period), 4/09 (in maturity period) and 2/63(in decline period). This means that Efficiency human capital has also changed in different period of its life cycle. Also structural capital efficiency is equal to 0/62 (in growth period), 0/83 (in maturity period) and 0/52(in decline period).This means that Efficiency structural capital has also changed in different period of its life cycle. So it has highest level in maturity period. In addition to, Capital Employed Efficiency is equal to 0/33 (in growth period), 0/31 (in maturity period) and 0/29(in decline period). These values indicate that capital employed efficiency changes does not follow the life cycle curve. Intellectual capital (that is obtained from the sum of these three variables) is equal to 4/93 (in growth period), 5/23 (in maturity period) and 3/44(in decline period). This means that intellectual capital changes follow the life cycle curve.

Table 2: Descriptive statistics for human capital and structural capital variables

Statistical measures	variables	mean	median	Standard deviation	min	max
Period						
growth	HC	123606	48434	352104	3571	4023596
	SC	344693	95712	1049538	-30175	8533108
maturity	HC	157196	47455	530781	3569	5716826
	SC	452010	69235	1485019	-52978	15844428
decline	HC	209726	59471	711244	5514	6632901
	SC	436208	63566	1744952	-100033	15336705

Table 2 shows the average amount of human capital over the corporate life cycle increased. And has highest level during decline period (209,726). These values indicate that human capital changes do not match with life cycle curve. In addition to, structural capital is equal to 344693 (in growth period), 452010 (in maturity period) and 436208(in decline period). These amounts show the partial adjustment for structural capital with the life cycle curve.

7.2. Inferential statistics (Testing of hypotheses):

We used SPSS software for analyzing data. At first, we tested data normality due to choosing suitable method. Then, research hypotheses have been tested using Kruskal- Wallis test. Because data on the

distribution of intellectual capital (VAIK) is abnormal, so the Kruskal - Wallis test is used to compare the median of these communities.

H1: there is a significant difference in company's intellectual capital during growth and maturity periods.

As following table shows, we concluded that there is a significant difference in amount of intellectual capital during growth and maturity periods (P-Value<0/016).

Table3: the results of testing H1

Sample size	Z Statistic	P-Value
682	-2/979	0/003

According to table 1 the amount of intellectual capital is equal to 5/23 in maturity period and is more than it in growth period (4/93) and this result is Consistent with its characteristics in life cycle. As we said, companies have more consistency in maturity period. Therefore, it is expected that this period has more intellectual capital.

H2: there is a significant difference in company's intellectual capital during growth and decline periods.

According to following table, the results show that there is a significant difference in intellectual capital amount during growth and decline periods.

Table 4: the results of testing H2

Sample size	Z Statistic	P-Value
413	-5/284	<0/001

According to table 1 the amount of intellectual capital in growth period (4/93) is more than it in decline period (3/44) and that is consistent with life cycle curve. During the growth period, the company has great flexibility in liquidity index. While the profitability index, liquidity index and obligations index have descending trend in decline period. Therefore, it is expected that the intellectual capital amount in during growth period is more than its amount during decline period.

H3: there is a significant difference in company's intellectual capital during maturity and decline periods.

According to p-value (<0/016), we concluded that there is a significant difference in intellectual capital amount in during maturity and decline periods.

Table5: the results of testing H3

Sample size	Z Statistic	P-Value
505	-3/182	0/001

According to table 1 the amount of intellectual capital in maturity period (5/23) is more than it in decline period (3/44) and that is consistent with life cycle curve.

7.3. Inferential statistic related to the intellectual capital components:

According to the aim of this research, we tested hypotheses related to intellectual capital components as additional results.

A) Capital Employed Efficiency (CEE)

About this variable we concluded that there is a significant difference for it between growth and decline periods (p-value: $0/013 < ((\frac{\alpha}{3}))$).

Table 6: CEE during growth and decline period

Sample size	Z Statistic	P-value
413	-2/479	0/013

B) Human Capital Efficiency (HCE)

As following table shows there is a significant difference during three periods.

Table 7: HCE during growth and maturity periods

Sample size	Z Statistic	P-value
682	-1/776	0/001

Table 8: HCE during growth and decline periods

Sample size	Z Statistic	P-value
413	-5/619	<0/001

Table 9: HCE during maturity and decline periods

<i>Sample size</i>	<i>Z Statistic</i>	<i>P-value</i>
505	-3/361	0/001

As well as intellectual capital the results, the hypotheses testing is consistent with the lifecycle curve. According to table HCE amount is equal to 3/98(in growth period), 4/09 (in maturity period) and 2/63(in decline period).

C) Structural Capital Efficiency (SCE)

According to the results we concluded that there is a significant difference for this variable in different period. Following tables show the results:

Table 10: SCE during growth and maturity periods

<i>Sample size</i>	<i>Z Statistic</i>	<i>P-value</i>
682	-3	0/003

Table 11: SCE during growth and decline periods

<i>Sample size</i>	<i>Z Statistic</i>	<i>P-value</i>
413	-5/081	<0/001

Table 12: SCE during decline and maturity periods

<i>Sample size</i>	<i>Z Statistic</i>	<i>P-value</i>
505	-2/973	0/003

According to table 1 the amount of SCE is 0/62 in grow period, 0/83 in maturity period and 0/52 in decline period. These values also indicate that, structural capital changes are consistent with life cycle curve.

8. Conclusion:

As we said, the main objective of this study is to investigate intellectual capital changes during the life cycle of the listed companies on the Tehran Stock Exchange. The period of this study consist of ten years from 2002 to 2011. According to the results we concluded that, there is a significant difference in intellectual capital amount during different periods. This amount increase in growing company and reaches the highest level in maturity stage and decrease in decline stage. These results are consistent with the firms' age curve and life cycle theory. In addition to, we tested hypotheses for intellectual capital components. The results showed that there is a significant difference in SCE and HCE during life cycle while this difference is during decline and growth for CEE.

9. Recommendations

In this paper, we used a method to compute the intellectual capital and the life cycle. It is suggested that in future research researchers use other methods to measure intellectual capital. In addition, the population of this study consists of the manufacturing companies listed on Tehran Stock Exchange, Therefore, these results can't be generalized to other companies. We recommended that further study population consisted of all companies, both manufacturing and non-manufacturing. And also a study can be done with the same level of intellectual capital changes during the life cycle of manufacturing and non-manufacturing companies. Another recommendation can be presented based on the results that the type of industry that is not addressed in this study.

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