OBJECTIVE ORIENTED PROBLEM SOLVING

A Case Study: Mugher Cement Factory

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ABSTRACT

Objective Oriented Problem Solving technique is presented in two stages, namely the analysis phase and the planning phase.The first deals with the analysis of participants, problems, objectives and alternatives. In the second phase an explanation on how to form a planning matrix is given by way of discussing objectives/activities, important assumptions, objectively verifiable indicators and means of verification.

Furthermore, the method is illustrated by using Mugher Cement Factory as a case. An introduction to cement technology is given to enhance the capacity of the reader to follow the actual activity/research which was carried out at the factory. Two groups were identified and a 120 hrs. training has been given in six weeks on the basics of production and maintenance management and then the groups were further divided into ten by the functions they perform. Each of these groups were closely followed up by the author for 160 hrs. over four months time in their effort to implement Objective Oriented Problem Solving technique in their own specific work area. The groups have come up with encouraging achievements and constructive recommendations at various levels.

BASICS OF OBJECTIVE ORIENTED PROBLEM SOLVING

INTRODUCTION

Objective Oriented Problem Solving technique is a set of procedures and instruments that helps to define realistic and definite objectives [5,6]. The defined objectives can be sustained in the long-term to improve communication between different levels of management group by means of joint planning and clear documentation; to clarify the scope of responsibility of each member and to provide indicators as a basic for monitoring and evaluation

It is obvious that a problem exists when a gap develops between the desired and the actual states of some system (the organization itself). Organizations have goals that are associated with the system's adjustment to its external environment. When tension occurs within a system, the system will employ its resources, in an attempt to improve its situation in the new environment. The technique used in this process is problem solving. Problem solving is both an art and a science[4]. As a science it is a well structured system of chain reasoning which goes by the rules of logical and mathematical inference. The heart of this process is a linear cause and effect analysis through a series of steps. There are usually branches, and the thinker is in the midst of a problem network, but rational thought proceeds one step at a time. Turning to the art side of problem solving process it is apparent that intuition, creativity and a sense of the "whole" figure prominently. Science strays into the areas of personal value and scientists are not immune from social influence. The result is that scientific methods developed to obtain useful solutions to difficult problems will have intuition mixed with its logic.

This method, which needs a realistic application generates a consensus of various opinions through the planning process. It is an open workable system which is as good as a planning team.

The implementation of this method is divided into two phases [5,6]. The analysis phase includes participants, problem, namely the analysis and the planning phases, objective and alternative analysis. The planning phase includes making decision on activities to be carried out, working out important assumptions, selecting verifiable indicators and arranging means of verification so as to meet the objective set in the first phase.

ANALYSIS PHASE

The first step in this phase is the formation of a team of workers connected with the problem in any way. In organizing the group, social characteristics of the individuals (member's social background, religion and cultural aspect), status (formal, informal or other) and

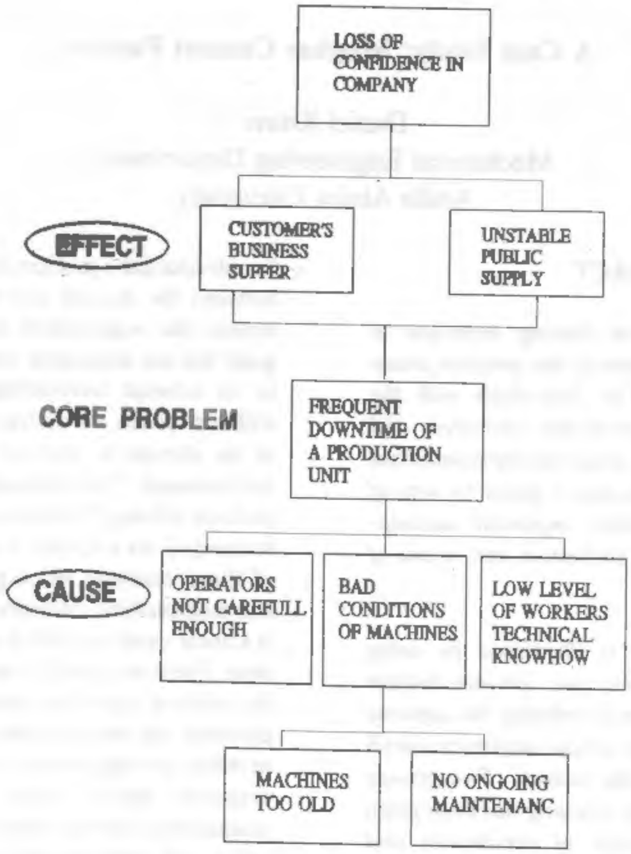

Figure 1 Problem Analysis - Company Example

structure (factory, organization, leader etc.) have to be clearly known. Along with the study of the characteristics of the individual in the group, the strength of the group regarding resources, right, monopolies etc.; weaknesses and shortcomings should be analyzed. The outcome of the group is highly influenced by the needs, wishes, hopes and expectations of the individuals which may be openly or overtly expressed. The attitude (friendly, hostile or neutral) of the group member towards the problem and the concerned people may also have a major influence on the output. A careful selection of members of the working team considering their characteristics, interest, motives, attitudes and potentials would pave a road to a fruitful outcome.

Problem solving is a function central in most of our lives. Similarities can be seen between many different forms of a decision.[8] Problems are either general or specific. A general problem may usually be taken as a conglomerate of several specific problems. If one is to study problems it is necessary to separate the subject, about which decision is being made (content) from the method used in arriving at the solution (process).

It is essential to solve the real problem, but this is not always as smooth as it seems. Scientific analysis often shows, the decision which really has to be made is not the one expected. It sometimes happens to be different.

In the second step of doing the analysis of the existing situation surrounding a given problem, the analyst must accept two dimensions of thought (art and science), which are operating simultaneously in a process of reflective thinking (an organized mental process to solve some problems). The problem solver employs rational thought, which simply means that each link in a cognitive chain follows logically from its predecessor. Such a linear process with branches resembles climbing up and down a decision tree.

Chain reasoning is a lot like travelling by train to go some where to achieve some destination. Suppose you boarded the train in Djibouti to come to Addis Ababa.

The train stops at Dire Dawa. You do not even plan to get off the train in Dire Dawa because it is not the end by itself, but it is important to you that the train pass through Dire Dawa. You will not reach Addis Ababa (core of the trip) unless the goal Dire Dawa is achieved.

The core problem of the situation has to be identified from the major problems in a given context. A core problem is the bottle neck of the situation which is caused by all the other problems directly or indirectly. It is also a point at which all the effects emerge directly or indirectly. Once the core problem is identified the causes of the core problem and the effect caused by the core problem are stated, thus forming a diagram showing the cause and effect relationship in the form of a problem tree (Fig. 1). A problem is not the absence of a solution, but an existing negative condition. Possible, imagined or future states of fear need not be considered as problems. For instance a problem worded "no spare parts available" is wrong because it is stating the absence of a solution. The right way to state the problem would be "bad conditions of vehicles".

The third step in this phase is transferring the problem tree into an objective tree (Fig. 2). In analyzing the objective, the future situation that will be achieved by solving the existing problems should be described. This can be done by restating all negative conditions of the problem tree into positive conditions that are desirable and realistically achievable. If necessary, when revising statements, new objectives may be added or deleted. Objectives relevant and necessary to achieve the stated goal at the next higher level may be added or which do not seem to be expedient may be deleted.

The fourth step in this first phase is alternative analysis. To carry out the analysis we begin by identifying objectives that are not wanted, desired or achievable. Then different "means-ends" ladders should be considered as possible alternative strategies. These alternatives should then be seen under the light of available resources, probability of achieving objectives, political feasibility, cost-benefit ratio, social risks, time horizon, sustainability etc. in order to decide upon one optional strategy to be adopted.

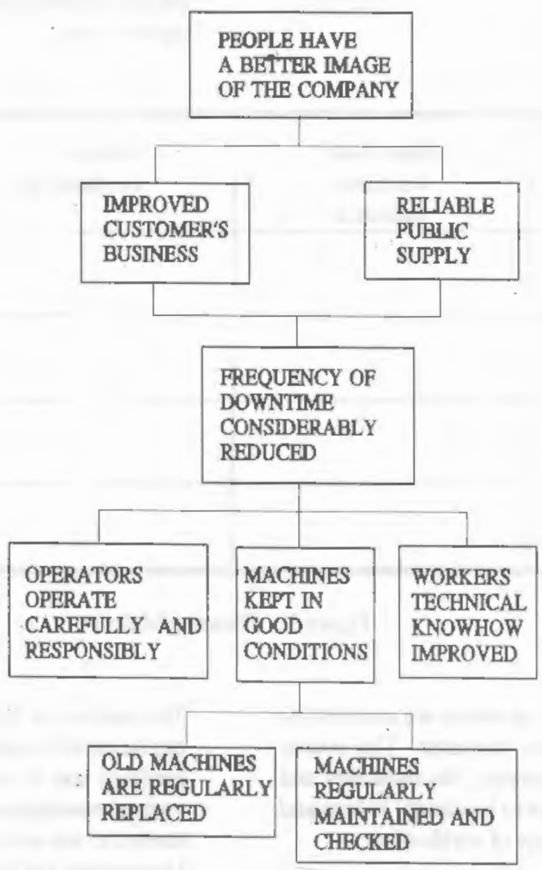

Figure 2 Objective Analysis - Company Example

The problem tree is developed around the core problem and the objective tree is developed from the problem tree. At this junction the strategy to achieve the envisioned objectives is identified. What remains is planning of the activities to be carried out to attain the overall objective.

PLANNING PHASE

In this phase activities are planned and a one page summary of planning matrix is developed (Fig. 3). The planning matrix provides us with the answer why an activity is carried out, what the activity is expected to achieve and how the activity is to achieve its goals. It shows us what external factors are crucial for the success of the activities, how we can assess the success, where we will find the data required to assess the success and what the activity will cost.

A column to be considered in the planning matrix is assumptions (Fig. 4). Assumptions are conditions, which may be derived from the objective tree and worded positively, that must exist if the activity is to succeed but which are not under the direct control of the activities.

Important assumptions which are logically necessary and additional conditions are expressed in positive conditions. These assumptions should be described in detail that we can exactly notice the occurrence of these external conditions. Assumptions which are important but improbable are killer assumptions and cannot be planned. If killer assumptions exist planning must be changed or the activity must be abandoned. When the activities, with the said assumptions are carried out, the performance standard to be reached in order to achieve the objective must be monitored and evaluated. Objectively verifiable indicators specify what evidence will tell you if an overall goal (purpose, results or outputs) is reached in terms of quantity, quality, time and location.

If the objective of the whole exercise can be stated as "Industrial production increased" then the objectively verifiable indicator may be stated as "A textile industry in Addis Ababa inc:eases its production by 20% between June 1995 and june 1996 maintaining the same quality of product as 1994". The indicator that is stated above reflects the essential content of an objective in precise terms. It is objective oriented and the degree to which the objective has been achieved can be measured directly and quite independently of the inputs made.

Summary of Objectives/ Activities	Objectively Verifiable Indicator	Means of Verification	Important Assumptions
Overall Goal			
Purpose			
Results/ Outputs			
Activities			

Figure 3 Planning Matrix

The means of verification tell us where we can find the data necessary to verify the indicator. The source (statistics, observation or records), the reliability and the accessibility of the data has to be clearly known and stated on the column of means of verification.

The method of Objective Oriented Problem Solving can be used by manufacturing plants or service giving facilities and by individuals or groups of people in various management levels. The author has used the method to see into problems of maintenance at African Universities (in Harare Zimbabwe); in Ethiopian

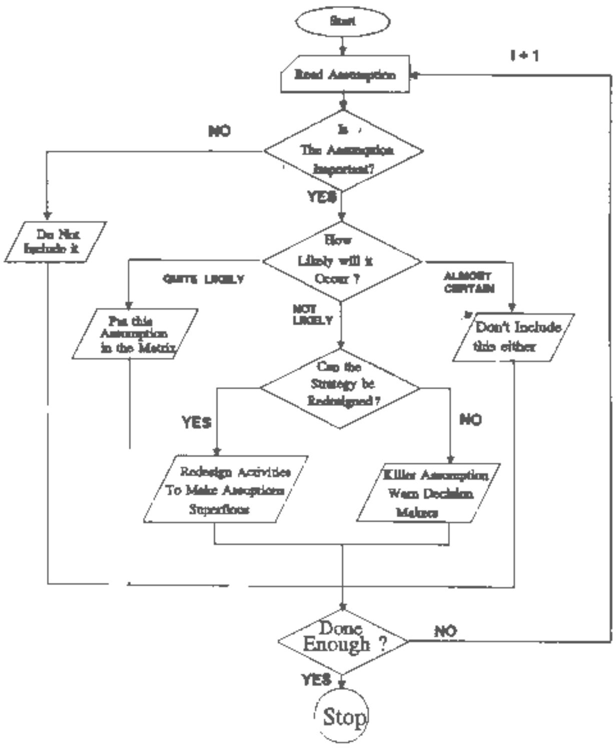

Figure 4 Assement of Assumptions

industries (Maintenance Management: Summer course for two groups of industrial personnel, August 1991 & August 1992), Mugher cement factory and Keren shoe factory. In all the cases the outcome has been very encouraging. [Annex 1,2,3]. In this paper the application of the method will be illustrated by using the research carried out at Mugher Cement Factory.

THE BASICS OF CEMENT PRODUCTION

(Mugher Cement Factory)

Cement may be defined as adhesive substance. When mixed with water it has the property of setting and nardening and it is capable of uniting fragments or masses of solid matter to a compact whole. It was Just 170 years ago that "Cement" as we know it today was developed and patented by Joseph Aspdin and was named "Portland Cement", because the hardened stone from the cement resembled Portland stone found in England. [1,7]

Portland cement consists of a mixture of Calcium Carbonate and Aluminium Silicate. The raw materials limestone and clay which occur in nature in a great number of varieties contain the chemical compositions needed for the production of cement. In the process of cement manufacture two processes are used, wet and dry processes as to whether the raw materials are ground and mixed in a wet or dry condition. The wet process was preferred because of the more accurate control of the raw mix, but with improved control, there has been a swing to the dry process for less fuel is required for burning than in wet process.

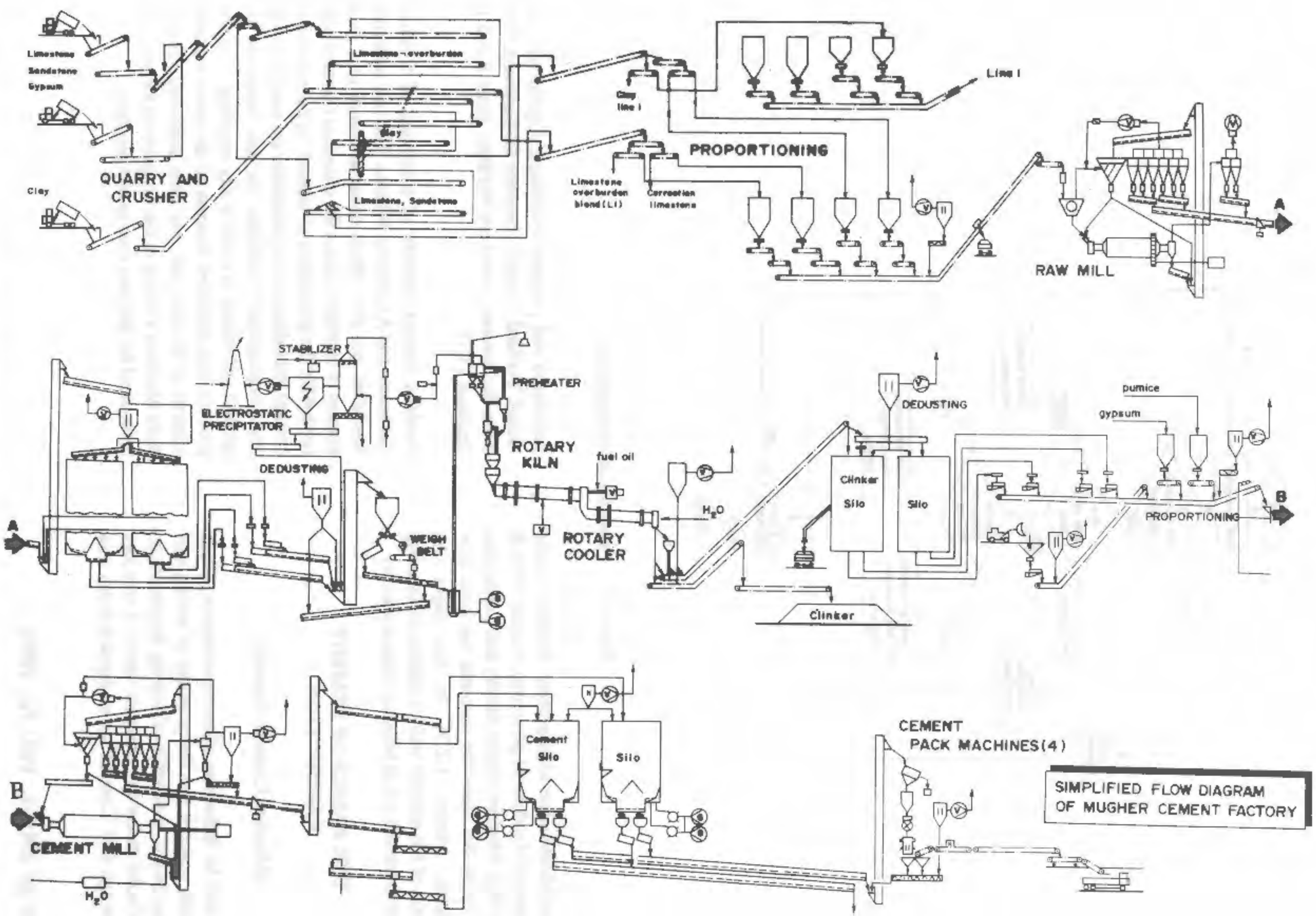

Figure 5 Simplified Flow Diagram of Mugher Cement Factory

In the dry process, in Mugher Cement Factory, as may be seen in fig. 5 (flow diagram of the plant), the raw materials received from the quarry are in lump form and by using dumpers the boulders are fed to the hoppers of the hammer crusher to get output lump size of 50 mm or less. As the mining operation is carried out in daylight hours only, the crushing operation is done 10 to 12 hours per day. The crusher has a 3500 tons per day of crushing capacity. This is then conveyed to the plant over a distance of 3.6 km by using three belt conveyors. The limestone overburden blend, sandstone, clay and correction limestone are proportioned (raw meal) before grinding is performed.

The raw meal is then ground in tube mills consisting of rotary steel cylinders containing balls of different size. The mills are continuous in operation, being fed at one end and discharging the ground material at the other. The output from the raw mill is then preheated and passes to the kiln.

The rotary kiln in which the material is burned at 1300-1500°C is a long cylinder, with refractory brick lining, rotating on its axis and inclined so that the materials fed in at the upper part travel slowly to the lower end. The fuel is blown in by an air blast and ignited. The dried material as it descends the kiln undergoes a series of reactions (Fig. 6) forming in the most strongly heated zone hard granular masses mostly from 4 mm to 20 mm diameter, known as clinker. The only loss to the system is carbon dioxide from the limestone, together with any moisture present. [3]

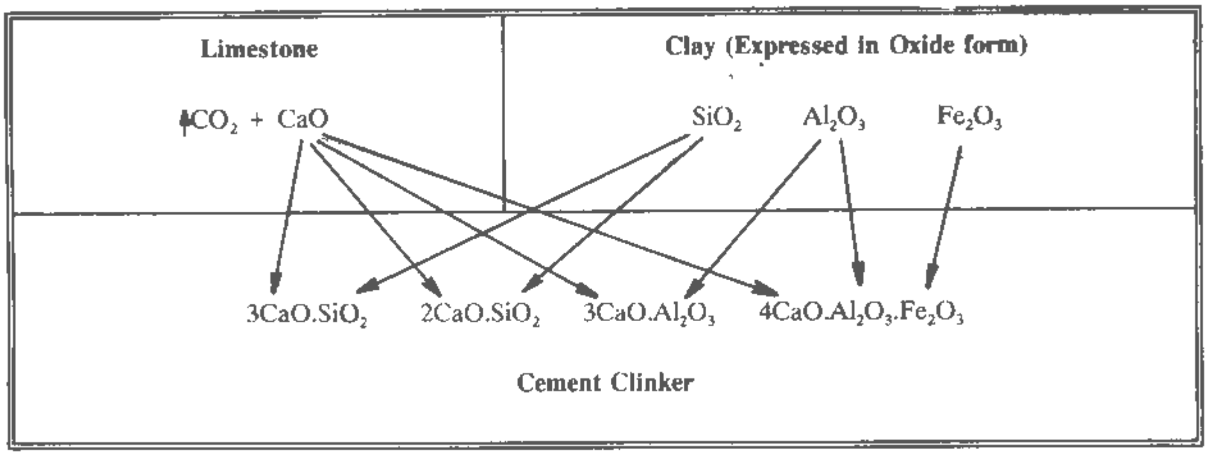

Figure 6 Transformation of Cement raw Material to clinker

The gases from rotary kilns carry with them a certain amount of dust which if allowed to escape can cause nuisance. The dust at the kiln exit can rise as high as 15% of the clinker output. Electrostatic precipitator, cyclone separators, and filter bags are used to trap the dust which is returned to the kiln. The dust is relatively rich in the more volatile constituents of the charge special potash. At the lower end of the kiln the clinker passes to coolers which consist of rotating steel cylinders arranged underneath the kilns in which particles of clinker are made to fall in a cascade thus being brought into contact with the current of cold air. The heated air drawn from the coolers is used for the combustion of fuel, so providing an economical exchange of heat. The cool clinker then falls on to conveyors and is transferred to storage hoppers or passes directly to the grinding mills. The grinding is done in large tube mills with different sizes of steel balls. They are water cooled in order to help dissipate the heat generated. A limited quantity of pumice and gypsum is added before grinding to control the grinding and the setting of clinker. Finely ground cement then passes to silos from which it is drawn for packing. The packing is performed by automatic machines.

Mugher cement factory established by the Ethiopian government with over 357 million Birr (212 million Birr for line I and 145 Million Birr for line II) has been operational since August 1984 (line I) and February 1990 (line II). The factory has a design capacity of 2000 tons cement production per day. It is the latest and the biggest plant in the country covering most of the country's demand of cement.

IMPLEMENTATION PROCEDURE

The names of all interest groups, sections and departments in Mugher Cement Factory which may hold an influential position or may be affected by the problem were gathered The name list was then scanned and two homogeneous groups were formed. The first group was composed of quarry and crusher department, quality control and lab section, clinker production section, and cement mill section workers. They were twenty one in number and according to their job assignment they were lab technicians, shift leaders, foremen, engineers economists, statisticians and section heads. The second group was composed of measuring and control technique section, mechanical maintenance section, electrical maintenance section, mechanical workshop, auto shop, and civil section workers. They were twenty three in number and they were senior technicians, foremen and section heads. After analyzing the groups' interests and needs two refresher courses were set in which introduction to Objective Oriented Problem Solving was included in both. Production management was given to the first group and maintenance management was given to the second group. The training was conducted by dividing each group into two sub groups so as to make one sub group from each group always on duty. This has helped the participants, while on duty, to analyze and practice what they had had in the training and at the same time the factory's annual production and maintenance program was not altered by the training. The training was given four hours a day, five days a week for six weeks. After one hundred twenty hours of training the participants were able to analyze the factory's problem and the objectives and work out the planning matrix. The exercises at this stage were general in nature, the first was regarding production and the second regarding maintenance.

After this phase of the training was over, the second phase of digging into specific problems was started by forming ten groups of study teams. The grouping was intended to cover the whole range of activities which may have any effect on the output of the factory. The objective of this phase is to identify real specific problems of the plant, to conduct objective analysis, to make planning matrix [Annex 1,2,3] and finally to carry out activities within the capacity of the team members and recommend to those who are out of the reach and influence of this training.

The study was conducted by arranging four contact programmes, four hours each over four months for each group. After each group completes problem analysis a contact was made to evaluate and summarize what had been done and to give a lead to the next exercise. The first contact point was important because once the teams have identified the problems then they will have to start looking into ways and means to solve the problems which are believed to be with in their reach.

The second contact was made to see if the teams have completed the objective analysis properly. This contact served also as another check point where difficulties in their effort to solve problems within their capacity are discussed and a joint effort is initiated if the problem under consideration involves more than one team. A lead on how a planning matrix is to be developed is discussed at this junction.

The third contact was made to evaluate the planning matrix and to see the developments made in the activities of each team or in the joint efforts to come up with better alternative solutions. On this contact a discussion was also made on how the teams should conclude as regards to reporting the achievements and drawbacks to the top management.

The fourth contact was used to summarize and evaluate what has been done over the past four months. Finally a workshop of two days was organized for the top management group on which each team leader presented a paper on what had been done over the past sixteen weeks. The workshop was considered as a discussion forum, but not as a challenge to the management nor a defence to the teams.

RESULTS/OUTPUTS AND ACHIEVEMENTS

The implementation of Objective Oriented Problem Solving technique has been a useful instrument to identify real problems and to come up with viable solutions and important recommendations.[2]

Problems Identified

The findings of the research may be summarized as follows:

1. There is high material preparation cost due to idle running of the crusher, high overhead cost, damaged belt conveyors, unnecessary consumption of clay and sand and high machinery down time.

2. The process variation is above expected due to improper functioning of lab instruments, poor homogenization of line II, erroneous weigh belt feeders, improper quantity of raw material supply, operational faults and improper performance of lab personnels.

3. The company is loosing 1.71515 Birr/t of raw meal, which amounts to 1,046,699 Birr/year of cost of production contributed by higher electric power consumption i.e. under capacity running of the raw mill, high utilization rate of homogenizing blowers, idle

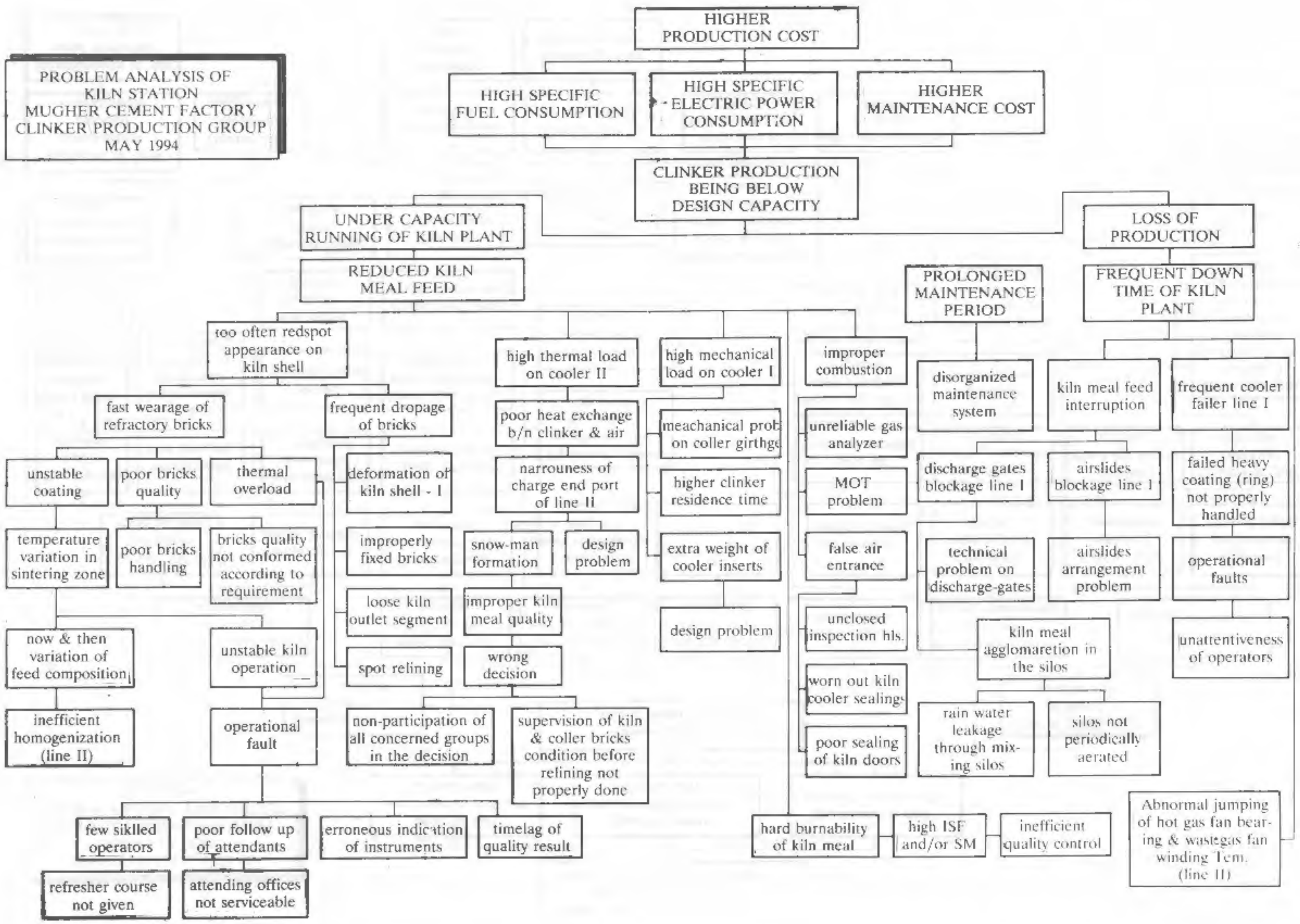

Figure 7 Problem Analysis of Kiln Station Mugher Cement Factory Clinker Production Group May 1994

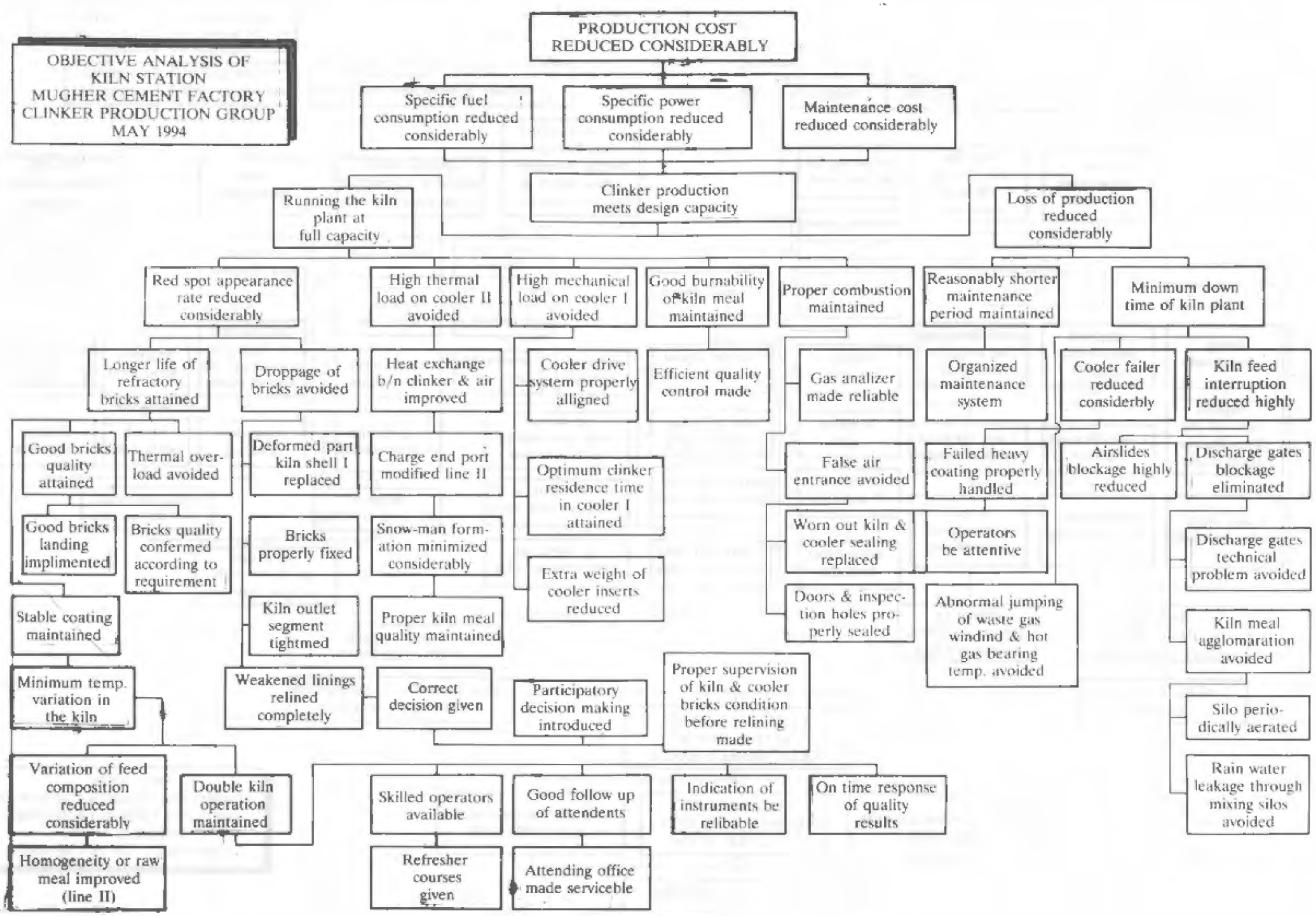

Figure 8 Objective Analysis of Kiln Station Mugher Cement Factory Clinker Production Group
May 1994

SUMMARY OF OBJECTIVES	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTION
OVERALL GOAL: Producing at optimum production cost	Eliminate the extra specific cost of production 5.1148 Birr/ton of clinker	Statistics and cost and budget sections	Management is cooperative
PURPOSE: Producing clinker at the designed capacity	ATTAIN 300,000 Tons/year of clinker	Statistics section	Reliable conversion factors of production be followed
OUT PUT: 1 Running the kiln plant at full capacity	Operate the kiln at 1000 Tons of clinker/day	Log-sheet of the kiln plant	Quality and efficient statistics in all aspects is maintained
OUT PUT: 2 Minimized production loss	Running days should meet 300 days/year	Log-book and log-sheet of kiln plant	

PROJECT PLANNING MATRIX
KILN STATION
MUGHER CEMENT FACTORY
MAY 1994

ACTIVITIES			RELATED ASSUMPTIONS
Made power supply from EELPA Reliable	Avoid abnormal jumping of waste gas fan winding and hot gas fan bean temp. indicats	Avoide discharge gate technical problem line I	Proper attention and consideration given to the tasks handed over to sections for solution
Plan and implement refresher course and on job training	Introduce participatory decision making on kiln relining	Introduce bricks quality conformation technique	Selection of trainees properly done
Seal rain water leakage through mixing silos	Replace deformed part of kiln shell line I	Make indication instruments reliable	Enough funds/budget is available for training
Make proper supervision before kiln & cooler relining	Make attending offices serviceable	Allign cooler I drive system properly	
Introduce supervision technique as to bricks handling	Make gas analyzers reliable	Give correct instruction to operators	
Make clinker residence time optimum	Seal kiln doors and inspection holes	Prepare reliable kiln meal factor	
Make efficient quality control on kiln meal	Inform quality results on time	Tighten kiln out let segment	
Implement organized maintenance system	Replace worn out kiln and cooler sealings	Aerate silos periodically	
		Fix bricks properly	

Figure 9 Project Planning Matrix Kiln Station Mugher Cement Factory
May 1994

running of machineries and unnecessary lighting. The calculation has been done by considering data from May 1, 1993 to April 30, 1994 for both lines of raw mill station. The actual specific power consumption (29,206 kwh/t), was higher by 10,4387 kwh/t than the commissioning norm for line I. For line II the actual specific power consumption (26,27 kwh/t) was higher by 7.9 kwh/t than the commissioning norm for line II.

4. A cumulative effect of high specific fuel consumption, high specific electric power consumption and higher maintenance cost resulted in an estimated loss of 1,855,764 Birr/year. The calculation has been done by using data from March 1 to May 31, 1994 for line I and from May 1, 1993 to April 30, 1994 for line II. The specific fuel loss is 1.35 l/t and 1.71 l/t higher than the average norm, 98 l/t, for line I and Line II respectively. The specific power loss is 10.26 kwh/t and 10.13 kwh/t higher than the norm 22.05 kwh/t, for line I and II respectively. The unit maintenance cost has increased by 1.62 Birr/t for both lines. The losses are evident in the kiln station due to under capacity running of the rotary kiln and loss of production.

5. The cement mill station is using extra 3.01 kwh/t of milled cement due to under capacity running of the cement mills and frequent on and off of cement mills.

6. The cement paper bag damage rate is high due to poor materials handling equipment, defective weigh balance of the packing machine, negligence of belt attendants, poor quality of paper bags and poor cost consciousness of workers regarding paper bags.

7. Frequent failure of electrical machines due to interruption of electrical power, poor maintenance, incorrect performance of operators, faulty measuring and controlling devices and mechanical overload.

8. Frequent downtime of measuring and control equipment due to incorrect performance of operators, improper compressed air supply, improper cooling water supply, poor quality of devices, poor maintenance, improper erection, poor quality of raw material, and electric power interruption.

9. Under capacity utilization of the mechanical workshop due to inoperative machines, poor communication with the other sections, scarcity of tools and cutters, less skilled personnel, delay of manufacturing time and few machineries.

10. Ineffective maintenance system of auto-shop as a result of ineffective way of data collection, poor preventive maintenance, delayed response of machine shop, poor relationship between machine operators and shop workers, shortage of spare parts, incorrect workshop layout, few power hand tools and few skilled personnel.

11. Frequent failure of machineries due to poor material quality of machinery parts, poor maintenance performance and incorrect performance of operators.

12. Delay of civil maintenance and construction works as a result of few trained personnel especially in brick lining of the kilns, inefficient method of planning and programming of maintenance and constructional works, scarcity of tools, shortage of building materials, manual execution, scarcity of technical drawings and difficulty of finding exact location of pipe lines as per available drawings.

Activities Carried Out

After working the analysis of the problems, objectives and the planning matrix, in depth to the grass root level, corrective measures were taken by the teams and further a recommendation was drawn to the top management for action.

Some of the activities conducted to solve the problems with in reach may be summarized as follows:

1. The number of boulders from primary blast, in the quarry and crusher section, have been reduced and as a result a reduction was noticed in idle running of the crusher, secondary blast cost and heavy excavation cost.

2. On the job training was given to operators to reduce high utilization rate of homogenizing blowers and encouraging results were observed. Multiple rate of homogenization has reduced by 30%. This improvement per silo of homogenizing blowers clearly indicated that the extra electric power consumption is reduced.

3. Better supervision of belt attendants was implemented. A person was assigned to check the unnecessary lighting and the flow of clinker was diverted into another silo when blockage occurs rather than switching on and off of the cement mill. By so doing a reduction in paper bags damage rate and a specific electric power consumption is noticed.

4. The electromechanical relays cubical was installed at dust free area and an estimated 7,200 tons/month of

material is saved. Furthermore by installing shelters for all AK boxes, repair boxes, and function boxes at station 3030/3020 about 7 hours of production time can be safe guarded from frequent control voltage actuation in one rainy season.

5. Numerous maintenances were carried out for temperature and measuring devices, for instance at 1223007 the temperature measuring device in elevating pipe was maintained; it had not been in operation for the last few years.

6. A number of modifications were done. For example, carbon sealing for oval gear meter was made from graphite, and rubber sealing was prepared for hydraulic load cells which were both expected to be imported. Production interruption due to short circuit on the control voltage preheater station 3320 was eliminated by replacing the electromechanical timers with electronic timers along with the rearrangement of the installations.

7. The mechanical workshop has started reorganizing itself and the forging shop which was non-existent is now ready to start operation.

8. Duties and responsibilities of auto shop workers was discussed and shop data collector was assigned. By so doing shop clerical works were facilitated and the performance of the auto shop was increased.

RECOMMENDATIONS

The recommendations of the research were as follows:

Realizing that

1. high specific energy consumption, high cost of maintenance and high paper bags damage rate are playing negative role in productivity of Mugher Cement Factory;

2. the factory lacks trained and motivated personnel, proper organizational set ups, planned maintenance procedures, an adequate inventory control system and suffers high attribution rate of skilled personnel and as a result is loosing huge sums of money;

It is hereby recommended that: (Detail recommendations are not listed here due to the fact that the objective of the paper is to illustrate the method of Objective Oriented Problem Solving rather than looking into the details of the factory. Hence, the recommendations given are general in nature).

1. The management should pay greater attention to the necessity of regular and systematic maintenance of the factory equipment.

2. Training and retraining of technicians, maintenance, repair personnel and operators should be given priority. Local and outside seminars, workshops and exchange of experience and competence in maintenance of equipment should be strongly encouraged.

3. Some improvements should be made to streamline procurement procedures of equipment, spare parts and consumables.

4. The spread of maintenance awareness among the workers be encouraged.

5. Although maintenance duties and responsibilities are part of the job descriptions of technical personnel, a system of co-ordination and discussion should be created with production personnel and the management.

6. Considerable effort should be made to have highly qualified technicians to maintain fine and sensitive equipment and to organize a reliable and professional brigade of brick liners of kilns.

7. Telephone, supermarket, transport, recreation and all other facilities that make Mugher attractive for living should be provided.

8. Quality control should be strengthened.

9. The factory should have a research and development department inorder to deal with inherent problems and/or advise a better and more economical way of running of the plant.

10. The link between higher institutions and the plant be strengthened.

CONCLUSION

Time and energy spent in solving real existing problems at the grass root level is an additional investment, otherwise a road to costly to be a lesson is paved by entertaining questions which do not stem from the need. Objective Oriented Problem Solving technique is a method by which real problems are identified and activities are planned to solve them with a target to be met and verified clearly.

The author believes that this article has given an overview of philosophy underlying Objective Oriented Problem Solving technique and has depicted the use of means-end analysis as a tool applied in concrete situation. The method, then, can be used by groups at any stage ranging from top management to any group at the floor level in any manufacturing or service giving facilities as in hotels, hospitals, aid agencies, banks, insurances and the like. It may also be used by individuals and the outcome is as good as a team approach and is more effective if the participants (the study teams) are made the actors to carry out the activities.

The research has demonstrated that above and beyond solving the existing problems, and drawing recommendations, it had a multifold advantage in improving communication among the participants, increasing power of objective reasoning of individuals in the group and in guiding the participants to be committed to do their share. Upon hearing the outcomes and achievements of the project there was a mutual understanding between the top management and the study teams that the blame is neither on the top management only nor on the workers alone. They all have come to a point where each one should contribute his own share towards the solutions to the problems. This by itself is an achievement in closing the communication gap between the top management and the others.

Objective Oriented Problem Solving technique may further be extended to study interdisciplinary problems and be applied in planning project preparation and implementation phases.

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