

# MAINTENANCE MANAGEMENT PRACTICES: A RETROSPECTIVE AND LITERATURE REVIEW

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## ABSTRACT

*Literature on maintenance management has so far been very limited. This paper reviews a large number of papers in this field and suggests a classification in to various areas and sub areas. Subsequently, various emerging trends in the field of maintenance management are identified to help researchers specifying gaps in the literature and direct research efforts suitably.*

*This paper provides a classification, review and analysis of the literature of maintenance management practices in different manufacturing organizations. There is a considerable amount of published research available concerning maintenance management during the last few decades. Thus one of the objectives of this literature review is to investigate the present state of management maintenance practices, based on studies conducted in different countries and published in a variety of journals over the past few decades. Another goal of this paper is to analyze the articles by year and type of journal they were published in, to determine the trends in maintenance management studies and recommend future direction for research.*

*The paper provides many references and case studies on maintenance management. It gives useful references for maintenance management professionals and researchers working on maintenance management.*

**Keywords:** *Maintenance, Manufacturing industries, Performance measures.*

## INTRODUCTION

The role of maintenance in modern manufacturing is becoming ever more important, with companies adopting maintenance as a profit-generating business element. As a result, traditional terms used to describe maintenance such as "necessary evil" seem to be obsolete. It would appear that the aim of the maintenance function is to contribute towards an organization's profit, clearly bringing the need for maintenance operations to be in harmony with corporate business objectives. As the measurement activity provides the link between the actual output and the desired results, performance measurement systems are crucial to those who have a stake in maintenance, to ensure that they are not in conflict with the overall business needs.

Even though maintenance is sometimes considered as a part of the broader term of “terotechnology”, its best definition is, perhaps, the one given by the British Standards Institute, namely:

Maintenance is a combination of actions carried out to retain an item in, or restore it to, an acceptable condition.

In spite of the haziness of the term “acceptable condition”, this is the most precise and yet comprehensive definition of maintenance developed so far. Similar definitions have also been advanced, but they all agree that maintenance includes any effort intended to keep an asset (facility, equipment, etc.) in an acceptable working condition. This includes both remedial and anticipatory functions.

Maintenance is usually categorized into the following three types (Dhillon, 2002):

(1) **Preventive maintenance** – all actions carried out on a planned, periodic and specific schedule to keep an item/equipment in stated working condition through the process of checking and reconditioning.

(2) **Corrective maintenance** – unscheduled maintenance or repair to return items/equipment to a defined state, carried out because maintenance persons or users perceived deficiencies or failures.

(3) **Predictive maintenance** – the use of modern measurement and signal processing methods to accurately predict and diagnose items/equipment condition during operation.

As the technology has advanced, sophistication of all man-made machines and systems has grown and, with that, the nature and needs of maintenance have drastically changed. Maintenance function has become not only more technical, more scientific and more complicated, but also more prominent, more pressing and more paying. Gone are the times when maintenance was considered “a necessary evil” or managers were contented even if all the profits went to maintenance.

### **Goals of the research**

It is essential that the present attempt is different from the earlier reviews and more concentrated in coverage, articles were collected and subsequently studied and analyzed for presenting in this work with following objectives

- To consolidate available literature on maintenance management

- To study maintenance management literature and broadly classify it based on some specific criterion
- To identify evolutionary trends in the field of maintenance management and future prospects
- To analyze and report the most important or finding from each study

## BACKGROUND

In today's highly dynamic and rapidly changing environment, the global competition among organizations has led to higher demands on the manufacturing organizations (Miyake and Enkawa, 1999). The contemporary global marketplace has been putting enormous pressures on the manufacturing organizations to continuously adapt proactive, innovative strategies for enhancing their manufacturing capabilities. To meet the challenges posed by the contemporary competitive environment, the manufacturing organizations must infuse quality and performance improvement initiatives in all aspects of their operations to improve their competitiveness (Ben-Daya and Duffuaa, 1995; Pintelon et al., 2006). For meeting the sustainability and growth endeavors of the organizations, manufacturing organizations need to strategically focus upon cost cutting, increasing productivity, quality, and guaranteeing deliveries in order to satisfy customers. The competitiveness of an organization depends upon its agility in imbibing proactive strategic initiatives for development of state-of-the-art innovative products, and to establish appropriate production processes, production lead-times and speed of distribution.

In contemporary highly challenging environment, a reliable production system has been considered as a crucial factor for competitiveness. Thus achieving excellence in maintenance issues has to be treated as a strategic issue for manufacturing organizations to create world-class manufacturers (Brah and Chong, 2004). The recent competitive trends have been pushing manufacturing managers to emphasize significantly upon impact and importance of increasing equipment utilization, increasing maintenance productivity, resource utilization, and increasing quality and responsiveness of maintenance services in achieving world class status to meet global competition. The recent competitive trends and ever increasing business pressures have been putting maintenance function under the spotlight as never before (Garg and Deshmukh, 2006).

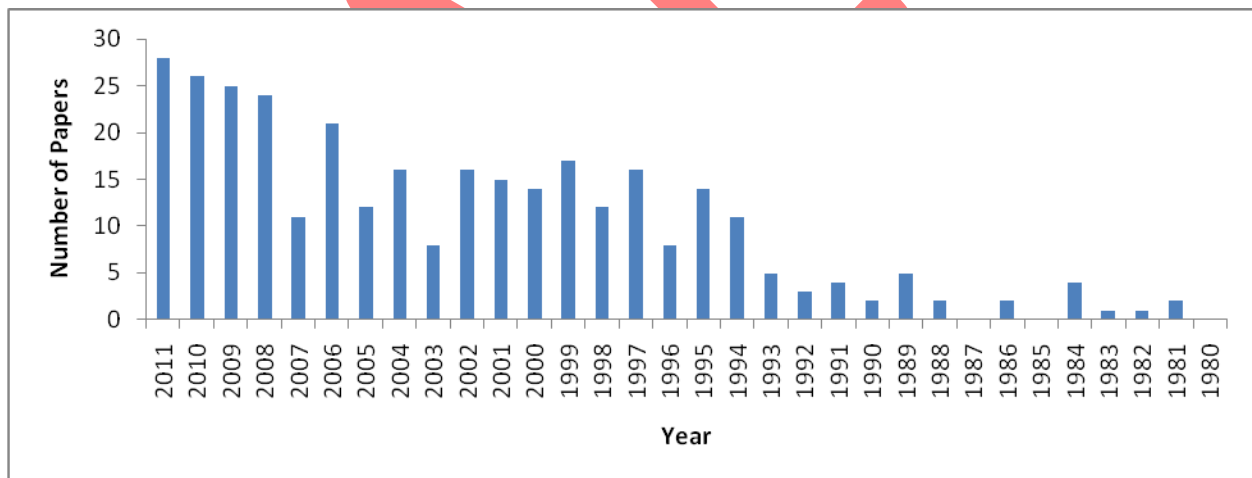
The ever increasing demands on the manufacturing organizations have contributed to complete overhaul of maintenance practices in manufacturing enterprises. The manufacturing organizations are being challenged with developing strategies for affecting improvements in the maintenance function for staying ahead of the competition. These pressures call for imbibing excellent organizational maintenance practices so as to ensure enhanced availability and reliability of the manufacturing systems, catering effectively to the production requirements at the appropriate quality level. An effective maintenance program can make significant contributions towards enhancing production efficiency, plant availability, reliability and

organizational profitability (Maggard and Rhyne, 1992; Coetzee, 1999; Jonsson and Lesshammar, 1999). For maintenance to make its proper contribution to profits, productivity, and quality, it must be recognized as an integral part of the plant production strategy (Kumar et al., 2004). In the highly competitive environment, to be successful and to achieve world-class-manufacturing, organizations must possess both efficient maintenance and effective manufacturing strategies (Ahuja, I.P.S. and Khamba, J.S.2008).

## METHOD

A systematic and exhaustive search of the literature related to maintenance management was conducted. This literature search was conducted using, among others, the following electronic databases: Emerald, ScienceDirect, InformaWorld, and SpringerLink. In addition, another search was conducted in an attempt to include related books and other research outlets. The time frame for this literature review was from 1980 to 2011. In total, 267 articles were reviewed. Figure 1 shows a year wise paper distribution.

The reviewed articles were published in 63 journals, between the beginning of 1980 and the middle of 2011. Based on this review, only 25 journals published two or more articles during this period (see Figure 2).



*Figure 1: Year wise Paper Distribution: 1980: 2011*

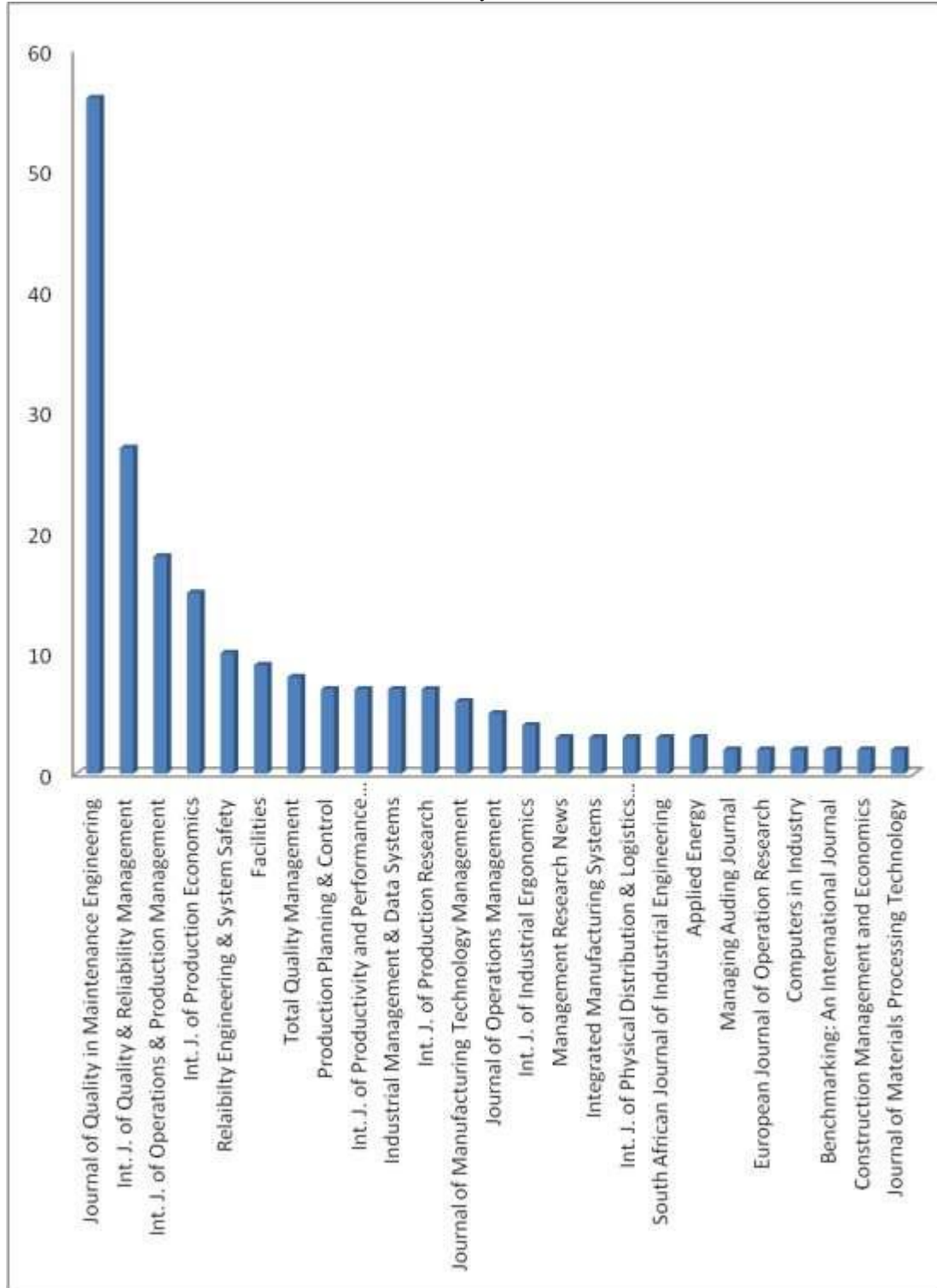


Figure 2: Number of papers per journal

**RESULTS**

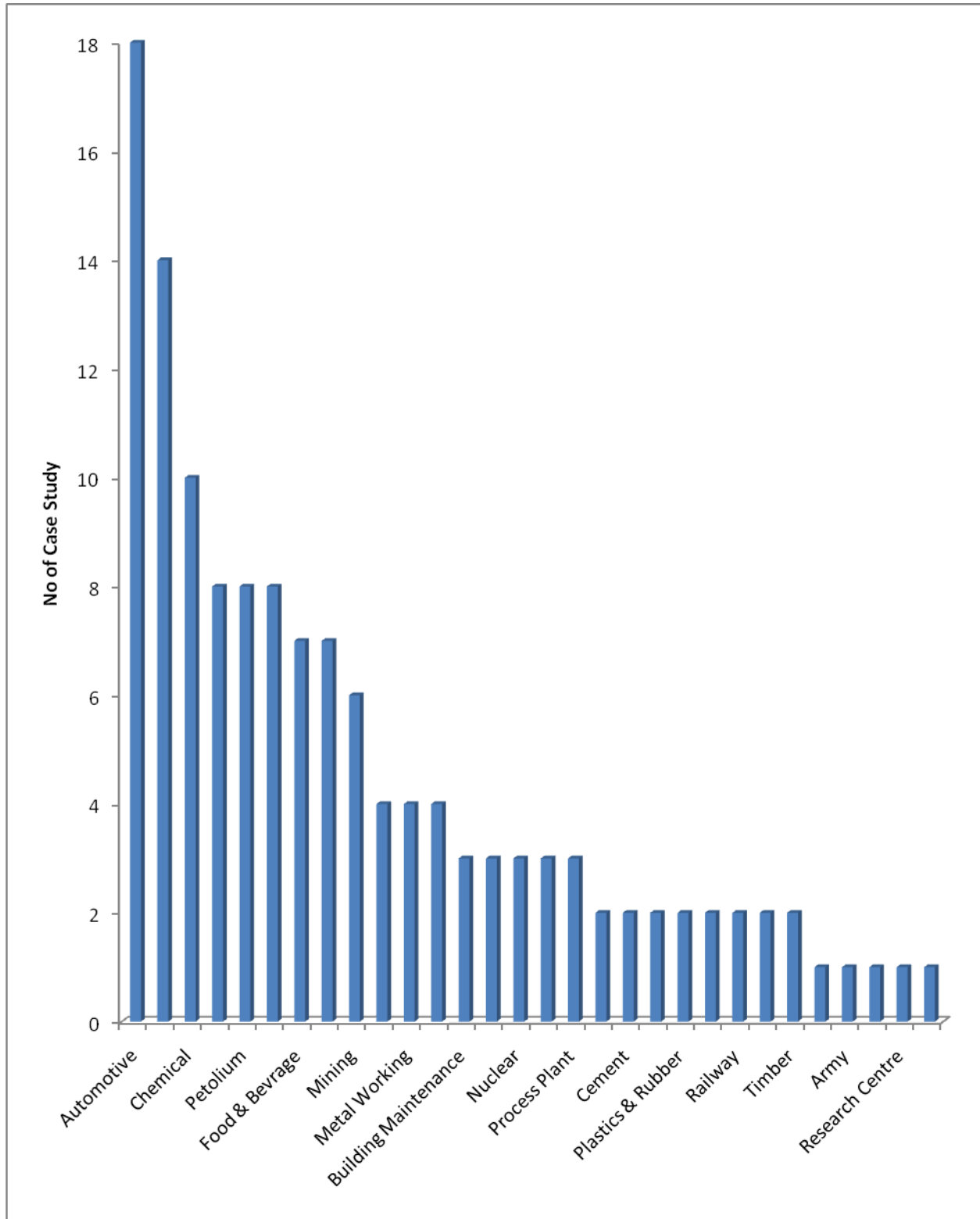


Figure 3: Distribution of Case Study per Industry

The results of the content analysis also showed that most of the reviewed research was derived from practical applications. As it can be seen in Figure 3, 131 case studies related to 29 different industries were identified. In this context, the automotive, electrical/electronic, and chemical were the most represented industries. Future research should attempt to integrate the findings from the case studies into practical implementations methodologies. The characteristics of the industry should be examined in attempt to conceptualize industry specific factors in relation to effective maintenance performance.

## **CONCLUSION**

This literature review examined issues relevant to the different facets of maintenance activities, resources, measures, and measurement in manufacturing organizations. Articles published from 1980 to 2011 were classified and analyzed. Based on the findings of this study, it is concluded that the area of maintenance performance and management is in need of more future systematic research efforts aimed at solidifying theoretical constructs and promoting the implementation of more practical approaches. There appears to be a shift away from viewing the maintenance performance measurement effort based on a mere budget reporting perspective, to viewing it based on a systematic, organizational perspective. The evolution of the organizational role of the maintenance function shows a clear path toward the integration of maintenance resources and activities into a total management system. This change appears to have evolved from a reactive, preventive, and predictive mode to a more holistic/process-oriented, complete, systematic organizational mode (Alsyouf, 2007). Such an evolution path was marked by different generations of maintenance milestones.

Based on the findings of this study, it is concluded that the area of maintenance performance and management is in need of more future systematic research efforts aimed at solidifying theoretical constructs and promoting the utilization of more practical applications.

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