ADOPTION OF CHOO'S MODEL OF KNOWLEDGE MANAGEMENT FOR ENHANCING CUSTOMER'S CAPITAL MANAGEMENT IN TPDDL

Project Report

Submitted in Partial Fulfillment of the
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Submitted by
Rounaq Singh
2K14/MBA/517

Guided by
Dr. Broto Bhardwaj

DELHI TECHNOLOGICAL UNIVERSITY
Bawana Road Shahbad Delhi

Certificate of Originality

This is to certify that the project report entitled "Influence of Customer Capital Management on the performance of TATA Power Delhi Distribution Limited by the Implications of KM by using Choo's Model" submitted to **Delhi Technological University** in partial fulfillment of the requirement for the award of the degree of Master of Business Administration is an original work carried out by me under the guidance of Dr.Broto Bhardwaj. The matter embodied in this project is a genuine work done by Sanjeev Kumar to the best of my knowledge and belief and has been submitted neither to this University nor to any other University for the fulfillment of the requirement of the course of study.

Signature of the student

DECLARATION

I Rounaq Singh student of EMBA 2014-2016 batch of Delhi School of Management, Delhi Technological University, Bawana road, Delhi-42 declare that term project **ADOPTION OF CHOO'S MODEL OF KNOWLEDGE MANAGEMENT FOR ENHANCING CUSTOMER'S CAPITAL MANAGEMENT IN TPDDL** submitted in partial fulfilment of Executive MBA programme is the original work conducted by me.The information and data given in the report is authentic to the best of my knowledge.

This Report is not being submitted to any other University for award of any other Degree, Award and Fellowship.

Name of candidate with

sign_____

Place: New Delhi

Date:

ACKNOWLEDGEMENT

"The successful completion of any task would be incomplete without accomplishing the people who made it all possible and whose constant guidance and encouragement secured us the success."
I am grateful to **Dr. Broto Bhardwaj** in Delhi School of Management, Delhi Technological University, Delhi, for his astute guidance, constant encouragement and sincere support for this project work. The knowledge and values inculcated have proved to be of immense help at the very start of our career.
I feel proud and privileged in expressing my deep sense of gratitude to all those who have helped me in presenting this project.

Rounaq Singh

TABLE OF CONTENTS

1.0 Industry Background:

Power is a significant input to the economy and plays a critical role for a sustained economic growth. In order to support a rate of growth of GDP of around 5 percent per annum, the rate of growth of power supply needs to be around 8-10 percent annually.

Today, India has an installed generating capacity of around 223 GW, the world's fifth largest. Capacitive power plants generate an additional 34 GW. Non-renewable power plants constitute 87.5% of the installed capacity and 12.5% of renewable capacity.

The per capita average annual domestic electricity consumption in India in 2009 8802213192 was 96 kWh in rural areas and 288 kWh in urban areas for those with access to electricity, in contrast to the worldwide per capita annual average of 2600 kWh and 6200 kWh in the European Union. India currently suffers from a major shortage of electricity generation capacity, even though it is the world's fourth largest energy consumer after US, China and Russia. The international Energy Agency estimates India needs and investment of at least $ 135 billion to provide universal access of electricity to its population.

The growth rate of demand for power in developing countries is generally higher than that of their GDP. In India, the ratio of demand growth to GDP growth was 3.06 in the first Plan and peaked at 5.11 during third plan and came down to 1.65 in the eighties. At present, a ratio of around 1.5 is projected. Therefore, in order to support a rate of growth of GDP of around 7 % per annum, the rate of growth of power supply needs to be over 10 % annually. This is evident from ever increasing power demand of the country's vibrant economy leading to a widening gap between the supply and demand. The Government of India had an ambitious mission of 'POWER FOR ALL BY 2012'

as per which the installed generation capacity was to be at least 2, 00,000 MW by 2012 which is successfully achieved.

Power Sector, hitherto, had been funded mainly through budgetary support and external borrowings. But given the budgetary support limitation, due to growing demands from other sectors, particularly social sector and the severe borrowing constraints, a new financing strategy was required. Financial requirement for the 11th Plan for the distribution sector had been worked out as Rs.3,07,000 crore. The expenditure incurred during the first 4 years of 11th Plan period in the distribution sector is about Rs. 75,000 crore.

On the basis of the ongoing works under distribution schemes, a total expenditure of Rs. 1,00,000 crore is expected to be made at the end of 11th Plan. The target was estimated on a normative basis including spill-over of 10th Plan. However, low investment in the distribution sector has been a matter of concern. The lack of adequate investment may lead to delays in capacity augmentation/ replacement of obsolete equipments which may adversely impact the performance of the distribution sector. The need of a new financing strategy was recognized by the Government as reflected in the new policy enunciated in 1991, allowing private enterprise a larger role in the power sector of India. Now, the central government owned public sector enterprises like Rural Electrification Corporation Limited and Power Finance Corporation Limited provide loans and guarantees for public and private electricity sector for enabling smooth implementation of various infrastructure projects in India.

2.0 Formation of TPDDL:

North Delhi Power Limited (TPDDL), which distributes and supplies power in North North-West of Delhi, was set up in terms of the Delhi Electricity Reforms (Transfer Scheme) Rules 2001 whereby the erstwhile vertically integrated State Government owned Utility, viz. the Delhi Vidyut Board (DVB) was unbundled and corporatized into its functional entities like Generation, Transmission and Distribution. For an effective reorganization of the electricity sector, whereby the Sector became efficient and commercially viable by ensuring a reduction in losses through better management practices and infusion of capital investment, it was considered imperative to privatize the distribution sector in the total energy chain.

The Bid Evaluation Criteria (BEC) for allotment of Distribution Companies to the private investors was the % Aggregate Technical & Commercial (AT&C) Loss Reduction (i.e. (Units Input – Units Realized)/ Units Input) commitment over a period of five years (subsequently reduced to four years and nine months i.e. till end of FY 2007) (hereinafter referred to as the "Initial Control Period"). The privatization policy (Policy Directions) assured a 16% p.a. Return on Equity provided the annual AT&C Targets were achieved, with certain incentives for over-achievement of Loss Reduction Targets. The assured Returns were to be ensured through an innovative mechanism whereby the Privatized Distribution Companies (Discoms) were allowed to pay for Power Purchase from the Delhi Transco Limited (DTL) at their respective paying capacities, which were computed as the residual amounts available with the Discoms after covering for their expenses (other than for power purchase) and Returns. In the event of any under-achievement of Loss Reduction Targets, the entire loss of Revenue on account of lower Loss Reduction (than committed) was to the account of Discom as the Power Purchase Cost payable to Transco would be determined ignoring any lower Revenue Realization due to lower Loss Reduction.

The sorry state of the entire electricity sector in general and the risks involved in turning around the distribution sector through the public-private route can be gauged from the fact that against thirteen potential bidders who submitted their 'Expression of Interest", six purchased the bidding documents, with only two finally bidding for the three distribution companies.

Based on the above mentioned BEC whereby the TATA Group committed to reduce the AT&C Losses to at least 31.1%, the management control together with a 51% Equity stake in TPDDL was transferred to the TATA Group for a consideration of Rs. 187.68 Crore with effect from 1 July, 2002. The balance 49% Equity is held by the Government of National Capital Territory of Delhi (GoNCTD) through the Government owned, Delhi Power Company Limited (the "Holding Company").

The Company changed its name from North Delhi Power Limited to Tata Power Delhi Distribution Ltd. in Nov 2011. The new name, while signifying TPDDL's direct relationship with the Tata Power Company Limited, allows the company

to significantly leverage its TATA lineage for enhancing sustainability and growth of business.

TPDDL's utility business is governed by the provisions of license issued by the DERC for the distribution & retail supply of electricity in North & North West Delhi for a period of 25 years. The DERC regulates the working of entire power sector of the Delhi state, including determination of tariff chargeable to end consumers and establishing performance norms (mainly related to loss reduction, reliability of power supply and consumer service delivery).

The norms/targets are set by the DERC after taking into account the past performance, existing levels and current operating environment, i.e., the ground realities and prevailing norms for other power distribution utilities across the country. Further, keeping the stakeholders' interest paramount, it captures the future expectations of the general Public/Govt./Utilities etc. through a public hearing.

Electricity Distribution Model:

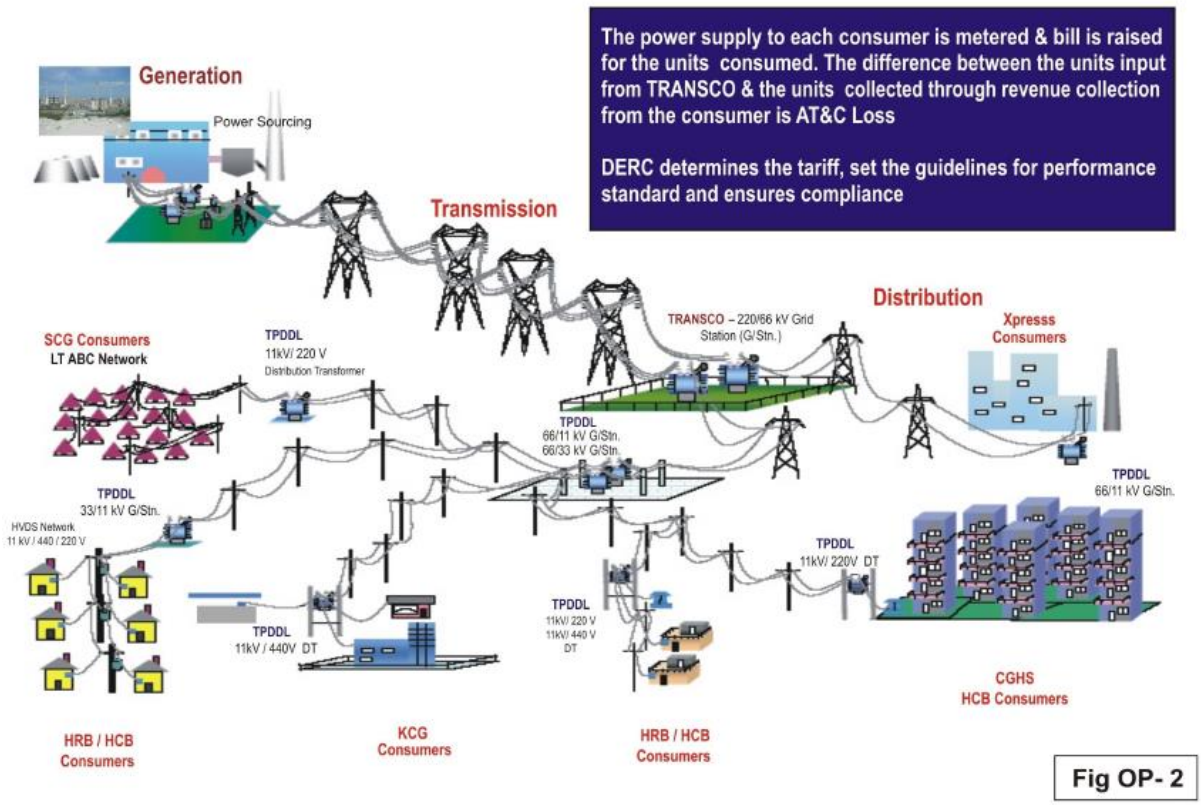

Fig OP- 2

3.0 Company Profile

TPDDL (earlier North Delhi Power Limited) was incorporated in July 2002 as a JV of Tata Power (51%) and Delhi Government (49%) on the Public-Private Partnership (PPP) model. TPDDL took over the license to distribute electricity to North & North West part of Delhi through a competitive bidding process initiated to reform the distribution sector in Delhi. The Company changed its name from North Delhi Power Limited to Tata Power Delhi Distribution Ltd. in Nov 2011. The new name, while signifying TPDDL's direct relationship with the Tata Power Company Limited, allows the company to significantly leverage its TATA lineage for enhancing sustainability and growth of business.

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across the country. Further, keeping the stakeholders' interests paramount, it captures the future expectations of the general Public/Govt./Utilities etc through public hearing sessions. In an environment where power distribution utilities across the country are reeling under heavy losses and experiencing acute power shortages, TPDDL has consistently over achieved its targets and scripted an unprecedented turnaround story. In a short span of 13 years, the AT&C loss levels have been reduced from 53% to 9.87% - showcasing one of the few success stories of the PPP model post implementation of distribution reforms. Besides, major improvements have been effected in the reliability of network and consumer services. The key differentiating factor has been the optimal and effective deployment of technology interventions through a comprehensive roadmap. Over the years, the company has received accolades in multiple areas like innovation, operational efficiency, safety, CSR, BSC & GIS implementation, policy advocacy etc.

In addition to the core licensed business, the Business Development Group was formed in 2010 to leverage TPDDL's domain expertise and provide end to end solutions to other power utilities. The Group has been offering its services through a pool of some of the best known names in the Indian Power Sector fraternity, who have played a major role in contributing to TPDDL's success. Its core competence lies in conceptualizing workable solutions and delivering immediate-to-long term sustainable results to the clients in areas of Project
Management, Technical Advisory, IT Services and Revenue Cycle Management. Further, it also provides support to Tata Power in its global expansion plans in the distribution space and prepares the organization to meet the upcoming external challenges. While TPDDL is taking initiatives to sustain its growth in licensed business, its future growth can be sustained only through new ventures/ initiatives. To create new business opportunities and to offer value added services within and outside the licensed area, a new department "Business Services Group" has been created.

This department is working towards implementing innovative ideas with major focus on Rooftop Solar Projects, ESCO Projects, EMobility charging solutions, Home Automation etc.

4.0 Organizational Environment

TPDDL is a utility which supplies *electricity* through its distribution network at regulated tariffs to all consumers in its licensed area along with providing consultancy services. TPDDL has established a 108MW combined cycle gas based captive power plant in its licensed area (Rithala).

TPDDL has been in the forefront in the adoption of latest technology in the utility sector. Together with its culture of Consumer Service Excellence, Continuous Learning, Performance Orientation, Innovation and Empowerment, it has been able to set benchmarks in accelerated reduction of AT&C losses (~80%), enhance consumer satisfaction and improve employee productivity. TPDDL's leadership had evolved an inspiring Vision,
Mission and Values in 2002-03, which have been revisited periodically and revised in 2013 to incorporate technology roadmap envisaged for the future and growth aspiration to provide services beyond Delhi's licensed area to other utilities nationally and internationally.

Growth plans of TPDDL includes load growth within licensed area (Delhi Govt's expectations), bagging and managing various consultancy assignments from different clients and complementing Tata Power's growth plan into distribution business Internationally/ Nationally (Tata Power's expectations). In order to capitalize on its core competency, enhancing employee engagement, enrichment and increase revenue in Non-regulated business, it has made a foray into IT & OT consultancy and implementation, Management Consultancy & Project Management Services & Revenue Management System both in Domestic as well as International arena. With the proposed modification in the Electricity Act 2003 where existing Distribution business will be split into Wire & Retail businesses, the BD Group is playing a key role in acquiring market intelligence and exploring possible tie up for gaining first mover advantage.
TPDDL has adopted Climate Change Policy in line with Tata Group's CC Policy. It has proactively been advocating with the regulator for driving DSM initiatives , solar rooftop, EV charging etc. TPDDL has a Safety Policy in place embedded within the IMS Policy.

5.0 Organizational Relationships and Networking

TPDDL's organization structures designed to meet the strategic objectives and business needs. TPDDL is authorized to operate only in its licensed area and plans to expand its consumer base outside its licensed area through the Open access route once the regulations are in place for segregation of Wire & Retail. TPDDL is working actively with the Govt. of India/Regulatory Bodies to develop an appropriate market design which should result in spurring competition through open access. Although DERC has defined the tariff and performance standard based on the usage and type of consumers, TPDDL's Consumer Segmentation has evolved over the years to address and cater to the differentiated needs of the consumers and business imperatives. .
TPDDL builds and nurtures ethical and value-adding relationships with its suppliers, vendors, partners etc. Supply reliability, AT&C Loss reduction and service excellence have been brought about by TPDDL with support of BAs/Collaborators and also by innovatively adapting and leveraging knowledge from members of GIUNC. BAs have been developed to assist TPDDL in innovative solutions in its work processes. Annual BA Meets, periodic meetings and BA SEEKH sessions throughout the year are organized to provide a formal platform for knowledge sharing and relationship building. TPDDL has established a BA Cell for catering to all statutory and training requirements of the BA employees – a unique concept amongst the utilities in India. This ensures skill up gradation, compliance and alignment to TPDDL's VMV. TPDDL employees also attend workshops, trade fairs and conferences to understand capabilities of existing and potential BAs.

6.0 Knowledge Management in TPDDL

6.1 Theoretical perspective

Knowledge sharing creates opportunities to maximize organization ability to meet those needs and generates solutions and efficiencies that provide a business with a competitive advantage.
Knowledge sharing occurs at the individual and organizational levels. For individual employees, knowledge sharing is talking to colleagues to help them get something done better, more quickly, or more efficiently. For an organization, knowledge sharing is capturing, organizing, reusing, and transferring experience-based knowledge that resides within the organization and making that knowledge available to others in the business. A number of studies have demonstrated that knowledge sharing is essential because it enables organizations to enhance innovation performance and reduce redundant learning efforts (Calantone et al., 2002; Scarbrough, 2003).

Figure 1: A general framework for studying knowledge sharing as follows

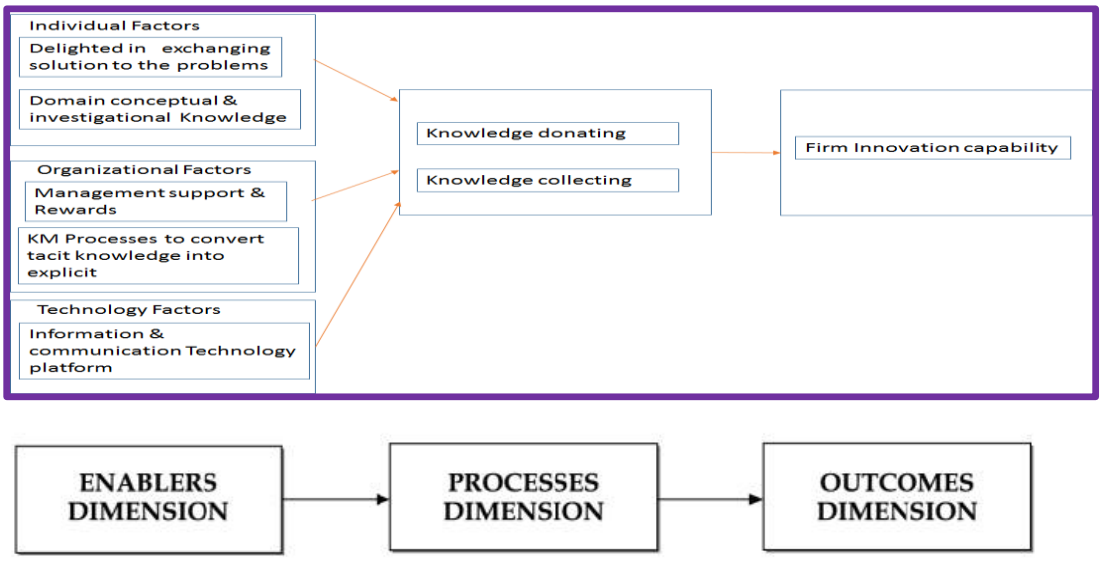


Figure 1 shows Knowledge Sharing Process in TPDDL

The nature of the role of knowledge management in innovation

Knowledge and knowledge management fulfils a myriad functions in the innovation realm.The first major role that knowledge management plays in innovation is enabling the sharing and codification of tacit knowledge. Tacit knowledge sharing is critical for organizations' innovation capability (Cavusgil *et al.*, 2003). According to Cardinal *et al.* (2001), replication of knowledge-based competitive advantage is inhibited by two factors. Causal ambiguity leads to specific practices or inputs (e.g. knowledge) for replication being unknown. Secondly, social complexity or unique firm history that produces the knowledge makes it difficult to replicate. Getting tacit knowledge from customers and suppliers is a valuable source for organizations'

innovation programs due to scarcity of such knowledge that can be used as input for innovation. Marina du Plessis also indicate that collaboration between organizations plays a significant role in sharing of tacit knowledge, which in turn positively impacts innovation capability (Cavusgil *et al.*, 2003).
The sharing of tacit knowledge as resource for innovation is especially important in developing fields where not a lot of explicit knowledge exists, such as biotechnology. Innovators in these fields combine partially codified knowledge with complimentary resources such as cross-functional teams or learning-bydoing capabilities, which leads to new product and process innovations (Cardinal *et al.*, 2001).
Cardinal *et al.* (2001) indicate that, in situations where a lot of tacit knowledge is used for innovation, collaboration between cross-functional teams is essential. Such interactions produce the routines that create new "recipes". However, the knowledge in these "recipes" is not necessarily codified, but often stays within the innovation and operational teams' routines and skills. Knowledge management can assist in the accessibility of such tacit knowledge and the codification thereof.

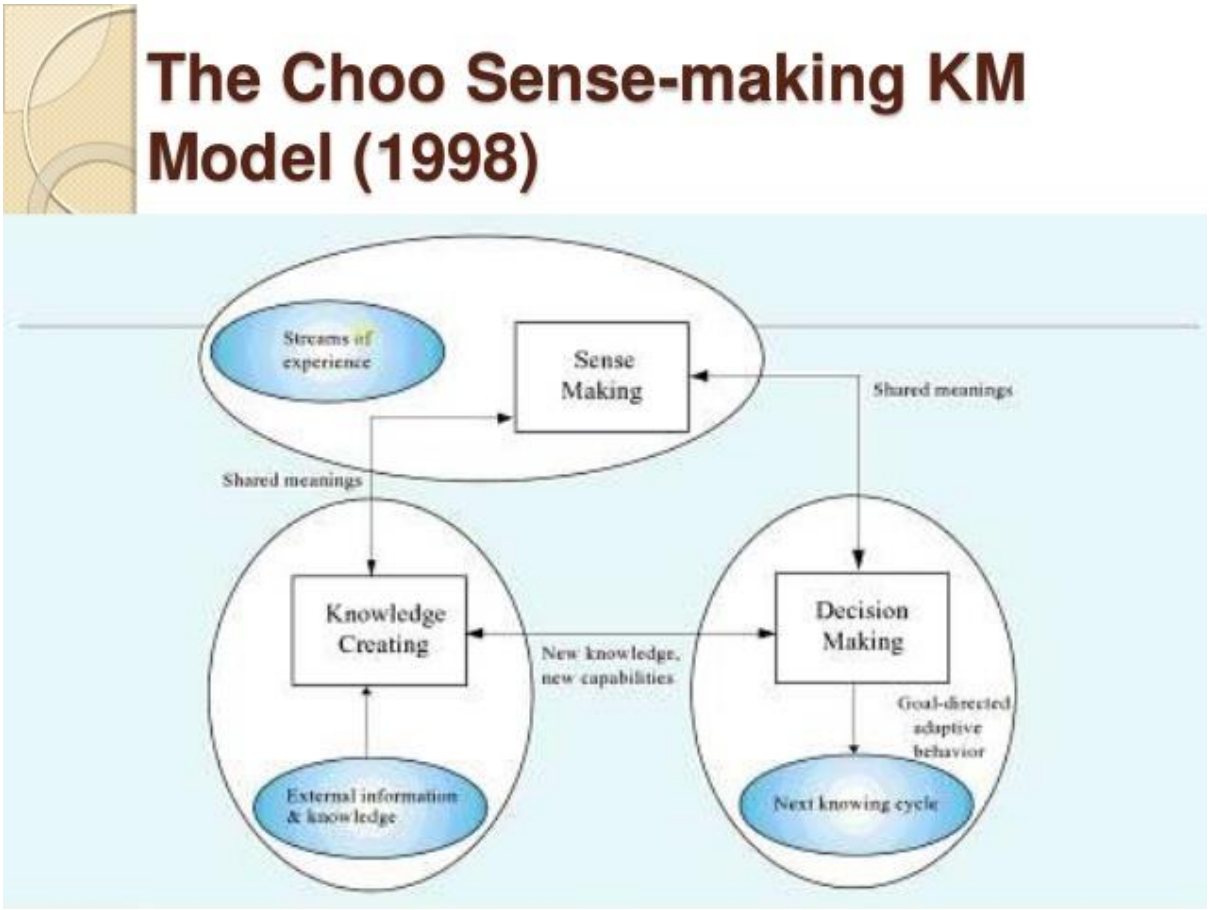


Figure 2: Choo model for KM

On the basis of Choo's model we have analyzed the KM model design for TPDDL:

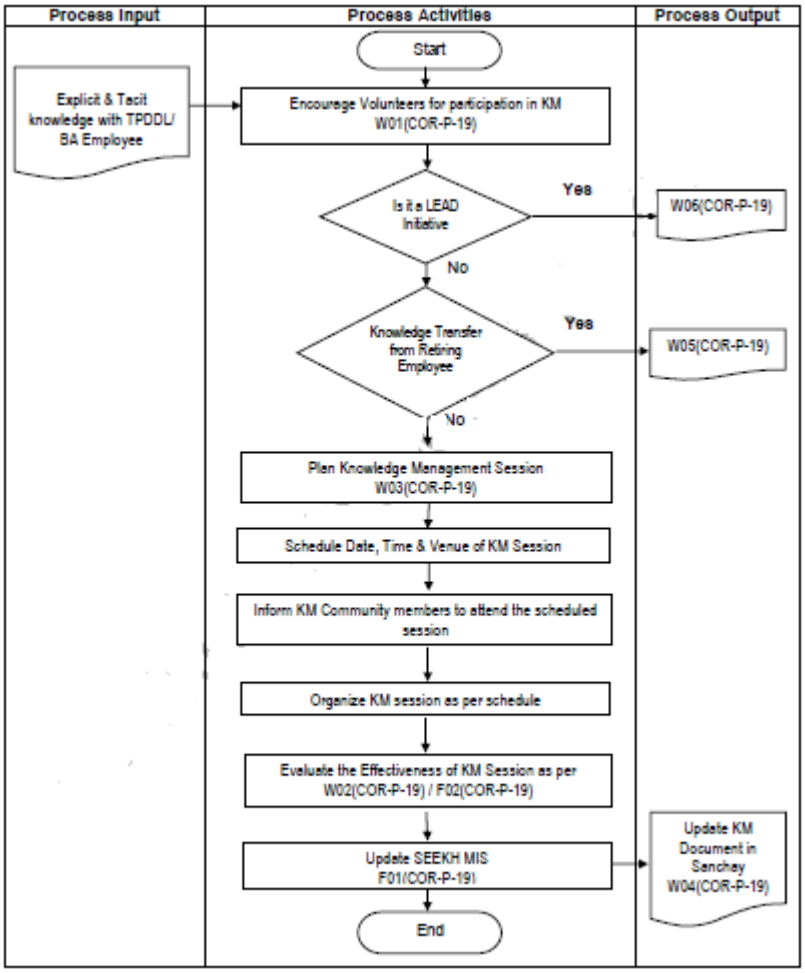
- **Streams of experience of customer management**: In Current State 80000 Consumers are laying in HRB (High Revenue Based) segment load 11-99 KW.

- **More accurate bills** Smart meters mean the end of estimated bills, the end of having to remember to provide meter readings and/or have a stranger come into your home to read your meter
- **Better understanding of your usage** With the in-home display, you can see immediately and directly how your habits and lifestyle impact your energy usage and ultimately your energy bill. By making your energy usage more easily understood, you can make smarter decisions to save energy and money, including feeling more comfortable switching energy supplier.
- **Faster and easier energy switching** Because your usage data is so easily accessible, the aim is to make energy switching as quick as just a half hour.
- **The future is smart**, and smart meters are part of the effort to create a smart grid, which is part of providing low-carbon, efficient and reliable energy to Britain's households.
- **Innovative energy tariffs** Using the data collected on when and how households are using energy, suppliers can create more competitive time-of-use tariffs with cheaper prices for off-peak use.
- **Auto access to metering complaints.**

6.2 Knowledge sharing process in TPDDL

Knowledge Management is concerned with systematic, effective management and Utilization of an organization's knowledge resources. Keeping in mind the above philosophy,
TPDDL introduced SEEKH as a platform for learning and sharing knowledge. SEEKH is based on the philosophy and principles of K-Community. The objective of KM is to capture tacit and explicit knowledge so that it can be shared across the organization.

6.3PROCESS APPROACH FLOW CHART:


Process Input
Process Activities
Process Output
Start
Explicit & Tacit knowledge with TPDDL/ BA Employee
Encourage Volunteers for participation in KM W01(COR-P-19)
Is it a LEAD Initiative
Yes
W06(COR-P-19)
No
Knowledge Transfer from Retiring Employee
Yes
W05(COR-P-19)
No
Plan Knowledge Management Session W03(COR-P-19)
Schedule Date, Time & Venue of KM Session
Inform KM Community members to attend the scheduled session
Organize KM session as per schedule
Evaluate the Effectiveness of KM Session as per W02(COR-P-19) / F02(COR-P-19)
Update SEEKH MIS F01(COR-P-19)
Update KM Document in Sanchay W04(COR-P-19)
End

6.4 Evolution of KM in TPDDL:

Year	Initiatives	Objectives
2005-07	KM Portal - For ALL	Sharing of Knowledge across TPDDL through portal
	Community of Practice through SEEKH	Engagement of maximum people through SEEKH
		KM Campaign across TPDDL Awareness about KM
	SHIKSHA	To capture learning from Training Conference, seminars etc
2007-09	O-PEDIA	Separate KM paltform for explicit knowledge
	Ask the Guru	Domain based Knowledge sharing
	Migration of KM Application	To include new Features, Improve user friendliness
	KM Audit (Internal & External)	KM health Check up and improvement on KM system
	R&R for KM	To motivate people in knowledge sharing
2009-11	Knowledge Café	Promoting unstructured way of knowledge sharing
	SEEKH Index	To increase the quality of K Sessions,ReUse of Knowledge
2011-13	Tata Innoverse	Inherent Knowledge of the workforce
	Benchmarking	Sharing of Best Practices with National / International ufilities
	KM Portal revamp	In-house revamped KM Portal - SANCHAY for workforce
	YLDP/ BE sessions	Sharing of knowledge on Safety,CC, Innovation,Ethics, CSR
	Interaction with BA / Partners	Sharing of knwoledge on new technology, Involvement in process improvement & product development
	IWA / RWA Meet	Safety, Ethics, CSR and CC sensitization, Innovative Suggestions
2013-15	Auto alerts	Subscription based auto-alerts on KM Portal
	Knowledge Sharing	Knowledge Update through Sandesh Mailers
	KM Revamp	Revised KM index, Migration to new platform, Additional features

[redacted] - E&I of KM Framework [redacted]

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6.5Knowledge Management & Organisational Learning:

Various platforms exist for capturing & sharing knowledge at TPDDL for various stakeholders.SANCHAY portal is the repository of organizational tacit and explicit knowledge accessible to workforce. SEEKH is based on the principles of 'Community of Practices (CoP)', wherein team members of a Group / District meet to share knowledge. To cover people at the ground level SEEKH platform, Quality Circle and PRAYAAS projects has been extended to Zonal level.

To inculcate the culture of innovation, TPDDL encourages its employees to give suggestions on the identified challenges through TATA Innoverse application. The Innovation Council formed also identifies opportunities for breakthrough innovation in products & services. MEGA SEEKH competition is organized at organizational level to share best practices / learning's. The knowledge of separating employees is shared and captured through knowledge capturing form as per the exit process. TPDDL is also partnering with technology partners and building Smart Grid Lab which shall serve as learning platform for implementation of new technologies. SEEKH on replicable SHINE project involves coming together of employees and BAs from other work units, so that learning can be rapidly deployed. Learning shared in SEEKH sessions are captured and stored in SANCHAY. Monthly reviews at Group level involve brainstorming, analysis and knowledge exchange among Group members leading to identification of SHINE projects and task-oriented

improvements. R&R functions also facilitate KM as it involves presentation / sharing of learning by the Award winners. Change management process of IT converts tacit knowledge to explicit in the form of concept note/ SRS, Release notes. SHIKSHA posted on SANCHAY is the repository of key learning from employees attending external trainings / workshops/ conferences / employee exchange programs, and this is also shared in Group level SEEKH sessions. Learning of completed SHINE projects are captured through SIPS and is available on SANCHAY. SIPS information is further analyzed for identifying best practices and deployment across TPDDL, wherever applicable.

Customers, BAs, partners and collaborators are engaged through KM platforms for dissemination of relevant knowledge, e.g. Contracts, EHV Projects, COS, etc. Consultants, experts, customers, collaborators, Technology Partners and BAs and regulator throughvarious forums share knowledge and provide key inputs, which is also used in SPP. A window to the outside world is alsoprovided through our website, where information related to customers, BAs and other stakeholders are available. Comments by reviewers on reports / MIS, MOMs, ATRs form an invaluable set of knowledge for daily work management. New policies, circulars, information, MIS and Zonal / District Scorecards are shared through SANDESH mails. The SAP CRM has a feature of building knowledge bank about customers profile, thus even a new employee joining will come to know about the customer history. TPDDL's monthly magazine Surkhiyan and Aap Tak captures the major initiatives, new imperatives and events across the organization which is shared with all employees, key associates, and key members in TPC / TNF, key customers and visitors / guests. Similarly, SAMPARK newsletter, RWA meetings and JIFs reinforces sharing of information with customers and employees.

Sources of Knowledge	Process To Use Knowledge		Process To Manage Knowledge
	Collect Knowledge	Transfer Knowledge	
Workforce Knowledge(Including contract workers)	SANCHAY, SEEKH, SRS/Concept notes, IMS & ISMS documents, MoM, SHIKSHA, TPDDL-o-Pedia, Manuals, Tata Innoverse	SANCHAY, SANDESH, IT Gyan Manch, Meeting, CFTs, Training, SHIKSHA, SEEKH, SHINE Assessment, BE R&R, Surkhiyan, Functional Newsletter, CENPEID & CENCARE Library	Community of practice (SEEKH), SHIKSHA, Meetings, Reviews, Newsletters
Customer Knowledge	RWA / IWA meets, Website, Customer feedbacks, Call centre feedback calling, CSS	Website, Call centre, IVRS, letters, meetings, face to face interaction, Nukkad Natak, Energy Clubs, e-Bills, e-SAMPARK	EoC, IVRS, Customer feedback analysis, Surveys Analysis & ATR
Supplier Knowledge	BA Meet, Vendor workshops, Supplier presentations through SEEKH, Technical literature, Manuals, Media, Internet	BA Meet, Vendor workshops, Supplier presentations through SEEKH, Technical literature, Manuals, Media, Internet	Consoldation of feedback, followed by ATR, SLAs, Contracts, SEEKH
Partner / Collaborator	Website, Letters, Meetings, Workshop, Conference	Website, Letters, Meetings, Workshop, Conference	Consolidation of feedback, followed by ATR, Association during project implementation
Rapid Identification, Sharing and Implementation Of Best Practices	Engaging Consultants based on criticality of requirement, Bechmarking, Interaction with group companies, GIUNC, Award Ceremonies	Bechmarking, Interaction with group companies, GIUNC, Award Ceremonies	Benchmarking, Best practice sharing session (e.g. TPDDL success story on SAP, information security benchmarking with Tata group cos.)
Transfer Of Knowledge For Use In The SPP	Stratgey workshop, Regulatory Information, Media informaion, BSC, FIBRES	Stratgey workshop, Regulatory Information, Media informaion, BSC, FIBRES	Strategic Planning Process

Knowledge Management Platforms at TPDDL

6.6Innovation Management:

Introduction

In the fast changing business world of today, innovation has become the mainstay of every organization. The nature of global economic growth has been changed by the speed of innovation, which has been made possible by rapidly evolving technology, shorter product lifecycles and a higher rate of new product development. Organizations have to ensure that their business strategies are innovative to build and sustain competitive advantage. Innovation has, however, become increasingly complex due to changing customer needs, extensive competitive pressure and rapid technological change (Cavusgil *et al.*, 2003). The complexity of innovation has also been increased by growth in the amount of knowledge available to organizations as basis for innovation. Innovation is extremely dependent on the availability of knowledge and therefore the complexity created by the explosion of richness and reach of knowledge has to be identified and managed to ensure successful innovation (Adams and Lamont,2003; Cardinal *et al.*, 2001; Darroch and McNaughton, 2002; Pyka, 2002; Shani *et al.*, 2003).

Definitions:

Herkema (2003) defines innovation as a knowledge process aimed at creating new knowledge geared towards the development of commercial and viable solutions. Innovation is a process wherein knowledge is acquired, shared and assimilated with the aim to create new knowledge, which embodies products and services. Herkema (2003) also states that innovation is the adoption of an idea or behavior that is new to the organization. The innovation can be a new product, a new service or a new technology. Innovation is related to change, which can be radical or incremental.

Innovation can broadly be described as the implementation of discoveries and interventions and the process by which new outcomes, whether products, systems or processes, come into being (Gloet and Terziovski, 2004). Marina du Plessis distinguished radical and incremental innovation from one another. Incremental innovations present themselves as line extensions or modifications of existing products. They are usually classified as market-pull innovations. Incremental innovation does not require significant departure from existing business practices and are therefore likely to enhance existing internal competencies by providing the opportunity to build on existing know-how. Radical innovations are likely to be competence-destroying, often making existing skills and knowledge redundant and necessitating different management practices. Radical innovations often put the business at risk because they are more difficult to commercialize. Radical innovations are considered crucial to long-term success as they involve development and application of new technology, some of which may change existing market structures. Companies that facilitate both radical and incremental innovation are more successful than organizations that focus on one or the other.

Drivers of the application of knowledge management in innovation

The first basic driver for knowledge management's role in innovation in today's business environment is to create, build and maintain competitive advantage through utilization of knowledge and through collaboration practices.

The second driver of the role of knowledge management in innovation is that knowledge is a resource used to reduce complexity in the innovation process, and managing knowledge as resource will consequently be of significant importance.

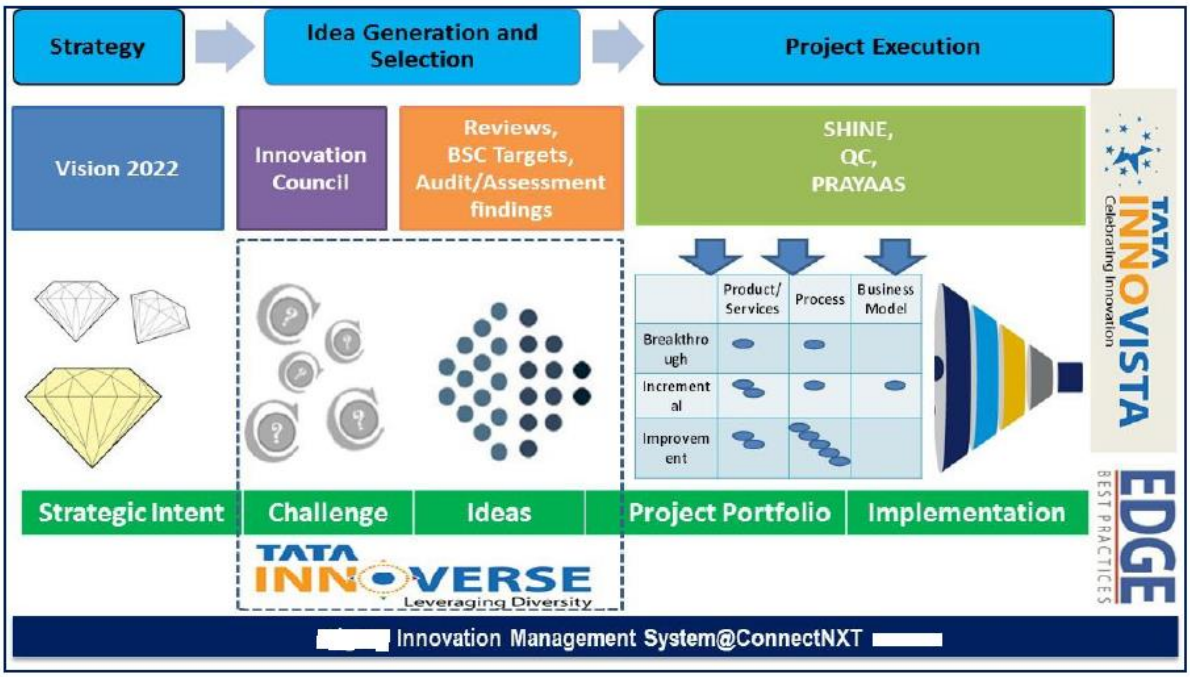
The third driver of applying knowledge management to the benefit of the innovation process is the integration of knowledge both internal and external to the organization, thus making it more available and accessible.

In nutshell, Innovation is a process that recombines existing knowledge in new ways. Knowledge management can play a significant role in making explicit knowledge available for recombination into new and innovative ideas. Knowledge management provides the tools, processes and platforms to ensure knowledge availability and accessibility, e.g. through structuring of the knowledge base. Knowledge management can also ensure that explicit knowledge, which can be used as input to the innovation process, is gathered internally and externally. Knowledge management finally also provides the means of ensuring the leverage of knowledge and to determine the gaps in the explicit knowledge base of an organization that could potentially negatively impact the organization's innovation program.
In conclusion, it can be said that knowledge management systems have a distinctive contribution in the development of sustainable competitive advantage through innovation. Whilst information and knowledge management systems alone do not possess the qualities required to provide organizations with sustainable competitive advantage, the bundling of knowledge management systems with other firm resources and core competencies is the key to developing and maintaining sustainable competitive advantage through product and process innovation. In such a position, knowledge management systems play a major role in the conversion of learning capabilities and core competencies into sustainable advantage by enabling and revitalizing organizational learning and resource development processes (Adams and Lamont, 2003):

TPDDL has a defined process for Managing Innovation. Innovation is fostered at strategic level through creation of Innovation Council which explores new Business Models, Products, Services and Solutions and paves way for identification and nurturing new Strategic Opportunities. Innovation amongst the workforce is managed through several initiatives such as SHINE, Shikhar Awards (which rewards new concepts / business model idea), Quality Circles, participation of workforce in group level innovation platforms like Tata Innoverse and Tata Innovista.
TPDDL takes intelligent risks by pursuing Strategic Opportunities.The projects are critically evaluated by a CFT from Finance Function and operational risks are identified and suitably mitigated. Based on the recommendations and management

approval, the financial and other resources are made available for the projects. TPDDL conducts pilots for establishing Proof of Concept and validating the Business

Case for all new opportunities Identified. The pilots which present a Business Case, are routed through Regulatory Approval process and scaled up suitably on obtaining concurrence. In case the financial viability is not evident then the same isdiscontinued and other higher priority alternatives are pursued.



Trigger for opting Smart Metering In TPDDL

As in the current scenarios Electricity consumption is increasing rapidly day by day and generation of power is not growing same the consumption and shortage of the resources such as fuel(Coal) add to this problem. To make sure that there is sufficient supply for the demand throughout the day, DISCOM's have make sure that they help their consumers to manage their power consumption in an efficient way in order to supply the reliable and quality electricity to all consumers as per their need.

One of the major challenges that DISCOM's face in today's scenario is to meet the ever growing peak demand. There are certain times in the days when the demand for the electricity is at its peak. During these times, DISCOM's have to purchase power at very high cost in order to provide uninterrupted power supply. To reduce the peak power demand there are two options: Either they reduce the power demand at the peak hours or overall reduction in power demand.

Smart meters is implemented aiming by which consumer can manage their power consumption during the peak hours as Smart Meters provides the data that enables consumer to make choice about how much electricity they use by allowing them to access accurate real-time information about their electricity consumption.

Unlike the convention meters, Smart meters are up to date two-way digital communication system and flexible electricity pricing, Connecting or disconnecting electricity, locating blackouts etc.

Need an Upgrade

With rising Electricity prices there is need to give consumers greater control over their Electricity consumption. Smart meter technology provides real-time information to consumer through devices such as in home display and web portals and provides every half hour consumption data to DISCOM's who then pass the information to respective consumer.

7.0 Case Study on Process Innovation:

7.1 Methodology Adopted:

The most effective way to increase the customer's awareness is to provide them with in-house displays of readable, easy to comprehend energy use information. Many observers think that once the consumer can see the changes in their energy use instantaneously they are much more likely to act to reduce that consumption.

An In-home display (IHD) is a consumer device that shows information needed to encourage consumer participation, like pricing and usage, icons, user friendly navigation, electricity prices and an interactive keypad as an option. The IHD receives the consumption values from the meter and based on pre-stored or real time prices from the utility, displays the current cost in rupees which is understood by everyone. The display can also provide information on CO2 emissions, thereby providing feedback in real time so that corrective action can be taken. Providing end-users with direct feedback of their energy consumption and costs is essential for deriving maximum energy saving from smart metering. There is an increase in effectiveness when this feedback is used with Time of Use (TOU) tariff. As a result, the utilities can achieve demand side management.

4.1 Communication Networks

An appropriate two-way communication media should be there. This media can be provided through the distributed line communication technology or it can be given through the radio communication technologies like HAN, LAN, WAN, Concentrators, Routers, etc. Communication Technologies generally adopted are Zigbee / RF mesh / 3G /etc.

There are many communication technologies used in the Home Area Network (HAN) side, but the most popular one is RF communication. RF is a wireless technology through Low Power Radio (LPR). Security systems, encryption, are deployed in the HAN to eliminate the possibility of cross-talk with the other HANs in the locality. Both of the technologies find usage in different implementation scenarios.

Areas where the meter population density is low should directly use WAN technology such as 3G at meter end to directly send data to NMS if economically feasible. RF mesh type of a network, especially in areas where the meter population density is high, may be a good choice. In such a scenario, a LAN/NAN would be formed using the RF mesh that would feed data from multiple meters to the nearest Access Point (AP). The Data from AP can be sent to NMS using the WAN technology such as 3G. It causes the system to be scalable and accommodates large numbers of meters in an AMI system.

The Local Area Network offered as part of the AMI Pilot Project should be suitable for operation across the range of configurations on the Networks distribution network. The LAN technology should be suitable for all electricity network configurations – however it may turn out that one technology is clearly best for urban and a different one for rural, in which case we may have to opt for a dual system.
Key requirements of the LAN include:

i. Security of data, communications equipment and metering infrastructure
ii. Available bandwidth for interval, register and event data transfers

iii. Stable mesh or DLC routing algorithms
iv. High Availability
v. LAN to be self correcting to allow for on-going data collection from all meters even in the event of failure of one of the WAN gateway nodes.
vi. LAN communications devices which have to be installed on the electricity network, beyond the meter position should be easy to install and manage.
vii. The design of new LANs or extensions to existing LANs must be clearly defined to simplify implementation by ESB Networks.

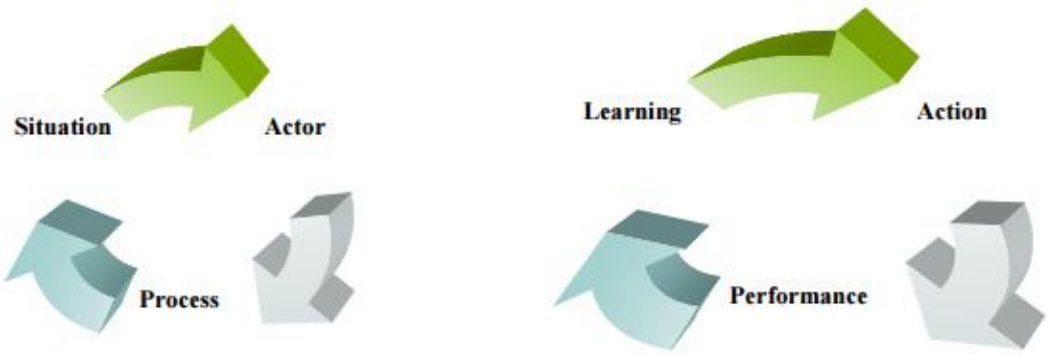
4.2 Access Point

The Access Point provides the central link between endpoint devices i.e. Smart Meter and NMS systems, enabling intelligent network control and monitoring. Its flexible communication features extend the reach and coverage of the network to thousands of customer premises, and its support for up to 5,000 endpoints per Access Point dramatically lowers ownership costs. The Access Point provides a highly reliable connection to electricity, water, and gas meters over a Neighborhood Area Network (NAN). It communicates with meters having in-built radio communication cards called “intelligent endpoints”. And it offers multiple paths to each endpoint, through sophisticated mesh network routing that ensures greater reliability and redundancy.

Access Point

The Access Point also provides Wide Area Network (WAN) connectivity to the NMS through digital cellular 3G communication connections. This flexibility enables to leverage low-cost public carrier networks.

The AP provides Full two-way, 900 MHz FHSS, One-watt transmitter, Dynamic network discovery and self healing with mounting kits for pole-top and other aboveground installations



SAP-LAP Framework (*Sushil, 2000*)

LAP links three components, i.e. learning issues, actions and performance. Actors consistently evaluate situation, follow 'practice, take actions, learn from their performances and depending on the results of performances either the processes are modified or same process followed for repeat performance. SAP-LAP framework can be used for case analysis, managerial inquiry and problem solving

7.11Situation/Trigger:

TPDDL with predominant urban geography has vast consumer base with network which delivers reliable and quality supply to its valuable customer base of 1.5 million. Untimely failure of these critical power delivery asset results in customer dissatisfaction viz.

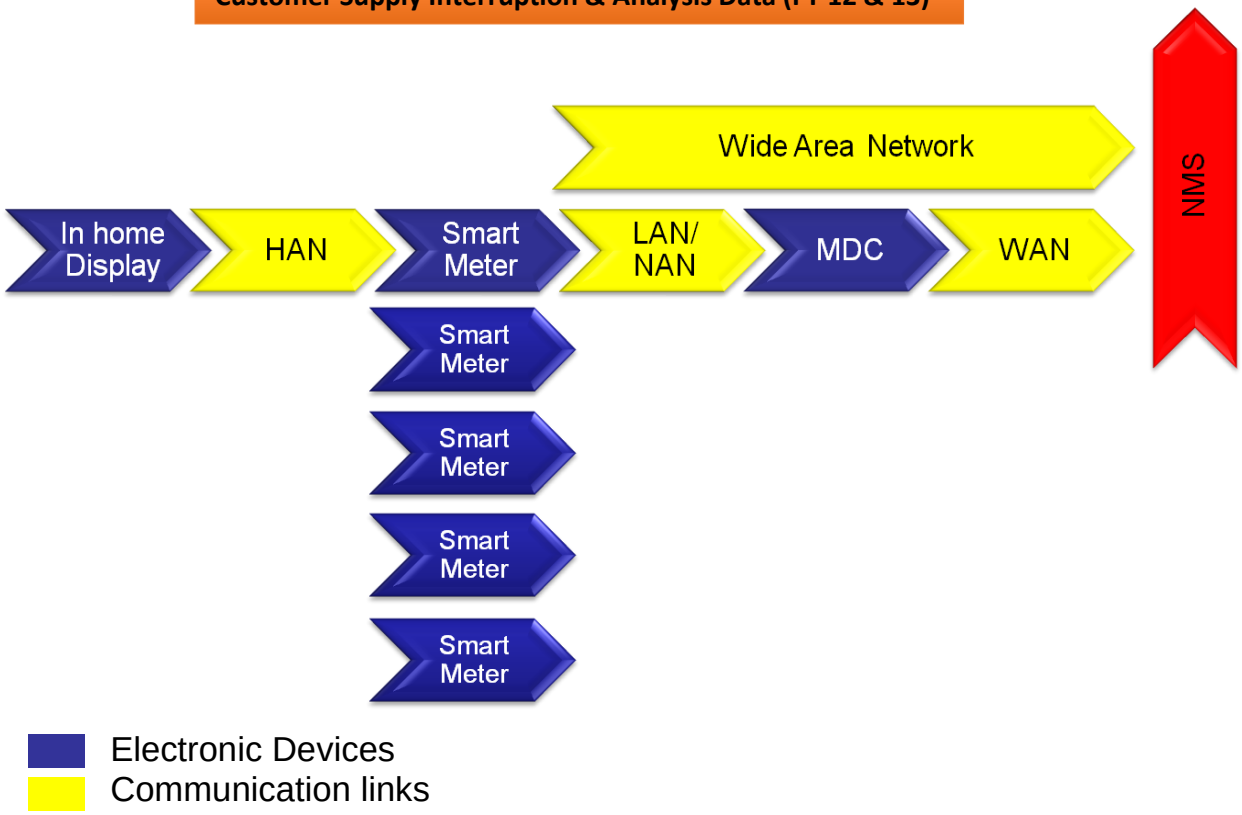
Reforms are being introduced in AMR technology in the electricity distribution services in Delhi. The reforms focus on increasing the “efficiency” and “Consumer and Financial sustainability” Focus Areas in Reforms “**To acquire meter data from the meters automatically from remote without any human interventions. Generation of bill for High Revenue consumers without any human intervention. The system should also able to support generation of MIS for decision making parameters, and distribution parameters”.**

7.12 Actors:

1.AMI Architecture

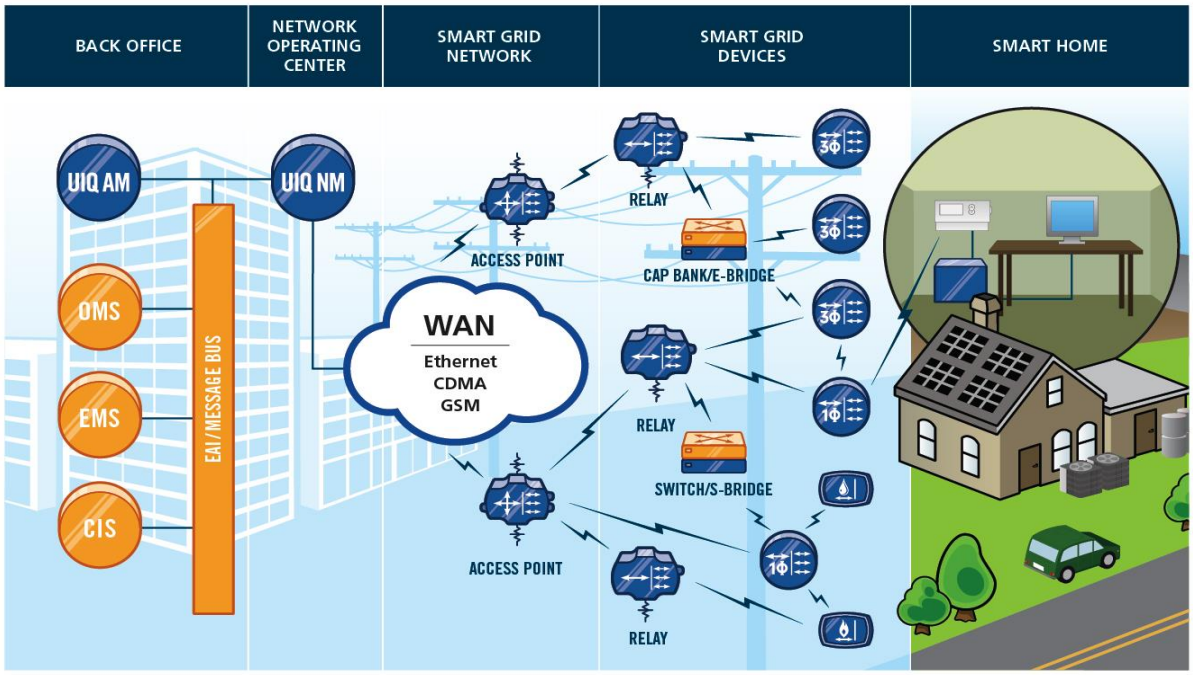
The proposed AMI Architecture for utilities is shown in below given diagram. The architecture includes from In-Home Display (IHD) to Network Management System (NMS) or Head end System (HES). The entire AMI evolved in and around electronic devices, IT and communication infrastructure keeping Smart meter as heart of

Customer Supply Interruption & Analysis Data (FY 12 & 13)



The communication between IHD and Smart meter is called as Home Area Network (HAN), this will be a wireless connectivity through Zigbee (SEP) protocol. The display will show information to the consumer related to the consumption and many more, beside this if any other devices like washing machine, Air Conditioner, etc are also available with Zigbee (SEP) then consumer will be able to control as well.

Between Smart Meter and Meter Data Concentrator (or Access Point (AP)) the communication is called as Local Area Network (LAN), this will be wireless communication through Radio Frequency Mesh Network (RF Mesh).



From Access Point (AP) to Network Management System (NMS) the communication is called as Wide Area Network (WAN), this will be wireless communication through 3G communication. The availability of the same is very much required at the AMI site.

2.Components of AMI

The system comprises of meters and several other electronics devices along with various communication technologies based upon the location, terrain, etc. AMI has four core components as explained below –

2. Advanced electricity meter; commonly called the smart meter
3. In-Home Displays,
4. Two-way communication system between each of the above core components for seamless data exchange.
5. Access Point
6. A Network Management System (NMS)

4.1 Smart Electricity Meter

A smart meter is an advanced meter that records consumption at regular intervals and communicates it, at least once a day, via a communications network back to the utility for monitoring and billing purposes. Besides having electricity measuring capabilities Smart meters also have remote connect/disconnect, programmable sensors to capture significant events, power outage notification and power quality monitoring.

A Smart meter is “advanced” compared to the traditional electronic meter and has the following additional functional elements which helps its integration with the metering infrastructure.

The 'intelligence' of the meter is incorporated in the electricity meter. It has three basic functions: measure the electricity used (or generated), remotely switch the customer and remotely control the maximum electricity consumption.

Sprint 200: 3P, 15(100)A, with or without 31.5 Amps load control. Optional 2A load control.

In-built radio module for LAN + HAN functionality
Provision for connecting external antenna

i-Credit 500: 1P, 1E or 2E, 15(100)A, with or without 31.5 Amps load control.

In-built radio module for LAN + HAN functionality.
Provision for connecting external antenna

A smart meter provides other data and functionality that address power quality / outage and other electricity service issues. And it is also having In-built time clock auto-synchronizing with central system clock. A smart meter should posses the following feature

i. Capable of measuring and recording usage data in time differentiated registers (TOD / TOU), including hourly or such interval as specified by regulatory authority.
ii. Allow electric consumers and utility to participate in all type of price-based demand response program.
iii. Remotely operated switch to permit disconnection / reconnection of customer's supply.
iv. Has an optional load control switch for consumer's load management.
v. It should provide other data and functionality that address power quality / outage and other electricity service issues.
vi. Allows display of price signals for different time periods as part of a cost reflective tariff.
vii. Multiple time-of -use (ToU) registers and allows for remote change of tariff, debt or other rates for utility charging without requiring access to the home.
viii. In-built time clock in meter – auto-synchronizing with central system clock
ix. Event recording / tamper alarms, including outage events.
x. Load limiting capability, with a number of variable settings available

4.2 In-Home displays

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xiii. LAN communications devices which have to be installed on the electricity network, beyond the meter position should be easy to install and manage.
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4.4 AMI Features

5.1.1 Connect/Disconnect Switch

Smart meters can disconnect and re-connect the supply remotely when the old customer moves out and the new one moves into the property; this is analogous to “pulling the fuse” in present day practice. The disconnect switcNMS are bi-stable in operation and do not consumes any power while staying in the ON/OFF position unlike an electromagnetic contactor which consumes a couple of watts. A few safety features are added to remote disconnect, e.g. the supply disconnects if there is a fire or if “high current/ power” is detected for a certain period immediately after reconnection.

5.1.2 Supply capacity control

Customer’s contract demand could be remotely programmed into the meter and at instances when the customer exceeds his contract demand over a programmed interval, the supply is disconnected (using connect/disconnect switch). Certain variations can be built around the load control regime in keeping with the contract agreement like auto ranging of the demand based on excess demand linked with fixed charges. As a smart alternative to load-shedding, the utility can impose Emergency Supply Capacity limits for certain hours of the day when the customer is not allowed to draw more than few hundreds of watts.

5.1.3 Utility control of load

Energy storage devices like an electric geyser or storage air conditioners where the time of using energy and usage of service are staggered in time, are connected to a separate terminal on the meter. The utility can remotely switch ON/OFF such loads when it has surplus power, with a ceiling.

5.1.4 Capability to record interval data

Grid prices change on an half hourly basis and to match the price with a customer’s bill, the utility requires half hourly data, kWH/ kVarh, of the energy used by the customer. Smart meters are able to provide this.

5.1.5 Event logging and alarms

A typical smart meter can recognize and record 40+ event types in its memory which can be collected on the daily read. Based on system parameters, the utility may chose which of the events are critical, on occurrence of any of tNMSe an alarm can be sent to the control centre.

5.1.6 Demand Response

Demand response refers to the reduction of a customer’s energy usage at times of peak demand to help in power system reliability, reflection of market conditions and pricing, and in supporting infrastructure optimization or deferral. Experiments have proved that if the price of electricity usage is known in real time, customers volunteer to reduce their non-essential load. LAN carries real time prices to the meter which in turn sends the price/consumption signals through the HAN

to the IHD and other load control devices. With the availability of HAN signals, the consumers could easily deploy intelligent relays which can turn ON/OFF equipment which can be used in a staggered manner without any inconvenience, such as storage water heaters, filling the overhead tank, irrigating the garden. Demand response programs provide a platform for dynamic pricing/tariffs, price-response demand bidding, contractually obligated and voluntary curtailment and direct load control/cycling.

5.1.7 Dynamic Pricing

Different prices for energy used during different time periods reflect the fact that power generation costs and wholesale power purchase costs vary during different time periods. TNMSe include Time-of-Use Pricing, Critical Peak Pricing and Real-Time Pricing.

5.1.8 Critical Peak Pricing (CPP)

A type of dynamic pricing whereby the majority of the electricity usage is priced at a declared tariff but during certain hours on certain days, when the system is experiencing high peak demand, is subject to higher hourly energy prices reflecting market conditions of economic order of dispatch. The CPP is available to electricity customers “day-ahead” or “hour ahead” allowing them to choose their time of use thus helping in demand management. Using CPP, the grid can be saved from cascade failure and can also bring down the “fixed cost” component of the tariff.

5.1.9 Real Time Pricing

Energy prices that are set for a specific time period on an advance or forward basis and that may change according to price changes in the generation spot market. Price of electricity for consumption during tNMSe periods are typically established and known to consumers a day ahead with final prices being published an hour before the event. Such a mechanism allows the consumers to vary their demand and usage in response to prices and manage their energy costs by shifting usage to a lower cost period or reducing overall consumption.

4.5 Network Management System

The network management system is an essential component that performs several important functions including the management of the communications network, scheduling and collection of meter readings and coordination of routine customer and meter data changes to ensure that all meters are read.

The Network Management System (NMS) is responsible to create the hierarchy relationship between a metering node to its primary/ secondary data concentrator or take-off point and provide data based on schedule to the upstream information system of the utility. It is by virtue of the NMS, the communication channel is connected to a particular meter using the most economical route for data transfer. Following are the typical functions performed by the NMS of a typical AMI system:

1. Sets up, performs, and monitors meter reads
2. Stores, displays, and exports meter read data
3. Provides a number of views/reports into the completeness of billing data
4. Allows two-way, real-time communication with meters and other network devices like load control switcNMS.
5. Manages/monitors the communication network

6. Records and displays configurable events across the system
7. Tracks meter states like active, connected, armed and retired.
8. Integrates with utility back-end systems

The NMS is designed to improve network visibility and performance by building and maintaining knowledge about physical and logical network connectivity. Using NMS, utility operators can connect and manage network devices (e.g., meters, data concentrators, in-home devices) with an online device status view of the entire AMI network. The NMS software automates the utility's business, operations, and networking rules (called policies), enabling cost efficient, centralized management of intelligent AMI network components.

The AMI value chain is connected to the NMS and typically includes:

a. Load forecasting module
b. Load connect / disconnect module
c. Outage management module
d. Demand response module
e. Granular energy audit at distribution transformer as well as feeder level.
f. Advance revenue protection module.
g. Distribution asset and facility management module.

4.6 Meter Data Management

Utilities Meter Data Management supports interval billing and various other MIS along with validation & verification algorithms.

The MDM can serve as the foundation for a Smart Metering initiative. It integrates with multiple advanced metering solutions and acts as a central data repository. It provides validated, 'clean' data for downstream systems such as billing, customer care, network management, and more. It feeds processed and formatted data to a variety of utilities applications that support Smart Metering, including: Load Analysis, Load Profiling and Settlement, Customer Care and Billing, Quotations Management, Mobile Workforce Management, Asset Management, Outage Management, and Distribution Management.

7.System Functionality

8.0 Intelligence dissemination/ Knowledge Sharing

Based on innovative product design & successful pilot implementation, specifications for LT cable design has been revised in TPDDL & all new procurements meters and modems are done with this new proposed design. Revised manufacturing&Installation processesdisseminated to each employee in the TPDDL through trainings, Seekh sessions and Sandesh mail.

The innovation was also shared at various platforms.

a. TATA groups of companies at innovation platform “TATA Innovista”. Appreciated by all jury members
b. Tata Power at their innovation platform “Shikhar”. Appreciated by them too.
c. At “Knowledge Fair, Mumbai”. Appreciated by Chairman-TATA Group.
d. Research paper is been selected, published and presented in the International Competition- GRIDTECH organized by Power Grid Corporation of India Limited.

9.0 Responsiveness/ Feedback from Stakeholders:

Failure rate has been reduced by 19% in FY: 13-14 & 23% in FY: 14-15. So, internal customers are very happy with this new product design.

10.0 Uniqueness / Scalability:

On uniqueness front, TPDDL is the only utility to adopt this new design product. It challenges conventional design as per IS 7098/IEC 60502 standards. Further, proposal already submitted to BIS to amend the existing IS to accommodate this unique design. Patent already filed for this innovative productdesign. **Reg. No. 1301/DEL/2014.**

On scalability part, all procurements LT XLPE cables are done as per new product design. Further, this is replicable across all power distribution utilities.

Conclusion:

Based on this study, it is clear that knowledge management plays a significant role in innovation and enhancement of knowledge at ground level. Further study shows the potential role of knowledge management in innovation and how the value of knowledge management can be maximized to ensure a more efficient and effective innovation process. Impact studies in this area may be extremely valuable, especially in organizations that have distinct knowledge management and innovation programs.

It is important for both innovation and knowledge Management professionals to understand the systemic relationship between these concepts and the value that it can generate in respect of creating and maintaining sustainable competitive advantage for organizations.

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