

# Integrated Quality and Safety in Maintenance as Perspective TQM

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## Abstract

Recent literatures show that costs account in industry for more than 30% of every dollar spent and safety and maintenance account for than 50% of the indirect cost. Moreover, both safety and maintenance issues are inseparable. On other hand, the basic principles at work in quality improvement processes are also at work in the behavior-based safety management process. Implementations of an effective program as perspective total quality management (TQM) can potentially reduce at least one-third of these costs and save billions of dollars annually for industries world-wide. So, both safety and maintenance play leading roles in quality performance and improvement program. Owing to the importance of safety and quality-related weak points intentioned maintenance program, the paper studies sample of maintenance performance which had been implemented in Alexandria Company for petroleum maintenance (petromaint). Furthermore, the paper adopts a maintenance service system as perspective total quality service (TQS). Moreover, the paper puts forth a scheme for the maintenance process such as fishbone (cause, and effect), flowchart to assess, plan, implement, follow up, and evaluate the value added for the maintenance programs as perspective total quality management (TQM). Main findings end up with a major responsibility health, safety, and environment (HSE) considerations, quality levels, and also inventory control behind most maintenance performance problems inside the companies and its outside, especially, another petroleum companies as external customers. In addition, the mechanism of maintenance service for other companies must apply the scientific approaches as perspective TQM to realize continuous improvement. Thus, the integrating of quality and safety management in maintenance services is considered the backbone to improve the managerial performance and in turn the all items of productivity.

**Keywords:** Fishbone (cause and effect), flow chart, health, safety, and environment (HSE), maintenance, total quality management (TQM), total quality service (TQS), customer, continuous improvement,

## I. INTRODUCTION

### A. Background

Since the industrial revolution, maintenance of engineering equipment in the field has been a challenge. Although impressive progress has been made in maintaining equipment in the field in an effective manner, maintenance of equipment is still a challenge due to factors such as size, cost, complexity, and competition. Needless to say, today's maintenance practices are driven , in particular for manicuring and process industry, service suppliers and so on [1]. If one is concerned about the safety and environmental performance and accomplishment record, then it is inevitable that soundness of maintenance programs. Thus, there is a definite need for an effective management and maintenance practices that will positively influence critical success factors such as safety, product quality, and speed of innovation, price, profitability, and reliable delivery as perspective TQM. Each year billions of dollars are spent on equipment maintenance around the world. The terms maintenance quality is important because it provides a degree of confidence that maintained, or repaired parts / equipment / system aril operate reliably and safety [2]. ISO 9000 and TQM supplement each other. A successful TQM effort will have a quality system that is similar to the ISO 9000 quality system [3]. If a company has no TQM initiative and has no reason to seek ISO 9000 registration, it should still consider doing an ISO 9000 assessment of its quality system and modifying it as appropriate. Unless a company has supreme confidence in adequacy of its present quality system and has recently confirmed it, an assessment is as critical to its health as to its financial audit. Although the exercise will not be a complete path to TQM, it should increase the quality awareness and the enlightenment needs to start a TQM program. If a company is just starting in TQM or reexamining its TQM efforts, it should consider integrating an ISO 9000 assessment into the program. Companies, seeking ISO 9000 registration that already have as successful TQM system; can manage the activity by making it a quality improvement project. Thus, ISO 9000 and TQM supplement each other [3]. The quality system of an organization is influenced by the objectives of the organization, by the product or service and by the practices specific to the organization, and therefore, the quality system varies

from one organization to another. Although product and service safety deals with the risk of the failure occurrence and the consequences of such failure; we find that product safety is still liability-free [4]. Behavior-Based Safety Management and Continuous quality improvement are closely related, perhaps so closely that they are essentially two sides of the same coin [5]. Quality improvement efforts minimize the variability of product quality. Safety management efforts minimize the frequency and severity of unplanned and untoward events that harm people [5]. The concept of TQM has become the single most powerful driving force for many companies today, but the desire to produce quality products and/or services the first time, on time and within budget is not a new idea. TQM is an effective tool that can help accomplish these desired objectives. To be completely successful, every one at all levels in an organization, regardless of its size, must firmly and unconditionally dedicate themselves to the philosophy and concepts of TQM. The safety and health professional is not excluded from this system [6]. Concepts such as identifying customer needs, satisfying them and obtaining feedback are essential to success of any company. Even with the new emphasis on quality, few managers really understand what it is or how to implement it in a comprehensive total management environment. Once the basic fundamentals are understood, it will soon be clear that, in a TQM environment, safety and health professionals must actively participate. Conducting business under TQM principles fosters a more complete and beneficial overall program because of the integration of safety and health into other aspects of the business, interdepartmental partnerships are also essential [6, 13]. On the other hand, both safety and maintenance issues are inseparable. If one is concerned about the safety performance and accomplishment record, then it is inevitable that the soundness of maintenance programs should be on equal concern. Both successes and failures of safety program can somehow be linked with a maintenance program in place. Moreover, direct costs associated with the plant, facility and equipment installation and operation have continued to hold steady for many years, but the indirect costs have gone up significantly. The result of the research provided herein indicates that indirect costs account for more than 30 % of every dollar spent and safety and maintenance issues account for over 50 % of these indirect costs [1]. The rationalization and implementation of an effective program management can potentially reduce at least one-third of these costs and save billions of dollars annually for the industries world-wide. So, both safety and maintenance play leading roles in quality performance and improvement program [1, 12].

### **B. Maintenance Service Approach in Petromaint Company**

Alexandria petroleum maintenance company (petromaint) aims to the provision of high quality services (projects & global maintenance) in order to satisfy its customers. Beside, petromaint provides safe work area inside and outside the company to ensure protection for its clients, employees, properties and operations against risk of illness and loss or damage. On other side, petromaint assures that quality; occupational health and environment (HSE) protection are the responsibility of everybody and strives to enhance the awareness of all its employees to make it an integral part of their performance. Moreover, petromaint is committed to comply with all technical specifications, statutory and regulatory and the other requirements concerning HSE, and assures the importance of the continual improvement of the integrated system to meet the requirements of the ISO 9001/2008, OHSAS 18001/2007, and ISO 14001 / 2004.

### **C. Types of Maintenance Program in Petromaint Company**

Petromaint is a top notch provider for world class global maintenance, on call maintenance, construction works, revamps projects and modification services to oil & gas upstream and downstream facilities, petrochemicals, and so on. Petromaint provides global maintenance services such as preventive, predicative, and corrective maintenance for all disciplines including mechanical, electrical, instrumentation, fire protection and detection, and bulk material handling facilities. Moreover, preventive maintenance (PM) was carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure of the degradation of the function of an item. Beside, predictive maintenance (PM) was carried out according to a program designed to predict and detect any problems before they occur, become serious. In addition to, corrective maintenance (CM) was carried out after fault recognition and intended to put an item into a state in which it can perform a require function. Petromaint is committed to add value to the clients operations through seamless integration of her services with their plants to achieve production targets while complying with world class health, safety, and environment standards.

## **II. MAINTENANCE SERVICE MODEL AS A STRUCTURAL ORGANIZATION**

Maintenance is an indispensable part of the business process and plays an important role in an organization's success and survival. The main purpose of maintenance is to ensure equipment functions at its original optimal level [7]. Maintenance is the combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it to

a state in which it can perform the required function [8]. Maintenance has had a tremendous impact on company's proficiency to optimize its service system in order to meet its long term objectives. Generally, a service system in which maintenance is not given attention may easily lead to the system producing defective service as a result of machine defect. Moreover, service performance is similar to the manufacturing model and it has two elements, service efficiency and service effectiveness [9, 10, and 11]. So, the paper adopts an effective maintenance service system where it can be considered as an integrated system with a set of interconnected activities carried out in parallel with service systems [12]. Fig. 1 indicates the maintenance process with a set of interconnected activities carried out in parallel with it such as HSE regulations, inventory control, quality levels (inspection, quality control, quality assurance, total quality control (TQC), and so on where any change in one element causes changes in other elements. Moreover, this system will be affecting with the social, economical, technology, and political environment. In addition to, maintenance service for number of customers must be work effectively to realize the actual needs for clients as perspective total quality services (TQS).

Poor inventory control-----70%  
 Shortage spare parts -----65%  
 Inadequate test tools-----55%  
 Inadequate time in maintenance-----65%

**Table.1: The Status of Preventive Maintenance (PM) Work Orders (W.O) for Variable Categories in Feb. 2015**

W.O	Issued	Canceled	Accessed	Completed	In progress
No	1056	239	817	735	82
%		22.6	77.4	90	10

**Notes:**

\*Percentage of cancelled and accessed work orders are related to issued work orders.

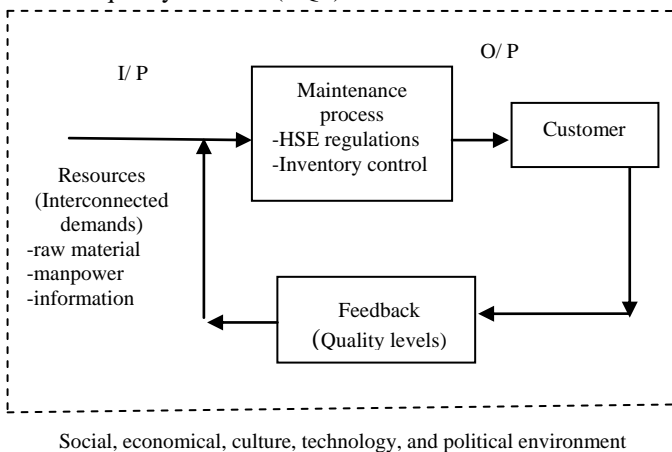
\* Percentage of completed and in progress work orders are related to accessed work orders.

\*Inspection work orders are included as number of issued work orders.

\*In progress means that (Awaiting shutdown, Awaiting spare parts, request or postponed to next possible time to be done).

**IV. THE FLOW CHART REPRESENTATION FOR MAINTENANCE SERVICE**

From maintenance process data analysis, the management assures that the aspects of quality; occupational health and environment (HSE) protection, and inventory control are the responsibility of everybody and strives to enhance the awareness of all its employees to make it an integral part of their performance. Beside, the mechanism is implemented by flow chart to provide safe work area inside and outside the company to ensure protection for its clients, employees, properties and operations against risk of illness and loss or damage. Furthermore, the flow chart diagram is a basic tool for maintenance process to be suggested to improve it or cost cut, as shown in Fig. 3.



**Fig. 1 The Maintenance Service System**

**III. THE FISHBONE REPRESENTATION**

Fig. 2 Shows a fishbone scheme of problems, which may have to failure. From data (1056) equipment in variable categories as shown in Table 1 especially, for preventive maintenance (PM) process through Feb.2015 which had analyzed for status of issued PM work orders. From analysis these data, it was found that the problems which were collected such as the maintenance, quality, inventory, and health, safety, and environment (HSE) management problems which it can be summarizing as follows:

Poor training in HSE-----85%  
 Lack of HSE assessment-----80%  
 Improper personal protective equipment (PPE)-----75%

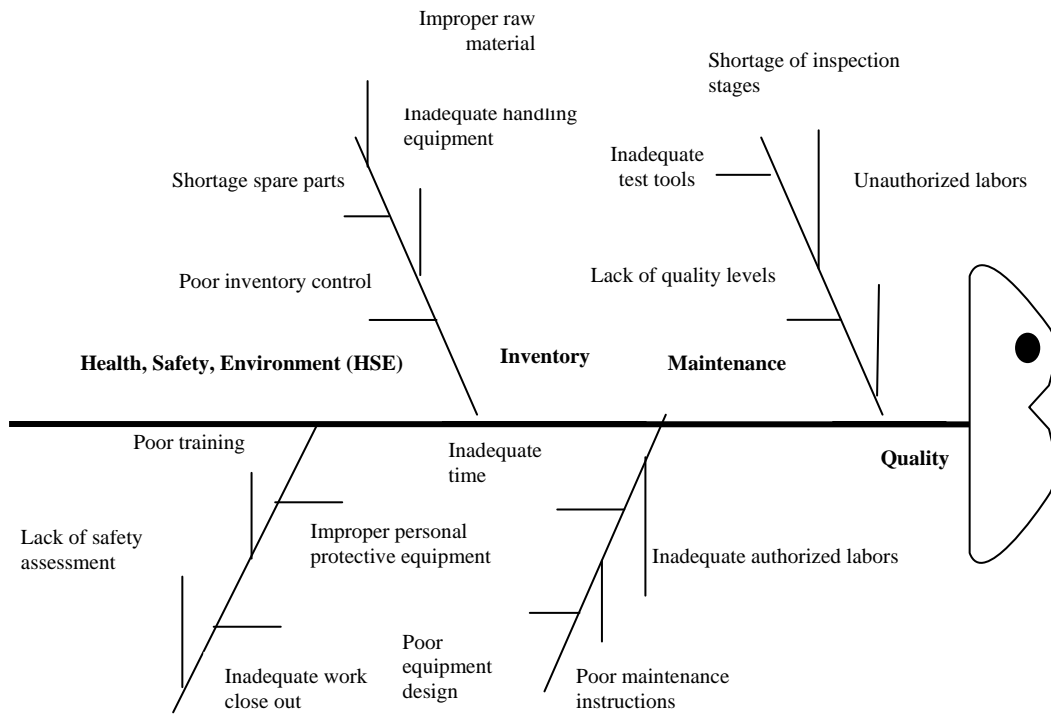


Fig. 2 Fishbone Representation for Problems

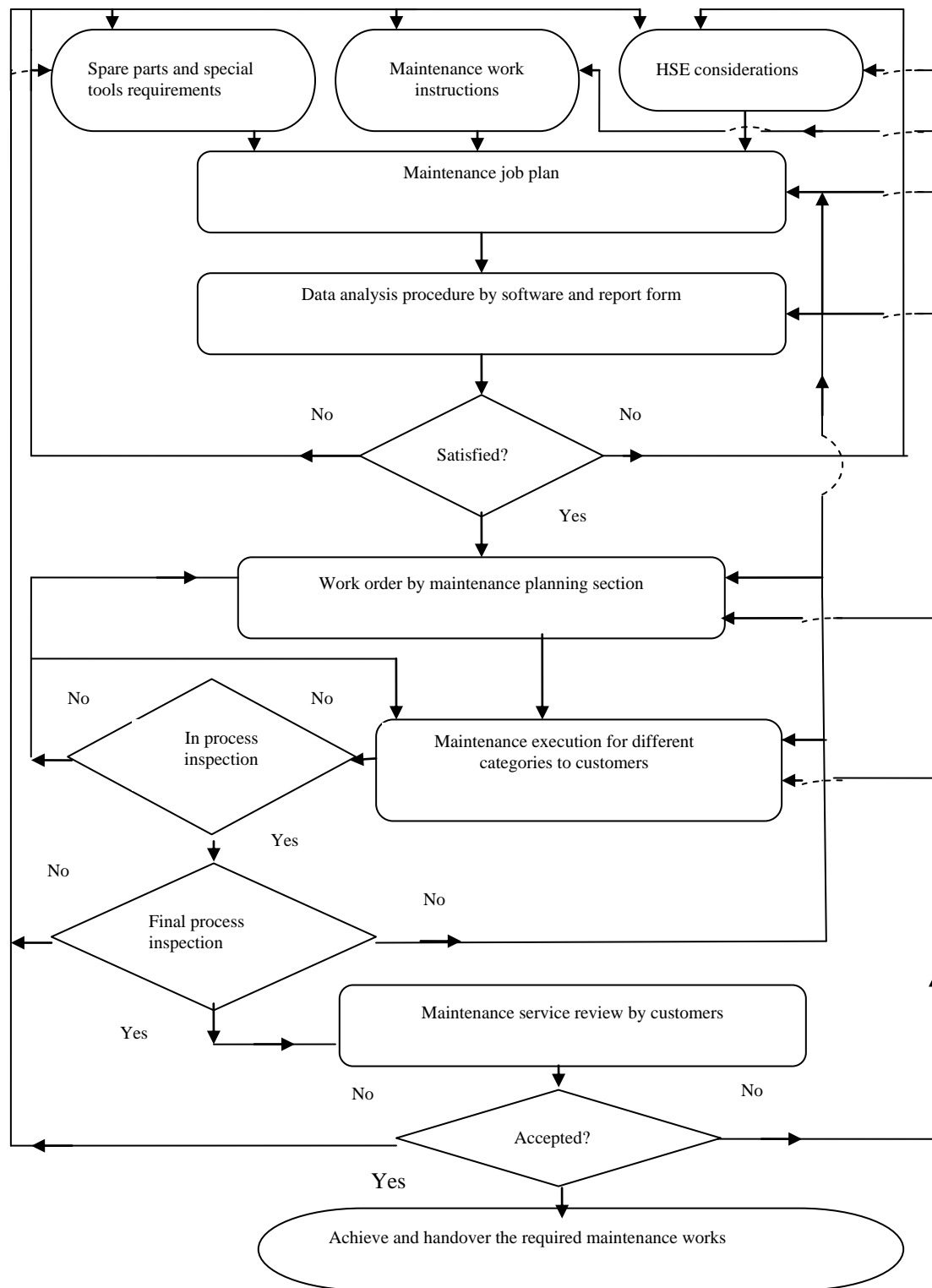


Fig. 3 Maintenance Process Mechanism

## V. CONCLUSION

- 1) From Fig. 1, the integrated service system for maintenance with a set of activities carried out in parallel with service systems will enhance the performance effectively inside and outside the company for customers as perspective total quality service (TQS).
- 2) From Fig. 2, and the findings we can conclude that the fishbone (Cause-and-Effect) diagram shows that it is a powerful tool to analyze and assess integrated service for maintenance problems.
- 3) From Fig. 3, maintenance mechanism in the planning and implementation shows that the flow chart diagram is the easiest and quickest tool used to manage and improve the maintenance service as perspective TQM. Besides, this mechanism is the backbone of the total service control for maintenance process and must continue to improve and develop the life cycle of maintenance especially, for customers.

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