

The Impact of Maintenance Policies on Some Items of ISO (9001-2000): A Survey Study in Industrial Companies in Iraq

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Abstract— The influence of maintenance policy on the industrial sector is highly important, where there is a significant correlation between maintenance policies and some of the items related to international standard (ISO 9001- 2000) such as infrastructure, work environment, control of the production and service operations, and the adjustment of the measurement and monitoring tools. The aim of this study is to provide the intellectual and workable framework that relies on the arguments of researchers and those interested in the fields of management, production and engineering operations to highlight the role of maintenance policies in contributing to the achievement of quality. The industrial and governmental sectors were selected in the province of Nineveh as an arena to do the field work. The sample of the study comprises of six governmental and industrial companies. Questionnaires are used as the main tool for data collection. The study shows the need for sites with appropriate physical working conditions of temperature, humidity, and ventilation to do work in order to ensure the quality of performance through the maintenance policies.

Index Terms— Maintenance policy, Quality Assurance, ISO items.

I. INTRODUCTION

Maintenance is one of the major activities in industrial sector as it highly influences production quality and quantity and directly affects production cost and customer satisfaction. As new manufacturing technologies emerge and global communication advances, new maintenance practices are developed to cope with these changes. The role of maintenance in maintaining asset value over time is getting more visible at the business level with the increase in its acquisition and maintenance costs [1].

Maintenance plays a major role in the success of organizations in various sectors. However, maintenance in the manufacturing sector attracted special attention puts maintenance in manufacturing in a leading position of development in maintenance. This attention is mainly due to the special features of the manufacturing and industrial sector [2], where there is a critical need for proper maintenance of manufacturing facilities. The maintenance process enhances customer satisfaction and reliability of the products, and increases the profit of the manufacturer. Therefore, a proper maintenance policy selection is a critical issue for

manufacturers, as an inefficient maintenance policy affects not only the direct cost of the firm but also the other aspects [3].

The company's management plays a clear role in following appropriate policies to maintain the operational level for these facilities and to provide appropriate conditions for the production process in order to produce an identical product that is in conformity with the required specifications accompanied by a high degree of control and precision in the treatment of malfunctions and reduction of defective products through setting and controlling the production process, and thus achieving the requirements of the quality. The ISO 9000 family of quality management systems standards is designed to help organizations ensure that they meet the needs of customers and other stakeholders while meeting statutory and regulatory requirements related to a product [4]. ISO 9000 deals with the fundamentals of quality management systems [5], including the eight management principles upon which the family of standards is based (Beattie). ISO 9001 deals with the requirements that organizations wishing to meet the standard must fulfill [5].

II. THE PURPOSE OF THIS STUDY

The current study aims to provide the intellectual and workable framework that relies on the arguments of researchers and those interested in the fields of management, production and engineering operations to highlight the role of maintenance policies in contributing to the achievement of quality. In addition to that the study aims to identify the nature of maintenance policies and some items of international standard (ISO 9001-2000), namely, infrastructure, work environment, control of the production and service operations, adjusting the measurement and monitoring tools in the sample companies of the study. Also the study attempts to reach the results and impact of the relationship between maintenance policies and some items of international standard (ISO 9001- 2000) in the sample companies of the study.

III. PROBLEM STATEMENT

The quality is one of the competitive advantageous for companies in the industrial sector, especially with the high competitions from international companies and the effect of globalization. This makes it necessary for those companies that want to survive in the market to adopt the philosophy of quality and focus on achieving the customer.

The maintenance operations are considered as one of the main axes of the operational activities to achieve the management objectives and operations as well as the company's objectives. Therefore the adoption of appropriate policies for the maintenance processes lead to the strengthening of the role

and function of production processes, specifically by clarifying the impact of the items next to that specification (infrastructure, work environment, control of the production and service operations, and adjusting the measurement and monitoring tools). However some companies are not able to implement the maintenance and some items of international standard (ISO 9001- 2000) due to lack of knowledge and experience to adopt these policies in production. It is found that many companies in the industrial sector are not applying maintenance policies items of international standard (ISO 9001- 2000) [7].

IV. THE CONCEPT OF MAINTENANCE

Scholars and specialists in engineering and management topics have different perspectives and opinions about giving a definition of the term maintenance. They depend on their understanding and their specialties.

There are many definitions which focused on the content of remedial maintenance, for example, Hutchins [8] has defined maintenance "as a set of activities leading to the repair of machinery and equipment resulting in maintaining the characteristics of material to be used with maximum efficiency". In the same vein, Isa [9] mentioned that maintenance as "a set of activities that lead to the repair of machinery and equipment, and lead to the preservation of their properties for the purpose of continuing to use the maximum degree of efficiency." However, another team of researchers focused on the content of preventive maintenance, including the British Standards Institute which described the maintenance as "a combination of any of the acts carried out in order to keep the material things or returned to acceptable condition" [10].

Some scholars have emphasized on the impact of implementing maintenance policy on the modern company which represented in its need to a production systems operate efficiently that can be implemented, and monitored efficiently commensurate with the nature of the production requirements of the modern era [11] [2]. They concluded that the need for maintenance policies has become urgent to develop production. Several factors of maintenance contribute to the production such as the following:

1. Increase and develop of mechanization. Due to increase of the technological level in the industry, mechanization has widened broadly which led to
2. Reduce of cost labor, while the role of maintenance of machinery was grown which necessarily reflect the importance of the availability of maintenance workers on a high degree of skill and training to enable them to adjust the machines constantly to be able to produce materials on the required accuracy.
3. Increase the stock of the numbers and varieties of spare parts due to increased mechanization and the complexity of machines, and this is what make spare parts need to efficient systems for storage and follow-up in order to implement preventive maintenance programs in accordance with planned plans.
4. Increase the requirements of quality:

The Maintenance affect the design of the product, transforming design into the production field requires creating and adjust the technical condition of the relevant

machine to get the precision and specified quality which in accordance with the specifications.

Manufacturing systems are subject to deterioration with usage and age. In case of repairable systems, maintenance can restore the operational status of manufacturing equipment after failures or can preserve it by reducing the occurrence of breakdowns. However, maintenance downtimes increase resources utilization and system variability, negatively affecting some relevant performance measures of manufacturing systems, such as work in process (WIP) and cycle time. While a vast body of literature about maintenance planning and optimization exists [13], the interactions between maintenance planning and manufacturing systems performances has been scarcely investigated. In particular, some criteria have been proposed to dynamically determine maintenance actions based on the system status [14] and to control manufacturing systems taking into account machines breakdowns [17].

Introduction historically, many industries have viewed maintenance departments as cost centers that do not contribute to a company's profitability. In recent times, this view has changed dramatically. Managers have recognized the cost savings that result from efficient maintenance operations [15]. Today, maintenance is regarded as an integral part of the production process that contributes to product quality, plant availability and the ability to meet delivery schedules [16]. This is especially important in the manufacturing sector where there is a growing trend aimed at embracing modern Lean and Just-In-Time manufacturing philosophies.

V. CONTEMPORARY TRENDS IN MAINTENANCE

The increasing of the use of robots techniques and automated machines with computer leads to the possibility of increasing of maintenance cost to higher levels than it was. This is what the report of the study conducted by (Wireman report) year (1989) in New York, showed that the estimated cost of maintenance has increased by (400) billion dollars to the results of year (1979). Companies, that their equipment or apparatus are faulted or failed, suffered from heavy losses as the repair was very expensive, and to reduce this phenomenon it was necessitated to adopt of a policy for maintenance based on the situation and not just on the basis of determining regular times for implementation [18]. On this basis trends and new concepts appeared in this regard which as follows:

1. TOTAL QUALITY MAINTENANCE (TQM)

Today, the challenge in the environment of work generally and industrial environment, specifically is to ensure the performance of machines and equipment with high reliability and with less cost as possible and this is reflected in the focus of attention on the expansion of maintenance perspective through its integration with the program of production and the market system [19].

2. TOTAL PRODUCTIVE MAINTENANCE (TPM)

Another new concept has been applied in the eighties of the last century in some Japanese companies, reflecting the idea of unification between the practice of preventive maintenance systems and concepts of modern manufacturing as a just-time production (Just in Time) and total quality management

(TQM). This concept adopts the principles of those systems of participation of workers in decision relying on data and the zero drawback and focus on the customer [20].

VI. THE CONCEPT OF QUALITY ASSURANCE

What emerged from the scientific and technological revolution is the developments in various areas and aspects of the life resulted in the emergence of obstacles and difficulties arising from the production and maintenance of modern machines because of the degree of complexity in making the industrial companies in the continuing need to ensure the achievement of its objectives in an integrated and interactive way for the production of products suitable for use and meet customer's needs, who is constantly demanding evidence indicates the accuracy of the various actions and activities which are practiced within the industrial company which is useful in gaining trust in the quality of products [21]. On this basis, the concept of confirmation or assurance of quality is emerged as a goal sought by all companies wishing to attract customers by demonstrating the active role of all sections of the company in developing , improving and preserving the quality in order to ensure of manufacturing product in the required quality and achieving its objectives by fulfilling its obligations and have a competitive advantage which is capable of on facing of their counterparts in the market as well as its prove to ensure the validity and relevance of the events and activities within the company and to satisfy customer who is being a target [18].

VII. THE PRINCIPLES OF ISO

ISO as a term is derived from the origin of Greek word ISOS, which means parity or equal (ISO, 2004:2), it is used as a prefix in some words on the concept of a parity and equality, as in (Isodynamous), which means equal force and (Isochromatic) means equal color [22] [23], while ISO as letters represents an acronym of three words which are International Standardization Organization (ISO, 2004: 2), which was founded in (1946) in Geneva / Switzerland, its mission is to issue international standards [24], its membership consists of national organizations concerned with the specifications in more than 90 countries and this organization is linked with International Electrotechnical Commission (IEC) both are working together to facilitate the development of agreements on global quality standards, and are about 900 specialized technical and subsidiary committee of the two organizations issued about 800 new global specification each (4-5) years [25]. ISO is characterized by the following [26]:

1. Apply to all companies, regardless of their nature or size they are fit to industrial, productive and service companies.

2. It contains to all the principles of total quality management, (which include management commitment to quality as a competitive weapon, to emphasize the need to involve workers to highlight their role in the construction and development of quality and focus on the customer and the participation of suppliers and work teams and prevent errors , integrated system , product design, inventory, training and the use of techniques of measurement and continuous improvement and comparison with other performance Bench Marking).

The International Organization for Standardization adopted (ISO) and issued specifications (ISO 9000) shown in Figure-3 on the same specification approach (BS 5750) and based on the principles and definitions of the standard (ISO 8402) [27].

VIII. RESULTS AND DISCUSSION

The study investigated the relationship between the independent variables which are the maintenance policies with the dependent variables which are selected items of international standard (ISO9001- 2000) for companies from the industrial sector in Iraq which are the samples of the study. The samples of the study consist of workers (technicians and administrators) working in the selected industrial companies, who were involved in the formulation and decision making of maintenance policies as well as the implementation of these policies.

The number of questionnaire distributed to participants equal 115. The items of the questionnaire associated with the quality of the products and the requirements of the application of certificate of Iraqi quality assurance levels, which are corresponding to International Standard (ISO 9001 - 2000).

1. The correlations between maintenance policies and selected items of international standard (ISO 9001-2000):

Complementing the descriptive and diagnostic operations that depend on the descriptive data analysis has identified the correlations between variables of the study as shown in table-1. Its data indicate the presence of significant positive correlation between maintenance policies and the selected items, the overall index is reaching the (0.370).

Table-1 shows the results of the correlation between maintenance policies and selected items of specification at the level of the sample companies.

The reference: prepared by the researcher in the light of the results of the electronic calculator. P * <0.05, N = 115.

The adopted variables	The infrastructure	The work environment	The control of the production and services operations	The adjustment of the measurement and monitoring tools	The total indicator
The independent variables					

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The maintenance policies	0.396	0.330	0.119	0.307	0.307
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The result shows that the interest of the study sample companies to follow proper maintenance policies for the provision of infrastructure responsive to the requirements of the application the mentioned Standard and thus achieve the identical product of the defined specifications. Besides, the maintenance policies also have a positive relationship with the item of work environment, the correlation coefficient values arrives (* 0.330). This outcome explains the focus of the study sample companies to adopt the required maintenance policies to keep matching the work environment, complying with specified down to the quality of product that is in conformity with the requirements of the specification mentioned.

The maintenance policies also have a positive relationship with the work environment item, the value of the correlation coefficient arrives (0 .307), and this result indicate that companies follow proper maintenance policies that led to an improvement in the performance measurement and monitoring tools. This is consistent with Quraytam [28] ascertain the extent of the product matching international standards (ISO 9001- 2000). These results reflect the fact that accept first major hypothesis which states that the existence of a significant correlation between maintenance policies and

some items of international standard (ISO 9001-2000) that represents the (infrastructure, work environment, control of the production and service operations, adjust the measurement and monitoring tools) as well as the acceptance of all the sub-hypotheses emanating from it and at the level of the sample companies.

2. The effect of selected items of international standard (ISO 9001 - 2000) on the maintenance policies:

The results of the regression analysis on the level of the study sample indicated companies in the table-2 to the existence of a significant effect of the policies of maintenance in terms of international standard (ISO 9001-2000), the value of (F) calculated (30.972), which is the largest of its tabular value which is (3.920) in the degrees (1113) and the level of significance (0.05), and by a factor of identification (R2) of (0.208), and the results of the treatments of beta (β) and test (t) have shown that the value of (t) calculated amounted to (5.565).

Table-2 shows the effect of selected items of international standard (ISO 9001 - 2000) on the maintenance policies Reference: prepared by the researcher in the light of the results of the electronic calculator. the value of (t) calculated N = 115 df (1,113) P * <0.05

The independence variables	The maintenance policies		R2	F	
	B1	B2		accountancy	Tabular
The adopted variables					
Items of the international standard(ISO 9001 - 2000)	1.214	0.464 (5.565)	0.208	30.972	3.920

3. The impact of maintenance policies on each item of international standard (ISO 9001- 2000) at the level of the sample companies:

The impact of maintenance policies of each selected items of the international standard (ISO 9001 - 2000) is shown in Table-3 shows the impact of maintenance policies in infrastructure item on the level of the sample companies. The results in Table-3 refer to the existence of a significant effect of the fundamentals of maintenance in infrastructure provision, the value of (F) calculated (21.916), which is the largest of Tabulated value of (3.920) when the degrees of

freedom (1113) and the level of significance is (0.05). The factor of determining (R2) of (0.162), and the results of beta treatments (β) and test (t) have shown that the value of (t) amounted to (4.682), which is the largest of Tabulated value of (1.658) at the degrees of freedom (1113) and the level of significance (0.05).

Table-3 shows the impact of maintenance policies in each item of international standard (ISO 9001- 2000) at the level of the sample companies.

Reference: prepared by the researcher in the light of the results of the electronic calculator. The value of (t) calculated N = 115 df (1,113) P * <0.05.

The independence variables	The maintenance policies		R2	F	
	B1	B0		calculated	Tabulated
The adopted variables					
The infrastructure	0.403 (4.682)	0.264	0.162	21.916	3.920

The work environment	0.406 (4.726)	0.951	0.165	22.337	3.920
The control over the production and service operations	0.251 (2.759)	1.918	0.063	7.610	3.920
The adjustment of the measurement and monitoring tools	0.379 (4.348)	1.699	0.143	18.905	3.920

CONCLUSIONS

The results of the description and diagnosis show that the direction of the companies, which are the samples of the study, that the physical facilities for the production in their companies need to corrective maintenance enhanced with preventive maintenance to ensure reduce the shutdown times, and using of any form of maintenance policies may be imposed by the degree of the direct impact of the machine on the production process, and this reflects the impact of the type of maintenance policy on the continuity of the production process and the degree of quality. The study shows a significant correlation between maintenance policies and selected items of international standard relationship (ISO 9001-2000) which are represented by (infrastructure, work environment, control of the production and service operations, adjust the measurement and monitoring tools). Also there is a significant effect between the maintenance policies and each item of those selected items of (ISO 9001-2000).

Based on the findings of this study; it is essential to achievement the requirements of the implementation of the international standard (ISO 9001- 2000) as well as to focus on the activities which are related to the contents of this standard, including the maintenance, and follow the most efficient and effective policies to achieve the main goal of those companies which comply with specific standards. In addition to that it is necessary to adopt special documenting maintenance activities Data System, which is used to the intuitive and logical analysis of the data to support computer to be able to make effective decisions regarding the proper maintenance policy and implementing of the tasks with briefing of materials and supplies which are required for this purpose.

The researcher recommend to provide buildings and sites with appropriate physical working conditions of temperature, humidity, and ventilation to do works in order to ensure the quality of performance through the maintenance policies. Moreover it is important to focus on adjusting and calibration of instruments and gauges, monitoring and maintaining them constantly to ensure the desired level of accuracy in their measurements to the levels of quality of products in

accordance with the requirements of the application of the international standard.

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