

Measuring Knowledge: Towards a Quantitative Approach

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This is a conceptual and theoretical paper written with a view to constructing a quantitative measurement model of knowledge for the organisations. Knowledge of a firm is the total accumulated knowledge for its operational and administrative requirements. This study attempts to find out the ways of measuring knowledge quantitatively in the organisations. This paper is mainly based on literature on Knowledge Management (KM) and Strategic Management with a special emphasis to Walsh and Ungson's (1991) six-retention bins and External Factor Analysis Summary (EFAS) of Maytag as adopted by Hunger and Wheelen (2002). The exhibited approaches provide quantitative techniques of knowledge measurement in the organisations. Organisations may calculate their total possession of knowledge numerically. A quantitative technique of knowledge measurement is developed which may be explored through empirical investigations. Knowledge managers do not have any tool box like finance managers by which they (knowledge managers) may identify the availability of knowledge and quantify those knowledge resources in their organisations. The quantitative approach to knowledge measurement is not addressed in the existing Knowledge Management (KM) literature. This paper advances the knowledge management process by prefixing a new element of 'knowledge measurement' to it (knowledge management process) and also exhibits the quantitative techniques to measurement knowledge in the organisation.

Keywords: Knowledge Management, Knowledge Management Process, Knowledge Measurement

Field of Research: Management

1. Introduction

It is Francis Bacon who first familiarised us with the popular quotation "knowledge is power" in 1597. Organisational knowledge of an enterprise helps to enhance the strategic advantage over its competitors. Knowledge strength of an organisation is the total accumulated knowledge for its operational and administrative requirements. So it is imperative for organisations to manage this valuable asset. Knowledge Management (KM) is comparatively a young (Schütt 2003), emerging (Jashapara 2004; Prusak 2001; Backman 1999) and a popular segment in the dictionary of management (Nan, 2008). Several authors (Jasimuddin, Connell and Klein 2006; Jennex, 2006; Watson 2003; Webb 1998) propose different activities such as knowledge acquisition, knowledge creation, knowledge storage, knowledge transfer etc. as the components of knowledge management process. These activities are often parallel to each other and in most cases these are not also chronological. More astonishingly, the issue like knowledge measurement is neither addressed in the existing Knowledge Management (KM) literature nor any endeavour is made by KM gurus (Nonaka and Takeuchi 1995; Szulanski 2000; Hansen 1999; Hansen, Nohria and Tiernary 1999; Grant 1996; Argote 1999; Scarbrough 2002, 2003; Abdullah, 2006; Hasnain and Jasimuddin 2012; Jasimuddin, Connell and Klein 2006) to incorporate such a vital element in the KM process. In this regard it may be mentioned that,

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Berghout and Remenyi (2003) analysed some 298 conference proceedings (10 years) of European Conferences on IT Evaluation (ECITE). It is understandable that the presenters failed to address the knowledge measurement issues there.

As a crucial element of knowledge management process, it is imperative to address the issue of knowledge measurement. So this paper works on the following central research question: 'How can we quantitatively measure knowledge in the organisation?'

In corporate environment, finance managers have tools like ratio analysis, budgeting, control of the financial resources etc. But Knowledge managers do not have any tool box as such (Probst, 1998) which could be used to identify and quantify the availability of knowledge resource in the organisations. It can be argued that organisational knowledge can be measured quantitatively and an organisation may have a clear idea about its total knowledge strength to achieve its objectives. Knowledge measurement can be treated as the first and foremost functioning in the chain of KM process. By definition, "Knowledge Measurement" is the technique of finding out the current accumulated knowledge strength of an organisation. All other activities of KM process such as, knowledge acquisition, knowledge creation, knowledge storage, knowledge transfer, use and disposal of knowledge will follow knowledge measurement. Correct Knowledge measurement may ensure correct forecasting.

This paper is organised in the following order: Section-1 focuses on the introductory issues consisting of the opening narratives, research question, motivation behind the study etc. Section-2 exhibits organisational knowledge banks. This section is the crux of the whole article and consists of (i) individuals' knowledge banks (ii) knowledge bank in culture (iii) knowledge bank in operations (iv) organisational culture as a knowledge bank (v) ecology as a knowledge bank (vi) external knowledge bank (vii) calculation. Section-3 concludes the article and also shows the approaches to explore for the future researchers.

2. Organisational Knowledge Banks

Organisational knowledge bank which may be compared with a human brain is the reservoir of all knowledge of an organisation. The knowledge bank contains all the information and knowledge (current, new, old etc). It also gives the directions for action and it always remains hungry for more information and knowledge. The knowledge that resides within the individuals (or groups of individuals in an organisation) is called the stocks of tacit organisational knowledge and outside the human brains contains codified and explicit organisational knowledge and includes formal policies and procedure, manuals and computer files, which is external knowledge stock (Alavi and Tiwana 2003). Walsh and Ungson (1991) formulate the structure of organisational knowledge stock showing individuals, culture, transformation, structures, ecology and external archives as the crucial knowledge retention bins in the organisation. I argue that these retention bins are the pockets where knowledge residing in the bins can be quantified. Drawing on the work of Walsh and Ungson's (1991) above mentioned six-retention bins and External Factor Analysis Summary (EFAS) of Maytag as adopted by Hunger and Wheelen (2002), a quantitative technique of knowledge measurement may be developed.

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2.1 Individuals' Knowledge Bank

Individuals are the source of knowledge in the organisations (Zack 1999). There is no alternative to the experienced, knowledgeable and qualified employees in the organisations. Individuals' professional knowledge, experience, skills, service length and education have significant impacts on the knowledge stock of the organisation. Individuals bank knowledge from their observations and experiences in the organisations (Walsh and Ungson 1991). Researchers (Jasimuddin 2005) comment that individual knowledge is tacit in nature and difficult to measure quantitatively. However, such knowledge may be traced from the activities and contributions of the employees to actions in the organisations.

2.2 Knowledge Bank in Culture

Culture is the reflection of the past experiences for solving the present problems. It follows the "learning and transferring" technique (Walsh and Ungson 1991) and gradually turns into traditions. Culture differs from organisation to organisation. Organisation's norms, values, practices, language, symbols, gossips knowledge management activities and practices are included in the culture of an organisation. The list of the elements differs from organisation to organisation. These elements are the depositories of knowledge.

2.3 Knowledge Bank in Operations

Operational domain is the paradise for knowledge to reside. In the operational activities transformation is the crucial process. 'Transformation' is used to refer the process that helps the conversion of given inputs into outputs of predetermined specifications for serving the needs of the prospective users. Transformation takes place throughout the organisation (Walsh and Ungson 1991). So it poses difficulties to grab knowledge from the transformation process. However, a thought over the entire transformation process will help to clarify the ambiguity. Input, processing and output are the elements of transformation process (Slack, Chambers and Johnston 2004). Here knowledge is attached with the raw materials, semi-processed goods, finished products, machines, etc. Additionally, knowledge also resides in the Standing Operating Procedures (SOPs), instructions, programmes, policies, training, systems, procedures etc. in the organisations.

2.4 Organisational Structure is Knowledge Bank

Organisational structure is the bridge between the individual role behaviour and the environment. Individual roles are treated as a part of knowledge bank where organisational knowledge inhabits. Written and unwritten individual charter of duties, individual interactions and behaviour with the environment and management styles are also the warehouses of knowledge.

2.5 Ecology as Knowledge Bank

Office settings and layout preserve knowledge. Walsh and Ungson (1991) find "employees who worked in a densely populated, dark office reported receiving low performance feedback in a setting that is marked by high interpersonal conflict and few opportunities to develop friendships" (p. 66). The office location, settings, interior

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arrangements, similar direction to the flow of work, lighting facilities etc nourish knowledge.

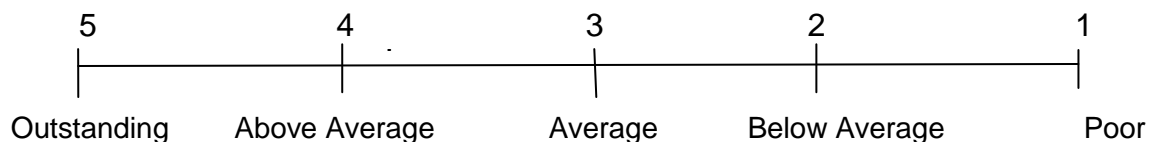
2.6 External Knowledge Banks

Ex-employees include the group of employees who are not parts of the existing workforce of the organisation. Once they used to work for the organisation. This includes the retired, the dismissed, the resigned and the discharged employees. Ex-employees' knowledge and problem solving techniques may be used to solve the present problems. It is believed that they usually possess significant amount of quality knowledge that may help to improve the performance of the organisation. Many business organisations and modern defence services (Royal Air Force, US Marine etc) maintain the list of their ex-employees (reservists' list) not only to participate in the wars and the battles, but also to provide their valuable experiences and suggestions for solving the present and future problems.

2.7 Calculation

The concept of calculation is derived from External Factor Analysis Summary (EFAS) in industry analysis model of Maytag adopted by Hunger and Wheelen (2002). Walsh and Ungson's (1991) above six retention bins (see paragraph-2 above) are used as the reservoirs of knowledge in the organisation. The calculation is based on the fictitious numbers. At the outset it should be mentioned that the allotment of numbers and points depend on the managerial judgement, organisation's objectives, mission and the type of business it is dealing with. An impartial distribution of points and rating provides accurate knowledge picture of the organisation. Six Tables are developed against six retention bins (knowledge reservoirs/banks). In column-1 of each table items of the respective knowledge reservoir is included. In column-2, a weight to each item from 1.0 (most important) to 0.00 (not important) is assigned based on its contributions to its knowledge reservoir. In column-3, a rating to each item from 5 (outstanding) to 1 (poor) based on that particular item's contribution of knowledge to the department / organisation. Multiply the weight in column-2, for each item with its rating in column-3 to obtain that item's weighted score in column-4. Add all the weighted scores to find out total weighted score. It may be mentioned here that the accounting unit of knowledge is decided after the name of the ancient Greek philosopher Aristotle (384BC-322BC).

Figure 1: Measurement Rating



One Table is needed for each member/employee of the organisation. The calculation of an individual is exhibited here:

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Table 1: Individual Knowledge Reservoir
Name of the individual: Mr X , Production department

Col.1 items	Col.2 Weight	Col. 3 Rating	Col.4 (Col.2X Col.3) Weighted Score
1. Service length	.05	3	.15
2. Formal Education	.05	4	.20
3. Job experience	.10	4	.40
4. Knowledge about own profession	.10	4	.40
6. Individual Contribution: productivity	.10	4	.40
7. Contribution to knowledge transfer in the organisation	.10	4	.40
8. Error free work	.20	4	.80
9. Idea generation	.20	2	.40
10. Trust	.10	4	.40
Total :	<u>1.00</u>		<u>3.55</u> Aristotle

Mr. X's (of production department) weighted score is 3.55 Aristotle. Suppose, there are 20 employees working at production department. It is assumed that, 5-employees scored 3.55 each and 15-employees scored 3.20 each. So, the Individual knowledge strength of production department is: $(3.55 \times 5) + (3.20 \times 15) = 65.75$ Aristotle

Therefore, total individual knowledge in various departments is as follows:

Table 2: Total individual knowledge in the organisation (I)

Functional Areas	Knowledge (Aristotle)
Production Department	65.75
Marketing Department	60.00 (assumed)
Finance Department	62.00 (assumed)
Human Resource Department	62.5 (assumed)
Total individual knowledge in the functional areas	<u>250.25</u> Aristotle

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Table 3: Knowledge in Culture (C)

Col. 1 (items)	Col. 2 (weight)	Col. 3 (rating)	Col.4 (weighted score) (Col. 2X Col. 3)
1.Practice of using past experience to solve present problems	.30	3	.90
2. Practice of knowledge creation	.20	2	.40
3. Practice of knowledge transfer	.20	3	.60
4. Practice of knowledge implementation	.20	3	.60
5. Use of technical language in day to day activities	.05	3	.15
6. Informal meetings and gossips	.05	3	.15
Total:	<u>1.00</u>		<u>2.80 Aristotle</u>

Table 4: Knowledge in Transformation (T)

Col. 1 (items)	Col. 2 (weight)	Col. 3 (rating)	Col.4 (weighted score) (Col. 2X Col. 3)
1. knowledge in raw materials	.15	4	.60
2. knowledge in semi processed materials	.15	2	.30
3. knowledge in finished goods	.20	4	.80
4. knowledge in wasted products	.05	3	.15
5. knowledge in machines	.05	3	.15
6.knowledge in SOPs	.10	4	.40
7.training	.10	4	.40
8.procedures, programmes and policies	.10	4	.40
9. Suppliers' knowledge	.05	4	.20
10. customers' knowledge	.05	4	.20
Total:	<u>1.00</u>		<u>3.60 Aristotle</u>

Table 5: Knowledge in Structure (S)

Col. 1 (items)	Col. 2 (weight)	Col. 3 (rating)	Col.4 (weighted score) (Col. 2X Col. 3)
1. knowledge in the top management's charter of duties	.40	4	1.6
2.knowledge in middle-management's charter of duties	.20	3	.60
3. Knowledge in lower-management's charter of duties	.20	4	.80
4. knowledge in management styles	.20	4	.80
Total:	<u>1.00</u>		<u>3.80 Aristotle</u>

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Table 6: Knowledge in Ecology (E)

Col. 1 (items)	Col. 2 (weight)	Col. 3 (rating)	Col.4 (weighted score) (Col. 2X Col. 3)
1. office location	.30	4	1.20
2. interior decoration	.10	3	.30
3. settings of office furniture and fittings	.10	3	.30
4.lighting arrangements in the offices	.30	4	1.20
5. Distance and communication facilities between the offices	.20	4	.80
Total:	1.00		3.8 Aristotle

Table 7: Knowledge in External Achieves (A)

Col. 1 (items)	Col. 2 (weight)	Col. 3 (rating)	Col.4 (weighted score) (Col. 2X Col. 3)
1.retired employees' knowledge	.60	4	2.40
2. resigned employees' knowledge	.20	3	.60
3. dismissed employees' knowledge	.20	3	.60
Total:	1.00		3.6 Aristotle

**Table 8: The Accumulated Knowledge
(Consolidated knowledge in the organisation)**

Serial	Knowledge bins	Available knowledge
1.	Individuals (I)	250.25
2.	Culture (C)	2.80
3.	Transformation (T)	3.60
4.	Structure (S)	3.80
5.	Ecology (E)	3.80
6.	External Archives (A)	3.60
Total available knowledge in the organisation:		267.85 Aristotle

So, consolidated knowledge in the organisation is=

$$(I) + (C) + (T) + (S) + (E) + (A) \\ = 267.85 \text{ Aristotle (see table-8 above)}$$

(Where, I= individual knowledge, C=Culture, T=Transformation, S=Structure, E= Ecology and A= External Archives)

The total available knowledge in the organisation is 267.85 Aristotle. It may be used for various intentions by the organisations. This figure may be compared with organisation's performance. For example: An organisation's total knowledge was 267.85 Aristotle in a particular time. Its objective was to increase 5% sales in that year. But it could achieve 2% increase in sales in that year. I argue, *ceteris paribus*, 3% deficit is caused by the total knowledge (e. g. 267.85 Aristotle) or one or more items of the knowledge retention bins. Managers may improve the performance of the organisations by taking necessary steps to increase total knowledge in the organisation and also manipulating the items of the each knowledge retention bin to achieve more 3% increase in sales in next year. Additionally, by judging an organisation's knowledge strength within its functional areas, a firm can overcome its

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shortcomings and increase the competitive advantages over its competing organisations in the same industry. The outcome of knowledge measurement helps the forecasting of the present and future course of actions for organisations. So formulation of strategies, fulfilment of organisational short term and long term objectives depend on correct measurement of knowledge.

Previous studies on KM as evidenced by the above literature review have not addressed the subject matter of this investigation. This investigation has become unique as it is based on literature on knowledge management and strategic management with a special emphasis on Walsh and Ungson's (1991) six-retention bins and External Factor Analysis Summary (EFAS) of Maytag as adopted by Hunger and Wheelen (2002). Thus this research exhibits its originality and adds value.

3. Conclusion and Future Research

"Knowledge is power"- was first identified by Francis Bacon in 1597. Knowledge helps the organisations to gain competitive advantages. In the present Knowledge Management literature, the issue of knowledge measurement is ignored. Knowledge is an intangible and valuable asset for the organisations. For better control and planning of this asset knowledge managers should have some managerial tools. Knowledge management tools do not have similarities with the financial or accounting tools. An accurate calculation on the availability of accumulated knowledge in the organisation may open many new insights of forecasting and decision making. Overall knowledge strength of the organisation may be perceived through this calculation. Knowledge calculation may also help the managers to put the right person at the right position. This paper is not beyond limitations. The technique is not empirically examined. The numbers shown in the tables are fictitious in nature. The precision and accuracy of the results demand more micro-fragmentations of the items of the retention bins (or, new knowledge retention bins may be incorporated). Future researchers may empirically examine the model in the real world situations.

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