

Increasing Productivity of the Libyan Petro-Mechanical Technology Company by Implementing Aspects of Quality Management

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Abstract— Productivity is a factor which every company or organization seeks to increase and on which it must focus. This study investigates productivity at the Petro-Mechanical Technology Company (PTC) where it is a major concern. PTC produces holders for detecting sensors and is one of the main suppliers for the oil and gas industry in Libya. This company presently cannot meet the demand for its detecting sensor holders and wishes to improve its productivity. This study focuses on changing PTC culture and improving productivity by adopting strategic operational systems such as Total Quality Management (TQM), Just in Time (JIT) and Total Productive Maintenance (TPM) strategies.

Index Terms— Productivity, Quality Management, just in Time, Productive Maintenance,.

I. INTRODUCTION

PTC is a medium size manufacturing company in Libya providing its services to oil and gas companies. Since the company was established in 1997 it has successfully built a good reputation and strong relationship with foreign oil and gas companies operating in Libya which were wasting time and money importing parts from abroad.

However, due economic changes in Libya and recent increases in material costs, PTC has faced issues which reduced productivity and left some customers dissatisfied..

The company has about 150 employees and uses up-to-date machinery technology (CNC – CAD–CAM SYSTEMS). The main activity of PTC is producing component part for the oil and gas sectors; the company is also interested in research and development such as technology transfer and reverse engineering of petro-mechanical systems.

This study addresses the use of operational quality management systems to overcome PTC’s problems; improve productivity, satisfy their customers and motivate their employees. Aim of the study

The aim of this study is to achieve high quality productivity with reduced manufacturing resources and reduced

production costs.

A. Objective of the study

The objectives of this study are to:

- Illustrate the current problems facing the company via a fishbone diagram.
- Examine and establish suitable quality management systems for PTC.
- Change the culture of PTC.
- Assess the benefits of implementing such quality systems in PTC

B. Problem Identification

The issues facing PTC that reduced productivity and caused related problems were divided into the categories: Hard problems and Soft problems as shown in table (1).

C. Fishbone Diagram:

Fishbone diagram is a Japanese quality control system ,an analysis tool which presents problems and the causes of those problems. The diagram shape looks like the simplified skeleton of a fish. The importance of the fishbone diagram is that it assists in identifying the causes of problems in a logical or systemic way.

Table 1. Hard problems and Soft problem

Hard problems	Soft Problems
<ul style="list-style-type: none"> • Poor machine maintenance • Lack of material supplies • Poor manufacturing operations • Rejected products • Customer dissatisfaction • Slow production delivery (do you mean: A long time between a customer placing an order and the product being delivered?) • Raw materials (do you mean: Difficulty in accessing an adequate supply of raw materials) 	<ul style="list-style-type: none"> • No quality strategies • Lack of communication • Staff not motivated • Company regulations • No company mission • or vision statements • Salary issues

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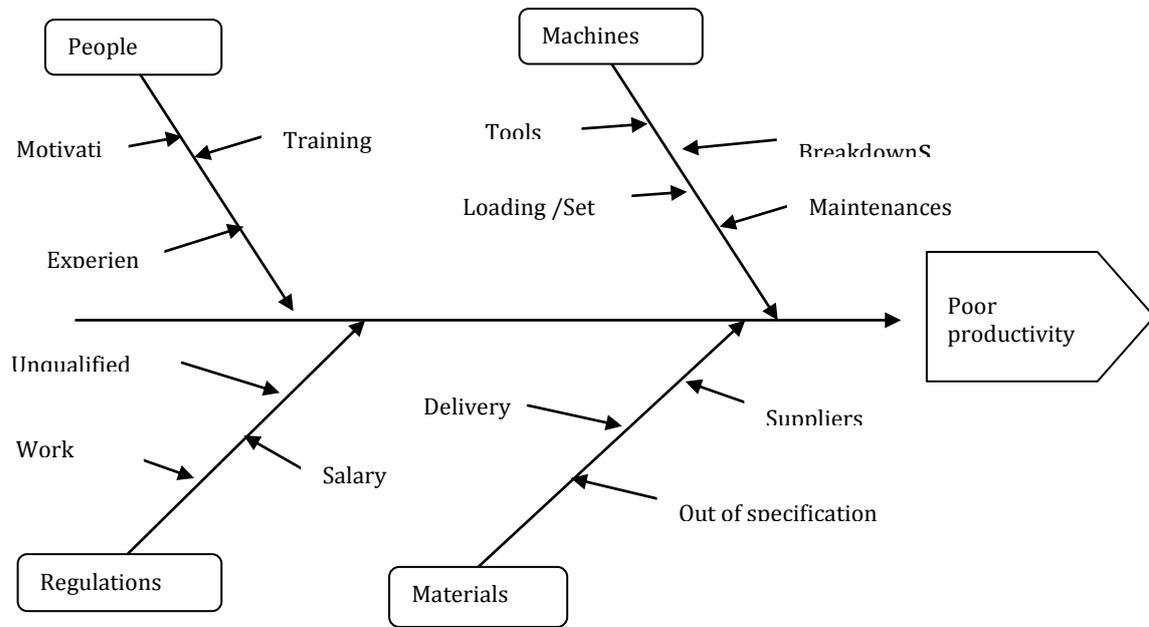


Fig1: Fishbone Diagram

The fishbone diagram showed in Fig.1 illustrates the current issues at PTC which lead to low productivity and customer complaints. The product is a detecting sensor holder (see Fig.2) used by oil and gas companies as an indicator for places on the earth’s surface requiring deeper exploration. Current market demand is 150.000 pieces per month, which means PTC should produce at least 5000 pieces per day. The present production capacity of PTC is between 3000-3500 pieces per day during the one shift worked (8:00 am to 5:00 pm).



Fig2: Detecting Sensor Holder

The main problem as described above was the result of interviews with the manager and senior engineers of PTC. A questionnaire was distributed to staff which will be discussing later in this study

1-Material problems as defined by senior staff: the main causes of problems with materials are:

- Supplies of raw materials: PTC wastes a lot of time searching for suitable material in terms of both prices and specifications. PTC deals with many different suppliers which invariably have different pricing structures, who deliver the raw materials in different shapes and sizes, and there can be shortages of specific raw materials.

- Out of specification raw materials: the oil and gas sectors demand a high quality product with specific material components. Selecting and finding the right material meeting these requirements can take considerable time.

- Delivery: delivery takes more time to deliver materials to the company as there is tabled time for delivering materials. PTC has set delivery timer which suppliers have difficulty meeting

2-People problems: the major staff problems are:

- Motivation: the company staff lacks any kind of encouragement or reward due company policies.

- Training: insufficient training courses and programs for company staff.

- Experience: insufficiently experienced technical staff and senior engineers who do not keep up with recent technological developments.

3- Regulation problems: The main regulation problems are:

- Salary: Staffs complain about low salaries – PTC belongs to the Libyan government.

- Job satisfaction: Some staff are not happy with their current jobs and want more training and top management changes.

- Work hours: staff complained that the scheduled work hours are not enough for the output demanded but due to PTC regulations they cannot exceed these hours.

4- Machines problems: The main causes of machine problems are:

- Maintenance: lack of a maintenance schedule and no skilled maintenance personnel to resolve machine and equipment breakdowns and/or accidental damage.

- Breakdowns: Frequent breakdowns and accidents occur during the operation cycle due to poor maintenance and inadequate training programs.

-Tools: inaccurate machine tools cause delays in the operational time.

-Set up: Time is wasted loading and setting up machines during the scheduled operating time

D. Quality Management Concept

Quality management systems play a vital role in achieving high levels of manufacturing operation and customer satisfaction.

(Oakland. 2005) indicated that in order to accomplish customer satisfaction it is necessary to determine and establish a process to achieve quality management systems performance. The successful operation of an organisation can be the result from implementing a quality management system which leads to continual improvement in performance.

E. Just-in-Time (JIT)

Recently, many manufacturing companies have been adopted Just in Time (JIT) in order to improve their operational performance. The concept of JIT from a production prospective is to eliminate wasted time, labour and storage space. In simple terms, the company produces only what is the customer's needs (Radisic. 2006).

(Toomey. 1996) indicated that JIT is a "pulling system" that enables companies to bring the required material into the operational stages at just the time it is required. Fundamental principles of JIT are:

- Reduce production operation process costs and times in major systems.
- Develop the operational manufacturing processes of a company.
- Conscientious improvement plans.
- Quality approaches.
- Supporting partnership between customers and suppliers.
- Flexibility and simplicity.
- Improve productivity.

PTC wishes to make changes in their supplier chain to eliminate suppliers' lead times and raise suppliers' responsiveness by establishing a "pulling system" which is a JIT technique. If a system began as a pulling process and racing its materials, then JIT follows is begin.

Top management at PTC should implement JIT techniques to help the company to solve production problems and add value to their products as such techniques will:

- Increase productivity and reduce wastage costs.
- More oil and gas customers will be satisfied.
- Better management of PTC suppliers and enhanced good relations with them to better rely on them providing raw materials on time.
- Well managed PTC storage and spaces.
- Improved products with high quality.
- Reduce the lead time during the production process.
- Enhanced flexibility.

Good implementation of JIT needs the full integration of all company activities and processes. To improve productivity and profit, and reduce both cost and time JIT also requires a strong involvement of the company management and of all employees.

F. Kanban system

Kanban is an important part of JIT techniques. The function of Kanban is to maintain a visual representation of material flows so that it easy to see from where the material

was ordered, where and how much material is needed, and the time by which the material should be delivered.

(Kouri. 2009) has stated that kanban cards can be used as signals during preceding production phases to authorise a specified component batch to be delivered or produced.

In recent years, numerous manufacturing companies have recognised the importance of Kanban system and its capacity for improving manufacturing operation processes. (Monden. 1993) showed that many companies have adopted their own version of the kanban system to support their specific operations management needs.

Using the Kanban card system PTC can successfully improve all its production operations including better control to their material flow and production processes involving operation and management staff. Numerous benefits could accrue to the company:

- Real and accurate information for PTC material flow and manufacturing processes.
- Improved communication throughout management levels.
- Better relations between PTC and its customers and raw material suppliers.

G. Total Productive Maintenance (TPM)

Total Productive Maintenance (TPM) is a management system involving both operational and management staff. It is aimed at increasing productivity and reducing costs caused by poor programs and systems for maintaining plant and machinery.

(Richard. 1993) indicated that TPM ensures that the factory or plant is in state of readiness at all times through the three goals of TPM:

- Regular preventive maintenance.
- Periodic, replacement or overhauls.
- Intolerant of breakdowns.

It is important for any company implementing TPM to include all types of maintenance. PTC needs to implement TPM systems in order to overcome the maintenance issues that cause breakdowns and accidents during the production processes. This will be enhancing by:

- Involving all technical staff in the company.
 - Developing training courses and programs to improve staff knowledge about TPM techniques.
 - Ensuring quality planned maintenance.
 - Consulting machine and equipment suppliers for more advice concerning integration of their machines into the company system.
- PTC will benefit from by:
- Improving PTC productivity and management and so reducing manufacturing costs.
 - Reducing breakdowns and accidents.
 - More satisfied customers (quality products delivered on time).
 - Employees sharing new knowledge and experiences.

II. INVESTIGATIONS

Structured into interviews and small questionnaire:

A. Interviews Top Managers of PTC.

The managers agreed that the company suffered from low

productivity and the company could not meet customer demands especially of oil and gas customers because they demanded a huge quantity of products during the year. The managers argued that the main causes of low productivity were fourfold:

- Raw material issues.
- Manpower issues.
- Machinery issues.
- Regulation issues.

Top managers outlined the need for PTC to change its strategies and implement quality management systems to cope with the company's problems and improve its market position in Libya.

An analytic investigation of issues affecting PTC and their identification is discussed in this study.

B. Questionnaire

In total of 20 employees from the production and administration departments were asked to answer a questionnaire which contained five questions related the issues mentioned above.

C. Analysis of responses

Issues:

It is clear from the pie chart , Figure 3, that most of the respondents agreed that machinery and material problems (35%, 30% respectively) are the main causes of low productivity.

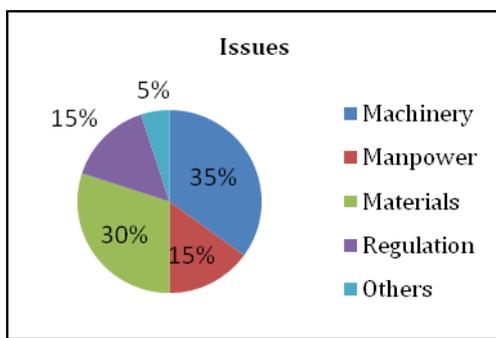


Fig3. Issue Pie Chart

Machines:

As shown in figure (4), 39% of respondents saw machine maintenance as the main cause of machinery problems. However, 28% said that breakdowns were only the secondary cause of machinery problems. These respondents gave priority to the difficulties in dealing with high technology machines and equipment which needs more care in both its operation and maintenance.

Remaining respondents indicated that tools, machine set up time are other causes of low productivity.

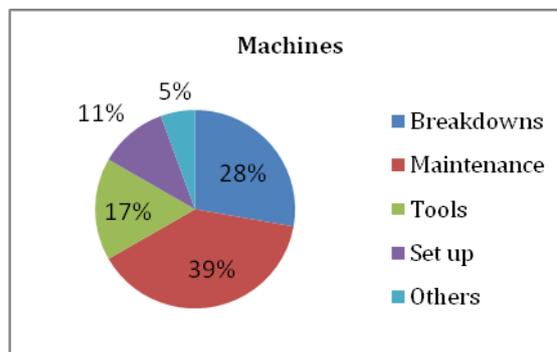


Fig4. Machine Pie Chart

Materials:

Figure (5) shows that 40% of respondents said that the main cause of problems with materials was it being out of specification due the customer's demand for high quality products with specific material properties. This leads to a delay in the production process. Another problem was with suppliers and delivery arrangements: 25% of respondents indicated that there is no commitment on the part of suppliers to deliver the right material at the right time.

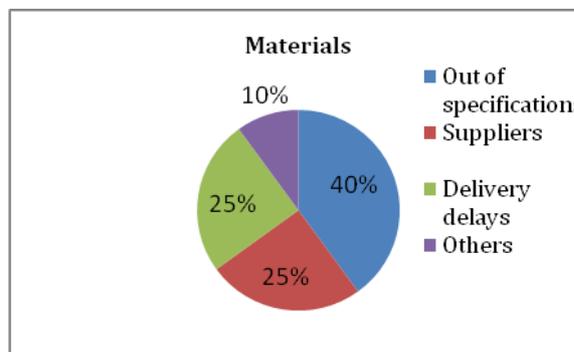


Fig5. Material Pie Chart

Manpower:

From figure (6), Respondents agreed that lack of training and motivation (35% and 30% respectively) are the main cause of manpower problems. Staff deals with high level technology which needs well-trained and motivated people to operate it efficiently.

20% of the responding staff said that there was insufficient experience within the staff of the company concerning the technology used, and little or no sources of information in the country.

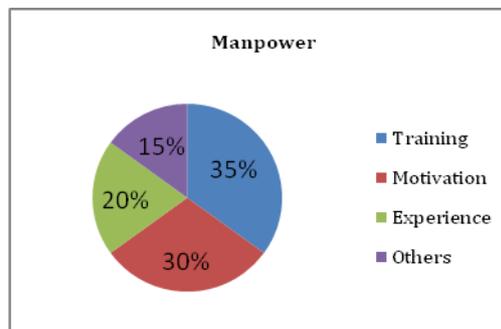


Fig6. Manpower Pie Chart

Regulation:

Most respondents argued that as the PTC belongs to the

Libyan government it is stuck in traditional regulations, especially when it comes to salary and working hours. The respondents believe that these problems are a major cause of low productivity as show in figure (7).

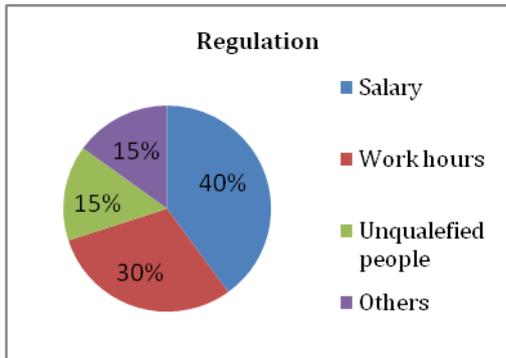


Fig7. Regulation Pie Chart

III. RESULTS AND DISCUSSION

This study has exposed that PTC is suffering from a number of severe problems, which have led to low productivity. The study has provided some suggestions on how to improve company productivity and increase customer satisfaction.

The project has analysed both hard and soft problems such as poor productivity, wasting time and money, poor communication and lack of quality management. It is important for PTC top management to take action to achieve high levels of manufacturing by implementing quality management standards. Also, PTC should be more responsive to technological and economic changes.

Implementing such quality management techniques as TQM, JIT and TPM would play a vital role in changing PTC culture and improving the work environment for both management and staff. PTC staff would be provided with more knowledge and technical expertise which would enable the company to achieve higher quality in all areas including relations with suppliers, customers and its own employees.

Providing further information and knowledge about quality systems and relevant training courses could help the company in improving the application of new technologies and encourage employees to work in efficient, effective and logical ways.

Finally, such changes and adaptation will rapidly lead PTC to success in achieving their targets and satisfy all parties involved: PTC customers, PTC suppliers and PTC employees.

Results:

Based in this study PTC Senior management proposed that PTC should implement the quality management systems and techniques mentioned in this report. The proposals contain:

Short term plan:

- Prepare company missions and visions statements.
- Increase flexibility and simplicity.
- Introduce new motivation plans.
- Establish a new salary payment scheme.
- Establish better relations between PTC customers and suppliers.
- Short term training courses and programs for company employee.

Long term plan:

- Implementing quality management and control such as TQM, JIT, TPM.
- Company to become customer focused.
- Better management of suppliers through kanban system.
- Long term training courses and programs for company employees.
- Develop and apply advanced maintenance programs and plans for company machines and equipment.
- Involve PTC staff in developing company strategies to improve communication through all management levels.
- Recruit experienced staff where and when it is necessary.
- Maximise PTC machine and equipment effectiveness.
- Ensure there is a system for documenting and recording future plans
- Shorten the production operation process cycles.
- Eliminate wasted time and expenditure in all company systems.

The initial results after the company starting implementing the short term plan show that company productivity increased by 20% from 3500 pieces/day to 4200 pieces/day and there was improved customer satisfaction.

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