# STORE PERFORMANCE EVALUATION: A CASE STUDY ON BPDB'S SHIKALBAHA POWER PLANT LOCAL STORE

**Submitted by**
Ashim Banerjee
ID No: 13182004

**Submitted to the Institute of Governance Studies, BRAC University, Dhaka for partial fulfillment of Masters in Procurement and Supply Management**

March, 2013

Institute of Governance Studies (IGS)
BRAC University, Dhaka, Bangladesh

# STORE PERFORMANCE EVALUATION: A CASE STUDY ON BPDB'S SHIKALBAHA POWER PLANT LOCAL STORE

**Submitted by**
Ashim Banerjee
ID No: 13182004

Approved to the style and content by:

_____

Dr. Md. Zohurul Islam
Assistant Professor
Institute of Governance Studies
BRAC University, Dhaka, Bangladesh

Supervisor

March, 2013

Institute of Governance Studies (IGS)
BRAC University, Dhaka, Bangladesh

# CERTIFICATE

This is to certify that I have done this work and it was not submitted elsewhere for the award of any degree or diploma or for any publication.

_____

Author

# CONTENTS

# ACKNOWLEDGEMENTS

I would like to extend sincere gratitude to Dr. Md. Zohurul Islam, Assistant Professor, Institute of Governance Studies, BRAC University, Dhaka, Bangladesh and my supervisor, for his time, encouragement, research ideas and guidance in conduction of this research work and throughout the writings. I would also like to thank him for his enormity of help and assistance with the data analysis, valuable critique and sharing insight.

I would like to extend sincere gratitude to the Director of IGS, BRAC University, Dr. Md. Rizwan Khair, for his advice in selection of the research study, guidance in preparation of research proposal and conduction of the research work.

I am also grateful to the senior officers, colleagues and junior staffs of Shikalbaha Power Station, Chittagong for giving their valuable time in providing the necessary primary data required for the study.

I would like to express hearties thanks to all the members of Institute of Governance Studies, BRAC University, Dhaka who directly or indirectly helped me in conduction of this research work.

# ABSTRACT

Power plant store keeps in stock the items that are of high value and critical to the power plant operation and maintenance. Useful working life of a power plant varies with the type of power plant used. Factors for example long working life of the power plant, uniqueness of the spare parts, dependency on foreign manufacturer for spare parts, rapid change of technology, fluctuations of the currency rate, long procurement lead time, bureaucracy in the procurement process etc influence the power plant to keep in stock the valuable items for long time. The purpose of this research is to identify the factors that are affecting the performance of local store and their impact on power plant operation and also to identify the most important areas of storage system that require immediate improvement. Data were collected using the questionnaire with a sample size of 31. The respondents were asked to response in four areas of storage system and they were store facility, record keeping system, staff performance and store security system. Officials of the power station who are directly or indirectly involved with the operation of the power plant store as well as operation of the power plant provided their opinion. Data were analyzed using frequency analysis, reliability test, descriptive analysis, correlation analysis, regression analysis and chi-square test. Results revealed that the store is suffering from poor store capacity, poor record keeping system and poor employee performance. Store security is comparatively better as store security is involved with the power plant security as a whole. However the store has no alarming system, no security signs and hitting and air-conditioning system. Regression analyses showed significant relationships between store performance and three of the five attribute factors. Chi-square analyses also showed significant relationship between store performance and three of the five attribute factors.

# LIST OF TABLES

# Chapter 1

# Introduction

## 1.1 General Introduction

Electricity has become the part and parcel of our life. The ever increasing populations of our country demands increase in employment to get escape from the curse of poverty which in turn requires industrial development. For industrial growth disturbance free electricity is the pre-requisite. Thus electricity is required for the improvement of standards of living. The increasing dependency on electricity for domestic, commercial and industrial development necessitates economic generation of bulk electric power. This is achieved with the help of suitable power generating units, called the power plant. Unfortunately electrical power cannot be stored and therefore the power station must produce power as and when demanded to meet the requirements of the consumers. On one hand, the alternators in the power station should run at their rated capacity for maximum efficiency and on the other hand the demands of the consumers have wide variations. This makes the design of a power station highly complex.

Each power plant have a variety of sub-systems such as fuel processing system, water treatment system, combustion system, energy conversion system, cooling system etc. Each of these sub-systems comprises of various types of machines for example, boilers, turbines, and generators, pumps, motors, regulators, transformers, control equipment etc all of which must be integrated to each other. These machineries and their spare parts are very much plant specific. The machineries can be supplied by a unique manufacturer or a group of manufacturers that makes the procurement process complex and time consuming. Advancement of technology makes the procurement process further complex as manufacturers are changing the design of the plant equipment to sustain in the increasing competitive market place. As all the strategic and bottleneck items are procured from abroad the authority has to consider the PESTLE factors and risks such as political instability, currency rate fluctuation, interest rate, tax, loss or damage during

transport, legal aspects, technological change etc. associated with the procurement process of power plant equipments. Also the prime objective of power plant operation is to deliver the electrical energy to the national grid with minimum interruption. The operation of the plant should be cheap, reliable and continuous. The widespread use of electrical energy by modern civilization has necessitated producing bulk electrical energy economically and efficiently. The increased demand of electrical energy can be met by building big power stations at favorable places where fuel (coal or gas) or water energy is available in abundance. This has shifted the site of power stations to places quite away from the consumers. This has made the procurement of even regular and leverage items difficult. Thus to meet the emergency requirements and to attain its overall objective this makes it necessary to keep the spare parts in stock over the working life of the plant.

For a power plant to return a profit on the capital invested, proper operation is very important. BPDB has number of power stations scattered over the country. Most of the electric power in the country is generated in steam-turbine plants. The only hydro power plant of the country is located in Kaptai hill tracts. Gas turbines and diesel power plants are used to a minor extent for short periods when a system is carrying peak load. Each power station has its own local store inside its area of existence. BPDB also has a central store located in Dhaka to meet the emergency store requirements of the organization as a whole. Local stores are very important to the power stations as it stores high value equipments that are critical to the specific power plant operation. Improper storage will cause deterioration, excess buying or duplication of buying, and even loss of valuable items. To avoid all these unexpected events to occur better stock management is crucial to the power stations.

Storage have crucial role to play in helping to deliver power plant's objective. Storage plays its roles by delivering the right goods for maintenance or operation of the plant at the right time in accordance with the requirements.

## 1.2 Statement of the problem

In power stations the operation and maintenance of plants and equipments are dependent on store because, for maintenance in case of emergency valuable spare parts always need

to be available on demand. If spares cannot be made available, operation and maintenance will fail. Failure in meeting emergency requirements leads to long time power cut, increase in plant shutdown time, staff idle time, cost of shutdown, economic loss for the country as a whole, public dissatisfaction etc.

Thus the objective is that in power plant high value equipments and spare parts need to be stored in a planned and organized way that are consistent with operational and maintenance requirements to ensure long time power plant operation and as a result reliability of electrical power to the national grid.

Management of stores is concerned with improving both the efficiency and the effectiveness of the stores function. It is achieved by the elimination of wastes from activities that add cost and at the same time maximizing those areas that add value. Any activity that is not handled efficiently or does not add value serves to add cost to the organization. Also provision of improved service will result in additional costs to the organization. In essence the higher the service levels the higher the cost. A cost-minimization approach is required to be adopted where objectives are met at minimum cost.

## 1.3 Significance of the Proposed Research

Many researches have been done on storage system and performance improvement of retail stores or departmental stores or storage system of other industrial sectors. But very little works have been done on the power plant stores in Bangladesh in particular. Power plant items are almost strategic or bottleneck in nature and plant performance is closely linked to the role of storage. Storage needs to ensure that goods are available or can be made available to meet emergency requirements. As the type of items stored in the power plant stores and their requirements are different it is therefore considered necessary to make a study in this area.

Shikalbaha power station has one local store for its 60MW steam power plant and 2x28MW barge mounted power plant. Recently a new 150MW gas turbine power plant has been installed but no store has been built for it. Thus the new plant is also using the

existing store for the storage of imported/purchased items that has made the storage system more complicated. The study will identify the factors affecting the current performance of power plant local store, impact of storage system on power plant operation and the potential areas for improvement. On the basis of the findings of this study we can therefore address those factors and locate possible remedies of the problems associated with.

## 1.4 Research Objective

- To identify the factors affecting the performance of local store and its impact on power plant operation.
- To identify the most important areas of storage that requires immediate improvements.

## 1.5 Research Question

- What are the factors that are responsible for the current level of performance?
- What measures can be undertaken to improve the performance of local store?

## 1.6 Scope and Limitations

Bangladesh Power Development Board has large number of power stations scattered over the country. Each has its own local store to meet its individual requirement. This is helpful because most of the required items are power plant specific. BPDB's central store at Dhaka fulfils the general requirement of the organization as a whole. Power plants are vulnerable to various technical problems that require immediate remedy. In that case transfer of goods every time of requirement from central store is time consuming. Performance measurement of all the stores in BPDB is time consuming. Thus due to time

constrains this study will be limited to the Bangladesh Power Development Board's Shikalbaha Power Plant's local store.

## 1.7 Organization of the Study

The First Chapter describes a general overview of the problem. This is followed by the objective of the study, research question, significance of the study and organization of the study. The remainder of this paper is organized as follows. The Second Chapter surveys relevant literature. Chapter Three describes the methodology of the study. As the study will be limited to the Shikalbaha Power Plant local store, a brief description of the plant and its overall storage system is given here. The chapter also describes demographic profile, our data set, transformation we performed on data prior to analysis and reliability test. Chapter Four describes our analysis and the resulting model. In this chapter we also describe our technical findings. In Chapter five we describe the conclusion and recommendation for future work on the basis of our findings. The necessary appendices and references have been included at the end of the study.

# Chapter 2

# Literature Review

## 2.1 Introduction

The study is limited to the performance evaluation of the local store of an important power plant of BPDB, the Shikalbaha power plant. This chapter attempts to have a discussion on the number of studies conducted before on various power plant stores. But specific studies on power plant stores are not found. It is found that number of studies were conducted before on retail and departmental stores. In Bangladesh large retail stores like Agora or Swapno are now seen in large cities of the country. In the developed countries large departmental stores like Tesco, Asda in England are seen from many days and various studies were conducted on their performance. Shikalbaha power plant store is very much similar to manufacturing company's store. The difference is that a manufacturing power plant has both raw material store and output product store. In raw material store stocks are stored prior to their use in the production process. The output product store of the manufacturing power plant holds its output products that wait there before delivery to the external market. But a power plant's output product is the electricity that cannot be stored but can only be generated when there is a demand for the electricity and transferred directly to the end consumer through transmission lines. In that sense the power plants local store is very much similar to the raw material store of a manufacturing plant. The chapter will discus in brief the main points of some previous studies to get the idea on what areas should be considered to evaluate the performance of the Shikalbaha power plant local store.

## 2.2 Previous Research

In the article "Retail Store Evaluations: Benefits of Assessment" the author Shari Waters argued that due to the occasionally overwhelming daily objectives the ultimate goal of the store may not always be executed as planned in spite of good intentions of providing the right products to the right people at the right time. It was revealed in the study that

store performance needs to be evaluated regularly to identify areas that are working well, locate overlooked problems, learn how the store compares to similar stores, examine the requirements and reduce waste. He also argued that in store performance evaluations, objectivity and neutrality are most important.

In "Performance evaluation of storage systems" (Journal: Energy and buildings, volume 22, issue 1, March 1995, page 15-24) authors Akbari H and Sezgen O argued that almost all problems related to the operation of stores could be traced back to the design of the storage system. It was identified in the study that conventional storage systems have many problems associated with it. By solving the problems associated with the design of the storage system it is possible to save considerable amount of money that can contribute to the organizations overall profit.

In another study "Factors affecting Customer Satisfaction- an empirical study" the authors Ankush Nagarwar, Amit Kaldate and Arpit Mankar has given the emphasis on Total Quality Management in store management.

In the study of "Evaluation of a multi-item inventory replenishment policy through simulation" the authors Carlos B. Ramirez Cerda and Armando J. Espinosa de los Monteros F. proposed a inventory replenishment policy. According to them organizations may require to keep a large number of stocks to deal with supply and demand uncertainty. Thus it requires accurate information on stock requirement to aid management to take decisions and thus to minimize total investment and maximize the efficiency. They also argued that this makes the situation complex because these objectives are in conflict with each other, and trade-offs occur when trying to improve one of them. For example, to deal with uncertainty, a relatively high investment in inventories is required, and due to capital constraints, these funds could have the opportunity of better profit in some other investment. Their emphasis was on simulation techniques that could be effectively used to determine an adequate ordering policy to deal with this type of problems.

Salmon (1989) argued that execution in storage has become more important than other aspects of the business (e.g., merchandising).

According to DeHoratius and Raman (2006) due to missing inventory and inventory record inaccuracy in storage system, because of store execution failures, it is often

difficult to find the items needed, even if these items are within the store. Raman et al. (2001a, 2001b) report that such issues arise mainly due to store replenishment processes, merchandising, inventory management and employee turnover. DeHoratius and Raman (2003) outline three approaches to the inaccurate inventory problem. They are prevention and elimination of root causes (using methods similar to the Ishikawa process of JIT principles), correction and identification of errors through inspection policies, and lastly software solutions that integrate the source of errors into the inventory management system.

In a follow-up study, Ton and Raman (2004) find that higher product variety and inventories lead to a higher incidence of phantom stockouts which means for example inventory is in the back room but does not reach the shelf, and thus gives rise to the difficulty in finding items when needed or deterioration or even duplication of purchase.

Ton and Huckman (2005) study the impact of employee turnover on process conformance within the stores and find that the negative effect of turnover is most pronounced in stores with low process conformance that is lesser discipline in process execution and adherence to quality standards.

Corsten and Gruen (2003) study the root causes of inventory stockouts and point to mechanisms that address the issue of stockouts.

Iacobucci et al. (1994, 1995) provide precise definitions of service quality versus customer satisfaction. They contend that service quality should not be confused with customer satisfaction, but that satisfaction is a positive outcome of providing good service.

Ittner and Larcker (1998) provide empirical evidence at the customer, business-unit and firm- level that various measures of financial performance (including revenue, revenue change, margins, return on sales, market value of equity and current earnings) are positively associated with customer satisfaction.

Sulek et al. (1995) find that customer satisfaction positively affects sales per labor hour at a chain of 46 retail stores. Anderson et al. (2004) find a positive association between customer satisfaction at the company level and Tobin's q (a long-run measure of financial performance) for department stores and supermarkets. Babakus et al. (2004) link

customer satisfaction to product and service quality within retail stores and find that product quality has a significant impact on store-level profits.

Another prominent focus on execution which takes the factory viewpoint is found in the automotive industry. In this context the role of process design and conformance has long been debated, and the virtues of the Toyota Production System are well documented. Womack et al. (1991) show that Toyota's competitive advantage arises from a combination of employee motivation, training, process designs and JIT techniques. Fisher and Ittner (1999) study the impact of product variety on automotive assembly plant operations and find that increased option content variability in car assembly has an adverse effect on plants' operational performance, which is manifested in higher total labor hours, overhead hours, downtime hours, rework and inventory levels.

Studies of execution in the healthcare industry focused on operational failures in the execution process (Tucker 2004) as well as on learning through these failures (Tucker and Edmondson 2003). Ren and Wang (2006a) empirically link process consistency and service quality while Ren and Wang (2006b) further show how service quality affects volume at US hospitals.

Using data on customer complaints caused by operational failures in the airline industry, Lapre and Tsikriktsis (2006) find that customer dissatisfaction follows a U-shaped function of operating experience: first dissatisfaction decreases with experience because airlines learn but then dissatisfaction increases because customers increase their expectations of service. Tsikriktsis (2006) shows that the relationship between operational performance and profitability depends upon a company's operating model.

Academic research to date has focused almost exclusively on planning functions. For example, the operations management literature includes numerous papers on inventory optimization that are applicable to setting planned inventory levels in a retail store. Recently, however, a few pioneering papers (Raman et al. 2001a, 2001b, DeHoratius and Raman 2003, Ton and Raman 2004, Corsten and Gruen 2003, Ton and Huckman 2005, Van Donselaar et al. 2006) have provided evidence of deficiencies in store execution, suggesting that optimized plans might be severely blunted by less than perfect execution. Although these papers have focused mostly on missing inventory, inventory record

inaccuracy and inventory replenishment, it is reasonable to suspect that, given the high level of problems with inventories, other aspects of store execution are imperfect also.

## 2.3 Summary

For the purposes of our paper, we focus only on the evaluation of store performance of Shikalbaha power station. The basic requirement of this research is to identify the factors affecting the performance and the area that requires improvement. The higher performance of the store the better the performance of the power plant operation as a whole. This is the place where much of the waste can be reduced and profitability can be improved. That will help the plant to remain in operation for long time and improve customer satisfaction, resulting in better financial performance.

From the above studies we see that store performance needs to be evaluated regularly and performance evaluation process requires objectivity and neutrality. We also see that almost all problems arise from the design of the storage system. For better stock management implementation of Total Quality Management in store management as well as inventory replenishment policy, accuracy in inventory recording system, reduction of employee turnover, identification of root causes of inventory stockouts and development of mechanisms to address the issue of stockouts, employee motivation, training, process designs and JIT techniques are very important. Store personnel can work as the facilitator, who are critical to improving the performance of the power plant as whole, by providing information to other departments on stock availability and stock shortage or requirements, helping in developing specification, delivering goods at the right time and so on. In power plant store the problem is that bottleneck items may required to be stored for long time. As bottleneck items are very critical to power plant operation they require extra care.

In this chapter what we have learned from other studies will be applied to evaluate the performance of the store under study. This will help to identify the reasons of under performance and potential remedies.

# Chapter 3

# Methodology

## 3.1 Introduction

The research methodology of the study determines the information that needs to be collected for the purpose of the study. Source of information and the procedure of information collection are also identified. A power plant store operation resembles with the factory operation and store employees are responsible for a wide range of execution tasks that collectively determine the success of the operation of the power plant as a whole. Factory related store execution tasks include receiving purchased items when they arrive at the store, unloading items and moving items from the back room to shelves, making items available to the respective personnel when demanded, checking for availability of items, providing information to the other departments about stock availability and enable them make a purchase decision etc. Fisher (2004) notes similarities between the execution tasks of a store andan automobile assembly plant, and suggests drawing on the Toyota Production System as a source of ideas for improving store execution.

This study involves the field survey conducted at the Shikalbaha Power Plant. In all the power stations of BPDB like SPS, procurement plans and storage decisions, setting store inventory levels are mostly formulated at the respective departments and executed in the store. Setting store staffing levels, determining how many stores to have and where they should be located and creating the physical design of stores and Plano grams that specify the location of items within the store are all planned and conducted during the construction phase of the power plant.

In Shikalbaha power station there are five divisions such as Electrical Maintenance Division, Instrumentation & Control Division, Mechanical Maintenance Division, Civil Division, Operation Division. Also there are administration department and store, security, and medical. Each department uses the power plant’s common local store. The

store is used for stocking the regular, leverage, bottleneck and strategic items that are critical for the power station operation. In this study the questionnaire survey was conducted. The respondents were approached at their office. The respondents were given the questionnaire to respond their views about the performance of the power station's local store. Responses were sought regarding store layout and facility, record keeping system, employee performance and security system. The data gathered through questionnaire survey are processed manually and analyzed statistically.

## 3.2 Shikalbaha Power Station in brief

Shikalbaha Power Station of Bangladesh Power Development Board is one of the largest power stations in Bangladesh. It has one 60MW steam power plant, one 150MW gas turbine power plant and a 2x28 MW barge mounted power plant which is currently not in operation due to technical problem. The steam power plant is a Czechoslovakian power plant that was installed just after the liberation war in 1971. The gas turbine power plant is a German power plant and installed by the Siemens Power Generation Company Ltd. in 2009. The barge mounted power plant is a Japanese power plant. Electricity generated in this power station is supplied to the national grid and it is distributed to the domestic, agricultural and industrial users throughout the whole country through the national grid particularly to the southern part of Chittagong. This power station plays a significant role in the national economic development by generating a significant amount of total demand for electricity in the country. In this power station, Natural Gas from Karnafuli Gas Transmission & Distribution Company Ltd. is used as fuel. Both plants have large number of auxiliaries such as pumps, fans, motors, exciters, regulators, high tension transformers, breakers, isolators, instrument transformers and so on. Employees of the power station are more than 100. In addition to the plant the power station has one common local store, one medical, one school and a number of residential buildings. Each year the power station has to purchase the strategic or bottleneck items such as electronic equipment, mechanical equipment etc. from abroad and leverage and routine items such as office stationary, industrial battery, chemicals and low value items from local market.

## 3.3 Storage System in Shikalbaha Power Station

The local store of the power plant is a two storied building with capacity of approximately 10000m². It holds a wide range of items. The items range from high value strategic items to low value stationary items for regular office use. The power plant's works are divided into the various organizational functions, such as electrical works, mechanical works, instrumentation and control works, civil works and regular administration works. Items required for electrical works are different from items required for mechanical works and so on. In the store, items are stored according to their functional requirement. Separate rooms are allocated for electrical, mechanical goods accordingly. For example two rooms for storing electrical goods, three or four rooms for mechanical goods and so on. Fixed racks are used in these rooms for storing items.

There is evidence of poor housekeeping. Damaged goods such as rejected high tension breaker, mechanical valves, control cables, vehicles are seen dumped in several locations outside the store building. Aisle in front of the office of the store is seen blocked with pipes, isolator arms, welding machine, pipe cutter etc. Goods loading and unloading area is dumped with mechanical valves due to shortage of store space. Therefore it is often seen goods are loaded and unloaded manually on the pick-up van outside the entry gate. The racks are of fixed heights which are of wrong size for some goods. That's why some goods are seen kept on the floor between two consecutive racks leaving free space on the racks. Goods supplied by the local supplier often have quality problems that are therefore subject to inspection. A small empty space in front of the store building is used as the checking and inspection area. Checking and inspection takes time and space that causes congestion in front of the store entrance.

Goods are often supplied from the store to the concerned maintenance personal without receiving requisition form in case of emergency. In that case the store keeper keeps the record of these items in a temporary register. The foreman submits the requisition form at the end of the week for all the items he has taken from the store throughout the week. After receiving the requisition form at the end of the week the store keeper records it in the main register. This often causes mistakes in recording.

Other areas inside the power plant such as part of the turbine floor for small 1500kv transformer, plant's ground floor for chemicals, mechanical valves are also used as the temporary store due to shortage of space in the main store building. Forklift trucks, crane etc are used for loading and unloading of goods in the store.

## 3.4 Sample Design

In the study opinions of personnel from various departments of the power station were surveyed by a questionnaire. Sample size was 31. The data came from personnel from five departments such as Electrical and Instrumentation Division, Mechanical Maintenance Division, Operation, Administration and Store. The respondents work for these departments of the power plant and are directly or indirectly involved with the operation of the store.

The questionnaire requested demographic information from the respondents. To obtain a profile of the respondents, they were asked to complete questions regarding their occupational status, length of service, age, education and department of the power plant for which they are working. Table 1 shows the distribution of the respondents by demographic characteristics.

35.5% of respondents were between the ages of 31-40. The second largest group, 25.8%, was between the ages of 51-60, followed by the 41-50 group (22.6%). Only 16.1% respondents were in the age group of 25-30. Respondents indicated their highest level of education achieved. The highest percentage of respondents, 54.8% indicated Bachelor Degree, followed by the Diploma in Engineering group (35.5%). 6.5% reported some SSC/HSC while 3.2% of the respondents reported Master Degree and above. The length of service question revealed that a majority of the respondents, 38.7%, are working for 1-8 years. 29% of respondents are working for 17-24 years while 25.8% respondents are working for 9-16 years and 6.5% reported their length of service more than 24 years. Question related to occupational status revealed that highest 29% respondents are Assistant Engineer followed by the Sub-Assistant Engineer group, 22.6%. 16.1% of the respondents are Sub-Divisional Engineer. Executive Engineers are also 16.1% of the total

respondents. While 6.5% respondents are Deputy Manager and 9.7% are store personnel. Respondent's department was also included in the questionnaire. 35.5% and 32.3% of the respondents were from Operation Division and Electrical/I&C Division respectively. The third largest group, 16.1%, was from Mechanical Maintenance Division. Only 9.7% of respondents were from Store and 6.5% were from Administration.

**Table 1: Frequency Analysis of Demographic Characteristics**

| | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| **Age Group** | | | |
| 51 to 60 years | 8 | 25.8 | 25.8 |
| 41 to 50 years | 7 | 22.6 | 48.4 |
| 31 to 40 years | 11 | 35.5 | 83.9 |
| Less than 31 years | 5 | 16.1 | 100.0 |
| **Total** | **31** | **100.0** | |
| **Education** | | | |
| Masters and above | 1 | 3.2 | 3.2 |
| Bachelor Degree | 17 | 54.8 | 58.1 |
| Diploma in Engineering | 11 | 35.5 | 93.5 |
| SSC/HSC | 2 | 6.5 | 100.0 |
| **Total** | **31** | **100.0** | |
| **Length of Service** | | | |
| More than 24 years | 2 | 6.5 | 6.5 |
| 17 to 24 years | 9 | 29.0 | 35.5 |
| 9 to 16 years | 8 | 25.8 | 61.3 |
| 1 to 8 years | 12 | 38.7 | 100.0 |
| **Total** | **31** | **100.0** | |
| **Occupational Status** | | | |
| Deputy Manager | 2 | 6.5 | 6.5 |
| Executive Engineer | 5 | 16.1 | 22.6 |
| Sub-Divisional Engineer | 5 | 16.1 | 38.7 |
| Assistant Engineer | 9 | 29.0 | 67.7 |
| Sub-Assistant Engineer | 7 | 22.6 | 90.3 |
| Store Officer/Store Keeper | 3 | 9.7 | 100.0 |
| **Total** | **31** | **100.0** | |
| **Respondents Department** | | | |
| Electrical / I & C | 10 | 32.3 | 32.3 |
| Mechanical Maint. Division | 5 | 16.1 | 48.4 |
| Operation Division | 11 | 35.5 | 83.9 |
| Administration | 2 | 6.5 | 90.3 |
| Store | 3 | 9.7 | 100.0 |
| **Total** | **31** | **100.0** | |

## 3.5 Data Description

Our study requires detailed store-level and survey data which is available from the employees working in the power station. Store performance depends on the facilities provided by the store in the form its layout, available MHE, material loading-unloading facility, movement facility, record keeping system, stock identification system, employee performance, store security etc. The questionnaire includes 57 questions in 4 point scale. The questions were grouped into four categories: STORE LAYOUT AND FACILITY, RECORD KEEPING SYSTEM, EMPLOYEE PERFORMANCE, and STORE SECURITY related questions. STORE LAYOUT related questions were again grouped into two sub-categories; they were STORE FACILITY and STORE SERVICE related questions. Similarly RECORD KEEPING SYSTEM related questions were grouped into two sub-categories and they were RECORDING SYSTEM and RECORD related questions. Out of 57 questions 24 questions were STORE LAYOUT AND FACILITY related, 13 questions were RECORD KEEPING SYSTEM related, 10 questions were EMPLOYEE PERFORMANCE related and remaining 10 questions were STORE SECURITY related. We limit our study to 6 months starting from June 2012 to November 2012. We summarize corresponding variables in Table 2 where we calculate descriptive statistics for each variable across stores over the period of study.

## 3.6 Data Transformation

We conducted exploratory analysis and questioned SPS employees regarding their opinion about the performance of the power plant store. Further, we conducted preliminary data analysis by correlations. Based on the exploratory analysis, first we determined that STORAGE CAPACITY, STORE LOCATION, FUTURE EXTENSION PROVISION, STORE ENVIRONMENT, MHE are all highly correlated with STORE FACILITY and DELIVERY LEAD TIME, COMPLIANCE WITH H&S STANDARDS, CONVENIENCE FOR MOVEMENT, RACKING SYSTEM, STOCK IDENTIFICATION SYSTEM, DISPOSAL SYSTEM, WASTE MANAGEMENT SYSTEM are highly correlated with STORE SERVICES. Hence, for the remainder of the paper, we combined those items into STOREFACILITY variable and STORESERVICES variable as our measure of STORE LAYOUT AND FACILITY performance. We combined RECORD KEEPING SYSTEM, STOCK IDENTIFICATION SYSTEM, LEVEL OF STOCK< COMPLEXITY OF RECORD< COMLETENESS OF RECORD, ACCURACY OF RECORD, TRUSTWORTHYNESS OF RECORD, TIME TO COMPLETE

DOCUMENTATION, DUPLICATION OF RECORD, STANDARDIZATION OF RECORDING SYSTEM, VARIETY OF ITEMS, AVAILABILITY OF STOCK into a single RECORD variable as measures of RECORD KEEPING SYSTEM performance. Furthermore, we see that STORE PERSONNEL'S KNOWLEDGE & SKILL, their SERVICE LEVEL, TRAINING are correlated with employee performance and we combine them into the single variable EMPLOYEES for the measurement of employee performance. Likewise ALARMING SYSTEM, CLARITY & VISIBILITY OF SECURITY SIGNS, STORE SECURITY AGAINST CRIME & NATURAL DISESTER, DURABILITY OF DOORS & WINDOWS, LIGHTING SYSTEM, LOCKING SYSTEM, are highly correlated with store security system and we combine them into a single SECURITY variable as the measure of security performance.

**Table 2: Store Performance Components**

| Dimension | Component | Content of Component |
|---|---|---|
| Store Layout | Store Facility | Store capacity<br>Store cleanliness<br>Location from work centre<br>Provision for extension<br>Convenience for movement of both MHE and staff<br>Store environment in terms of temperature, humidity etc.<br>Vehicle & MHE access facility |
| | Store Service | Heavy/small item storage capacity<br>Heavy item in and out facility.<br>Heavy/small item load-unload facility<br>Racking system<br>Stock location identification system<br>Visibility of stock<br>Delivery lead time<br>Disposal system of obsolete stock<br>Waste management system<br>Compliance with H&S standards |
| Record Keeping System | Record | Computerized/Manual<br>Stock Identification System<br>Complexity<br>Completeness<br>Accuracy<br>Trustworthiness<br>Time to Complete Documentation<br>Duplication of Record<br>Standardization of recording system<br>Stock Availability in Requirement |

**Table 2: (Continued)**

| | | |
|---|---|---|
| Employee | Service of Store Personnel | Store Personnel's Knowledge & Skills<br>Service Level of Staff<br>Problems in case of Absence of Staff<br>Performance Evaluation System |
| Security | Store Security | Alarming system in the store<br>Clarity and Visibility of Security Signs<br>Employee capability in dealing with emergency like fire<br>Store security against crime<br>Durability of Doors and windows to prohibit forced entry<br>Locking system of store rooms<br>Store security from natural disasters<br>Heating and air-conditioning system<br>Lighting system<br>Loaded Firearm in Plant Premises |

## 3.7 Reliability

To measure reliability of factors, the researchers employed Cronbach's Alpha test for all variables. The calculated values of Cronbach's Alpha are given in table 3. It is generally accepted that for internal consistency Cronbach's Alpha should be greater than 0.7. Our measurement of almost all variables had Cronbach's Alpha greater than 0.7 which satisfies the requirement. Thus we can say that the question items have strong internal consistencies.

**Table 3: Reliability Test**

| Dimension | Component | Cronbach's Alpha |
|---|---|---|
| Store Layout | Store Facility | 0.706 |
| | Store Service | 0.748 |
| Record Keeping | Record | 0.717 |
| Employee | Service of Store Personnel | 0.592 |
| Security | Store Security | 0.816 |

## 3.8 Summary

In this chapter we have described the research methodology of the study. The chapter included a brief description of the plant and its overall storage system. Field survey was conducted at the Power Plant. The Opinions of personnel on store layout and facility, record keeping system, employee performance and security system were sought from five divisions of the power station by the questionnaire. Frequency analysis of demographic characteristics was performed. The chapter also describes the data set and transformation we have performed on data prior to analysis. We also performed the reliability test to determine the internal consistency of the question items. The data gathered through questionnaire survey will be processed manually and analyzed statistically in the next chapter.

# Chapter 4

# Data Analysis, Findings and Result Discussion

## 4.1 Introduction

Store evaluation program creates a more pleasant and productive working environment for employees. To become successful it requires to recognize the importance of maintaining and constantly updating a store evaluation program. It also requires to encourage the employees to participate, form focus groups within each store to solicit employee input and strengthen employee loyalty. An effective store evaluation program is a very good offensive move, aimed at helping to maintain the security of goods to deal with emergency needs. For performance measurement it requires performance indicators. In this chapter we will explore the theories related to the store performance measurement that will used in the next chapter for data analysis and deriving conclusion. Performance measurement and monitoring are important to the effective management of the store. Measurement provides information at both strategic and operational level. At the strategic level, measurements relate to long-term planning and direction. The measurement of key criteria evidences how the store is performing against anticipated goals and may highlight areas that require review or additional requirement. At the operational level measurement has more to do with the effectiveness and efficiency of the store operation and how it is reaching standards. The areas of responsibility for a store include the effective management of the operation of the store. Included within that broad remit is the planning and control of operations and the optimization of resources in meeting

operational objectives of the store. A store does not operate in isolation. They are part of a wider logistics operation and problems and issues in other related areas such as late deliveries and rejection of goods may impact widely. It is difficult to implement meaningful measures in storage without measuring the inputs of other functions.

## 4.2 Descriptive Analysis

Descriptive statistics of the store layout and facility related data used in the analysis are presented in Table 4. Respondent's opinions are that the store's stock holding capacity, cleanliness, movement facility, environment, vehicle & MHE facility, disposal & waste management facility, H&S standard are poor on average. Whereas location of the store from work centre, future extension facility and stock load-unload facility are comparatively much better.

Table 5 shows the descriptive statistics of the record keeping system related data used in the analysis. Respondent's opinions are that the record is not complex on average. Record is very much complete and accurate thus employees can trust the record and there is also less duplication of the record. This has made it possible to maintain a good delivery lead time on average. But record keeping system is fully manual thus poor and takes long time to complete the documentation. This has made the stock identification system difficult. Record keeping system is not standardized.

Descriptive statistics of the employee performance related data are presented in Table 6. It shows that the store is running with less number of employees. Their knowledge and skill and service level are poor. They have the need for training.

Whereas in the descriptive statistics of store security related data (presented in Table 7) it is seen that store security from natural disaster is very good as expected. Security against crime, durability of doors and windows as well as locking system is good. But the store has lack of alarm system and security signs. The store has no heating and air conditioning system. Employee's emergency handling capacity and lighting system are also poor.

**Table 4: Descriptive Statistics (Store Layout and Facility)**

| | Mean | Std. Deviation |
|---|---|---|
| Capacity | 1.84 | .454 |
| Cleanliness | 1.77 | .617 |
| Location | 2.74 | .575 |
| Extension Provision | 2.10 | .597 |
| Movement Facility | 1.6452 | .34357 |
| Environment | 1.42 | .502 |
| Vehicle & MHE Facility | 1.5645 | .46083 |
| Stock Load-Unload Facility | 2.0645 | .41204 |
| Disposal & Waste Mgt Facility | 1.0806 | .29146 |
| H&S Standard | 1.39 | .495 |

**Table 5: Descriptive Statistics (Record Keeping System)**

| | Mean | Std. Deviation |
|---|---|---|
| Record Keeping System | 1.94 | .574 |
| Complexity of record | 2.35 | .608 |
| Completeness of record | 2.97 | .547 |
| Accuracy of record | 2.94 | .512 |
| Trustworthiness of record | 2.90 | .597 |
| Documentation time | 1.42 | .765 |
| Duplication of record | 2.74 | .682 |
| Standardization of record | 1.29 | .643 |
| Stock Identification System | 1.55 | .568 |
| Delivery Lead Time | 2.0484 | .43503 |

**Table 6: Descriptive Statistics (Employee Performance)**

| | Mean | Std. Deviation |
|---|---|---|
| Number of staff | 1.68 | .653 |
| Knowledge and skill | 1.94 | .629 |
| Service level of store personnel | 1.71 | .693 |
| Training of store personnel | 1.77 | .617 |

**Table 7: Descriptive Statistics (Store Security)**

| | Mean | Std. Deviation |
|---|---|---|
| Alarming system of store | 1.03 | .180 |
| Emergency handling capability | 1.55 | .675 |
| Visibility of security sign | 1.03 | .180 |
| Security against crime | 2.00 | .632 |
| Heating and air conditioning system | 1.06 | .250 |
| Security from natural disasters | 2.90 | .831 |
| Durability of doors and windows | 2.06 | .574 |
| Locking system | 2.10 | .539 |
| Lighting system | 1.65 | .661 |

## 4.3 Correlation Analysis

Table 8 presents correlations between store layout and facility related items. These correlations are based on data from the full sample. It shows that the facilities for movement in the store are significantly correlated with store cleanliness, location of store, available vehicle and MHE facility and health and safety standards whereas store location is significantly correlated with store capacity, store cleanliness, movement facility, disposal & waste management facility. Store capacity is correlated with store location and disposal & waste management facility while cleanliness of store is seen correlated with store location and movement facility. Vehicle and MHE facility is correlated with movement facility and H&S standards. Disposal and waste management facility is correlated with store capacity and store location. Health and safety standard is seen correlated with movement facility and vehicle & MHE facility. Correlation between future extension provision, environment, and stock load-unload facility and other factors are not significant in most cases.

Similarly Table 9 presents correlations between record keeping system items. These correlations are also based on data from the full sample. It indicates that completeness of the record is positively and significantly correlated with needed accuracy, trustworthiness, documentation time, duplication and standardization of record. Similarly, as expected, trustworthiness of the record is correlated with complexity, completeness, accuracy, duplication and standardization of the record whereas duplication of the record is correlated with completeness, trustworthiness, documentation time and standardization of the record. As expected, accuracy of the record is significantly correlated with completeness, trustworthiness and documentation time whereas documentation time is significantly correlated with completeness, accuracy and duplication of the record whereas standardization of the record is seen negatively and significantly correlated with completeness, trustworthiness and duplication of the record. Record keeping system as a whole is significantly correlated with stock identification system and completeness of the record. Stock identification system and complexity of the record is significantly

correlated with only one factor and they are record keeping system and trustworthiness of the record respectively.

Whereas correlations between employee performance related items are given in Table 10. These correlations are based on data from the full sample as usual. As expected, accuracy of the record is significantly correlated with store personnel's knowledge and skill, their service level, required trustworthiness, documentation time and completeness of the record. Similarly, as expected, documentation time is also significantly correlated with store personnel's knowledge and skill, their service level, required accuracy, unexpected duplication and completeness of the record. As before completeness of the record is significantly correlated with accuracy, trustworthiness, time to complete documentation and, duplication of the record. Store personnel's knowledge and skill is significantly correlated with their level of service, accuracy of record and time to complete documentation whereas service level of store personnel is significantly correlated with their knowledge and skill, accuracy of record and documentation time. Trustworthiness of record is significantly correlated with accuracy, duplication and completeness of record whereas duplication of record is seen significantly correlated with trustworthiness of record, documentation time and completeness of the record.

Table 11 presents correlations between store security items. These correlations are based on data from the full sample as before. The table shows that store security against crime is positively and significantly correlated with security against pilferage, natural disasters, durability of doors and windows to prohibit forced entry and locking system of store rooms as expected. Both security of small items from pilferage and security from natural disasters are significantly correlated with security against crime, durability of doors and windows to prohibit forced entry and locking system of store rooms. Similarly both durability of doors and windows to prohibit forced entry and locking system of store rooms are significantly correlated with store security against crime, security of small items from pilferage, security from natural disasters and lighting system. As expected, alarming system of store and clarity and visibility of security signs and only significantly correlated with each other.

**Table 8: Correlation (Store Layout and Facility)**

| | SF1 | SF2 | SF3 | SF4 | SF5 | SF6 | SF7 | SF8 | SF9 | SF10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **SF1** | 1 | .341 | **.600** | -.186 | .191 | .307 | .051 | .028 | **-.528** | -.010 |
| **SF2** | .341 | 1 | **.394** | .152 | **.396** | -.115 | .053 | .168 | -.266 | .077 |
| **SF3** | **.600** | **.394** | 1 | -.119 | **.364** | .272 | .316 | .096 | **-.369** | .128 |
| **SF4** | -.186 | .152 | -.119 | 1 | -.044 | .305 | .098 | .041 | .049 | -.018 |
| **SF5** | .191 | **.396** | **.364** | -.044 | 1 | -.010 | **.711** | .272 | -.093 | **.377** |
| **SF6** | .307 | -.115 | .272 | .305 | -.010 | 1 | .095 | -.028 | -.125 | .130 |
| **SF7** | .051 | .053 | .316 | .098 | **.711** | .095 | 1 | .314 | -.102 | **.398** |
| **SF8** | .028 | .168 | .096 | .041 | .272 | -.028 | .314 | 1 | .117 | .309 |
| **SF9** | **-.528** | -.266 | **-.369** | .049 | -.093 | -.125 | -.102 | .117 | 1 | -.108 |
| **SF10** | -.010 | .077 | .128 | -.018 | **.377** | .130 | **.398** | .309 | -.108 | 1 |

SF1 - Store Capacity, SF2 - Store Cleanliness, SF3 - Location Of Store, SF4 - Provision For Future Extension, SF5 – Convenience for Movement, SF6 - Store Environment in terms of temperature, humidity etc, SF7 – Vehicle & MHE Facility, SF8 – Stock Load-Unload & In/Out Facility, SF9 – Disposal & Waste Management Facility, SF10 - Compliance With Health and Safety.

**Table 9: Correlation (Record Keeping System)**

| | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 |
|---|---|---|---|---|---|---|---|---|---|
| **R1** | 1 | **.387** | .304 | **.400** | .316 | .268 | .319 | .141 | .025 |
| **R2** | **.387** | 1 | .177 | .267 | .055 | .034 | .305 | -.027 | .212 |
| **R3** | .304 | .177 | 1 | .136 | .290 | **.373** | .243 | .309 | -.272 |
| **R4** | **.400** | .267 | .136 | 1 | **.587** | **.602** | **.432** | **.424** | **-.447** |
| **R5** | .316 | .055 | .290 | **.587** | 1 | **.850** | **.412** | .333 | -.245 |
| **R6** | .268 | .034 | **.373** | **.602** | **.850** | 1 | .238 | **.428** | **-.532** |
| **R7** | .319 | .305 | .243 | **.432** | **.412** | .238 | 1 | **.406** | -.053 |
| **R8** | .141 | -.027 | .309 | **.424** | .333 | **.428** | **.406** | 1 | **-.508** |
| **R9** | .025 | .212 | -.272 | **-.447** | -.245 | **-.532** | -.053 | **-.508** | 1 |

R1 – Record Keeping System, R2 – Stock Identification System, R3 - Complexity of record, R4 - Completeness of record, R5 - Accuracy of record, R6 - Trustworthiness of record, R7 - Time to complete documentation, R8 - Duplication of record, R9 - Standardization of recording system.

**Table 10: Correlation (Employee Performance)**

| | E1 | E2 | E3 | E4 | E5 | E6 | E7 |
|---|---|---|---|---|---|---|---|
| **E1** | 1 | **.644** | **.400** | .338 | **.405** | .115 | .091 |
| **E2** | **.644** | 1 | **.415** | .333 | **.489** | .260 | .327 |
| **E3** | **.400** | **.415** | 1 | **.850** | **.412** | .333 | **.587** |
| **E4** | .338 | .333 | **.850** | 1 | .238 | **.428** | **.602** |
| **E5** | **.405** | **.489** | **.412** | .238 | 1 | **.406** | **.432** |
| **E6** | .115 | .260 | .333 | **.428** | **.406** | 1 | **.424** |
| **E7** | .091 | .327 | **.587** | **.602** | **.432** | **.424** | 1 |

E1 - Store personnel's knowledge and skill, E2 - Service level of store personnel, E3 - Accuracy of record, E4 - Trustworthiness of record, E5 - Time to complete documentation, E6 - Duplication of record, E7 - Completeness of record.

**Table 11: Correlation (Store Security)**

| | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 |
|---|---|---|---|---|---|---|---|---|
| S1 | 1 | **1.000** | .000 | .000 | -.202 | -.021 | -.033 | .100 |
| S2 | **1.000** | 1 | .000 | .000 | -.202 | -.021 | -.033 | .100 |
| S3 | .000 | .000 | 1 | **.849** | **.634** | **.551** | **.587** | .239 |
| S4 | .000 | .000 | **.849** | 1 | **.646** | **.595** | **.543** | .222 |
| S5 | -.202 | -.202 | **.634** | **.646** | 1 | **.573** | **.543** | .300 |
| S6 | -.021 | -.021 | **.551** | **.595** | **.573** | 1 | **.950** | **.502** |
| S7 | -.033 | -.033 | **.587** | **.543** | **.543** | **.950** | 1 | **.568** |
| S8 | .100 | .100 | .239 | .222 | .300 | **.502** | **.568** | 1 |

S1 - Alarming system of store, S2 - Clarity and visibility of store sign, S3 - Store security against crime, S4 -Security of small items from pilferage, S5 - Store security from natural disasters, S6 - Durability of doors and windows to prohibit forced entry, S7 - Locking system of store rooms, S8 - Lighting system.

## 4.4 Regression

Degree of store performance is regressed for 5 variables. The variables are Store Facility, Store Service, Record, Employee Service and Security. The results are given in table 12. The regression model is meaningful since it has significant F statistic. Among the variables, Store Service, Record and Employee Service are statistically significant. This implies that the store will have to pay attention to Store Service, Record Keeping System and Employee Performance. The store can make its contribution more valuable to the power plant operation by improving Store Service, Record Keeping and Employee Performance. The coefficients of Record and Employee Service have statistically meaningful values in store regression. The coefficients of Record and Employee Service are 0.552 and 0.298 respectively. That is, the store can enhance store performance with improvement in Record Keeping System and Employee Service.

**Table 12: Regression Results**

| **Independent Variable** | **Standardized Coefficient** | **t-value** |
|---|---|---|
| (Constant) | | -1.014 |
| Store Facility | -0.077 | -0.472 |
| Store Service | 0.026 | 0.148 |
| Record | 0.552 | 2.412 |
| Employee Service | 0.298 | 1.819 |
| Security | -0.096 | -0.410 |
| | **Adjusted $R^2$ 0.284** **F = 3.385 ( df = 30 )** | |

## 4.5 Chi-Square test

Chi-square analysis was used to test the relationship between the store facility, recording system, employee performance and available security. The test statistics are shown in Table 13. Results reveal that the items included in store faculty, recording system and employee performance are significantly related to the poor store performance at the 0.05 level of significance. Items included in store facility, recording system, employee performance and available security are shown in Table 2.

**Table 13: Chi-Square Test Statistics**

| | Facility | Record | Employee Service | Security |
|---|---|---|---|---|
| **Chi-Square** | 5.290 | 6.839 | 20.387 | 9.097 |
| **df** | 24 | 22 | 8 | 10 |
| **Asymp. Sig.** | 1.000 | .999 | .009 | .523 |
| **Exact Sig.** | 1.000 | 1.000 | .010 | .561 |
| **Point Probability** | .000 | .001 | .002 | .072 |

## 4.6 Discussion

From the opinion of respondents it is clear that the power station is experiencing some store capacity related problems. A new power plant has been installed recently and it is seen that no store building was constructed for it. Both 60MW steam turbine plant and new 150MW gas turbine plant are sharing the existing old store. Also opinion of respondents is that the store is located in a convenient area and future extension provision is also good but due to poor environment and disposal and waste management system the store is suffering from poor vehicle, MHE, staff movement facility and vulnerable to health and safety risk. Correlation analysis also shows that movement in the store is significantly correlated with store cleanliness, available vehicle and MHE facility and health and safety standards. Store capacity is seen correlated with disposal & waste management facility. That is poor disposal and waste management system is making congestion and has reduced the store capacity. Thus store facility related factors that are influencing the performance of the store and thus require immediate improvement are capacity, disposal and waste management system and store environment.

From the response on record keeping system we see that record keeping system is completely manual. Thus in spite of less complexity of the record it

takes long time for documentation and there is lack of standardization. It also takes long time for locating a stock on the shelf. Thus delivery lead time is little bit long. But it seems, respondents can rely on the record because according to them it is accurate, complete and there is less duplication of the record. Correlation analysis also shows that documentation time is significantly correlated with completeness, accuracy and duplication of the record. That is as the record keeping system is manual it takes long time for documentation to maintain the record more accurate, complete and reduce duplication. Record keeping system as a whole is seen significantly correlated with stock identification system and completeness of the record. Regression and Chi-square test also shows that record keeping related issues are responsible for current level of performance of the store. Thus the factor is the manual record keeping system that needs to be computerized for improvement.

Employee performance related response shows that overall performance of the staff is poor. There is less number of staff than actual requirement. They also have lack of knowledge and skill. Thus their service level is poor and requires training. Correlation analysis shows that knowledge and skill of the staff is correlated with accuracy of the record and documentation time. Regression and Chi-square test also shows that employee performance is significantly related to the current level of performance of the store. Thus employee performance related factors that have the influence on performance of the store are number of staff and their knowledge and skill.

From the security related response we see that the store has no security signs, alarming system, heating and air-conditioning system. But security against forced entry, crime and natural disaster is good. Regression analysis does not show that store performance is significantly related to the current performance of the store. Thus security related factors that have influence on store performance are alarming system, security sign, heating and air-conditioning system, lighting system etc.

# Chapter 5

# Recommendation and Conclusion

## 5.1 Recommendations and Conclusion

For Shikalbaha Power Station the store represents an important and costly asset. But it is experiencing some capacity problems. The situation is further aggravated by the recent installation of another 150MW gas turbine plant as no store was built for new plants and both plants are sharing the existing old store. In dealing with capacity problem some long term strategic issues such as construction of a new automated store need to be considered. However SPS clearly face some operational issues that require some short-to-medium term actions. At this point the operational considerations for storage will need to be carefully aligned with the strategic positioning. Following the review of the store operation in Shikalbaha Power Station following actions are recommended.

### Inventory management

Due to the installation of a new power plant the increase in product portfolio is creating pressure on the storage capacity. Prior to considering issues such as racking and storage density the initial focus should be on controlling the inventory profile in the most cost effective manner. An initial stock audit should be undertaken to establish current accuracy status. Following the audit, elementary techniques such as Pareto analysis could be used to develop stock classification. This classification would enable correct identification of the high runners that probably influence 80% of the stock turnover. Equally classifications could be set up for slow moving and obsolete stocks. This would allow the introduction of formal replenishment and control procedures, including disposal procedures for obsolete and slow moving stock. This

would also allow the store to best utilize available space, materials handling equipment and reduce unnecessary movement.

## Racking

The current racking is fixed leading to many locations having empty space above the products being stored. Racking is therefore inflexible to full utilization of the store space. Some of the floor space congestion is caused by the inflexibility of the racking system. Improved racking such as adjustable pallet racking and/or high-rack and narrow aisle racking would improve both the effective and efficient use of the available capacity. In addition, installing mezzanine floors where possible can also enhance the use of existing cubic capacity.

## Materials handling equipment (MHE)

A comprehensive survey of existing MHE is recommended. Depending on the outcome of the MHE survey continue with the existing MHE supported by a formal maintenance procedure and train MHE personnel in the fundamentals of preventive maintenance to further assist in improving equipment reliability.

## Computer systems

The existing computer system is somewhat old and used for routine clerical work only. The inventory management system is manual. As seen this causes delay in documentation, increase delivery lead time, increase variety and reduce standardization. Thus the computer system requires to be changed and use warehouse management software. This will eliminate the problem encountered due to staff shortage, improve stock control system, increase efficiency of the picking process (eg RFID picking via radio terminals, eliminating the need for manual pick lists), improve pick accuracy and completeness of the record.

## Staff management

A training need analysis needs to be performed. The lack of basic skills is partially responsible for some of the operational issues currently being

encountered. The training need analysis should include the operation of the store management system, if and when implemented.

## Security

Installation of alarming system, security signs, heating and air-conditioning system and adequate lighting system are recommended.

The proposed areas for improvement identified above would collectively assist the SPS operation in the short-to-medium term. In addition, the capital outlay for these proposals would be relatively modest in the context of the SPS operation.

# References


Sung Jin Woo and Young Jae Chang (2005), "An Exploratory Research on the Store Image Attributes Affecting Its Store Loyalty", Seoul Journal of Business, 11(1)

Chaiyasoonthorn, Wornchanok and Suksa-ngiam, Watanyoo (2011), "Factors Affecting Customers Using Modern Retail Stores In Bangkok", International Conference on Business and Economics Research, Singapore, 16.

Rafiei, Farimah Mokhatab (2012), "Designing a Model for Performance Evaluation of Chain Stores Using DEA: A case study", Interdisciplinary Journal of Contemporary Research in Business, 3(11).

Ghosh, Dipankar and Robert F. Lusch (2000), "Outcome effect, controllability and performance evaluation of managers: some field evidence from multi-outlet businesses", Accounting, Organizations and Society, 25.

Moye, Letecia N. (1998), "Relationship Between Age, Store Attributes, Shopping Orientations, and Approach Avoidance Behavior of Elderly Apparel Consumers", Interdisciplinary Journal of Contemporary Research in Business, 12

Banker, Rajiv D. and Mashruwala, Raj (2007), "The Moderating Role of Competition in the Relationship between Non-financial Measures and Future Financial Performance", Contemporary Accounting Research, 24(3).

The Official CIPS Course Book (2010), Storage and Distribution, Profex Publishing Limited.

Fisher, Marshall L., Krishnan, Jayanth and Netessine, Serguei (2006), "Retail Store Execution: An Empirical Study", Working Paper, The Wharton School, University of Pennsylvania.

Nagarwar, Ankush , Kaldate, Amit and Mankar, Arpit (2008), "Factors affecting Customer Satisfaction- an empirical study forsome departmental stores in Mumbai", Working paper, Institute of Management and Computer Studies, Thane.

Rushton, Alan; Croucher, Phil and Baker, Peter (2010), The Handbook of Logistics and Distribution Management, Replika Press Pvt Ltd, India, 4th Edition.

Stevenson, William D. Jr. (1996), Elements of Power System Analysis, McGraw-Hill Book Company, Singapore, 4th Edition.

Skrotzki, Bernhardt G.A. and Vopat, William A. (2004), Power Station Engineering and Economy, Tata McGraw-Hill, India, 2nd Edition.