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ORIGINAL CONTRIBUTION

KNOWLEDGE MANAGEMENT IMPLEMENTATION IN INDIAN POWER SECTOR (GENERATION, TRANSMISSION & DISTRIBUTION) ORGANIZATIONS: AN EXPLORATORY STUDY

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ABSTRACT

Knowledge is increasingly getting important as an ingredient for business success and as a source of wealth at all levels of an economy. In fact, there is no reason but to consider knowledge as the key source of competitive advantage for an organization. Today majority of business organizations have knowledge management programmes in one form or another. Power sector establishments in India are also no exception. As power sector plays a very important role in growth & development of an economy, it can be said that knowledge management plays a very relevant role in the power sector which is evident on reviewing the available literatures on existing practices of knowledge management vis-a-vis the documented evidences of practices in the major power sector organizations in India. It is evident that Indian power sector organizations (generation, transmission & distribution) are also feeling the increasing need for successful sharing of information and having a structured knowledge pool so that power sector activities can be made more rewarding. This paper is a concept based paper (and not a survey research) which attempts to identify and highlight the application of knowledge management towards an improved functioning of Indian power sector organizations and emphasizes on scope of Knowledge Management practices in power sector organizations in its future growth and development. The focus is on understanding the areas of the knowledge management implementation process and how it can be driven to derive its benefits. The paper investigates the scope of effective implementation of a knowledge management strategy in the workplace of Indian power sector organizations, with an emphasis on creation of a learning environment by providing future directions in which human capital is best deployed not only for an enhanced organisational effectiveness but for industry up gradation that will in turn contribute for economic development of the nation.

KEYWORDS — Power sector, Information, Knowledge, Knowledge Management, Learning Environment, Technologies.

Abbreviations used in Full Paper—Knowledge Management (KM);Transmission Service Agreement (TSA);District Industries Centre(DIC); Operation & Maintenance(O&M);Mega Watt(MW); Safety, Health & Environment (SHE); Client Relationship Management(CRM);Right of Way(ROW);Central Transmission Utility(CTU); State Transmission Utility(STU);Business Intelligence (BI); Learning & Development(L&D);

1. INTRODUCTION

"Knowledge is the source of Wealth. Applied to tasks we already know, it becomes Productivity. Applied to tasks that are new, it becomes Innovation"

...Peter F Drucker (in: Management Challenges of 21st Century, Harpercollins, 1999)

Knowledge is a complex concept that attracts many philosophers, researchers of other disciplines, and practitioners. Different typologies have been developed but the only consensus is the notion that knowledge is more than just mere data and information. Wang and Noe (2010) defined knowledge as “information

processed by individuals including ideas, facts, expertise, and judgment relevant for individual, team, and organisational performance.” Davenport and Prusak (1998) defined knowledge as “A fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knower’s.”

Knowledge Management (KM) refers to the systematic process within an organization to utilize its information and expertise to improve its responsiveness, innovativeness, productivity and competence which are the essential ingredients of wealth creation. It includes organizational processes like developing IT infrastructure or information processing systems, and developing a knowledge culture in organization.

At times, it is being mistakenly assumed that knowledge management is about capturing all the best practices and knowledge that people possess and storing it in a computer system with the hope that one day it will be useful. In fact, this is a good example of what knowledge management is not about! Sound knowledge management practice is all about getting the *right knowledge*, in the *right place*, at the *right time*.

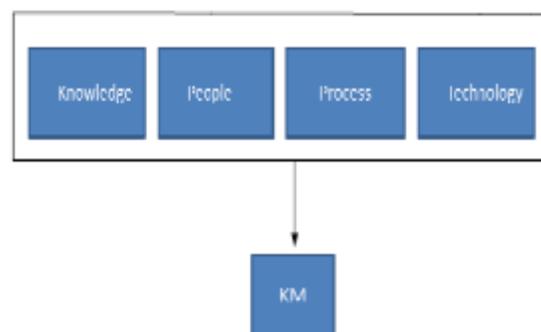
The ‘*right knowledge*’ is the knowledge that one needs in order to be able to do his job to the best of his ability, whether that means diagnosing a problem, making a decision, administering a solution, training a new colleague, interpreting a piece of research, using a computer system, managing a project, dealing with suppliers etc. Information and knowledge can usually be found in a whole variety of places – research papers, reports and manuals, databases etc. The ‘*right place*’, however, is the point of action or decision. The ‘*right time*’ is when one (the person or the team performing the work) needs it.

Key components of knowledge management

Many organisations have realized that technology-based competitive advantages are

transient and that the only sustainable competitive advantages they have are their employees and so to remain at the forefront and maintain a competitive edge organisations must have a good capacity to retain, develop, organise, and utilise their employee competencies (GroÈnhaug and Nordhaug, 1992). The realization came that processes and technology alone are not enough to drive an organisation but its human force (staff) plays a pivotal role in organisation’s success.

Therefore, in order to manage knowledge effectively, attention must be paid on to four key components: **Knowledge, People, Processes** and **Technology (KP2T)** (De’ souza 2011). In essence, the focus of KM is to connect people, processes, and technology for the purpose of leveraging knowledge.



Knowledge, the first component in KM, is described as an essential part of Knowledge Management. Baloh, Desouza, and Paquette (2011) say that without having knowledge to manage, there would be no knowledge management. Knowledge basically refers to a collection or a body of information. This could mean that the information is embedded in the form of theories, processes, systems, or it could be voiced in form of opinions, theories, ideas and analysis. Knowledge is the insight, understandings, and practical know-how that people possess. It is the fundamental resource that allows people function intelligently. In organisations, knowledge becomes embedded not only in documents or repositories, but also in organisational routines, processes, practices, norms and cultures.

The second component of KM is **people**. People are the sources of knowledge. The ability of humans to think creatively and uniquely, coupled with experiences and talents, make humans valuable sources of knowledge. People are the creators and consumers of knowledge because individuals consume knowledge from various sources on a daily basis, in addition to creating knowledge.

Baloh et al. (2011) define **processes**, which is another KM component, as mechanical and logical artefacts that guide how work is conducted in organisations. Processes govern work in organisation and so are critical to the functioning of organisation. It is therefore pertinent for a KM program to recognize their importance. Processes might be made of, and executed by, humans, machines, or a combination of the two. A critical requirement for KM is to be able to understand work processes and how to map them. By so doing, inputs, outputs, personnel, resources and work being conducted in a given process can be easily described. Mapping of processes helps to depict what is really going on in the organisation and how tasks are being accomplished.

The last component of KM is **technology**. Technology is a critical enabler and foundation element of a KM plan. With the advances in Information and Communication Technologies (ICTs), KM can be attained through technological solutions. ICTs facilitate collaboration between people and teams which are geographically dispersed. ICTs also facilitate KM activities through the codification of knowledge as well as rich and interactive forms of communication through the Internet. While technology is important and can significantly enable KM, it is pertinent to state that it is not a solution in and of itself. Technology does not make organisation share knowledge, but if people want to share it, technology can increase the reach and scope of such exchanges.

Hence, it can be said that Knowledge Management is an orderly process for generating, obtaining, producing, learning, allocating and using knowledge and understanding to achieve organizational goals.

An appropriate flow of information is indispensable for the development of every organization. Knowledge management will be playing a vital role, and those organizations that use it early will have an edge. Knowledge management is not just a technology or tool. It is more about finest practices and actions rather than pure technology. Therefore, it requires support from knowledge workers and effective use can happen only when all of them are energetically involved and committed to make it successful.

Currently with the inevitable growth and research in the field of innovation, KM has become a key factor in developing organizational competitiveness, image and social responsibility. KM includes new knowledge construction, knowledge embodiment, knowledge dissemination and knowledge use. KM is the process to critically manage knowledge to meet existing needs, to exploit existing knowledge and developing new opportunities. Knowledge management can accomplish a great deal of functions in the innovation process. The premiere function is that knowledge management enables the cohesion of tacit knowledge, the dissemination of which is critical for organization innovation capability. Institutional success, creativity and innovation depend highly on exploring, critical thinking and analysis, use of latest technology and hands on doing, which are very relevant aspects for power sector organizations too where design aspects, technology up gradation, automated fault detection, process orientation & operational skills are essential pre-requisites for project success.

While integrating the four components of Knowledge Management, the emergent paradigm need to be adhered to which speaks about:

(1) innovation (2) collective learning (3) collective learning through individual talent (4) attracting and retaining talent (5) the leader as a 'facilitator' (6) building a culture of trust and relationships (7) knowledge dissemination through networking, alliances, joint research &

study (8) reaching beyond 'the Corporation'(9) moving from confrontation to cooperation

(10) interactive collective learning, cooperation, and improved avenues towards a better quality of life (11) evaluating and selecting knowledge (12) storing and distributing knowledge, through databases, knowledge managers & workers, and events.

In the context of power sector organizations in India, it can be said that knowledge management is a topic of increasing involvements in strategic development. Management of knowledge is the most important point of new sustainable development. The awareness of importance of processing and managing knowledge is of vast importance as a focus on an application capacity of information science.

2. REVIEW OF LITERATURE

While undertaking the literature survey on KM application in Indian Power sector, it has been observed that although different studies have been made in Indian context on application of KM in Manufacturing, Engineering, Banking, Automobiles, IT sectors etc., no significantly prominent study has been made on Power sector on this aspect. A paper entitled "**Knowledge Management Processes: A Case Study of NTPC and POWERGRID**", (Global Business Review ,vol. 15 no. 1 page :151-174 March 2014, March 2014, Sage Publications) by Krishna Nath Pandey, Chief Manager (HRD), Power Grid Corporation of India Ltd, Gurgaon attempted to identify KM practices in power sector in India.

Fulfilment of this gap in research can be contributory not only for Indian Power Industry but for the Indian economy too, as power is the backbone for economic growth of a nation.

Objectives

The objective of this paper is to review both, the literature on KM and the practices relating to it in the power sector, and to offer some views about possible future directions. In order to do that, it will also be necessary to explain some of the key general knowledge management concepts.

3. METHODOLOGY

As it is a concept based paper and not a Survey research in true sense, especially support of secondary data has been taken. In collecting those secondary data, website, trade journal, company newsletter etc. were some convenient & authenticate sources.

Current Power sector structure in India : Major stakeholders

The **electricity sector (power sector) in India** had an installed capacity of 255.012 GW as on end of November 2014 and generated around 703.1 BU for the period April - November 2014. India became the world's third largest producer of electricity in the year 2013 with 4.8% global share in electricity generation surpassing Japan and Russia. Over the past 60 years or so, India has taken rapid strides in the development of the power sector both in terms of enhancing power generation as well as in making power available to widely distributed geographical boundaries. In spite of the massive addition in generation, transmission and distribution capacity over the last sixty years, growth in demand for power has always exceeded the generation capacity augmentation. Although the country has achieved capacity addition of about 1,81,500 MW over the last Six decades, peak and energy shortages of varying magnitude are being experienced.

The major stakeholders in present power sector structure in India are the following:

Ministry of Power: The Ministry is entrusted with the responsibilities of perspective planning, policy formulation, processing of projects for investment decisions, monitoring of the implementation of power projects, training & manpower development and administration and enactment of legislation in regard to power generation, transmission & distribution.

Central Electricity Authority of India (CEA): This body advises the Government on matters relating to the National Electricity Policy and formulates short term & perspective plans for the development of electricity systems.

Central Electricity Regulatory Commission (CERC): It regulates tariff; formulates policies regarding subsidies, and promotion of efficient and environmentally benign policies at central level.

State Electricity Regulation Commission (SERC): It regulates tariff; formulates policies regarding subsidies, and promotion of efficient and environmentally benign policies at State level.

Central Transmission Utility (CTU): Ensures development of an efficient, coordinated and economical system of inter-State transmission lines and undertakes inter-state transmission.

Private / PPP: Develops transmission lines on BOO model and charges for wheeling electricity within the tariffs specified by CERC/SERC.

State Transmission Utility (STU): Ensures development of an efficient, coordinated and economical system of intra-State transmission lines and undertakes intra-state transmission

Power sector in India & its role in Indian economy

“Indian Economy has witnessed rapid growth in the past decade and to sustain a similar growth

Segment-wise Impact of Electricity Act 2003 in different segments of Power

Segment	Objective	Impact
Generation	1.De-licensing of generation 2.Liberalisation in captive power policy	1.More players attracted towards generation 2.Captive generation increases
Transmission	1.Open access to transmission & distribution lines	1.Choice to choose customer/efficient transfer of power
Distribution	1.Open access in phase manner 2.Stringent penalties for power theft 3.Transparent subsidy management	1.Choice for buyer to choose supplier 2.Reduction in losses 3.Equal benefit to all

Past scenario, present changes & issues

It goes without saying that the growth of power sector is contingent to development of a robust and a non collapsible transmission network. Over the past decades, the total power capacity

trajectory of 9%, power sector needs to grow at least 8.1 % per annum”

-Planning Commission (Presently NITI Aayog)

The Indian economy has experienced unprecedented economic growth over the last decade. Today, India is the ninth largest economy in the world, driven by a real GDP growth of 8.7% in the last 5 years (7.5% over the last 10 years). In 2010 itself, the real GDP growth of India was 5th highest in the world, next only to Qatar, Paraguay, Singapore and Taiwan.

Sustained growth in economy comes with growth from all sectors, among which growth in infrastructure sector is a key requirement for growth in sectors within manufacturing and services. With in infrastructure, growth in power sector is one of the most important requirements for sustained growth of a developing economy like India. The policy landscape in India has progressively evolved since Independence and has led to radical changes in the power sector, especially in terms of competition, private sector involvement and focus on green energy over the last decade, commencing with the passing of the Electricity Act, 2003.

has witnessed commendable growth, with more than 232 GW of generation capacity currently installed in India. However, India's peak load supply is only 141 GW, and aggravating this situation further is that some

of India's power surplus regions do not have adequate power evacuation infrastructure which could alleviate the recurring supply shortages in other parts of the nation.

While the issues related to Generation and Distribution sectors, rightfully, got due focus from policy makers to industry stakeholders, Transmission which is the critical link of power supply with no fall back option got downplayed due to multiple reasons. In light of this, FICCI constituted a Task Force on Transmission with participation from various key stakeholders including developers, contractors, reputed consultants, legal firms and regulators with primary intent of sensitizing the policy makers on prevailing problems which are hampering the growth of Transmission sector. Clearly, successful PPP in transmission would be vital to meet the huge investment & capacity enhancement target in transmission. A sound Knowledge Management infrastructure will be a real facilitator in the growth & development of power sector that will include & co-ordinate with people, process & technology to derive best outcome.

Additionally, there are certain regulatory, administrative & commercial aspects, an in-depth knowledge on which are relevant in power sector and which deserves special mentioning in this context. They are as follows:

1. Securing land and clearances

Land is a basic necessity when it comes to pre-requisites for power generation & transmission projects. A lot of projects are either cancelled or delayed due to non-availability of land or difficulties in land acquisition. Another major hurdle, post identification and selection of land is securing the required clearances. There are a number of clearances required from the MoEF, Ministry of Aviation, Department of Forests and other government bodies. Past experience indicates that there are major hurdles for land acquisition and securing clearances which include the following:

- Social reasons like opposition from nearby residents due to concerns over loss of land, water and pollution;

- Resettlement and rehabilitation issues;
- Regulatory delays;
- Environmental issues like deforestation;
- State specific issues like unavailability of supporting infrastructure;
- Financial reasons resulting from rising costs of land.

2. Issues pertaining to competitive bidding

Competitive bidding in power generation and transmission is viewed as a major fundamental change – a move towards a competitive market, which would attract private sector participation and also help in discovering competitive prices in a largely regulated market. The typical duration for which companies quote their tariffs in competitive bidding scenario, is 25 years and 35 years for generation and transmission respectively. The duration is fixed considering the life of assets and the period within which companies would be able to recover their costs at reasonable tariffs. The results in competitive bids in the recent past in India indicate that the tariffs discovered have been in most cases significantly lower than regulated tariffs. There are risks associated with projects that, if the bidder does not cover/hedge, would expose the bidder to a potential downside over a 25/35 year period.

3. Change in regulation in transmission sector

Mid of 2010, CERC issued new regulation on Point of Connection (PoC) method for sharing of transmission charges of inter-state transmission services in India. Point-of-connection scheme of transmission pricing charges the participants a single rate per MW depending on their point-of-connection. According to the commercial arrangement proposed under the PoC regime, the CTU would now be responsible for collection and settle of transmission charges on behalf of all transmission service providers. This would imply that there would no more be a TSA directly between transmission service providers and the beneficiaries (DICs). The collections would be disbursed by the CTU among the

transmission service providers on pro-rata basis. The change in regime is expected to increase perceived business risk for transmission sector. Investors would no longer treat transmission as a safe business, if the issues pertaining to the change in regulation are not addressed.

4. One Nation-One Grid

The Indian Power system for planning and operational purposes is divided into five regional grids. The integration of regional grids, and thereby establishment of National Grid, was conceptualized in early nineties. The integration of regional grids which began with asynchronous HVDC back-to-back inter-regional links facilitating limited exchange of regulated power was subsequently graduated to high capacity synchronous links between the regions. Synchronization of all regional grids will help in optimal utilization of scarce natural resources by transfer of power from Resource centric regions to Load centric regions. Further, this shall pave way for establishment of vibrant electricity market facilitating trading of power across regions. One Nation, One Grid shall synchronously connect all the regional grids and there will be one national frequency.

KM application in Indian Power sector

The importance of knowledge management in organizations are on the rise and are getting included it as part of the organizational policies. The companies which have been using knowledge management processes have experienced lesser costs, saved time and better results than others which lack in knowledge management. A company's value is now not determined just by what it has done but by what its potential is. As a result many companies now show their Knowledge Capital, a measure of their KM infrastructure and employees' expertise, in their financial reports. With growing competition, it has become imperative for all companies to survive and grow, to have an effective KM strategy and Indian power transmission sector companies are no exception.

The pre-dominance of power in infrastructure industry is a pivotal one and with the emergence of knowledge economy, it is imperative to use

knowledge as an asset in power industry. Largely, knowledge-driven processes have occupied the central place in power industry as well. This necessitates that knowledge management is implemented in letter and spirit in this industry. Knowledge management processes are the most crucial part of knowledge management. To address these issues, several organizations, mainly PSU's, have formulated KM policies for themselves. To mention the Knowledge Management practices in NTPC, the largest in power sector companies in India, it says, "To meet our ultimate objective of becoming a learning organization, an integrated Knowledge Management System has been developed, which facilitates tacit knowledge in the form of learning and experiences of employees to be captured and recognizing for future reference."

Acknowledging the importance of Knowledge management, Power Grid Corporation India Limited, a central transmission utility has formulated a Knowledge management policy. Some initiatives taken under this are forming a virtual Knowledge Management cell at the corporate centre, which has professionals from all the departments, and knowledge mapping of the organization. The company has employed an intranet portal, POWERPORTAL and a database management system has also been installed which has information about employees and their expertise, notices, reports about projects completed and undergoing, new developments in the field and, manuals and e-books. To promote the knowledge culture, CoPs are formed in various domains and mentorship programs for new entrants are being conducted. The company incentivises the employees by giving Knowledge Currency Units (KCU's) for knowledge sharing. For the best CoP of year, a 'Rolling Shield' is awarded to it. The Knowledge Management cell measures the impact of the Knowledge Management policy and works to improve it.

In general, it has been observed that the KM initiatives taken by the organizations generally include ERP systems, Intranet, CRM, practices like Kaizen , 6 sigma and TQM, leadership development programs, Communities of Practice

(CoPs), incentivizing employees for knowledge sharing.

NTPC emphasises that as a result of such effective knowledge management interventions,

there is a continuous growth in generation per employee as well as value addition per employee which are reflected in the following two graphs.

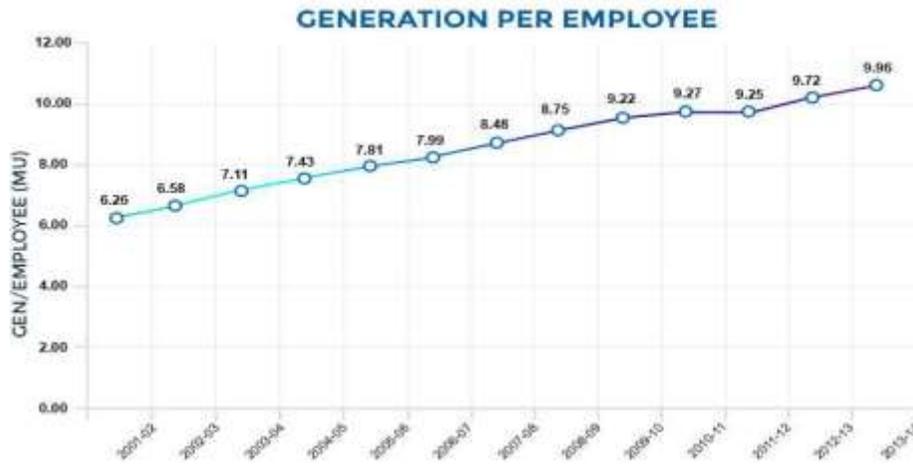


Figure 1: NTPC: Generation per Employee in MU



Figure 2: NTPC: Value Added per Employee (Rs. In Lacs)

Type of knowledge elements

The following can be treated as the essential process steps for successful KM application in Indian Power Sector:

- Step 1:** Acquiring present know-how
- Step 2:** Retention & Application
- Step 3:** Transfer of knowledge

It has been observed that some typical knowledge elements are essential pre-requisite for successful functioning in this segment, some of which can be enlisted as follows:

(A) Technical &/or Technological

1. Knowledge about technological advancements
2. Awareness about technical up gradation
3. Knowledge about design aspects
4. Knowledge relating to civil construction &

electrical engineering 5.Knowledge about survey & use of survey equipments

(B) Project Planning & Management

1. PERT/CPM
2. Project execution knowledge
3. Supply chain management & logistics etc.

(C) Commercial

1. Tendering
2. E-Tendering
3. Billing, banking & Insurance etc.

(D) Regulatory

1. Land acquisition
2. ROW issues etc.

(E) IT & ITES

1. Earthing Mat design for Substation
2. Primary Technology CAE System for CAD Design of High-Voltage Switchgear (Primtech)
3. Substation Automation Management System Software
4. Auto Cad (Graphic)
5. Electrical Analysis Software
6. E-TAP & SYMGRID (Earthing design software)
7. DIALUX (Illumination design software)
8. PIPE NET Software (Fire fighting system design)
9. SCADA (Substation Automation & Data Acquisition)

Suggestions

As the knowledge-based economy grows exponentially, the knowledge assets become valuable to the organizations. Effective use of knowledge has been crucial to the organization's survival and success in competitive global markets and has a strong potential to problems solving, decision making, organizational performance enhancements and innovation. KM and BI, need to be considered together as necessarily integrated and mutually critical components in the management of intellectual capital. KM through L&D might act as an effective tool where the following steps may play their roles:

Step 1: Standardization of Work Procedure (Covering relevant domains, in own language, with suitable examples)

Step 2: Authentication of Step 1(To convince clients)[By complying with standards like IEC(Europe),IEE(USA),IS(India)]

Step 3: During in-house training, this work procedure will be explained with examples

Step 4: These work procedures will now be implemented in projects

Step 5: Projects will provide feedback to Knowledge Hub/ Training Centers

Step 6: Knowledge Hub/Training centers will modify according to feedback at implementation stage

Some more additional steps can be useful in this regard:

1. Making a system of knowledge Audit

The term "Knowledge Audit" is in some ways a bit of a misnomer, since the traditional concept of an audit is to check performance against a standard, as in financial auditing. A knowledge audit, however, is a more of a qualitative evaluation. It is essentially a sound investigation into an organization's knowledge "health". The knowledge audit provides an evidence-based assessment of where the organization needs to focus its knowledge management efforts. It can reveal the organization's knowledge management needs, strengths, weaknesses, opportunities, threats and risks. The essential elements of such knowledge audit are: Identifying knowledge needs, drawing up a knowledge inventory, Analyzing knowledge flows, creating a knowledge map.

2. Developing a knowledge management strategy

A knowledge management strategy is simply a plan that describes how an organization will manage its knowledge better for the benefit of that organization and its stakeholders. A good knowledge management strategy is closely aligned with the organization's overall strategy and objectives.

3. Full integration of information

The life blood of every modern enterprise is information. In addition to the internal information, information from different external

sources and applications such as documents, libraries, spreadsheets, e-mail and instant messaging archives, electronic forms and records, publicly available web pages and commercial information services must be structured & archived.

4. A focused approach to innovation

There is an emerging need for a focused approach towards innovation in power sector. Innovative approaches include use of IT enabled technologies like CAD/CAM in tower design, use of GIS/GPS software in survey, introduction of new form of GIS Sub-stations, Helicopter method of stringing, use of SCADA in distribution and so and so forth. All of them are having a core focus of better service delivery.

4. CONCLUSION

It has been found that there are many initiatives for good practice of knowledge management in the sector, and some organizations, especially two major players, NTPC & Power Grid, are seen as pioneers in KM practice initiatives. However, other organizations have yet to embark on explicit KM initiatives.

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When Karl-Erik Sveiby (1997) created the first framework defining intellectual capital, he defined three elements:

1. Employee competence (the capabilities of people in an organization – its human capital);
2. Internal structure (structured or organizational capital, including patents, documented processes, computer-based data, and the vision, strategy, and policies created by leadership); and
3. External structure (customer or relationship capital – the value of a firm’s relationships with the people with whom it does business).

Considering those above stated three elements, it can be said that the quality of intellectual capital in Indian power sector will be improved by enhanced employee competence, blended with improved internal as well as external structures, finally leading towards a brighter Indian economy.

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