Design of Sustainable Development: Intellectual Value of Large BRIC Companies and Factors of their Growth

Elvina Bayburina and Tatiana Golovko
State University – The Higher School of Economics, Moscow, Russia
elvina.bayburina@gmail.com
tgolovko@hse.ru

Abstract: Intellectual capital and its components can be regarded as the source for a company’s organic growth to maintain sustainable development. Under the crisis conditions most of financial reserves are unavailable; the inner organizational efficiency by means of intellectual capital is a question of survival edge for most of the large companies of emerging markets. Multidirectional trends of the development of BRIC economies played a significant role in this discussion and the issue became more complicated under the pressure of the crisis. Notwithstanding BRIC countries can be regarded as leaders of so-called developing economies. In terms of the downturn, however, the problem of the crisis should not be overstated: due to the cyclical changes of the world economy the stagnation will be rearranged by upturn sooner or later, however the accumulation of intellectual capital is the over time process. Intellectual capital of the company and its components can be regarded as “latent reserves” of the long term value growth. Intellectual capital is the “intangible safety-cushion” and it can be used only by those companies who have created it years before and therefore have focused on sustainable development. The research of intellectual capital components and its role in value creation and building competitive advantage can remain an actual topic for empirical investigations, carried out in various countries and by different research centers. The intellectual value of a company is a part of the total value, created through the process of the intellectual components’ accumulation. The main goal of this research is to evaluate by means of the panel data analysis the influence of particular components of intellectual capital on the intellectual value of BRIC companies. The process of intellectual capital accumulation is over time and it can be measured according to the long run panel data analysis not less than 5 years. The panel data analysis revealed that the human capital can be considered the key factor of the long-term growth of BRIC companies of all industries. Employees and their competencies are this basis which is undervalued currently whereas most of financial assets lost trust and its value. However, specified directions of internal reserves audit and discussion of the Intellectual value on the emerging markets are very close to the fact that large BRIC companies depend a lot on the specific features of the infrastructure of each developing country. India and Russia are countries with the industrial potential, which is not fully realized, e.g. a lot of Russian companies are underinvested with unbalanced development strategies. Decrepit and out-of-date production facilities, in turn capital expenditures are a matter of great importance. The capital expenditures together with innovative managers and management techniques tend to be the leverage, which can push these companies towards intensive development, especially Russian companies.

Keywords: intellectual capital, human capital, stakeholders, growth drivers, sustainable competitive advantage, value, intellectual value, financial crisis, BRIC, developing countries, emerging markets

1. Introduction

Intellectual capital and its components can be regarded as the source for the company’s organic growth. Under the crisis conditions most of financial reserves are unavailable; the inner organizational efficiency by the means of intellectual capital is the question of the survival edge for most of large BRIC companies. The analysis and the closer valuation of internal sources is now of a great importance especially for companies from developing countries, due to the fact that under the financial crisis conditions these immature capital markets with weak infrastructure can be revealed in terms of the future potential and can break the trend of the world economy global downturn.

It is crucial to underline that the problem of highlighting and unification of outstanding capital markets of developing countries is on the edge of discussions among economists worldwide. It is important to emphasize that in most cases there is no common view on whether it is still reasonable to group BRIC countries (Brazil, Russia, India and China). The term “BRIC” was launched in the year of 2003 by an economist from Goldman Sachs investment bank Jim O’Neill in one of his analytical reports. He has assumed that this group of countries had common characteristics:

- national financial assets are underestimated and have a great potential of growth;
- all countries can be recognized as developing ones;
- up to 2020 years the aggregated GDP of BRIC countries would exceed the GDP volume of the so-called G-7 (“Great Seven”) countries.
Multidirectional trends of the development of BRIC economies played the significant role in this discussion and the issue became more complicated under the pressure of the crisis. It is necessary to mention that BRIC countries are considered to be the largest developing markets; simultaneously they are characterized by a diverse level of potential. Before the crisis experts have selected a group of “leaders”, China and Brazil, and a group of “pushovers”, India and Russia. However now at the first stage of the global downturn it can be assumed that the BRIC group can be divided accordingly: “source economies” Brazil - Russia, “innovative economies” India – China. India is characterized by a high level of the consumer demand and high forecasted levels of GDP growth, and in addition by the aggressive external expansion and the maintenance of the fixed exchange rate of national currency, which ensures high competitiveness of national export goods.

The crisis has revealed that four BRIC countries have a range of distinctions, particularly in possibilities and methods of national economics’ stimulation under downturn conditions. Notwithstanding these countries can be regarded as leaders of the so-called developing economies. In terms of the downturn, however, the problem of the crisis should not be overstated: due to the cyclical changes of the world economy the stagnation will be rearranged by the upturn sooner or later, however accumulation of the intellectual capital is the over time process. Especially due to this reason the latent reserves of the companies of developing capital markets in the long-run still plays an important role.

*Intellectual capital* of the company as a whole and its components can be regarded as “latent reserves of the long term value growth. Intellectual capital is the “intangible safety-cushion” and it can be used only by those companies who have created it years before and therefore have directed the cash flows to maintain sustainable development.

Generally the additional reports published by the company or some other public information may provide details about intangibles of the company (these reports can for example contain rules of various groups of intangible assets accounting principles, their amortization period, etc.) Nevertheless, the so-called *intellectual capital* reports to some extent can reduce investors’ risk, due to the fact that such reports disclose more relevant information in comparison towards standard companies’ reports.

The research of *intellectual capital* components and its role in the value creation and building the competitive advantage can remain an actual topic for the empirical investigations, carried out in various countries and research centers. Bismuth and Tojo (2008) have come to the conclusion that companies should stimulate investment in innovations, should increase innovation capital, and supervising authorities, government should protect intellectual property rights and should also stimulate the mobility of the workforce and the knowledge exchange.

From the point of view of Bayburina, Golovko (2008) the *intellectual capital* is a complexity of key qualitative characteristics of the company, which are not always objects of intellectual property, such as, for instance, competencies. Thus, *intellectual capital* is a complexity of knowledge, accrued experience of employees and intellectual property. It is important to mention that not all objects of engineering design are the objects of the intellectual property; however its importance for the process of the value creation is difficult to underestimate, for example, in the companies of the high tech industry. Simultaneously it is complicated to provide the full, complete, exact definition of the notion ‘intellectual capital of the company’. For this purpose it is reasonable to concentrate on its structure and the content. In less details it is possible to form a structure of *intellectual capital*, which consists of the 5 following components or the elements of the first level of *intellectual capital*; this approach has been used by the authors Bayburina, Ivashkovskaya (2007); Bayburina, Golovko (2008); Bayburina, Golovko (2009). Briefly, the structure of *intellectual capital* could be described as follows:

- **a)** human capital (key knowledge and abilities of the personnel);
- **b)** process capital (key characteristics of the business processes of the company);
- **c)** client capital (key features of the company which are necessary to manage customer relationship and loyalty);
- **d)** innovation capital (renovation techniques to maintain the future growth of the company);
- **e)** network capital (synergy which occurs from the interactions of the company).
The complexity of such characteristics represents the competitive advantage originated inside and within the company. According to Bayburina and Golovko (2008) from the one hand the volatility of the business environment from the other hand the opposite stakeholders interests stipulate the fact that value becomes the result of constant strategic changes. In this case the value becomes a complicated intellectual parameter, which is managed and defined by the multi-level combination of interactions of different groups of stakeholders. By this pattern the value is generated by its intellectual part. So, Bayburina, Golovko (2008) conclude, that the *Intellectual value* of the company is a part of the total value, created through the process of the intellectual components’ accumulation. And moreover this value can be “traced” by the external stakeholders of the company. In addition, we can underline that the delta (the difference) between the Market value of the equity and its Book value can also be “traced”.

According to Bayburina (2007); Bayburina and Ivashkovskaya (2007) it is necessary to determine the reason for taking into account only the characteristics of the Equity. Managers of BRIC companies when targeting the capital structure of the company do not always consider future growth and sustainable development as the long- and medium term goal especially with emerging markets sample of companies. That is why the choice of the capital structure by BRIC companies depends on a range of factors, which cannot be considered in this article and are left for the future distinguished research from the conceptual point of view.

The main goal of this research is to evaluate the influence of particular components of *intellectual capital* on the *Intellectual value* of BRIC companies.

2. Intellectual value research

2.1 Background approach

The research described in this article focuses on the assessment of *intellectual capital components and subcomponents’* contribution to the process of the company value creation over the long-term period. The notion *intellectual capital* in general is more broad and complex than *Intangible Assets* (*intellectual capital* includes *intangible assets* and other qualitative, non-financial key characteristics reflecting the current status of the company, by taking into consideration its potential for the future growth).

It is possible to define two aggregate approaches to the measurement of the company’s activity with the purpose of evaluating its potential for future long-term growth (and thereafter). So, according to this logic, the authors of this article can determine two approaches to measurement of the company’s value added:

- the analysis of the company is based on the accounting reports and,
- the analysis based on VBM principles.

The *Intellectual Value Based Management* approach is regarded as the modification of the basic Value Based Management approach in terms of the current dynamic economic changes (see Figure 1, 2).

Consequently the analysis of the *Intellectual value* of the company should be systematic (i.e. should be observed across a number of consecutive time periods) and should include either the assessment of fundamental characteristics of the company, or the assessment of its *intellectual capital* components. According to Bayburina (2007) the analysis of the company’s accrued *intellectual capital* should serve as the measure of the company’s attendant risk, the risk of the deviation of the actual performance results from the predicted ones, including financial performance of the company. The classification of the factors, which influence the Value of the company created by Edvinsson and Malone (1997), the founders of the *intellectual capital theory*, is presented in figure 3.
Approaches to measurement of the company’s value

Accounting
Basic is reporting

Intellectual
Basic is managing

Figure 1: Accounting approach towards the performance evaluation

Figure 2: Intellectual approach towards the performance evaluation

Figure 3: Edvinsson and Malone (1997) classification
Since there is a lack of academic research which consider the analysis of intellectual capital components in the large companies of emerging markets and which are aimed at revealing the factors of the long-term growth of its value, the results of this research might add to the existing Knowledge Management Concepts, and offer a new instrument for this kind of analysis.

The results of the empirical research may be used either by internal stakeholders (managers), or by external stakeholders (investors). The former can use it in addition to the basic Value Management principles; however investors can use it in the process of investment portfolio diversification (in terms of buying shares).

The research model is based on the methodologies used by the large consulting companies focused on the Intellectual capital valuation (Skandia Navigator, Celemi Monitor) and methods of measuring intangible assets used by Karl-Eric Sveiby.

The examples of intellectual capital components used within the above mentioned methods for evaluating various companies are shown in the Figure 4 below.

**Figure 4:** Methods of measuring intellectual capital components: some examples of proxy variables

The main aim of the research is to determine the impact of the following factors (independent variables, IC components and sub-components) on the dependent variables (the indicator of the intellectual value):

- Fundamental factors (a group of explanatory variables representing the fundamental factors of the Value’s growth of the company);
- Intellectual capital components (a group of factors representing the components of the intellectual capital).

According to the Intellectual capital components' classification, this approach has been used and developed by the authors Bayburina, Ivashkovskaya (2007); Bayburina, Golovko (2008); Bayburina, Golovko (2009), the following IC structure is used: human capital, process capital, client capital, innovation capital, and network capital. In order to reach the objectives of the current research the structure of IC, developed in the above-mentioned research, was transformed to the following hierarchy of components (human capital, process capital, client capital, innovation capital, network capital) and the second – level sub-components of IC (trainings of employees, R&D expenses, etc.)
2.2 Hypotheses

The process of intellectual capital accumulation of BRIC companies is over time and it can be measured according to the long run panel data analysis not less than 5 years. To realize the panel econometric analysis the data of the BRIC companies are to be comparable. The basic assumption of this article is that the information used in this research is public (is legible to disclosure) and can be considered by potential investors and all other external interested parties and stakeholders.

To realize the main goal of this research the four components of intellectual capital will be investigated: human capital, process capital, innovation capital and network capital. The authors suppose that the client capital for the purpose of the comparable principle of the panel data research of BRIC companies is less appropriate taking into consideration the features of the disclosed. According to the previous research of the large Russian companies only 4 components of Intellectual capital were significant:

- human capital (expenses for trainings of employees, total assets/number of employees),
- innovation capital (delta investment, delta dividend payout),
- process capital (sales & administrative costs),
- network capital (the existence of controlling shareholder).

To conduct this research over BRIC companies it is important to design the hypothesis and comparable subcomponents of intellectual capital, or the elements of the second level. The influence of these subcomponents on the intellectual value will be estimated and discussed.

Authors of the research designed the following hypotheses:

**Hypothesis 1.** Positive influence of human capital subcomponents on the Intellectual value of the company.
Employees of companies can be regarded as one of the most valuable assets: the financial crisis has proved this statement. The benchmark companies in all industries have been making attempts to support the key staff, which possesses the accrued skills and is loyal to the company. Such companies prefer not to hire new employees, companies prefer to retain and to develop the existing team.

Human capital can be regarded as the “latent source” of the value growth and this research verifies such hypothesis. Ballester, Livnat and Sinka (2002) investigate the market reaction on the chosen level of personnel expenses with the usage of the approach analyzed by Ohlson (1995). The authors investigate which part of the personnel expenses the market considers as an investment in the staff. This is not the easy matter to define what part of the personnel expenses is the investment part. However, the authors of this research tend to think that in reality it is important how much the company pays the personnel in general, whether to consider separately the importance of salary and human capital investment. Due to the fact that large BRIC companies are the companies from various industries, therefore their role in the process of value creation is probably distinct, thus the influence of the human capital subcomponents which characterize specific features of the organization may vary from company to company.

The authors of this research suppose that the indicator of the usage of assets, which is calculated as the total assets divided by number of employees, characterizes the efficiency of usage of the company’s assets by its employees and positively affects the Intellectual value of the company, the same approach was executed by Scandia.

Hypothesis 2. Positive influence of operating expenses as the subcomponent of the process capital on the Intellectual value of the company.

Operating expenses reflect the level of the expenditures spent on the maintaining of the production process and can be regarded as a proxy variable for measuring the company’s process efficiency; the same approach was executed by Scandia.

Hypothesis 3. Direct influence of capital expenditures as a subcomponent of the innovation capital on the Intellectual value of the company.

It is assumed by the authors that if the company has the opportunity and bears substantial capital expenditures, the company may have more opportunities and can qualitatively improve its production, intensifies, renews and creates assets. The capital expenditures as the indicator reflects the possibility of the company to implement innovations, its direction towards the optimization of the current assets structure, replacement of old equipment by new more productive one. Consequently, it is possible to conclude that by means of new equipment the company increases the probability of its own growth.

Hypothesis 4. Reverse influence of the dividends paid as a subcomponent of the innovation capital on the Intellectual value of the company.

Dividend policy can be considered as one of the crucial parts of the implemented financial policy due to the ambiguity. The irrelevance of dividend policy towards the corporate value under the terms and conditions of the perfect market was shown in the research of Miller and Modigliani (1961). The main focus of the research in such a field according to the stakeholders’ theory is the influence of dividends towards the corporate value. From the one hand, the increase of dividends usually leads to a decrease of reinvestment in business, from the other hand dividends are considered to be a signal for the market, however such a signal may have either a positive, an improvement of the financials, or a negative nature of the influence, the change of the ownership due to a possible financial distress. In case of the inefficiency and the imperfection of capital markets the dividend policy may affect the price of the shares and also may increase liquidity of the company’s shares.

Nonetheless, according to the framework of this research the dividend policy of the company is analyzed from the positions of the signaling theory. Companies with the higher level of intellectual capital tend to pay fewer dividends as the signal that they intend to implement responsibilities towards all stakeholders. In addition the smaller dividend payout is considered as a signal of intentions to invest in the sustainable development of the company.
Hypothesis 5. Positive influence of R&D expenses on the Intellectual value of the company.

Research and Development Expenses, R&D expenses form a long-term basis for the company’s future development and therefore for future growth of its intellectual value. Thus, Bublitz, Ettredge (1989) have concluded that the market value of the company may fluctuate according to the dynamics of R&D expenses, because the market regards such expenses not as costs of the company, but as the future development investment. Corresponding results obtained Chaucin and Hirschey (1993); Green, Stark and Thomas (1996).


According to the framework of this research it is assumed that in the period of the rapid growth of the market the factor of the “particular year” can influence the intellectual value. The rapid growth of the market capitalization of companies in the regarded period 2004-2007, the economic crunch in 2008 for sure tend to influence the intellectual value, but in its own particular way, therefore a set of year-dummy variables was introduced into the research model.

Hypothesis 7. Significant influence of a particular industry on the Intellectual value of the company.

According to the expected influence of the particular industry on the possibility of the intellectual value creation a set of industry-dummy variables was introduced into the research model.

2.3 Research model

The main goal of this research is to evaluate the influence of particular components of the intellectual capital on the Intellectual value of BRIC companies. To reach the main goal of the research the special research model has been introduced and a series of linear regression tests has been held.

The value created primarily due to the internal integration of intellectual capital components is the Intellectual value of the company. The accumulation of the intellectual capital is the over time process, not less than 5 years of the research should be taken into the consideration. The Intellectual value of the company can be calculated as the delta between market and book values of the company’s equity in purposes of this research in the period of 2004-2008.

2.3.1 Research model. dependent variable.

Intellectual Enterprise Value as the dependent variable is the value created primarily by internal integration of intellectual capital components, IEV, calculated in US dollars as of the formulae:

\[ \text{IEV}_t = \text{Market Value of Equity}_t - \text{Book Value of Equity}_t, \]

Where

- \( i \) – the BRIC company index
- \( t \) – the year index.

\[ \text{Market Value of Equity}_t = N_{\text{shares}} \times \text{Last Price}, \]

Where

- \( N_{\text{shares}} \) – number of shares in circulation;
- \( \text{Last Price} \) – last available price (in the corresponding period).

\[ \text{Book Value of Equity}_t = \text{Pref}_{\text{shares}} + \text{Minor}_{\text{Int}} + \text{Ord}_{\text{shares}}, \]

Where

- \( \text{Pref}_{\text{shares}} \) – preferred shares;

The accumulation of the intellectual capital is the over time process, not less than 5 years of the research should be taken into the consideration. The Intellectual value of the company can be calculated as the delta between market and book values of the company’s equity in purposes of this research in the period of 2004-2008.
Due to the fact that from the one hand fundamental variables should be included to the research model of intellectual capital influence on the intellectual value, from the other hand certain comparable components and subcomponents of intellectual capital, independent variables, should be included into the research model.

According to the principle of comparability and principle of long-term analysis the empirical research on BRIC countries is highly limited due to a specific level of the intellectual capital information disclosure for a particular company, particular industry, and even particular country of the BRIC group. Therefore the model does not include specific subcomponents measured by IC Occurrences Variables technique, as it was in the research of Bayburina (2007).

According to all limitations and principles of the analysis the basic research model can be presented as following:

\[ \text{IEV}_t = \alpha (\rho_{1t}, \ldots, \rho_{1t}) \times \text{IC} + \beta_t \times \text{FV} + \epsilon_t \]

where

- \text{IC} – a vector of intellectual capital subcomponents;
- \text{FV} – a vector of fundamental variables;
- \epsilon – a vector of random errors (“white noise”).

### 2.3.2 Research model. independent variables. fundamentals

The model includes a range of fundamental variables for comparison its influence on the Intellectual value correspondingly with the influence of intellectual capital components on the dependent variable.

Consequently the model includes the following variables.

a) Total revenues of the goods sold less adjustment on returns, discounts, insurance payouts, tax on sales, value added tax, \( \text{Sales}_{adj} \)

In general the meaning of variable is calculated in US dollars and reflects the level of the stated financial indicator on the date of December, 31 of each regarded year. Unless otherwise specified.

b) Book value of Assets, in US dollars, \( \text{TA} \)

c) Net Assets, in US dollars, \( \text{NA} \)

The meaning of the variable is calculated as follows:

\[ \text{Net Assets} = \text{Assets} - \text{Current Assets} - \text{Long Term Borrowings} - \text{Other long-term liabilities}, \]

d) Net income, in US dollars, \( \text{NI} \)

The profits after all expenses have been deducted. Net income includes the effects of all one-time, non-recurring, and extraordinary gains, losses, or charges.

e) Return on Assets, %, \( \text{ROA} \)

The meaning of the variable is calculated as follows:

\[ \text{ROA} = \left( \left( \frac{\text{Net Income} - \text{Pref_payments}}{\text{Assets}_{avg}} \right) \times 100 \right), \]

Where
Net Income – net income for the period (calendar year);

Pref_payments - total cash preferred dividends for the same period;

Assets_avg – average value of assets for the ended financial year (calendar year).

f) Return on equity, %, ROE

The meaning of the variable is calculated as follows:

(7) \( \text{ROE} = \left( \frac{\text{Net Income} - \text{Pref_payments}}{\text{Ord_shares_avg}} \right) \times 100 \),

where

Net Income – net income for the period (calendar year);

Pref_payments - total cash preferred dividends for the last 12 months;

Ord_shares_avg – average value of ordinary shares.

g) Earnings before interest, taxation, depreciation and amortization, in US dollars, EBITDA

The meaning of variable is calculated as follows:

(8) \( \text{EBITDA} = \text{Operating Income} - + \text{D&A} \),

where

Operating Income – income from the company’s operating activity;

D&A – depreciation and amortization.

h) EBITDA growth rate, %, a percent change of EBITDA from the previous period to the regarded period, EBITDA_GROWTH,

i) Earnings before interest and taxation, in US dollars, EBIT

j) Natural logarithm of the company’s value of assets (as a proxy variable for the company’s size), LN_TA.

Fundamental variables will also be included into the model as control variables, the combination of such variables in the model will be defined during the research process.

2.3.3 Research model. independent variables. components and subcomponents of intellectual capital

Proxy variables for the research were grouped as follows.

a) Human capital. Personnel expenses reflect “the intention” of the company to invest in its employees.

1) Personnel expenses, in US dollars, PE

The figure includes wages and salaries, social security, pension, profit-sharing expenses and other benefits related to personnel.

b) Human capital. Efficiency of the company’s assets usage by its employees;

1) Number of employees; N

2) Total Assets/Number of employees, TA/Nempl
c) **Process capital.**

1) Operating expenses, in US dollars, $OE$

Indirect operating expenses after Cost of Goods Sold. If there is no breakdown between Cost of Goods Sold and SG&A, it includes the entire amount which represents total operating expenses. Includes amortization of intangibles including goodwill and stock-based compensation.

d) **Innovation capital.** Measures implemented to support the long-term growth of the company.

1) Capital expenditures, in US dollars, $Capex$

2) Dividends paid, in US dollars, $DVD$

The figure includes dividends actually paid out as cash disbursements including both common stock of the parent company and preferred stock of all consolidated companies.

3) R&D Expenses, in US dollars, $RND$

Research and development expenditures incurred in the fiscal period.

e) **Network capital.** The influence of a particular time period was included into the model. The influence of the economic upturn business activity, 2004-2007 is connected close to the possibility of creating value networks among companies. The period of downturn and compressing of the business activity in 2008 and features of each industry on the development of the company were included into the model.

A set of corresponding dummy variables, which are proxy variables for estimation of each year influence, was included into the model.

a) $D^{04}$ - equals “1”, if the year is 2004 и “0” otherwise;

b) $D^{05}$ - equals “1”, if the year is 2005 и “0” otherwise;

c) $D^{06}$ - equals “1”, if the year is 2006 и “0” otherwise;

d) $D^{07}$ - equals “1”, if the year is 2007 и “0” otherwise;

e) $D^{08}$ - equals “1”, if the year is 2008 и “0” otherwise;

A set of corresponding dummy variables, which reflect industry influence, was included into the model.

a) $I^{01}$ - equals “1”, if industry i in year t is industry «Basic materials», and “0” otherwise;

b) $I^{02}$ - equals “1”, if industry i in year t is industry «Telecommunications», and “0” otherwise;

c) $I^{03}$ - equals “1”, if industry i in year t is industry «Consumer goods (cyclical)», and “0” otherwise;

d) $I^{04}$ - equals “1”, if industry i in year t is industry «Consumer goods (non-cyclical)», and “0” otherwise;

e) $I^{05}$ - equals “1”, if industry i in year t is industry «Diversified production», and “0” otherwise;

f) $I^{06}$ - equals “1”, if industry i in year t is industry «Energy», and “0” otherwise;

g) $I^{07}$ - equals “1”, if industry i in year t is industry «Financial», and “0” otherwise;

h) $I^{08}$ - equals “1”, if industry i in year t is industry «Industrial production», and “0” otherwise;

i) $I^{09}$ - equals “1”, if industry i in year t is industry «Technology», and “0” otherwise;
j) \( I_{it}^{10} \) equals “1”, if industry \( i \) in year \( t \) is industry “Utilities”, and “0” otherwise;

Model of the research therefore is:

\[
IEV_{it} = \alpha + \sum_{j=1}^{n} \beta_{jt} X I_{jt}^{1} + DE_{it} + \sum_{k=1}^{m} \gamma_{kt} X D_{kt} + \sum_{l=1}^{h} \delta_{lt} X \frac{D}{I_{lt}} + (\eta_{1it}, \ldots, \eta_{nit}) XI + (\eta_{1it}, \ldots, \eta_{nit}) XD + \epsilon_{it}
\]

Where

- HC – a vector of subcomponents of the human capital;
- OE – operating expenses;
- Capex – capital expenditures;
- DVD – dividends paid;
- RND – R&D expenses;

\( I \) – a vector of dummy variables which reflect the influence of a particular time period;

\( D \) – a vector of dummy variables which reflect the influence of a particular industry of the economy;

\( \epsilon \) – a vector of random errors (“white noise”).

Table 1 provides hypothetical signs of connection between the dependent variable and the independent variables.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Hypothetical sign of connection with the dependent variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales_{adj}</td>
<td>+</td>
</tr>
<tr>
<td>Net Assets</td>
<td>+</td>
</tr>
<tr>
<td>Total Assets</td>
<td>+</td>
</tr>
<tr>
<td>Net income</td>
<td>+</td>
</tr>
<tr>
<td>ROE</td>
<td>+</td>
</tr>
<tr>
<td>LN(Total Assets)</td>
<td>+</td>
</tr>
<tr>
<td>ROA</td>
<td>+</td>
</tr>
<tr>
<td>EBITDA</td>
<td>+</td>
</tr>
<tr>
<td>EBITDA Growth rate</td>
<td>+</td>
</tr>
<tr>
<td>EBIT</td>
<td>+</td>
</tr>
<tr>
<td>Personnel Expenses</td>
<td>+</td>
</tr>
<tr>
<td>Total Assets/Number of employees</td>
<td>+</td>
</tr>
<tr>
<td>Number of employees</td>
<td>+</td>
</tr>
<tr>
<td>Operating expenses</td>
<td>+</td>
</tr>
<tr>
<td>Capital expenditures</td>
<td>+</td>
</tr>
<tr>
<td>Dividends paid</td>
<td>-</td>
</tr>
<tr>
<td>Research &amp; Development Expenses (R&amp;D Expenses)</td>
<td>+</td>
</tr>
<tr>
<td>Industry influence</td>
<td>Significant</td>
</tr>
<tr>
<td>Time period influence</td>
<td>Significant</td>
</tr>
</tbody>
</table>

2.4 Sample and sources of data

The sample was formed according to the goal of the research. According to the principle of comparability the standard of public corporate reports became a primary criterion for BRIC sample selection.

In the initial stage of the BRIC research the following criterion was formed: the company should have IFRS financial reports in the long-term persistent period during at least 3 years. Indian and Brazilian companies were not included in the sample (top-5 in each country), such as Brazilian Petrobras and one of the Indian largest companies ONGC do not have IFRS financial reports in the period earlier than 2005 year. Also the principle of long-term panel data not less than 5 years analysis was not
Elvina Bayburina and Tatiana Golovko

executed. Thus, to make a representative and comparable sample of these companies with the usage of IFRS financial reports was impossible.

In terms of implementation the aims of the research a new criteria was formed for financial reports of the companies: companies should have financial reports along with the National GAAP accounting standards, therefore the sample includes BRIC companies and the research period has been extended not less than 5 years due to the fact the main constraint of IFRS reports availability was removed.

The final research sample was formed along with the following criteria:

- a) Market capitalization of each company at the end of the second quarter of 2009 was not less than $200 mln, thus the sample consists of rather large companies, which despite the downturn of the world economy were able to retain market capitalization at high level. The data source is Bloomberg.
- b) Information of bids and prices is available for the period of 2004-2008. The data source is Bloomberg.
- c) The availability of corporate accounting reports prepared according to GAAP accounting standards to make the results comparable since 2004 till 2008 years. The data source is Bloomberg.
- d) The existence and feasibility of a corporate web-site which provides sufficient information of the companies.
- e) Along with all the criteria being met the final sample was formed and it includes 115 companies from BRIC countries, representing companies of 10 industries.

In this research three subsamples were collected BRIC sample, Brazil-China sample, India – Russia sample. The foregoing samples have been regarded in the period of economic upturn of the 2000-s as “leaders” and “pushovers”, correspondingly, see Figures 6,7,8,9.

![Graph of Brazil main macroeconomic indicators](www.ejkm.com)

**Figure 6:** Brazil main macroeconomic indicators
Figure 7: Russia main macroeconomic indicators

Figure 8: India main macroeconomic indicators

Figure 9: China main macroeconomic indicators
Table 2: BRIC sample

<table>
<thead>
<tr>
<th>No</th>
<th>Name of the BRIC company</th>
<th>Industry</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Petroleo Brasileiro SA</td>
<td>Energy</td>
<td>Brazil</td>
</tr>
<tr>
<td>2</td>
<td>Vale SA</td>
<td>Basic materials</td>
<td>Brazil</td>
</tr>
<tr>
<td>3</td>
<td>Cia de Bebidas das Americas</td>
<td>Consumer goods (non-cyclical)</td>
<td>Brazil</td>
</tr>
<tr>
<td>4</td>
<td>Usinas Siderurgicas de Minas Gerais SA</td>
<td>Basic materials</td>
<td>Brazil</td>
</tr>
<tr>
<td>5</td>
<td>CPFL Energia SA</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>6</td>
<td>Telemar Norte Leste SA</td>
<td>Telecommunications</td>
<td>Brazil</td>
</tr>
<tr>
<td>7</td>
<td>Tractebel Energia SA</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>8</td>
<td>Bradespar SA</td>
<td>Financial</td>
<td>Brazil</td>
</tr>
<tr>
<td>9</td>
<td>Weg SA</td>
<td>Industrial</td>
<td>Brazil</td>
</tr>
<tr>
<td>10</td>
<td>Cia Paranaense de Energia</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>11</td>
<td>Empresa Brasileira de Aeronautica SA</td>
<td>Industrial</td>
<td>Brazil</td>
</tr>
<tr>
<td>12</td>
<td>Cia De Transmissao De Energia Eletrica Paulista</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>13</td>
<td>Amplia Energia e Servicos SA</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>14</td>
<td>EDP - Energias do Brasil SA</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>15</td>
<td>Duke Energy International Geracao Paranaapanema SA</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>16</td>
<td>Totvs SA</td>
<td>Technology</td>
<td>Brazil</td>
</tr>
<tr>
<td>17</td>
<td>Equatorial Energia SA</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>18</td>
<td>Cia Energetica do Rio Grande do Norte</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>19</td>
<td>Centrais Eletricas de Santa Catarina SA</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>20</td>
<td>Companhia Estadual de Geracao e Transmissao de Energia Eletrica</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>21</td>
<td>Mahle-Metal Leve SA Industria e Comercio</td>
<td>Consumer goods (cyclical)</td>
<td>Brazil</td>
</tr>
<tr>
<td>22</td>
<td>Itautec SA - Grupo Itautec</td>
<td>Technology</td>
<td>Brazil</td>
</tr>
<tr>
<td>23</td>
<td>Cia Energetica de Pernambuco</td>
<td>Utilities</td>
<td>Brazil</td>
</tr>
<tr>
<td>24</td>
<td>Lukoil OAO</td>
<td>Energy</td>
<td>Russia</td>
</tr>
<tr>
<td>25</td>
<td>Novolipetsk Steel OJSC</td>
<td>Basic materials</td>
<td>Russia</td>
</tr>
<tr>
<td>26</td>
<td>Mobile Telesystems OJSC</td>
<td>Telecommunications</td>
<td>Russia</td>
</tr>
<tr>
<td>27</td>
<td>Tatneft</td>
<td>Energy</td>
<td>Russia</td>
</tr>
<tr>
<td>28</td>
<td>Mechel</td>
<td>Basic materials</td>
<td>Russia</td>
</tr>
<tr>
<td>29</td>
<td>Sistema JSFC</td>
<td>Telecommunications</td>
<td>Russia</td>
</tr>
<tr>
<td>30</td>
<td>Moscow City Telephone</td>
<td>Telecommunications</td>
<td>Russia</td>
</tr>
<tr>
<td>31</td>
<td>Vsmpo-Avisma Corp</td>
<td>Industrial</td>
<td>Russia</td>
</tr>
<tr>
<td>32</td>
<td>Cherkizovo Group OJSC</td>
<td>Consumer goods (non-cyclical)</td>
<td>Russia</td>
</tr>
<tr>
<td>33</td>
<td>Oil &amp; Natural Gas Corp Ltd</td>
<td>Energy</td>
<td>India</td>
</tr>
<tr>
<td>34</td>
<td>NTPC Ltd</td>
<td>Utilities</td>
<td>India</td>
</tr>
<tr>
<td>35</td>
<td>Infosys Technologies Ltd</td>
<td>Technology</td>
<td>India</td>
</tr>
<tr>
<td>36</td>
<td>Larsen &amp; Toubro Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>37</td>
<td>Maruti Suzuki India Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>No.</td>
<td>Name of the BRIC company</td>
<td>Industry</td>
<td>Country</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------</td>
<td>---------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>38</td>
<td>Tata Steel Ltd</td>
<td>Basic materials</td>
<td>India</td>
</tr>
<tr>
<td>39</td>
<td>Hero Honda Motors Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>40</td>
<td>Sun Pharmaceutical Industries Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>41</td>
<td>National Aluminium Co Ltd</td>
<td>Basic materials</td>
<td>India</td>
</tr>
<tr>
<td>42</td>
<td>Nestle India Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>43</td>
<td>ABB Ltd/India</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>44</td>
<td>Hindustan Petroleum Corp Ltd</td>
<td>Energy</td>
<td>India</td>
</tr>
<tr>
<td>45</td>
<td>GlaxoSmithKline Pharmaceuticals Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>46</td>
<td>Dabur India Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>47</td>
<td>Lupin Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>48</td>
<td>Ultratech Cement Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>49</td>
<td>Piramal Healthcare Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>50</td>
<td>Cadila Healthcare Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>51</td>
<td>Thermax Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>52</td>
<td>Godrej Industries Ltd</td>
<td>Basic materials</td>
<td>India</td>
</tr>
<tr>
<td>53</td>
<td>Glenmark Pharmaceuticals Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>54</td>
<td>Financial Technologies India Ltd</td>
<td>Technology</td>
<td>India</td>
</tr>
<tr>
<td>55</td>
<td>Jain Irrigation Systems Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>56</td>
<td>Shree Cement Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>57</td>
<td>Tata Tea Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>58</td>
<td>Ashok Leyland Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>59</td>
<td>Marico Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>60</td>
<td>GlaxoSmithKline Consumer Healthcare Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>61</td>
<td>Voltas Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>62</td>
<td>Procter &amp; Gamble Hygiene &amp; Health Care Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>63</td>
<td>Century Textile &amp; Industries Ltd</td>
<td>Diversified</td>
<td>India</td>
</tr>
<tr>
<td>64</td>
<td>Rashtriya Chemicals &amp; Fert</td>
<td>Basic materials</td>
<td>India</td>
</tr>
<tr>
<td>65</td>
<td>Chennai Petroleum Corp Ltd</td>
<td>Energy</td>
<td>India</td>
</tr>
<tr>
<td>66</td>
<td>Aventis Pharma Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>67</td>
<td>Blue Star Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>68</td>
<td>Madras Cements Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>69</td>
<td>Coromandel International Ltd</td>
<td>Basic materials</td>
<td>India</td>
</tr>
<tr>
<td>70</td>
<td>Pfizer Ltd/India</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>71</td>
<td>Torrent Pharmaceuticals Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>72</td>
<td>Apollo Tyres Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>73</td>
<td>Kirloskar Oil Engines Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>74</td>
<td>ICI India Ltd</td>
<td>Basic materials</td>
<td>India</td>
</tr>
<tr>
<td>75</td>
<td>AstraZeneca Pharma India Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>76</td>
<td>3M India Ltd</td>
<td>Diversified</td>
<td>India</td>
</tr>
<tr>
<td>77</td>
<td>Wockhardt Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>№</td>
<td>Name of the BRIC company</td>
<td>Industry</td>
<td>Country</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------------------</td>
<td>---------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>78</td>
<td>Ipca Laboratories Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>79</td>
<td>Godfrey Phillips India Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>80</td>
<td>Praj Industries Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>81</td>
<td>Novartis India Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>82</td>
<td>Lakshmi Machine Works Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>83</td>
<td>CMC Ltd</td>
<td>Technology</td>
<td>India</td>
</tr>
<tr>
<td>84</td>
<td>Nagarjuna Fertilizers &amp; Chemicals</td>
<td>Basic materials</td>
<td>India</td>
</tr>
<tr>
<td>85</td>
<td>BOC India Ltd</td>
<td>Basic materials</td>
<td>India</td>
</tr>
<tr>
<td>86</td>
<td>Amara Raja Batteries Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>87</td>
<td>Orchid Chemicals &amp; Pharmaceuticals Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>88</td>
<td>Chettinad Cement Corp Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>89</td>
<td>Bannari Amman Sugars Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>India</td>
</tr>
<tr>
<td>90</td>
<td>Bajaj Electricals Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>91</td>
<td>Ingersoll-Rand India Ltd</td>
<td>Industrial</td>
<td>India</td>
</tr>
<tr>
<td>92</td>
<td>China Hongxing Sports Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>93</td>
<td>Pine Agritech Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>94</td>
<td>Ying Li International Real Estate Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>95</td>
<td>Tianjin Zhong Xin Pharmaceutical Group Corp Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>96</td>
<td>People's Food Holdings Ltd</td>
<td>Consumer goods (non-cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>97</td>
<td>Konka Group Co Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>98</td>
<td>BOE Technology Group Co Ltd</td>
<td>Technology</td>
<td>China</td>
</tr>
<tr>
<td>99</td>
<td>Yantai Changyu Pioneer Wine Co</td>
<td>Consumer goods (non-cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>100</td>
<td>Inner Mongolia Yitai Coal Co</td>
<td>Energy</td>
<td>China</td>
</tr>
<tr>
<td>101</td>
<td>Chongqing Changan Automobile Co Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>102</td>
<td>Changchau Co Ltd</td>
<td>Industrial</td>
<td>China</td>
</tr>
<tr>
<td>103</td>
<td>Weifu High-Technology Co Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>104</td>
<td>Shanghai Diesel Engine Co Ltd</td>
<td>Industrial</td>
<td>China</td>
</tr>
<tr>
<td>105</td>
<td>Eastern Communications Co Ltd</td>
<td>Telecommunications</td>
<td>China</td>
</tr>
<tr>
<td>106</td>
<td>Shanghai Baosight Software Co Ltd</td>
<td>Technology</td>
<td>China</td>
</tr>
<tr>
<td>107</td>
<td>Lao Feng Xiang Co Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>108</td>
<td>Jinan Qingqi Motorcycle Co</td>
<td>Consumer goods (cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>109</td>
<td>Shanghai Yaohua Pilkington Glass Co Ltd</td>
<td>Industrial</td>
<td>China</td>
</tr>
<tr>
<td>110</td>
<td>Wuxi Little Swan Co Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>111</td>
<td>Shanghai Highly Group Co Ltd</td>
<td>Industrial</td>
<td>China</td>
</tr>
<tr>
<td>112</td>
<td>Hefei Meiling Co Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>113</td>
<td>Kama Co Ltd</td>
<td>Industrial</td>
<td>China</td>
</tr>
<tr>
<td>114</td>
<td>Shenzhen Textile Holdings Co Ltd</td>
<td>Consumer goods (cyclical)</td>
<td>China</td>
</tr>
<tr>
<td>115</td>
<td>Wafangdian Bearing Co Ltd</td>
<td>Industrial</td>
<td>China</td>
</tr>
</tbody>
</table>
Figure 10: The structure of BRIC sample

Figure 11: The structure of Brazil-China sample
3. Results

3.1 Data analysis:

- a) Test for normality of variables distribution, to fulfil the task a corresponding test for normality was held (Skewness-Kurtosis Test for Normality). All variables of BRIC sample are normally distributed.

Data verification was held by the means of correlation analysis, special tests for multicollinearity. Various types of OLS regression models were tested and VIF-tests for two samples were held. Distinct models were chosen with meanings of VIF-tests not greater than critical levels, 10 for individual VIF meanings and 6 for average meanings for group of factors according to the Stata criteria and thereon the final model of the research was chosen. The meaning of VIF contributed to 1,61 for the chosen set of variables in the sample for four countries.

- b) All variables of subsample “Brazil-China” are normally distributed. The meaning of VIF contributed to 2,25 for the chosen set of variables in subsample.

- c) All variables of subsample “India-Russia” are normally distributed. The meaning of VIF contributed to 5,91 for the chosen set of variables in subsample.

3.2 Multiple linear regression model

In order to evaluate the influence of each independent factor a series of linear regression tests has been held for each determined sample: BRIC, Brazil-China, India-Russia.

i. As the final model of the research the authors of this article have chosen the model in which all the factors are significant (at no less than 5% level of significance). For the chosen BRIC models specification tests were held, tests for model specification selection which reflects temporal structure of the data available.

The authors have carried out the Wald Test, Breusch-Pagan Test, Hausman Test:

- a) Wald test showed that the Pooled-up model is rejected compared to the Fixed Effect model.
b) Breusch-Pagan test showed that Pooled-up model is rejected compared to the Random Effect Model.

c) Hausman test showed that the Fixed Effect model is rejected compared to the Random Effect Model.

According to the results of the tests the following model with the Random Effect was chosen for the BRIC sample. According to the results the Random effect model of the regression has been chosen. So the basic criterion was the highest value of the Wald statistics (1109,88).

<table>
<thead>
<tr>
<th>Table 3: BRIC model specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
</tr>
<tr>
<td>Wald test</td>
</tr>
<tr>
<td>Breusch-Pagan test</td>
</tr>
<tr>
<td>Hausman test</td>
</tr>
</tbody>
</table>

The final model with the Random Effect for the BRIC sample is presented below:

(10) \( \text{IEV}_i = 790.09 + 0.34 \text{TA}_i + 4.59 \text{PE}_i - 7.78 \text{DVD}_i - 2536.87 \text{I}^{01}_i - 3851.39 \text{I}^{02}_i - 3524.7 \text{D}^{08}_i \).

The subcomponents of human capital such as personnel expenses and the subcomponents of innovation capital such as dividends paid are significant. The reverse dividends hypothesis is confirmed: the less are the paid dividends, the more is the Intellectual value of the company. The widespread example is the company of W. Buffett Berkshire Hathaway. This company for years didn’t pay dividends. Before the crisis the increase of the prices of shares was guaranteed so that shareholders were absolutely sure to sell the shares in several years so that would get much more benefits without dividends (no doubt that the taxation issue is also worth of the consideration to finalize the discussion).

The influence of the telecommunications industry is significant and negative, that means that Intellectual value of the companies of this industry was destroyed through the investigated period. Year 2008 can be considered as the first year of the economic downturn, the period of 2000-2007 is the world economy upturn especially concerning the emerging markets. The influence of the 2008 year is significant and negative in the model. The book value of assets is the significant fundamental variable, but its “weight” is quite small.

The long-term data analysis gives the opportunity to eliminate speculative value fluctuations. Accordingly the accumulation of the intellectual capital is the time-demanding process: the performance should be evaluated over the long-run horizon. The meaning of the constant in final BRIC model is positive, that means that in general the Intellectual Value of the BRIC companies was increasing over the investigated period 2004-2008. However according to the results of the former research of Russian and Chinese companies Bayburina, Golovko (2008) the constant in the model was negative over the investigated period of 2002-2007, we can admit that the world economy was overheated till 2007 year, despite all the development programs the Intellectual Value of the large companies was destroying.

ii. For the chosen Brazil-China models specification tests were held, tests for model specification selection which reflects temporal structure of the data available. The authors have carried out the Wald Test, Breusch-Pagan Test, Hausman Test:

a) Wald test showed that the Pooled-up model is rejected compared to the Fixed Effect model.

b) Breusch-Pagan test showed that Pooled-up model is rejected compared to the Random Effect Model.

c) Hausman test showed that the Fixed Effect model is not rejected compared to the Random Effect Model.

The sample of companies in the research is closer to the general (universal) set than the fixed set of data, the Random Effect model is more appropriate than the Fixed Effect model. According to the
results of the tests the following model with the Random Effect was chosen for the Chian-Brazil sample.

Table 4: Brazil-China model specification

<table>
<thead>
<tr>
<th>Test</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wald test F test that all u_i=0:</td>
<td>F(4, 84) = 37.73 Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td>Breusch-Pagan test χ²(1)=12.10 Prob &gt; χ² = 0.0005</td>
<td></td>
</tr>
<tr>
<td>Hausman test χ²(3)=16.12 Prob &gt; χ² = 0.0011</td>
<td></td>
</tr>
</tbody>
</table>

For the subsample Brazilian and Chinese companies the final model with Random effect was chosen, Wald statistics is acceptable (444.46). The final model with the Random Effect for Brazilian and Chinese sample is presented below:

\[(11) \text{IEV}_{it} = -2389.14 +0.23TA_{it} +11.78PE_{it} -7.40DVD_{it} +6067.32 D_{07}it\]

The dividends paid, personnel expenses are significant. The last year of the growth stage (2007) year makes a contribution to the increase of the IEV. The negative constant testifies the effect that the IEV of large Brazilian and Chinese companies was destroying year by year. However the data panel is long-term concerning the history of listing and the companies in the sample are the largest ones, so accordingly the variable of total assets is significant. The insignificant variables are not included into the model.

iii. For the chosen India-Russia models specification tests were held, tests for model specification selection which reflects temporal structure of the data available. The authors have carried out the Wald Test, Breusch-Pagan Test, Hausman Test:

a) Wald test showed that the Pooled-up model is rejected compared to the Fixed Effect model.

b) Breusch-Pagan test showed that Pooled-up model is rejected compared to the Random Effect Model.

c) Hausman test showed that the Fixed Effect model is rejected compared to the Random Effect Model.

Table 5: India-Russia model specification

<table>
<thead>
<tr>
<th>Test</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wald test F test that all u_i=0:</td>
<td>F(61, 224) = 2.21 Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td>Breusch-Pagan test χ²(1)=8.24 Prob &gt; χ² = 0.0041</td>
<td></td>
</tr>
<tr>
<td>Hausman test χ²(6)=38.04 Prob &gt; χ² = 0.0000</td>
<td></td>
</tr>
</tbody>
</table>

The final model with Random Effect was chosen for the second subsample (Russia-India). The final criteria is Wald statistics (477.35). The final model with the Random Effect for Brazilian and Chinese sample is presented below:

\[(12) \text{IEV}_{it} = 275.23 -0.44TA_{it} +1,01PE_{it} -14.51DVD_{it} +6.7\text{Capex}_{it} +3600.53 I_{09}it +1829.33 d_{07}it -3978.1 D_{08}it\]

4. Results and managerial implications

*Intellectual capital* and its components can be regarded as the source for the company’s *organic growth*. In the era of crisis, when most of financial reserves are unavailable the inner organizational efficiency by the means of *intellectual capital* is the question of the survival edge for most of large companies. *Intellectual capital* of the company and its components can be regarded as "latent reserves" of the long term value growth. *Intellectual capital* is the "intangible safety-cushion" and it can be used only by those companies who have created it years before and therefore have directed the cash flows for the purposes of "sustainable wealth" creation. The research of *intellectual capital* components and its role in the *value* creation and building its *competitive advantage* remain an actual topic for the empirical research, carried out in various countries and by different research centers.
**Intellectual value of the company** is a part of the total value, created through the process of the intellectual components’ accumulation.

The main goal of this research is to evaluate by the means of the panel data analysis the influence of particular components of the **intellectual capital** on the **intellectual value** of BRIC companies. The process of **intellectual capital accumulation** is over time and it can be measured according to the long run panel data analysis not less than 5 years.

The panel data analysis revealed that the **human capital** can be considered the key factor of the **long-term growth** of BRIC companies of all industries. Employees and their competencies are this basis which has not undervalued whereas most of financial assets lost trust and its value. Some significant conclusions are made below:

- the statistically significant influence of human capital, innovation capital and network capital on the **Intellectual value** of large listed BRIC companies was found out;
- the significant influence (reverse) of dividends and personnel expenses on the **Intellectual value** in line with such indicators as capital expenditures and assets value was proved;
- the influence of the telecommunications industry is significant and negative, that means that **Intellectual value** of the companies of this industry was destroyed through the investigated period.

However it is necessary to mention that a kind of a paradox of the **Intellectual value** creation of the large companies of BRIC was revealed. The annual growth of the **Intellectual value** can be traced during the analysis of data which include a break of tendency of the year 2008, when the economy overheat has turned into slump. Simultaneously, the authors Bayburina, Golovko (2009) previously have shown that upon analyzing data of the upturn period 2002-2007, excluding the data of the year 2008, a destruction of **Intellectual value** of the large companies of BRIC was revealed. The analysis of the large companies of BRIC and **Intellectual value** can be regarded as the basis for the implementation of the tendencies indicator. This indicator can show whether the world economy is overheated or not. By means of this research in terms of the crisis it is possible to specify directions of the internal reserves audit to prevent the considerable **Intellectual value** decrease and to stipulate the corporate growth.

However, specified directions of the internal reserves audit and the discussion of the **Intellectual value** on the emerging markets is very close to the fact that large BRIC companies depend a lot on the specific features of the infrastructure of each developing country. India and Russia are countries with the industrial potential, which is not fully realized, e.g. a lot of Russian companies are underinvested with unbalanced development strategies. Decrepit and out-of-date production facilities, in turn capital expenditures are the matter of great importance. The capital expenditures together with the innovative managers and management techniques tend to be the leverage, which can push these companies towards intensive development, especially in Russia. The current economic downturn has reallocated the role of each country of the BRIC group. China and India can be considered as leaders due to the sustainable economic features towards crisis. In 2009 Chinese government has adopted $600 bln plan to recover the national economy by the means of investments target infrastructural projects. The Chinese companies (with the governmental support) execute an aggressive expansion towards the foreign markets, mainly towards emerging markets: African countries, Venezuela, Russia and Australia, Turkmenistan (gaz contracts together with Russian companies), etc.

The economy of India is also marked out by some outstanding competitive advantages, such as the high level of consumer demand, innovativeness in comparison with other BRIC countries, e.g. industrial park in Keral, established in 1982, and the well-developed network of industrial parks. Unlike innovativeness of China and India mainly the raw materials export characterizes Russia and Brazil. Governmental investments, tax burden depend a lot on raw materials prices, in turn the business activity, the innovative path of development, the scope for investment depend a lot on the conjuncture of raw materials. Correspondingly close to the end of the economic downturn these BRIC countries can be regrouped and analyzed separately to investigate the **Intellectual value** and factors of the growth of large companies of the each particular emerging market, undoubtedly new research challenges may appear.
5. References


Abstract: This paper reports on data collected over time on intellectual capital levels in three high-tech industries. Data are also presented on competitive intelligence activity in the same industries. These data shed light on the idea that knowledge management is more strategic than is commonly portrayed, with the level of development and sharing of knowledge depending on circumstances at the national, industry, and firm level. Similarly, competitive intelligence offense and defense also vary according to environment. Given the evidence here that knowledge assets vary widely by industry and by firm, as do competitive intelligence efforts, organizations should scan their environments and adopt knowledge strategies appropriate to their circumstances.

Keywords: strategy, knowledge management, intellectual capital, competitive intelligence, technology

1. Background

Empirical work is beginning to take a central stage in the field of intellectual capital (IC), as we move from case studies and conceptual work to broader industry-wide or nationwide work. For a long time, IC studies concentrated on a single firm or a small group of firms in order to define terms and illustrate best practices. Increasingly, however, both practitioners and scholars are looking for more convincing evidence of the positive impact of knowledge management (KM) systems installed to better manage intellectual capital. This paper continues in that direction.

IC theory and practice has developed over the past twenty years, basically as a reaction to our inability to measure and manage intangible assets. As closely allied efforts to install knowledge management systems also gained momentum, IC was used to try to better define these softer knowledge assets, assess their levels, and obtain competitive advantage by applying them more effectively. Much of the early work had to do with human capital, specifically the skills and expertise of individual employees, be they on the line, in management, or in support positions. Peter Drucker's (1991) “knowledge workers” was one of the first suggestions that human capital would be a critical source of competitive advantage. This concept of a knowledge economy, in which individuals' unique knowledge and skills would confer marketplace advantages, fit well with burgeoning interest in the resource-based theory of the firm (Dierickx & Cool 1989, Nelson & Winter 1982). This concept, from strategic planning, suggests that sustainable competitive advantage comes from the unique resources of the firm, in this case its particular knowledge assets, which provide core competencies (Prahalad & Hamel 1990) and superior performance. The natural conclusion from IC and KM is that it is, indeed, knowledge that is the key resource in firms, and those organizations looking to effectively differentiate themselves should seek to better manage that knowledge through identification, assessment, and development (Zack 1999, Stewart 1997, Grant 1996, Quinn 1992).

With this conceptual foundation in place, much of the proceeding work in the field has focused on that issue of how to better manage knowledge assets (Choi & Lee 2003, Schulz & Jobe 2001, Nonaka 1994). On one hand, some efforts have emphasized defining knowledge assets and better understanding their makeup. The difference between tacit and explicit knowledge, for example, is important to the field. While tacit knowledge is individual and may be hard to express, explicit knowledge can often be codified and thus easier to share. As a consequence, the techniques for managing each type of knowledge are quite different (Nonaka & Takeuchi 1995, Boisot 1995). In fact, efforts to manage tacit knowledge may be more trouble than they are worth, something organizations should keep in mind before even attempting knowledge management installations. This again implies a more strategic approach to KM.

Another important conceptual distinction is between the different types of intellectual capital: human capital, structural capital, and relational or collaborative capital (Bontis 1998, Edvinsson & Malone 1997, Stewart 1997). These refer, respectively, to more job-related knowledge, organization-related knowledge, and external-related knowledge. This framework was important to incorporating all manner of intangible assets into the intellectual capital fold, allowing corporate culture and IT systems to be considered as significant knowledge assets.
(structural capital) as well as brand equity and regulatory experience (relational capital) to be identified, valued, and managed in the same way as human capital. All are unique elements of the knowledge of the firm, and all can be better measured and managed if properly identified and understood.

The presumed connection between better knowledge management and enhanced competitiveness (leading to superior financial performance) encouraged research on measurement and on KM techniques that could lead to measurable change (Marr & Schiuma 2001). Investment in information technology systems designed to better manage explicit knowledge, applications to deal with tacit knowledge such as expert systems or communities of practice, and other such installations were undertaken with an expectation that identifying, organizing, and distributing knowledge was the path to greater returns. The underlying assumption was that the more widely knowledge could be identified and shared, both throughout the firm and across its extended network, the better. At the same time as the increase of interest in KM and its practice, however, we saw a similar growth in the use of competitive intelligence (CI) operations. And given that a competitor’s CI function was often aimed at precisely the valuable proprietary knowledge that a firm was carefully managing, there was a natural question as to whether those knowledge assets should be shared quite so freely. Could oversharing, especially outside the core firm, leave an organization more vulnerable to competitive intelligence incursions? Should the degree of KM employed be a more strategic decision, leveraging knowledge assets to a greater or lesser degree depending on competitive conditions, including both the potential from KM growth and threats from CI activities?

Although not a totally ignored question within IC/KM circles, neither is protection of knowledge assets widely recognized as a concern. A few researchers have raised the issue (Liebeskind 1996, Zander & Kogut 1995), but the number of scholars aware of the risks does remain limited. Should more attention be paid? Probably, as CI operations continue to grow (ASIS 1999) and effective competitive intelligence itself is increasingly seen as a means of competitive advantage by developing a better understanding of what competitors might be up to and acting appropriately. In a manner similar to KM, CI identifies knowledge assets (concerning a competitor), seeks out additional knowledge to close gaps, and develops actionable insights through analysis (Rothberg & Erickson 2005, Rothberg & Erickson 2002, Bernhardt 2002, Cappel & Boone 1995).

Sum it all up, and there is a great case to be made for employing KM to better manage the knowledge assets of the firm. In doing so, the organization clearly wants to make good use of its knowledge, leveraging it by putting it in the hands of as many affiliated individuals as possible. But that view is tempered by the CI threat. Not all affiliated individuals (and their organizations) are equally reliable, and lax security procedures may leave the core firm open to loss of its proprietary knowledge, watching all those precious assets leak to a competitor. Consequently, the KM decision may be far more strategic than what we typically believe. Depending on the benefits accruing from distributing the knowledge more widely balanced against the potential costs emanating from knowledge loss, a firm in given circumstances may decide to pursue less than full development and distribution of its knowledge. How much does it gain from extensive sharing? How much does it risk? Should distribution be limited to individuals inside the firm? To first-tier network partners? Or be totally unlimited? How aggressively should the firm conduct counterintelligence or enact protection measures?

Clearly, the answer depends on circumstances and becomes something of a strategic choice. But what environmental variables influence this choice? Natural candidates include national variables (IC reporting encouraged or required, strong intellectual property protections, etc.) and industry variables as we know conditions vary widely according to each. Consider the potential for KM in circumstances such as pharmaceuticals vs. motion pictures or the threat of CI in financial services vs. retail. In addition to these areas, the firm itself and the type of knowledge it employs (tacit vs. explicit, complexity, teachability) will matter. All of these variables, at the firm, industry, and national levels have the potential to be important to the strategic decision concerning KM development and protection (Rothberg & Erickson 2005).

Obviously, we would like to measure the circumstances as a start to providing practitioners with concrete guidance on how far to develop knowledge assets and how far to protect them. One of the issues is how much a firm would benefit from further KM development. That would seem to be at least partially dependent on the importance of intellectual capital within the firm’s industry. How much
Scott Erickson and Helen Rothberg

IC do it and its principal competitors, or whoever represents best practice, possess? The literature is full of attempts to measure IC, especially its details within the firm. Skandia Navigator (Edvinsson & Malone 1997) was one of the first systems and has been employed at a number of other firms as well, as has Pusic’s (2004) VAIC method. Even the well-known Balanced Scorecard (Kaplan & Norton 1992) can provide something of a measurement of knowledge assets within a given firm. Related studies have sought to measure specific components of IC (e.g. human capital only or structural capital only) (Tan, Plowman & Hancock 2007, Chen, Cheng & Hwang 2005, Firer & Williams 2005, Lev & Radhakrishnan 2003). As with the other techniques mentioned, one can use these approaches to build up to an overall assessment of IC, essentially a micro to macro progression. All are fruitful and have yielded interesting results, helping to better identify and manage IC. But their very complexity makes them somewhat unreliable and difficult to apply beyond a single firm or small group of firms. The type of strategic approach we have been discussing would benefit more from cutting right to a macro (firm/industry) level measure.

This study continues our work attempting to better measure the level and success of knowledge management within a given industries, providing better guidance to practicing managers in determining how much they should pursue KM systems and practice. This study also adds a competitive intelligence perspective to the discussion. We look to directly measure IC in industries related to information technology, assessing both its importance and the relative success of participating firms. We also look to measure CI activity in the same industries, providing some sense of the threat posed by such efforts. Finally, we obtain a second measurement ten years later, allowing some perspective and some insights about how knowledge development and protection strategies may need to change over time. The results provide some guidance to firms as to what they might measure and how they might react in relation to their KM strategies.

2. Conceptual framework and methodology

In assessing a firm’s need to develop KM, we need to measure the level of IC generally required to compete in that industry. In short, we need to measure IC by industry to determine how an individual firm in that industry compares and what it must do to remain competitive. Quite a number of potential measures are available (Tan, Plowman & Hancock 2007) though like some of those noted earlier, they are really meant to tease out the individual components of IC, building up to the overall measure. We are applying a variation on Tobin’s q, a measure of intangible assets with a long history in the literature, widely accepted, easily available, and robust across different applications. It has been effectively used in industry comparisons such as these (Bramhandkar, Erickson & Applebee 2008). The measure is simply the difference between market capitalization and asset replacement cost, essentially value of the firm less tangible assets. The remainder are the intangible assets, essentially the knowledge assets of the firm. Since replacement cost can be hard to obtain, a common variation on Tobin’s q is book value. A further choice is whether to treat the difference as a ratio or an actual difference. The former can yield misleading results if very small firms are included while the latter makes comparisons between different sizes of firms difficult. Our data set includes only large firms, so the ratio approach makes the most sense. With this measure, a high ratio indicates significant IC is apparent in the firms in the industry, suggesting that a certain aggressiveness in developing IC is probably necessary in order to compete. Alternatively, a low ratio indicates minimal IC exists and it may be either difficult or unnecessary to develop in that industry. Further, an individual firm with a higher ratio has presumably done a more effective job of developing its IC—it has more for a given level of tangible assets. Alternatively, a firm with a lower ratio than its industry is underperforming in terms of IC development and may be at a competitive disadvantage.

In assessing competitive intelligence, we used membership figures from the Society of Competitive Intelligence Professionals (SCIP). By obtaining an average number of members per firm for an industry, we can proxy the level of CI activity in that industry, essentially the incursion threat facing all the member firms. Even though the numbers are fairly small, the presence of just a member or two can be indicative of substantive CI operations as a SCIP member may have numerous other employees working under them.

We limited this study to related industries though with some potentially interesting differences. This is useful in this type of analysis since physical asset requirements of industries can vary dramatically, potentially skewing the denominator of our IC measure. Consider the different percentages of capital equipment, financial capital, labor, and intangibles across industries such as aircraft manufacturing, retail banks, and entertainment providers. Within an industry, those percentages will be similar,
eliminating the problem. While cross-industry comparisons would be useful in another context, they need to be done with some care. We eliminate some of the issues with the focus of this study.

Two data sets are present. The first is from 1993-1996 and is the more complete of the two. The second is from 2003-2006, is still under development and so is somewhat more limited. We used Compustat and StockVal to gather the financial data, organizing it by SIC code and NAICS code, respectively, for the two time periods. Market capitalization and book value were obtained and averaged across the four-year periods by firm, and then aggregated by industry. The four years helps to even out some of the influence of a particularly good or bad year while also illustrating trends. We also obtained SCIP membership data from 1993—1996. We are in the process of obtaining such data for the more recent period, but for now have only information for the current year.

3. Results

As illustrated in Table 1, we included three computer-related technology-oriented industries, all with substantive manufacturing components (even if much might be outsourced). As noted, the 1993-1996 database is more complete, including the Fortune 500 as well as a number of other large firms with a SCIP presence. The newer database is under construction and includes only select firms to this point. Consequently, the data in Table 1 represent 10-15 firms per industry for the earlier time period, with some illustrative individual firms broken out below. The later time period includes only those illustrative firms.

**Table 1: Tobin’s q, SIC 3571 electronic computers**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amdahl</td>
<td>1.29</td>
<td>1.44</td>
<td>0.46</td>
<td>1.06</td>
<td>0.42</td>
<td>6.36</td>
<td>6.03</td>
<td>2.98</td>
<td>1.88</td>
<td>4.31</td>
</tr>
<tr>
<td>Apple</td>
<td>3.04</td>
<td>1.96</td>
<td>2.19</td>
<td>1.67</td>
<td>2.22</td>
<td>0.88</td>
<td>6.36</td>
<td>6.03</td>
<td>2.98</td>
<td>1.88</td>
</tr>
<tr>
<td>Compaq</td>
<td>4.78</td>
<td>4.78</td>
<td>3.81</td>
<td>3.81</td>
<td>4.30</td>
<td>1.71</td>
<td>16.51</td>
<td>15.73</td>
<td>13.61</td>
<td>15.28</td>
</tr>
<tr>
<td>Dell</td>
<td>9.97</td>
<td>6.23</td>
<td>3.53</td>
<td>2.74</td>
<td>5.62</td>
<td>2.24</td>
<td>16.51</td>
<td>15.73</td>
<td>13.61</td>
<td>15.28</td>
</tr>
<tr>
<td>DEC</td>
<td>1.57</td>
<td>2.51</td>
<td>1.48</td>
<td>1.02</td>
<td>1.65</td>
<td>0.66</td>
<td>2.74</td>
<td>2.18</td>
<td>1.53</td>
<td>1.80</td>
</tr>
<tr>
<td>HP</td>
<td>4.76</td>
<td>4.28</td>
<td>2.92</td>
<td>2.50</td>
<td>3.62</td>
<td>1.44</td>
<td>2.74</td>
<td>2.18</td>
<td>1.53</td>
<td>1.80</td>
</tr>
<tr>
<td>Sequent</td>
<td>1.59</td>
<td>1.76</td>
<td>2.35</td>
<td>2.84</td>
<td>2.14</td>
<td>0.85</td>
<td>2.74</td>
<td>2.18</td>
<td>1.53</td>
<td>1.80</td>
</tr>
<tr>
<td>Stratus</td>
<td>1.39</td>
<td>1.57</td>
<td>2.08</td>
<td>1.61</td>
<td>1.66</td>
<td>0.66</td>
<td>2.74</td>
<td>2.18</td>
<td>1.53</td>
<td>1.80</td>
</tr>
<tr>
<td>Sun</td>
<td>4.72</td>
<td>3.76</td>
<td>1.93</td>
<td>1.66</td>
<td>3.02</td>
<td>1.20</td>
<td>2.29</td>
<td>1.86</td>
<td>2.16</td>
<td>2.37</td>
</tr>
<tr>
<td>Tandem</td>
<td>1.46</td>
<td>1.57</td>
<td>2.66</td>
<td>0.95</td>
<td>1.66</td>
<td>0.66</td>
<td>2.29</td>
<td>1.86</td>
<td>2.16</td>
<td>2.37</td>
</tr>
<tr>
<td>Unisys</td>
<td>0.71</td>
<td>0.43</td>
<td>0.59</td>
<td>0.83</td>
<td>0.64</td>
<td>0.25</td>
<td>2.29</td>
<td>1.86</td>
<td>2.16</td>
<td>2.37</td>
</tr>
<tr>
<td><strong>Means</strong></td>
<td>3.40</td>
<td>2.74</td>
<td>2.27</td>
<td>1.82</td>
<td>2.51</td>
<td>3.79</td>
<td>6.65</td>
<td>5.60</td>
<td>4.92</td>
<td>5.96</td>
</tr>
</tbody>
</table>

**Table 2: Tobin’s q, SIC 3572 Storage, 3577 peripherals**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>6.53</td>
<td>5.31</td>
<td>10.52</td>
<td>17.49</td>
<td>9.36</td>
<td>1.88</td>
<td>2.80</td>
<td>2.71</td>
<td>3.10</td>
<td>2.93</td>
</tr>
<tr>
<td>Maxtor</td>
<td>4.85</td>
<td>1.61</td>
<td>0.87</td>
<td>2.44</td>
<td>0.46</td>
<td>1.88</td>
<td>2.80</td>
<td>2.71</td>
<td>3.10</td>
<td>2.93</td>
</tr>
<tr>
<td>Quantum</td>
<td>2.83</td>
<td>1.90</td>
<td>1.74</td>
<td>1.55</td>
<td>2.01</td>
<td>0.38</td>
<td>2.80</td>
<td>2.71</td>
<td>3.10</td>
<td>2.93</td>
</tr>
<tr>
<td>Seagate</td>
<td>3.51</td>
<td>2.49</td>
<td>1.31</td>
<td>1.61</td>
<td>2.23</td>
<td>0.42</td>
<td>2.80</td>
<td>2.71</td>
<td>3.10</td>
<td>2.93</td>
</tr>
<tr>
<td>Storage Tech</td>
<td>3.16</td>
<td>1.22</td>
<td>1.33</td>
<td>1.30</td>
<td>1.75</td>
<td>0.33</td>
<td>4.37</td>
<td>5.27</td>
<td>5.20</td>
<td>4.78</td>
</tr>
<tr>
<td>Cisco</td>
<td>16.20</td>
<td>9.80</td>
<td></td>
<td>13.0</td>
<td>2.46</td>
<td>0.33</td>
<td>4.37</td>
<td>5.27</td>
<td>5.20</td>
<td>4.78</td>
</tr>
<tr>
<td>Synoptics</td>
<td>3.45</td>
<td>7.89</td>
<td>5.67</td>
<td>1.07</td>
<td>3.59</td>
<td>3.99</td>
<td>4.15</td>
<td>3.86</td>
<td>3.90</td>
<td></td>
</tr>
<tr>
<td><strong>Means</strong></td>
<td>6.45</td>
<td>5.33</td>
<td>4.25</td>
<td>5.79</td>
<td>5.29</td>
<td>3.59</td>
<td>3.99</td>
<td>4.15</td>
<td>3.86</td>
<td>3.90</td>
</tr>
</tbody>
</table>

**Table 3: Tobin’s q, SIC 3674 semiconductors**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AMD</td>
<td>2.04</td>
<td>1.23</td>
<td>1.78</td>
<td>1.65</td>
<td>1.68</td>
<td>0.46</td>
<td>1.86</td>
<td>3.98</td>
<td>2.87</td>
<td>2.13</td>
</tr>
<tr>
<td>Analog Devices</td>
<td>4.97</td>
<td>5.35</td>
<td>3.88</td>
<td>3.88</td>
<td>4.35</td>
<td>1.20</td>
<td>3.31</td>
<td>4.30</td>
<td>3.79</td>
<td>5.51</td>
</tr>
<tr>
<td>Intel</td>
<td>8.61</td>
<td>5.41</td>
<td>3.19</td>
<td>4.40</td>
<td>5.40</td>
<td>1.48</td>
<td>3.31</td>
<td>4.30</td>
<td>3.79</td>
<td>5.51</td>
</tr>
<tr>
<td>Int’l Rectifier</td>
<td>1.86</td>
<td>3.63</td>
<td>2.67</td>
<td>1.51</td>
<td>2.42</td>
<td>0.66</td>
<td>2.65</td>
<td>3.65</td>
<td>3.16</td>
<td>2.67</td>
</tr>
<tr>
<td>Level One</td>
<td>5.99</td>
<td>4.24</td>
<td>6.38</td>
<td>5.54</td>
<td>5.54</td>
<td>1.52</td>
<td>3.65</td>
<td>3.65</td>
<td>3.16</td>
<td>2.67</td>
</tr>
<tr>
<td>Micron Tech</td>
<td>2.99</td>
<td>5.91</td>
<td>4.08</td>
<td>2.90</td>
<td>3.97</td>
<td>1.09</td>
<td>1.60</td>
<td>1.23</td>
<td>1.22</td>
<td>1.76</td>
</tr>
<tr>
<td>Motorola</td>
<td>2.97</td>
<td>3.99</td>
<td>5.18</td>
<td>4.95</td>
<td>4.27</td>
<td>1.17</td>
<td>2.65</td>
<td>3.65</td>
<td>3.16</td>
<td>2.67</td>
</tr>
<tr>
<td>Ntl Semi</td>
<td>2.14</td>
<td>1.88</td>
<td>2.04</td>
<td>2.33</td>
<td>2.10</td>
<td>0.58</td>
<td>3.67</td>
<td>4.61</td>
<td>3.24</td>
<td>4.28</td>
</tr>
<tr>
<td>Siliconix</td>
<td>2.42</td>
<td>8.06</td>
<td>2.14</td>
<td>1.47</td>
<td>3.52</td>
<td>0.97</td>
<td>3.67</td>
<td>4.61</td>
<td>3.24</td>
<td>4.28</td>
</tr>
<tr>
<td>Texas Inst</td>
<td>2.95</td>
<td>3.60</td>
<td>3.02</td>
<td>2.99</td>
<td>3.14</td>
<td>0.86</td>
<td>3.67</td>
<td>4.61</td>
<td>3.24</td>
<td>4.28</td>
</tr>
<tr>
<td><strong>Means</strong></td>
<td>3.69</td>
<td>4.33</td>
<td>3.43</td>
<td>2.82</td>
<td>3.64</td>
<td>2.62</td>
<td>3.55</td>
<td>2.86</td>
<td>3.27</td>
<td>3.07</td>
</tr>
</tbody>
</table>

The data provide some interesting insights. There is a very clear difference between industries in terms of the level of intangible assets/intellectual capital. There is also a very clear difference

www.ejkm.com

562
©Academic Conferences Ltd
between some of the firms within a given industry in terms of IC. Further, both of these circumstances can and do change over time. Consider each in more detail.

The Tobin's q ratio for computers runs between 0.64 and 5.72 with an mean of 2.51 over the early period in the database, considerably below the 2.10 to 5.54 (3.64 mean) of semiconductors and, especially, the 1.75 to 13.0 (5.29) of peripherals. This makes some sense as we remember that the mid-nineties generally saw a commoditization of computers. It was in the early to mid part of the new century that Dell started to practice its customization and low-price offensive that made it the largest player in the market for a number of years. Its burgeoning IC indicated not only manufacturing prowess and a highly efficient supply chain but also an ability to read customer needs and wants. Apple's design prowess and brand image brought it similar results beginning in 2005. Both firms possessed demonstrably higher levels of knowledge during this period and were rewarded in the marketplace. One could argue that Dell's more recent outsourcing of manufacturing and customer service, and the resulting loss of unique knowledge, is reflected in its more disappointing current results.

Semiconductors are more of a mixed bag, with some cutting edge chips being released regularly, some copies following close behind, and a number of commodity chips being produced for basic electronics goods. Intel's enduring success based on its R&D abilities, customer relationships with pc makers, and brand image isn’t surprising, especially its consistent IC dominance of rival AMD. Texas Instruments, at one time a laggard to industry IC levels now exceeds them while Micron has gone in the other direction. In peripherals, the high amounts of IC possessed by both EMC and Cisco just prior to the tech boom are not as impressive now, though both continue to indicate possession of considerable knowledge assets.

The indices are presented to give an idea of the relative importance of intangibles relative to the physical assets (whatever their absolute level might be). In the case of computers, for example, Dell is 2.24 times above the average ratio while other competitors lag at 0.25 and 0.42 of the average intangible to tangible ratio. For peripherals, the story is much the same with Cicso at 2.46 times the average ratio vs. others with 0.33 and 0.38. In semiconductors, the results are much more bunched, from a high of 1.52 for Level One to a low of 0.58 for AMD. What this means is that the presumably higher performing firms in terms of IC development have built intangible levels much higher in the computer and peripherals industries than is the case with semiconductors. Again speculating, we can hypothesize that the former industries are more apt to have dominant firms with superior knowledge assets than is the case in semiconductors where numerous strong firms compete in quite a few niche markets (Intel and TI, for example, tend to make very different types of chips).

The critical point is that intellectual capital does wax and wane, as circumstances change. Further, firms need to be cognizant of the conditions in their industry and their place in it. If the industry average for Tobin's q, for example is around 4.0, and you have competitors substantially above that while you are below it (not identical to, but similar to HP’s situation in the later time period in Table 1), you had better look to more aggressively manage your IC, closing that gap. Information on competitive practices, the areas of IC in which the gaps are present, would be useful in supporting this more strategic approach to knowledge management.

In Table 2, the competitive intelligence data tell a similar story. As noted earlier, these numbers reflect the average number of SCIP members per firm for the earlier time period (again, number of firms 8-15, depending on the SIC classification).

**Table 4: SCIP Membership (average across industry and by firm)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.75</td>
<td>2.79</td>
<td>1.93</td>
<td>1.21</td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td>SIC 3577: Peripherals</td>
<td>2.00</td>
<td>1.55</td>
<td>0.90</td>
<td>0.64</td>
<td>0.18</td>
</tr>
<tr>
<td>SIC 367: Semiconductors</td>
<td>0.75</td>
<td>4.00</td>
<td>3.14</td>
<td>1.07</td>
<td>0.43</td>
</tr>
</tbody>
</table>

As with the IC results, we see quite a range of outcomes. All three industries saw substantial growth in CI activity over the four-year period in the 1990’s. Further, there are definite differences between the industries, with semiconductors showing quite high levels of competitive intelligence compared to...
each of the others, especially peripherals during that early time. CI actions also vary by firm. Although we can’t reveal firm-specific from the current database for confidentiality reasons, computer firms range from 0 to 6 SCIP members (and both computers and semiconductors had firms with double-figure memberships during the 1990’s.

What does this mean? Once again, one needs to be aware of circumstances and the implication for competition intelligence offense and defense. In an industry with extensive CI activity, an organization needs to guard its knowledge assets more carefully, perhaps not developing and sharing them as much through a KM system as it might otherwise. Further, if a specific competitor has very high levels of CI activity, that would be a real red flag for KM development. Finally, if the practice in the industry is extensive CI and the firm in question doesn’t have an active team, it should probably look into doing something about that as well.

4. Conclusions

This study focuses on three specific, related high-tech industries and a number of individual firms within those industries. By examining levels of intellectual capital over time, it better establishes the strategic foundation for knowledge management practice. The potential and need to develop KM varies markedly by industry. In some cases, KM may be difficult to further develop and, if others in the industry refrain, the prudent firm might also. In other cases, aggressive KM may be a requirement to even participate. In such cases, a substantial and effective KM program needs to be quickly employed.

Similar conclusions can be drawn from the CI data. Limited knowledge sharing because of dangerous competitive intelligence activity can also be a critical strategic decision. Alternatively, if CI is not a threat, KM can be freely pursued, if worthwhile. The case for establishing one’s own CI operation and/or incorporating counterintelligence procedures into firm practice can also be made depending on circumstances.

This and similar studies better establish knowledge development and protection as strategic options. It is not the case that KM should always be pursued to its greatest degree, collecting and distributing knowledge as widely as possible. It is also not the case that CI always should or should not be practiced, it really depends. Further explorations in this direction will help us to determine what variables help us to decide what makes sense in what circumstances.

Acknowledgement

The authors gratefully acknowledge the cooperation of the Society of Competitive Intelligence Professionals which provided data used in this study.

References


What is the Value of Knowledge Management Practices?

Fahmi Ibrahim and Vivien Reid
Glasgow Caledonian University, UK
f.ibrahim@gcal.ac.uk
v.reid@gcal.ac.uk

Abstract: What are the appropriate sources from which to draw evidence about Knowledge Management (KM) and its added value to organisations? This paper attempts to answer this question, first examining the literature for approaches to measuring KM from the perspective of Intellectual Capital (IC) theory. However, findings indicated that many measurement methods or frameworks have limitations. Following the literature review, the researchers then approached KM practitioners, within the UK car manufacturing industry, and undertook in-depth interviews in an attempt to understand how these organisations value their KM practices. The UK car manufacturing industry was selected because little previous research has been undertaken in this context, most previous studies having concentrated mainly on service industries. It was discovered that, in most of the organisations studied, the link between KM, business benefits and bottom line is almost axiomatic, especially amongst those who are enthusiastic advocates of KM. Drawing on the evidence from the in-depth interviews, the paper concludes that there is an absence of linking mechanisms between value and measurement. This is due to the differences between the concept of a value and measurement approach and the importance of these two concepts to justify the outcome of KM practices. Recommendations are made through the development of a theoretical framework that includes both objective and subjective dimensions of KM measurement strategy.

Keywords: knowledge management, intellectual capital, uk car manufacturing industry, theoretical framework, value, measurement

1. Introduction

Over the past decade, KM has come into the limelight and received considerable attention from academics and practitioners. This is evidenced from a recent bibliometric analysis of global KM research which shows that 2727 authors have contributed 1407 KM publications since 1975 (Gu, 2004). In addition, a significant number of organisations and practitioners are involved in various KM programmes. A KPMG survey of 423 leading European and American companies found that 70% of respondents were undertaking some kind of KM initiative (KPMG, 2000). Another recent UK survey of top 1,000 British companies found that 64% of responding firms had introduced KM while 24% of them were at the introduction stage (Moffett et al., 2003). This highlights the immense and rapidly increasing interest in KM. In relation to this phenomenon, Grant (2001:p.27) suggests that ‘among the innovations that have swept through the world of management during the past two decades……KM has probably aroused the greatest interest and made the biggest impact’. However, some critics suggest that this is probably because of an explosion interest in the term of ‘Knowledge Management’ and all that it may or may not imply (Despres and Chauvel, 2000).

The most significant factor of this phenomenon is the recognition of the importance of knowledge as a critical resource for organisations (Drucker, 1998; Nonaka, 1991; Davenport and Prusak, 1998; Prusak, 1997; Leonard-Barton, 1995). Thus, knowledge is claimed as the main distinguishing factor of business success and competitive advantage (Carlucci and Schiuma, 2006; Pan and Scarborough, 1999). If the knowledge is deemed to be the most important resource of organisations, then clearly the need to secure that resource must be of primary concern and demands good management. Consequently, it is becoming accepted that ‘the only true competitive advantage for organisations, over the long term, is knowledge that is, how organisations create or acquire knowledge, how organisations retain and store knowledge, how organisations disseminate and use knowledge, and how organisations protect and manage the knowledge they have’ (Gallupe, 2001:p.61).

However, despite growing interest from academics and practitioners, KM is not a commonly shared concept and definition. This is because KM field is relatively young (Serenko and Bontis, 2005) and in its infancy (Jarar, 2002; Gallupe, 2001) and still requiring further extensive development (Metaxiotis et al., 2005). The purpose of this research is to address the gap through informing the theory into practice and vice versa. The main focus of this paper is on the development of a conceptual framework to provide a profound and comprehensive understanding of the role of KM, its added value and measurement mechanisms. This is important because researchers and practitioners need to understand the theoretical underpinning which embedded in KM applications and how KM adds value to the organisation through the KM measurement approach.

ISSN 1479-4411
Reference this paper as
Ibrahim, F and Reid, V. “What is the Value of Knowledge Management Practices?” Electronic Journal of Knowledge Management Volume 7 Issue 5 (pp567 - 574), available online at www.ejkm.com
The literature review highlights a number of success stories with regard to added value resulting from KM practices in companies such as Hewlett Packard, Xerox, Dow Chemicals and Texas Instruments among others. These companies benefited from KM practices to gain competitive advantage. However, there is a dearth of literature on the subject in the context of the car manufacturing industry. Therefore, this paper aims to contribute to close this gap by exploring the experience of UK car manufacturing companies in KM practices. This paper is organised into five sections beginning with introduction, through the literature review, methodology and major findings and discussions where the proposed framework is developed and discussed. The final section closes the paper with some concluding comments of the research.

2. Literature review

The fundamental idea of KM, as originally proposed, is dealing with the management of knowledge in related activities (Wiig, 1997). This includes organising, sharing and using knowledge in order to create value and achieve competitive advantage for an organisation. Whilst knowledge has been a central topic of debate in philosophy and epistemology since the time of Plato and Socrates, it is claimed to be among the newest ideas in management, the idea of capturing knowledge gained by individuals and spreading it to others in the organisation (Takeuchi, 2001p.315). One view of the development of KM, is to distinguish this into two generations (McElroy, 2003). First generation KM is known as ‘supply side’ (subjectivist perspective) and includes capturing, codifying and sharing knowledge. For instance, Dow Chemicals share and protect their IC by codifying the knowledge in the form of patents (Davenport, 1998). In contrast, second generation KM is known as ‘demand side’ (practice-based perspective) and is concerned with knowledge creation and knowledge sharing through people utilisation. For example, at Chaparral Steel, the company has unique apprenticeships for all production workers that include both classroom and on-job-training (Leonard-Barton, 1995). While the former focuses on an IT approach, the latter emphasis is on ‘people’ with initiatives such as collaboration and team working. Both generations highlight the managerial facet and emphasise ways to manage organisational knowledge. This reflects the view of KM as a set of processes concerned with the usage, development, renewal and application of knowledge (Wiig, 1997).

However, another development arises as an extension of the KM concept which is concerned with value creation (Carlucci and Schiuma, 2006). On this subject, it has been primarily concerned with assessing, evaluating or ‘measuring’ KM practices. An increasing number of contributions have been produced and some new concepts have been introduced in the literature. In particular, IC has emerged among the key concepts to analyse and evaluate KM practices. Several models have been developed to assess KM practices, including the balanced scorecard (Kaplan and Norton, 1992), Skandia Navigator, (Roos et al., 1997), Intellectual Capital Index (Edvinsson and Malone, 1997) and the Intangible Asset Monitor (Sveiby, 1997). The common feature of these models is that they are often described as non-financial models. In contrast, traditional measurement models, such as those presented in financial statements and balance sheets, still have a heavy reliance on financial value. This is partly due to the fact that it is often very difficult for accountants and economists to allocate an orthodox valuation to intangibles, such as knowledge, as they rarely have an exchange value (Bontis, 1999) and do not have direct representation of firm value (Mouritsen, 2004). In relation to this issue, Johnson and Kaplan (1987p. 202) state that:

“A company’s economic value is not merely the sum of values of its tangible assets, whether measured at historic cost, replacement cost, or current market prices. It also includes the value of intangible assets: the stock of innovative products, the knowledge of flexible and high quality-production processes, employee talent and morale, customer loyalty and product awareness, reliable suppliers, efficient distribution network, and the like…….reported earnings cannot show the company’s decline in value when it depletes its stock of intangible assets”

Nevertheless, it is questionable whether such measurement models are really grasping the ultimate value of knowledge, resulting from KM practices. Moreover, there is additional complexity due to the nature of knowledge characteristics in different types of knowledge, which subsequently understates the value resulting from the measurement process. Arguably, organisations struggle to understand the adding value or the impacts of KM initiatives, which make them difficult to justify (Chong et al., 2000; Skyrme and Amidon, 1998). Likewise, there are no straightforward links between KM and business performance but, instead, a complex relationship (Carlucci and Schiuma, 2006). This is further complicated by the existence of various forms of KM initiatives ranging from those focusing purely on technological perspectives to those focusing on mainly human perspectives which results in
multidimensional implications. Therefore, understanding the linkage between KM practices and their implications can help explain what is the adding value to organisations. An important question that arises in relation to this matter is: how can KM add value to organisations? The following section will discuss the research methodology of this study.

3. Methodology

This qualitative research study which conceived as theory-building approach was performed through in-depth interviews by questioning six senior managers from different companies in the UK car manufacturing industry. In the course of the in-depth interviews, the general interview guide approach was used to make sure all relevant topics were covered, combined with standardised open-ended questions in pre-determined fashion in order to guide the flow of the interview. The opportunity for narratives or ‘story telling’ and expressions of opinion was considered more important than strictly addressing each question in order to gain insight into context and meaning and secure richness of data. It can be claimed that the interviews were conducted in a ‘non-judgemental form of listening’ (Zuboff, 1988:p. 428), with questions asked to probe emergent issues and seek explanations.

The analysis of the interviews followed the thematic analysis technique, as suggested by Ritchie and Spencer (2002). The main themes of the research were identified through the process of spelling out the meanings and concepts of each statement in the transcripts. It should be noted that the list of themes underwent iterative revisions and refinements until saturation point was achieved (Glasser and Strauss, 1967; Lincoln and Guba, 1985). The themes were then clustered into main components and the conceptual framework developed. The researcher presents this as a ‘logical chain of evidence’ (Miles and Huberman, 1994:p.260).

4. Findings and discussions

There has been widespread acknowledgement in the literature that KM is critical for organisations to create or add value in sustaining competitive advantage through the impact of, and benefit from its practices. Although some authors, such as Skyrme and Amidon (1998:p.20) and Scarborough (1999:p.360), recognise the capability of KM in adding value, it is argued that the link between KM and the business benefit or bottom line was almost ‘axiomatic’. Following this, the added value or the business benefits were identified based on rigorous research and empirical investigations, as indicated by Robinson et al. (2005) and Breu et al. (2000). Nevertheless, it is still unclear how KM adds value or even impacts on business performance in view of the controversy surrounding the concepts.

For confidentiality purposes the organisations’ names were coded accordingly. They were coded as Company A, Company B, and Company C etc. It was reported from the findings that added value is gained in the practice of KM. Basically, added value is determined and described through the implication and benefits of the KM initiatives. Given that manufacturing is the organisations’ nature of business, there is a link between KM practices and operational benefits which suggests that the main reason is because the role of KM is aimed at improving manufacturing processes which are embedded in the organisation’s business strategy. From the findings, it was indicated that KM practices improved their organisations’ operational activity in variety of ways, such as reducing the design cycle time, lead time, cost, reducing time product-to-market, and improving the quality of product. For example, for Company A, the design cycle time was massively reduced from 120 hours to 8 hours through the utilisation of knowledge-based tools. This is illustrated as knowledge-based tools enabled engineers to design products according to specifications. ‘Codified knowledge’ embedded in knowledge-based tools is used in the process. Moreover, tacit knowledge of the engineers is codified throughout the process where the design is stored in a database of knowledge-based tools for them to reuse and review the design. In consequence, this reduces the cost of designing cars since less time is required to produce such designs. This is because the engineers don’t have to design from scratch as the same design is reused. In contrast, the participant of Company B claimed that sharing best practices allows the organisation to improve the quality, and reduce lead time and cost, because they have found new ways and techniques of process improvement through knowledge creation and sharing processes. As a result, they are able to produce cars quicker to customers than their competitors. Competitive advantage, it is claimed can be achieved with ‘extra knowledge’ than competitors of efficient manufacturing processes resulting in delivering products on time to customers.
Besides the operational benefits, it was found that KM initiatives had improved the business processes. For Company A, knowledge of design that is codified will be used as ‘standard’ for the same process in the company Group. This can establish synergies across the brand with the best standard of design. Further, as indicated by the interviewee from Company C, the organisation can reduce time for business processes by not having to ‘reinvent the wheel’, since they can share best practices and apply those in different geographical areas. With other mechanisms, as highlighted by the interviewee from Company B, business processes were improved through conversations and discussions that can generate invaluable knowledge for forecast saving and cost reduction. In addition, with the available information and knowledge about processes and product, business processes were improved by providing rapid response and solutions to customer complaints. Also KM practices had improved the business process with the quality of cars produced, where this can further retain the existing customers, as indicated by the interviewee from Company C.

With regard to financial value, the literature review highlighted a few KM case studies (Robinson et al., 2005). From the findings, the interviewees described how process improvement and KM benefits were translated into financial value. Interestingly, the financial value was described through the result of operational and process improvement activities. As stated by the interviewee from Company B, the financial value was gained through less repairs and maintenance due to improvements in the quality of the product. Consequently, this would reduce customer complaints. This is important because poor quality products, in turn, will lead to customer dissatisfaction and, further, could reduce sales turnover. Moreover, financial value was defined through the reliability of machinery and equipment. This means the production volume will be affected by low quality machines which require high maintenance costs that may cause losing potential sales turnover. Hence, with less breakdowns and repairs, the company can achieve production targets that are worthwhile in terms of financial value. Nevertheless, financial value is not always described explicitly and straightforwardly, but rather in metaphorical terms, as highlighted by both interviewees from Company F. This may imply the difficulties of measuring the value and impact of an abstract concept, such as knowledge (Elliot and O’Dell, 1999). Further, the findings can confirm the results undertaken by Chong et al. (2000:p.374), suggesting that relatively few organisations can monitor the costs and benefits of KM initiatives.

In another aspect, the findings disclosed that KM practices had an impact on organisational culture. The results were not surprising because the KM literature highlighted that previous surveys had consistently revealed that social and cultural issues were the main obstacles to the success of KM practices. However, as mentioned by the participant from Company B, the organisational culture had changed towards a knowledge sharing culture where employees were driven to generate and share knowledge for the purpose of organisational improvement. The employees are more motivated and willing to share their knowledge because they feel more valued for their intellectual capabilities and skills when they can see their contribution towards improvements in the organisation. This is related to Kim and Mauborgne’s (1998:p.332) argument stating that ideas and making workers feel valued can impact on attitudes towards knowledge sharing; ‘when they felt that their ideas and person get recognised through fair process, they were willing to share their knowledge and their all’. Moreover, as indicated by an interviewee of Company D, employees from all levels were actively involved in knowledge sharing as their contributions were recognised as team rather than individual achievements. The employees were becoming multiskilled and also more flexible and capable of performing various kinds of jobs. The ability to be flexible and being multiskilled are part of the working culture and they didn’t view it as an extra burden to their workload.

Despite the perceptions or interpretations of added value described by the interviewees as discussed above, it is important to investigate what measurement approach is used and how the value is justified. From the findings, it was revealed that various unspecific measurement approaches were utilised by interviewees’ organisation to assess or evaluate the outcome of KM initiatives. For example, Company A’s KM initiatives were measured against operational objectives, i.e. time, quality and cost. Similarly, Company B and Company D linked their measurement approach to organisational targets. Although KM measurement models, such as the Skandia Navigator, IC Index and Intangible Asset Monitor, were not adopted by the organisations, the findings implied the importance placed on the ability to measure what they can manage. This is relevant as the KM literature indicates the concept of the relationship between measurement and management of KM initiatives (Roos et al., 1997; Liebowitz and Suen, 2000:p.54). The established KM measurement models are not utilised, which may suggest that the models are not applicable in a manufacturing context. For instance, Skandia Navigator was developed based on financial services which contrast with the car...
manufacturing context. This is related to the argument made by Bontis et al. (1999:p.400), stating that the measurement tools are more or less inappropriate to specific situations and companies. Similarly, it suggests that there is no generally accepted theoretical model for understanding, managing and measuring IC, as indicated in the literature review (Petty and Guthrie, 2000:p.165). Thus, the ‘unspecific measurement approaches’ might be appropriate to be utilised by the interviewee’s organisation to justify the added value resulting from KM outcomes. The literature review seems to support this claim, as knowledge itself cannot be measured, but the activities or outcomes associated with applying knowledge can be measured (Davenport and Prusak, 1998). Further, Cohen (1998:p.33) noted that knowledge cannot be directly measured, but it is possible to measure the outcomes, such as changes in profitability, efficiency and rate of innovation resulting from KM initiatives.

However, their measurement approaches involve using a vast array of metrics to evaluate and assess KM initiatives, which seem similar to the established KM measurement models, as disclosed in the findings. The usage of extensive metrics has limitations for measuring KM initiatives. These limitations lie in the concepts of metrics as codified knowledge that typically looks at knowledge as a static asset (Bontis et al., 1999). This is related to the findings, as the interviewees who adopt a metrics approach believe that KM initiatives are measurable and can be quantified. Nevertheless, the process of measuring KM is criticised because the real potential lies in tacit knowledge which remains elusive when it comes to measurement (Holtshouse, 1999). In other words, attempts to measure all aspects of knowledge would neglect the added value of tacit knowledge, which is not measurable. This is viewed as ‘false recipe’ syndrome (Johnson, 2002:p.419). Moreover, the issue is relevant to the response given by an interviewee of Company C, that ‘the real value is to transform from being conceptual to being practical and delivering value…..how do you take it from words, concepts and theory to actually deliver cost reduction, efficiency, quality improvement…..’. The literature highlights this as criticisms and problems of measurement through philosophical lens as highlighted by Mouritsen (2004) and Andriessen (2004:p.239). Therefore, in light of the criticisms, it is not surprising that some of the responses argue that the added value is based on logical sense or assumptions, which are quite philosophical to some extent. This was related to the argument which indicated that value is based on people’s perceptions – ‘in the eye of the beholder’ (Andriessen, 2004:p.237). Therefore, it seems that there is a missing link between value and measurement, as Andriessen (2004) argues that KM measurement frameworks (he uses the term ‘intellectual capital’) are a measurement method not a method for valuation, because they use a measurement scale that cannot represent the real value with such scaled numbers quantitatively. But Rescher (1969:p. 61) describes valuation (he uses the term evaluation) in the strictest sense as “e-value-tion” which is ‘a comparative assessment or measurement of something with respect to its embodiment of a certain value’. Knowledge is not an object or thing but more an aspiration to be insightful, it is dynamic and grows in firms all the time and therefore, it makes little sense and is impossible to arrive at one finite ‘value’ that is presented in IC measurement frameworks (Mouritsen, 2004). But how can knowledge be managed if the value of knowledge is not predictable? KM value, as perceived through IC measurement, is not about the precise prediction of knowledge but about orienting the production of knowledge towards a purpose that involves being able to make a difference to somebody or being good at something (Mouritsen, 2004). In summary, the value through measurement frameworks is not easy to establish and the mechanisms do not have explanatory power to demonstrate the linkage.

Meanwhile the complexity concept of value makes it even more difficult to justify through measurement. The literature review frequently mentioned the complexity and multidimensional nature of the effects generated by implementing the KM initiatives, as indicated by Chong et al. (2000) and Kaplan and Norton (2004:p.29-30). In fact, the findings revealed that benefits and value of KM appeared to be direct and indirect to one another. For example, sharing best practices directly impacts on the operational activities, i.e. reduction of lead time, quality improvement, but at the same time, also impacts on the organisational culture through such issues, as team working and the motivation of employees. On the one hand, the added value it is claimed can be quantified through the metrics measurement, while, on the other hand, added value is also recognised from people-related and behavioural aspects such as employee’s motivation that cannot be measured quantitatively. Inadvertently, this also refers to the issue surrounding the nature of knowledge, which is idiosyncratic and lies in the philosophical assumptions. In summary, this section revealed that the role of KM is largely based on how to transform knowledge from being conceptual to being practical, and delivering significant results to the organisation.
5. Development and description of the proposed KM conceptual framework

This section draws from the main findings of the research to develop a conceptual framework in order to provide a profound and comprehensive understanding of the KM role, its added value and interrelated mechanisms. The framework provides a sense of understanding the KM and its added value by showing the interrelationship mechanisms between KM perspectives, i.e. objectivist and practice-based, and KM measurement approaches leading to added value. Given that the framework shown in Figure 1 does not represent exact measurement of added value in ‘objectivity sense’ as a result of KM practices, the illustration is only conceptual based on the interpretations from the findings of the empirical work.

KM measurement is recognised as an important component to be included in the framework, as illustrated at Figure 1. Moreover, this includes important issues of measurement in KM highlighted in the literature and empirical evidence. Although the utilisation of a measurement model was criticised with regard to the capability of measuring tacit knowledge, the development of such a measurement model is important as a basis for the justification of the outcome of KM practices. Therefore, the mechanisms of a KM measurement approach should include both subjectivity and objectivity dimensions in order to negotiate the implications of the multidimensional nature of added value. The criticisms of measurement models are not seen as a barrier, rather, are congruent to justification of added value based on the logical sense and interpretations of the organisation. Nevertheless, the primary concern is the identification of added value resulting from KM practices in a particular organisation. This is important because while there is a problem in measuring KM initiatives, it all comes down to whether or not the organisations achieve the business objectives. From the findings, the conceptual framework consolidates the added value that can be categorised into: financial value, operational benefits, business process improvement and organisational culture. The illustration of Figure 1 is meaningful because it integrates the interrelated mechanisms; strategy, KM applications with a balanced view of KM perspectives, KM measurement approaches, and its added value into a single framework. This research was motivated by the gap between KM theory and practice identified in the past KM literature.

**Figure 1: Conceptual framework**
6. Conclusions

This research was motivated by the gap between KM theory and practice identified in the past KM literature. In order to gain deeper insights and bridge the gap, UK car manufacturing industry was approached to address the issue of KM role in adding value into organisation. Indeed, to conclude this research, it can be claimed that KM plays a significant role in adding value in UK car manufacturing industry. This study is able to make contribution through the development of conceptual framework in the understanding of the role of KM through its practical manifestations and nature of its implications. The new body of theory developed in this study has potential to provide a guideline for practitioners not only to succeed in KM but to secure the added value which was criticised as being elusive. Accordingly, the proposed framework is intended to be neither normative - as it describes how organisations ought to function and not necessarily how they actually do function - nor to be a rigid set of prescriptive rules that would guarantee KM success. However, the framework can serve as a useful guideline for drawing attention to theoretical underpinnings of the knowledge concept and the characteristics of KM implementation factors, understanding the interplay between these and measurement approaches and the nature of added value.

References


Intellectual Capital Disclosures: the Search for a new Paradigm in Financial Reporting by the Knowledge Sector of Indian Economy

Mahesh Joshi¹ and Dharminder Singh Ubha²
¹RMIT University, Melbourne, Australia
²GSSSDGS Khalsa College, Patiala, India
mahesh.joshi@rmit.edu.au
savidharm@gmail.com

Abstract: In a rapidly changing world evidenced by a transition from industrial to knowledge economy, India’s progressing knowledge sector has attracted the attention of the entire globe. The future drivers of any economy will no longer be capital, land or equipment; but the people and their knowledge. Indian corporate sector, now, is in search of a new paradigm in accounting, which would enable it to record its new journey from financial capital to intellectual capital. With this background in mind, the study of 15 leading Indian Information Technology companies, considered to be highly knowledge intensive, is undertaken in order to find out the disclosure level of recording and reporting of intellectual capital by these companies. An effort has been made in this paper to identify the meaning and significance of intellectual capital and to evaluate the prevailing practices of recording and reporting of intellectual capital by the Information Technology sector in India by using the content analysis method. The results of the study demonstrate that intellectual capital reporting in the Indian Information Technology companies are almost negligible and it is evident that intellectual capital reporting has not received any preference or priority for the mentors of the Indian corporations.

Keywords: intellectual capital, knowledge capital, Indian economy, information technology sector, human capital

1. Introduction

The world is fast changing from industrial to knowledge economy and Indian economy has attracted the attention of the whole globe with its fast growing knowledge sector. In its 11th five year plan (2007-08), the Planning Commission, Government of India highlighted that Information technology had made a revolutionary change in the history of global trade and services. Today, India has made its presence felt in the Information Technology world and is considered as the premier destination for the global sourcing of Information Technology and IT-enabled Services. The exceptional growth of the Indian Information Technology Software and Services and IT-enabled Services-Business Process Outsourcing (ITES-BPO) sector has put a perceptible multiplier effect on the Indian economy as a whole. According to the estimates of the Planning Commission, “India’s success in the export of Information Technology Software and Related Services and IT-enabled Services-Business Process Outsourcing (ITES-BPO) sector has put a perceptible multiplier effect on the Indian economy as a whole. According to the estimates of the Planning Commission, “India’s success in the export of Information Technology Software and Related Services and IT-enabled Services-Business Process Outsourcing (ITES-BPO) sector has put a perceptible multiplier effect on the Indian economy as a whole. According to the estimates of the Planning Commission, “India’s success in the export of Information Technology Software and Related Services and IT-enabled Services-Business Process Outsourcing (ITES-BPO) sector has put a perceptible multiplier effect on the Indian economy as a whole. According to the estimates of the Planning Commission, “India’s success in the export of Information Technology Software and Related Services and IT-enabled Services-Business Process Outsourcing (ITES-BPO) sector has put a perceptible multiplier effect on the Indian economy as a whole. According to the estimates of the Planning Commission, “India’s success in the export of Information Technology Software and Related Services and IT-enabled Services-Business Process Outsourcing (ITES-BPO) sector has put a perceptible multiplier effect on the Indian economy as a whole. According to the estimates of the Planning Commission, “India’s success in the export of Information Technology Software and Related Services and IT-enabled Services-Business Process Outsourcing (ITES-BPO) sector has put a perceptible multiplier effect on the

Dun and Bradstreet in its survey (2008) depicts that the contribution of the Information Technology industry to the GDP of India has grown significantly from 1.8% in 1999-2000 to around 5.4% in the financial year 2007. According to The National Association of Software and Services Companies (NASSCOM), the size of the Indian Information Technology industry was estimated to be approximately US$ 47.8 billion in the financial year 2007. The exports market constitutes the largest segment accounting for around 65.5% of the total revenue generated by the Indian Information Technology industry, including hardware. It is more aggressive in tapping the global market. Thus, it is in the convenient to interpret that during the last few years, Indian Information Technology companies have established themselves in the global market and the country is on the threshold of becoming a knowledge superpower because one of its strongest assets as a nation is the toiling nature and creativity of its people.

It is important that people will be the key factor in the future and their knowledge reservoir will be the most valuable resource of the organisation. According to Patibandla and Petersen (2002), the knowledge-based software and service export industry in India is, by its nature, Human Capital
intensive with physical capital requirements confined to office space and hardware and that in this industry production activity embodies technological learning that requires skills, knowledge and capabilities. Thus, the future drivers of the economy will no longer be capital, land or equipment; rather it will be the people and their knowledge because in a knowledge economy, intangible assets are the key drivers of market value. The real sources of success in this system are the intelligence, flexibility and innovativeness of people, enterprises and nations.

A knowledge-intensive company leverages know-how, innovation and reputation to achieve success in the marketplace. Managing a knowledge organization necessitates a focus on the critical issues of organizational adaption, survival, and competence in the face of ever-increasing, discontinuous environmental change. The profitability of a knowledge firm depends on its ability to leverage the learnability of its professionals, and to enhance the reusability of their knowledge and expertise. The intangible assets of a company include its brand, its ability to attract, develop and nurture a cadre of competent professionals, and its ability to attract and retain marqué (brand) clients (Infosys Annual Report, 2007-08).

It is evident from the above description that knowledge assets have a significant role in defining the growth of a high-tech company. It is with this background in mind that the study of 15 leading Indian Information Technology companies, considered to be highly knowledge intensive, is undertaken to ascertain their disclosure level of recording and reporting of intellectual capital. An effort has been made in this paper to identify the meaning and significance of intellectual capital along with studying the viewpoint of early exponents of intellectual capital and to evaluate the prevailing practices of recording and reporting of intellectual capital by the corporate sector in India. The scope of the paper has been limited to the selected 15 companies of the Information Technology sector on the basis of the total income generated by them in the year 2007-08.

2. Concept of intellectual capital

The concept of intellectual capital gained momentum in the 1990s with the rapid emergence of information and communication technologies. The Organisation for Economic Co-operation and Development (2000) describes intellectual capital as the economic value of two categories of intangible assets of a company: organizational capital and human capital. It is possession of knowledge, applied experience, organizational technology, customer relationships and professional skills that provide a competitive edge in the market (Edvinsson, 1997). As a consequence; it signifies that information is an important factor of production along with land, labour, capital and energy. It is the prime source of organisation that needs to be sustained, nurtured and accounted for. Natrajan and Ganesh (2003) describe Intellectual capital as the documented knowledge available in the form of research papers, reports, books, articles, manuscripts, patents and software. Magdaraog (2004) believes that the essence of knowledge capital does not lie in its creation or codification rather in its use and realization because knowledge created and codified is worthless until it is put to use and people benefit from its use. The following descriptions of Intellectual capital available in the existing literature on the subject are worth noting and quoting:

- Intellectual material that has been formalized, captured and leveraged to produce a higher valued asset (Klein and Prusak, 1994);
- Accumulated value of investments in employee training, competence and the future (Skandia, 1996);
- Combined intangible assets of market, intellectual property, human-centred and infrastructure which enable the company to function (Brooking, 1996);
- Information and knowledge applied to create value (Edvinsson, 1997);
- Intellectual capital is the net difference between the market value of a corporation and its tangible assets (Strassmann, 1999);
- Knowledge, information, intellectual property, experience that can be put to use to create wealth (Stewart, 1997);
- The holistic meta-level capability of an organisation to generate creative and effective responses to extant and emerging, present and potential challenges facing it, in an ongoing manner (Rastogi, 2000a, 2000b);
- Claim to future benefits that does not have a physical or financial embodiment (Lev, 2001);
Knowledge that can be converted into profit (Sullivan, 2000);
Individual knowledge stock of an organisation as represented by its employees (Bontis 2003); and
Difference between company’s market value and its book value, or the resources created from internal learning and development of valuable relationships (Ordonez de Pablos, 2003).

On the basis of the above descriptions, it can be concluded that the collective intellectual capital of an organization is represented by the skill and experience of its employees as also by its corporate information repositories. Petty and Guthrie (2000) conclude that intellectual capital is a reliable indicator of the future earning potentialities or net worth of a company and in one form or the other, it is implied in recent economic, managerial, technological and sociological developments in a manner previously unknown and largely unforeseen.

3. Constituents of intellectual capital

Broadly speaking, intellectual capital consists of two components which are not only interrelated but are also interactive. These are: human capital and information. Of these two, human capital is the collective human competence comprising intelligence, education, skills, experience, intuition and imagination as influenced by emotional and motivational attributes. Apparently, this kind of knowledge is difficult to be documented, communicated and transmitted. The second component information constitutes those achievements and experiences of individual which can be documented, communicated and transferred. These include books, papers, studies, reports, software, databases, CDs, and patents etc. This information becomes independent of its creators once it is documented and communicated. It can be tested objectively for its reliability and validity and can also be altered, improved and used simultaneously by any number of people. Thus, intellectual capital exists within the minds of the people as well as in the form of formal information which is outside the minds.

4. Early exponents of intellectual capital

The evolution of knowledge capital management and intellectual capital as a discipline can be traced to the long past though no visible pattern was discernible then. Sullivan (2000) describes, “Knowledge capital management movement is believed to have taken off from three distinctly different origins. The first was the pioneer work of Hiroyuki Itami of Japan who studied the impact of invisible assets on the management of Japanese corporations. The second was the work of economists like Penrose, Rumelt, Wemerfelt and others on technology commercialization. Finally, there was the work of Karl-Erik Sveiby in Sweden which addressed the human capital dimension of intellectual capital.”

Sveiby (1997) is regarded as the founding father of knowledge management and intellectual capital movement in Sweden, who gave a logical explanation about the management of the organizations who had only knowledge and creativity of their employees as key elements of growth of their business but not the traditional production function. He proposed a theory for measuring knowledge capital by dividing it into three categories: Customer Capital, Individual Capital, and Structural Capital. His contributions have been widely recognised by various researchers in the field of knowledge management and are proven to be guiding source for knowledge based companies.

The Swedish insurance company Skandia published the first intellectual capital report in 1994 signifies intangible assets that included human capital; customer/market capital; process capital; and, renewal and development capital. According to the report, the potential financial returns that are attributable to these intangible or non-financial assets represent the value of intellectual capital. This model provides a comprehensive and integrated view of financial as well as intellectual capital. Generally, it is the hard quantitative data that is used as indicators for scrutinizing the internal and external processes taking place in a country. However, this model declared that such indicators failed to provide full and accurate assessment of the country’s assets and its potential for future growth. Thus, it described intellectual capital as a complement of financial capital. It is a point to be noted that as an outcome of this model it becomes evident that while financial capital highlights the history and achievements of the past of a country, the intellectual capital reflects its hidden national potential for future growth.

Strassmann (1999) laid emphasis on the value of corporate knowledge. According to him, intellectual capital is nothing but creative energy which springs forth from something that is intangible, as if it were an artistic conception. It ultimately leads to management value addition. It is because of this value addition that market value of a company is different from its book value. Apparently, management
value-added depends, to a large extent, on the level of knowledge capital. This accumulated knowledge increases work efficiency which ultimately increases the total value of products or services of a company.

Kaplan and Norton (1992) rejected the traditional financial reporting calling it too narrow in its outlook. They averred that it ignored the future and focused only on present and past. They suggested that the companies should use a ‘balanced score card’ that included, besides the traditional financial measures, other things such as customer satisfaction and turnover as well as comparative product quality, as these things were better indicators of current performance and likely future performance. They opined that intellectual capital must be a part of the balanced scorecard.

Lev (2001), who started his research in the early 1990s on the valuation of intangibles, focused on quantifying the value of intangibles and correlating the values so obtained with financial measures adopted in the capital markets. He opines that the traditional accounting model which recognizes only tangibles assets and focuses only on legal transactions while ignoring other value-changing events was not appropriate to deal with the new economic environment. He asserts that it no longer meets the needs of the managers and investors of the present times. He presented an improved GAAP; double-entry system based on the economic definition of an asset as Financial-Economic Capital and an information system aimed at capturing the links between resources and outcomes as Non financial-Path Matrices.

5. Methodology

The main objective of the paper is to evaluate the prevailing practices of recording and reporting of intellectual capital by the corporate sector in India. The sample of the study consists of 15 top Information Technology companies of India selected on the basis of their total income as per the 2008 publication of Dun and Bradstreet, a premier survey agency of the country. The annual reports of the selected companies were obtained for the year 2007-08 in abode acrobat format from the respective websites of the companies. Content analysis has been used to analyse the extent of disclosure of intellectual capital reporting by the companies under study. Many studies have been conducted to analyse the intellectual capital reporting practices by using the content analysis of annual reports (Guthrie and Petty, 2000; Brenan, 2001; Olsson, 2001; Bontis, 2003; Bozzolan et al., 2003; Abeysekera and Guthrie, 2004; Ordonez de Pablos, 2005). Researchers have used similar approach to investigate intellectual capital trends in Australia (Abeysekera, 2007), UK (Striukova et al., 2008), Sri Lanka (Abeysekera and Guthrie, 2005), Spain (Olveras et al., 2008) and India (Kamath, 2008) intellectual capital trends between countries; Australia and Sri Lanka (Abeysekera, 2007); Singapore and Sri Lanka (Abeysekera, 2008). In India, one such study is available on Intellectual capital disclosure in India: Content analysis of ‘TECK’ firms (Kamath, 2008).

The items of intellectual capital selected for the purpose of study depicts the same list of 39 terms that was summarized by a panel of researchers from World Congress on Intellectual Capital which were found comprehensive enough to represent IC literature (Bontis, 2003). The annual reports were searched electronically to find out the presence or absence of the said terms. Results were tabulated on the basis of the number of companies disclosing these terms in their annual reports. Company-wise analysis, along with testing the degree of variance, has also been undertaken.

The content-wise analysis has been presented in table 1, company-wise analysis in table 2 and the variation in disclosure has been presented in table 3.

Table-1: Content-wise analysis of Intellectual Capital disclosure

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Items of Intellectual Capital</th>
<th>No. of Disclosing Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Business knowledge</td>
<td>Nil</td>
</tr>
<tr>
<td>2.</td>
<td>Company reputation</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Competitive intelligence</td>
<td>Nil</td>
</tr>
<tr>
<td>4.</td>
<td>Corporate learning</td>
<td>Nil</td>
</tr>
<tr>
<td>5.</td>
<td>Corporate university</td>
<td>Nil</td>
</tr>
<tr>
<td>6.</td>
<td>Cultural diversity</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>Customer capital</td>
<td>Nil</td>
</tr>
<tr>
<td>8.</td>
<td>Customer knowledge</td>
<td>Nil</td>
</tr>
<tr>
<td>9.</td>
<td>Economic value added</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Employee expertise</td>
<td>Nil</td>
</tr>
<tr>
<td>11.</td>
<td>Employee know-how</td>
<td>Nil</td>
</tr>
</tbody>
</table>
6. Analysis of the results

Table-1 indicates that only 14 items out of the list of 39 were found in the annual reports of the companies. The term intellectual property had the maximum disclosure by 13 companies followed by the disclosure of the term information system. Intellectual capital, the theme term of the paper, was disclosed by a meagre 2 companies i.e. Moser Baer India Ltd. and Patni Computer System Ltd. Moser Baer declares in its annual report of the year 2007-08:

*Quality of our human resources charts the success and growth potential of our business. The Company has managed to keep attrition rates well in control by imbibing a sense of ownership and pride and strong HR initiatives geared to nurturing latent talent and unlocking the power of intellectual capital. The Company continues to drive organization development and also build management resources for a multi-business enterprise.*

Patni Computer System Ltd. makes a mention of its intellectual capital in its annual report for the year 2007-08 as under:

*The global sourcing market has matured from those days when India was considered to be a source of 'low-cost manpower'. Today, it has earned the distinction of being a ‘preferred destination for intellectual capital’ that accelerates the trend - globalization of services.*

The term knowledge management which is supposed to occupy a place of prominence at least in knowledge based Information Technology companies was disclosed only by 5 companies. However, most of the terms relating to the employees and customers could not find any place in the annual reports of the selected companies. The important constituents of intellectual capital-relational capital, structural capital and customer capital also did not figure in any of the annual reports of the companies under study.

Table-2: Company-wise analysis of intellectual capital disclosure

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Company</th>
<th>No. of Items Disclosed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tata Consultancy Services Ltd.</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Wipro Limited</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Infosys Technologies Ltd.</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>HCL Infosystems Ltd.</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Siemens Information System Ltd.</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Satyam Computer Service Ltd.</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>HCL Technologies Ltd.</td>
<td>3</td>
</tr>
</tbody>
</table>
Table-3: Variation in item-wise disclosure

<table>
<thead>
<tr>
<th>No. of Disclosing Companies</th>
<th>2007-08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Items Covered</td>
<td></td>
</tr>
<tr>
<td>0-3</td>
<td>7</td>
</tr>
<tr>
<td>3-6</td>
<td>6</td>
</tr>
<tr>
<td>6-9</td>
<td>1</td>
</tr>
<tr>
<td>9-12</td>
<td>0</td>
</tr>
<tr>
<td>12-15</td>
<td>1</td>
</tr>
<tr>
<td>Mean Disclosure</td>
<td>3.9</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>3.12</td>
</tr>
<tr>
<td>Coefficient of Variation</td>
<td>80%</td>
</tr>
</tbody>
</table>

Table-2 highlights that Infosys Technologies Ltd. has disclosed the maximum number of items (13) from the total list of 39 items. It is worth mentioning that this company was the first Indian company to win the ‘Most Admired Knowledge Enterprise in Asia’ award in the year 2002. However, it is surprising to note that this company did not make any mention of the theme term intellectual capital in its annual report though it is the only company among the companies under study to use intangible assets score sheet as a measure to disclose the intellectual capital. The company in its annual report of the year 2007-08 makes the following remarks:

We published models for valuing two of our most important intangible assets – human resources and the “Infosys” brand. This score sheet is broadly adopted from the intangible asset score sheet provided in the book titled The New Organizational Wealth, written by Dr. Karl-Erik Sveiby and published by Berrett-Koehler Publishers Inc., San Francisco. We believe such representation of intangible assets provides a tool to our investors for evaluating our market-worthiness.

Tata Consultancy Services Ltd. disclosed only 7 items which is followed by Sataym Computer Service Ltd. with a disclosure of 5 items. Rest of the companies disclosed in the range of 1 to 3 items as far as disclosure of intellectual capital terms are concerned. It is also important to note that the disclosed items have been shown at scattered places in the annual reports (Table 3). The mean disclosure comes to be as low as 3.9 items. There is a variation of 3.12 items on average as suggested by the value of standard deviation. The coefficient of variation comes to be as high as 80% which indicates a significant variation in item-wise disclosure in the annual reports of the companies. However, there is no specific reporting of intellectual capital as a special part or content of the annual report inspite of its high relevance in the knowledge intensive industries.

7. Conclusion

The above analysis makes it amply clear that intellectual capital recording and reporting in the Indian knowledge sector companies is almost negligible. It is evident from the above results that intellectual capital reporting has not received any preference or priority for the mentors of the Indian corporations. The average number of items reported by the companies is deplorably low which suggests that there is neither awareness nor any interest to record and report intellectual capital variables by the companies. Even the items which were reported were expressed in discursive rather than in numerical terms. It has also been found that there exists no clear cut pattern or system of intellectual capital disclosure in the annual reports. The reporting was not uniform and no evidence of its well defined measurement basis was found in the annual reports. Thus, Indian companies are also lagging behind in the field of measurement, reporting and disclosure of intellectual capital. Our findings are found similar in comparison to various other studies on the subject (Bontis, 2003, Brennan, 200, Ordonez de Pablos, 2003 and Kamath, 2008) which signify very low level of intellectual capital disclosure. However, it is surprising to find that the Information Technology companies which are most dominating group in the knowledge sector, have failed in reporting Intellectual capital in their annual reports.

www.ejkm.com 580 ©Academic Conferences Ltd
It is evident that human knowledge is the key factor of the future industrial growth and the intellectual capital is the key driver of market value in the knowledge economy. It is strongly recommended that companies must create a culture that emphasizes the importance of intellectual capital in achieving business advantage. The accounting bodies at the global level should join heads to develop an internationally accepted valuation system and approaches for reporting of intellectual capital. The regulatory bodies should establish some parameters for the disclosure of Intellectual Capital in a similar fashion as have been defined for disclosure of corporate governance as per clause 49 of Securities Exchange Board of India (SEBI) in order to make a beginning in the field.

References

Klein, D.A., and Prusak L. (1994), Characterizing Intellectual Capital, Center for Business Innovation, Ernst & Young LLP.

www.ejkm.com 581  ISSN 1479-4411
Evaluating Knowledge Management Performance

Clemente Minonne¹ and Geoff Turner²
1Switzerland and University of South Australia, Adelaide, South Australia
2Universities of Nicosia, Cyprus and University of South Australia, Adelaide, South Australia

clemente@minonne.ch
turner.g@unic.ac.cy

Abstract: As organisations become increasingly aware that knowledge is among their most valuable strategic assets, they will be forced to re-evaluate the way in which they engage with the source of that knowledge to underpin their sustainable development. This will create a fundamental change to established practice; a change that results in a paradigm shift from the traditional operational approach to a more strategic involvement in knowledge management. This change is promoted by the knowledge management maturity model (KM³). KM³ is founded on the idea that successful knowledge management comprises four forms of integration, namely cultural, organisational, procedural and methodical. Despite an emphasis on one of these forms by many organisations, it is understood that all forms of KM integration should be considered in parallel to implement knowledge management practices in an integrative manner. Key indicators that measure the performance of knowledge management integration are needed. They need to measure both effectiveness and efficiency. In many cases, organisations having, and actively executing, a knowledge management strategy tend to focus on the efficiency dimension because it can be evaluated more easily than the effectiveness dimension. Yet this path is fraught with danger because, as with many other aspects of business, the management of knowledge has to be effective before it may provide efficiency gains. Nevertheless, organisations require appropriate forms of measurement. Those that are unwilling, or unable, to develop effective measuring and reporting systems are likely to suffer from product or service quality decreases, lower productivity growth and a reduced ability to compete because they will be less successful in acquiring and using relevant knowledge resources. Key performance indicators that are developed to assess the progress of organisations in this compelling activity need to be aligned with one or another of the four forms of integration and may be either qualitative or quantitative in nature. The balanced scorecard concept is used to measure performance of the KM³ where the balance between the four forms of integration is the prime consideration. Each of these is represented by one segment of the knowledge management monitor (KM³) to facilitate a better understanding of the cause-and-effect relationships. It does so by providing structured information about an organisation's knowledge resources: how they are nurtured and how they contribute to organisational sustainability. At the same time, use of KM³ is related to organisational economy. Good economy means good resource management, which for many organisations translates to how they manage individual and accumulated organisational knowledge. This has become so important that they are looking for a more integrated way of managing the three interdependent and complementary pillars of knowledge management, which are organisational learning management, organisational knowledge management and intellectual capital management. Although these three concepts lack a unifying vision, they all relate to each other by informing one another and provide the pathway for a knowledge-based orientation of strategic management.

Keywords: strategic knowledge management, performance measurement, integrative approach

1. Introduction

Since Handy (1996) suggested that managing the knowledge and skills of its employees was a key organisational challenge, each of the management disciplines has contributed to the concept of Knowledge Management (KM) in a rather independent way. Utilising the data collected during a field study of more than 260 participants from over 250 different organisations in various industries in the German speaking region of Europe (Minonne 2008), Turner and Minonne (2009) investigated the lack of a general integrative, or synchronised, approach to measuring the effects of KM practices as a foundation for effective corporate strategy development and management decision making. In a further development of that work, this paper considers how it may be possible to measure the performance of KM integration. Using deductive reasoning to argue its practical rationality, a framework is developed that organisations may experiment with to better understand the effectiveness of their integrative approach to KM. This has become so important because organisations are looking for a more integrated way of managing the three interdependent and complementary pillars of KM, which are Organisational Learning Management (OLM), Organisational Knowledge Management (OKM) and Intellectual Capital Management (ICM). To this day, these three concepts lack a unifying vision, even though they all relate to each other by informing one another (see this concept displayed in Figure 1) and collectively they provide the pathway for an integrative knowledge-based orientation of strategic management.
The extent to which an integrative approach helps an organisation more effectively manage its knowledge assets was examined in depth by Minonne (2008) resulting in the identification of four complementary forms of integration. These are cultural integration, organisational integration, methodical integration and procedural integration and they are the conduits of an assessable KM strategy as depicted in Figure 2. Despite an emphasis on one or other particular form of integration by many of the field study's respondents, it is evident that each of the four forms of integration need to be considered in parallel if organisations want to implement KM practices in an integrative way.

Cultural integration allows KM to become an integral part of the overall organisational culture. It systematically encourages the exchange of organisational knowledge and its application contributes to high esteem within an organisation. Some common practices in this field are after action reviews, job rotation and communities of practice.

Methodical integration attempts to integrate human and system oriented KM practices into knowledge intensive work processes in such a way as to positively influence organisational performance in terms of quality, productivity, and innovation gains. Some common practices in this field are: skills inventories, mentoring and document management.

Procedural integration aims to integrate KM into business processes throughout the organisations’ value chain so that it becomes an integral part of the intra- and inter-organisational work-flows. The aim of such practices typically lies in the implementation of continuous business processes, in the reduction of processing time, and the avoidance of work redundancy.

Organisational integration endeavours to integrate KM into the organisational structure and facilitate dedicated management of the organisational knowledge base. Some common approaches applied in this field are the centralisation, decentralisation, and responsibility (for example revenue, cost, profit, investment) centres.

The study identified several obstacles facing organisations that wish to pursue an integrative and assessable KM strategy. One is the apparent difficulty, the root of which is the pursuit of system oriented practices ahead of human oriented practices, in establishing a KM culture. This results in a leaning towards efficiency rather than effectiveness oriented approaches, which should be the first consideration. However, some alignment between both orientations is preferable and there are models available to assist in that regard (see, for example, EIDA in Minonne 2007). Another is an inability to derive pertinent KM targets from overall corporate strategy. A superior appreciation of the four forms of integration should help to resolve this obstacle by establishing appropriate measurable targets that inform strategic direction. Finally, there is the obstacle of performance measurement. In some ways this derives from an inability to set appropriate targets but also arises from an inability to determine appropriate quantitative, preferably, or qualitative key performance indicators (KPIs).

With a greater awareness of the four forms of KM integration allied to the managing and leveraging of human oriented and system oriented KM practices and an appreciation of the optimum proportion of
each, organisations should be better placed to create a performance measurement system that accounts for the integrative management of an organisation's knowledge assets. Fundamentally, KPIs that measure effectiveness and efficiency of an organisation’s KM initiatives in each of the four forms of integration are required.

Figure 2: Integrative approach to knowledge management adapted from Minonne (2008)

At present it appears that organisations having a KM strategy and actively managing their organisational knowledge focus, as a first priority, on the efficiency dimension because it can be operationalised more easily than the effectiveness dimension (Turner and Minonne 2009). They go on to suggest that an effective measurement system to assess the effects of organisational KM practices, which includes critical success factors, a mix of financial and non-financial data, and a balance between the four forms of integration is essential.

At all times, effective performance measures have to be congruent with an organisation’s strategic objectives as well as easily understood by all employees and should promote intended behaviour within the organisation. However, there is no unique solution to this problem. Uniqueness only arises in the need to have an assessable strategy and this doesn’t appear in an instant. Its development is progressive and represents a fundamental paradigm shift from the traditional operational approach to a more strategic involvement in KM. This is supported by the concepts embedded in the Knowledge Management Maturity Model (KM³). KM³ is founded on the idea that successful KM requires a recipe comprising different, yet balanced, proportions of the four forms of integration (i.e., cultural, organisational, procedural and methodical).

An appreciation of the progression embedded in KM³ facilitates the development of the Knowledge Management Monitor (KM²), which is the objective of this research. KM² utilises the underlying principles of Kaplan and Norton’s (1996) balanced scorecard concept (BSC). Their model is built on the understanding that cause and effect leads to strategic success. This cause and effect hypothesis is fundamental to understanding the metrics that the BSC prescribes and so it is with KM², which promotes an understanding of cause and effect linking the four forms of integration. This is considered essential in the effective measurement of KM performance. It will do so by providing structured information about an organisation’s knowledge resources: how they are valued, how they are nurtured and how they contribute to organisational sustainability.

2. Assessing knowledge management maturity – the KM³ Model

The degree of progression in the development and implementation of a KM strategy may be simply explained with a two-dimensional model (see Figure 3). One axis is used to ascertain the level of implementation and the other to pinpoint the degree to which implementation is managed, in other words the level of control. The question that arises is, which is dependent on the other, that is, which should be shown on the y-axis and which on the x-axis of a graphical presentation. Is the level of implementation dependent on the degree of management or is it the other way around? Which leads and which follows?
Modern day strategic planning should be an exercise in interpolation rather than extrapolation. This means that organisations start with an image of what they want to look like in the future, highlighted in their vision statement. Then they decide on the changes required to develop that image from their current state for inclusion in their mission statement. If this process takes a static view of the future then the level of implementation is decided first and the control system put in place afterwards to identify actual deviations from plans, the causes of the deviations and the appropriate actions to remedy the situation. Thus this type of control system is dependent on the level of implementation.

Figure 3: The Knowledge Management maturity model (KM³)

On the other hand, and this is the perspective we choose to take, the image of the future is constantly changing, like the scenery along the road being travelled, and this requires an altogether different view of the control system. The tracking and checking-up characteristics of the control system remain but, rather than being concerned with what has already happened, they look forward by continually tracking how the future is changing. In much the same way as a global positioning system, the control system is updated frequently to correspond to the shifting reality. As such, the level of implementation is dependent, thereby occupying the y-axis, on the information provided by the control system, which will be reported on the x-axis.

The control system for the effective implementation of KM strategy needs to measure current performance and guide the organisation toward its changing image of the future. To do this effectively a system should include four compulsory elements before control may be fully established. These elements are a predetermined set of targets, a means of measuring current activity, a means of comparing current activity with each target, and a means of correcting deviations from the targets. These targets may be scientifically calculated or set arbitrarily using reasonable or totally unreasonable expectations, good or bad. The control system merely provides a means by which activity is directed toward their achievement. In general, the predetermined criteria should be stated explicitly and for this reason quantitative statements are preferred although not absolutely necessary.

In developing a way to assess the level of maturity in implementing a KM strategy, the control sphere is observed over five stages ranging from no control established to full control established as depicted in Figure 3. In the very early stages, when no control has been established, an organisation would only have an image of the future with no real way of tracking its path in that direction. As an organisation’s KM strategy takes on a more formidable look and character, the degree of control improves up to the point where quantitative metrics of effectiveness and efficiency have been established to guide the organisation towards its ever-changing image of the future. A summary of the expectations in each of the five stages of the control system are shown in Table 1.
In a similar fashion, Table 1 provides an idea of what might be achieved at each stage of the implementation of an integrative KM strategy. A more comprehensive explanation of each of the stages in the process of KM implementation is provided in the following paragraphs.

**Table 1: Stages of implementation and control maturity**

<table>
<thead>
<tr>
<th>Level of implementation</th>
<th>Maturity Stage</th>
<th>Level of Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>The basics of KM and the difference between it and information management are understood by some within the organisation. The potential benefits and the use of KM have been discussed in some functional areas.</td>
<td>1</td>
<td>No KPIs other than perhaps some qualitative assessment of efficiency in managing knowledge assets.</td>
</tr>
<tr>
<td>An intermediate level of cultural integration has been achieved. Organisational integration remains at a low level and no meaningful methodical and procedural integration are yet established.</td>
<td>2</td>
<td>A few qualitative metrics developed to control efficiency in guiding the implementation of KM strategy towards the future.</td>
</tr>
<tr>
<td>An advanced level of cultural and organisational integration as well as an intermediate level of methodical and procedural integration has been achieved.</td>
<td>3</td>
<td>Mainly qualitative, but some quantitative KPIs developed to monitor efficiency and some qualitative KPIs to assess effectiveness in the implementation of KM strategy.</td>
</tr>
<tr>
<td>An advanced level of all forms, cultural, organisational, methodical and procedural, integration has been achieved. The organisation has reached world class status.</td>
<td>4</td>
<td>Qualitative and quantitative KPIs in place to monitor the implementation of an effective and efficient KM strategy to take the organisation in the direction of its perceived future image.</td>
</tr>
<tr>
<td>An advanced level of all forms, cultural, organisational, methodical and procedural, integration has been achieved. The organisation has reached world class status.</td>
<td>5</td>
<td>KPIs, both quantitative and qualitative, in place to measure changes in the image of the future and frequent reassessment of KM strategy to reflect changes in that image.</td>
</tr>
</tbody>
</table>

- **Stage 1**: The basics of KM and the difference between it and information management are understood by some within the organisation. The potential benefits and the use of KM have been discussed in some functional areas.

- **Stage 2**: An executive responsible for the KM program has been named. A virtual team of supporters from across the organisation has been established and an appropriate KM model has been chosen. Knowledge exploration (“E” of EIDA, see Minonne 2007) is supported and actively promoted with the aim of identifying appropriate KM practices that enhance effectiveness. Furthermore, a structured exploration of the organisation’s existing knowledge-base is undertaken with an expectation that additional meaningful and valuable knowledge assets would be uncovered.

- **Stage 3**: Appropriate personnel and monetary resources are made available for current activities and firmly committed for future developments in KM. Knowledge innovation (“I” of EIDA, see Minonne 2007) is supported and actively promoted. This fosters increasing effectiveness by leading to new ideas, combinations or new applications and thus puts in place a foundation for the development of new products or services.

- **Stage 4**: KM is now an integral part of an organisation’s business processes. Knowledge dissemination (“D” of EIDA, see Minonne 2007) is supported and actively promoted. This should enhance efficiency by focusing on the structured disposition of knowledge assets. Although information systems may be used to achieve a high degree of efficiency in disseminating particular knowledge assets throughout the organisation, human beings play the more important role when it comes to transforming explicit knowledge (meaning information) into implicit
knowledge. However, the main outcome of this phase is to achieve economies of scale in the context of knowledge application.

- **Stage 5:** KM is now an integral part of an organisation’s strategy development and execution. Here, a regular and thorough analysis of the first three processes presented in the EIDA model (Minonne 2007) is undertaken to identify potential ways of improving efficiency when either exploring, creating (innovation) or disseminating knowledge assets. Knowledge automation ("A" of EIDA, see Minonne 2007), by making use of both system and efficiency oriented channels, is a key outcome of this process leading to economies of scale in the application of knowledge while at the same time fostering improvements in both efficiency and effectiveness in the management of knowledge assets.

It is now possible, after a detailed examination of the existing KM situation in an organisation, to understand the current degree of maturity in implementing an integrative KM strategy. With this position firmly established, an organisation should be able to introduce new and/or improved initiatives that will take them to the fifth and final stage of KM maturity understanding, of course, that the level of KM implementation is dependent on the progress made in the development of the control system. Unless suitable ways and means are found to track and check-up on the development and implementation of an appropriate strategy it will be hard to move forward with any confidence.

### 3. Criteria for knowledge management performance measures

Organisations are becoming increasingly dependent on knowledge and it has become a fundamental ingredient of what organisations make, do, buy and sell (Stewart, 1997). In every way, the foundation of strategic success relies on the effective management of an organisation's knowledge assets and for this to be successful there needs to be an effective way of assessing performance (Turner and Jackson-Cox, 2002). KM and particularly its performance measurement dimension has become the most important economic task for most organisations. For management accountants, the elevation in importance of knowledge has raised the thorny issue of how to account for its management. They need to establish a set of KPIs that assess their organisation's performance in implementing an integrative KM strategy. In doing so, they should resist the temptation to focus only on what is easily measurable, which generally is the efficiency dimension of activities and costs (Pfeffer, 1997). Rather, they should focus on measuring outcomes that meet real organisational needs such as innovation, technological development and employee attitudes, experience, learning, tenure and turnover, which are more likely to represent KM effectiveness rather than efficiency. While numerous performance indicators may be developed, each is only useful if it allows management to evaluate ongoing performance. As such, it is considered necessary that senior managers who have a comprehensive picture of the organisation’s vision and priorities are involved in developing KPIs.

![Figure 4: The Knowledge Management monitor (KM2)](image)

Every KPI, whether it is used to simply clarify the current position, guide the implementation of KM strategy, check the effectiveness of KM strategy or track changes in the image of the future, will affect
actions and decisions. Choosing the right KPIs is critical to success but the road to good indicators is littered with pitfalls. Many seem right and are easy to measure but have subtle, counterproductive consequences. Others are more difficult to measure but focus the organisation on those decisions and actions that are critical to success. In this setting, the task at hand is to consider ways of assessing performance in each of the four forms of integration, which are cultural, organisational, methodical and procedural integration in a way that will enable an organisation to assess its KM position. KPIs used to assess the progress of organisations in this compelling strategic activity of integrative KM need to be aligned with one or another of these forms of integration. With all of this in mind, work begins on the development of a prospective control framework, the KM2.

4. Monitoring Knowledge Management progress – the KM2 framework

The control framework that is developed as part of this research and presented in this paper supports the positive progression by organisations through the five stages of KM3. Yet with all control frameworks, or measurement systems, measuring social phenomena is fraught with difficulty, if not impossible. All measurement systems rely on proxies, such as monetary units or other indicators that often bear little resemblance to the actual events being reported.

Even so, Arora (2002) suggests that organisations can effectively implement KM by developing and applying a KM index based on the BSC. This index is a single number that incorporates key parameters for assessing KM performance in each of the business process, customers, learning and growth, and financial perspectives of the BSC. Each parameter is weighted according to its importance in achieving the organisation's KM strategy and as such the basis of the index will change as often as the KM strategy changes. Nevertheless, it represents a balanced consideration of the impact of KM, which is a similar view to that we have taken in the development of KM2. The key difference is that Arora's index reflects the progress of KM across the four perspectives of the BSC whereas KM2, depicted in Figure 4, has its focus on the four forms of integration discussed earlier.

The first task in building a working model based on the KM2 framework is to define strategic objectives, establish initiatives and construct targets across the four forms of integration. Then, to monitor and measure it is necessary to develop metrics for performance against each of the targets. These will become the KPIs on which the effective implementation of an integrative KM strategy will progress.

To start we need some model strategic objectives, initiatives and targets around which KPIs can be developed. These, which have no direct organisational origin and are simply based on the authors' wide business experience, are provided in Table 2. Using this information a set of KPIs to identify the cause and effect of implementing a KM strategy are developed. The measures developed for our working KM2 model may be either qualitative or quantitative. Qualitative measures are typically judgement based and are often used when the item to be measured or the attribute of interest does not lend itself to precise or quantifiable measurement. Indeed, they provide a sense of what is happening in the sense of the direction, rather than the speed, of change. Quantitative measures are usually integer-based and there are two further divisions: financial and non-financial.

Table 3 provides some example KPIs for each of the proposed KM targets included in Table 2. They represent a cross-section of qualitative and quantitative measures and financial and non-financial measures. Finally, KM2 was unintended to promote an understanding of cause and effect linking the four forms of integration, which has been achieved to a large extent with the example KPIs put forward.

5. Conclusions and recommendations

The frameworks proposed in this paper, first KM3 and then KM2, join a list of more than 30 other models for measuring intellectual capital that have been developed since the 1970s (Sveiby, 2007). Their purposes have been many and varied yet few have found favour to any great extent among organisations. Some of these models are broader and some more narrow than KM2, which provides a more integrated way of managing the three interdependent and complementary pillars, that is OLM, OKM and ICM, of KM.
<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>INITIATIVES</th>
<th>TARGETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CULTURE</td>
<td>KM is an integral part of the organisational culture</td>
<td>Conduct community building by establishing communities of practice (CoP)</td>
</tr>
<tr>
<td>KM enables collaboration between experienced and inexperienced personnel</td>
<td>Establish a godparent scheme</td>
<td>All employees with less than five years service to have an experienced godparent</td>
</tr>
<tr>
<td>KM encourages and facilitates the exchange of organisational knowledge</td>
<td>Create an organisation-wide job-rotation scheme</td>
<td>An employee internal job rotation frequency of 2 years</td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>KM defines the organisational structure</td>
<td>Create a process-oriented organisational structure throughout the value-chain</td>
</tr>
<tr>
<td>KM supports inter-departmental collaboration</td>
<td>Create a KM team comprised of representatives from each business function</td>
<td>Year-on-year increase in employee satisfaction with inter-departmental collaboration</td>
</tr>
<tr>
<td>KM supports the collaboration between employees and managers</td>
<td>Redefine job specifications to diminish managerial hierarchy and cultivate a team ethos within business functions</td>
<td>Year-on-year increase in employee perception of managerial collaboration</td>
</tr>
<tr>
<td>METHODS</td>
<td>KM practices are integrated into knowledge-intensive work processes</td>
<td>Create knowledge maps of the organisation to clarify the knowledge-intensive business processes and support them with appropriate KM methods</td>
</tr>
<tr>
<td>KM supports the integrative (synchronised) approach to managing implicit and explicit knowledge assets</td>
<td>Identify and synchronise initiatives related to the management of knowledge as well as those related to the management of information</td>
<td>Year-on-year increase in the number of synchronised activities</td>
</tr>
<tr>
<td>KM supports the exploration, innovation, dissemination and automation of knowledge</td>
<td>Create and execute a KM strategy using an integrated model such as EIDA</td>
<td>Year-on-year increase in the stock of knowledge assets</td>
</tr>
<tr>
<td>PROCESSES</td>
<td>KM supports the establishment of continuous business processes</td>
<td>Codify the organisation's key process models, analyse their connecting interfaces and optimise knowledge and information exchange through these interfaces</td>
</tr>
<tr>
<td>KM supports the reduction of work processing time</td>
<td>Conduct an audit of the speed of business processes and initiate appropriate KM practices to make them faster</td>
<td>Year-on-year improvement in the speed of business processes</td>
</tr>
<tr>
<td>KM supports the avoidance of work redundancy</td>
<td>Identify redundant work activities and eliminate them by applying useful KM practices</td>
<td>Elimination of 40% of redundant work activities within five years</td>
</tr>
</tbody>
</table>
### Table 3: Indicative key performance indicators

<table>
<thead>
<tr>
<th>TARGETS</th>
<th>KPI</th>
<th>LEVEL OF CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CULTURE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active CoP within each business function and cross-functional CoPs at points of interaction</td>
<td>Number of CoPs actively producing new KM initiatives at a functional or cross-functional level</td>
<td>1</td>
</tr>
<tr>
<td>All employees with less than five years service to have an experienced godparent</td>
<td>Percentage of employees with less than five years service who have a godparent and percentage of experienced employees who act as a godparent</td>
<td>2</td>
</tr>
<tr>
<td>An employee internal job rotation frequency of 2 years</td>
<td>Percentage of employees engaged in a planned two year job rotation scheme</td>
<td>3</td>
</tr>
<tr>
<td><strong>ORGANISATION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process-oriented organisation structure established and implemented in three years</td>
<td>Percentage of required changes satisfactorily implemented</td>
<td>2</td>
</tr>
<tr>
<td>Year-on-year increase in employee satisfaction with inter-departmental collaboration</td>
<td>Continuously updated on-line employee satisfaction survey, based on a Likert scale, producing an average satisfaction rating</td>
<td>2</td>
</tr>
<tr>
<td>Year-on-year increase in employee perception of managerial collaboration</td>
<td>Continuously updated on-line employee satisfaction survey, based on a Likert scale, producing an average perception rating</td>
<td>3</td>
</tr>
<tr>
<td><strong>METHODS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annually, identify at least five new KM initiatives that enhance the organisation's knowledge assets</td>
<td>Maintain a register of new KM initiatives implemented identifying the projected and actual present value of the initiative</td>
<td>3</td>
</tr>
<tr>
<td>Year-on-year increase in the number of synchronised activities</td>
<td>Maintain a register of new synchronised activities implemented identifying the projected and actual present value of each activity</td>
<td>4</td>
</tr>
<tr>
<td>Year-on-year increase in the stock of knowledge assets</td>
<td>The average, weighted according to organisational significance, of the percentage change in average employee service, average level of education, value-added by KM initiatives and return on investment in information systems</td>
<td>5</td>
</tr>
<tr>
<td><strong>PROCESSES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year-on-year increase in the number of implemented value adding continuous business processes</td>
<td>Maintain a register of new value adding continuous business practices implemented identifying the projected and actual present value of each initiative</td>
<td>4</td>
</tr>
<tr>
<td>Year-on-year improvement in the speed of business processes</td>
<td>Year-on-year change in processing time for a basket of organisational transactions</td>
<td>4</td>
</tr>
<tr>
<td>Elimination of 40% of redundant work activities within five years</td>
<td>Cumulative percentage of identified redundant work practices successfully eliminated</td>
<td>5</td>
</tr>
</tbody>
</table>

Furthermore, over many years, authors have proffered a variety of suggestions about the development of suitable KPIs for the management of knowledge assets (see, for example, Arora 2002, Edvinsson and Malone 1997, Fitz-Enz 1995, Lev 2001, Neely 2002, Sveiby 1997 and Turner...
but they have often been focused on the operational, rather than the strategic, aspects of KM. In the frameworks proposed in this paper, which are yet to be tested in practice, the focus is on forward-looking strategic aspects that are embedded in the vision, which provides the standard against which KM is measured.

The road ahead is winding, with many hazards. Further investigation is needed on two aspects. First, we need to have a more comprehensive understanding of the extent of strategic and operational KM in organisational life and how that is managed. Second, we need to investigate why the models developed through research and application are, in the main, rejected by management.

References


Knowledge Management Implementation: a Process Design Proposition at Brazil’s ONS (National Operator of the Interconnected Power System)

Rivadávia Correia Drummond de Alvarenga Neto¹, Renato Rocha Souza², Jairo Gomes Queiroz³ and Hermes Chipp³
¹Fundação Dom Cabral (FDC), Brazil
²Universidade Federal de Minas Gerais, Brazil
³ONS – Brazil
rivadavia@fdc.org.br
rsouza@eci.ufmg.br
jairogq@ons.org.br

Abstract: The implementation of Knowledge Management (KM) processes has been long overlooked in the KM literature. This paper describes and analyzes the implementation of a KM process within the Brazilian organizational context based on a theoretical framework entitled “The SET KM Model”. Both propositions – a process design for KM Implementation and “The SET KM Model” - came out as results of different sets of studies and researches conducted by two of the authors within the past decade. The methodology, qualitative in nature, is based on the study of multiple cases with incorporated units of analysis and three criteria were observed for the judgment of the quality of the research project: validity of the construct, external validity and reliability. Multiple sources of evidence were used – semi-structured interviews, extensive documental research, direct observation and participant observation – and data analysis consisted of three flows of activities: data reduction, data displays and conclusion drawing/verification. Among others, the case study conducted at ONS is highlighted in order to discuss a successful implementation experience in its early stages. The results confirmed the frameworks proposed and the conclusions suggest that (i) within KM, what is managed it’s not knowledge itself, but solely the context where knowledge emerges and is socially constructed (ba) and (ii) KM implementation processes should be developed around strategic organizational issues and involve key knowledge activists in the organizations, mainly middle-managers composing a governance committee supported by top administration.

Keywords: Knowledge Management; Knowledge Management implementation; KM in interconnected power systems; the SET KM model; ba

1. Introduction

Knowledge Management is a controversial, complex and multifaceted subject. In spite of the fact that the term is not yet stable, there’s been a growing interest worldwide within the past two decades - from academics to practitioners - in the management of knowledge and its related topics, such as “organizational epistemology” (TSOUKAS, 2005), “knowledge creation processes” (CHOO, 1998), “knowledge-based theory of the firm” (GRANT, 1996; NONAKA, VON KROGH and VOELPEL, 2006), “the concept of ba” (NONAKA and KONNO, 1998) and “enabling conditions” (VON KROGH, ICHIJO, NONAKA, 2000; VON KROGH, 1998), “knowledge tools” (BONTIS et al., 1999), “knowledge types” (BLACKLER, 1995), “knowledge assets” (BOISOT, 1998) and “knowledge taxonomies” (ALAVI and LEIDNER, 2001), among others.

KM initiatives have been adopted worldwide with distinct conceptions, objectives, practices, emphases and metrics (ALVARENGA NETO 2005). There has been successful initiatives reported on qualitative studies (ALVARENGA NETO, 2005, 2008), elegant quantitative studies on specific aspects (CHOU and WANG, 2003), in-depth case studies (PELTOKORPI et al, 2007) and deviate studies that combine myopia, territory defense and solely IT as the core concept (SOUZA and ALVARENGA NETO, 2003).

In our researches within the last ten years, concerning the management of knowledge in world-class organizations, we have come out and discussed similar topics and approaches, but above all, we have stressed out two main concerns: (i) a long standing misinterpretation that considers knowledge management and information management (IM) as synonyms. We shall call this “information reductionism”, as the “map is not the territory” (TSOUKAS, 2005; WEICK, 1979). IM is just one of the components of KM, as KM also incorporates other concerns such as to the creation, sharing and
enabling condition for organizational knowledge (Alvarenga Neto, 2008); (ii) a long overlooked topic in the KM literature: KM implementation processes (Alvarenga Neto, 2005).

As we have already addressed the first concern in different publications within the past decade, we have decided to move on and examine/discuss the implementation of KM processes. To justify our decision, we argue that the literature concerning this specific topic is scarce or mainly publicized with commercial interests (consulting and IT firms) and, uttermost, there is a knowing-doing gap concerning a process that is highly embedded and firm-specific. Therefore, our goal in this paper is to describe and analyze the implementation of a KM process within the Brazilian organizational context based on a theoretical framework entitled “The SET KM Model”. Both propositions – a process design for KM Implementation and “The SET KM Model” came out as results of different sets of studies and researches conducted by two of the authors within the past decade. A case study applying our propositions has been successfully conducted - and will be highlighted, although still in early stages – at ONS, a Brazilian organization responsible for operating the national interconnected power system.

The psychologist George Miller in his famous article “The Magic Number Seven Plus or Minus Two: Some Limits in Our Capacity for Processing Information” suggested the inclination human beings have to classify things into seven due to the fact that this magic number reflects the chunks of information we are able to store in our short-term memories. We too, somehow, serendipitously, ended up in this paper with such a “pernicious Pythagorean coincidence” (Mintzberg, 1989), as it is structured around Miller’s magical number: (i) this introduction, (ii) our proposition of a theoretical framework for KM (The SET - Strategy-Environment-Toolbox - KM Model”, (iii) a process design proposition for the implementation of KM, (iv) an implementation case study at Brazil’s ONS, (v) conclusions and (vi) references.

The proposition and results shall be presented in the lines below.

2. A theoretical framework for KM: the “SET KM Model” as a dynamic model to unify the trinity of strategy (knowledge vision) - environment (enabling context) - toolbox (action)

Alvarenga Neto (2005, 2008), Souza and Alvarenga Neto (2003) and Alvarenga Neto, Souza, Barbosa and Neves (2008) proposed a KM integrative conceptual mapping proposition as a result of their researches of multiple case studies in world class organization within the past decade. The multiple case studies involved KM initiatives of 23 international firms, such as 3M, Dow Chemical, Xerox, PricewaterhouseCoopers, Siemens, CTC (Sugarcane Technology Center), Ernst & Young, British Telecom, Microsoft, Novartis and Chevron, among others. This so called “KM Integrative Conceptual Mapping Proposition” was further developed by one of the authors within his work at Fundação Dom Cabral – a Brazilian business school - into a comprehensive KM model used as theoretical framework for executive education and consulting services in many different best-in-class organizations within the Brazilian organizational context such as Embrapa, Anglo America, Mittal Steel, Astra Zonoca, the Linde Group, NEC, Petróbras, Prosegur, Santander- ABN Amro Bank and local state governments, among others. Henceforth, this model is entitled "the SET KM Model", a dynamic model to drive the KM strategy into action by unifying the trinity (i) Strategy (knowledge vision, knowledge as a potential to act and knowledge as a commitment to act), (ii) Environment (the enabling context for knowledge creation, hereafter “ba”) and (iii) Toolbox (the IT tools and managerial practices used to drive the organizational knowledge strategy into action).

As mentioned above, the SET KM Model is grounded on three basic conceptions, as for now explained in details, that is to say: (i) Strategy – a strategic conception of organizational information and knowledge, as proposed by Choo (1998) in his “Knowing Organization Model”; (ii) Environment - the creation of an enabling context or “ba” - the “shared contexts in motion’ where organizational knowledge is created, shared and utilized - plus the enabling conditions that should be provided by the organizations to energize and support its different ba types (care, trust, commitment, lenience in judgment, tolerance to ‘honest mistakes’, openness to multiple and conflicting mind-sets, etc.) as suggested by Nonaka and Konno (1998), Von Krogh, Ichijo & Nonaka (2001) and Alvarenga Neto (2005, 2008); (iii) Toolbox - the provision of IT tools and managerial practices/processes to drive the strategy into action: intranets, portals, information systems, processes for information management, “yellow pages”, best practices repositories, places for face-to-face interaction, front line contact with customers and other external environment’s actors, informal circles, storytelling, communities of practice, OJT and other practices of organizational learning, among others.
These conceptions will be thoroughly discussed below:

i) The SET KM Model Part I: a strategic conception for information and knowledge use in organizations

Choo (1998) asserts that the “knowing organizations” are those which use information strategically in the context of three arenas, namely, (a) sense making, (b) knowledge creation and (c) decision making. These three highly interconnected processes play a strategic role as to the unfoldment of the organization’s knowledge vision, its potential to knowledge creation and its commitment into taking knowledge creation to the utmost consequences. Concerning (a) Sense making, its long term goal is the warranty that organizations will adapt and continue to prosper in a dynamic and complex environment through activities of prospecting and interpretation of relevant information enabling it to understand changes, trends and scenarios about clients, suppliers, competitors and other external environment actors. Organizations face issues such as the reduction of uncertainty and the management of ambiguity.

(b) Knowledge creation is a process that allows an organization to create or acquire, organize and process information in order to generate new knowledge through organizational learning. The new knowledge generated, in its turn, allows the organization to develop new abilities and capabilities, create new products and new services, improve the existing ones and redesign its organizational processes. This process reveals the organization “potential to act”.

The third component of Choo’s (1998) model involves (c) decision-making. The organization must choose the best option among those that are plausible and presented and pursue it based on the organization’s strategy. Decision making process in organizations is constrained by the bounded rationality principle, as advocated by March & Simon (1975). Many inferences can be made upon the decision making theory, Choo (1998) lists a few of them: (i) the decision making process is driven by the search for alternatives that are satisfactory or good enough, rather than seeking for the optimal solution; (ii) the choice of one single alternative implies in giving up the remaining ones and concomitantly in the emergence of trade-offs or costs of opportunity; (iii) a completely rational decision would require information beyond the capability of the organization to collect, and information processing beyond the human capacity to execute. The decision-making process results in the organization commitment for action.

It’s imperative to take Choo’s (1998) strategic conception of the Knowing Organization model and place it in the context of organizational levels/structure as a way to incorporate it into organizational KM (or KM Models, such as the “SET KM Model” presented here) as shown in FIGURE 1 at the end of this section.

Knowing what to do is not enough (PFEFFER and SUTTON, 2000) as the firm must turn its knowledge into action. As one can note in FIGURE 1, the tactical level “stands/sits” in between the strategic and operational levels. Our argument here is that in between the strategic intentions and visions of top-management, and the chaotic reality of operational level workers, the role of leadership in the tactical level is to create an environment that not only enables, but mainly energizes the creation and sharing of organizational knowledge. Hereafter, the environmental conditions may be translated into the Japanese concept of ba (NONAKA & KONNO, 1998; NONAKA, VON KROGH and VOELPEL, 2006). Therefore, ba is the bridge that links strategy to action and this re-defines the role of leadership of middle-managers in the means of knowledge enablers or knowledge activists. This conception will be discussed as part II of “the SET KM Model”

ii) The SET KM Model Part II: “Environment”- the creation of ba or/and an enabling context for organizational knowledge creation and sharing

The concept of ba was first introduced in the management literature by Nonaka and Konno (1998) and further developed and enhanced until Nonaka, von Krogh and Voelpel’s (2006) inclusion of the concept into a comprehensive, yet contested (TSOUKAS, 2005; SNOWDEN, 2003), knowledge-based theory of the firm. We argue that knowledge without a context is meaningless. Knowledge needs a context to be created and this context is ba. According to Nonaka et al. (2006): ba is defined as a shared context in motion in which knowledge is created, shared and utilized; it can be physical
(office space, dispersed business unit), and/or virtual (e-mail, videoconference) and/or mental (shared ideals and ideas); it can emerge in individuals, working groups, project teams, informal circles and front-line contact with customers; there are four types of ba (originating, interacting or dialoguing, cyber or systemizing, exercising) each of which corresponding to each one of Nonaka and Takeuchi's (1995) SECI model of knowledge creation.

To the concept of ba, knowledge activists should add the enabling conditions (e.g., care, trust, commitment, lenience in judgment, tolerance to 'honest mistakes', manage conversations, among others) that must be provided by the organization to energize and support its different types of ba. It's a *sine qua non* condition to highlight the fact that “ba” and enabling conditions” are not synonyms, but rather complementary concepts. The different types of ba need different types/combinations of enabling conditions. The creation of organizational knowledge is, in fact, the augmentation of knowledge created by individuals, once fulfilled the contextual conditions that should be supplied or enabled by the organization. This is what Von Krogh, Ichijo & Nonaka (2001) call the enabling conditions for knowledge creation and sharing. Alvarenga Neto’s (2005, 2008) definition of “enabling context” mirrors von Krogh’s et al. (2001) and Nonaka’s et al. (2006) conceptions: *the propitious conditions created by the organization in order to favour, stimulate and reward sharing, learning, upcoming of new ideas and innovation, tolerance to “honest mistakes” and collaborative problem solving.* It’s Alvarenga Neto’s (2008) argument that “ba” and “enabling conditions” are needed in the tactical level – and achieved through middle-managers' leadership - in order to bridge the existing gap between strategy and action. In this context, the understanding of the word “management” when associated with the word “knowledge” should not mean control, but promotion of activities of knowledge creation and sharing in the organizational space. Hence, KM assumes a new hermeneutic perspective – from knowledge as a resource to knowledge as a capability, from knowledge management to a management towards the context where knowledge emerges and is socially constructed. Nonaka & Takeuchi (1995) and Von Krogh, Ichijo & Nonaka (2001) also list other elements that shape the enabling context, namely: creative chaos, redundancy, layout, organizational culture and human behavior, leadership, intention or vision of future and empowerment, not to mention organizational structure and layout, among others.

iii) The SET KM Model Part III: “Toolbox”- the provision of IT tools and managerial practices/processes to drive the organizational knowledge strategy into action

Last but not least, the “toolbox” metaphor assumes that knowledge workers need managerial practices/processes and IT tools to leverage the knowledge that exists solely in one’s cognition and “in the magic space” between creative heads in synergy of purposes and action. We advocate that out of people’s heads and out of a context (ba), knowledge is not only meaningless, but also equaled to information. KM encompasses in its aegis many themes, managerial approaches/processes/practices and IT tools that concern the use of information and knowledge in the daily activities of the knowing organization. Alvarenga Neto (2005, 2008) highlights a few of these processes and tools encompassed under KM initiative/processes in the firms considered in his studies, which he named the “KM Umbrella Metaphor”: ‘strategic information management’, ‘IT’, ‘intellectual capital’, ‘organizational learning’, ‘competitive intelligence’, ‘communities of practice’, among others. These knowledge tools in a knowledge toolbox are orchestrated – solo and collectively – in the daily and creative routines of firms committed to the management of knowledge. The use and emphasis will vary depending on directions provided by the strategic level and coordinated/enabled by middle-managers in the tactical level. For example, if a organization focuses its strategy in the sense making arena - in order to collect and interpret information concerning the different actors of the external environment - it can rely – at the operational level – in specific tools for achieving action coordination, such as competitive intelligence or market research. The same thing applies when the firm focuses on the strategic arena of knowledge creation – communities of practice and spaces/approaches to organizational learning practices are tools that drive the strategic concept “knowledge creation” into action. It's exactly the interrelation and permeability between those many themes that enable and delimitate the upbringing of a possible theoretical framework which can be entitled “the SET KM Model”.

Figure 1 illustrates the “SET KM Model” as a multifaceted organizational process that involves (i) a strategy, (b) the creation of an organizational environment or space for knowledge - known as the “enabling context” or the Japanese concept of “ba” - which in its turn is quintessential to bridge the gap between organizational strategy and organizational action and (iii) an operational/action toolbox
consisting of IT tools and managerial practices to effectively put the strategy into action. Hereafter, we’ll substitute the tactical level for “environment” and the operational level for “toolbox”:

Figure 2 updates Alvarenga Neto’s (2005, 2008) original integrative conceptual map. This ontology is an evolution of the studies of the authors (SOUZA & ALVARENGA NETO, 2003; ALVARENGA NETO, 2005, 2008) and was used both as a theoretical framework and a guide for field research and data collection, and shows the levels of strategy, environment (“ba”, or the enabling context), along with the IT tools and managerial practices/processes found in the firm’s knowledge toolbox:

Figure 1: THE SET KM model – source: Alvarenga Neto, 2008

Figure 2 KM: Alvarenga Neto and Souza’s update to Alvarenga Neto’s original KM integrative conceptual map (Alvarenga Neto & Souza, 2008)

The “SET KM Model” was used as the basis for the development of a process design proposition useful in the implementation of a KM process. We’ll advance in this discussion in the next section.
3. KM implementation: a process design proposition

Our proposition of a process design for the implementation of KM initiatives derives from the “SET KM Model” proposition. It is made of 7 generic parts (Figure 3) that can be interchangeable, added, excluded, combined, re-defined and “served as you like”, considering the specificities of each individual organization. We have no assumptions – as we do not take it for granted - of it as being a hermetic or highly prescriptive process. It’s just a starting point than can be used to aid managers involved with KM implementation.

![Figure 3: A process design for the implementation of KM. source: Alvarenga Neto, 2008.](image)

We’ll briefly explain each of the seven basic parts and, in the next section, describe and analyze its application on a single case study at Brazil’s ONS:

- **Epistemological view**: the organization needs to define its own understanding of knowledge and information and how these two concepts differ (or not!). This is useful in building a common vocabulary in the organization. E.g.: at Siemens Brazil, explicit knowledge is equal to information, while tacit knowledge resides only in people’s head (Alvarenga Neto, 2005). This stresses our opinion that organizational epistemology matters and needs further discussion and research;

- **Constitution of a multidisciplinary committee for the governance of the KM process with direct report to the organization’s CEO**: top-management support is a cardinal condition for successful KM. By fully supporting KM and the multidisciplinary KM committee, top-administration is openly communicating that KM is welcome and that it will receive full nurture and support to perform. A multidisciplinary committee for the governance of the KM process shall encompass members from different parts of the organizations, with different backgrounds and readiness to act as knowledge brokers and knowledge activists. It’s recommended to involve middle-managers from strategic organizational areas and held them responsible for conducting the KM process. The idea behind the committee is to involve and entrust the organization as a whole, communicating that it’s everyone’s responsibility to make KM a successful process in the organization. This committee shall meet on a regular basis and all decisions involving the firm’s KM process should be discussed and approved within this instance. Top-administration shall receive regular reports on the upbringing of the process. It’s important to notice the link between this part and the “SET KM Model” environment part;

- **Identification and mapping of organizational macro-knowledge (the Knowledge Map)**: our point here is to identify and map the organization’s macro-knowledge. We define macro-knowledge as the wide categories of knowledge that are intrinsic to the organizations’ successful operation and survival in dynamic and complex environments. One can note here the link to the “SET KM Model’s” strategy part. Wide macro-knowledge categories are generally derived from the organization’s strategy or strategic planning, BSC, macro-processes map and others. If an organization’s business is within the electrical or power systems, one can assume that one of its macro knowledge derived from its strategy would be “the energetic matrix” or “new technologies for generation or transmission”;

- **Deployment of the Knowledge Map (K-Map) in all of the organization’s directorships into more specific levels**: the macro-knowledge categories generated in the latter step are very
comprehensive, thus they need to be refined and deployed until specific levels of knowledge are reached and these are suitable for incorporation in the organization’s actions and planning. Knowledge taxonomies are created in order to develop and deploy macro-knowledge into more specific levels, e.g. the macro-knowledge “new technologies for generation or transmission” can be deployed to a second more specific level of “transmission technologies”. If this second level is still too broad, the knowledge can be deployed again into a third level until its specific enough to be object of organizational action;

- **Emphasis definition**: once the organization has defined its deployed knowledge taxonomy and the KM Committee has chosen the ones to be privileged, the organization will now, within the KM Committee, define the emphasis it wants on that specific knowledge type: retention, sharing or creation. One single emphasis or any combinations of them can be chosen. Once again, the KM committee decides and submits its decision to top-management. e.g.: if the specific knowledge “models of optimization using XYZ model” is chosen, an emphasis – retention, sharing, creation – should be delineated;

- **Selection of IT tools, managerial practices/processes and definition of metrics**: once the emphasis is chosen - e.g., emphases on sharing and creation - the organization can choose (a) to share that knowledge within on-the-job training, intranet or information systems, and/or (b) to create new knowledge based on that specific knowledge within a task-force or a project team. It’s our understanding that the organization is what it measures. When KM is concerned, metrics should be both quantitative and qualitative. Metrics are still not well clearly defined to measure KM initiatives, but they vary on a continuum that goes from the BSC, number of hits in intranets or communities of practice to “informal” conversations with organizational members. There’s a strong link between this part and the part entitled “Toolbox” in the “SET KM Model”;

- **Implementation of a Pilot Project**: the idea here is to start the implementation with small progressive bites. A pilot project should be put to proof in a critical place of the organization or in an area that it’s most likely to succeed. Feedback is now achieved and the whole never-ending process starts again.

The application of this process design for KM implementation at Brazil’s ONS will be now described and analyzed.

4. **One case study highlighted: Brazil’s ONS experience with KM implementation**

The methodology, qualitative in nature, is based on the study of multiple cases with incorporated units of analysis and three criteria were observed for the judgment of the quality of the research project: validity of the construct, external validity and reliability. Multiple sources of evidence were used – semi-structured interviews, extensive documental research, direct observation and participant observation - and data analysis consisted of three flows of activities: data reduction, data displays and conclusion drawing/verification. Among others firms cited in the lines above from the authors’ previous researches, the case study conducted at ONS is highlighted in order to discuss a successful implementation experience in its early stages.

The National Operator of the Electric System – ONS is a not for profit private company constituted on August 26th, 1998, which is regulated and audited by the National Electric Energy Agency – ANEEL. ONS is responsible for the coordination and control of the operation of generation and transmission facilities of its associate members, which form the Brazilian National Interconnected Power System (SIN). The National Operator manages a network formed by its associate members in different categories – production, transport, distribution of energy and free consumers – and works to guarantee the continuous, safe and economical supply of electric energy, through the SIN, to millions of Brazilians all over the national territory.

ONS’s mission is

“to operate the National Interconnected Power System in a transparent, equanimous and neutral manner, to guarantee a safe, economic and continuous electric energy supply to the country.” ([www.ons.org.br](http://www.ons.org.br))

Federal laws have designated ONS with the following responsibilities:

- Planning and programming of the electric operation and the centralized dispatch of energy generation in the country.
Supervision and control of operations of the national power systems and the international interconnections with neighboring countries.

Contracting and administration of transmission services, providing access to the Main Transmission Network and all ancillary services.

Supervision and coordination of the ONS Operation Centers of the electric power systems in Brazil.

Elaboration of transmission network expansion and reinforcement proposals.

Definition of transmission network operation rules and procedures.

In Brazil, the electric energy production, transportation and distribution systems are in the hands of multiple owners that are interconnected from the western area of the state of Pará, in the north, to the Brazil’s southernmost state, Rio Grande do Sul, forming what is known as the National Interconnected Power System. The SIN is made up by the assets of more than a hundred generation, transmission and distribution agents, as well as free consumers, who supply almost all energy produced in the country. Only 4.6% (2006) of this energy come from small isolated systems and producers outside the SIN, mainly located in the Amazon region.

When operating the SIN, ONS bases its actions on technical procedures and solutions that produce the best results for the country’s population and at the same time, takes into consideration the different interests of its associates, ensuring every sector agent a fair and just treatment.

It's important to point out that KM has always been an important strategic issue for ONS. The documental research came up with some sort of an internal developed knowledge typology, named “ONS Knowledge Typology”. ONS’ Knowledge Typology defines 4 different types of knowledge within ONS’ knowledge domain (Figure 4):

- **Strategic Knowledge**: related to the strategic goals of ONS. In a broader sense, it corresponds to resources that allow for innovation, that is to say, to create new products, processes and readily reply to environmental changes. It also includes new knowledge that ONS might need in the future to achieve its organizational mission;

- **Knowledge of Specific Responsibility/Domain**: this type of knowledge is specific to ONS’s raison d’être and are singular types of knowledge existing only within the nature of the firm;

- **Critical Knowledge**: this type of knowledge refers to existing organizational knowledge types that are in a critical condition according to the following three criteria (a) knowledge not available within the firm; (b) knowledge that will soon fade, either because it's concentrated in a few singular minds, or because people with that specific knowledge are about to retire, or else because the knowledge is concentrated within partner firms; (c) knowledge associated to productivity gaps. The lack of these knowledge means actual risks to ONS’ Mission achievement;

---

**Figure 4: ONS’ knowledge types/domain. source documental research and Queiroz 2007**

- **Strategic Knowledge**
- **Knowledge of Specific Responsibility/Domain**
- **Critical Knowledge**

---
Knowledge of Priority Focus: this specific type of knowledge lies on the intersections of the three previous ones in either (i) a combination of all three knowledge types all together (strategic-specific responsibility/domain-critical) or (ii) a combination of any two knowledge types being one of them strategic.

The KM implementation process at ONS is described in the lines below within each of the seven parts of our proposal:

- Epistemological view: ONS assumes that knowledge resides in one’s cognition and in between creative minds;
- Constitution of a multidisciplinary committee for the governance of the KM process with direct report to the organization’s CEO: top-management support was granted. A KM Committee was established with members appointed by all of ONS’ directors, giving the committee a sense of organizational representativeness. ONS’s KM Governance Committee meets on a regular basis;
- Identification and mapping of organizational macro-knowledge (the Knowledge Map): after discussions based upon ONS’ strategic planning and macro-processes map, four macro-knowledge were selected by the KM Committee and later approved by top-management: 1) electro energetic security/safety; 2) energetic matrix and new technologies for generation and transmission, 3) management of the relationship network; 4) corporative management;
- Deployment of the Knowledge Map (K-Map) within each and all the organization’s directorships into more specific levels: deployment matrices were developed using Microsoft’s Excel within each specific directorship with the purpose of deploying the K-MAP into knowledge of more specific levels. After the deployment task, each directorship should also classify its results (the more specific knowledge levels) using “typology matrices” based on ONS’ knowledge typology in order to find and justify its “priority focus knowledge” types. In this sense, the fact that ONS’ KM Committee was formed by representatives of all the directorships made it easier for each committee member – appointed by its director as a committee component – to set the deployment task as a priority within his/her own directorship. Each directorship felt the urge to guarantee that its views and opinions were represented at ONS’ KM Committee as they would be affected by the decisions made within the KM Committee. After discussions and conclusions, KM committee members within each directorship were held responsible for presenting its results at the KM Committee’s next meeting. After all the results were presented, it was the KM Committee’s task to gather and analyse the overall results that would constitute “ONS’ Knowledge Map of Priority Foci”. After the deployed K-map was assembled, the choice and decision of two or three knowledge of priority focus for immediate organizational action was also the KM’s Committee responsibility and this decision would be further submitted to top-administration’s approval.

Figure 5 illustrates the deployment and typology matrices used in this part of the process.

<table>
<thead>
<tr>
<th>Deployment/Typology Matrix – Third level knowledge classification</th>
<th>Sheet 1 of 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxonomy GC / ONS</td>
<td>DAC - Corporate Affairs Directorship</td>
</tr>
<tr>
<td>Group:</td>
<td></td>
</tr>
<tr>
<td>Macro-knowledge (First level)</td>
<td>Second Level Knowledge</td>
</tr>
<tr>
<td>Electro Energetic Safety</td>
<td></td>
</tr>
<tr>
<td>Energy Production Matrix / New Technologies for Generation and Transmission</td>
<td></td>
</tr>
</tbody>
</table>
Figure 6 illustrates the use and deployment of the matrix displayed on FIGURE 5 within one specific directorship (Operation’s Directorship):

<table>
<thead>
<tr>
<th>Deployment Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Macro-Knowledge (First Level)</strong></td>
</tr>
<tr>
<td>Electro-energetic Safety</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Figure 6:** Matrix used at ONS’ operations directorship. Source: documental research.

The Operations Directorship justified its choice of the third level knowledge “Organon” because this tool was internally developed at ONS and the knowledge about it, at present, is fully concentrated in one single professional. For this motive, there are difficulties in both new development and maintenance development due to low productivity. It’s actually knowledge with high potential risk of imminent loss and for this specific directorship this is a “priority knowledge focus” type. This specific directorship’s decision would then have to be submitted to ONS’ KM Governance Committee.

The final product of this stage is ONS’s Knowledge Map shown in FIGURE 7. Note that an organization’s knowledge map should be revised in a continuous basis, as knowledge management is a dynamic process.

- **Emphasis definition:** two priority knowledge types – among the seven more specific levels highlighted on Figure 7 - were chosen by the KM Committee and they’ll serve as the starting point for ONS’ KM initiatives. The decided emphases for these two rely in all of the three originally proposed emphases in the implementation process: creation, retention and sharing.

**Figure 7:** ONS’ knowledge map and priority knowledge types. Source: documental research, 2008.

The other remaining two phases were not yet accomplished by ONS’s KM initiative. It’s important to highlight that ONS is still working in its implementation process and that it faces a process of organizational change.

5. Conclusions

This paper’s main goals were the proposition of a theoretical framework for KM – “the SET KM Model” - and the proposition of a KM process design for the implementation of KM. This latter was successfully put to proof in a single case study at Brazil’s ONS.

Our conclusions, coherently with our researches and studies within the past decade, suggest that knowledge as such cannot be managed; it is just promoted or stimulated through the creation of a favourable organizational context. There is strong qualitative evidence of a major shift in the context
of the organizations contemplated in this study: from “knowledge management” to the “management of ‘ba’ and the enabling conditions” that favours innovation, sharing, learning, collaborative problem solution, tolerance to honest mistakes, among others.

Although ONS has been successful with its KM implementation process, it hasn’t completed the implementation process’ full cycle. Even when it does, ONS faces a long walk until KM, as an organizational process, reaches a stage of maturity. It’s recommended to test this model in different organizations of different types/sizes and belonging to different sectors of the economy.

The SET KM Model needs to be further enhanced through extensive testing in other organizations. The authors are currently adapting it and will present it in the future as a general KM development strategy.

Acknowledgements

The authors would like to thank ONS’ KM Governance Committee and Fundação Dom Cabral for their unconditional support.

Dr. Rivadávia C. D. de Alvarenga Neto would like to thank Brazil’s FAPEMIG – Fundação de Amparo à Pesquisa do Estado de Minas Gerais – for its support to this publication and his post-doctoral research at the University of Toronto, Canada.

Dr. Renato Rocha Souza wishes to thank Brazil’s CNPQ – Conselho Nacional de Desenvolvimento Científico e Tecnológico – for supporting this publication and his post-doctoral research in the United Kingdom.

References


Queiroz, Jairo Gomes. Gestão do Conhecimento no ONS - Plano Diretor e sua implantação In:: II Seminário Internacional: Reestruturação e Regulação do Setor de Energia Elétrica e Gás Natural Rio de Janeiro: GESEL/UFRJ, 2007
Tsoukas, Haridimos. Complex knowledge: studies in organizational epistemology
Weick, K. (1990), 'Introduction: Cartographic Myths in Organizations', in A.S. Huff (ed.), Mapping Strategic Thought (Chichester: Wiley), 1-10
Let’s Learn Unlearning: How Top Managers Conceive and Implement Knowledge Active Forgetting

Mehdi Bagherzadeh Niri1, Mohammad Hosein Rezazade Mehrizi 2, and Reza Hosnavi Atashgah1
1MALEK-ASHTAR University of Technology, Tehran, Iran
2ESADE Business School, Barcelona, Spain

Abstract: Regarding the influential role of top managers in the process of unlearning, the main question in this paper is “how top managers understand and approach unlearning” in their managerial activities. Toward this aim, based on several case studies with top managers who have recently been involved in the process of knowledge based changes, we realized that top managers are more apt to focus on technical and concrete types of knowledge such as knowledge which resides in systems and procedures. Moreover, among all different possible approaches toward unlearning, they mainly make sense of this it as a process of “pushing by new knowledge”, and “abandoning old knowledge” that both of them are radical approaches toward unlearning. The main lesson drawn in this study is that researchers who interact with managers in their inquiry about unlearning must be aware about the natural orientations of top managers and how this might affect the validity of their field inquiry. Above all, the insights gained in this study shows that field study about unlearning based on the opinions of managers is easy to start with, as managers can make sense about this process easily, but is difficult to focus on, because managers easily shift from unlearning old knowledge to learning new knowledge in their thoughts.

Keywords: Knowledge Management (KM), Knowledge Active Forgetting (KAF), creative destruction, unlearning

1. Introduction

Looking at knowledge management literature from a process view shows that compared with “assessment”, “creation”, “absorption”, “storage and organization”, “sharing”, and “utilization”, there is a gap in terms of considering the role of “knowledge active forgetting” (Rezazade mehrizi and Bontis, 2009; De Holan and Phillips, 2004). So the notion of knowledge active forgetting and other closely related concepts like “unlearning” haven’t been well developed in the literature (DeHolan and Filiphs, 2005).

One of the inevitable consequences of rapid changes in technical and non-technical knowledge in today’s business life is the obsolescence of current knowledge. In fact, the other side of the creation and development of new knowledge is the accumulation of old knowledge and technologies that not only remain in the labyrinth of organization, but also, might negatively influence the process of creation and learning new knowledge (Schumpeter, 1934; Schumpeter, 1943; Winter, 1984). For this reason, firms need to consider their strategies toward such old and obsolete knowledge in an explicit way.

On the other hand, the influential role of top managers in formulating and implementing strategic actions can lead us to this conjecture that the way in which they conceive and implement the process of unlearning might have a direct bearing on the success of this KM process. Also, it stands to reason that top managers make and take their strategic (as well as non-strategic) decisions and actions based on their understanding from their business. So, the way in which they understand and make sense about the concept of old and obsolete knowledge, and the process of KAF, not only has a significant bearing on whether they consider this course of action as a strategic agenda, but also can fundamentally influence the specific approach that they might adopt in dealing with such old and obsolete knowledge.

In this research, we focus on top managers to examine “how they understand the concept of unlearning” (and its closely related concepts, such as “unfreezing” and “creative destruction”), and “how they try to put this concept into practice”. This investigation will provide us with insights about how managers can support or prohibit the process of unlearning in their organizations. Also, it can help us examine the process of unlearning in our empirical inquiry in a more valid way.

Reference this paper as
Niri, M. B, Mehrizi, M. H, and Atashgah, R. H. “Let’s Learn Unlearning: how top Managers Conceive and Implement Knowledge Active Forgetting” Electronic Journal of Knowledge Management Volume 7 Issue 5 (pp605 - 614), available online at www.ejkm.com
Through a review of the related literature on KAF, we will come up with a classification of five approaches through which the old and obsolete knowledge could be managed (Starbuck, 1996; Becker, 2008; Howells and Mitev, 2008; Lee and Lim, 2001). Also, we try to spot main issues why KAF is a strategic issue. Then we will consider the influential role of top managers in the process of KAF and how their perceptions could affect their courses of action in this domain of practice. In the third section, we will elaborate our research method and then, in the fourth part of the paper we simultaneously report and analyze the collected data, as is the case in the reality of qualitative research. Then, major conclusions about the understanding of top managers about knowledge forgetting, and its possible practical and theoretical implications will be discussed.

2. Theoretical background

It is almost the dominant view that in today's economic competitiveness, knowledge, is one of the, and possibly the, most important competitive advantage of firms (Davenport and Prusak, 1998; Mayo and Lank, 1994). The increasing role of knowledge based sectors on one hand, and the ever increasing depth and breadth of global competition has heightened this trend. So, today, the KM discourse is one of the top priorities of research and also practice.

The other side of this story is the rapid pace of change in both technological and managerial knowledge. The increasing rate of patents, new products, new firms, new managerial tools and techniques are just a few evidences that point to the rapid rate of obsolescence and depreciation of old knowledge and technology. But seems this side of the story has attracted relatively less scholars' attention.

The wealth of research in the realm of KM and learning has provided us with numerous definitions, specifications and classifications of knowledge (Drucker, 1999; Davenport and Prusak, 1998; Nonaka, 1994; Descartes, 111; Locke, 1987). Instead of digging into the controversial debate about what is knowledge (Jasimuddin, 2006, Nonaka and Takeuchi, 2004, Tsoukas, 2003, Lubit, 2001, Tsoukas and Vladimirou, 2001, Stenmark, 2000/2001, Meso and Smith, 2000, Spender, 1996, Lyles and Schwenk, 1992, Penrose E., 1959), and regarding the aim of this paper which is understanding different ways that top managers make sense about the old knowledge and KAF, we prefer to adopt a broad definition of knowledge that includes both its tacit and explicit attributes of knowledge (Nonaka, 1994; Nonaka and Takeuchi, 1995; Polanyi, 1966; Cowan et al., 2000; Wagner and Sternberg, 1986).

Also, we would like to emphasize that knowledge here could be at different levels of aggregation form individual to inter-organizational (Hedlund, 1994), and also we need to consider different characteristics of knowledge types based on their stickiness (Szulanski, 1996), process of creation, context-dependency (Asheim and Gertler, 2004), the scope of influence (Schank and Abelson, 1977), and their different types (for example being descriptive, managerial, procedural, or causal (Anderson, 1985, Nonaka and Takeuchi, 1995; Schank and Abelson, 1997)).

One of the peculiarities of knowledge as a unique asset is its stickiness to its context and owners (Kakabadse et al., 2003). This makes knowledge different form data and information as the old knowledge has a natural tendency to reside in organization in different ways. In fact, detaching the old knowledge from organization seems to be much more difficult than just abandoning physical assets, and even firing part of human resources.

Linking the two above points, first, the rapid pace of obsolescence of knowledge on one hand, and the difficulty involved in detaching the obsolete knowledge from the organizational memory (Spender, 1996, Stein, 1995) on the other reveals that dealing with the old and obsolete knowledge is neither easy nor a matter of rapid actions overnight. As mentioned by many authors, the natural tendency of organizations is a kind of inertia and resistance that seems to be even more serious in the case of knowledge intensive changes (Malerba and Orsenigo, 1997; Poel, 2003; Breschi and Orsenigo, 2000; Nolan and Croson, 1995). So, briefly, organizations need to think seriously about their old knowledge and how to manage them toward their organizational goals, in an active way.

Defining knowledge active forgetting as “the process in which organization tries to deal with its old and obsolete knowledge in order to reduce its possibly negative impacts and to ensure the achievement of organizational goals in a conscious way”, we devote the resting part of the paper to this concept. However, the literature of knowledge management is highly dominated by the idea of knowledge sharing(Rezazade Mehrizi and Bontis, 2009), and the literature of organizational learning
is mainly concerned about the creation and adoption and accumulation of new knowledge (DeHolm and Filips, 2005, de Holan et al., 2004, de Holan and Phillips, 2004).

KAF is important at least for different reasons. Firstly, the existence of old and obsolete knowledge, especially when the new knowledge is radically different from the old one, can negatively affect the process of understanding, absorbing and assimilating the new knowledge (Schumpeter, 1934; Cohen and Levinthal, 1990; Miles et al., 1998; Nystrom and Starbuck, 1984; Carlile, 1997). On the other hand, while the old knowledge is still resides in the organizational routines and processes, it makes difficult to apply new ways of action that are based on the new knowledge.

The dominance of the existing knowledge, with its own assumptions and underlying paradigms, metal models and schemas (Walsh, 1995, Walsh and Ungson, 1991, Walsh, 1988) can prohibit firms to detect the sights of new knowledge and also impair their potential for creativity, the fact that is mentioned in part of literature as core rigidity (Leonard-Barton D., 1992), and success competence trap (Liebowitz and Margolis, 1995, Witt, 1997, Cowan, 1990, Arthur, 1989).

For more clarification, the process of KAF although conceptually differs from learning in the sense that its focus is on the old rather than the new knowledge, but practically, it is inextricably intertwined with the learning and development of new knowledge (Howells and Mitev, 2008). As an analogy, when a car moves from point A to point B, it could be described in two ways:

1. The car detached from A.
2. The car reached B.

Both of these two descriptions are true, and basically reporting the same behavior but in different ways.

In this example, looking at the underlying mechanism of movement, we might find the someone pushed the car farther from A and/or pulled toward B. Although here, these two mechanism are not mutually exclusive (because both can happen at the same time), the resulting outcome would be the same, the movement of car between A and B.

Conceptually, if we consider learning as acquiring or creating new knowledge1, and unlearning2 and forgetting as the way in which we deal with the old knowledge, a similar confusion might happen when we focus at the behavior or outcome of these two processes. In both learning and unlearning process, the result, in case of success, would be a new state. But when we focus on the underlying mechanism and trace what has happened to the old and new knowledge and which one has been the focus and leveraging point, it would be clearer to distinguish between these two different mechanisms.

Apart from this conceptual discussion, the process of KAF composes of two parts (not necessarily successive stages): 1) identification 2) action.

In the Identification part, the firm consciously realizes the existence of the old and obsolete knowledge and reflects (Scarbrough et al., 2004) on the possible negative or limiting impacts of it. This part is necessary to makes KAF as a kind of active (rather than just a kind of passive improvising). For example, learning from failures, could be one of the methods through which this identification phase takes place.

---

1 Although there are some authors that argued against this concept about learning and claimed that learning covers also the concept of unlearning, but for two reasons, we adopt this view here: 1) because the overall tone of literature of organizational learning is mainly considers learning as the way in which we acquire and create new knowledge, and 2) because this helps us to proceed though our discussion will less confusion.

2 Although many authors like (DeHolm and Filips, 2005, de Holan et al., 2004, de Holan and Phillips, 2004) implicitly or explicitly used unlearning and forgetting interchangeably, we think that these two concepts are different as the KAF has more clear emphasis on the knowledge as the subject of forgetting, while in unlearning, we might unlearn not only the old knowledge, but also old behaviors, situations, structures, and even artifacts.
The second part of the KAF is related to the action that firms perform to deal with this identified old and obsolete knowledge. Based on a literature review, the described and prescribed ways of KAF can be summarized as these five categories:

**Awareness**: just knowing and declaring which knowledge is obsolete or harmful is enough

There are different ways in which this approach can be implemented. For example, some scholars have emphasized on a kind of “continuous skepticism” or “doubts about current beliefs and methods” (Starbuck, 1996: 725) as a necessary condition in dealing with old knowledge.

**Stop using**: unlearning means just not using the old and obsolete knowledge, but still the knowledge resides in the organizational memory

Sometimes the normal processes of forgetting and transition may not be sufficient (Becker, 2008), so we need to go through more aggressive and formal methods of unlearning. Maybe the most popular approach in dealing with the old knowledge could be just not using that specific knowledge (Howells and Mitev, 2008). For example, stopping the production based on a specific technology, or not using the old methodologies of software development could be evident examples of this approach.

**Stop knowledge development**: here KAF means not only stopping using old and obsolete knowledge, but also changing the process of knowledge creation and absorption to stop the process of development obsolete knowledge.

In this way, stop development could be implemented through stopping R&D projects, and even intentionally stopping knowledge transfer and knowledge collaborations. The most evident example of this strategy is when Korean companies stopped developing their knowledge on the production Static-RAM once the Dynamic-RAM technology came to the market (Lee and Lim, 2001).

**Push out by new knowledge**: KAF here means just trying to learning new alternative knowledge is enough for the aim of actively forgetting the old knowledge.

This approach is conceptually different from absorbing new knowledge in the way that is more specific. A company might adopt a specific knowledge and adds it to its knowledge repository. In this case, there is not replacement, instead we are dealing with the knowledge accumulation. But this approach toward KAF means the firm intentionally replaces the old knowledge by the new one.

**Wipe out old knowledge**: here KAF means explicitly and formally removing the old parts of organizational memory in a radical way. For example firing old experts.

The most aggressive approach toward KAF seems to be abandoning. As an analogy, this is like a kind of surgery for removing the malfunctioned part.

Taking the old hardware and software out of the organization, throwing out dated documents and records and even firing experts who have been addicted to the old knowledge are some examples of this approach.

Vividly, these five approaches are not necessarily mutually exclusive (because sometimes more than one approach is used in a specific case), nor exhaustive. There might be other approaches (a new combination of these approaches or a completely different one) for the action part of KAF process. But for the aim of our paper this list seems prepare a satisfactory basis for thinking about the variety of possible approaches toward KAF. Finally, under each approach, there might be a pretty large number of ways in which it can be materialized. Examining the effectiveness of these approaches deepening on different contingencies (such as the type of knowledge, organizational factors, and the history of organization) is an interesting research agenda which out of the purview of this paper.

Regardless of the approach(es) used for KAF, there almost of a great consensus that the role of top managers in the process of KAF is crucial, both in positive (Hamel and Prahalad, 1994: 56; Normann, 1971; Starbuck, 1983) and in negative way. For example, as clearly mentioned by Nystrom and Starbuck (1984):
“Top managers’ ideas dominate organizational learning, but they also prevent unlearning. Encased learning produces blindness and rigidity that may breed full-blown crises.” (Nystrom and Starbuck, 1984: 52).

They add:

“top managers, bolstered by recollections of past successes, live in worlds circumscribed by their cognitive structures. Top managers misperceive events and rationalize their organizations’ failures.” (Nystrom and Starbuck, 1984: 57-58).

Also, top managers have a heavy agenda of possibly positive actions that can facilitate the process of KAF, such as supporting new ideas and formally criticizing and sometimes abandoning the resources and structures shaped around the old knowledge (Nystrom and Starbuck, 1984, Lyles and Schwenk, 1992).

The wealth of literature on the decision making and organizational behavior has revealed that managers like all human beings behave based on their mental models (Walsh, 1995) and generally, their understanding and perception about the subject. However, because of the limited cognitive capabilities of managers (Simon et al., 1963), and also other institutional boundaries there is no guarantee that their conception of issues correspond with the reality. Although reaching the ideal state of manager’s understanding is not feasible, it stands to reason that we have to try to foster the level of correctness and relevance of their understanding about the important issues.

Following this line, the understanding of top managers from the concept of old and obsolete knowledge and possible approaches for managing it seems to be of a great potential impact on the success of the process of KAF. Although measuring the strength of this relation between the managers’ understanding of the concept of KAF and the proper action that they take accordingly seems a relevant and interesting line of research, it is again out of the focus of this paper. But, as in imperative for such kind of inquiry, we need first to depart from the academic and theoretical discourse, and immerse in the reality of the business digging down into the cognition of managers in this regard. Knowing how managers, and especially top managers, think and make sense about the concepts related to KAF has these possible advantages.

Firstly, in a descriptive sense, it can provide us with new insights to have a better understanding of old and obsolete knowledge, and how it can be managed. Finding concrete examples of old knowledge, how managers understand the old-ness and obsoleteness of knowledge can deepen our conceptual framework and also avoiding us from falling the trap of a tautological debate. Secondly, it can help us to better communicate with managers in this area and create a more reliable and valid measurement methods (not necessarily in a quantitative way) for further researches. And thirdly, it might reveal how managers are aware or ignorant about this important issue.

So, based on the above discussion, our main research question here is how managers understand and make sense about the concept of old and obsolete knowledge and also the process of KAF.

3. Methodology

Regarding the aim of research which understanding the way in which top managers conceive the concepts related to KAF, and due to the fact that our subject of study is the managers’ understanding which is a subjective issue the most relevant research strategy would be a kind of interpretative research (Schutz, 2005).

For this reason, we used a qualitative approach based on interviews with top managers. The necessity of richness of the experience of managers about the knowledge based changes determined to a great deal the targeted audiences. So, we mainly selected three top managers (in this case the first two levels of organizational chart) that have been involved in knowledge based organizations. The first case was related to a management consultancy unit in one of the Iranian Ministries. The second one was the head of a dedicated training and education institute that was associated to one of the ministries. And the third case was the CEO of one of the largest automotive companies. All managers have had an experience of more than 10 years managing in different positions and almost all of them have been involved in several knowledge based changes. The diversity of the organizations helped us to cover a range of both technical and managerial knowledge.
For sure, because of the need to getting rich data and the difficulty of getting in touch with top manager due to their busy schedule, our options was limited in terms of the number of managers.

**Data collection method:**

A critical incident interview protocol (Boyatzis, 1998) has been developed before each interview. We found some examples of knowledge based changes for each case. We started the interview session with a short introduction about the overall research. Then we focused on the concrete examples of knowledge based changes, asking the managers to describe us their story about the process of change. We tried to ask them indirectly to more focus on the old knowledge and how they identified it, what were the sights of the obsoleteness, and how they dealt with it. Admittedly, they were more eager to talk about the new changes and the new knowledge, so it in some cases it took us more than one session to get sufficient insights related to the KAF.

Using the overall approach of critical incident techniques helped us to get more reliable and concrete clues about the understanding of top managers about the old knowledge and the process of KAF.

**Data analysis method**

We transcribed the recorded interviews and using a paper and pencil method of inductive thematic analysis (Boyatzis, 1998) we analyzed the data. For the aim of more reliability and validity of results, implemented the triangulation of researchers (Eisenhardt, 1989) as two researchers coded the data independently and the results were compared and analyzed.

4. Findings and analysis

To frame our findings, we focus on three key topics: 1) How managers understand the concept of knowledge and how identify it, 2) How they make sense about the concept of old and obsolete knowledge and how identify it, and 3) how they understand and enact the process of KAF.

**The Concept of Knowledge and its Identification**

By and large, top managers referred in their answers to knowledge mainly through issues such as policies, routines, procedures, systems and processes that exist in the organization, as well as individuals' behavioral patterns and habits. For example one of them mentioned, "the procedure in our organization, employee behavior, methods which are institutionalized in our organization ..."

**The Concept of old and obsolete knowledge and its identification**

After getting some clues about how top managers understand the concept of knowledge, we try to analysis top managers' views about the concept of old knowledge in the organization. Basically they sensed the oldness and obsoleteness of knowledge through two things: first when they compared it with a new alternative knowledge and second when they faced a serious problem that happened because of an old and obsolete knowledge.

- Facing a new knowledge

It was very difficult for the top managers to label something as old knowledge without comparing it with some new knowledge and in fact they could hardly perceive old and obsolete knowledge without having been exposed to new knowledge. For instance one of the top managers mentioned that: "considering the situation and new developments in our work area, we decided that we needed to bring about changes and inject new knowledge into the system".

- Facing a critical and serious problem in the organization

Another situation that helped managers to make sense about their old knowledge was when they faced a serious problem because of the obsoleteness of their knowledge. In other words, top managers' understanding about old knowledge reflects a sort of failure in using their old knowledge. For example when asked about old knowledge and ways to identify them, one of them expressed: "one of the most important problems that I noticed in my organization was that: people tried to give a solution before having the problem well defined and measured", "our problem was to use a third party regarding the issue of organizational excellence and after a while a saw that
the organizations under our supervision do not reflect the realities throughout their respective organizations", and in fact they tried to identify old knowledge when they encountered a problem.

The process of KAF

We tried to figure out how managers make sense about the process of KAF. The result of our thematic analysis can be summarized as follows.

- Great tendency to use new knowledge and replace old knowledge by the new one

As top managers are often inclined to use and push new knowledge and new methods, compared to other processes for knowledge active forgetting, they usually preferred to KAF as a kind of replacement procedure. Based on our five approaches, they well understood KAF in terms of “pushing by new knowledge”. For example we saw statements like: "we saw that some of the procedures which were quite prevalent throughout the organization were actually wrong and so we promoted new procedure to replace the old ones", "what we did was to define an educational mechanism and to create a higher goal, so that people could compare themselves with it and update themselves, and in this way they automatically discarded much knowledge that needed to be put away".

- Abandoning of old knowledge

In addition to “pushing by new knowledge” which was the most convenient way of making sense about KAF process, managers understood this process as an “abandoning” process of old and obsolete knowledge. However, as the process of abandoning and letting go of old knowledge can have many negative effects on the organization and incite serious resistance, most top managers are not very much inclined to use this process for KAF. Besides the top managers that participated in our study, worked in the public sector, therefore because of some considerations such as implementation risks, organizational tensions, resistance among members they had more hesitation to consider abandoning as a feasible approach toward KAF. This statement by one of the executives is illuminating, "In fact it is not operationally possible for us to through them away".

- Stop using old knowledge

Top managers usually use this method in order to forget less importance old knowledge. In fact the managers pointed out that “considering some knowledge that is not very important and is worn out, it should not be used and should be left alone”. Therefore, this method may be useful in dealing with some knowledge which is of less importance.

5. Conclusion

In this paper we tried to focus on the understanding of top manages about KAF. Therefore we analyzed the views and opinions of managers regarding the tree important issues: the concept of knowledge, the concept of old and obsolete knowledge, and the process of KAF.

Moreover, interviews with managers indicated that facing the concept of knowledge their attention quickly moves toward more concrete instance of knowledge and in fact they tend to have a better understanding of this type of knowledge. In talking about knowledge, whenever we mentioned this type of explicit knowledge, afterward it was very difficult for them to redirect their attention to implicit and subjective knowledge in their organization. This shows that dealing with top managers in our filed inquiry, we have to bear in mind that their attention to knowledge is not comprehensive to include all types of knowledge. So, researches must think about other complementary ways that help them to elicit the views of top managers about other more intangible and subjective types of knowledge.

It was very difficult for the top managers to focus on the concept of forgetting and thus they tended to pay attention to new knowledge and the ways to acquire that knowledge. Therefore, it can be concluded that when speaking to managers about KAF, it is better to start from learning new knowledge in order to get them into the subject, but then, we need to shift their attention from new knowledge to the old knowledge. Through this process, the can start thinking about old knowledge and how they managed it in a better way.
Furthermore, managers did not show a comprehensive view about KAF and did not pay attention to all the methods through which we might implement unlearning. Thus it is necessary for us to offer a complete and thorough introduction to the subject so that the top managers can have a complete, systemic and systematic understanding of forgetting in the organization. This has some implications for not only academic research in this field, but also training programs for top managers to draw their attention toward the whole spectrum of approaches toward managing old and obsolete knowledge.

Though, it is important to mention that this paper is a first step toward investigation of top managers’ understanding about KAF. In the future, more comprehensive researches need to be conducted based on the findings of this paper to investigate the understanding of managers about forgetting of different types of knowledge - implicit, explicit, individual, organizational, technical, managerial, descriptive, procedural, causal- in organizations through more deep case studies in different sectors.

References


Perceptions on Complexity of Decisions Involved in Choosing Intellectual Capital Assessment Methods

Agnieta Pretorius and Petrie Coetzee
Tshwane University of Technology, Pretoria, South Africa
pretoriusab1@tut.ac.za
petrie.coetzee@gmail.com

Abstract: Intellectual capital (IC) is increasingly acknowledged as a dominant strategic asset and a major source of competitive advantage for organisations. Despite an overwhelming body of literature on methods, models, systems and frameworks for assessment of IC, and increased awareness of the need for such assessment, relatively few organisations are actively and comprehensively assessing their IC. Choosing an appropriate method is problematic. It has been argued that, due to the complexities involved in choosing (selecting and customising) an appropriate method for assessing intellectual capital in a particular context, management support systems with knowledge components are needed for managing the evolving body of knowledge concerning the assessment of intellectual capital. To empirically test this argument, a survey making use of a self-administered questionnaire was performed to test perceptions of suitable consultants, practitioners and researchers on the complexity levels of decisions to be made in selecting and customising methods for assessment of IC. Respondents were selected through convenience sampling coupled with snowball sampling. Data collected on respondents themselves confirms their expert status regarding IC and aspects thereof. The majority of these respondents indicated that, given any particular context, the decisions involved in selecting and customising an appropriate method for assessment of IC is often or always very complex. Decisions involved in selection are perceived as marginally more complex than decisions involved in customisation. Respondents provided valuable insights and rich examples of scenarios on the higher and lower regions of the complexity scale for the decisions involved in the selection, as well as, for the decisions involved in the customisation of IC assessment methods. It is concluded that the perceived complexity of the decisions involved in choosing IC assessment methods supports the notion that supporting systems are required to assist human decision makers in making sense of the complexities involved in choosing IC assessment methods.

Keywords: intellectual capital, intangible assets, methods of assessment, complexity of choice, management support systems

1. Introduction

Intellectual capital (IC) – also referred to as intangible assets, knowledge assets, core competencies or goodwill – is increasingly acknowledged as a dominant strategic asset, and a major source of competitive advantage for organisations (Teece 2003; Koulopoulos & Frappaolo 1999; Harrison & Sullivan 2000; Sánchez, Chaminade & Olea 2000; Housel & Bell 2001; Kalafut & Low 2001; Holsapple 2003; Kannan & Aulbur 2004; Park 2005). Despite an overwhelming body of literature on methods, models, systems and frameworks for assessment of IC, and increased awareness of the need for such assessment, relatively few organisations are actively and comprehensively assessing their IC (Andriessen 2004b; Best Practices, LLC 1999; Chen, Zhu & Xie 2004; Bontis 2001; Green 2005; Marr 2005; Pretorius & Coetzee 2005; Smith & McKeen 2003).

Smith and McKeen (2003:354) note that both practitioners and academics have conveyed “frustration and dissatisfaction” with the capability of current methods to assess intangibles such as IC. According to Klein (1998:6) the IC of professionals (constituting the building blocks of the IC of organisations) is typically measured by “rough indicators such as education and years on the job”. Van Buren (1999:72) notes that organisations have “only a vague understanding of how much they invest in their IC, let alone what they receive from those investments”. Almost a decade later Sullivan and McLean (2007:36) refer to assessment of this kind as the “confusing task of measuring intangible value”.

Pretorius and Coetzee (2005) argue that, due to the complexities involved in selecting and customising an appropriate method or combination of methods for assessment of IC, there is a need for management support systems with knowledge components to manage (organise, store and retrieve) the evolving body of knowledge concerning such assessment. Since the sensibility and usefulness of any supporting system for choosing (selecting and customising) IC assessment methods is critically dependent on judgement concerning the complexity of this process, perceptions on the levels of complexity involved in choosing IC assessment methods need to be tested empirically.
before proceeding to design and develop such systems. This paper reports on the methodology and results of a survey performed to test perceptions of suitable experts on the complexity levels of decisions to be made in selecting and customising a method (or combination of methods) for assessment of IC. (These results confirm but also complement interim results based on a smaller sample, as reported in Pretorius and Coetzee (2007).)

2. Terminology

The following sub-sections explain some of the terminology of this paper.

2.1 Intellectual capital

According to Brooking (1999) "intellectual capital" refers to the collective intangible assets that enable an organisation to function, including market assets, intellectual property assets, human centred assets and infrastructure assets. As illustrated in Figure 1, similar to the components of IC identified by Brooking (1999), but not explicitly including intellectual property assets, Sveiby, as cited by Bontis (2001), refers to three of these categories as individual competence, external structure and internal structure respectively. Stewart, as quoted by Smith and McKeen (2003:356), states that it is "generally agreed by academics" that IC consists of "at least" three categories, namely human capital, structural capital and customer capital. This third category is also referred to as relational capital, including in that notion not only relationships with customers, but also relationships with other stakeholders. De Pablos (2004:231), for example, defines relational capital as "knowledge in the form of business connections with customers, suppliers, shareholders, alliance partners and other agents". Edvinsson and Malone, as cited by Kannan and Aulbur (2004), subdivide structural capital into organisational capital, process capital and innovation capital.

![Table showing the components of IC](image)

**Figure 1:** Components of IC source: extended from Pretorius and Coetzee (2005)

2.2 Assessment

Although the terms "measurement", "(e)valuation" and "assessment" are often used interchangeably, authors such as Andriessen (2004a), reflecting on the work of Rescher and Swanborn, notes a distinctive difference between measurement and (e)valuation: Rescher (1969:61) portrays "valuation" (employing the term "evaluation") as "a comparative assessment or measurement of something with respect to its embodiment of a certain value". Swanborn (1981:61-62), on the other hand, describes "measurement" as "the process of assigning scaled numbers to items in such a way that the relationships that exist in reality between the possible states of a variable are reflected in the relationships between the numbers on the scale". In this paper the word "assessment" includes measurement, (e)valuation and all other such notions for determining value.

2.3 Context

Existing literature suggests that the appropriateness of assessment methods depends on factors or dimensions such as:

- **Audience** (Sveiby 2007);
- **Business sector** (Malhotra 2003);
- **Goals and objectives of organisation** (Harrison & Sullivan, 2000; Smith & McKeen 2003);
Industry and line of business (Van Buren 1999);
Level of assessment (Sánchez, Chaminade & Olea 2000; Smith & McKeen 2003);
Purpose of or motivation for assessment (Andriessen 2004a; Housel & Bell 2001; Sveiby 2007);
Level of resources the organisation is willing to commit towards assessment of IC (Harrison & Sullivan 2000); and
Size of organisation (O'Sullivan 2005).

“Context” is here interpreted as a vector comprised of factors such as these listed above, them being viewed as variables to the process of selecting an appropriate method for assessment of IC, given any particular context.

2.4 Choosing, selection, customisation, implementation and application

The term “choosing” (of IC assessment methods) as illustrated in Figure 2, is employed in this research to include both the selection and the customisation of an appropriate method (or combination of methods) for assessment of IC, given any particular context. It should be noted that the selection process (of IC assessment methods) includes consideration of the customisability of the selected method to suite a particular context. In this paper the term “customisation” (of an IC assessment method) is used to refer to the adaptation of a method (or methods) to suit a particular context, i.e. the detailed design of the manner in which a particular selected method (or methods) will be implemented or applied in a particular context. The term “implementation” is employed to refer to the putting into operation of a method and the term “application” to refer to the customisation and implementation of a method (refer to Figure 2).

Figure 2: Usage of the terms “choosing”, “selection”, “customisation”, “implementation” and “application”

3. Methodology

Let us consider the research question and objectives, the research design, the data collection and the instrument used for data collection.

3.1 Research question and objectives

As mentioned above, perceptions on the complexity levels of choosing (selecting and customising) IC assessment methods need to be tested empirically. We have taken the research question to be as formulated in Figure 3.

What are perceptions on the complexity levels of decisions involved in choosing IC assessment methods?

Figure 3: Research question

Corresponding to this research question, we have taken the objective of this research to be as to test perceptions of suitable experts on:

- complexity levels of decisions to be made in selecting a method (or combination of methods) for assessment of intellectual capital; and
- complexity levels of decisions to be made in customising a method (or combination of methods) for assessment of intellectual capital.
This research departed from the assumptions that:

- Individuals knowledgeable on intellectual capital or aspects thereof can be considered to be suitable experts.
- Such experts may be recruited from amongst authors or co-authors of peer-reviewed publications on IC or aspects thereof.
- Such experts could be located through their involvement in recent international conferences focusing on or containing streams on IC.
- Such experts could contribute to the location of additional suitable experts (by providing contact details of such experts).

Note that the intention was to collect expert opinions on the complexity of the decisions involved in the process of selecting and customising appropriate methods for assessment of intellectual capital and not to obtain generalisable quantitative measurements nor to test a hypothesis of any nature.

### 3.2 Research design

Table 1 summarises the research design according to the eight descriptors of research design (appropriate for collection of primary data) proposed by Cooper & Schindler (2006:139-143). The options chosen for addressing the research question are highlighted.

Other classification schemes for research design types include those by Mouton (2005:144-180), Welman, Kruger and Mitchell (2005:78-101) and Babbie (2008:95-117).

**Table 1: Descriptors of research design**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>“degree to which the research questions has been crystallized”</td>
<td>exploratory study, formal study</td>
</tr>
<tr>
<td>D2</td>
<td>“method of data collection”</td>
<td>monitoring, communication study</td>
</tr>
<tr>
<td>D3</td>
<td>“power of the researcher to produce effects in the variables under study”</td>
<td>experimental, ex post facto</td>
</tr>
<tr>
<td>D4</td>
<td>“purpose of the study”</td>
<td>descriptive, causal</td>
</tr>
<tr>
<td>D5</td>
<td>“time dimension”</td>
<td>cross-sectional, longitudinal</td>
</tr>
<tr>
<td>D6</td>
<td>“topical scope—breadth and depth—of the study”</td>
<td>case, statistical study</td>
</tr>
<tr>
<td>D7</td>
<td>“research environment”</td>
<td>field setting, laboratory research, simulation</td>
</tr>
<tr>
<td>D8</td>
<td>“participants’ perception of research activity”</td>
<td>actual routine, modified routine</td>
</tr>
</tbody>
</table>

### 3.3 Instrument

Communication approaches include self-administered questionnaire, phone interview and personal interview (Cooper & Schindler, 2006:140). Taking into account the wide geographical spread of potentially suitable respondents and the nature of the questions that need to be posed, a self-administered questionnaire (Olivier 2004; Cooper & Schindler 2006:253-259) was chosen as communication approach.

- Part A tests perceptions on the complexity of the decisions involved in the selection and customisation of an appropriate method for assessment of IC, given any particular context. For
both the decisions involved in the selection and the decisions involved in the customisation of an appropriate method for assessment of IC, respondents were asked to select one option per row in a matrix like the one illustrated in Table 2 below. The matrix contains multiple rows to cater for the possibility that respondents may not perceive such decisions to be equally complex in all situations (contexts). Respondents were further asked to, optionally, provide scenarios for which decisions fall in the more complex range of this complexity spectrum and scenarios where such decisions fall in the less complex range.

Table 2: Matrix used in Part A of questionnaire

<table>
<thead>
<tr>
<th>Complexity</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 not complex at all</td>
<td>never</td>
<td>sometimes</td>
<td>often</td>
<td>always</td>
<td>none of the options in this row apply</td>
</tr>
<tr>
<td>2 slightly complex</td>
<td>never</td>
<td>sometimes</td>
<td>often</td>
<td>always</td>
<td>none of the options in this row apply</td>
</tr>
<tr>
<td>3 moderately complex</td>
<td>never</td>
<td>sometimes</td>
<td>often</td>
<td>always</td>
<td>none of the options in this row apply</td>
</tr>
<tr>
<td>4 very complex</td>
<td>never</td>
<td>sometimes</td>
<td>often</td>
<td>always</td>
<td>none of the options in this row apply</td>
</tr>
</tbody>
</table>

- Part B tests perceptions on the importance of various factors in determining an appropriate method for assessment of IC and is outside the scope of this paper.
- Part C contains questions relating to the respondent profile, including number of years of involvement in assessment of IC as consultant, practitioner and/or researcher respectively, the methods consulted on, used in practice and/or tested empirically, and the number of different methods studied.
- Part D provides space for additional comments.

3.4 Data collection

Conference proceedings and/or other conference documentation and correspondence of four relatively recent international conferences were scanned for authors of papers on IC, intangible assets, knowledge assets or components thereof, e.g. human capital.

The 128 resulting authors were contacted via e-mail and requested to respond to a questionnaire. Note that these 128 authors could be considered a non-probability sample (attained through convenience sampling) of a larger population. In addition, snowball sampling was employed in that respondents were asked to, optionally, provide contact details of other suitable candidates. The snowball sampling component yielded another 14 candidates who were then also requested, via e-mail, to fill out the same questionnaire.

During the first two weeks 18 completed questionnaires were received and another three during the next four weeks. Follow-up requests were made to candidates who had not responded after six weeks. A total of 142 questionnaires were distributed, harvesting 38 completed questionnaires over a three-month period, representing a response rate of 26.76%.

Where responses were incomplete, were unclear and/or appeared contradictory, respondents were requested to improve completeness and clarity (provided that they had indicated their acceptability to be contacted for further details). Where incomplete or contradictory responses to questions considered critical for processing of questionnaires (e.g. responses pertaining to the matrices in Part A and Part B) could not be resolved, questionnaires were removed from the sample, reducing the
sample size from 38 to 31. Where unclear statements (in optional comments) could not be resolved satisfactorily, such statements (and not the whole questionnaire) were excluded from the subsequent analysis.

Note that since a probability (random) sample was not obtained, it is not possible to perform (statistically) reliable generalisations to a larger population.

4. Results and discussion
As already mentioned, 38 completed questionnaires were received and seven excluded due to possible irregularities. Let us consider the results obtained from the remaining 31 responses. Results are reported under the headings:

- Profile of respondents
- Complexity of decisions involved in selecting appropriate methods
- Complexity of decisions involved in customising methods

Please note that, due to percentages being rounded to the nearest integer, total percentages may not always add up to 100%.

4.1 Profile of respondents
The data collected on respondents themselves was intended to provide an indication of the expert status of respondents and to serve as background for interpretation of the other categories of responses to the self-administered questionnaire. Analysing the data collected on the 31 respondents – whose responses were included in the analysis – it was found that:

- The respondents' area of residence covers 22 countries from a variety of international regions, of which Europe has the greatest representation.
- 48% of respondents classified themselves as researcher only, 26% as consultant, practitioner and researcher; 23% consultant and researcher; and 6% as practitioner only.
- The majority of respondents that classified themselves as consultants (61%), the majority of respondents that classified themselves as practitioners (66%) and half of the respondents that categorised themselves as researchers (50%) reported six or more years of experience.
- Half of the respondents that classified themselves as consultants (50%) indicated that they had consulted on at least six methods, the majority of respondents that classified themselves as practitioners (66%) indicated that they had used at least six methods in practice and almost all respondents that classified themselves as researchers (92%) indicated that they had empirically tested at least two methods.
- Almost all respondents (94%) indicated that they had studied at least two IC assessment methods and the majority (68%) that they had studied six or more methods.

4.2 Complexity of decisions involved in selecting appropriate methods
Responses to Part A, Section 1, of the questionnaire, pertaining to perceptions on the complexity of decisions involved in the selection of appropriate IC assessment methods (given any particular context) provided the following results, as also graphically portrayed in Figure 4:

- 45% indicated that selection of appropriate methods, given any particular context, is often very complex, followed by 26% indicating it is sometimes very complex, 19% indicating that it is always very complex, and 10% indicating that it is never very complex or that the description very complex does not apply. Adding the percentages for always very complex and often very complex, reveals that 65% (the majority of respondents) perceived the decisions involved in selecting an appropriate method for assessment of IC (given any particular context) as often or always very complex.
- 55% indicated that selection of appropriate methods, given any particular context, is often moderately complex, followed by 29% indicating that it is never moderately complex or that the description moderately complex does not apply, 13% indicating that it is sometimes moderately complex and 3% indicating that such selection is always moderately complex.
Figure 4: Complexity of decisions involved in selection of appropriate methods for assessment of IC

- 55% indicated that selection of appropriate methods, given any particular context, is sometimes slightly complex, followed by 32% indicating that it is never slightly complex or that the description slightly complex does not apply and 13% indicating that such selection is often slightly complex.

- 65% indicated that the selection of appropriate methods, given any particular context, is never not complex at all or that the description not complex at all does not apply, followed by 19% indicating that such selection is sometimes not complex at all, 10% indicating that such selection is often not complex at all and the remaining 6% that such selection is always not complex at all.

Examples of scenarios for which decisions involved in the selection of an appropriate method for assessment fall in the more complex range of the spectrum and also of scenarios for which such decisions fall in the less complex range, as provided by respondents, are provided in Table 3.

Table 3: Scenarios where decisions involved in selection of IC assessment methods fall in the more complex range or in the less complex range of the spectrum

<table>
<thead>
<tr>
<th>No</th>
<th>Scenarios falling in the more complex range</th>
<th>Scenario falling in the less complex range</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Assessment is performed for the first time.</td>
<td>There is an established model to follow.</td>
</tr>
<tr>
<td>S2</td>
<td>Assessing IC for large organisations.</td>
<td>Assessing IC for small to medium size enterprises (SME’s)</td>
</tr>
<tr>
<td>S3</td>
<td>Assisting a company working from baseline zero intending to clone a successful business and place it offshore in collaboration with an overseas partner.</td>
<td>Assessing an IP and know-how portfolio.</td>
</tr>
<tr>
<td>S4</td>
<td>Context of assessment is not clearly defined.</td>
<td>Context of assessment is clearly defined.</td>
</tr>
<tr>
<td>S5</td>
<td>A sophisticated management system (other than an IC management system) already exists.</td>
<td>No competent competing systems are in place.</td>
</tr>
<tr>
<td>S6</td>
<td>A range of stakeholders is involved.</td>
<td>The user does not require detail, the results are to be presented in a form that favours a particular methodology or the organisation has a single objective.</td>
</tr>
<tr>
<td>S7</td>
<td>No problem diagnosis has been made.</td>
<td>A problem diagnosis has been made.</td>
</tr>
<tr>
<td>S8</td>
<td>Top management is not convinced of the need for assessment of IC.</td>
<td>Top management is convinced of the need for assessment of IC.</td>
</tr>
<tr>
<td>S10</td>
<td>The project leader does not have sufficient knowledge and experience.</td>
<td>An experienced knowledgeable project leader is available to lead the assessment project.</td>
</tr>
<tr>
<td>S11</td>
<td>Assessing IC in emergent markets (more complex markets, a large number of variables).</td>
<td>Assessing IC in mature markets (less complex markets, smaller number of variables).</td>
</tr>
</tbody>
</table>
Selection of IC assessment methods

<table>
<thead>
<tr>
<th>No</th>
<th>Scenarios falling in the more complex range</th>
<th>Scenario falling in the less complex range</th>
</tr>
</thead>
<tbody>
<tr>
<td>S12</td>
<td>Assessing IC of firms in developed countries.</td>
<td>Assessing IC of firms in developing countries (most IC literature focuses on developed countries).</td>
</tr>
<tr>
<td>S13</td>
<td>Assessing IC in the context of product development (more complex, as it is future oriented, uncertain and highly complex).</td>
<td>Measurement of human capital (less complex as there are many indicators available, e.g. education level, network analysis).</td>
</tr>
</tbody>
</table>

In addition to providing the scenarios listed in Table 3, respondents explain that the complexity of decisions involved in selection depends on:

- internal factors: dimension, history, maturity of organisation;
- external factors: complexity of market (a large number of variables), product life cycle (e.g. manufacturing vs. service business), technology involved, intensity of knowledge;
- sophistication of recipients of results, time available to participate, costs, resources available (e.g. large companies tend to have more resources availability than small and medium enterprises (SME’s) and would consequently be more suitable for in-depth analysis); and
- the decision maker him- or herself.

Respondents indicating that decisions involved in selecting IC assessment methods are always very complex, explained that:

- The first (often neglected) issue is to pin-point the actual problem to be solved by the assessment (system).
- The most complex component (of the assessment process) is to define intangible assets to be assessed.
- Assessment scenarios are distinguished (not so much by context, but) by the conceptual view of intangibles to be assessed derived from the capturing of operational elements.

Respondents indicating that decisions involved in selecting IC assessment are of limited complexity, presented arguments (similar to each other) such as:

- A limited number of methods have been validated in practice. To establish whether a method is worthy of being used in practice, it needs to be asked:
  - How many companies are using it?
  - How many companies have changed their behaviour as a consequence of using such methods for assessment of IC?
- Since the capabilities of most existing methods are limited, when faced with real situations, the actual options available are very limited. While methodologies can appear to work when devised, the only test that counts is:
  - Can they be used?; and
  - Can they deliver useful results in practice? (In this context, “useful” results are defined as results that are detailed, reproducible, free from bias and actionable.)

Respondents indicating that decisions involved in selecting IC assessment methods are never very complex explain, e.g., that:

- Selection of an appropriate method is never a problem, because the same method is always used.

Other insights gained regarding decisions involved in the selection of IC assessment methods include:

- Many factors have to be considered before tying the assessment process to a specific method.
- Early IC assessments should have very clear and realistically attainable objectives. An important focus of the initial assessment process may be to obtain buy-in from participants who have to collect/process data and from end-users of the assessment results. As the assessment process becomes established and well accepted, focus can shift to the achievement of highest quality results.
Particular combinations of context and intention may require the use of techniques from more than one assessment method or induce an evolution from a simpler method (with easier to achieve results) to a more ambitious method (as the requirements of the target organisation develop and its culture becomes more supportive).

4.3 Complexity of decisions involved in customising methods

Responses to Part A, Section 1, of the questionnaire, pertaining to perceptions on the complexity of decisions involved in the customisation of appropriate IC assessment methods (given any particular context) provided the following results, as also graphically portrayed in Figure 5:

- 45% indicated that customisation of appropriate methods, given any particular context, is often very complex, followed by 26% indicating it is sometimes very complex, 19% indicating that it is never very complex or that the description very complex does not apply and 10% indicating that such customisation is always very complex. Adding the percentages for always very complex and often very complex, reveals that 55% (the majority of respondents) perceived the decisions involved in customising an appropriate method for assessment of IC (given any particular context) as often or always very complex.
- 52% indicated that customisation of appropriate methods, given any particular context, is often moderately complex, followed by 29% indicating that it is sometimes moderately complex, 16% that it is never moderately complex or that the description moderately complex does not apply and 3% indicating that such customisation is always moderately complex.
- 48% indicated that customisation of appropriate methods, given any particular context, is sometimes slightly complex, followed by 26% indicating that it is often slightly complex and 26% indicating that such customisation is never slightly complex or that the description slightly complex does not apply.
- 68% indicated that selection of appropriate methods, given any particular context, is never not complex at all or that the description not complex at all does not apply, followed by 16% indicating that it is sometimes not complex at all, 13% indicating that it is often not complex at all, and 3% indicating that such customisation is always not complex at all.

Examples of scenarios for which decisions involved in the customisation of an appropriate method for assessment of IC fall in the more complex range of the complexity spectrum and also that of scenarios for which such decisions fall in the less complex range, as provided by respondents, are provided in Table 4 (even though this was not explicitly asked for).
Table 4: Scenarios where decisions involved in customisation of IC assessment methods fall in the more complex range or in the less complex range of the complexity spectrum

<table>
<thead>
<tr>
<th>No</th>
<th>Scenarios falling in the more complex range</th>
<th>Scenario falling in the less complex range</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Assessment for enterprises.</td>
<td>Assessment for universities.</td>
</tr>
<tr>
<td>C2</td>
<td>Assessment of human capital and relational capital (it is difficult to assess what is inside people's minds).</td>
<td>Assessment of structural capital.</td>
</tr>
<tr>
<td>C3</td>
<td>Gaining understanding of the strategic value drivers of an organisation.</td>
<td>Identification of intangibles with a market value.</td>
</tr>
<tr>
<td>C4</td>
<td>Assessment in monetary items.</td>
<td>Assessment by indicator-based methods.</td>
</tr>
</tbody>
</table>

5. Summary and conclusion

A self-administered questionnaire for data collection was administered to gather information regarding perceptions of consultants, practitioners and researchers on the levels of complexities involved in the decisions to be made in selecting and customising IC assessment methods.

The results indicate that decisions involved in choosing (selecting and customising) an appropriate IC assessment method to be used in a particular context, are indeed perceived as complex by respondents to the self-administered questionnaire, with the majority of respondents perceiving such decisions as always or often very complex. The data collected on respondents themselves indicates that they are a suitable group of individuals for answering questions concerning the complexity levels of the decisions involved in choosing IC assessment methods.

The perceived complexity of the decisions involved in choosing IC assessment methods supports the notion that supporting systems are required to assist human decision makers in making sense of the complexities involved. With a substantial portion of a suitable group of individuals knowledgeable on IC or aspects thereof perceiving the decisions involved in choosing IC assessment methods as always or often very complex, it is deduced:

- that there most likely is a need for supporting systems to assist human decision makers in dealing with the complexities involved in choosing IC assessment methods and for managing the evolving body of knowledge concerning such assessment; and

- that it makes sense to develop such a system.

6. References


Knowledge Management Discipline: Test for an Undergraduate Program in Turkey

Mustafa Sagsan
Baskent University, Ankara, Turkey
msagsan@baskent.edu.tr; msagsan@gmail.com

Abstract: This study aims to explain the theoretical aspect of KM in order to construct a new undergraduate program. Knowledge management as a discipline plays a crucial role at the undergraduate level in universities. Firstly, it is needed to create a common terminology from which the scholars can establish programs. Secondly, a set of sciences are needed. These two stages will allow us to redefine the knowledge management discipline from an interdisciplinary perspective that is based on four fundamental paradigms: (1) technological, (2) socio-technical, (3) inter/intra organizational and (4) humanist paradigm. This will allow us to have an opportunity to improve the common terms, which we can establish the knowledge management undergraduate programs from. In addition, the practical perspective of this study will be tested in Turkish universities, which have knowledge management undergraduate programs, which will enable us to suggest a new sample for how knowledge management undergraduate degree programs should successfully be constructed in Turkey.

Keywords: Knowledge Management, paradigm, discipline, academic education, undergraduate degree program in Turkey

1. Introduction

The purpose of this paper is to determine the elements of knowledge management as a discipline and to put forward the paradigms of knowledge management on epistemological dimension. Kuhn has used the term “paradigm” (1970) instead of alternative realities of sciences. Again, the term paradigm as Kuhn (1977) represents a belief system that encompasses those concepts, models, assumptions, and metaphysical principles that are shared within each community. According to Kuhn (1970), sciences are competing with each other and paradigm emerges from this competition, which contains beliefs, rules, values and conceptual tools. Paradigm can also be defined as ‘common values that are shared by scientific community’. In addition to Kuhn’s definitions about the term paradigm, Ritzer (1975) indicates that consensus among a community of practitioners is reinforced through a paradigm’s exemplars, images of its subject matter, and its distinctive practices. Briefly, for Ritzer a paradigm is the broadest unit of consensus within a designated field of study.

In this study, instead of focusing on “the reality of construction as normal or progressive sciences” with paradigm concept and discussing the theory in praxis, I emphasize the term of paradigm here is different perspectives on scientific works about any discipline; topic map from scholars’ point of view; collectivity of thought patterns; or consensus among a community of practitioners.

The study aims to put forward a comprehensive understanding about knowledge management discipline or education at the undergraduate level. It is well known that there are some of academic knowledge management graduate and postgraduate degree programs (Capar, 2003; Sutton, 2002) or some of knowledge management courses (Chaudhry and Higgins, 2001) related to the information studies departments but only few knowledge management programs are directly related to the knowledge studies, which is based on the knowledge hierarchy: data, information and knowledge. At this point, the basic research question of this study is which paradigms can contribute to design a comprehensive new knowledge management undergraduate degree program based on the knowledge hierarchy. In order to design such an undergraduate program, it should not only focus on data and information but also the concept of ‘knowledge’ in terms of k-hierarchy should be taken into account. In addition, we should transfer our understanding related to knowledge from objectivist perspective to the subjectivist one, because of the nature of knowledge. Both of these perspectives can be associated with paradigms that include some fundamental sciences.

2. Knowledge management paradigm

Only few studies have directly focused on the discipline or education of knowledge management in terms of paradigm in the literature (Ives and Torrey, 1998; Koenig, 1999; Sattar and Higgins, 2001; Dalkir, 2005, Stankosky, 2005, Sagsan, 2007, Hazlett, McAdam and Gallagher, 2005, Gloet and Berrell, 2003) but emerging knowledge as a discipline or science with regard to different epistemological dimensions reviews (Boer, Van Baalen and Kumar, 2002; Dueck, 2001; Martensson,
2000) the processes of knowledge especially knowledge creation in organizations (Gioa and Pitre, 1990; Nonaka, 1994 & 1995; Levinthal and March, 1993; Crossan, Lane and White, 1999;). These epistemological dimensions which are based on creating knowledge can be grouped into three perspectives: (a) knowledge as a residing in individuals’ minds means cognitive perspective, (b) knowledge, as a social constructed perspective, (c) knowledge, as an object perspective.

Most of the scientific research on knowledge management practices has analyzed the processes of knowledge at the individual, organizational or inter-organizational level or combined knowledge management with another field. The knowledge management academic discipline has progressed through the knowledge management life cycle models or epistemological dimensions of knowledge management (Awad ve Ghaziri, 2004: 24; Fernandez, Gonzalez ve Sabherwal, 2004:32-36; O’Dell, Grayson ve Essaides, 2003: 25; Alavi ve Leidner, 2001; Meyer and Zack, 1996; Nickols, 1999; Wiig, 1993; McElroy, 1999; Rollet, 2003; Bukowitz and Williams, 2003, Sagsan, 2006) in the literature. Dalkir argues that the nature of knowledge management discipline can be seen as interdisciplinary and these related disciplines are database technologies, collaborative technologies, organizational science, electronic performance support systems, document and information management, decision support systems, library and information sciences, web technologies, artificial intelligence, technical writing, cognitive science and help desk systems.

Jennex and Croasdell (2007) are investigated the knowledge management by considering Kuhn’s criteria in terms of being a discipline. According to them, knowledge management is completely supported by these criteria. For example, knowledge management has its own specialized journals, professional societies, and academic curricula, accepted body of knowledge for group members as well as promulgation of scholarly articles.

Gloet and Berrell (2003) stated that two main paradigms should consider for managing knowledge in organizations. These are information technology paradigm and humanist paradigm. Information technology paradigm emphasizes on technology, systems and applications one hand, humanist paradigm focuses on people and process on the other. The authors have integrated these paradigms in terms of human resources management applications in organizations.

There are four layers that help in establishing and advancing the discipline of knowledge management (Schwarts, 2007: 26) as considering the Encyclopedia of Knowledge Management. The central core layer (1°) includes the philosophers that must inform our choice of practical knowledge management processes. It presents one view of the different stages activities and cycles that comprise knowledge management (2°). These processes must be implemented and adapted in order to address organizational, social and managerial needs (3°). Finally, the implementation of knowledge management process to meet our organizational needs must be supported by and implemented through a set of relevant information technologies (4°). The Schwartz’s () argument or layers shows us that there are four fundamental sciences that comprise the discipline of knowledge management: technology science, organization & management science, social science and philosophy.

Sveiby (1996, 2001) indicates that two important tracks should be considered at two levels of managing knowledge: organizational and individual. The first track is based on information technology. According to this model, knowledge can be matched as an object; re-engineers play a crucial role at organizational level, and specialists are important at the individual level. The second track is based on people, and knowledge can be evaluated as a process. In this model, organization theorists are playing a specific role at the organizational level and psychologists are important for processing knowledge at the individual level.

Sagsan (2007) argues that knowledge management discipline should be evaluated from interdisciplinary perspectives, which are based on communication science, library and information science, business and administration sciences and technology science. Stankosky (2005) details these sciences as multi-discipline branch or theory such as communication theories, system theory, organizational psychology, strategic planning, decision support systems, data mining, system analysis, total quality management, database design and management and theories of management and organization.
Peachey, Hall and Cegielski (2007) are summarized the topics of knowledge management by giving the top-tiers journals from 2000 to 2005 as focusing on the processes of knowledge such as the construct of transfer, creation, storage/retrieval, application and roles/skills. The conclusion of their study shows us that the construct of knowledge transfer is more frequently used than the others and the studies about knowledge management should be transformed from Information Systems discipline to knowledge management systems discipline. Also, knowledge management is more than regeneration or integration of other more mature topics such as expert systems, or decision support systems.

For Koenig (1999:26-28), some important topics such as information technologies and applications, common culture and change agent, business and economy should be included in a program which is based on knowledge management discipline. These topics are given in some universities’ undergraduate and graduate program as courses, especially in information science, computer technology and business administration departments (Sattar, Higgins, 2001: 3). Finally, some scholars (Ives, Torrey and Gordon; 1998: 273; Sagsan, 2007) state that the foundation for the discipline of knowledge management were laid by experiences acquired from practices and particularly thanks to the training and on-the-job practices provided by consulting firms abroad. According to Hazlett, McAdam and Gallagher (2005) knowledge management has revealed two paradigms: information systems and management but there is little evidence of synergy and convergence due to dichotomy. Therefore, knowledge management is currently in a state of pre-science. In contrast to Hazlett et al, Lee and Chris (2005) describe knowledge management as an interdisciplinary area that encapsulates processes and techniques for the creation, collection, classification, distribution, evaluation and reuse of instructional knowledge before designing master and postgraduate program based on both discipline, not a technology and sciences such as management, information technology, engineering, social work, health care and libraries. Lastly, Grossman (2007) current study summarizes the statistics about knowledge management undergraduate, graduate and postgraduate degree programs by giving some universities name and the doctoral dissertations, which were written of the last decades.

Knowledge management subtopics in terms of discipline or education can be grouped as four paradigms: organizational, humanist, socio-technical and technological. Each of these paradigms reflects its own school of thought about managing information objectively and managing knowledge as subjectively. In addition, these paradigms allow us to assess knowledge management as discipline or science and to put forward misunderstandings about the argument of knowledge management is pre-science. Like Burrell and Morgan's sociological paradigms (1980) in the field of organizational theories (Burrell and Morgan, 1979, Morgan, 1980), Figure-1 enable us to determine which paradigms can obviously based on which theories about managing knowledge in organizations.

As considering the Figure 1, knowledge management discipline can obviously be seen as interdisciplinary perspectives. The paradigms include basic sciences, which created knowledge management discipline and reflect a network of school of thought, differentiated approach and perspective but sharing common fundamental assumptions about the nature of information and knowledge with different scholars.

Technological paradigm is based on the important assumptions related to technological advancements which have crucial role concerning with providing, sharing and disseminating ‘structured information’ in the system. Thus technology science, computer science, system theory can be grouped into technological paradigms. These sciences indicate the dimension of the knowledge management technologies and they process only structured information. Technology is a tool or an object for establishing information systems and it enables us to produce new information orderly. These systems for example are involved in information management, information engineering, system engineering, management information systems, decision support systems, web technology systems, database management systems, etc.

Socio–technical paradigm is based upon unstructured or semi structured information. The fundamental sciences such as communication, library and information, and sociology are taken place in this paradigm and they can be assessed subjectively because information is processed at the individual level. The paradigm attempt to combine social and technical systems for manipulating information in the system that can occur as unstructured or semi structured forms. The sciences such
as communication studies, inter personal communication, librarianship, information resources documentation, archiving, information management, etc can be grouped in this paradigm.

### KNOWLEDGE

<table>
<thead>
<tr>
<th>Explicit</th>
<th>Tacit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra/Inter Organizational paradigm (Management &amp; organization science, business and administrative science)</td>
<td>Humanist paradigm (Cognitive science, psychology, learning science)</td>
</tr>
</tbody>
</table>

### OBJECTIVE

<table>
<thead>
<tr>
<th>Technological paradigm (Computer Science, Technology Science, System Theory, Engineering Science)</th>
<th>Socio-technical paradigm (Communication science, sociology, library and information science)</th>
</tr>
</thead>
</table>

### SUBJECTIVE

<table>
<thead>
<tr>
<th>Structured</th>
<th>INFORMATION</th>
<th>Un/Semi-structured</th>
</tr>
</thead>
</table>

**Figure 1**: Knowledge management paradigms from interdisciplinary perspective

*Inter / Intra organizational paradigm* emphasizes how explicit knowledge is socially created by workers and collaboratively diffused in/inters organizations. These organizations should be understood here, as 'knowledge creating companies' which is firstly used by Nonaka (1991) and the paradigm should focus on both explicit and tacit knowledge. Knowledge is processed by many activities such as creating, sharing, structuring, using and auditing in organizations objectively. As we consider k-hierarchy here, information is transformed into knowledge and objectivity is stated instead of subjectivity. The topics of organizational learning, organizational culture, structure and change, organization theories, strategic management, process management, leadership theories, human resources management, production management, accounting management, supply chain management, marketing management, macro and micro economy, etc are covered by this paradigm.

*Humanist paradigm* is predicated upon a view of humanity as a potentially dominating force. It is tied to a cognitive process of human being, which is defined by soft sciences and level of abstraction. Thus, the paradigm is certainly subjective and focused on the tacit form of knowledge. The knowledge here is created individually and appears through human information processing that emphasizes the cognitive models. It includes topics such as individual learning, learning theories, motivation theories, human capacity, personalities, etc.

As a result, each of these paradigms defines the grounds of knowledge management discipline or education, highlights to develop a *comprehensive* (includes data, information and knowledge) undergraduate academic program and gives us different implications for the study of knowledge management in theory and practice at universities.
2.1 Inter-paradigms connectivity

These four paradigms have tightly coupled relations that enable us to assess it in interdisciplinary perspective. The sciences, which belong to the knowledge management discipline or education based on these four paradigms, are not limited here. One paradigm’s tenets may be influenced from the others’ thought patterns. Thus, it is possible to say that, the transitions between the paradigms reveal interdisciplinary fields which can be named as ‘shared values in the same ideology’. The term ideology here means ‘knowledge management paradigm’. In other words, connectivity within these four paradigms is caused to create new interdisciplinary fields such as management information systems, decision support systems, organizational or social learning, etc. In summary, the characteristic of knowledge management discipline or education based on k-hierarchy is introduced some of ‘intersection fields’ between the paradigms from interdisciplinary perspective. The term field is used in this study as “subject activity” and referred to the common branch of knowledge. The concept of paradigm is a broader term than the concept of field, because according to Figure 2, any paradigm can contain many fields.

![Diagram of four intersection fields]

**Figure 2:** Four-intersection fields based on four-knowledge management paradigms

1\textsuperscript{st} intersection field addressed technological and organizational paradigms that essentially produce structured information and create explicit knowledge as an object. 1\textsuperscript{st} intersection field is embedded in the technological and organizational system. New interdisciplinary fields are produced by integrating organizational and technological paradigms. Management information systems, information management, knowledge management systems can be given in the field.

2\textsuperscript{nd} intersection field is associated with technological and socio technical paradigm which are focused on structured and semi structured information. Decision support system, expert system, artificial system can be given as examples in this field.
3rd intersection field includes humanist and socio-technical paradigms, which produce both unstructured and semi structured information, and creates tacit knowledge. These two paradigms attempt to combine human activities and technical system in terms of socially constructed environment. Despite the fact that, information is an object, it can be easily structured by the technical system. In addition, information is formed in unstructured or semi structured, because it is a subject and ready for interpretation or structuring. Social and individual learning theories, cognitive science, social psychology and related sciences can be considered in this filed.

Knowledge should be realized at the 4th intersection field. It contains explicit knowledge as an object, which is created by organizations in the organizational paradigm; and the tacit dimension of knowledge purely creates by individuals to perform tasks through their experiences in the humanist paradigm. Specific knowledge management courses are occurred by this intersection field. Organizational learning theories, knowledge theories, communities of practice, human and organizational intellectual capital, innovation theories, can be exampled here.

3. Knowledge management undergraduate program in Turkey

According to k-hierarchy, these four paradigms include data, information and knowledge in terms of objectivity and subjectivity. In 1980’s many academic programs at undergraduate level related to information studies, indicate only data and information. Unfortunately, these programs’ curriculums are based on technological, organizational and socio-technical paradigms. The departments or schools are about management information system, information studies, library and information studies, business and information management, etc. Especially in Turkey, the undergraduate programs based on information studies have different names such as Information and Document Management, Management Information Systems, Business Informatics, Information Systems Engineering, Computer Technologies, Business Information Management, Management Systems, Archives Management, Librarianship at different universities. Most of these programs emphasize the importance of information, rather than knowledge. Therefore, a gap between information and knowledge studies occurs. Başkent University designed the first and a new comprehensive undergraduate degree program for filling this gap, titled “Department of Knowledge Management” in 2002 in Turkey. The Department’s curriculum are involved in multidisciplinary perspectives and based on four paradigms, which are mentioned above at the level of courses. In addition, courses can be grouped at four fundamental studies such as library and information, information technologies, communication and business. In the light of these explanations, these four intersection fields also lead to form specific knowledge management courses (See Figure 2) in the program. Briefly, these fundamental studies can be matched the four paradigms as we mentioned before. For instance, library and information studies can be equalized to socio-technical paradigm; information technologies studies can be balanced to technological paradigm; communication studies can be grouped in humanist paradigm and business management can be categorized in the intra-inter organizational paradigm. The undergraduate level program’s courses can be also given below in the four paradigms.


The courses based on humanist paradigm: The paradigm heavily not only relies on the soft dimension of knowledge management courses but also includes partially all four intersections fields. Social Psychology of Organizing, Introduction to Knowledge Management, Knowledge Management
Applications I-II, Knowledge Management Case Studies, Knowledge Management and Public Relations, Intellectual Capital, Knowledge Mapping, Final Project related to knowledge management.

The Department of Knowledge Management undergraduate degree program in Baskent University aims to provide a new position in public and private organizations in the name of “knowledge manager” or “chief knowledge officers”. In addition, the program can be evaluated as a sample model for designing a new comprehensive undergraduate degree knowledge management program at international level.

4. Discussions and conclusion

When focusing on the discipline of knowledge management, based on four paradigms or interdisciplinary / multi-disciplinary perspectives with respect to k-hierarchy, information is evaluated as a process and object at the organizational level relied on organizational technology; knowledge is directly related to people and analyzing subjectively at the individual level based on people’s mind, behaviors, practices, and experiences. One of the most important thing here is to transform information to the knowledge, both individual and organizational level. The last item allows us (I mean knowledge) to conceive a new discipline or education in the title of “knowledge management” which differentiates from “information management”, and covers, according to k-hierarchy both data and information. For this reason, it should be well known that the differentiations between information management and knowledge management fields based on theoretical and practical level. Both of them certainly have crucial roles in organizations, but if we focus knowledge management discipline or education at the undergraduate level, we are also manage and process information based on these four paradigms. In addition, it is possible to say that knowledge management as a discipline can be redefined interdisciplinary perspectives and it newly emerged as a separate discipline in the field of social sciences in 1990’s. Each paradigm feeds its own science, which comes from theory and goes to the practice or vice versa. The most important benefit of knowledge management interdisciplinary perspectives for professionals or practitioners is based on education that includes k-hierarchy. Through these four paradigms, knowledge management education comprehensively can be given at undergraduate level. Many practical opportunities can be given for managing knowledge through these four paradigms in organizations for the graduates. For instance, these paradigms’ sciences and intersection fields allow us to:

- draw a new roadmap about managing data, information, and knowledge, depends on organizational structure, culture and environments,
- perform knowledge management life cycle models, based on the knowledge processes such as creating, sharing, structuring, using and auditing,
- design a knowledge management team in organizations, which include information manager, web designer, communication specialist, graphic artist, information analyst, content manager, human resources manager, public relations specialist, financier and knowledge missioner and champion,
- codify knowledge based on computer programming and document management systems,
- transform information into knowledge through technological networks based on intranets and extranets,
- establish knowledge management systems architecture through web-based technologies,
- design database management systems to store and retrieve data and information,
- organize data and information by the web content management systems,
- align organizational strategies with knowledge management ones,
- build social communication networks for sharing explicit knowledge,
- motivate people by creating new knowledge to use organization’s products, services and workflows,
- exploit tacit knowledge and transform it for organizational benefit,
- capture knowledge by designing knowledge maps benefit from conceptual maps and cognitive maps,
- adapt organizations with their environments based on supply chain management, customer relations management, markets and industrial relations,
maximize organizations’ intangible assets through organizational members,
• enhance incrementally organizational knowing and innovative capacity,
• integrate people culturally with technological systems,
• encourage white colored and senior workers to manage their own knowledge,
• generalize collectively learning systems from individual to organizational level and finally create collective mind,
• contribute organization’s intellectual capital through intangible assets,
• develop communities of practice for sharing knowledge effectively in organizations,
• structure reward systems based on sharing and creating knowledge,
• collaborate other departments, which are directly related to creating and sharing knowledge,
• determine strategic priorities for managing knowledge with top management… etc.

In summary, the tasks that belong to knowledge managers could not be performed without education of discipline of knowledge management based on these four paradigms, which draw us a new road map to design a comprehensive knowledge management undergraduate degree program at national and international level. In addition, the intersection fields among the paradigms underline the multidisciplinary aspect of knowledge management discipline. The development of this new interdisciplinary field depends on the designing of new undergraduate degree programs, and the determining of positions of the graduates of these programs in the organizations they are going to work. It is obvious that the scientific studies about knowledge management on the job descriptions of these positions increase in the future. Nowadays this new job titles can be differently named as “chief knowledge officers, knowledge managers, intellectual capital managers”…etc in the literature but of course both knowledge management discipline and job titles are going to institutionalize in the nearest future as a separate field/area or department or position in the organizations.

References

Capar, B. (2003), “Bilgi Yönetimi: Nası Nasi Bir İnsançucu?”, 2nd National Knowledge, Economy and Management Congress Published Papers In 421-432.ss., Kocaeli University, Faculty of Economic and Administrative Sciences, İzmit, Turkey.
Ritzer, G. (1975). *Sociology, a multiple paradigm science*, Allyn and Bacon, Boston, MA.
An Experimental Comparison of 3D Virtual Environments and Text Chat as Collaboration Tools

Andreas Schmeil¹, Martin Eppler², and Mattia Gubler¹
¹University of Lugano, Switzerland
²University of St. Gallen, Switzerland

andreasschmeil@gmail.com
epplerm@gmail.com
mattiagubler@gmail.com

Abstract: A key prerequisite for effective team collaboration concerns the team members’ knowledge about their different backgrounds, skills and experiences. While face-to-face interaction provides multiple opportunities for learning about these vital personal elements informally, a computer-mediated communication setting may make knowledge sharing about team members and their specific backgrounds more difficult. This knowledge sharing, however, may be crucial and should thus be supported also in remote settings. In this paper, we present the design and results of a controlled experiment in which participants needed to share information and make decisions with team members online, in a simulated project kick-off meeting. Five experimental groups collaborated in a three-dimensional Virtual Environment (3D CVE), five control groups in text chat sessions. Opposing these two media, we were able to extrapolate the essential characteristics of 3D CVE. The experiment yields first results proving improved retention when collaborating with avatars in 3D environments and provides insights about the value of this media as a collaboration tool.

Keywords: avatars, virtual environments, experiment, group interaction, decision-making

1. Introduction

A key prerequisite for effective team collaboration concerns the team members' knowledge about their different backgrounds, skills and experiences (i.e., their professional profiles). This situation in which collaborating partners have only partial and biased information has been labeled a Hidden Profile situation (Stasser & Titus, 1985). While face-to-face interaction provides multiple opportunities for learning about these vital personal elements informally, a computer-mediated communication (CMC) setting may make knowledge sharing about team members and their specific backgrounds more difficult. This knowledge sharing, however, may be crucial in order to assign roles or tasks according to abilities, to foster mutual understanding, and to ensure team cohesion and trust. Thus, it should be supported also in remote settings and other situations when people choose to work together online, mediated by computers.

In this paper, we present the design and results of a controlled experiment in which participants needed to share information with team members in an online meeting. The experiment simulated the kick-off meeting of a project; participants needed to present themselves and clarify their main goals jointly. They further needed to assign project roles to each member, based on his or her specific experience, skills and education.

The experimental groups collaborated in a three-dimensional Collaborative Virtual Environment (3D CVE), the control groups in a text chat session. With our investigation we attempted to provide evidence for the existence of advantages in using 3D environments for collaboration tasks. In a simplified view, a 3D CVE can be seen as a text chat augmented by (a) the concept of space, (b) the fact of being represented or embodied as a customized avatar in that virtual space, and (c) the feeling of being there together as a team. Thus, by opposing the two media, this experiment was designed to let us examine these latter notions separately, and to extrapolate the supposedly added value, when dealing with real collaboration tasks.

The remainder of this paper starts with describing our research questions and design, then explains the design of the experiment itself, the measurements we took, and its results in detail. After that, we discuss some limitations of the study, and finally present the conclusions we could draw from this investigation.
2. Research question and design: investigating 3D virtual environments for collaboration tasks

The main research questions of our investigation are “Can 3D Collaborative Virtual Environments bring added value to real collaboration tasks?” and “If so, what exactly is the added value, and how can these virtual environments be designed for collaboration tasks to better benefit from the distinct possibilities these environments offer?”

At a theoretical level, we consider answering these questions as an opening up of novel and innovative ways of working together, harnessing new possibilities recent advancements of communication and technology have brought. Benefits could emerge not only for knowledge management, but also for related fields like collaborative learning and education in general, as well as for entirely different domains like science, healthcare, and games.

At a practical level, we aim to extract important findings on how to design online 3D collaborative virtual environments (also referred to as virtual worlds) and the collaboration settings and tasks for the users, and thus to be able to provide guidelines for practitioners who seek to benefit from virtual collaboration (Kahai et al. 2007). A recent Gartner article points out that businesses focus on technology rather than the users’ requirements when trying out virtual worlds, which they believe is one of the main reasons for the failure of 90% of current corporate virtual world projects, as it is anticipated by Gartner (Gartner 2008). Guidelines that we believe will emerge from our research could help in designing memorable virtual experiences that lead to real added value, and thus render the use of virtual worlds and 3D collaborative virtual environments in general more worthwhile for corporate communication, collaborative work, and other business use cases.

To address the aforementioned complex and interdisciplinary research questions, we have chosen to follow a three-step research design:

As a first step, we started to identify existing ways of collaborating in 3D multi-user virtual environments. We looked into the literature, watched relevant news, blogs and online magazines, and observed groups of users in the popular virtual world Second Life (Second Life 2009) with the aim to find out how people interact with each other and work together – which is an important first step in order to identify the users’ needs (Tromp et al. 2003). Using a pattern-based approach, we also created novel patterns that harness the possibilities of these environments. We developed a first description logic to formalize collaboration patterns in 3D virtual environments, and classified them according to the design effort they require and to the added value the particular collaboration patterns bring (Schmeil and Eppler 2009). The classification covers both learning patterns and patterns for collaborative work.

With that classification in hand, it was noticeable that the vertical axis unit – the amount of added value the patterns bring – needed to be defined more clearly. We thus developed a framework for collaboration in virtual environments, formalizing the necessary elements, and structuring their interplay (Schmeil and Eppler 2009b). This framework can furthermore be used as a blueprint in order to guide users and virtual environment designers in the creation of new collaboration patterns. Guidelines on how to design usable worlds and virtual objects have long been identified as a major requirement for improving the usability of 3D CVE; however, just little research has been done addressing the issue (Tromp et al. 2003).

The third step of our research concerns the experimental evaluation of 3D CVE and collaboration patterns in these environments. The paper at hand describes the first round of experiments we conducted: a comparison of collaboration using two different media, in order to find evidence that 3D virtual environments bring added value. Future experiments will include evaluating and comparing different collaboration patterns inside CVE.

3. Experimental design

As briefly explained in the previous chapter, the experiment was designed to measure the added value of collaborating in a 3D virtual environment in comparison to collaboration through simple text chat. This systematic media comparison was intended to extrapolate the value of a 3D virtual environment’s essential characteristics: the fact of being embodied as customizable avatars in a...
configurable three-dimensional space which simulates the real world while having the benefit of not being limited by real physical constraints.

We implemented a 2x3 experimental design, with 3 tasks: (1) information sharing, (2) grounding and team discussion, and (3) decision making and subgroup building, and two conditions: (I) collaboration in a 3D virtual environment, and (II) collaboration in pure text chat. The independent variable was the environment for online collaboration, and the dependent variables were: satisfaction with process and outcome (Briggs 2006), productivity of the collaboration, and retention (memorability).

In this first round of the experiment we had 50 bachelor and master students, who we divided into groups of five students. Five experimental groups used our configured 3D CVE to fulfill collaboration tasks, the other five groups – the control groups – worked on the same collaboration tasks under the control condition, that is, using pure text chat. The 3D CVE groups used OpenSim (an open-source virtual world server and client system that was derived from the released Second Life viewer source code and is now an independent project: http://opensimulator.org), while the text chat groups used Skype (a popular telephony and chat software, http://www.skype.com, used without its audio and video conferencing functionalities).

In order to ensure the simulation of a remote situation while still having a controlled experiment, we conducted it – in five sessions – in one of our university’s computer labs, and paid heed to keep the participants from talking to each other. Only text chatting in the respective medium was permitted. Also, we understood it as crucial for the experiment results to not be influenced by any personal relations between the students, and thus placed the participants in a way that did not allow them to see the screens of other participants’ in their groups. This way, their hidden profiles could only be shared communicating online, and could not be associated with a classmate’s real identity, which could have significantly biased the retention results. The groups were randomly assigned by the experimenter as suitable in most experiment settings (Friedman and Sunder 1994). Prior to these five sessions of which we analyzed the results, we conducted a pre-test with two groups of five students collaborating in our 3D CVE, and two smaller groups in text chat.

After the collaboration task, we measured the participants’ subjective assessments through a post-task survey and their objective achievements (the recall of their team members’ profiles and the recall of decisions made during the collaboration meeting) through a follow-up test and result evaluation. The following subsections present our hypotheses including their development, then describe the collaboration tasks and the test environment in detail, and explain which measurements we took and how we analyzed the results.

3.1 Hypotheses

Numerous studies have shown evidence that pictures yield better results than simple text in terms of recalled items and comprehension (Nelson et al. 1976, for a review see Snodgrass and Vanderwart 1980), this however is contingent on certain conditions that depend on the application context of images (Stenberg et al. 1995). Collaboration and team knowledge sharing are one such context in which the picture superiority effect has not been analyzed extensively through experiments (for an exception see Stewart and Stewart 2001). Our study thus aims at examining the added value of using visual cues for collaboration based on the premise that the picture superiority effect is also relevant for collaborative settings.

The empirically validated pictorial superiority effect states that the use of images in cognitive tasks leads to systematically higher recall (and recognition) than the mere use of words (because of the additional encoding enabled by pictures and their distinctiveness; see Snodgrass and Vanderwart, 1980, 177; compare also Dual Coding Theory, Paivio 1986). Based on these existing findings, we extend the picture superiority effect to the realm of team communication and hypothesize that 3D collaborative virtual environments – which are based on advanced computer graphics and extensively supported by visual cues (Kahai et al. 2007; Schmeil and Eppler 2009b) – lead to superior results than text-only based ones. These superior effects are not only limited to recall, but also regard team productivity and group work quality.

We thus hypothesize that the fact of being embodied as avatars in an immersive 3D virtual environment will lead to more effective and sustainable knowledge sharing and to a higher satisfaction, motivation and recall of other team members’ backgrounds – compared to pure text chat.
3.2 Task and test environment

The simulated project-kick-off meeting consisted of three tasks. First, participants should introduce their personas to their team members, second, the team should discuss the project and agree on main project goals, and third, the team should assign its members to project roles. These tasks were given to all groups. While the control groups could only communicate using pure text chat (in Skype), the experimental groups using 3D CVE (an OpenSim environment) could use all the functionality our virtual environment offered, including the inherent text chat functionality (no voice communication was used). Our OpenSim environment was structured and supported the tasks as described in the following:

Upon login, all participants landed at the location for the first task (shown in Figure 1), facing a signboard on which the main instructions for the first task were given, namely to introduce and present oneself to the other team mates. Each avatar's appearance corresponded to the profile information given to each participant (in terms of age, profession or hobby).

For the first task of introducing all the team members to each other, the participants were provided with one table each, on top of which informative objects had been put that helped each subject present its persona to the others (see Figure 2). These objects included a computer with a web portal loaded on the screen for the person with a web publishing hobby, books and chalk for the team member who had a teaching and writing background, or two editions of economic newspapers for the person having worked in Journalism. For the person having worked on housing mortgages a thesis document and a number of houses had been placed on a table. Each participant introduced him- or herself through the text chat function, and by activating customized gestures (mostly used for hobbies; e.g. a tennis serve, dancing, and kick boxing moves).

![Figure 1: Entry point and location for the first task in the OpenSim environment](image1)

![Figure 2: One of the team members presenting himself to the others, with help of personal objects](image2)

As each participant began to type and to reveal information about his or her persona, the curtain around his or her own table began to fade automatically (the other curtains closed), thus revealing to the others the objects that illustrated the participants’ background. The presentation task lasted for approximately 10 minutes and allowed the team members to learn about each participant’s background (important information for the final task: assigning people to project roles). In the far corner of this first meeting location, the participants could see a signpost board pointing to a path that lead to the next task location (seen in Figure 1). Thus, from this first location, the participants then moved on to the second meeting place in order to discuss the project's main goals. All five team members thus walked along the path, leaving the tables and their objects behind, and re-gathering in front of a large target or bull's eye sign, a moment later.

Having arrived at the location for the second task, the participants could see another signboard indicating that they needed to discuss the project's goals. The brief instructions also indicated how to capture the main goals on the target board (see Figure 3). Again, there was a signpost and a pathway in the background that indicated where the participants needed to walk once they had completed the project scope discussion and documented it on the large bull's eye canvas. The time given for this task was also approximately 10 minutes.
After their second walk on a pathway, the participants reached the final meeting destination for the third task. This meeting spot contained four artifacts: a set of bricks representing the web development or construction role, a megaphone representing the marketing role, a white canvas representing the content and graphic design role, and a top hat, representing the project leader role. While the first three objects were fixed to the ground and connected with three color-coded lines, the top hat was placed in the middle. The participants were instructed (again with a wooden board at the entrance of the area) to position their avatar near the one or two roles that they agreed made sense for their profile (for a description of this collaboration pattern see ‘Spatial Group Configuration’ in Schmeil and Eppler 2009b; see also Friedman et al. 2007). The person that was decided to be the project leader needed to take the top hat, wear it, and also position him-/herself close to one or in between two roles (see Figure 4). In this way each participant was able to assume the relevant/matching project role(s). With this positioning, the participants had completed their final task, as well as the overall mission of the team meeting.

3.3 Measurements

Before beginning the experiment task, the participants were given a first questionnaire gathering some demographic data about them including age, gender, mother tongue, and the subjective amount of prior experience in using text chat, and in using 3D virtual environments. An accompanying sheet gave all the required information about the collaboration tasks, the (fictitious) project context, as well as the detailed description of one of the five profiles that was to impersonate.

The dependent variables were measured with both objective and subjective measures. In detail:

- Satisfaction: with process and with outcome. Subjective measures through a post-task questionnaire, the questions of which were oriented by pre-validated scales (Briggs et al. 2006).
- Productivity: subjective measures and open questions through a post-task questionnaire.
- Retention: quantity of recalled items, of team mates’ profiles and of team decisions made in the collaboration meeting.

Directly after completion of the collaboration tasks the participants were asked to log out of the virtual environment, or to close the text chat, respectively. They were handed a second questionnaire for subjective measurements: satisfaction with the collaboration outcome, the process, the media that was used, and the motivation/willingness to use the media for collaboration tasks again. In addition to seven-level Likert scales (Likert 1932) we used open questions to get the participants’ subjective assessments and opinions about the relatively new media of 3D CVE and its use.

The retention was measured about 20 minutes after the experiment (after a diversion task), by a questionnaire that had not been announced before. This third questionnaire included two empty tables, merely with headings that structured the recalled items. The participants were asked to fill in all the information about their team mates they could recall into the first table, and make crosses in the second table to represent the assignment of project roles to team mates, as far as they could
remember. For this first experiment in a series of experiments (as described in section 2), we decided to use questionnaires instead of longitudinal behavioral data (Yee and Bailenson 2008); we did not expect data of avatar navigation and view control to be meaningful, given that the experiment was designed without any introduction and training prior to using 3D CVE (for a discussion of these two methods of analysis see Schroeder et al. 2006).

4. Results
A first questionnaire was filled in by the participants for us to get their demographics; our subjects were 50 bachelor, master and PhD students with 11 different mother tongues, and of an average age of 25.0 years. 48 of 50 stated they had had prior experience in teamwork. We also asked about their prior experience in both the media that were to compare, yielding a significant higher result for pure text chat than for 3D environments – on a scale from -3 (no experience) to 3 (a lot of experience) the average results were 0.8 for text chat and -1.5 for three-dimensional environments or video games. This difference is graphed as the leftmost column pair in Figure 5.

The analysis of the main measurements of the experiment was done in three parts. The first part was the analysis of the second questionnaire – using descriptive statistics methods. Having used the same scale from -3 (totally disagree) to +3 (totally agree) for all items, we switched the polarization of some items for the illustration in figure 5 in a way that for every item the positive value is upwards (the higher, the better).

For the items Common Understanding (if and how fast a common understanding was reached), Personal Conflicts (if there were any conflicts that distracted from communicating and collaborating), and Perceived Performance (“I performed well” and “My team mates performed well”) the results were equal for both the experimental groups and the control groups. Satisfaction (satisfaction of both process and outcome, which yielded the same results) was rated a notch higher by the text chat groups, whereas for the item Self-Presentation (the perceived quality of the possibilities to present oneself to others in the online meeting), the results show a significantly more positive assessment by the 3D CVE groups. The Role Assignment item (if and how straightforward project roles could be assigned) showed very positive results for both conditions, with a little advantage on the side of the virtual environment condition. For Media feel/re-use (how comfortable participants were in using the media), there is an advantage for the text chat groups, as well as for the item On Topic (the perceived probability to stay on topic and not get distracted). The second significant difference that could be measured was for the item No Communication Difficulties (determining whether communication was problematic), which yielded a much more positive result for the text chat groups.

For the interpretation of these results, we have to bear in mind the novelty effect of the 3D CVE medium: the Experience with Media comparison shows that text chat is much more widespread than virtual environments, and participants’ comments also confirmed that the majority feels more comfortable in text chat, while some even stated a feeling of confusion when entering the three-dimensional virtual space. We expected this novelty effect to be visible in the questionnaire results and believe it to bias the results in favor of text chat, and indeed some observed phenomena can be explained with it. So does it seem logical that Satisfaction is biased negatively by discomfort and confusedness many participants felt that were using 3D CVE. The subjective conception of the 3D environment (which we called Media Feel) and the participants’ willingness to deliberately use the media for future collaboration tasks with colleagues or peers (Media Re-use) is also likely to be influenced significantly by the novelty effect of the 3D environment. Again here, participants commented their answers by stating that they did not feel at ease or that the medium was unfamiliar, and thus confirmed our interpretation of the novelty effect. The biggest differences in the comparison chart in Figure 5 is the better result in No Communication Difficulties and On-Topic for the text chat groups – meaning that there were more difficulties for communication in the 3D CVE groups, and that they got distracted more often, causing the effect to talk off-topic. Unfortunately, this question had no free-text comment option in the questionnaire which could have confirmed our interpretation, but the possibility of the novelty effect causing a notable bias also here seems logical. On the other hand, there are two measurements that showed a more positive value for the 3D CVE groups; firstly, the participants confirmed one of our main hypotheses, namely that the media richness and particular characteristics of a 3D multi-user environment improves Self-Presentation, and secondly, a higher satisfaction value for Role Assignment for the 3D collaboration groups was yielded. How far these measurements are biased by the novelty effect is unclear, and could thus be focus of future experiments.
The second main part of the analysis was the coding and numeric comparison of the items the participants had recalled from the meeting. In the coded results, each correctly recalled item was marked (for the age value an age interval of 8 years surrounding the actual age of the persona was interpreted as correct answer). These as correct marked items were counted and put into comparison; the results are illustrated in Figure 6. The graph shows a very clear result: the groups using 3D collaborative virtual environments could remember more items about their team mates’ profiles, for all the personas, and also about the decisions made in the role assignment task (the unit of the vertical axis denotes the number of items recalled in total). This result proves one of our main hypotheses, namely that 3D multi-user virtual environments improve the recall of information and knowledge shared or created (decided upon) in a meeting in the environment, as opposed to online text chat.
The third and last part was a qualitative content analysis of the chat logs of both media environments. Seven of ten teams communicated in English, three in the Italian language. A team meeting had a length of about 40 minutes in average, and consisted of about 1200 chat lines (these values are equal for both media). A first difference in chat usage we could observe was that participants in the 3D virtual environment entered shorter messages, but entered them more frequently than those participants in pure text chat. The use of emoticons was slightly higher in the text chat groups (7.8 emoticons in average per meeting, compared to 6.6 in the 3D CVE). The usage of capitalized text (usually for emphasis of speech, to ‘shout’) was used 2.2 times in average in the text chat, and only 0.8 times in an average virtual environment meeting. Participants were interrupted by their virtual team mates more often in the simple text chat condition (3.6 times in average, 1.0 times in CVE). We counted 14 deictic references in average in a meeting in the virtual environment (in the text chat groups, there were none – deictic references are not applicable with pure text only).

Participants further stated in the open comment sections in the questionnaires that the pure text chat was often unstructured; 3D CVE users did not comment that once. Thus, it indicates that the concept of space and the environment design we used (above all the spatial separation of tasks with pathways) helped to structure the conversation and the team meeting in general. In debriefing sessions that were held in lectures of the students’ master and bachelor programs, several participants confirmed that the several visual cues of different nature that were provided in the 3D collaborative virtual environment helped to memorize both information about the other participants and the decisions that were made during the online team collaboration meeting.

5. Limitations of this study and research outlook

For this first in a series of experiments we had only 50 participants, breaking down to five experimental groups and five control groups. Besides aiming at giving first results about the usefulness of 3D CVE for collaboration tasks we could test our environment and got valuable insights into conducting experiments with this media.

One negative outcome of the conduction of the experiment was that the presence (or rather the absence) of the class’s professor was reflected in the results of the satisfaction and the objective retention measurements. Although it occurred for the same amount of groups for the two conditions and thus should not have had too much of an influence on the results, this variable should be kept constant in future experiments. Also, another improvement would be to use pre-validated scales for the questionnaires.

Our current work is preparing to replicate the experiments with more students from classes at other universities (in Switzerland as well as in Denmark), and after that also with managers with professional experience. The analyses of these experiments will include an inferential statistical analysis (factorial analysis / ANOVA). We are also thinking of applying a thorough multi-level analysis; it might be feasible to regard both individual and team levels, once we have a higher number of participants. In another ongoing project, the ShangAI Lectures (http://shanghailectures.org) we are recording and analyzing longitudinal behavioral data of intercultural student teams collaborating in a 3D CVE; there we are also using another 3D virtual environment platform (Hasler et al. 2009).

For future work, we plan to move the focus of our research towards the design of the virtual environment and the collaboration in it. On that end, we are planning to compare different collaboration patterns in the same 3D collaborative virtual environment. In that new round of experiments we will also try to minimize the novelty effect that we believe was prominent in the presented results by training the participants in the use of 3D CVE before starting the collaboration tasks.

6. Conclusion

The presented work was a first experiment in a series of experiments, aiming to yield first empirical results to the question if 3D virtual environments can add real value to online collaboration. In spite of a noticeable novelty effect of the media which we believe has put a negative bias on the results of the 3D CVE groups, our hypothesis that being virtually embodied in a configurable 3D collaborative environment improves retention, was confirmed. Another finding was that the meetings in our virtual environment were found to be more structured. On the other hand, pure text chat was rated more positive in many subjective assessments, including communication difficulties, distraction probability, and also satisfaction with the meeting. For research, these results give motivation and purpose to
investigating collaboration in 3D virtual environments, by showing first experimental evidence that this medium brings real added value. In our belief outcomes other than retention can be evaluated using similar experiment designs. Implications of the study at hand for collaboration practice include the motivation to promote 3D CVE for collaboration tasks, and a verification of the importance of a structured design of collaboration tasks.

References


Activities and Outputs of a Clinical Faculty: an Intellectual Capital Concept Map

Belinda Wilkinson, Clare Beghtol and Dante Morra
University of Toronto, Canada
belinda.wilkinson@utoronto.ca
clare.beghtol@utoronto.ca
dante.morra@utoronto.ca

Abstract: The concept of intellectual capital (IC) was used to evaluate the activities and outputs of a university medical department. First, a conceptual framework was developed to highlight the importance of various activities as dimensions of IC. The conceptualization of IC was further developed using concept mapping (CM). The authors first considered the problem of what comprises IC and determined whether previous researchers have defined IC in terms of activities. The importance of IC, its definition as an organizational resource and activity, the link between IC and value creation and extraction activities, and the problem of the associated composition of IC taken from existing European guidelines and regulations were discussed. To begin to construct a classification of activities and outputs, the information currently employed for assessing the research, education, and related academic activities and outputs of faculty members were analyzed. Four different evaluation approaches were compared to identify the activities and outputs of a university medical department, and to consolidate the information being collected for evaluation of universities, university-affiliated research institutes, researchers within universities, and faculty within university departments into an inclusive set of activities and outputs. These were two forms of IC reporting, one used in Austrian universities and the other at a university-affiliated Swedish research institute together with two other long-established means of assessing faculty, the Research Assessment Exercise in the UK, and the faculty evaluation and promotion requirements at the University of Toronto in Canada. Education administrators’ perceptions were solicited to derive the IC used in a research faculty of a Canadian university. The results indicate that IC can be understood in terms of both activities and outputs. Clinical faculty can be expected to engage in research and its supervision, education, obtaining qualifications, clinical and professional practice, and service. Within these categories, individual activities and outputs were not considered to be of equal importance or impact. Among seventy activities and outputs, articles in internationally refereed journals was ranked as most important, whereas teaching awards was ranked as having the most impact by the most participants. This study extends existing research by using CM to generate a conceptual framework of IC for a department of medicine.

Keywords: intellectual capital, guidelines, concept mapping, university medical department, clinical faculty, education administrators

1. Introduction

Intellectual capital (IC) is a major source of competitive advantage for any organization. Since the beginning of the 1990s, a number of researchers have defined, classified, and measured IC to examine relationships among its components and its influence on performance in organizations (Castellanos, Rodríguez, & Rangelov 2004; Leliaert, P.J.C., Candries, W., & Tilmans, R. 2003; Menor, Kristal, & Rosenzweig 2007). While there is still no generally accepted conceptual framework, new guidelines for reporting IC within organizations have been published. The MERITUM (Measuring Intangibles to Understand and Improve Innovation Management) guidelines represent an important consolidation of IC research (MERITUM Project 2002).

IC research, however, is still in the exploratory phase with no consensus on its meaning. Karl-Heinz Leitner (2004) is among a group of researchers currently investigating IC in European universities. Austria is the first country in the world to introduce compulsory IC reports for their universities. In a study of the specifics of IC reporting in Austrian universities, he states that IC reporting “…focuses on the identification of various forms of IC and tries to link them to outputs of the universities” (p. 137).

In light of the theoretical and empirical evidence, it is suggested that entire universities and departments in North America may not understand the use of IC and, in particular, the need to identify and manage their IC. The primary purpose of this study is to investigate the composition of IC in universities. The conceptual framework in Figure 1, adapted from models by Cañibano et al. (1999), Castellanos, Rodríguez, and Rangelov (2004), Martinez-Torres (2006), Menor, Kristal, and Rosenzweig (2007), and the MERITUM Project (2002), will be used to understand the importance of activities and outputs relative to other dimensions of IC. We propose that activities undertaken in
universities to create, disseminate, and use knowledge (e.g., research and education) and to develop operating capabilities (e.g., process changes and innovation) are an important part of IC.

Figure 1: A framework of intellectual capital, capabilities, performance, and value

The primary research question raised in this study is what are the activities and outputs which comprise the IC of a Canadian university medical department.

- Is understanding the identification and measurement of IC considered useful?
- Is there any attempt being made to identify and measure IC?
- What data are currently available?
- What are the possible groupings of IC activities and outputs?
- How are these activities and outputs rated in terms of importance and impact?

2. Literature review

2.1 Importance of Intellectual Capital

The nature and value of IC and intangibles within organizations as a source of competitive advantage, although said to be extremely important, is not well understood (Bontis 1999; Swart 2006). In a review of the literature since 1997, Kaufmann and Schneider (2004) found that IC research “…is characterized by a large variety of views and interpretations—dominant schools of thought have yet to develop” (p. 366). Underlying the range of views and interpretations held by economists, accountants, managers, and researchers are the problems of the composition and measurement of a conceptual asset, not immediately embodied in physical form, which is intended to generate value. Patrick H. Sullivan (2000) refers to value creation as “…the generation of new knowledge and its conversion into innovations…” and value extraction as “…converting created value into a form that is useful to the organization…this often involves…cash or...some form of strategic position” (p. 226). To link IC to value creation and extraction processes, several international and intergovernmental organizations and national governments, mainly in Europe, have taken the lead in sponsoring the development of guidelines and regulations for reporting on IC.

2.2 Defining Intellectual Capital as an organizational resource and activity

The term IC was introduced by John Kenneth Galbraith in 1969. Interest in the nature of intangibles, considered by some to be analogous to IC, can be traced much further back to Yang in 1927 (in European Commission 2003: 15). Awareness of the increasing importance of investments in intangibles and IC within organizations has been followed by attempts in many fields to define and classify these terms as a basis for generating new information. In a review of major publications between 1997 and 2003, Kaufmann and Schneider (2004: 374) found that definitions for IC and related terms all can be characterized as being broad “…very abstract…and offer little help for practitioners or researchers”. Past literature reviews (Brennan & Connell 2000; Cañibano, García-Ayuso, & Sánchez 2000; Kannan & Aulbur 2004; Petty & Guthrie 2000) and recent guidelines and regulations on IC reporting agree on the knowledge and value attributes of IC.

Current research suggests that in thinking about the composition of IC it is the interrelationships and interactions between resources and activities that are important. Table 1 shows definitions and example of the terms intangible resources, intangible activities, and critical intangibles from the MERITUM guidelines on IC reporting. In this study, the concept of IC is perceived as a knowledge-based asset which exists in different states within an organisation; as either an intangible resource (an immaterial, embodied, objectified, or static state) or an activity (a dynamic state of transformation) of value that can be measured in terms of indicators.
Table 1: Definitions and examples of the terms intangible resources, intangible activities, and critical intangibles from the MERITUM project (2002) guidelines

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definitions</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intangible resources</td>
<td>“…the stock or current value of a given intangible at a certain moment in time. They may or may not be expressed in financial terms” (p. 65)</td>
<td>Worker competencies (HC), intellectual property rights (SC), agreements with suppliers (RC)</td>
</tr>
<tr>
<td>Intangible activities</td>
<td>“…imply an allocation of resources aimed at: a) developing internally or acquiring new intangible resources, b) increasing the value of existing ones, or c) evaluating and monitoring the results of the former two activities” (p. 65)</td>
<td>Training (HC), R&amp;D (SC), Employee surveys (RC)</td>
</tr>
<tr>
<td>Critical intangibles</td>
<td>“…the main factors, the key drivers, which contribute most to the value creation process. They embrace the core competencies the company possesses or needs to develop in order to attain its objectives” (p. 68)</td>
<td>Increase market share</td>
</tr>
</tbody>
</table>

2.3 Linking Intellectual Capital and value creation and extraction activities

2.3.1 The role of Intellectual Capital in organizations

Organisations require a stock of knowledge-based resources to function. The value created and extracted from resources by means of investments in, for example, research and education, is largely unmeasured. It is understood that organizations invest in IC to increase knowledge, reduce uncertainty, gain first access to market advantages, and create scalability and network effects (European Commission 2003). Realisation of the importance of valuing and measuring IC has emerged with the recognition of the existence of a large unquantified stock of intangibles that may be more beneficial to production and growth than cash, fixed capital, and tangible assets. It is not only the stock of resources which is of importance, but its use as a means of creating and extracting value (Hunter, Webster, & Wyatt 2005; MERITUM Project 2002; Sullivan 2000).

2.3.2 IC Reporting

A generally accepted means of analyzing IC in organisations for determining value does not exist. Guidelines for IC reporting are part of the ongoing effort to understand IC and find a means of generating comparable data. IC reporting for organizations is unique among instruments devised for management in that it is not based on measuring results by indicators (performance management) or assessing efficiency and effectiveness (evaluation), but the identification, measurement, and management of IC or intangible resources and activities (Leitner 2004).

2.4 The problem of the composition of Intellectual Capital

2.4.1 An overview of the European Intellectual Capital report

In the last decade, various guidelines and regulations for IC reporting have been developed for organisations in order to report information on IC that are not dealt with in financial statements or management reports. Prominent among the many sources of guidelines and regulations for IC reporting in Europe are the MERITUM Project, various accounting standard-setting bodies, and several governmental agencies, such as in Austria, Denmark, France, Germany, and Spain. Denmark was the first country in the world to publish a national guideline for IC statements in 2000, followed by legislation in 2001 that requires companies to disclose information on IC in their management reports. There is some agreement that the MERITUM guidelines contain the strongest and most rigorous conceptual framework (Guimón 2003). The MERITUM guidelines were selected here for comparison with the Austrian regulation for IC reporting to explore the role of IC in universities.

2.4.2 The MERITUM guidelines

In 2002, the MERITUM Project published guidelines for the management and reporting of information on intangibles. The guidelines were the result of research between 1998 and 2001 on intangibles (Bukh & Johanson 2003). Researchers from Denmark, Finland, France, Norway, Spain, and Sweden
participated in the MERITUM Project, directed by M. Paloma Sánchez, professor of applied economics, Autonomous University of Madrid.

2.4.3 The Austrian regulation on university Intellectual Capital report

Each Austrian university began publishing IC reports annually from 2006. The IC report is one of several reports in a complex university reporting system that is a consequence of the restructuring of the educational and legal framework of universities.

2.4.4 Intellectual Capital composition

In both the MERITUM guidelines and Austrian university regulation, the question of what IC is composed of is answered in terms of broad categories. In conceptualising IC, the guidelines identify and define different types of intellectual capital and intangibles, namely human capital (HC), structural capital (SC), relational capital (RC), intangible resources, intangible assets, intangible activities, and critical intangibles. The difference between intangible resources and intangible activities is of central importance to understanding the nature and composition of IC. Intangible resources classified as assets and skills are static and measurable at any given time. Intangible activities are dynamic and involve the allocation and use of intangible resources.

The Austrian regulation on university IC reports groups information on IC into three broad categories—IC, core processes, and the output and impact of core processes. The Universities Act 2002 states that an IC report “…shall, as a minimum, present in itemised form:

- the sphere of action, social goals and self-imposed objectives and strategies;
- its intellectual capital, broken down into human, structural and relationship capital;
- the performance processes set out in the performance agreement, including their outputs and impacts” (s. 13).

In these two IC reporting concepts, IC is depicted as either a network of intangible resources and activities or a portfolio of inputs, processes, outputs, and impacts. It is questioned, here, whether inputs and outputs can be clearly demarcated, whereas the distinction between resources (i.e., assets and skills) and activities may be a more suitable structure for the identification of IC.

3. Methodology

IC research is still in its infancy. Recent applications of concept mapping (CM) suggest that this is a method uniquely suited to identifying and classifying the dimensions of IC (Burke et al. 2005). This study deals with the use of the IC of a university department and an exploration of education administrators’ perceptions of the activities and outputs of a clinical faculty. This is the first use of CM to consider the components of IC in a university medical department. The Trochim approach of CM was used to structure the collection and analysis of the data for this study. In brief, there are six phases in this form of CM: (1) preparation, (2) generation, (3) structuring, (4) representation, (5) interpretation, and (6) utilization. Below, we describe how each phase was adapted to address the primary research question.

3.1 Preparing for Concept Mapping

In the first stage of CM, the major research question was decided and participants selected. We focused on activities that develop new or improve existing resources together with outputs because of the difficulty in demarcating activities from outputs. Given our primary interest in what comprises the IC of a university medical department, we selected senior academic medical education administrators at the University of Toronto (U of T), Canada, as the study population. These persons are policy makers, decision makers, educators, and researchers. The sample consisted of twenty-four participants from the Faculty of Medicine. Seven of 24 (29%) participants responded.

3.2 Generating a list of knowledge-based activities and outputs of clinical faculty

The first research goal was to quickly generate a list of activities and outputs of a university medical department. The focus statement used for generating the list was: “A specific activity or output that a clinical academic undertakes to acquire, produce, or increase the medical department's stock of intangible resources (e.g., knowledge, internal processes, and industry relationships) is...”
It is believed that an agreed classification system with shared meanings is a key component of an IC conceptual framework. The information currently employed for assessing activities and outputs for universities was analyzed from four sources: 1) the Austrian government’s (2006) Regulation on Intellectual Capital Reports for universities, 2) the British Medical Association’s (2005) report entitled Research Assessment Exercise 2008 - Survey of Clinical Academics and Research Staff, 3) the Intellectual Capital Report 2004 of the Center for Molecular Medicine, Karolinska University, Sweden, and 4) the internal faculty evaluation and promotion documents of the Department of Medicine (DOM), U of T, published on their Career Advancement website. These four different forms of evaluation were compared to identify distinctive activities and outputs, and to consolidate the information being collected into an inclusive set of seventy items.

3.3 Structuring the activities and outputs

Structuring tasks involved obtaining the participants’ perceptions of a consolidated list of seventy activities and outputs of the clinical faculty. For data collection, each participant received access to the CM questionnaire online. The first structuring task was to obtain groupings of the activities and outputs. For the grouping task, participants received the following instruction: Group these activities and outputs according to a common concept or in other words “place the items into piles in whatever way makes sense to you” (Kane & Trochim 2007). Next, participant ratings were collected on two measures of interest: importance and impact. Participants were given a Likert-type scale with ‘1’ indicating little importance or impact, ‘2’ indicating some importance or impact, ‘3’ indicating medium importance or impact, ‘4’ indicating much importance or impact, and ‘5’ indicating a lot of importance or impact.

The research protocol received approval by the Social Sciences, Humanities and Education Research Ethics Board at the U of T prior to recruitment. Informed consent was obtained from the participants at the start of data collection. Each participant received a monetary reimbursement of $10 for their contribution.

3.4 Representation, interpretation, and utilization

Concept Systems (CS) software was used to collect and analyze the participant data using multidimensional scaling (MDS) and hierarchical cluster analysis (HCA) and to represent it in the form of various concept maps and quantitative summaries. MDS locates items as separate points on a map with items closer to each other showing stronger affinities. HCA partitions items into clusters. Average ratings were computed for each item and cluster. The two ratings were compared and analyzed using pattern matching and go-zone graphs.

4. Grouping and rating of clinical faculty’s activities and outputs

CM structuring “…yields a conceptual framework for how a group views a particular topic or aspect of a topic” based on data about the similarity and rating of a set of items (Galvin 1989; Trochim 1989 cited by Burke et al. 2005: 1393).

4.1 Point and point cluster maps

The point map of the seventy activities and outputs of the clinical faculty is shown in Figure 2. A stress value of 0.2263 implied that the point map is a close approximation of the group similarity matrix. The point map has a point for each item. Their proximity (not exact location, but distance between them) shows items most likely to have been grouped together by participants.

The next analysis of the sorted data was a grouping of the activities and outputs to reflect similar concepts using HCA. The type of HCA used was Ward’s HCA which partitioned the X-Y MDS scaling coordinate values into clusters on a point cluster map. Figure 3 shows the activities and outputs grouped into 6 clusters on the point cluster map. The authors chose the number of clusters based on the average number of groupings and an examination of the items being merged by participants. Each cluster contains activities and outputs that were most likely to have been grouped together by participants. Together, the point and point cluster maps constitute the conceptual framework generated. A list of the activities and outputs in each cluster is given in Table 2. Based on an analysis of the cluster labels provided by the CS core program, the contents of each cluster, and the suggested labels of the participants, the terms that seem to best describe the 6 clusters are (1)

Figure 2: Activities and outputs point map

Figure 3: Activities and outputs point cluster map

4.2 Point and cluster ratings

Participants were asked about the level of importance and impact they attached to the seventy activities and outputs. Importance refers to how important the activity or output is for the purpose of assessing the performance of the clinical faculty. The average levels of importance ranged from 2.14 to 5. Publications: Articles in international refereed journals (53) was ranked as most important with an average importance rating of 5 by participants, followed by Publications: Research papers (4) with an average importance rating of 4.86. An additional 24 items were also ranked highly (i.e., of much and a lot of importance). Impact refers to how the activity or output gives rise to results which contribute to a department’s strategic objectives and are measurable. The average levels of impact ranged from 2.43 to 4.86. Teaching awards (11) was ranked as having the most impact with an average impact rating of 4.86 by most participants, followed by Publications: Articles in international refereed journals (53), Publications: Research papers (4), Number of hours of formal teaching (i.e., scheduled) (29), and
Belinda Wilkinson, Clare Beghtol and Dante Morra

Honour, prizes, or awards received (32) each with an average importance rating of 4.71. An additional 23 items were also ranked highly (i.e., of much and a lot of impact). Participant ratings were combined with the multivariate analyses to produce aggregated average ratings for each statement and cluster. First, the importance and impact ratings were averaged for each statement and then the ratings were averaged for each cluster as shown in Table 2. The Research Supervision cluster received the highest importance rating. Research Supervision was followed by Education, Research, Qualifications, and Clinical and Professional Practice all considered of medium importance and Service of some importance. The Education cluster received the highest impact rating. Education was followed by Research Supervision considered of much impact, and Research, Qualifications, Clinical and Professional Practice, and Service all considered of medium impact.

Table 2: The seventy activities and outputs grouped in six clusters with average importance and impact ratings

<table>
<thead>
<tr>
<th>Activities and Outputs (Item Numbers)</th>
<th>Importance Rating</th>
<th>Impact Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publications: Articles in international refereed journals (53)</td>
<td>5.00</td>
<td>4.71</td>
</tr>
<tr>
<td>Publications: Research papers (4)</td>
<td>4.86</td>
<td>4.71</td>
</tr>
<tr>
<td>Number of grants (50)</td>
<td>4.57</td>
<td>4.29</td>
</tr>
<tr>
<td>Investigator of ongoing evaluated research and development projects funded by the university (33)</td>
<td>4.43</td>
<td>4.14</td>
</tr>
<tr>
<td>Research fellowships (51)</td>
<td>4.43</td>
<td>4.00</td>
</tr>
<tr>
<td>Investigator of ongoing research and development projects supported by third-party funds (26)</td>
<td>4.29</td>
<td>3.57</td>
</tr>
<tr>
<td>Type of grants obtained: Local, pharmaceutical (9)</td>
<td>4.29</td>
<td>3.71</td>
</tr>
<tr>
<td>Type of grants obtained: Government (23)</td>
<td>4.14</td>
<td>4.29</td>
</tr>
<tr>
<td>Publications: Editorials (46)</td>
<td>4.00</td>
<td>4.14</td>
</tr>
<tr>
<td>Publications: Authored Books (24)</td>
<td>4.00</td>
<td>3.71</td>
</tr>
<tr>
<td>Publications: Systematic reviews (21)</td>
<td>4.00</td>
<td>3.86</td>
</tr>
<tr>
<td>Committees: Editor, editorial board (6)</td>
<td>3.86</td>
<td>3.57</td>
</tr>
<tr>
<td>Type of grants obtained: Other (15)</td>
<td>3.71</td>
<td>3.43</td>
</tr>
<tr>
<td>Publications: Reviews (47)</td>
<td>3.71</td>
<td>3.86</td>
</tr>
<tr>
<td>Financial value of grants (43)</td>
<td>3.57</td>
<td>3.71</td>
</tr>
<tr>
<td>Committees: Trial steering (14)</td>
<td>3.43</td>
<td>2.86</td>
</tr>
<tr>
<td>Type of grants obtained: Charities (25)</td>
<td>3.29</td>
<td>3.86</td>
</tr>
<tr>
<td>Patents awarded (20)</td>
<td>3.29</td>
<td>3.00</td>
</tr>
<tr>
<td>Other research (66)</td>
<td>3.14</td>
<td>2.71</td>
</tr>
<tr>
<td>Publications: Other (45)</td>
<td>3.14</td>
<td>3.29</td>
</tr>
<tr>
<td>Committees: Data monitoring (62)</td>
<td>3.14</td>
<td>2.86</td>
</tr>
<tr>
<td>Councils: Research society (1)</td>
<td>2.86</td>
<td>2.57</td>
</tr>
<tr>
<td>Number of reviews performed by ethics committees (41)</td>
<td>2.86</td>
<td>3.29</td>
</tr>
<tr>
<td>Public involvement in research activities (42)</td>
<td>2.86</td>
<td>3.29</td>
</tr>
<tr>
<td>Number of patients involved in clinical trials, performance assessments and other clinical studies (63)</td>
<td>2.57</td>
<td>2.71</td>
</tr>
<tr>
<td><strong>Average:</strong></td>
<td><strong>3.74</strong></td>
<td><strong>3.61</strong></td>
</tr>
<tr>
<td>Activities and Outputs (Item Numbers)</td>
<td>Importance Rating</td>
<td>Impact Rating</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Research student supervision: Dissertations completed (59)</td>
<td>4.57</td>
<td>4.14</td>
</tr>
<tr>
<td>Research student supervision: PhD (13)</td>
<td>4.57</td>
<td>4.29</td>
</tr>
<tr>
<td>Research student supervision: MD (68)</td>
<td>4.29</td>
<td>4.14</td>
</tr>
<tr>
<td>Number of presentations held as invited speaker or selected presenter at scholarly events (38)</td>
<td>4.29</td>
<td>4.14</td>
</tr>
<tr>
<td>Research student supervision: Funded for research and development projected supported by university or third-party funds (10)</td>
<td>4.14</td>
<td>4.00</td>
</tr>
<tr>
<td>Presentations (70)</td>
<td>4.00</td>
<td>4.14</td>
</tr>
<tr>
<td>Research student supervision: UG (28)</td>
<td>4.00</td>
<td>3.86</td>
</tr>
<tr>
<td>Research student supervision: MSc (3)</td>
<td>3.86</td>
<td>4.00</td>
</tr>
<tr>
<td>Number of graduate students (17)</td>
<td>3.86</td>
<td>4.29</td>
</tr>
<tr>
<td>Research student supervision: BSc (52)</td>
<td>3.71</td>
<td>3.29</td>
</tr>
<tr>
<td><strong>Average:</strong></td>
<td><strong>4.13</strong></td>
<td><strong>4.03</strong></td>
</tr>
</tbody>
</table>

**Education**

<table>
<thead>
<tr>
<th>Activities and Outputs (Item Numbers)</th>
<th>Importance Rating</th>
<th>Impact Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching awards (11)</td>
<td>4.71</td>
<td>4.86</td>
</tr>
<tr>
<td>Number of hours of formal teaching (i.e., scheduled) (29)</td>
<td>4.43</td>
<td>4.71</td>
</tr>
<tr>
<td>Courses taught (49)</td>
<td>4.14</td>
<td>4.29</td>
</tr>
<tr>
<td>All types of examination related activities including subject and final examinations and examinations before a committee (18)</td>
<td>3.71</td>
<td>3.86</td>
</tr>
<tr>
<td>Number of hours of informal teaching (i.e., non-scheduled, e.g., clinical teaching rounds) (8)</td>
<td>3.57</td>
<td>4.00</td>
</tr>
<tr>
<td>Preparation and reviewing of teaching contents (5)</td>
<td>3.29</td>
<td>4.14</td>
</tr>
<tr>
<td>Other educational (39)</td>
<td>2.71</td>
<td>2.86</td>
</tr>
<tr>
<td><strong>Average:</strong></td>
<td><strong>3.80</strong></td>
<td><strong>4.10</strong></td>
</tr>
</tbody>
</table>

**Clinical & Professional Practice**

<table>
<thead>
<tr>
<th>Activities and Outputs (Item Numbers)</th>
<th>Importance Rating</th>
<th>Impact Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contributions to the development of professional practice (69)</td>
<td>4.29</td>
<td>4.14</td>
</tr>
<tr>
<td>New medical treatments or diagnostic programs in progress (34)</td>
<td>4.14</td>
<td>4.29</td>
</tr>
<tr>
<td>Exemplary professional practice (12)</td>
<td>4.14</td>
<td>3.86</td>
</tr>
<tr>
<td>Treatment and care of patients (30)</td>
<td>3.43</td>
<td>4.00</td>
</tr>
<tr>
<td>University, hospital, and other positions held (58)</td>
<td>3.43</td>
<td>3.71</td>
</tr>
<tr>
<td>Committees: Universities (61)</td>
<td>3.29</td>
<td>4.00</td>
</tr>
<tr>
<td>Administration: Universities (36)</td>
<td>3.14</td>
<td>4.43</td>
</tr>
<tr>
<td>Clinical appointments (i.e., positions held) (2)</td>
<td>3.00</td>
<td>3.14</td>
</tr>
<tr>
<td>Councils: Professional (7)</td>
<td>2.86</td>
<td>2.86</td>
</tr>
<tr>
<td>Other service (54)</td>
<td>2.71</td>
<td>2.71</td>
</tr>
<tr>
<td>Administration: Other (67)</td>
<td>2.71</td>
<td>2.86</td>
</tr>
<tr>
<td>Public service: Other (65)</td>
<td>2.71</td>
<td>2.57</td>
</tr>
<tr>
<td>Number of patients (35)</td>
<td>2.43</td>
<td>3.29</td>
</tr>
<tr>
<td>Other clinical practice (44)</td>
<td>2.43</td>
<td>2.57</td>
</tr>
<tr>
<td>Other professional (not creative professional activity) (22)</td>
<td>2.14</td>
<td>2.43</td>
</tr>
<tr>
<td><strong>Average:</strong></td>
<td><strong>3.12</strong></td>
<td><strong>3.39</strong></td>
</tr>
</tbody>
</table>
Activities and Outputs (Item Numbers)

<table>
<thead>
<tr>
<th>Service</th>
<th>Importance Rating</th>
<th>Impact Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration: Educational (16)</td>
<td>3.86</td>
<td>4.43</td>
</tr>
<tr>
<td>Public service: Research leader in information meetings with patient organizations (55)</td>
<td>3.00</td>
<td>3.43</td>
</tr>
<tr>
<td>Public service: Participation in public debates (48)</td>
<td>2.86</td>
<td>3.29</td>
</tr>
<tr>
<td>Public service: Media interviews (60)</td>
<td>2.71</td>
<td>3.00</td>
</tr>
<tr>
<td>Number of completed training programs for medical specialists (64)</td>
<td>2.71</td>
<td>3.43</td>
</tr>
<tr>
<td>Other education and training received (56)</td>
<td>2.57</td>
<td>2.71</td>
</tr>
<tr>
<td><strong>Average:</strong></td>
<td><strong>2.95</strong></td>
<td><strong>3.38</strong></td>
</tr>
</tbody>
</table>

Qualifications

<table>
<thead>
<tr>
<th>Qualifications</th>
<th>Importance Rating</th>
<th>Impact Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honours, prizes, or awards received (32)</td>
<td>4.71</td>
<td>4.71</td>
</tr>
<tr>
<td>Professional innovation (31)</td>
<td>4.14</td>
<td>4.29</td>
</tr>
<tr>
<td>Professional opinion paper (37)</td>
<td>3.57</td>
<td>3.71</td>
</tr>
<tr>
<td>Spin-off company created (27)</td>
<td>3.14</td>
<td>2.57</td>
</tr>
<tr>
<td>Other creative professional activity (40)</td>
<td>3.00</td>
<td>2.86</td>
</tr>
<tr>
<td>Degrees earned (19)</td>
<td>3.00</td>
<td>3.14</td>
</tr>
<tr>
<td>Non-medical degrees (i.e., bachelors, masters or diploma degrees other than medicine) earned (57)</td>
<td>2.71</td>
<td>2.57</td>
</tr>
<tr>
<td><strong>Average:</strong></td>
<td><strong>3.47</strong></td>
<td><strong>3.41</strong></td>
</tr>
</tbody>
</table>

### 4.3 Pattern matching and go zones

The two rating variables of importance and impact were compared using pattern matching. Figure 4 shows the pattern match for importance versus impact. The figure shows that there was consensus among the participants in the rating priorities for both variables with the exception of the first two clusters Research Supervision and Education. The participants rated Research Supervision of higher importance than Education and Education of higher impact than Research Supervision. The Pearson product-moment correlation of \( r = 0.84 \) showed a strong relationship between the two ratings.

![Figure 4: Pattern match for importance versus impact](image)

**In summary, there is substantial agreement among education administrators on the following:**

- The categorization of seventy possible activities and outputs of clinical faculty as research supervision, education, research, qualifications, clinical and professional practice, and service
Publications: Articles in International Refereed Journals was the output ranked as being most important for the purpose of assessing an individual’s performance.

Teaching Awards was the output ranked as having the most impact for the purpose of giving rise to results which contribute to a department’s strategic objectives and are measurable.

The Research Supervision cluster received the highest importance rating.

The Education cluster received the highest impact rating.

For the other clusters, there was consensus in the rating priorities for both importance and impact.

Based on a comparison of the relative ratings of activities and outputs within each cluster for importance and impact, the items in Figure 5 were likely to be more important and have more impact.

Figure 5: The intellectual capital of clinical faculty in a university department of medicine as described by senior academic medical education administrators

The variables importance and impact were used to consider whether there are differences in the roles of the activities and outputs of faculty for the purpose of assessing individual and departmental performance. The results suggest that there was a perceived difference: the Publications: Articles in International Refereed Journals and Research Supervision activities of clinical faculty were most important with regard to individual performance, while the Teaching Awards and Educational activities of clinical faculty had the most impact with regard to departmental performance.

5. Discussion

This study explored the use of IC in a university department. It extends existing research about the dimensions of IC in universities by examining the possible activities and outputs of a clinical faculty in a university department of medicine and considering education administrators’ perceptions of these activities and outputs. The findings of the study are integrated to address six research questions with reference to the literature review, proposed conceptual framework for IC reporting, and CM method.

The first three research questions focused on determining whether universities understand and hold the identification and measurement of IC to be useful, whether there are any attempts being made to identify and measure IC in universities, and, if so, what data are available. The literature on IC suggests that, with some important exceptions, universities do not understand and may not hold the identification of IC to be useful. There are few studies on IC in universities. Wall’s (2005) survey of 100 public sector organizations in Northern Ireland, including 24 education institutions and boards, is a notable exception. The literature on IC in universities suggests that, if a similar survey were to be carried out in universities in North America to investigate their understanding of the term IC and perceptions of the usefulness of its identification and measurement, there would be little understanding and consensus largely due to the lack of a commonly accepted definition of the term IC.
Belinda Wilkinson, Clare Beghtol and Dante Morra

and conceptual framework. In universities, associated with this is a basic inability to characterize not only research, but education, service, third missions (relationships with industry, public authorities, and society) and related academic activities because of a lack of data (Schoen, Laredo, Bellon, & Sánchez 2007). Important exceptions are universities in Austria and researchers in universities mainly in Europe who began studying IC in universities only recently.

The literature on IC in universities can be summarized as follows:

- Few researchers are studying IC (mainly in Europe). In Spanish-led research initiatives emphasis is placed on developing universally accepted guidelines for reporting IC. One initiative—the Observatory of European Universities project—aimed to enhance the internal strategic capabilities of universities by developing a methodological framework for the characterisation of university research activities by linking strategic issues and thematic dimensions (i.e., funding, human resources, academic outcome, third mission, and governance) (Schoen, Laredo, Bellon, & Sánchez 2007).

- IC studies are still in the exploratory stage, including, for example, assessing various aspects of IC reporting (Leitner & Warden 2004; Renzl 2006; Sanchez & Elena 2006), the identification of knowledge drivers of R&D&T capital (Castellanos, Rodríguez, & Ranguelov 2004), and the identification of intangible assets comprising IC (Martínez-Torres 2006).

- Austria is attempting to redefine the way its universities view themselves from an IC perspective. Since 2006, twenty-one universities in Austria report IC annually by law. Among these are three independent medical universities established in 2004, from university medical faculties in Vienna, Graz, and Innsbruck.

- There has been recognition of the economic importance of applied as distinct from basic research since the 1970s, and recognition of IC in universities by policy makers, including national governments, the OECD, World Bank, and European Commission (European Commission 2006; Mowery & Sampat 2005; OECD 2006). This has come about due to efforts to use universities as institutions for economic development by forcing universities to become less dependent on public funding.

A literature review indicates that universities in North America do not use the term IC, but they do collect IC data to provide a link between performance and faculty evaluation and promotion or university funding. A fundamental question remains unanswered: What comprises the IC of a university (and every level within it)? To those interested in measuring and managing IC, data on activities related to IC is particularly important. We suggest that the activities (or core processes) of an organization is a group which from an IC perspective can be defined as “…an allocation of resources aimed at: a) developing internally or acquiring new intangible resources, b) increasing the value of existing ones, or c) evaluating and monitoring the results of the former two activities” (MERITUM Project 2002: 65).

The literature offers possible definitions of terms, classifications, and conceptual frameworks that universities can use to report IC. Classifications identify possible components of IC, such as human, structural, and relational knowledge-based assets. IC frameworks explain the structural relationships that may exist between, for example, resources and activities, or inputs, processes, and outputs—terms that have meaning within universities. Based on an analysis of exploratory IC research, we

- Defined IC as a knowledge-based asset which exists in different states within an organisation, as either an intangible resource or an activity of value that can be measured in terms of indicators

- Using IC frameworks put forward by Cañibano et al. (1999), the MERITUM Project (2002), and Sullivan (2000), focused on activities as an important dimension of IC in universities with outputs included because they touch on IC, are used as performance measures, and may not be differentiated from activities

- Applied the model for the analysis of intangibles developed by Cañibano et al. (1999) and the MERITUM Project (2002) to generate a list of seventy activities and outputs of clinical faculty (Table 2) from four sources: regulations for university, including medical university, IC reporting; a university-affiliated medical research institute’s IC report; a nation’s faculty research assessment exercise; and a university medical department’s faculty evaluation and promotion requirements

- Found that the specific variables differ in the literature and among the sources used to construct a list of the activities and outputs of clinical faculty in a university medical department
Assessed these activities and outputs by means of a participant-generated grouping and rating of the importance they attach to and perceived impact of each activity and output. The CM methodology was used to map participants understanding of what comprises the activities and outputs of clinical faculty. It was based on the reporting by universities, a university medical department, and a university-affiliated medical research institute of what clinical faculty are actually doing, i.e., their activities and outputs and also the literature on the topic of IC. A CM or conceptual framework of the activities and outputs of clinical faculty is reported here from the unique perspective of educational administrators at the Faculty of Medicine, U of T. In order of priority based on a comparison of importance and impact ratings, which reflect consensus of thought among participants, faculty in the Department of Medicine at U of T can be expected to engage in the following types of activities: research supervision, education, research, qualifications, clinical and professional practice, and service. In Figure 5, the top three activities and outputs within these six groups are shown (in order of priority based on a comparison of the relative importance and impact of each). In the case of a university department of medicine, the results indicate that faculty’s activities and outputs, particularly in research supervision, education, and research, are not only important for assessing the performance of faculty, but give rise to results with contribute to the department’s strategic objectives and are measurable. The study suggests that in light of existing guidelines and regulations for IC reporting, the requirements for university internal self-evaluation at the departmental level can provide data useful for IC reporting.

Using the perceptions of educational administrators to create a conceptualization of IC based partly on existing requirements for faculty evaluation and promotion or, in other words, how they account for IC, the study suggests that there is consensus of thought among participants in terms of the grouping and rating of activities and outputs which resulted in a conceptualization of one dimension of IC—activities with outputs that touch on IC mixed in. It is argued that six groups of knowledge-based activities can be used to describe the IC of the DOM at the U of T, and CM can be used to develop frameworks for conceptualizing IC in other university departments based on data about the similarity and rating of activities. Based on these findings, it is suggested that the composition of IC includes open and closed groupings; open groupings for components that can be constantly added and deleted, e.g., types of activities such as research for creating or extracting IC; closed groupings for components that explain relationships between the open groupings—but may have little meaning on their own, e.g., intangible resources and intangible activities.

5.1 Motives for using IC reporting in universities: linking the activities of academics to Intellectual Capital, value creation, and value extraction

Even though a few universities are interested in and recognize the importance of establishing indicators for measuring and managing their IC, there is still no clear understanding of IC on which to base measures. In their article, Discussing the Dynamics of Intellectual Capital in Universities: A Model for Reporting, Sánchez, Elena, and Castrillo (2007) stated that, “HE [higher education] organizations should use the Intellectual Capital (IC) framework as a heuristic tool to aid them in their new management challenges and diffuse their intangible resources and activities to their stakeholders and society at large” (p. 3). Yet, evidence is inconclusive about how best to identify, classify and measure IC for internal management reporting purposes (Brennan & Connell 2000: 213). Based on the literature, four assumptions underlying this research were that:

- a university department’s performance depends on the IC of its faculty members;
- classifying and measuring IC—resources and activities (which produce resources)—is a necessary step in measuring performance;
- demonstrating that investments in IC lead to improved performance is critical; and
- departments measuring the IC of faculty outperform departments that do not.

IC covers a broad range of resources and activities. It is widely argued that the most important component of IC is HC and, in universities, HC accounts for most of the value created. HC is described as the knowledge, skills, intellect and talent of individuals which varies in terms of its uniqueness and value (Swart 2006). In a discussion of some issues in IC reporting at the Department of Management and Tourism, University of Innsbruck, Birgit Renzl (2006) stated that “The primary objective is more transparency about activities related to intellectual capital” (p. 300). In the 2004 IC report prepared by the Department of Management and Tourism the following activities were identified: research, teaching, further training, services, commercialisation, and networking (Renzl
2006). At the DOM, U or T, elsewhere at the university, and it can be assumed at universities throughout Canada, the process of faculty evaluation and promotion assesses the performance of individual faculty by identifying elements of their research, teaching, service, and related academic activities and outputs. In this way, the capabilities of individuals are being assessed within departments and throughout the university. However, this information is incomplete—it does not show whether and how value has been created or extracted by faculty linked to strategic objectives and performance measures. Undoubtedly, these core functions are related to value. There are many end products of these activities which can be identified and valued, including publications, dissertations, patents, consulting processes, improved organizational efficiencies, and improved innovative capabilities (measured by individual and group-based performance indicators). Given that there is no common international conceptual framework for IC or guidelines for IC reporting, to begin the process of developing an IC reporting system for Canadian universities—based on the results of this study—I suggest that in Canada where faculty embody IC and universities have no prior experience in IC reporting, the activities of faculty compiled from best practices in universities for IC reporting and performance measurement, could serve as a basis for introducing universities to the concept of IC. The conceptual framework for IC reporting in Figure 1 is one possible model for the identification of IC in universities.

In examining past literature reviews on IC, many questions motivating IC research were uncovered about the need to achieve consensus on the definition and classification of IC and intangibles. The observation that universities lack an understanding of IC on which to base performance measures generates the question: “What information do education administrators have to offer that can be used in developing IC measures?” This is appropriate because education administrators are responsible not only for organizing and conducting educational programs, but also for organizing and conducting evaluations of the performance of faculty. Their experience in evaluating faculty in their teaching and research roles provides grounds for optimism about their ability to identify, measure, and manage IC. The suggestion is that education administrators have valuable information that can be used in standardizing guidelines for the managing IC because they understand everyday activities, i.e., faculty in their various education, research, and service roles; management challenges; university and departmental strategy; and indicators. They should also understand the need to invest in IC as part of a culture that understands, values, and raises the profile of IC in university medical schools and work towards standardized guidelines and metrics for IC measurement. In conceptualizing IC in universities, it seems important to not only be clear about the problems that the identification and measurement of IC can solve, but also to ground IC measures in everyday activities.

6. Conclusion

Assuming that activities defined as “...an allocation of resources aimed at: a) developing internally or acquiring new intangible resources, b) increasing the value of existing ones, or c) evaluating and monitoring the results of the former two activities” (MERITUM Project 2002: 65) comprise IC, in the DOM at the U of T where the mission statement is “We prepare future health leaders, contribute to our communities, and improve the health of individuals and populations, through the discovery, application and communiciation of knowledge” (Dept. of Medicine, Collaborating for Excellence: Strategic Plan 2005-2010: 7), based on the perceptions of education administrators, IC in a university department of medicine can be operationalized as a factor to be described and possibly measured in terms of activities. A possible application of this study is to report on activities of faculty in university departments as IC. Future research is needed to continue to explore the concept of IC by:

- Generating concept maps of the activities of other departments from an IC perspective
- Exploring relationships between strategic objectives, activities, and value to develop activity-based IC measures

There are several limitations of this study. The study focused on a very narrow aspect of a complex and not well understood concept. The CM aims to display all of the knowledge-based activities and outputs which comprise IC in a university medical department, show how these activities and outputs are related to each other, and which are more important and have the most impact. The researcher-generated list of seventy activities and outputs may not represent the entire conceptual domain of interest. And, given the small number of respondents, it is not appropriate to generalize the findings. Despite its limitations, this study is an important endeavour to better understand the concept of IC in a university department of medicine which characterizes the activities of clinical faculty as dimensions of IC.
References


University of Toronto, Department of Medicine (2008). *Career Advancement*, [online], http://www.deptmedicine.utoronto.ca/Faculty/advance.htm.


