Knowledge Capital Management of Indian Public Sector Enterprises - A Panel Data Analysis

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Productivity comes from Knowledge Capital (KC) aggregated to the employee's in the form of useful training and company-relevant experience. His or her wage is based on prevailing wage rates for entry level skills at the time of joining. Ten years later, that person becomes a manager or expert, earning three or four times the entry level wages. How does a firm justify spending three times more on the identical person? The accumulation of company-specific knowledge explains the difference. During those ten years, the organization invested anywhere from a year's to several years of salary in helping the employee to function more effectively. In that way, the company will be recovering the investment on its knowledge capital as incremental profits. Value Added Intellectual Coefficient (VAIC) is a management and control tool that is designed to enable the organizations to monitor and measure the KC performance and potential of the firm. The primary objective of this study is to evaluate the performance of Knowledge Capital of the Public Sector Enterprises in India so that ordinary shareholder's earning is maximised. Ten years data i.e. from 2001-02 to 2010-2011 for 50 number of Public Sector Enterprises listed in Bombay Stock Exchange have been taken for analysis.

Keywords: Knowledge Capital, Public Sector Enterprises, VAIC, Panel Data Analysis, Fixed Effects, Random Effects

Introduction

The following section discussed different aspects of Knowledge Capital / Intellectual Capital, importance of it's management and it's valuation. The concept of knowledge capital gained popularity in the 1990s with the rapid emergence of information and communication technologies. Soon it began to be considered more important for the success of an organization than physical capital. Consequently, both public and private sector organisations started attributing their business value to intangible, knowledge-based assets. On the other hand, traditional measurement systems of accounting were not sophisticated enough to value these intangible assets. Thus, the past about one and a half

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decade realized the importance of intangible assets in the operation and valuation of organizations resulting in new ways of management and evaluation of performance. As a result of this development, human resources are treated as assets to be invested in, deployed, and developed carefully, and not as costs on profit and loss statement. Knowledge Capital (KC) or Intellectual Capital signifies that information is an important factor of production along with land, labour, capital and energy.

The full cycle of knowledge capital must commence from inception or creation to realization. Realization is important if one is to focus on wealth creation. Knowledge capital that does not contribute to wealth creation is really doing work for nothing, or simply the epitome of gross inefficiency (Sveiby, 2007). It can be concluded that the collective knowledge capital of an organization is represented by the skill and experience of its employees as also by its corporate information repositories. It is a very reliable indicator of the future earning potentialities or net worth of a company.

The Knowledge Capital Model provides a new perspective for managing the intangible assets in an organization—for systematically developing, maintaining, leveraging, and renewing them. An organization creates value when individual employees interact with customers. The quality of these relationships will determine the effect on the organization's customer capital. The structural capital interacts directly with customer capital but also serves mainly as the platform from which human capital can increase the value created for customers.

Knowledge Capital & it's Valuation

Groups and individual knowledge capital has great potential. It can achieve almost anything in this era. It is said to be the future of this century and one would witness its amazing performance and would overshadow every activity including commercial one. Therefore, it should get place in the financial statements. The reason for not including knowledge capital in financial statements is due to money measurement concept. So the solution lies in finding a way of its measurement i.e. accounting of knowledge capital. There is a growing need to raise knowledge capital because:

- KC has the power to influence profitable existence of an organization.
- KC is needed for collaboration contracts and its implementation.
- KC is needed for carrying amalgamation and mergers.
- KC has the capacity to build brand.
- KC is the basis for other forms of capital.
- KC makes high quality and international mobility possible.

It has great analytical power and it has given it an extra edge over any other form of capital. This analytical power leads to new technologies, strategies, policies, principles, tactics etc. Understanding something and understanding it properly and then finding out way to work with it has made this capital great.

For this purpose these three major elements of intellectual capital are observed and defined separately:

1. Human Capital – the first element that is defined as the force behind the human intellect and innovation of the firm.
2. Structural Capital - the second element (also called organizational capital) allows the creation of wealth through the transformation of the work of human capital.
3. Customer Capital – is the third major element of intellectual capital (also called clients or relational capital). It is defined as the ability of the firm to interact positively with business community members to stimulate the potential for wealth creation by enhancing human and structural capital.

VAIC (Value Added Intellectual Coefficient)

Stewart (1991) defined IC in his research study as: "The sum of everything everybody in your company knows that gives you a competitive edge in the market place. It is intellectual material - knowledge, information, intellectual property, experience - that can be put to use to create wealth". Introducing the notion of intellectual capital into business was a considerable step forward as it represented the beginning of a new age with focus on the employees, knowledge and intellectual assets as an essential presupposition for knowledge based economy. In order to become an integral part of business the concept of IC required adequate measurement techniques.

The VAIC analysis is based on two key resources in each business, Capital Employed (physical and financial capital) and Intellectual Capital. Both are treated equally as investments and both are in the function of value creation. The human capital of a company consists of all employees, their organization and their ability to create value that is evaluated at the market. A company can have the best qualification structure, i.e. intellectual potential, but if it creates little value with regard to its resources, its intellectual ability is low. Therefore, in order to get a full and objective picture of business success, it is necessary to monitor not only the performance of Capital Employed, but also the performance of Intellectual Capital, particularly the human component.

Two key resources, Capital Employed (CE) and Intellectual Capital (IC), create the value added. In order to calculate the efficiency of their value creation, each of these resources is related to the achieved value added. Thereby one gets the efficiency indicators: CEE – Capital Employed Efficiency, HCE – Human Capital Efficiency and SCE- Structural Capital Efficiency. By adding up the efficiency indicators, the result is VAIC (Value Added Intellectual Coefficient), which is an indicator that reflects the company's "total efficiency" or its "intellectual ability". The higher this indicator the better management has utilized existing potential. It takes care of both intellectual capital and financial performance which help in combining two distinctive discipline of finance and performance measurement (Pulic, 2000 and 2002).

Knowledge Capital and Indian Public Sector

In this research, the researcher is focussing on the Public Sector Enterprises (PSEs) which are listed at Bombay Stock Exchange (BSE). If 51 per cent or more of the paid-up share capital of a company is held by the Central Government and/or any one or more State Governments, the company becomes a Public Sector Enterprises. PSEs grew up to occupy commanding heights in the Indian economy and still continue to contribute greatly to the growth of India's economy. This can be judged from the fact that there are seven Indian Companies in the Global Fortune 500 list for 2009. Out of these seven companies, five are PSEs and only two are private corporate (Fortune, 2009). It is a matter of great pride that the top ranking company today is a PSE and that too in a liberalized scenario when most of the areas are open to private investment.

The primary objective of this study is to evaluate the performance of Knowledge Capital of the Public Sector Enterprises in India so that ordinary shareholder's earning is maximised. The study is based on the argument that the shareholders earning is an outcome of Knowledge Capital efficiency.

Value Added Intellectual Coefficient (VAIC)

The following section presents introduction to VAIC, it's different components, and its calculation.

Ante Pulic proposed in 1998 a coefficient to provide information about the value creation efficiency approach when determining tangible and intangible assets within a company. The model proposed is an analytical procedure that can be easily used by the relevant stakeholders of a company to effectively monitor and evaluate the efficiency of value added (VA) according to a firm's total resources (including intellectual resources) and each major component of these resources.

An employee cost includes salary and other expenses on employees. Ante Pulic treat this cost as investment and it is called Human Capital.
Value Added= Total Income-Total Expenses + Personal Expenses
The value added (VA) of a company can be calculated as outputs less inputs, e.g.:

$VA = P + C + D + A$

P describes operating profits, C employee costs (the salaries and the social expenses of staff) and D + A , depreciation and amortisation of assets.

Labour expense is not calculated into "value added" because of its active role in the value creating process. It is instead considered part of the intellectual potential expressed by a firm. Value added grows out of physical capital and intellectual capital but, instead of directly valuing the intellectual capital of a firm, the coefficient mainly measures the efficiency of the firm's three types of inputs:

- Physical and Financial Capital (Capital Employed).
- Human Capital.
- Structural Capital.

Capital employed efficiency (CEE) is an indicator of Value Added efficiency (VA) of the capital employed. Human capital efficiency (HCE) is an indicator of VA efficiency of human capital. Structural capital efficiency (SCE) is an indicator of VA efficiency of structural capital.

The sum of HCE and SCE gives ICE and sum of the three measures results in the coefficient VAIC, calculated by Pulic: ICE and VAIC. The higher a company's ICE and VAIC value, the better its value creation potential.

This aggregated indicator allows us to understand the overall efficiency of an enterprise, including its intellectual potential. In simple terms, ICE and VAIC measures how much new value has been created per monetary unit invested in resources. The benefit of such an analysis is that ICE and VAIC also provides a standardized and consistent basis of measurement. Thereby, better enabling the effective conduct of a national comparative analysis using a large, multi-company sample size.

Alternatives to VAIC are limited in that they:

- Utilize only that information provided from a single group or country.
- Lump distinct financial and non-financial indicators into a single comprehensive measure.
- Must be customized to fit the profiles of individual companies/nations.

Considering the above limitations, the possibility of utilizing other models for the measurement of the intellectual capital ("IC") across a large and diversified sample is diminished.

What is more, all data used in the VAIC approximation are based on audited information, which means that the results obtained can be considered objective and verifiable, whereas other IC measurements contain information that is impossible to verify and subjectively interpret results. VAIC is a straightforward technique that enhances cognitive understanding and enables case-by-case calculations by various internal and external stakeholders. It is for this reason that the researcher has selected the VAIC method as a means of interpreting the efficient use of IC in the Indian public sector.

The Value Added Intellectual Coefficient (VAIC) used in this study as a basic methodology to measure the Intellectual Capital or Knowledge Capital. The core concept of VAIC is that human capital is mainly responsible for overall value creation performance of the organization. VAIC is the universal indicator which shows value creation ability of a company in quantitative terms and represents as measure of business efficiency in knowledge based economy. VAIC has three components which are –

1) Human Capital Efficiency (HCE)
2) Structural Capital Efficiency (SCE)
3) Capital Employed Efficiency(CEE)

The researcher has taken all the three as independent research variables. Earnings Per Share (EPS) is the earning per share held by the shareholders which has been taken as dependent variable as this is best indicator for return to shareholders.

In addition to this, the researcher has taken five additional variables to enhance the VAIC model

Frequency of Board meeting (MEETING) –If the Board (top level decision making body) meets frequently then more meaningful knowledge of company policy will be inducted to the organization which will create more values(Vafeas,1999).

Size of the total asset of the company (ASSET) – The size of the asset is helping to increase value of the organization (Ho and Williams,2003).

Salaries of CEO, directors (top level executives) (CEOEXDIR) – If the good executive directors are in the board who can be inducted with higher remuneration, they would dedicate to the creation of value to the organization (Merhebi,2006).

Number of Executives in the company (NOEXE) – the number of executives the company has who are knowledge workers also contributes to the value creation for enhancing corporate performance (Weill, 2005) and

Ratio of Non-executive directors to total number of directors in the board (NONR) – The function of the Board of Directors as an internal control mechanism is enhanced by the inclusion of outside directors. This has been a one of the emphasis of corporate governance guidelines and laws (Cadbury,

1992; Sarbanes-Oxley Act, 2002; Indian Companies 1956, clause 49 of the agreement). This factor has influence on value creation as more and more non-executive director will bring out-side appropriate knowledge to the organization to create value.

Out of a total of 280 numbers of Public Sector Enterprises, 247 constitutes Central Public Sector Enterprises (CPSEs), 27 constitutes Public Sector Banks (PSBs), 6 constitute State Level Public sector Enterprises (SLPEs). There are 61 listed companies in BSE (http://www.bsepsu.com/bsepsu_index.asp). Out of these 61 listed companies, 3 companies (State Bank of Mysore-SBM, State Bank of Travancore-SBT and State Bank of Bikaner and Jaipur-SBBJ) are subsidiaries of State Bank of India (SBI), one company Chennai Petroleum Corporation (CPC) is subsidiary of Indian Oil Corporation (IOC) and one company Mangalore refinery and Petroleum Corporation (MRPL) is a subsidiary of Oil and Natural Gas Corporation(ONGC). The financial data of subsidiaries company's annual report (here input data) are consolidated in the holding company's annual report. Researcher is not taking the subsidiaries data as he is taking holding companies data. So, effectively only 56 independent CPSE as are listed in BSE (N=56). For population size (N) is known (Krejcie, Morgan 1970) the sample size,

$s = X^2NP(1-P) \div d^2(N-1) + X^2P(1-P)$ where

s = required sample size.

X=the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N= the population size.

P=the population proportion (assumed to be 0.50 since this would provide the maximum sample size).

d= the degree of accuracy expressed as a proportion (0.05).

The amount of s is calculated as 48.99. The researcher has taken as 50. The researcher has randomly selected 50 companies for the purpose of the study. The annual reports for the period from financial year 2001-02 to 2010-11 only of these companies are reviewed for the study.

Methodology

Panel Data Analysis

If a cross-sectional sample are measured two or more times, the resulting observations are described as forming a panel or longitudinal data set. The data for the current study is an example of panel data as the variables are taken for 50 companies for 10 years. As it has a time component, researcher has felt the need to include panel data analysis also as the earlier analysis does to include time effect (Wasim-ul-Rehman, 2013).

There are several reasons for the increasing interest in panel data sets. An important aspect is that their use offers a solution to the problem of omitted variable bias caused by unobserved heterogeneity, a common problem in the fitting of models with cross-sectional data sets. Data sets that combine time series and cross sections are called longitudinal or panel data sets. Panel data sets are more orientated towards cross section analyses – they are wide but typically short (in terms of observations over time). Heterogeneity across units is central to the issue of analysing panel data. To collect panel data one collects data on the same units for two or more time periods.

In panel data analysis there are broadly two type of approach Fixed effects approach and Random effects approach.

Fixed Effects (LSDV) versus Random Effects model (ECM)

Panel data models examine group (individual specific) effects, time effects or both. These effects are either fixed effect or random effect. A fixed effect model examines if intercepts vary across groups or time periods whereas a random effect model explores differences in error variances. A one-way model includes only one set of dummy variables (e.g. firm) while a two way model considers two sets of dummy variable (firm and year). If it is assumes the error component and X's are uncorrelated, ECM may be appropriate. Whereas if they are correlated FEM may be appropriate. Keeping this fundamental difference in the two approaches in mind, the choice between FEM and ECM may be done by:

- If T(the number of time series data) is large and N(the number of cross-sectional units) is small there is likely to be little difference in the values of the parameters estimated by FEM and ECM,. Hence the choice here is on computational convenience. On this score FEM may be preferable.
- When N is large and T is small, the estimates obtained by the two methods can differ significantly. Recall that in ECM $\tilde{a}_{1i} = \tilde{a}_1 + \tilde{a}i$ but in FEM it is treated $\hat{a}1i$ as fixed and non-random.
- If the individual error components $\tilde{a}i$ and one or more repressor are correlated then the ECM estimators are biased whereas those obtained from FEM are unbiased.
- If N is large and T is small and if the assumption underlying ECM hold, ECM estimators are more efficient than FEM estimators.

Hausman Test is used to choose between FEM and ECM. The null hypothesis underlying the Hausman test is that FEM and ECM estimators do not differ substantially. The test statistic developed by Hausman has an

asymptotic chi-square distribution. The Hausman test statistic has an approximate chi-square distribution with *k* degrees of freedom, where *k* is the number of slope parameters in the model. If the null hypothesis is rejected, the conclusion is that ECM is not appropriate and that may better off using FEM in which case statistical inferences will be conditional on the error components in the sample.

The data being a panel data, the researcher has analysed different types of panel data analysis.

Which type of analysis is suitable for these data is determined by the following table.

Table 1. **Selection of approaches (OLS,FEM or ECM) Random/Fixed or OLS**

No.	Fixed effect (F test)	Random effect (B-P LM test)	Selection
1	H0 is not rejected (No fixed effect)	H0 is not rejected (No random effect)	Pooled OLS
2	H0 is rejected (fixed effect)	H0 is not rejected (No random effect)	Fixed effect model
3	H0 is not rejected (No fixed effect)	H0 is rejected (random effect)	Random effect model
4	H0 is rejected (fixed effect)	H0 is rejected (random effect)	Fixed effect model is chosen if the null hypothesis of aHausman test is rejected; otherwise, random effect model is fit.

Source : Park (2011)

The objective in this study is to use a sample of data on Indian Public Sector Enterprises to obtain an unbiased estimate of the effect of Earning Per Share. The researcher believe that the most important variables that affect the Earning per Share are HCE, SCE, CEE etc. and one unobserved variable say governmental interference. HCE,SCE, CEE are observable confounding variables. Because the researcher can obtain data for HCE, he can control it by including it as an explanatory variable in his model. Governmental interference is an unobservable confounding variable. Because the researcher cannot observe governmental interference and collect data for it, he cannot control for it by including it as an explanatory variable. However, the researcher believes that governmental interference differs across Indian Public Sector Enterprises, but is constant over time. Therefore, if he can collect panel data on HCE,SCE,CEE etc. and he can specify a fixed- effects model and statistically control for innate ability.

Hypothesis

The hypotheses are test –

- H0: The panel data has no Fixed effect
- H1: The panel data has Fixed effect

Results and Discussion

Panel Data Analysis

The fixed effect model examines difference in intercept among groups, assuming the same slopes. By contrast the random effect model estimate error variances of groups, assuming the same intercept and slopes. Here different models are tested in Gretl software with the researcher's balanced panel data. In the Model1 Fixed effects are analysed with 500 observations. In the table below Model1 is shown as Fixed effects. Also Random effects are shown for Model 2 and Model 3 (using Nerlove's transformation). The Random effects were tested with the same data.

Table 2. **Comparison of different Fixed Effect and Random Effects Models**

		Cross Sectional Units - 50, Time Series Length - 10, 500 Observations Dependent Variable - EPS		
		Model 1 Fixed Effect	**Model 2 Random Effect (GLS)**	**Model3 Random Effect (GLS)using Nerlove's transformation**
Constant	Coefficient	-5.33859	14.8427	7.8675
	Standard Error	9.83686	8.97386	11.5222
	t-ratio	-0.5427	1.654	0.6828
	p-value	0.5876	0.09877 *	0.49505
HCE	Coefficient	0.612945	0.347682	0.551812
	Standard Error	0.268739	0.23145	0.251802
	t-ratio	2.2808	1.5022	2.1914
	p-value	0.02303 **	0.13369	0.02889 **
SCE	Coefficient	14.6094	15.8565	15.1942
	Standard Error	3.8653	3.93111	3.76411
	t-ratio	3.7796	4.0336	4.0366
	p-value	0.00018 ***	0.00006 ***	0.00006 ***
CEE	Coefficient	1.49321	1.2466	1.35012
	Standard Error	1.52599	1.52924	1.48151
	t-ratio	0.9785	0.8152	0.9113
	p-value	0.32835	0.41537	0.36258
ASSET	Coefficient	-0.00049959	-0.000316712	-0.000333159
	Standard Error	0.000215848	0.000170681	0.000194378
	t-ratio	-2.3145	-1.8556	-1.714
	p-value	0.02110 **	0.06411 *	0.08717 *

MEETING	Coefficient	-0.932154	-0.896252	-0.964162
	Standard Error	0.431747	0.423683	0.41729
	t-ratio	-2.159	-2.1154	-2.3105
	p-value	0.03139 **	0.03490 **	0.02127 **
NOEXE	Coefficient	0.00302617	0.000672927	0.00165081
	Standard Error	0.000491767	0.000214112	0.000344318
	t-ratio	6.1537	3.1429	4.7945
	p-value	<0.00001 ***	0.00177 ***	<0.00001 ***
CEOEXDIR	Coefficient	9.9509	8.70751	9.14765
	Standard Error	1.30454	1.28162	1.25058
	t-ratio	7.6279	6.7941	7.3147
	p-value	<0.00001 ***	<0.00001 ***	<0.00001 ***
NONR	Coefficient	-2.83814	-2.36797	-4.95017
	Standard Error	10.6632	10.1364	10.2043
	t-ratio	-0.2662	-0.2336	-0.4851
	p-value	0.79024	0.81538	0.62782
Mean dependent variable		27.43552	27.43552	27.43552
S.D. dependent variable		32.90774	32.90774	32.90774
Sum Squared Residual		164840	497194.3	723220.1
S.E. of Regression		19.31168	31.78927	38.34005
R-squared		0.694954	-	-
Adjusted R-squared		0.655615	-	-
F(49, 442)		15.3902	-	-
P-value(F)		2.04E-68	-	-
Breusch-Pagan test	Chi-square(1)	-	624.421	624.421
	p-value	-	8.17E-138	8.17E-138
Hausman test	Chi-square(8)	-	42.5284	21.3101
	p-value	-	1.08E-06	0.00636785

In Model1, Fcritical(49,442) is 1.721 with p-value < 0.005.

So, the null hypothesis is rejected. Moreover, for both the random models, Chi-square value is very high (624.421) for Breusch-Pagan test. So, the null hypothesis is rejected.

Also, for Hausman test, Ch-square (8) with p=5% significance is 15.507. Therefore, researcher has chosen Fixed effects model. As the values of the above two Random models are more than this value. The researcher has rejected the null hypothesis and adopted Fixed effect model.

The researcher has observed that

H0 : The panel data has no Fixed effect - rejected

H1 : The panel data has Fixed effect - accepted

The researcher has taken Fixed effects model with time dummies and found the result as follows.

Table 3. **Fixed Effect Model with Time Dummies**

	Model 4 (Fixed Effect Model with Time Dummies)			
	Cross Sectional Units - 50, Time Series Length - 10, 500 Observations Dependent Variable - EPS			
	Coefficient	**Standard Error**	**t-ratio**	**p-value**
Constant	-3.3537	9.9547	-0.0005	0.73636
HCE	0.6579	0.2648	2.4843	0.01336 **
SCE	11.1979	3.8715	2.8924	0.00402 ***
CEE	1.0638	1.5031	1.5031	0.47950
ASSET	-0.0006	0.0002	-2.8120	0.00515 ***
MEETING	-0.9480	0.4237	-2.2375	0.02576 **
NOEXE	0.0024	0.0005	4.6614	<0.00001 ***
CEOEXDIR	6.1175	1.6938	3.6117	0.00034 ***
NONR	-3.7688	10.5049	-0.3588	0.71994
dt_2	2.0432	3.81132	0.5361	0.59217
dt_3	5.9713	3.84402	1.5534	0.12106
dt_4	6.6894	3.84126	1.7415	0.08231 *
dt_5	9.8423	3.84821	2.5576	0.01088 **
dt_6	13.6146	3.89789	3.4928	0.00053 ***
dt_7	17.7679	3.97519	4.4697	0.00001 ***
dt_8	12.7980	4.12408	3.1032	0.00204 ***
dt_9	14.4875	4.51878	3.2061	0.00145 ***
dt_10	17.0722	4.60395	3.7082	0.00024 ***
Mean dependent variable	27.43552	-	-	-
S.D. dependent variable	32.90774	-	-	-
Sum Squared Residual	153300	-	-	-
S.E. of Regression	18.81599	-	-	-
R-squared	0.716309	-	-	-
Adjusted R-squared	0.673068	-	-	-
F(49, 433)	16.2972	-	-	-
p-value	4.58E-71	-	-	-
Wald Test - Chi-square(9)	32.5951	-	-	-
- p-value	0.000157055	-	-	-

Wald test it is seen that F-test p-value is < 0.0001, which is lower than 1% of α. Hence, we can reject the null hypothesis and most of the variables in this list are significant. Time variant also has significance. Also, R-squared is much improved from the OLS value of 0.174.

Conclusion

The result found that model of fixed effect has been selected to be appropriate and also received one single equation. That means with different intercept with same slope. 2nd year (2002-03) and 3rd year (2003-04) have no significant effect but from 4th year (2004-05) onwards it has a significant effect on EPS. It has also been seen that the time coefficients are increasing only dropped in 8th year (2008-09) and again increasing from 9th year(2009-10). The researcher has also observed that HCE, SCE, ASSET MEETING and NOEXE are having significant effect in EPS. But CEE and NONR has no significant effect on EPS.

Here, CEE is an important constituent of VAIC (Wasim-ul-Rehman et. al, 2013) but it is insignificant in the above analysis. Here the author found that CEE's effects is insignificant on EPS. The reason might be that each company has different size and portfolio of financial and physical assets. Also, Gu Lixia et al.(2009) while studying listed companies in China found that Board independence (the ratio of independent director in the board) has insignificant effect on EPS.

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