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TQM and BPR: lessons for maintenance management

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Abstract

Competitive pressures on manufacturing organisations have obliged them to look at all improvement possibilities. Among the most popular and well-documented change interventions have been total quality management (TQM) and business process reengineering (BPR). As the management of physical assets now accounts for a rapidly increasing share of operational costs, greater attention is being directed to maintenance thinking. Two maintenance interventions — reliability-centred maintenance (RCM) and total productive maintenance (TPM) — have seen significant industrial application over the last decade. It is the purpose of this paper to apply the general approach of Meredith in an earlier paper to analyse the implementation of these with reference to the TQM, BPR and other change intervention literature and to assess the extent to which the maintenance implementation follows the path of other interventions. Four postulates relating to the implementation of new maintenance systems are analysed: the significance of a prescriptive methodology, quantification of objectives, managerial attitudes, and the importance of not appending maintenance initiatives to existing operations practices. This will facilitate a critical assessment of the potential for and implications of RCM and TPM intervention and thus contribute to the development of the maintenance management field.

Keywords: TQM; BPR; Maintenance; Implementation

1. Introduction

Companies are continually seeking new management interventions to improve their operations. Among these, TQM and BPR have been the subject of much practitioner and academic debate. Claims and counter-claims persist as to their effectiveness, and what has gone right and wrong in their implementation. Impressive reports of vast cost reductions and quality improvements are countered by scepticism and refutation. The same comments could be made about most other management innovations and change programmes. One functional discipline that has been rather neglected is the management of physical assets [3]. Two maintenance approaches have been developed and expanded in the last decade, and it is the purpose of this paper to consider some of the evidence of how reliability-centred maintenance (RCM) and total productive maintenance (TPM) are faring. As academic and critical practitioner maintenance management literature is limited, the exploratory study described in this paper leans on the theory and practice of TQM, BPR and other interventions. In so doing, it considers factors which are conducive to or hamper their successful implementation, assesses whether these can be

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extended to a maintenance situation, and shows how managers implementing RCM and TPM can benefit from the findings of the study.

The research follows the approach of Meredith [57] who studies a number of postulates proposed from a review of the literature pertaining to the implementation of advanced technologies. We analyse four case studies with a view to establishing the validity of the postulates. Our postulates are derived from the TQM, BPR, JIT and other literature relating to the implementation of new technologies and systems. Having implemented TQM or BPR or both, the case organisations could relate these experiences with their maintenance encounters. Further, TQM and, to a lesser extent, BPR have been widely used in industry. As such, when considering the generalisability of the study, many organisations contemplating a new maintenance approach will readily be able to link maintenance implementational issues to TQM and BPR. Our choice of these interventions has parallels with the study by Flynn et al. [30] of the 'mutually supportive' nature of TQM and JIT. Through 'analytical generalisation' [93] the cases are used to assess the extent to which these factors apply to maintenance.

Section 2 contains a review of RCM and TPM in a managerial context, followed by a description of the case studies. Each postulate is presented with an explanation of the RCM and TPM experiences in the case organisations, and a discussion of the literature associated with it. We then compare the implementation of RCM and TPM, and make a series of prescriptive recommendations for managers on maintenance implementation. Finally we consider the limitations of the study and suggest areas for future research.

2. RCM and TPM in a managerial context

Manufacturing organisations have been compelled to look at their maintenance function for several reasons: increased competition has demanded strict cost control, with maintenance accounting for an increasing share of operational costs [65]; automated facilities require higher availability and reliability from plant and equipment; safety and environmental disasters are increasingly attributable to equipment failure; a reassessment of maintenance practices has been instigated by fundamental changes in the understanding of equipment failure [60,75]. Powerful proponents are selling RCM and TPM: the forceful persuasion behind RCM is frequently "this is the way the airline industry has been doing its maintenance for years" [64], while TPM is sold as the way Toyota and other successful Japanese companies do their maintenance [91].

RCM is a methodology where functionality of equipment, through a failure mode and effects analysis, and failure consequence evaluation, is used to determine appropriate maintenance tasks and the intervals at which these should be carried out. TPM provides a maintenance plan for the life of equipment through the elimination of the 'six big losses' [63]. Brief descriptions of RCM and TPM are given in Appendix A. The first problem in researching these concepts is to determine whether definitive, generally acceptable versions of RCM and TPM exist. The text of the originators of RCM [64] was written exclusively for the airline industry, but practitioner books [60,75] on the subject for industrial application have kept close to the generic version[1]. This is therefore the application presented here. Consultants and individual practitioners have produced their own variants, but these do not seem to have wide application. The acknowledged TPM expert is Nakajima, so the description in Appendix A is essentially taken from Nakajima [62,63], with additional material from Willmott [91].

Management commitment, appropriate support systems and effectively managing resistance to change are necessary for success in any management intervention (see for example, [24,57,64]) and apply as much to TQM and BPR as to maintenance. Much of the TPM philosophy is directed at addressing these conditions. There are other factors which pertain directly to maintenance: knowledge of machine capabilities, a thorough understanding of the production process and a high level of production competence are essential before maintenance requirements can be determined [13,29,44,60]. These are considered in the functional analysis of RCM. Improving performance remains an important task of maintenance [6,8], and with greater emphasis on functionality, the task of maintenance now becomes that of ensuring such functionality [34], rather than simply preventing failures. The basic types of maintenance have been extended from preventive, predictive and corrective to include detective maintenance[2] [60], which encompasses the developing technology for the maintenance of protective systems.

[1] A doomed attempt at a British Standard for RCM was made in 1994 (Document 94/408162); various versions have been developed, inter alia, by the US Defense Department, the Royal Navy, the Royal Air Force and Electricité de France. These have been adapted specifically to meet the requirements of those sectors.

[2] Preventive maintenance implies overhauls/rework or replacement at regular intervals; predictive maintenance refers to action which predicts failure (also referred to as condition-based maintenance); proactive maintenance is a generic term encompassing predictive and preventive maintenance; corrective maintenance means repair once failure has occurred; detective maintenance is a functional check, frequently of a protective system, to establish whether it is still working.