



Addis Ababa University
School of Graduate Studies
School of Business and Public Administration

Impact of Power Interruption on Capacity Utilization: The Case of
Kaliti Food Share Company

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partial fulfillment of the requirements for the Degree of Master of Business
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**Addis Ababa University
School of graduate Studies**

School of Business and Public Administration

Impact of Power Interruption on Capacity Utilization: The Case of Kality Food Share Company

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DECLARATION

I, Habtamu Endris declare that this work entitled ***“Impact of Power Interruption on Capacity Utilization: The Case of Kality Food Share Company”***, is outcome of my own effort and study and that all sources of materials used for the study have been duly acknowledged. I have produced it independently except for the guidance and suggestion of the Research Advisor.

This study has not been submitted for any degree in this University or any other University. It is offered for the partial fulfillment of the degree of MA in Business Administration [MBA]

By: Habtamu Endris

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Date_____

CERTIFICATION

This is to certify that this project work, *“Impact of Power Interruption on Capacity Utilization: The Case of Kality Food Share Company”*, undertaken by Habtamu Endris for the partial fulfillment of Master of Business Administration [MBA] at Addis Ababa University, is an original work and not submitted earlier for any degree either at this University or any other University.

Signature _____

Date _____

Research Advisor

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ACRONYMS

EEPCo-----Ethiopian Electric power Corporation

GWS-----Giga watt Second

KFSC-----Kality Food Share Company

KWH-----Kilowatt Hour

KWS-----Kilowatt Second

MND-----Ministry of National Defense

MW-----Megawatt

ABSTRACT

In this paper, the impact of power interruption on capacity utilization is considered and investigated at Kality Food Share Company. Interview was conducted to different line managers of KFSC and officials of EEPCo. The result reveals that power interruption was the prominent problem of the company for the last three years. During these three years EEPCo was using power rationing scheme extensively. The company's production cost and profit level were highly influenced by power interruption. To alleviate the problem and to reduce the possible costs of power interruption the management of KFSC has taken different measures.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Manufacturing companies are continually striving to achieve and maintain high level of operational excellence. Operational excellence requires continuous improvement of a company's manufacturing operations.

For the past decades, the enterprise environment has changed rapidly such that business emphasis moved from seller-centered to customer-centered enterprises. Accordingly in some customer centered industries the products have been more diversified, the lot size has shrunk, the production processes have become complicated, the demand has been more uncertain, and the life cycle has shortened to meet the customers dynamic need. Under these circumstances effective capacity utilization becomes a major priority (Lee, 2003).

Capacity is the limiting capability of a productive unit to produce within a stated time period, normally expressed in terms of output unit per unit of time. But capacity is an elusive concept because it must be related to the intensity with in which a facility is used (Buffa & Sarin, 1987). Designed capacity is the rate at which a firm would like to produce under normal circumstances and for which the system was designed. Maximum capacity is used to describe the maximum output rate that could be achieved when productive resources are used to their maximum. If capacity is in adequate, a company may lose customers through slow service or

by allowing competitors to enter the market. If capacity is excessive, a company may have to reduce its prices to stimulate demand, underutilize its workforce, carry excess inventory, or seek additional less profitable products to stay in business (Chase & Aquilano, 1992).

If capacity is inadequate, a company may lose customers through slow service or, by being unable to accept some orders and allow competitors to enter the market. On the other hand, excessive capacity may require a company to reduce prices to stimulate demand, seek additional products, carry excess inventory, or leave part of its workforce and equipment idle.

For the last three years EEPCo was forced to ration power on scheduled basis particularly for the industries which utilize/consume high energy sources. However, during the same period, there was unscheduled interruption of power. It generates 3,515,373,505KWH, 3,959,768,358 KWH and 3,229,857,626 KWH in 2000, 2001 and 2002 respectively. In 2001 the total power shortage was 560 GWS in the country (source: Interview for EEPCo officials).

EEPCo is engaged in power generation transmission, distribution and sale of electricity. The Company is the sole power producer, transmitter and distributor of electricity in Ethiopia. It supplies power to around 1,396,000 customers. EEPCo operates through two different power supply systems, namely, the Inter- connected system (ICS) and Self - Contained System (SCS). The Company generates 814.14 MW power from its interconnected (national grid) and self connected systems; but hydropower accounts for 98% of its total generation capability. It also maintains a wide network of transmission and distribution systems (Source: [http://: www.eepco.gov.et](http://www.eepco.gov.et)).

Ethiopia's electricity is generated from hydroelectric dams, which accounts for 98% of its total generation. Power generation is vulnerable to changes on natural phenomenon and creates problem in the generation and distribution of power in the country (source: <http://www.eepco.gov.et>).

Capacity utilization becomes critical issue in this changing and highly dynamic business environment. KFSC produces five products: Flour, Bread, Biscuit, Spaghetti and Macaroni. The designed capacity of the organization is 1500 quintal of flour, 300 quintal of high energy biscuit, 100 quintal of sweet biscuit, 75 and 50 quintal of bread in Kality and Akaki production lines respectively, 200 quintal spaghetti and 200 quintal macaroni per day. This is the designed capacity of the organization for its major products to meet the demand of their customers which is going to be distributed through its different outlets.¹

KFSC established in 1938 is owned and operated by the government with 420 employees currently working in the Company. The present KFSC has growing to a far reaching reputation for mounting quality and taste of its products among the customer all over the country. It has a vision of “*Being a pioneer, reputable, model food industry*”.²

The researcher was interested to study the extent of the effect of power interruption on capacity utilization at KFSC.

¹Data taken from KFSC 2000, 2001 and 2002 annual report

² Data taken from KFSC 2000, 2001 and 2002 annual report

1.2.Statement of the Problem

At the time where managing capacity is a central feature of strategic operations management, Ethiopia is experiencing power shortage which affects majority of small and large industries which are involved in different production activities. Power supply is considered as a major determinant of the effective capacity of an organization. Power interruption is the major challenge and prevailing issue in most industries in Ethiopia.

KFSC which is one of the firms which involve in the production of food items is affected by the existing power interruption predicament in the country. The factory produces its major products in seven production lines which all function by electric power. The factory operates in three shifts (eight hours each) and 24 hours per day. The total installed power capacity of the machineries in the organization is 3181.94 KW from which 1875.4 KW is used to produce the products of the Company. ³All production lines are automated and operated by electric power. If there is power interruption there is not any kind of production in the factory except that spaghetti or macaroni production lines which may get power supply from a standby generator. The Company has a standby power generator that consumes 50 liters of petrol oil per hour.

³ Data taken from KFSC 2000,2001 and 2002 annual report

The major power consumption is by flour and biscuit production lines, 1025 KW and 986 KW respectively. ⁴ The major product which will have a significant effect on the overall operation of the organization is flour production unit which involves three major activities: pre-cleaning, cleaning and milling. Since flour is the major input to other products, its effective and efficient production will determine the supply of major input to other production lines and accordingly the overall performance of the organization.

Power interruption was the major/prevaling issue in the past three years which affects significantly the overall operation of the organization. In most cases when power is interrupted, the Company's all production process stops which lead it to different financial and non financial problems like increment in fixed costs, idle human labor, idle capacity, in fuel consumption to operate the generator, in waste which will affect the factory's profitability accordingly. To alleviate the above mentioned problems the organization takes different actions.

This project investigates the problems and the response of the management of KFSC.

1.3. Objective of the Study

The prime purpose of the study was to investigate the extent of the impact of power interruption on capacity utilization at KFSC and to determine the extent to which capacity under-utilization caused by this interruption has affected the overall performance of the organization.

⁴ Data taken from KFSC 2000,2001 and 2002 annual report

To be more specific, the study was undertaken in order to:

- Identify the extent of the effect of power interruption on capacity utilization.
- Identify the responses of the Company to alleviate capacity related problems.

1.4. Scope of the Study

This study focused only on the impact of power interruption on capacity utilization of KFSC for three consecutive years: 2000, 2001 and 2002. These three years were considered based on the severity of the problem in the country as well as in the factory. As a project it intended to get an in-depth observation of the problem in only one factory. Therefore, the findings of the study cannot be generalized for other factories which undermine capacity utilization in KFSC nor to situations of other factories.

1.5. Limitation of the Study

The researcher had faced different limitations in the process of collecting relevant information. Unavailability of organized data on capacity utilization of the Company and inconsistency of data from different organizational units were the major challenges. The other limitation the researcher encountered during the data collection process was that finding specific information such as setup costs of the factory and customer categories on industry basis and their power consumption from EEPCo were hard to determine from available data. Since this project was conducted during election most of the officials were hesitant to fully disclose information.

1.6. Significance of the Study

This study provides an in-depth observation on the effect of power interruption that occurred during the last three years on the performance of a factory and operational responses that managers have taken.

- It gives the researcher the opportunity to gain deep knowledge in the practice and management of capacity
- This observation and the interpretations which followed will help both practitioners and researchers to take the situation seriously.
- In addition to the above points, the Company in which this study bases, can use the study or the recommendations included in this paper as a base to improve its operation after carefully evaluating its impact.

1.7. Organization of the Paper

The report is organized into six chapters. Chapter one deals with introduction, chapter two deals with review of the related literature, chapter three is about research methodology, chapter four deals with result and interpretation, chapter five is about discussion and finally chapter six contains conclusions and Recommendations.

Note: Ethiopian calendar is used in all discussion and interpretations except the theoretical concepts.

CHAPTER TWO

REVIEW OF RELATED LITRATURE

2.1. Conceptual Definition of Capacity

According to Adam & Ebert (1982), capacity is the maximum theoretical rate of productive or conversion capability for the existing product mix of an organization's operation. Capacity incorporates the concept of rate of conversion within an operation setting. A change in product mix can change unit output capacity.

Designed capacity of a facility is the planned or engineered rate of output of goods or services under normal or full scale operating conditions. System/effective capacity: System capacity is the maximum output of the specific product or product mix the system of workers and machines is capable of producing as an integrated whole. System capacity is less than design capacity or at the most equal it because of the limitation of product mix, quality specification, and breakdowns. The actual is even less because of many factors affecting the output such as actual demand, downtime due to machine/equipment failure, unauthorized absenteeism (Kumar & Suresh, 2009).

Waters (2001,cited in Steve, 2005), suggests that there is a difference between 'designed capacity', defined as 'the maximum output of a process under ideal conditions', and 'effective capacity', defined as 'maximum output that can be realistically expected under normal conditions'. He explains that, usually, effective capacity is less than designed capacity, due to set-up times, breakdowns, stoppages, maintenance, and so on. Whilst this is true in many

cases, especially in materials processing operations, there are instances in which effective capacity may be greater than designed capacity.

The capacity of the operations refers for the productive capability of a facility; it is usually expressed as volume of output per time period. Operation managers are concerned with capacity for several reasons. First they want sufficient capacity to provide the timing and quantity of output needed for meeting current and future customer demand consistent with the organizations strategic mission. Further the available capacity affects the efficiency of operations including the ease or difficulty of scheduling output and the costs of maintaining the facility. Finally the acquisition of capacity is an investment by the organization. Since we seek a good return on investment, both the costs and the revenues of a capacity decision must be carefully evaluated (Adam & Ebert, 1982).

The capacity of the production system defines the firm's competitive boundaries. Specifically, it sets the firms response rate to the market, its cost structure, its workforce composition, its level of technology, its management and staff support requirements, and its general inventory strategy. If capacity is inadequate, a company may lose customers through slow service or by allowing competitors to enter the market. If capacity is excessive, a company may have to reduce its prices to stimulate demand, underutilize its work force, carry excess inventory, or seek additional, less profitable products to stay in business (Chase & Aquilano, 1992).

Manufacturing capacity describes a physical production limitation per unit of time for a firm or industry. Porter and Spence make this point forcefully: "if the firm fails to add capacity at the appropriate time, it not only losses immediate sales and market share but also may

diminish its long-run competitive position-if a firm adds too much capacity, it can be burdened with unmet fixed charges for long periods of time (Buffa, 1983).

Overcapacity can be defined as a situation where observed capacity output is greater than the expected target output. Whereas under-capacity can thus be defined as a situation where observed capacity output is less than expected/target output. Production can fall temporarily at lower level in this case if it does machine and labor resources will be underutilized and unit costs will therefore increase. Output could be increased to higher levels but then unit costs would increase of excessive overtime, inadequate preventive maintenance, and higher congestion in existing facilities (Adam & Ebert, 1982).

Identifying the size and timing of projected capacity gaps provides an input for the generation of alternative plans. We may plan to meet demand either by providing the expected required capacity or by partially utilizing alternative sources, or we may observe some lost sales. We can provide the needed capacity in smaller increments that may involve initial slack capacity. We may enlarge existing facilities, establish new producing locations for the additional capacity, or reallocate the entire operation (Buffa & Sarin, 1987).

2.2. The Process of Capacity Planning

Capacity planning is to be carried out keeping in mind future growth and expansion plans, market trends, sales forecasting, etc. It is a simple task to plan the capacity in case of stable demand. But in practice the demand will be seldom stable. The fluctuation of demand creates problems regarding the procurement of resources to meet the customer demand. Capacity

decisions are strategic in nature. Capacity is the rate of productive capability of a facility and usually expressed as volume of output per period of time.

According to Chase and Aquilano (1992), the process of capacity planning is summarized as follows:

- i. Predict future demands, including the possible impact of technology, competition, and other events.
- ii. Translate predictions into physical capacity requirement
- iii. Generate alternative capacity plans related to requirement
- iv. Analyze economic effects of alternative plans
- v. Identify risks and strategic effects of alternative plans
- vi. Decide on a plan for implementation

2.3. Importance of Capacity Decision

Capacity decision provides numerous advantages for a manufacturing unit. According to Kumar and Suresh (2009), capacity decision has the following importance/significance for the organization:

- Capacity decisions have a real impact on the ability of the organization to meet future demands for products and services; capacity essentially limits the rate of output possible. Having capacity to satisfy demand can allow a company to take advantage of tremendous opportunities.

- Capacity decisions affect operating costs. Ideally, capacity and demand requirements will be matched, which will tend to minimize operating costs. In practice, this is not always achieved because actual demand either differs from expected demand or tends to vary (*e.g.*, cyclically). In such cases, a decision might be made to attempt to balance the costs of over and under capacity. Capacity is usually a major determinant of initial cost. Typically, the greater the capacity of a productive unit, the greater its cost will be. This does not necessarily imply a one for-one relationship; larger units tend to cost proportionately less than smaller units.
- Capacity decisions often involve long-term commitment of resources and the fact that, once they are implemented, it may be difficult or impossible to modify those decisions without incurring major costs.
- Capacity decisions can affect competitiveness. If a firm has excess capacity, or can quickly add capacity, that fact may serve as a barrier to entry by other firms. Then too, capacity can affect delivery speed, which can be a competitive advantage.
- Capacity affects the ease of management; having appropriate capacity makes management easier than when capacity is mismatched.

2.4. Factors Affecting Capacity Utilization

There are different factors which affect the capacity utilization of an organization. According to Chase and Aquilano (1992), Capacity is affected by both external and internal factors. The external factors include government regulations (working hours, safety, and pollution), union agreement, and supplier capabilities. The internal factors include product and service design, personnel and jobs (worker training, motivation, learning, job content and methods), plant

layout and process flow, equipment capabilities and maintenance, materials management, quality control system and management capabilities. This internal and external determinates or factors affect the capacity utilization rate of an organization.

2.5. Alternative sources of Capacity

Another issue in generating capacity plans is whether or not alternative capacity sources can be used near a capacity limit. The cost effects of using alternative sources of capacity are to trade off some of the costs of carrying slack capacity against the costs of overtime and multiple shift premiums, productivity losses resulting from pushing capacity beyond normal limits and the extra costs of subcontracting units of output. Again whether or not the use of alternate sources as capacity will be more economical for a particular organization depends on the balance of incremental capital and operating costs (Buffa, 1983).

2.6. Predicting Future Capacity Requirements

Long range forecasts of demand are difficult. There are always contingencies that can have important effects, such as recessions, wars, oil embargos, or sweeping technological innovation. Therefore, predicting demand also requires an assessment of contingencies. The contingencies are apt to be rather different, depending on the situation. Mature products are more likely to have stable and predictable growth, whereas the markets for new products may be quite uncertain (Buffa, 1983).

2.7. Measure of Capacity

When output units are relatively homogeneous, capacity units are rather obvious. When output units are more diverse, it is common to use a measure of the availability of the limiting resources as the capacity measure.

Capacity utilization rate

The extent to which a firm uses its capacity is defined by its capacity utilization rate, which is calculated as follows:

$$\text{Capacity used} \div \text{Design capacity}$$

The capacity utilization rate is expressed as a percentage and requires that both the numerator and the denominator be measured in similar units and time periods (machine hours/day, barrels of oil/day, patients/day, and dollar of output/month).

These different measures of capacity are useful in defining two measures of system effectiveness: efficiency and utilization. *Efficiency* is the ratio of actual output to effective capacity. *Utilization* is the ratio of actual output to design capacity.

$$\textit{Efficiency} = \textit{Actual output} \div \textit{Effective capacity}$$

$$\textit{Utilization} = \textit{Actual output} \div \textit{Design capacity}$$

It is common for managers to focus exclusively on efficiency, but in many instances, this emphasis can be misleading. This happens when effective capacity is low compared with design capacity. In those cases, high efficiency would seem to indicate effective use of resources when it does not (Kumar and Suresh, 2009).

2.8. Capacity Management

Design of the production system involves planning for the inputs, conversion process and outputs of production operation. The effective management of capacity is the most important responsibility of production management. The objective of capacity management (*i.e.* planning and control of capacity) is to match the level of operations to the level of demand.

The capacity management once framed in a long term perspective revolves around matching of available capacity to demand or making certain capacity available to meet the demand variation. Capacity management is very important for achieving the organizational objectives of efficiency, customer service and overall effectiveness. While lower than needed capacity results in non fulfillment of some of the customer services and other objectives of production/operation system, a higher than necessary capacity results in lower utilization of the resources or in other words lower efficiency of the conversion operation.

There could be a flexibility built into the capacity availability, but this depends upon the technology decision to some extent and also on the nature of the production/operation system. While some operation systems can flex significantly, some have to use inventories as the flexible joint between the rigidities of a system. The degree of flexibility required depends upon the customers demand fluctuations and thus the demand characteristics of the operation system (Chary, 2000).

2.9. Economies of Scale

The nature of cost structure suggests that for a given facility there should be an optimum output that minimize fixed plus variable costs. Unit costs vary, depending on the amount of overtime used for the direct and indirect work force and the costs incurred by management decisions to expand or contract workforce. Usually there are economies of scale that may come from two basic sources: lower fixed cost per unit and lower variable costs per unit. The lower fixed costs accrue because plant and equipment costs of larger plants are less than proportional to capacity. Larger plants are likely to have better balance of subunits with less slack capacity in subunits. Lower variable costs may also accrue to the larger plant because larger volume may justify more mechanization and automation. The result is that minimum unit costs could be substantially less for larger plants (Buffa, 1983).

2.10. Strategies for Modifying Capacity

After existing capacity has been measured and future capacity requirements assessed, Alternative ways of modifying capacity must be identified. Planners must device both short-run and long run modification strategies.

Short run response: for short run periods of up to one year, the fundamental capacity of the conversion process is of fixed size. Major facilities are seldom opened or closed as a regular monthly or yearly practice. Many short run adjustments for increasing or decreasing capacity are possible, however. Which adjustments to make depends on whether the conversion process is primarily labor or capital intensive and whether the product is one that can be stored in inventory.

Capital-intensive processes rely heavily on physical facilities, plant, and equipment for performing the conversion operations. Short-run capacity can be modified by operating these facilities more or less intensively than normal. The problem with modifying short-run capacity is that temporary changes of this type can be very expensive. The costs of facility setup, changeover, maintenance, procurement of raw materials, manpower procurement, scheduling and inventory management can be increased by such capacity changes.

Labor-intensive conversion processes are dominated by human skills rather than by such physical resources as plant and equipment. In labor-intensive process, short run capacity can be changed by laying off or hiring people or by having employees work overtime or be idle. These alternatives are also expensive, though since hiring costs and severance pay may be necessary, premium wages may have to be paid, and the risk of losing scarce human skills may increase.

Present strategies for changing capacity also depend upon the extent to which the product can be stored in inventory.

Long run response expansion: the costs, benefits and risks of the expansion alternatives pose an interesting decision problem. By building the entire addition now, we avoid higher building costs; we avoid the risk of accelerating inflation and we avoid the risk of losing additional future business because of inadequate capacity. But there may also be disadvantage of this strategy. First, our organization may not be able to muster the large financial requirement initially needed. Second, if we expand now we may find later that our demand forecasts were bad; we may find that ultimate demand is lower than expected and we have

over built. Finally, even if furcated demand is ultimately realized, it may not fully materialize until the end of the five year planning horizon. If so, we will have invested in an excess capacity facility on which no return was realized.

Long run response: contraction and constant capacity sometimes long range planning indicates that future capacity requirements are lower than the existing capacity can already produce. When this happens, we can either produce capacity or find new ways of using what exists. Capacity contraction most often involves selling of existing facilities, equipments and inventories and firing employees. Organizations permanently reduce capacity or shut down facilities only as a last resort (Buffa, 1983).

2.11. Capacity Flexibility

Capacity flexibility essentially means having the capability to deliver what the customer wants within a lead time shorter than competitors. Such flexibility is achieved through flexible plants, processes, workers and through strategies that use the capacity of the organization.

Flexible plants: perhaps the ultimate in plant flexibility is the zero-change over time plant. Using moveable equipment, knockdown walls, easy accessible and returnable utilities, and such a plant can adopt to change in real time.

Flexible process: Flexible processes are epitomized by flexible manufacturing systems on the one hand, simple easily set-up equipment on the other. Both of this technological approach

permits rapid low cost switching from one product line to another, enabling what is sometimes referred to as economies of scope.

Flexible workers: flexible workers have multiple skills and the ability to switch easily from one kind of task to another. They require broader training than specialized workers and need managers and staff support to facilitate quick changes in their work assignment.

Using external capacity: two common strategies for creating flexibility by using the capacity of other organizations are subcontracting and sharing capacity (Chase & Aquilano, 1992).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Research Strategy

“Qualitative approaches employ open-ended questions, emerging approaches, text or image data, interview data, observation data, document data and audiovisual data text and image analysis. Quantitative approaches employ closed-ended instrument based questions, performance data, attitude data, observational data, and census data statistical analysis. And mixed methods approaches use open- and closed-ended questions, both emerging and predetermined methods, and both quantitative and qualitative data and analysis (Creswell, 2003)”.

Accordingly, mixed method research strategy was designed to undertake the project. Performance data related to sales, production and profit level were collected. In addition interview, observation, document review were the qualitative data used in the project. By integrating the two data the researcher understood and described the situation in KFSC.

Case study uses as many data sources as possible to investigate systematically an individual, group, organization or event. Case studies are performed when a researcher desires to understand or explain a phenomenon (Tayie, 2005). In view of that, case study research method was employed to understand or explain the situation at KFSC in relation to power interruption by collecting numerous data using both primary and secondary data sources.

3.2. Source of Data

In an attempt to assess the impact of power interruption on capacity utilization at KFSC and provide possible recommendations, the project used both primary and secondary data sources. With regard to primary data, first hand data was collected through interview conducted to KFSC and EEPCo officials and using factory visit of KFSC. The secondary data source includes pertinent documents and reports of KFSC and EEPCo. EEPCo's annual report and other information were collected from the internet.

In addition to the aforementioned sources, the researcher tried to refer different books, published and unpublished documents, journals, articles and research papers to get information on the theoretical frame work of the study.

3.3. Selection of Participants and Documentary Material

In both KFSC and EEPCo, individuals who have responsibilities that are directly related to the theme of the project were identified: 13 and 7 officials respectively. In case of KFSC; biscuit production section, spaghetti and macaroni production section, flour production, Kality bread production and Akaki bread production were included. In addition human resource administrative office, budget and planning office, utility section, finance department, sales unit, production manager and electrical unit were the offices considered in the project. In case of EEPCo; strategic management office team leader, transmission office head, distribution office head and planning and sales office head, public relation office were the offices incorporated in the project.

To extract all the necessary information for the project and have deep understanding about the prevailing power supply and impact of power interruption at the firm, unstructured interview was conducted for the above mentioned officials of KFSC and EEPCo. Questions were raised for KFSC officials regarding the response of the management and effect of power interruption on capacity utilization. Factors affecting transmission and distribution system, causes for power interruption and response of EEPCo for the problem, mode of distribution, the industry power consumption and the consideration given by EEPCo were the data collected from EEPCo officials.

Officials of both organizations with different organizational levels were identified based on their direct relationship with the theme of the project. Arrangement for interview was made based on the convenience of the officials. To extract the necessary information it takes 1 hour and 15 minutes on average with each official. The interview questions were summarized and analyzed based on the research objective.

To make out the impact of power interruption on the overall performance of the organization three years (2000, 2001 and 2002) documentary materials which the researcher believes are important for the project were retrieved and reviewed. Data related to designed capacity, effective capacity, actual capacity, product lines, profit level, number of days and hours power was interrupted, installed power capacity, production cost, sales volume and production performance and other information included in the study. The data were retrieved and reviewed from various publications, daily report and annual report of the organization.

To spot how much the problem was real and collect the necessary information which supplements the case in KFSC the researcher collected three years (2000, 2001 and 2002) data from EEPCo. Documentary materials were reviewed and data related to generated power, distribution system, and demand for power were collected.

3.4. Difficulties During Data Collection

a) To get access

There was not a significant difficulty to get access to the offices of KFSC. There was a problem of getting access to the offices of EEPCo and have arrangement for interview.

b) To make arrangement

The difficulty the researcher face is arranging the time for interview. The officials were busy in their work and in meeting most of the time.

c) To conduct the interview

Once the researcher gets the access to the office and has an arrangement, there was not as such a considerable problem during interview. Most of the officials were willing and cooperative to provide the information as per the researcher request. But some officials were hesitant to fully disclose information.

There was difficulty of accessing secondary data sources. To collect data related to the number of days and hours power was interrupted the researcher undertaken clerical work for 3 days from daily report of KFSC. Even though it was the researcher's interest to know power

consumption on industry basis and the trend in food industries power consumption particularly it was not possible to get full information from EEPCo. In general the problem in both companies to provide secondary data was related to unavailability of well organized data base.

3.5. Data Collection Tools

Primary and secondary data gathering tools were employed to collect the necessary data for the project. Unstructured interview was used as a primary data gathering tool. According to Cohen (2005), unstructured interview is an open situation, having greater flexibility and freedom. Although the research purposes govern the questions asked, their content, sequence and wording are entirely in the hands of the interviewer.

Personal observation is the other primary source of data. By having factory visit for three days in which power was interrupted in the factory the researcher understood the production process and the general situation in KFSC related to power interruption.

Secondary data sources were retrieved and reviewed using documentary materials based on their significance/relevance to the project. Three consecutive years: 2000, 2001 and 2002 data from each Company was collected based on its relevance to achieve the research objective.

3.6. Method of Data Analysis

The data gathered through both primary and secondary methods of data collection is summarized using tables and percentages to give a condensed picture of the data. The primary data collected was analyzed descriptively. The secondary data is analyzed by comparing the firm's performance in the three years by taking 2000 as a base year. Accordingly, the summarized data is analyzed in the context of the theoretical frame-work.

CHAPTER FOUR

RESULT AND INTERPRETATION

This chapter deals with the presentation of results and its interpretation.

Power interruption becomes the prominent problem in manufacturing as well as service industries since year 2000 and the country is experiencing power shortage to supply power for its developing service and manufacturing industries. Power supply is dominated by the Government and all industries' energy source is dependent on the power supplied by EEPCo. For the last three years EEPCo is forced to ration power on scheduled basis particularly for the industries which utilize/consume high energy sources. However, during the same period, there was unscheduled interruption of power. This programmed and unprogrammed power interruption significantly affects the performance of the newly emerging and underdeveloped industries in the country. KFSC as one of the food processing firms was affected by this external power supply problem in the country.

All the production system of the factory is automated and driven by electric power, if power interruption occurs; the factory's overall production and operation system is significantly affected. Currently it is producing its major products through seven production lines which all demands energy supply. The total installed power capacity of the machineries in the organization is 3181.94 KW from which 1875.4 KW is used. Majority of power consumption

is for operating flour and biscuit production lines which is 1025 KW and 986 KW respectively.⁵

5.1. Power Interruption in the Company

Table 1 Summary of Power Interruption in 2000, 2001 and 2002

year	2000		2001		2002	
	No of Days	HRS	No of Days	HRS	No of Days	HRS
Sep.	3	2:00	3	2:30	3	22:35
Oct.	1	3:30	2	1:37	2	1:35
Nov.	2	5:30	4	9:00	2	4:00
Dec.	1	8:00	10	35:45:00	1	1:15
Jan.	1	1:10	4	12:15	7	14:05
Feb.	3	2:25	6	15:35	10	49:55:00
Mar.	9	44:40:00	6	46:20:00	10	47:25:00
April	13	75:05:00	8	86:40:00	13	52:10:00
May	20	197	13	154:30:00	-	-
Jun	13	32:40:00	17	230:25:00	-	-
July	7	36:15:00	14	226	-	-
Aug	4	19:45	13	173	-	-
Total	77	428	100	972	48	193

Source: daily report of utility section of KFSC

The number of days and total hours in which power was interrupted in the Company was 77 days or 428 hours, 100 days or 972 hours and 48 days or 193 hours, of the working days for 2000, 2001 and 2002 (eight months from September to April) respectively. In the three years power was interrupted for 21%, 27.4% and 13.15% of the working days respectively. The frequency and time duration of power interruption was higher in year 2001(See table 2)

⁵ Data taken from KFSC 2000,2001 and 2002 annual report

The number of days and hours in which power was interrupted in the three years when the same period of time was considered (eight months from September to April) shows increment from 2000 to 2001 and decline from 2001 to 2002. It was for 33 days or 141.4 hours, 43 days or 209.37 hours and 48 days or 193 hours in year 2000, 2001 and 2002 respectively. There was frequent and long staying power interruption in KFSC in the three years but the frequency and time duration was higher in 2001 (See table 2).

5.2. Capacity Adjustment in the Company

The other interest of the project was to look how capacity is determined and what major factors are included in capacity design of the organization. The organization considers factors related to: forecasted demand for the product, availability of raw materials, power supply, the total working days in the fiscal year, financial resource, the available human resource, the capacity of machineries and equipments, competition in the industry and competitors performance in the industry to plan the production capacity. In the three years of operation the target production level of the factory decreases. The management of the Company give due consideration for power interruption and made capacity adjustment each year.

5.3. Major Costs Resulting from Capacity Under Utilization of the Company

Power interruption has two forms of effects on the capacity utilization of the organization: direct and indirect effects. The direct and indirect impacts are related to: re-work, setup, waste, and customer dissatisfaction, idle resource (opportunity lost of idle resource) and diverting management attention. The impact of power interruption on the Company is reflected basically in its production cost and profitability.

The major cost categories which increase the manufacturing cost of the factory are related to: re-work costs of direct and indirect labor and energy costs. The direct and indirect labor cost of the organization increases in the three years of its operation. The additional overtime work and energy supply required due to power interruption increases these cost categories.

The other cost sort which increase the manufacturing cost of the organization is the setup cost which includes boiling of water and heating of the production lines. Once power is interrupted all the production system of the organization stops. To restart the production system there is additional power consumption for boiling of water and heating of all the production lines. To start the full production process it is always mandatory to boil water through the boilers for 2 hours and 30 minutes before the production process is started. Boiling water require 50 liters furnace oil per hour which will be 125 liters for one start up. If there is frequent power interruption and if it is necessary to restart the production process, it is a must to boil water which will let the Company to incur additional cost for 125 liter furnace oil per each interruption.

There is no documented Power consumption cost the organization incurs to restart the production system in each production line. The total cost is reflected in the total power consumption cost of the organization.

For the production of one batch product of biscuit, spaghetti, and macaroni products; it takes on average four hours and 30 minutes. When accidental power interruption occurs the Company loses on average eight quintal products, but to minimize the possible waste it uses a standby power generator.

Making customer backlog is the other cost of capacity-under utilization resulted by power interruption. The Company produces large quintal of high energy biscuit (Galleta) for its sole buyer MND. The installed power capacity of biscuit production line is very high which makes it impossible to use the other power source (generator). If there is power interruption there is no biscuit production in the factory. Due to this fact the organization always fails to meet its delivery date and dissatisfy its sole buyer.

Lose of the advantage of economies of scale is the other opportunity which is lost by the Company due to production interruption resulted by power supply. Unit cost varies depending on the amount of overtime used for the direct and indirect work force and the costs incurred by management decisions to expand or contract the workforce. The factory has three shift operations, if there is power interruption in the working days there will be only one shift operation. Decline in the number of shifts in which the factory could operate results decline in the number of units produced in the total system. Decrease in the number of units produced increase the manufacturing cost and let the factory to lose the advantage of economies of scale.

The above cost categories increased the manufacturing cost of the factory. Increase in the manufacturing cost of the product reduces the profit level in which the Company could generate by producing and selling a given level of output. The organization does not make price adjustment when the unit manufacturing cost of the product increases. This increase in the manufacturing cost affects the profit level, if the price is not adjusted in the same rate as the increase in manufacturing costs.

5.4. Production Cost, Sales Volume, Production Level and Profit of KFSC

Table 2 Production Cost and Level, Sales Volume, and Profit from 2000-2002

	Operation years					
	2000	Per quintal cost	2001	Per quintal cost	2002(6 months)	Per quintal cost
Cost, sales, production and profit						
Actual production	184,665	-	186,649	-	89,507.09	-
Actual sales	111,814.58	-	105,664	-	50,331	-
Heat, light & power	2,361,676	12.79	2,816,431.34	15.08	1,062,969.74	11.87
Direct labor	2,276,009	12.32	2,770,145	14.84	1,274,375.24	14.23
Indirect labor	890,859	4.82	903,639.52	4.84	484,378.68	5.4
Furnace oil	963,230	5.21	1,186,237.20	6.35	-	-
Profit after tax	1,845,745	10	2,220,008	11.89	293,096.52	3.27

Source: annual report of the finance department of KSFC

When we look the relationship between production level and production cost, 1.07% increase in production from year 2000 to 2001 increases heat, light and power cost by 19.25%, direct labor by 21.7%, indirect labor by 1.43% and furnace oil cost by 23.15%. A slight increase in total production is accompanied by a higher rate increase in heat, light and power, direct and indirect labor and furnace cost of the organization.

When the per quintal cost of heat, light and power, direct labor, indirect labor and furnace oil cost of the organization is computed it shows increment from one production year to the other. The cost of this four cost categories is higher in year 2001 but shows decline in year 2002. In the three years the total per quintal direct and indirect manufacturing cost shows increment (See table 3).

The per quintal profit level shows higher value in year 2001 it is due to higher price charge of the Company from its flour production and high sales volume of energy biscuit to the MND.

5.5. Sales Performance of the Company

Table 3 Sales of KFSC from August 1, 1999 to March 30, 2002

		Product	Flour	Biscuit	Energy biscuit	Spaghetti	Macaroni	Bread Kality	Bread Akaki	Total
2000	Sales Quintal	Budget	93,523	15,000	46,000	50,000	55,000	12,500	22,500	294,523
		Actual	27,057.63	1,901.70	14,474.70	14,317.84	37,352.86	2,843.75	13,866.10	111815
		%	28.93	12.68	31.47	28.64	67.91	22.75	61.63	38
	Sales in birr in 000's	Budget	38,344	15,000	35,881	38,500	31,175	5,362	9,652	173,914
		Actual	17,948.21	1,685.15	14,078.72	13,005.90	26,761.04	1,421.87	7,644.07	82544.9
		%	46.81	11.23	39.24	33.78	85.84	26.52	79.2	47.5
2001	Sales Quintal	Budget	24,952	10,000	10,000	25,000	35,040	10,000	20,020	135012
		Actual	31,249	1,784	14,320	8,396	26,562	7,025	16,328	105664
		%	125	18	143	34	67.17	70	82	78.26
	Sales in birr in 000's	Budget	14,999	15,323	12,535	29,374	30,624	6,600	13,213	122668
		Actual	22,067	2,340	20,307	9,775	24,403	5,113	11,910	95915
		%	147	15	144.11	33	80	77	90	78
2002(9 months)	Sales Quintal	Budget	35,380	4,636	20,250	18,250	32,220	7,600	19,113	137449
		Actual	24,467	1,779	12,369	2,298	6,311	3,224	6,194	50331
		%	69	38	61	13	32	42	32	36.6
	Sales in birr in 000's	Budget	24,178	3,491	25,619	19,986	28,264	6,654	16,733	124925
		Actual	14,873	2,439	17,421	2,745	5,992	2,693	5,700	51863
		%	62	70	68	14	21	40	34	41

Source: annual budget and report of planning office of KFSC

In year 2000 except macaroni and Akaki bread product lines the other product lines sales performance level was less than 50%. Even though there are other major factors which attributed to the low sales volume, the impact of power interruption was not negligible.

In the other hand in year 2001 there was an improvement in the sales volume of the organization which is the result of changes in economic system rather than improvement in the supply of power. In this situation the Company shows terrific sales performance especially in flour and energy biscuit product lines. In year 2002, still the sales performance level of the organization is less than 50% in most of the product lines

5.6. Production Performance of the Company

Table 4 Production Level from August 1, 1999 to March 30, 2002

	Product Type	Flour	Biscuit	Energy biscuit	Spaghetti	Macaroni	Bread Kality	Bread Akaki	Total
2000 yearly production and power interruption as a cause for below capacity in percent	Budget	288,000	15,000	46,000	50,000	55,000	12,500	22,500	489,000
	Actual	102,621	1408.13	13,497.5	12,500.5	37,907.9	2,843.75	13,886.1	184665
	%	35.63	9.39	29.34	25	68.92	22.75	61.63	37.76
	Cause	17%	17%	17%	17%	17%	34%	34%	
									240560
2001 yearly production and power interruption as a cause for below capacity in percent	Budget	130,500	10,000	10,000	25,000	35,040	10,000	20,020	240560
	Actual	108,800	1,939	14,227	9,204	29,173	7,000	16,306	186649
	%	83	19	142	37	83	70	81	77.59
	Cause	32%	16.96%	17.90%	12.30%	23.50%	50%	50%	
2002 yearly production and power interruption as a cause for below capacity in percent	Budget	127,089	2,833	18,375	18,250	32,220	7,600	19,113	225,480
	Actual	56,257	2075	13,129	3,590	5,059.62	3,273.64	6,122.83	89,507.0
	%	44.27	73.23	71.45	19.67	15.7	43.07	32.03	39.69
	Cause	24%	29%	56%	10%	13%	17%	29%	

Source: annual budget and report of planning office of KFSC

In year 2000, the Company was able to achieve 37.76% of its production plan on average. The impact of power ranges from 17% to 34% on the production level. For the decline in bread production in both production lines, power interruption takes 34% share to be a cause. In all product categories the factory fails to achieve the targeted production volume in this production year.

In year 2001, the organization achieves 77.59% of its production plan in all production lines. Power interruption takes from 12.30% to 50% share to be a cause for capacity-under utilization. In the same period the factory was able to produce 83% of flour production target, 81 and 70% of bread production in Akaki and Kality production lines and the impact of power interruption was 32%, 50% and 50% respectively. In this period tremendous performance is observed in the production of high energy biscuit which is the major product of the Company even though it is affected by power interruption.

In year 2002, the Company achieves 36.69% of the production plan in nine months (from July 2001 to March 2002). The impact of power interruption on the production level ranges from 10 to 56% or 31.15% on average. In this production period the factory was able to achieve 71.45% of its production target of high energy biscuit. In this time the impact of power on high energy biscuit production was 56% and seems lower on macaroni and spaghetti production lines due to the availability of a standby generator for these two production lines.

In general, KFSC was not in a position to meet its production target as well as its projected sales volume.

5.7. Computing Capacity Utilization Rate

$$\text{Efficiency} = (\text{Actual output} \div \text{Effective capacity}) \times 100$$

Efficiency 2000	$(184665 \div 489,000) \times 100 = 37.76\%$
Efficiency 2001	$(186649 \div 240560) \times 100 = 77.59\%$
Efficiency 2002	$(89,507.09 \div 225,480) \times 100 = 39.69\%$

As the above computation reveals, the Company's efficiency is less than 50% in the two years of its operation. Less than 50% efficiency rate means the organization was capable to use half of its effective capacity. Low efficiency rate has a significant effect on the overall operation of the firm and signifies ineffective use of organizational resources. Lower efficiency rate was resulted from different factors, but the impact of power was higher in the firm in the three years.

In conclusion, power interruption was one of the major factors which affect the capacity utilization of the organization. It was on average a 17%, 31.25% and 33% cause for capacity-under utilization in 2000, 2001 and 2002 (nine months from July 2001 to March 2002) respectively.

5.8. Response of the Management

To overcome the above mentioned problems the management takes different measures. The Company has prepared one standby generator which is used to supply power for macaroni or

spaghetti production lines with 512KW. The generator supply power for finishing the already started products and for the production of macaroni or spaghetti.

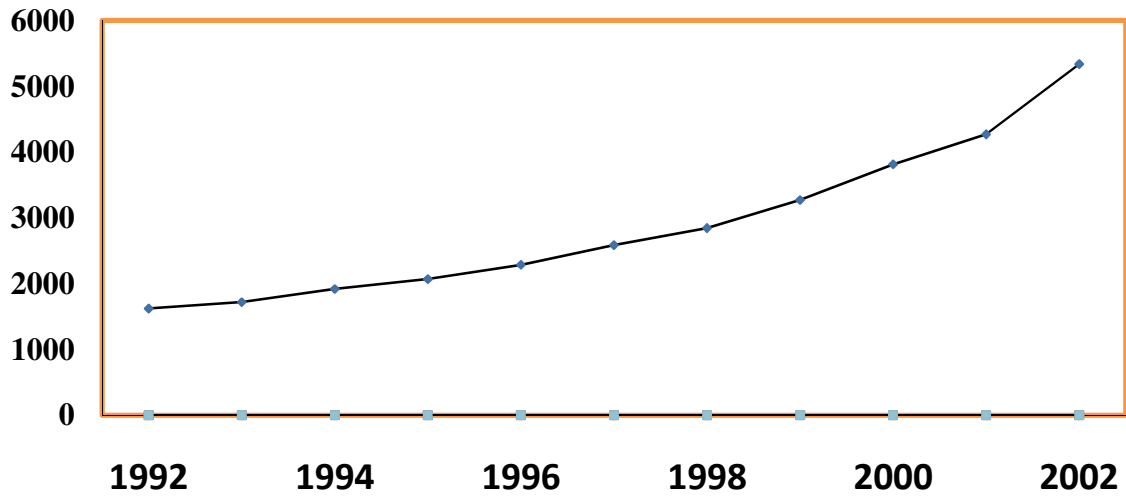
The other action which is taken by the management was consideration of power interruption in capacity planning and revision of the production target. The production level shows decline in the three consecutive production years. The management of the Company considers power interruption as one of the constraints while it sets production and sales target of the organization.

Power interruption creates idle capacity in machineries and equipments as well as human resource of an organization. The researcher raises one question on how the organization manages its idle human resource. To utilize the idle human resource the factory designs to undertake small maintenance, inspection of materials, cleaning of the production machineries and production rooms. These are the major mechanisms the management designs to utilize the idle human resource.

The other measure/response of the management was taking preventive measures to minimize the possible losses resulted from power interruption: using the generator to finish the already started products, negotiate with EEPCo to be granted special privilege since it produces MND's ration and arranging production and operation sessions according to the power interruption program which is provided by EEPCo. These are the major responses taken by the management for the prevailing power interruption problem in the Company.

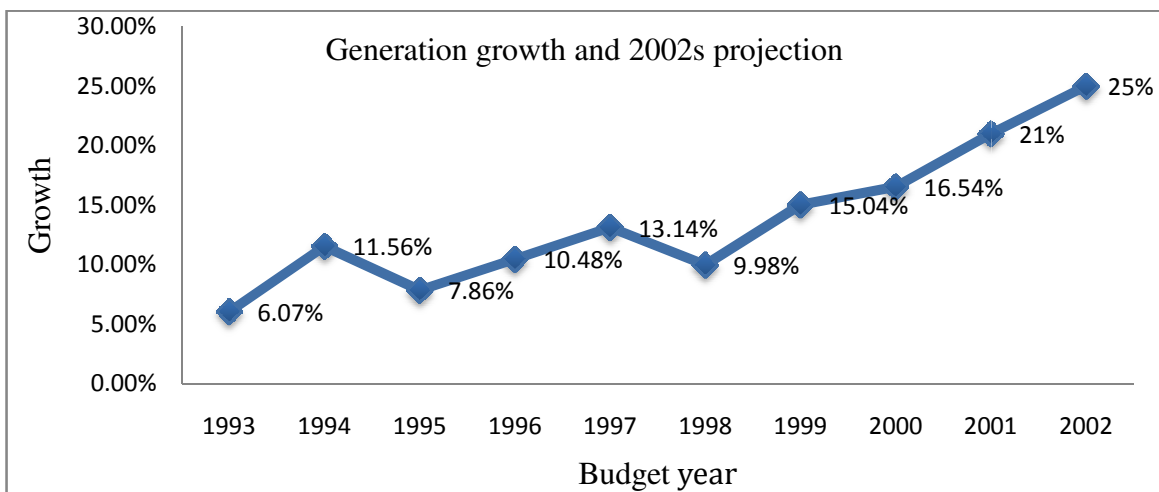
5.9. Power Generation and distribution by EEPCo

Figure 1 generated power and 2002's projection



Source: EEPCo annual report

Figure 2 power generation growth and 2002's projection



Source: EEPCo annual report

There are two conditions in which power was interrupted in the country; programmed and unprogrammed. There are different causes for the interruption of power in the country. Human, technical and accidental factors contributed a lot for the unscheduled power interruption. Technical factors are related to the technical capability of EEPCo in its transmission and distribution system and the others are accidents created by the society. These two categories (internal/external factors) regulate the power distribution and transmission system in the country.

For the scheduled power interruption there are two major causes: increase in demand for electric power and long staying drought in the country. In the three years demand for power increase from 16.54% in 2000 to 25% in 2002 in the same period the generated power shows increment from 14.19% to 25% but it was 11.96% in 2001 when demand shows 21% increase. In 2001 the total power shortage was 560 GWS in the country (See figure 1&2).

There are different factors EEPCo associated with the existing power shortage: high industrial expansion, demand from the agricultural sector, extended drought and fast economic growth of the country. A 1% economic growth is associated with 2.13% growth in power consumption in the whole economic system and they use GDP to forecast the future power consumption (source: Interview for EEPCo officials).

EEPCo provide due consideration for exporters which are considered as key sectors for the economic development of the country. Besides the exporters it gives privilege to hospitals educational centers and other key government organizations. The measures EEPCo takes to overcome the existing power crises are related to: changing bulbs, efficiency measures (power factor correction) and building or constructing new power plants in the country.

CHAPTER FIVE

DISCUSSION

5.1. Analysis of the effect of power interruption at KFSC

Power interruption was the major problem which affects the effective capacity of the organization. On average power was interrupted for 41 days or 182.26 hours each year (in eight months from September to April). In 2001 the total power shortage was 560 GWS in the country. In the same period there was highly frequent long staying power interruption in the organization and its impact was higher relative to other operation years. The effective capacity of the organization was significantly affected by power interruption.

Adam & Ebert (1982) described under-capacity is a situation where observed capacity output is less than expected/target output. According to them decline in production results under utilization of machine and labor resources and increase in unit cost. Output could be increased to higher levels but then unit costs would increase of excessive overtime, inadequate preventive maintenance, and higher congestion in existing facilities.

When we come to KFSC the production level shows decline in the three consecutive years. The factory achieves 37.76%, 77.59% and 36.69 % (nine months from July 2001 to March 2002) of its production target each year. The production levels the Company attains signify the capability of the organization to utilize its resources. Under utilization of machine, human resources and other facilities were the prominent issues which results increase in the manufacturing cost of the factory.

According to Adam and Elbert (1982), when the production level of a Company fall the machine and labor resources will be underutilized and unit cost will increase. When we look the case at KFSC a 1.07% increase in production from year 2000 to 2001 increase the heat, light and power cost by 19.25%, direct labor by 21.7%, indirect labor by 1.43% and furnace oil cost by 23.15%. In addition per quintal manufacturing cost of the organization was increased in the same period. Decline in the production level create idle human, machine and equipment and increase the cost of heat, light and power, direct and indirect labor, furnace oil cost and the per quintal manufacturing cost of the factory. From this relationship we can conclude that decline in the production level increases the manufacturing cost of the factory.

Unprogrmmed power interruption creates on average eight quintal waste.⁶ This is due to the long time required for processing a single batch product and the frequency of power interruption. The other problem is in case of programmed power interruption; in such situation there is always an elapsed time before and after power interruption. When the frequency of power interruption increases the production system is interrupted and this interruption creates waste. The prevailing power supply significantly affects the operation system of the factory and its impact was mirrored on the manufacturing cost as well as profit level.

Chase & Aquilano (1992) described that if capacity is inadequate, a Company may lose customers through slow service or by allowing competitors to enter the market.

⁶ Data taken from KFSC 2000,2001 and 2002 annual report

According to them if a Company fails to utilize its full capacity it will not only lose immediate sales and market share but also lose its long term competitive position. When we come to the case of KFSC the Company produces large quintal of high energy biscuit (Galleta) for its sole buyer MND. Due to the very high installed power capacity of biscuit production line and the frequent and long staying power interruption the factory always fails to meet its delivery date and dissatisfy its sole buyer. The existing situation will let the Company to give its market share and competitive position for its competitors.

Buffa (1983) explained the nature of cost structure and suggests that for a given facility there should be an optimum output that minimize fixed plus variable costs. Unit costs vary, depending on the amount of overtime used for the direct and indirect work force and the costs incurred by management decisions to expand or contract workforce.

When we look the case in KFSC it has three shift operations, if there is power interruption in the working days there will be only one shift operation. Decline in the number of shifts in which the Company could operate results in decline in the number of units produced in the total system and increase the unit cost of the product. As it is stated above the Company was not able to realize its target production level. As Buffa (1983) concluded there should be an optimum output that minimizes the fixed and variable cost of a facility. But in case of KFSC due to interrupted production system the factory was not in a situation to produce the optimum level to minimize its fixed as well as variable costs. In conclusion, the factory loses the advantage of economies of scale and produces its product at a higher cost.

According to him the decision of the management to expand or contract the workforce and the overtime work required determines the manufacturing cost. In the case of KFSC the management does not take a decision to contract its workforce rather decides to use the idle human resource to undertake different small maintenance and cleaning services. The factory is working in three shifts in 24 hours per day. As it is stated above if there is either programmed or unprogrammed power interruption the Company loses at list one shift operation. Maintaining all human resources under such circumstances is costly for the factory and has significant effect on the manufacturing cost as well as profit level.

5.2. Analysis of the Response of the Management

By recognizing the long term effect of capacity decisions and the nature of the problem, the Company's management decides measures with less strategic impact to minimize the effect of power supply at the factory.

One of the management's responses was using the standby generator for finishing on process products and for the production of spaghetti or macaroni products. Using the generator increases the furnace consumption cost. The generator consume 50 liter furnace per hour and its cost is five times the cost of using electric power. The relative cost of using generator is costly to the Company. Most of the time by considering the relative cost the factory does not use the generator. The decision to use the generator as an alternative energy source is not a long term solution for the Company.

As it is stated in the literature capacity decision has strategic impact on the long- run performance of the organization. By considering its strategic impact the management set the effective capacity after detail revision and evaluation of different factors which affect capacity utilization rate.

The Company considers power interruption, holidays, scheduled machine down times and other factors in its capacity planning. Even though the factory considers power supply as one factor affecting capacity utilization in its capacity planning the programmed and unprogrammed power interruption exceeds this consideration and significantly affects its overall operation. The management give due consideration for the existing power supply and reduce the target production level each year. This indicates how much power supply was a problem for the Company and how it diverts the management attention.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1. Conclusion

Based on the result and interpretation and discussion presented in the previous section, the following conclusions are drawn.

Power interruption was the prominent problem to regulate capacity utilization in KFSC and created direct and indirect effect on the performance of the organization. In addition to this, there was long staying and highly frequent power interruption in the Company. In 2001 the total power shortage was 560 GWS in the country. During the year, frequency and time duration of power interruption was higher in the factory.

The efficiency rate of the organization in the three years was low. Different factors affect the efficiency rate of the Company but the impact of power interruption takes on average the highest value.

The manufacturing cost of the organization increased throughout the operation years. Using alternative source of power and re-work of products increase the production cost of the factory. The heat, light and power, direct and indirect labor and furnace cost of the organization shows increment. In addition to this, the setup cost which relates with boiling of water and heating of the production lines was high. In the other hand, loss of the advantage of economies of scale is the other opportunity which is lost by the organization due to

inconsistent and low volume production. Despite this fact, the Company does not make price adjustment for the increase in manufacturing cost.

Power interruption has little impact on the sales volume as well as overall marketing practice of the Company. But its impact was mirrored on the response rate of the factory in energy biscuit product line.

By understanding the strategic nature of capacity design, the management considers factors related to forecasted demand for the product, availability of raw materials, power supply, the total working days in the fiscal year, financial resource, the available human resource, the capacity of machineries and equipments, competition in the industry and competitors performance in the industry to determine the capacity of the organization. Power supply is one of the factors in which the management gives due consideration in its capacity design.

The company's management takes different measures to reduce the possible losses related to power interruption. Giving due consideration for power interruption in capacity design, using the idle human resource to undertake maintenance and cleaning service, negotiating with EEPCo to be granted special privilege, scheduling the production system as per EEPCo's program and using generator when the power is interrupted were the measures taken by the management.

6.2. Recommendations

Based on the results and the conclusions drawn in the previous sections, the following recommendations are forwarded.

- The management will be better off if it tries to convince EEPCo's management to grant special privilege to the Company. If the management tries to convince EEPCo's management by emphasizing their role in the country, so long as they produce MND's ration, they may get consideration.
- The major cost category the Company incurs due to power interruption is related to direct and indirect labor. To minimize the direct and indirect labor cost, the factory is better off if it reduces the number of daily labors and use its permanent employees in its all production lines.
- Undertaking preventive measures, considering the impact in its capacity design and maintaining the current situation is the other possible option for the Company to overcome the existing power supply problem.

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Appendices

Interview questions

For KFSC

1. What major problems yours organization face in relation to power interruption?
2. How power interruption affects the service delivery performance of the organization?
3. How the organization overall marketing activity is regulated?
4. What is the response of the management?
5. What are the major costs of power interruption?
6. How you determine your capacity? What are your considerations in capacity planning?
7. What measures the management does take in relation to the idle human resource?

For EEPCo

1. How effectively the power is distributed in the country?
2. What the mode of distribution looks like?
3. Is there any privilege given for food producers?
4. What was the total generated power in the country?
5. What are the main causes for the prevailing power shortage in the country?
6. What measure the corporation undertakes to alleviate the existing power supply problem in the country?