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APPLICABILITY OF INFORMATION SYSTEM TECHNIQUES: A STUDY OF PUBLIC AND PRIVATE POWER SECTOR

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ABSTRACT

Power is a vital necessity for all spheres of our life. It has been found as a fundamental human need. It is a significant infrastructure on which the social and economic progress of the country depends. Supply of power at sensible rates to the rural areas is indispensable for the overall development of the nation. Equally important is availability of reliable and quality power supply at viable rates to Indian industry also to make it internationally competitive. Services sector has made significant contribution in the growth of our national economy. Power keeps primary importance in any economy. The study is to find out how information system is helpful to the power sector and the effectiveness of the information system and to analyze the policy perspective and the problems faced by the public and private power sector in collecting and using the vital information on time.

KEYWORDS

information system techniques, power sector.

INTRODUCTION

To make the economy efficient and competitive, it is necessary for India to revitalize its infrastructure. Infrastructure development can be done when an economy is financially vibrant and viable. Restructuring is usually advocated for streamlining country's economic policies with respect to investment and expenditure, ownership and environment. Because of its requirement and acceptance to all communities in the country, infrastructure development becomes very essential. But for development of entire economy, power and energy plays vital role. It gives strength to entire economy provided it is blessed with sufficient availability of resources. Adequate availability of power has always been a challenge since independence.

Central government also started to participate in generation, transmission and power grid management. Indian Government started power sector reforms in the country in early 1990s. The National Development Council (NDC) in association with multilateral funding agencies like World Bank and Asian Development Bank prepared an agenda for power sector reforms in India in 1994. Various schemes have been launched by the government under planning period to promote supply of electricity. Under 10th five year plan government of India launched Accelerated Power Development Programme (APDP). Under this special Programme, Government of India provides Additional Central support for amplification and up gradation of sub transmission and distribution network. Under 11th five year plan Government of India launched Restructured Accelerated Power Development and Reforms Programme (RAPDRP) in July 2008, with focus on founding of the base line data, fixation of accountability, reduction of AT&C, losses up to 15% level through strengthening & up gradation of Sub Transmission and Distribution network and adoption of Information Technology.

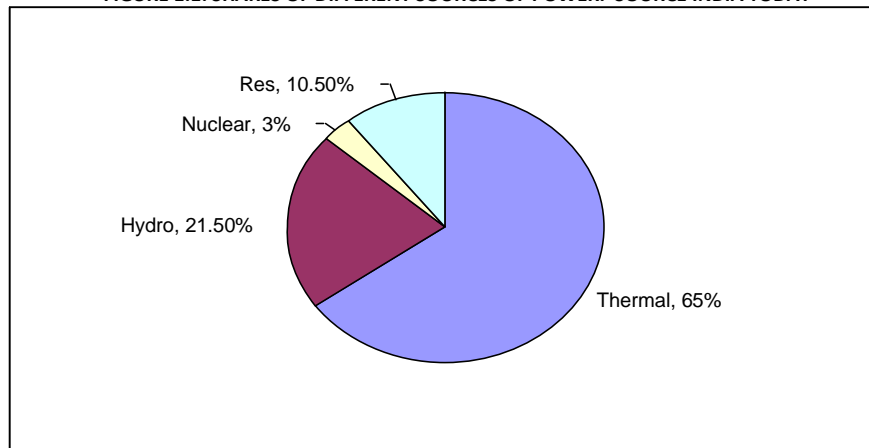
Under Rural Electrification Initiatives, Government of India launched Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY). This scheme was implemented for creating power infrastructure in villages and completing domestic electrification and up gradation of available power systems. There have been various positive aspects of Rajiv Gandhi Gramin Vidyutikaran Yojana for the profits of end consumers like presence of information with regard to details of areas electrified, franchise system, details regarding launching of schemes and its objectives etc. But more efforts are necessary to enhance the condition of power in India. Government should improve all the aspects of power generation and transmission. State of the art techniques should be used and state governments should be caught up well in linking the substructure all over the nation.

According to planning commission only 50% of overall targets were met in 8th, 9th and 10th five year plans. The target for the 11th five year plan was revised downwards from 78,700MW to 62,374MW. The table below shows the real picture of the power sector. None of the target for the thermal, hydro and nuclear sources was achieved. So this brings out a clear picture that capacity additions are not up to the mark in Indian Power Sector. Moreover Indian Power sector is dependent on the thermal sources of power around 65% as on April 2011 (Nayyar) but according to the planning commission estimates there is acute shortage of coal. Official figures are that in 2007 there were 35 million tons of shortages which will rise to 83 million tons in 2012.

TABLE 1.1: CAPACITY ADDITIONS DURING APRIL-DEC 2010 (MW) (SOURCE INDIA TODAY)

Year	Thermal		Hydro		Nuclear		Total	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Central	5890	2115	529	120	1220	0	7639	2235
State	6012	2331	597.5	178	0	0	6609.5	3509
Private	5891	4795	219.5	192	0	0	6110.54	986.50
Total	17793	9241	1346	490	1220	0	20359	9730.5

FIGURE 1.1: SHARES OF DIFFERENT SOURCES OF POWER. SOURCE INDIA TODAY



So it is clear from the above data that the power growth is abysmally low and the most alarming situation is that whatever the respective State Electricity Boards (SEB) are producing they are not even able to distribute it properly. There are at least 30% losses during the distribution process which means combined losses of SEB's will be whopping 70,000 Crores losses by 2014 (according to 13th Finance Commission Report). Majority of the losses are pilferage of electricity, improper billing and redundant technology. According to Shahi the Power sector has taken various strides since independence. The following section throws light on the journey of power sector since independence.

Electricity industry in last several decades has been supplying the electricity to customers under the culture that the organizations are not marketing the power but they are giving power. So customers feel a lot of problems at various stages be in the form of getting new connections, metering, fluctuations etc. Then there is another concern is that there is lack of rational approach which is prime most factor in the poor financial health of the organization. Giving Subsidy is right intention but those who really want subsidy they are not getting the advantage of this scheme rather there is blatant misuse of the subsidy in the form of giving free power to the landlords. India faces formidable challenges in meeting its energy needs and providing adequate energy of desired quality in various forms for different sectors of economy in a sustainable manner and at reasonable costs. If one looks at the pattern of electricity supply and demand scenario, the extent of power shortage varies up to 25.4% with all India average of 11.7%. Similarly energy shortage is up to 20% with all India average of 7.4%. In order to fulfill this gap between demand and supply and to ensure sustainable energy in future it is essential to project future electricity demand in the various sectors of economy.

POWER SECTOR IN THE NATIONAL CAPITAL REGION

Power is an important aspect of the physical infrastructure that requires planning in advance, development and management for improved quality of life, productivity and economic activities. The status of power supply in the National Capital Region has not kept pace with the increasing population and the growth of economic activities such as industries, trade, commerce, offices etc. There is an overall shortage of power in the Northern Grid, from where the region draws its power and hence, power cuts have become a routine affair, disturbing daily life as well as affecting economic productivity. The situation is even worse in the rural areas where the quantity and quality of power supply is very poor. Although augmentation of generating capacities of power and improvement in transmission and distribution system is a gigantic task requiring substantial resources, yet it is essentially required to be taken up for the balanced and harmonized development of the region.

DEMAND AND SUPPLY SCENARIO OF ELECTRICITY

Projections made by Central Electricity Authority (CEA) have revealed the requirement of huge additional generation of power for the region. Table 1.2 reveals that additional capacity required by the year 2006-2007 is 4,513 MW and by the end of year 2020-2021 it will be 23,345 MW. The total additional installed capacity requirements by the year 2020-2021 is expected to be 4,862 MW in Haryana Sub-region, 1,690 MW in Rajasthan Sub-region, 9,195 MW in UP Sub-region and about 7,597 MW in NCT-Delhi Sub-region. These projections have been worked out by assuming that there will be an addition in the power generation capacity of 2,764 MW from the year 2002 to 2007 and 2,922 MW from the year 2007 to 2012.

TABLE 1.2: ADDITIONAL GENERATION CAPACITY REQUIRES (in MW)

Sub-region/region	IC at the beginning of plan	Capacity Addition including CS share of Plan	Total IC at the end of plan (2=3)	IC Required	Additional capacity Required(5-4)
1	2	3	4	5	6
NCT-Delhi					
2002-2007	3098	1614	4712	6157	1445
2007-2012	4712	1902	6614	8337	1723
2012-2017	6614	Not available	6614	11236	4622
2017-2021	6614	Not available	6614	14211	7597
Haryana					
2002-2007	1815	819	2634	2563	(-)71
2007-2012	2634	700	3334	3899	565
2012-2017	3334	Not available	3334	5903	2569
2017-2021	3334	Not available	3334	8196	4862
Rajasthan					
2002-2007	42	44	86	667	581
2007-2012	86	51	137	969	832
2012-2017	137	Not available	137	1384	1247
2017-2021	137	Not available	137	1827	1690
Uttar Pradesh					
2002-2007	459	287	746	3303	2557
2007-2012	746	269	1015	4956	3941
2012-2017	1015	Not available	1015	7418	6403
2017-2021	1015	Not available	1015	10210	9195
Total NCR					
2002-2007	5414	2764	8177	12690	4513
2007-2012	8177	2922	11099	18161	7062
2012-2017	11099	Not available	11099	25941	14842
2017-2021	11099	Not available	11099	34444	3345

According to CEA, there are no plans for additional capacity generation beyond 2012. In fact, this capacity addition also includes allocation from the central sector projects that are proposed to be commissioned by the end of 10th and 11th Plans. An important point to consider is that the average energy consumption pattern in the concerned Sub-regions during the period 1998 to 2001 was 42.80% of the total consumption in Haryana State, 5.00% of the total consumption in Rajasthan State and 15.00% in case of the State of Uttar Pradesh. In view of this, the distribution of allocations from central sector projects to respective Sub-regions has been made in the similar proportions.

Influence decision of the manager and the decision methodology used by him arriving at the optimum decision. The concept of MIS gives high regard to the individual and his ability to use information. An MIS gives information through data analysis. While analyzing the data it relies upon many academic disciplines. These include theories, principles and concepts from the management science, psychology and human behavior, making the management information design more effective and useful. These academic disciplines are used in designing the MIS, evolving the decision support tools for modeling and decision making. The MIS has more than one definition, some of which are given as following:

"MIS is defined as a system which provides information support in decision making in the organization"

Management Information System (MIS) can be defined as collecting and processing of raw data into useful information and its dissemination to the user in the required format. It consists of information, which impacts managements to feel the pulse of the organization and take decisions accordingly. In fact a full MIS consists of all the systems that the institution uses to generate the information that guide management's decisions and actions.

A management information system (MIS) is a computer-based system that provides the information necessary to manage an organization effectively. An MIS should be designed to enhance communication among employees, provide an objective system for recording information and support the organization's strategic goals and direction. There are four types of MIS that will be introduced in ascending order of sophistication.

CHARACTERISTICS OF MIS

A well-designed Management Information System is likely to have following characteristics:

1. MIS is a system; it is a logical grouping of discrete and mutually dependent components of information and elements, assembled for furnishing and generation of information.
2. It may involve use of instruction manual devices put in frequently manual mechanical and electro technical devices. Often MIS is said to be associated with the use of computers.
3. The role of MIS is basically generating and packaging of information in the useful quantum of knowledge. The design of management report embodying such MIS is important and crucial.
4. MIS is related to organizational levels. At top most level, the information required in a flash form. At the lower and middle levels it is more detailed for exercising day to day control. The frequency of information furnished will be decided by the need of the management. The frequency of information is higher at middle and low levels. Besides it is internally focused at the lower and middle level whereas' external directed at the top level. It is associated with the organization of data, store in a central unit that computer data close to its origin and connects their input into management information.
5. Information communication is parallel and vertical, throughout the application. It is necessary therefore, to employ in use refined communication decision devices.
6. The information supplied is Exception oriented showing the level at which actions required. There are in fact exceptions which decide when to report.
7. Information supplied is innovative i.e. predictive. It primarily aims at giving a feed for the developed and the trend thereof. An effective MIS desire for "before the fact reporting".
8. It must involve complete dedication and loyalty of the executives. There should be periodical review of the system as the organization grows or decays.
9. Management gets a balanced flow of information on a regular basis, the right information to the right people, at the right time and cost.
10. The system is composed of a collection of sub-system with varying degrees of integration among the parts.

REVIEW OF LITERATURE

Electricity is an important input for all types of economic development related activities especially in the field of agriculture, industries and commercial. It has a critical role to play in the field of economic development and revenue generation for a particular country. It is extensively used as a source of light, heating, ventilation and air-conditioning (HVAC). Electricity is the driving force and has a special place in the modern household appliances, thereby considerably improving the quality of life of individuals. There are number of studies which cover the working pattern of the State Electricity Board's and their contribution in the economic development of a particular state and country. A large number of particular studies have tried to conduct covering of the performance and the contribution in the promotion of economic development by the State Electricity Boards.

Sagar, Ramana, Prasad, Kukde and Eisendrath (2004) highlights that the distribution reforms in India began in the mid- 90s, and followed the World Bank's model of privatization. This goal required intermediate steps of unbundling and corporatization of vertically integrated state utilities. So far, Orissa and Delhi have already privatized their distribution companies, while Karnataka and Andhra Pradesh have undertaken aggressive steps in the same direction. The study gives the insight into these reforms done by various states. The reform process began with the enactment of the Orissa Electricity Reform Act in 1995. Orissa was the first state to initiate the reform process. The new legislation was enacted for the purpose of restructuring the electricity industry, for taking measures conducive to increasing the efficiency of each activity i.e. generation, transmission, and distribution of electricity, for opening avenues for private participation and for establishing the Regulatory Commission. Similarly the study presents the cases of the Delhi, Karnataka and Andhra Pradesh.

Singh and Sood (2008) stated that the global demand is expected to increase considerably during the next decade at the same time environmental pollution is also increasing with the development of conventional energy source. Every country intends to meet the additional demand of energy in part by renewable energy (RES). To meet the global energy demand various support schemes and policies for promotion of renewable energy sources in restructured power sector were discussed in this paper. The paper took a close look at the regulatory policies for the promotion of electricity generation from renewable energy sources, which are currently at the center of global discussion.

Soham Ghosh (2012) studied that the mindset, of the policy makers who are responsible for ongoing reforms in power sector has rightly been shifted towards the up gradation of the sub-transmission and the distribution system. This paper further studied that ongoing power sectors reforms have been able to improve the efficiency of the organizations dealing in power thereby reducing Aggregate Technical and Commercial (AT & C) Losses. Finally this may also contribute in the process of overall development of the country.

Nweze (2013) illustrates that sufficient supply of power is an important requirement for the development of a particular nation. This paper further revealed that generation of electricity, transmission and distribution (T&D) are amongst those intensive activities which require huge amount of funds and huge resources of capacity. This paper further revealed that persistent power failures in Nigeria have resulted into non-regular production of electricity in addition to underutilization of industry resources and resources in educational institutes. Government of Nigeria had to face embarrassment when Power Holding Company of Nigeria (PHCN) switched off supply of electricity during official government functions and programmes. The Power Holding Company of Nigeria (PHCN) ultimately resulted into an object of mockery and criticism for a period covering over two decades. This research work therefore, sets out to analyze the reforms to be proposed in power sector, the extent to which the reforms are required in Nigeria, numerous challenges, opportunities, possible threats and impact of reforms on the quality of electricity in the power sector in Nigeria.

RESEARCH METHODOLOGY

NEED FOR STUDY

Since the area of governance of an power generation and distribution company is very extensive; the system of information flow should assist the top management to have full accessibility and control over the operations. To have effective management it is very important that top or decision level management should have access towards the critical activities of organization. The basic purpose of this study is to study and analyse the present status of information system prevailing in power sector companies and the effectiveness of the information system. In order to have a wider perspective it is very important that the top level management should monitor critical activities on routine basis and take timely action before the situation goes out of control or become critical. Moreover the information that is sought by the top management is the processed information and not the raw information.

In the study, few key activities are studied. All of these activities are very critical and needs updated and timely information to function well. The top level or decision makers in any organization need to have updated information on timely basis to handle the situations on day to day basis.

OBJECTIVES

1. To analyze the management information system techniques adopted by the public and corporate power sector.
2. To analyze the policy perspective and the problems faced by the public and private power sector in collecting and using the vital information on time.

The primary data is collected using structured questionnaire. The data is collected from various companies operating in Delhi and NCR region. Out of eight companies, three private sector and five are public sector companies. Table describes the profile of respondents and companies.

Sector	Sample Size	Name of Company	Respondents	Key Business Activities
Private	50	Alsthom Power	21	Power Generation
		Reliance Power	17	Power Generation and Distribution
		Tata Power	12	Power Generation and Distribution
Public	50	Delhi Electricity Board	15	Power Generation and Distribution
		Haryana Power Generation Corp. Ltd.	05	Power Generation and Distribution
		Dakshin Haryana BijiVitrans Nigam Ltd.	10	Power Distribution
		UP State Electricity Board.	13	Power Generation and Distribution
		NTPC. Faridabad Unit	07	Power Generation

FINDINGS

Based on the data analysis, the followings are the findings of the study -

1. The position of computerized information system can be measured in terms of three broad components – Physical infrastructure, financial support and manpower enforcement. The three broad components represents the three pillars of success of management information system in any organization. These three pillars are essential for the sustainability of management information system in any organization.
2. Physical infrastructure exhibits the level of infrastructure support available in any organization to support computerized information system. It requires lot of infrastructural support in the form of computerization and connectivity between all the departments of the organization. Also, it require uninterrupted internet connectivity.
3. Maintaining a computerized information system in any organization is very costly affair. It requires sufficient funds in the form of hardware and software investment and maintenance and then updating the hardware and software as the load increases.
4. Also, it demands lots of qualified manpower enforcement. The required manpower should be technically sound to handle the complexities of information required to support the decision making in the organization.
5. The three constructs have sufficient high level of reliability. Cronbach's alpha value for all of constructs if above 0.7 which is acceptable.
6. Public and private sector companies are significantly different from each other on physical infrastructure ($p < .05$). The effect size is also large (0.73).
7. On physical infrastructure, private sector power companies have scored better over public sector companies. The mean score of private sector companies is 4.11 while the mean score obtained by public sector companies is 3.74.
8. On manpower enforcement, public sector power companies and private sector power companies are not significantly different at 95% confidence level.
9. On financial support, public and private power sector companies are significantly different ($p < .5$) at 95% confidence level. The effect size is also large (0.81).
10. The mean score obtained by public sector companies is 4.08 in comparison to mean score of 4.55 of private sector companies.
11. Achieved power of t-test for comparing the means is 95%.
12. Public and private sector companies have different level of automation of different activities.

13. Public and private sector power companies are significantly different on Automation of new connections ($p < .05$) at 95% confidence level and 95% power. The effect size is large (0.81).
14. The total score of level of automation of private sector companies is 124 and for public sector companies is 108.
15. Public and private sector power companies have different level of automation of bill generation activity.
16. Public and private sector power companies are significantly different on Automation of bill generation ($p < .05$) at 95% confidence level and 95% power. The effect size is large (0.78).
17. The total score of level of automation of private sector companies is 145 and for public sector companies is 127.
18. On revenue reporting, public and private sector companies are not significantly different ($p > .05$).
19. On inventory control, the total score of private sector companies is 117 while for the same, the total score of public sector companies is 94. The public and private sector companies are significantly different ($p < .05$) at 95% confidence level. The achieved power of test is 99% and effect size is also large (1.43). The difference is quite substantial between public and private sector companies. Private sector companies have been able to streamline the inventory control system using MIS.
20. The private sector is far more efficient in energy accounting and auditing as compared to public sector companies as it is obvious from the test statistics. On Energy accounting and auditing, the total score of private sector companies is 132 while the total score of public sector companies is 102. The public and private sector companies are significantly different ($p < .05$) at 95% confidence level. The achieved power of test is 99% and effect size is also large (0.94).
21. In NCR region of UP and Haryana, there seems no provision to manage substation assets so that unplanned downtime is minimized. This has cascading effect which results in the unscheduled maintenance and increase in inventory is increased. This is very essential in increased productivity and to improve resource utilization by having the right skills and the right spares at the required time and place. Delhi is very less effected by such problem. Private sector companies are far better off from such problems
22. In the MIS system used by public sector companies, there is no provision to better manage the process of acquisition of new connections, maintenance and updating of database of metered consumers and to facilitate disconnections and reconnections. This information is very helpful in integrating the data with the GIS system for the prompt resolution of issues. While only one of the private sector company is suffering from such problem.

LIMITATIONS

The major limitation of the study was getting appointment with officials of power sector companies. Executives at middle and top level are always pre-occupied with official works and finding time to provide information was always difficult. This is one of the reason the sample size is limited to 100. Sample size of 100 respondents is statistically not sufficient to run confirmatory factor analysis which is correct tool to validate the scale.

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