CONCEPTUALISATION FOR IMPLEMENTING TOTAL PRODUCTIVE MAINTENANCE THROUGH THE ISO 9001:2008 STANDARD-BASED QUALITY MANAGEMENT SYSTEM

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ABSTRACT

This paper conceptualises the integration of total productive maintenance (TPM) and ISO 9001 certification by contributing a model called TPM 9001:2008. Through this conceptualisation, the eight TPM pillars are amended to the five major clauses of the ISO 9001:2008 standard. To illustrate this conceptualisation, the contents of a sub-clause of the TPM 9001:2008 model are presented, and the rationale behind its designation is appraised.

OPSOMMING

Hierdie artikel konseptualiseer die integrasie van Totale Produktiewe Instandhouding (TPI) en ISO 9001 sertifisering deur 'n model bekend as TPI 9001:2008 voor te stel. Deur hierdie konseptualisering word die agt TPI-pilare aangepas met die oog op die vyf belangrike klousules van die ISO 9001:2008 standaard. Ter illustrasie van die konseptualisering word die inhoud van 'n sub-klousule van die TPI 9001:2008 model voorgehou en die grondslag daarvan beoordeel.

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1. INTRODUCTION

The customers of any business in the modern world expect products and services to meet the highest standards. The rapid rate of globalisation has prompted customers all over the world to develop these high expectations [40]. This phenomenon has forced organisations to provide products and services at a world class level [28,65], reached through adopting and implementing world class strategies. Total productive maintenance (TPM) and ISO 9001 certification are two of the strategies that propel organisations to reach this world class level [23,26].

The ISO 9001 standard was formally published in 1987 [6,23]. Since then, the rate of adoption of the ISO 9001 standard-based quality management system has been high, and 1,109,905 organisations in 178 countries have been certified to the ISO 9001 standard [31]. The success of the ISO 9001 certification can be attributed to its ability to transform any organisation into a world class organisation. Some of the evidence of superior performances by ISO 9001-certified organisations, reported by many researchers and practitioners, espouses the success of the ISO 9001 certification [22,24,61]. TPM has a similar history reported in the literature. TPM was developed in Japan in 1971 [67]. Later that year it was promoted throughout Japan by the Japanese Institute of Plant Maintenance (JIPM). Over the years, the application of TPM spread to many sectors, and its scope expanded from improving maintenance quality to enhancing the performance of organisations. At present, TPM is widely adopted to enhance the quality, productivity, and profit of an organisation through equipment maintenance. TPM is today regarded as a world class manufacturing (WCM) strategy due to its ability to enhance the performance of an organisation to be sustainable in the global competitive scenario [2,4].

Over the years, TPM has evolved by adopting the principles of various maintenance strategies. As a result, TPM has become a comprehensive strategy to aid enhanced quality in maintenance activities [2,16]. Along with maintenance, TPM facilitates plant management with the emphasis on quality, safety, and productivity, resulting in the overall enhancement of organisations' performance [26,35]. TPM is an application of TQM principles in the maintenance engineering field [26]. TQM principles, like employee involvement, continuous improvement, and customer focus, are encapsulated in the TPM model. The ISO 9001 certification can be regarded as an offshoot of TQM as it embraces eight quality management principles. In other words, ISO 9001 certification facilitates the building of a TQM culture in organisations [41]. These facets imply that TPM and ISO 9001 certification are built on TQM principles. Both TPM and ISO 9001 certification by themselves should thus have common elements. If these common elements are identified and suitably integrated, the synergistic benefits of implementing TPM and obtaining the ISO 9001 certificate can be more effectively obtained. In this context, it is presumed that the integration of TPM principles with the ISO 9001:2008 standard will help organisations to acquire world class manufacturing competencies. However, no research or practical work on this has so far been reported.

To fulfill the need to integrate the TPM principles with the ISO 9001:2008 standard, a model called TPM 9001:2008 has been conceptualised in this paper, which has been organised into five sections. After this introduction, the details of a literature survey conducted before designing the TPM 9001:2008 model are briefly described. The information and knowledge gained by conducting this literature survey were used to design the TPM 9001:2008 model. These details are presented in the third section. The fourth section concludes the paper.

2. LITERATURE SURVEY

The literature survey reported here was carried out to study the developments that have occurred in the fields of ISO 9001 certification and TPM. After studying these developments, a search was made to identify any research that has resulted in the integration of TPM

principles with the ISO 9001:2000 and ISO 9001:2008 standards. These details are described in the following subsections.

2.1 Origin and growth of the ISO 9000 series of standards

The origin of the ISO 9000 series of standards can be dated back to the time of the Second World War. The army procurement standards used in that war planted the seeds of what became the ISO 9000 series of standards. These army procurement standards were adopted in 1979 as the BS 5750 standard. In 1987, the ISO 9000 series of standards were formally published by adopting the contents of the BS 5750 standard. The first revised ISO 9000 series of standards were published in 1994. These standards were made available as ISO 9001, ISO 9002, and ISO 9003, giving quality management systems (QMS) specifications for 'design and development', 'production and installation', and 'final inspection' respectively. The ISO 9001:1994 standard contained 20 clauses. During its revision in 2000, these were replaced by five major clauses. The latest revised version of the ISO 9001 standard is ISO 9001:2008, published on November 15, 2008. The ISO 9001:2000 and ISO 9001:2008 standards do not differ much from each other, as the modifications made to the ISO 9001:2000 standard to evolve into the ISO 9001:2008 standard were minimal [6,47,48,56,61,69,70].

The number of companies obtaining ISO 9001 certification has grown extensively over the years [22]. The statistics provided by the ISO Survey 2009 also indicate this massive growth in ISO 9001 certification [31]. This can be related to the ability of the ISO 9001 certification to aid organisations in meeting global customer requirements. Presently, ISO 9001 certification has become near-mandatory for organisations' recognition and survival in the global market [48,61].

2.2 Benefits and criticisms of the ISO 9001 certification

Some of the benefits gained by companies through the ISO 9001 certification, as reported in the literature, are listed below. Organisations with internal motivation to implement and maintain the ISO 9001 certification have accrued more benefits than organisations that are externally motivated to implement and maintain this certification [72,73]:

- Market expansion [12,37,38,46,48,52,66,70]
- Improved product and service quality [25,36,37,46,48,51,66]
- Cost reduction and financial benefits [25,34,38,51,66]
- Improved customer satisfaction and confidence [25,38,46,52]
- Enhanced employee involvement and morale [48,52,66,70]
- On-time product delivery and improved product performance [25,37,52]
- Systematic organisation [12,25,51,66].

Despite these benefits, a few criticisms of the ISO 9001 certification have appeared in the literature. These criticisms, as reported by some researchers and practitioners, are listed below:

- ISO 9001 certification results in internal bureaucracy and documentation [14,23]
- ISO 9001 certification is combined with very high implementation costs (cost of auditors, consultants, time, and resources) that are unaffordable for various organisations, especially small- and medium-scaled enterprises [14,39]
- The ISO 9001 standard is generic in nature, not industry-specific [39]
- The benefits of obtaining ISO 9001 certification are not clearly evidenced [39,58].

Despite these criticisms, ISO 9001 certification has grown exponentially worldwide, and has been increasingly adopted [48].

2.3 Origin and growth of TPM

TPM was first introduced in 1971 by Nippondenso Co., a company in the Toyota group. Later that year, Seiichi Nakajima promoted TPM throughout Japan. Four decades since its

inception, TPM has become a renowned comprehensive maintenance management strategy [2,4,35,43]. Today TPM is successfully implemented in many countries, including the USA, China, India, Malaysia, South Africa, Libya, Nigeria, Ethiopia, Puerto Rico, Hong Kong, Greece, and Italy [1,2,3,16,21,30,45,59,62,63,67]. The 2010 TPM excellence awards have been awarded by the Japan Institute of Plant Maintenance (JIPM) to organisations in many countries, including Argentina, India, Brazil, Thailand, Turkey, Serbia, China, Romania, Saudi Arabia, and Egypt [32]. The success of TPM can be attributed to its comprehensive nature, combining the three aspects of maintenance, production, and resources. Another reason for TPM's success is that it has encapsulated the best practices of earlier maintenance strategies; breakdown maintenance, predictive maintenance, and preventive maintenance [2,4,26,49].

2.4 Benefits and criticisms of TPM

Some of the benefits made available through successful TPM implementation are:

- The creation of a defect-free, interruption-free, and accident-free production environment [2,26,35]
- An improvement in end product quality [1,5,11,19,55,63,64]
- An increase in overall productivity [1,2,11,19,63,64]
- The creation of a sense of ownership among the operators through autonomous maintenance [5,15,16,55,62]
- The promotion of employee education and training [16,19,20,55,68]
- Multi-skilling of employees [11,16,20].
- The enhancement of the levels of productivity, quality, financial performance, delivery performance, safety, and morale in the organisation. [2]

In the literature, criticisms of TPM implementation are scarce. Some of them are reported by the researchers below:

- Resource scarcity increases if TPM is implemented simultaneously on too many machines. This can lead to low or even zero productivity improvement, and can result in the demotivation of TPM personnel, in turn leading to the total failure of the TPM programme [16,17].
- Operators performing autonomous maintenance may become frustrated due to the increase in workload [49].

As the benefits override the criticisms, TPM continues to grow as a world class strategy [2].

2.5 Integration of TPM and ISO 9001 certification

TPM is regarded as a world class manufacturing strategy that assists organisations to achieve world class performance [2,71]. Contemporary researchers refer to TPM not only as a maintenance strategy, but also as a 'total productive manufacturing' strategy [71] due to its ability to enhance the levels of productivity, quality, financial performance, delivery performance, safety, and morale in an organisation [2]. The ISO 9001 standard is a widely-adopted international standard [22] that has evolved over the years as a successful standard for developing QMS in various organisations [31].

During the past few years, many researchers have worked on the integration of various strategies to gain synergy. The result is the optimisation of resources and non-duplication of procedures and processes. Some of the integrated models of these world class strategies are the lean Six Sigma [44], agile [28], Six Sigma maintenance [60], and the lean Six Sigma quality management systems [33]. This has led to a literature survey to identify any research reporting the integration of TPM elements with those of the ISO 9001:2008 standard. No model was found in the literature to integrate TPM and the ISO 9001 standard. However, three papers published by Bamber *et al*. in 2000 [9], 2002 [7], and 2004 [8] were found to emphasise the necessity of integrating TPM with an integrated management system (IMS). In these papers, IMS integrates with ISO 9001-based QMS, the ISO 14001-based environmental management system (EMS), the TPM and 5S-based maintenance management

system, the operations management system incorporated with just-in-time and *Kaizen*, and the BS 8800-based occupational health and safety management system (OHSAS). The authors of these papers pointed out the importance of the roles played by the maintenance personnel in adopting IMS. In particular, the listing of 27 maintenance engineering documents in Bamber *et al*. [8] that correlate with the QMS, EMS, and OHSAS, is noteworthy. Yet these papers have not contributed any model that integrates TPM and IMS. As a consequence, relevant information and knowledge was gathered from the literature to design a model to integrate the elements of TPM with those of the ISO 9001:2008 standard. This model was named 'TPM 9001:2008'.

In the context of integrating TPM and the ISO 9001 certification, the relationship between the two was examined by reviewing the literature. This literature review revealed the existence of connections between TPM and ISO 9001 certification from four angles [57]. These are briefly described below.

2.5.1 Principle-based connections

Two of the TPM principles – small group activities and continuous improvement – coincide with the eight quality management principles on which the ISO 9001 standard has been developed [13,62].

2.5.2 Element- and technique-based connections

Some of the common elements and techniques of TPM and the ISO 9001:2008 standard found in the literature are total employee involvement, leadership and management commitment, continuous improvement, training, and education [5,41,42,47].

2.5.3 Connections through award-based quality frameworks

The quality management principles are similar to the principles of the quality frameworks; the Malcolm Baldrige National Quality Award, the European Quality Award, and the Deming Prize [10,13,24,27,54]. These quality framework principles are, in turn, common with 11 dimensions of the JIPM TPM award [53].

2.5.4 Plan-do-check-act (PDCA) cycle-based connections

TPM adopts the PDCA cycle in the 'quality maintenance' pillar [1], whereas the PDCA cycle is used in the ISO 9001:2008 standard [61] to portray the clauses of QMS requirements.

The existence of a relationship between TPM and ISO 9001 certification, and the absence of a model connecting their elements, initiated new research. In this context, the TPM 9001:2008 model was designed. The conceptual features of this model are illustrated in the next section.

3. CONCEPTUAL FEATURES OF THE TPM 9001:2008 MODEL

Researchers have established that the eight pillars of TPM form the foundation of world class performance (WCP) by organisations [2]. On the other hand, the process-based model encapsulated in the ISO 9001:2008 standard is found to be a reflection of Deming's plan-do-check-act (PDCA) cycle [61], which has been reported to have aided organisations to achieve WCP. On observing these findings, the TPM 9001:2008 model was designed by merging the principles of TPM with the process-based model of the ISO 9001:2008 standard. The details of designing this model are described in the following subsections.

3.1 The constituents of the ISO 9001:2008 standard

The ISO 9001:2000 standard rests on the eight quality management principles and on Deming's PDCA cycle. The five major clauses of the ISO 9001:2000 standard have been retained in the latest ISO 9001:2008 standard [47]. The clauses describing the requirements of the ISO 9001:2008 standard-based QMS are listed below [29]:

- Quality management system
- Management responsibility
- Resource management

- Product realisation
- Measurement, analysis, and improvement.

The working of the ISO 9001:2008 standard-based quality management system is shown in Figure 1.

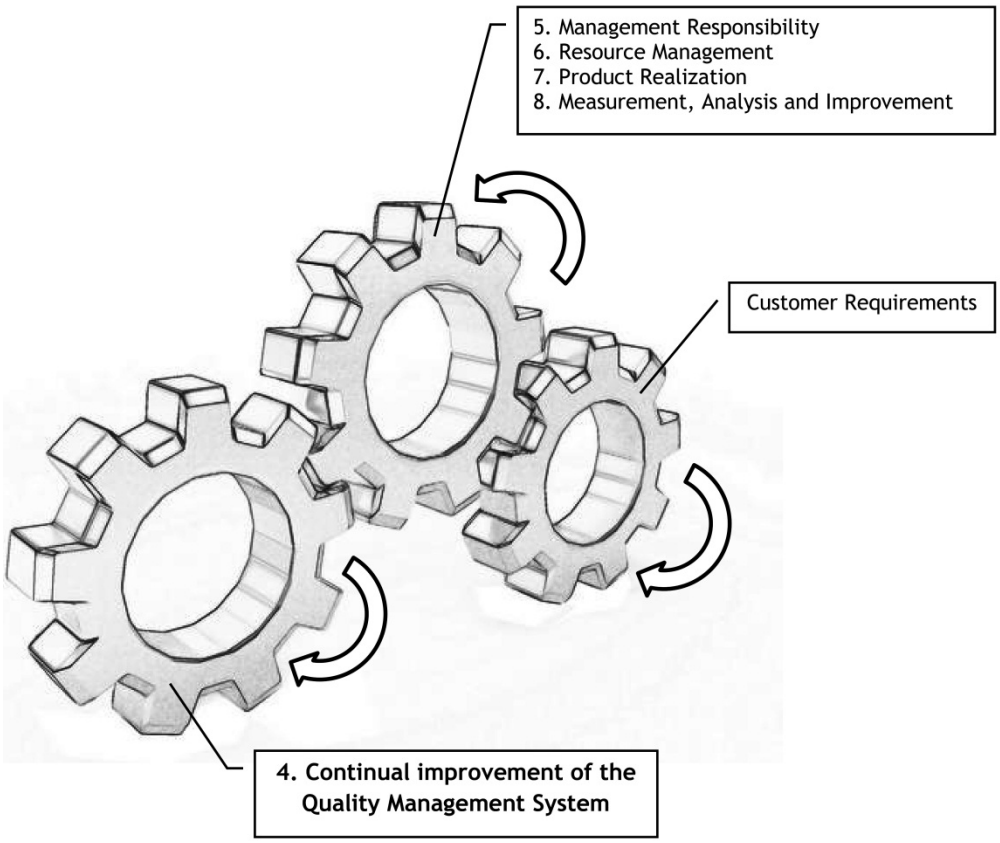

Figure 1: Working of ISO 9001:2008 standard-based quality management system

The four clauses – 'management responsibility', 'resource management', 'product realisation', and 'measurement, analysis, and improvement' – drive the continual improvement of the quality management system. The thrust of this drive comes from the requirements that serve as input to the QMS. The continual improvement of the QMS is realised in customer satisfaction. Any recommendations and feedback from satisfied (or unsatisfied) customers are input into this model. In this way, continual improvement is achieved – and the cycle continues.

3.2 TPM pillars and world class performance

Since its inception, TPM has been built on various pillars. Initially formulated with five, the current structure of TPM is built on eight pillars [2], which are listed below:

- Autonomous maintenance
- Planned maintenance
- Focused improvement
- Quality maintenance
- Education and training
- Safety, health, and environment
- Office TPM
- Development management

An effective TPM programme requires the implementation of these eight pillars, leading organisations to achieve zero breakdowns, zero defects, and zero accidents [2]. In other words, implementation of the TPM pillars enables the organisations to perform at world class level. This is pictorially depicted in Figure 2.

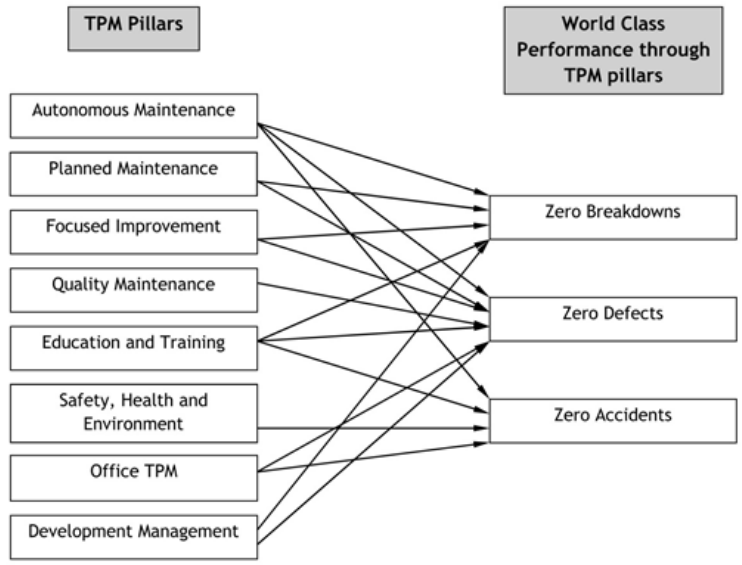

Figure 2: The TPM pillars and their roles in achieving world class performance

Five of the eight TPM pillars – 'autonomous maintenance', 'planned maintenance', 'focused improvement', 'education and training', and 'development management' – mainly enable interruption-free production through achieving zero breakdowns. (This zero-defect level is promoted by seven of the eight pillars; 'safety, health, and environment' does not do this.) The three remaining pillars – 'education and training', 'safety, health, and environment', and 'office TPM' – primarily reduce or eliminate accidents when implemented [32].

3.3 Amending the TPM pillars in the ISO 9001:2008 standard

The clause entitled 'product realisation' in the ISO 9001:2008 standard helps to fulfil customer requirements. As TPM pillars also facilitate performance at a world class level, it is appropriate to amend the TPM requirements to fit the 'product realisation' clause. Of all the TPM pillars, three ('education and training', 'office TPM', and 'safety, health and environment') are most concerned with the management of resources and the organisation's infrastructure. The 'resources management' clause of the ISO 9001:2008 standard encompasses the sub-clauses 'human resources', 'competence, training, and awareness', 'infrastructure', and 'work environment'. As the contents of these sub-clauses deal with the management of resources and infrastructure, the TPM pillars of 'autonomous maintenance', 'education and training', 'office TPM', and 'safety, health and environment' can be appropriately amended in the 'resource management' clause of the ISO 9001:2008 standard.

The TPM pillar of 'development management' aims to improve existing systems, to train employees to fit in to the improved system, and to initiate new maintenance improvement initiatives. The requirements of this 'development management' pillar will be fulfilled through the implementation of three clauses of the ISO 9001:2008 standard: 'resources management', 'product realisation', and 'measurement, analysis, and improvement'. TPM performance is measured using the 'overall equipment effectiveness' (OEE) parameter. OEE is measured and then analysed to determine the deficiencies, and the activities required to improve the maintenance quality. OEE is the product of three components; 'availability', 'performance efficiency', and 'quality rate' [2]. These three components of OEE measure

variables relating to breakdowns and defects. However, OEE does not have a component that measures accidents or variables relating to health and safety [50]. Therefore any suitable measures for measuring health and safety performance are to be added to achieve 'zero breakdowns' – one of the results of TPM implementation. Hence OEE and appropriate measures for health and safety performance can be amended in the 'measurement, analysis, and improvement' clause of the ISO 9001:2008 standard. Successful TPM implementation also requires teams and small groups [2]. This requirement can be appropriately amended in the 'management responsibility' clause of the ISO 9001:2008 standard. In this way, amending TPM elements to match the ISO 9001:2008 standard was conceptualised in designing the TPM 9001:2008 model. The conceptual features of this model reflecting these amendments are shown in Figure 3.

3.4 The TPM 9001:2008 model

As mentioned in the previous section, the TPM 9001:2008 model has been developed by amending the elements of TPM in the clauses of the ISO 9001:2008 standard. To carry out this task, the activities to build each TPM pillar had to be delineated. During the literature survey, it was found that Ahuja & Khamba [2] had pinpointed the activities required to build TPM pillars as a result of their extensive research; and these are appropriate for adoption in organisations. So it was decided to incorporate their activities with small modifications into the TPM 9001:2008 model's design. Those activities are shown in Table 1.

Table 1: Activities for constructing the eight TPM pillars

TPM pillar	Activities for building the TPM pillar
Autonomous maintenance	• Fostering operator skills • Fostering operator ownership • Performing seven autonomous maintenance activities; (i) initial cleaning, (ii) countermeasures for cause and effect of contamination sources, (iii) establishing cleaning and lubricating standards, (iv) general inspection, (v) autonomous inspection, (vi) organisation and tidiness, and (vii) full implementation of autonomous maintenance.
Focused improvement	• Systematic identification and elimination of 16 losses • Loss mitigation through structured why-why analysis and failure mode and effect analysis • Achieving improved system efficiency • Improving OEE of the systems
Planned maintenance	• Planning efficient and effective preventive maintenance, predictive maintenance, and time-based maintenance systems throughout equipment life cycle • Establishing 'preventive maintenance' check sheets • Improving mean time between failure (MTBF) and mean time to repair (MTTR)
Quality maintenance	• Achieving zero defects • Tracking and addressing equipment problems and root causes • Setting 4M (man, machine, material, and method) conditions
Education and training	• Imparting technological, quality control, and interpersonal skills • Multi-skilling of employees • Aligning employees' mindset with organisational goals • Periodic skill evaluation and updating
Safety, health, and environment	• Ensuring safe working environment • Providing appropriate work environment • Eliminating incidents of injury and accidents • Providing standard operating procedures
Office TPM	• Improving synergy between various business functions • Removing procedural hassles • Focusing to address cost-related issues • Applying 5S housekeeping procedures (5S stands for the Japanese terms *Seiri, Seiton, Seiso, Seiketsu, and Shitsuke*) in office and working areas
Development management	• Deploying new equipment using minimum time • Learning from existing systems to develop improved new systems • Maintenance improvement initiatives

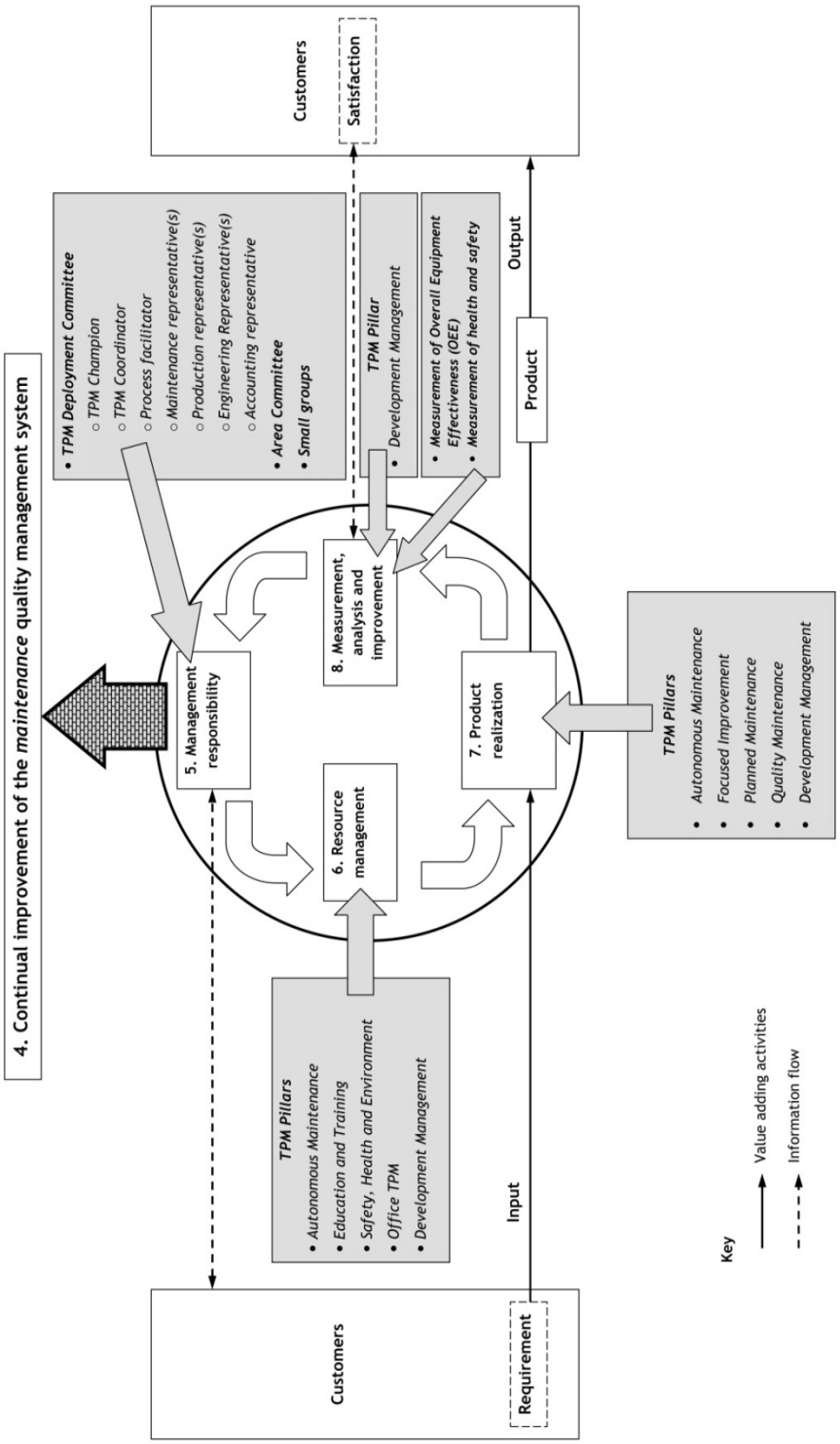

Figure 3: Conceptual features of TPM

The activities listed in Table 1 were considered 'requirements', and were amended in the ISO 9001:2008 standard in accordance with the conceptual features shown in Figure 2. An excerpt from the TPM 9001:2008 model thus designed is presented in Table 2. As seen there, clause 6.2.2 of the TPM 9001:2008 model is obtained by amending appropriate TPM requirements of the ISO 9001:2008 standard. This aspect is shown pictorially in Figure 3; five of the TPM pillars are amended in the sixth and seventh clauses of the ISO 9001:2008 standard. Apart from the 'office TPM' pillar, the other four TPM pillars are amended under the sub-clauses numbered 6.2.2. f to l. The TPM pillars 'autonomous maintenance', 'focused improvement', 'planned maintenance', 'quality maintenance', and 'development management' are amended under the sub-clauses numbered 7.3.1. These TPM pillars amended in the 6.2.2. and 7.3.1. clauses of the ISO 9001:2008 standard are indicated in Table 2 using ***bold and italicised*** letters. An important fact to be observed in Table 2 is that the TPM pillars are amended with ISO 9001:2008 standard elements. This amendment ensures that the ISO 9001:2008-based QMS elements, including documentation, are not disturbed when the TPM 9001:2008 model is implemented in a company. Moreover, the same files used in the ISO 9001:2008-based QMS may be used while implementing the TPM 9001:2008 model in companies. This facility also indicates that the management representative of the ISO 9001:2008 standard-based QMS of the company can continue to perform as 'process facilitator' to facilitate the implementation of the TPM 9001:2008 model in the same company.

Table 2: Excerpt from the TPM 9001:2008 model

6.2.2 Competence, training, and awareness

The organisation shall

a) determine the necessary competence for personnel performing work affecting conformity to product ***and TPM requirements***,
b) where applicable, provide training or take other actions to achieve the necessary competence,
c) evaluate the effectiveness of the actions taken,
d) ensure that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality ***and TPM*** objectives,
e) maintain appropriate records of education, training, skills, and experience (see 4.2.4)
f) foster operator skills to perform autonomous maintenance on the equipment and facilities (these activities facilitate the building of the TPM pillar 'autonomous maintenance'),
g) impart technological, quality control, and interpersonal skills among the personnel (one of the requirements under the TPM pillar 'education and training'),
h) promote multi-skilling of personnel involved in TPM activities (these activities facilitate the building of the TPM pillar 'education and training'),
i) align the attitudes of TPM personnel with the organisational goals (these activities facilitate the building of TPM pillar 'education and training'),
j) evaluate and update the skills of the TPM personnel periodically (these activities facilitate the building of the TPM pillar 'education and training'),
k) train the personnel with safe and standard practices (these activities facilitate the building of the TPM pillar 'safety, health, and environment'), and
l) ***use the lessons learned from the existing TPM to create an improved TPM and formulate a training structure to ensure continual improvement in the implementation of TPM activities (this process builds the TPM pillar 'development management').***

7.3 Design and development

7.3.1 Design and development planning

The organisation shall plan and control the design and development of the product.

During the design and development planning, the organisation shall determine

a) the design and development stages,
b) the review, verification, and validation that are appropriate to each design and development stage, and
c) the responsibilities and authorities for design and development.

The organisation shall manage the interface between different groups involved in design and development to ensure effective communication and clear assignment of responsibility.

Planning output shall be updated, as appropriate, as the design and development progresses.

NOTE: The design and development review, verification, and validation have distinct purposes. They can be conducted and recorded separately or in any combination suitable for the product and the organisation.

7.3.1.1 Design and development planning for TPM
The organisation shall plan and control the design and development of the TPM pillars. During the design and development planning, the organisation shall determine and plan

a) the following requirements to build the TPM pillar 'autonomous maintenance':
- ***i. fostering operator ownership, and***
- ***ii. performing the seven autonomous maintenance activities.***

b) the following requirements to build the TPM pillar 'planned maintenance':
- ***i. planning an appropriate maintenance method (preventive, predictive, or time-based maintenance) over equipment life cycle,***
- ***ii. establishing preventive maintenance (PM) check sheets, and***
- ***iii. adopting suitable activities to increase MTBF and decrease MTTR of equipment and facilities.***

c) the following requirements to build the TPM pillar 'focused improvement':
- ***i. identifying and eliminating the 16 major losses in a production environment, and***
- ***ii. mitigating losses through the adoption of suitable analysing methods.***

d) the following requirements to build the TPM pillar 'quality maintenance':
- ***i. performing activities to achieve zero defects,***
- ***ii. tracking and addressing equipment problems and root causes, and***
- ***iii. deploying 4M (man, machine, material, and method) conditions to achieve zero defects.***

e) the following requirement to build the TPM pillar 'development management':
- ***i. adopting the lessons learned while implementing TPM within or outside the organisation.***

4. CONCLUSION

TPM and ISO 9001 certification are widely adopted globally, and the benefits gained from applying them indicate the capabilities of these two strategies [2,48]. Despite being recognised as world class strategies, TPM and ISO 9001 certification are applied separately in contemporary organisations. In a search through the literature, no system integrating TPM and ISO 9001 certification could be identified. Only a few authors [7,8,9] have emphasised the importance of linking a maintenance function into integrated management systems. To overcome this deficiency, the TPM 9001:2008 model, amending TPM requirements in the ISO 9001:2008 standard-based QMS, was conceptualised in this paper. The unique feature of the TPM 9001:2008 model is that, while implementing this model, the existing ISO 9001:2008-based QMS in the company is not modified or disturbed. This is because in the TPM 9001:2008 model, the TPM elements are only amended (not mixed) with the elements of the ISO 9001:2008 standard. The audit of the TPM 9001:2008 model may be conducted as a whole. Where the ISO 9001:2008 standard-based QMS is already audited in the company, the elements of this QMS may be excluded, and the remaining elements of the TPM 9001:2008 model may be audited. Thus the implementation of the TPM 9001:2008 model will not affect the ISO 9001:2008 standard-based QMS, but will bring the company benefits such as an increased OEE of the equipment, enhanced safety and health levels of the environment, and interruption-free production. The practical compatibility of this model will have to be checked by implementing it in several types of organisations.

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