



Total Productivity Maintenance (TPM): A Hospitality Industry's New Maintenance Approach.

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Abstract

As never before, our modern changing competitive work environment puts maintenance activities under the spotlight. Obtaining competitive advantage in our modern world needs special maintenance applications and approaches that improve both costs and quality. Total productive maintenance (TPM) is represented nowadays as one of the most renovated approaches related to achieving high level and continuous production of both tangible and intangible products. This research paper aims to introduce TPM as a new maintenance approach to be adopted in hospitality industry premises to eliminate traditional limitations between production and maintenance processes. Depending on descriptive analytical method, the research was accomplished through interviewing of 77 employees from 5 hotels that classified as 5 stars in Alexandria. Those employees are distributed on three departments: front office, housekeeping and kitchen. While the results showed no statistical significant relationship between implementation of TPM and guest satisfaction in hospitality premises, other results showed a statistical significant relationship between TPM adoption and all of productivity and performance efficiency, product quality, cost efficiency and profitability and employee morale and loyalty in hospitality premises..

1. Introduction

Because of globalization, customer expectations are developed promptly (Maletic *et al.*, 2012). Therefore, fulfilling such expectations becomes more and more difficult (Inman *et al.*, 2011). These developments make organizations to be in need to apply renovated approaches to provide customers with world class level products and services (Singh *et al.*, 2011). Production equipment represented as one of the most critical assets in any organization that leads success, profitability, quality improvement, cost efficiency, growth and expansion and competitiveness (Nzewi, 2016). Depending on results of many studies, maintenance department represented about 30% of total staffing in manufacturing organizations. In terms of costs, maintenance activities can be translated into more than 20% of the total operating

costs (Wakjira and Singh, 2012). Of course, these percentages are minimal in field of hospitality as they belongs a human extensive industry, but with the increased dependence on modern sophisticated technologies and the wide direction toward automation, such percentages expected to be increased day after day. Therefore, the significance of maintenance needs no other evidence.

As never before, our modern changing competitive work environment puts maintenance activities under the spotlight (Adhiutama *et al.*, 2020). Obtaining competitive advantage in our modern world needs special maintenance applications and approaches that improve both costs and quality. Total productive maintenance (TPM) is represented nowadays as one of the most renovated approaches related to achieving high level and continuous production of both tangible and intangible products (Graisa and Al-Habaibeh, 2011).

The main objective of the research is to introduce TPM as a new maintenance approach to be adopted in hospitality Industry premises to eliminate traditional limitations between production and maintenance processes. The research aims to:

- Introduce TPM as a new maintenance approach to be adopted in hospitality Industry premises to eliminate traditional limitations between production and maintenance processes.
- Investigate the extent of TPM implementation acceptance among research sample.
- Investigate the intention of TPM commitment among research sample.
- Explore the proposed impact of TPM adoption on Productivity and performance efficiency, Product quality, Cost and profitability, Guest satisfaction and Employee morale and loyalty from research sample prospective.
- Introduce a general framework of TPM implementation to establishments in hospitality industry.

2. Background

2.1. Maintenance Management

According to literatures, maintenance can be defined as "*any technical and administrative efforts done in purpose of restoring or retaining any production item to perform in a normal manner*" (Aryee, 2011). It is "*all implementations that done to retain the productivity system in an acceptable working condition*" (Enemu, *et al.*, 2016).

Ghazi (2016) referred that maintenance management categorized into 4 main types:

- **Routine Maintenance:** All daily repetitive activities that aimed to prevent equipment's breakdowns.
- **Unplanned Corrective Maintenance:** Running production equipment until unexpected breakdown occurs. Such type of maintenance support equipment useful life.

- **Planned Preventive Maintenance:** Scheduled maintenance depending on organized periodical inspection of equipment to avoid any breakdowns before occurrence.
- **Unplanned Emergency Maintenance:** Any immediate actions needed to prevent equipment damage as a result of unplanned increasing in production volumes.

For many reasons related to the modern nature of hospitality establishments, such a previous classification became more traditional and unsuitable. There is a growing pressure of competition, a desiring to gain increasing market shares, the developing needs for efficient productivity and operational expenses saving, the progressive looking for accurate and specific standards and the unlimited arising of new market trends (e.g. the green customer) and governmental requirements (like Disability Act and health and safety regulations) in hospitality industry (Aryee, 2011). All these factors beside others make it essential to borrow a new maintenance approach from other industries to implement in our hospitality industry. This approach could be the TPM.

2.2. TPM Concept

Going to automation, simultaneously with the modern equipment sophistication, TPM becomes one of the most prevailing maintenance techniques that applied in modern industries to enhance efficiency in production fields by gaining both the support and commitment of management and the participation of all workforce members (China Productivity Center, 2017). It is more than a professional maintenance as it tends to be a modern cultural modification program (Owen, 2014). However, it had been emerged to be applied in manufacturing industries, it expanded to cover the majority of businesses and industries in our modern world. As a technique, TPM tries to enhance employees' technical knowledge and skills related to maintenance and transfer these skills into actions that improve overall equipment effectiveness (China Productivity Center, 2017). Thus, TPM can be defined as *"a continuous maintenance application that concentrates on full involvement of all employees from the senior one of the top management to the lesser crew member in the organization"* (Nzewi, 2016). From this prospective, management should look at TPM as a culture not as an operation. When such a culture directly or indirectly dominates maintenance operations, productive equipment effectiveness occurred, and positive results gained.

In details, TPM is the daily-base attention that given to equipment for the purpose of improving their working condition, productivity, performance and life span (Kumbi and Mbohwa, 2013). According to Ahuja and Singh (2012), TPM is known as *"an approach that transforms maintenance activities from specialty maintenance department to all employees in the organization by gaining total employees' involvement towards maintenance activities"*. It means that all individuals within the organization from all levels should be involved in maintenance programs that help avoiding any production obstacles in order to improve performance, reduce costs, introduce high quality products, deliver on-time services and achieve flexibility. It

works to increase personnel skills and knowledge in field of machines' cleaning and maintenance to increase efficiency and profitability by preventing speed losses, quality defects and unexpected breakdown.

According to Owen (2014), The Japan Institute of Plant Maintenance (JIPM) defines TPM as following:

- T=Total: Indicates the necessity involvement of all employees.
- P=Productive: Indicates the efficient positioning of all resources.
- M=Maintenance: Indicates remaining the Man-Machine-Material framework in the best condition.

TPM is a continuous improvement program that helps effectively in obtaining customer satisfaction by preventing the occurrence of defects instead of finding and repairing them. Thus, TPM approach collects the best of all traditional maintenance features to introduce a new advanced one that aimed at maximization of equipment effectiveness and preventing them against unexpected defects and breakdowns.

2.3. Origin and Development of TPM

While TPM started to be applied in some American companies during the end of 1980's, this approach wasn't fully understood as it had been remained a secret till 1990's when the Japan Institute of Plant Maintenance (JIPM) decided to introduce it to the western world by organizing the first TPM workshop in the English language (JIPM, 2020). Then, hundreds of companies had been adopted this approach and thousands of articles and books have been written in all languages about it (Kholopane, 2008). Nowadays, TPM is tending to be a popular application in all types of operations because of its positive effect on production (David and Moreno, 2020).

In the last few decades, TPM had been emerged as one of the most useful tool that enhances companies' competitiveness (Renganathan, 2014). Before 1950s, activities of maintenance were related to breakdown occurrences and no preventive programs were done in organizations. With the beginning of 1950s, Japan was introduced a "preventive maintenance" as a new maintenance concept that depending on following some instructions to avoid equipments breakdowns (Levitt, 2010). The preventive maintenance transferred from Japan to America where it had been developed through providing manuals for preventive maintenance of all equipment types. With the beginning 1970s, in conjunction with globalization arises, TPM was born in Japan when Nippondenso Co., one of Toyota group, presented such approach (Wakjira and Singh, 2012; Renganathan, 2014; Singh *et al.*, 2018). A few years later, Seiichi Nakajima, who has known as the father of TPM, presented it throughout Japan to support TQM programs. After four decades, TPM transferred overseas to be a dependable strategy of maintenance in the majority of European and American manufacturing companies (Lazim and Ramayah, 2010).

However TPM was beginning as a tool of enhancing production in manufacturing organizations, their application spread to cover many other sectors (Ahuja and Singh, 2012). Nowadays, TPM represented as a successful manufacturing implementation in all developed countries all over the world (Wakjira and Singh, 2012). The spread and

popularity of applying TPM may be due to its nature that combining the best aspects of all traditional maintenance types in one modern application (Graisa and Al-Habaibeh, 2011). With the beginning of the recent millennium, TPM entered the Arab area as the Japan Institute of Plant Maintenance (JIPM) has been awarded its TPM excellence awards to many organizations in Saudi Arabia and Egypt (Salaheldin and Eid, 2007).

2.4. TPM Objectives

TPM aims at increasing equipment's efficiency to achieve more and more productivity through decreasing overall losses, wastes, breakdowns and defects. Kalwang *et al.*, (2020) concluded the major objectives of TPM as follows:

- Achieving equipment's higher productivity levels.
- Assuring quality.
- Reaching zero breakdowns and defects.
- Minimizing of raw materials.
- Decreasing avoidance wastage and costs to minimal levels.
- Developing workers skills.

2.5. TPM and Hospitality Industry

Maintenance in hospitality industry requires competent staff to undertake as it directly affects the quality of provided services which impacts guests' impression of the premises (Chan *et al.*, 2003). Therefore, selecting and developing an appropriate maintenance strategy represented as a major in improving competent working environmental conditions (Aryee, 2011). Keeping plant, machinery, equipment and systems in a condition to meet operating requirements is the basic function of maintenance (Alseiari and Farrell, 2020).

In hospitality operations, the quality of products, services and performance of all equipment and facilities are fundamental aspects in achieving guest's satisfaction (Vikas and Carly, 2010). Thus, maintenance is of critical importance in fulfilling guests' needs and gaining their satisfactions (Enemuo *et al.*, 2016).

However TPM isn't applied in hospitality industry till now, according to Venkateswaran (2017), there are no reasons that prevent its application and adoption in hospitality premises as it can be implemented in all organizations from all sectors and industries. Because of the direct relation between maintenance and guests' satisfaction, there are increasing pressures on hotel operations to give the priority to their maintenance practices. Such priority makes it essential not only to concentrate on supporting traditional maintenance practices, but also to render another advanced maintenance approaches such as TPM to apply.

2.6. TPM in Relation to Human and Process

2.6.1. Human-Oriented Strategy and TPM

In relation to human-oriented strategies, Lazim and Ramayah (2010) and Renganathan (2014) referred that succeeding in TPM implementation needs to cover the following three sides:

- **Top Management Support and Commitment:** Kicking-off TPM within organization needs a full top management commitment and support. Top management's commitment represents the core factor in TPM implementation success as it involves a changing revolution in working culture. Therefore, the absence of top management commitment and support, especially during the transition period, explains the majority of TPM implementation failed cases.
- **Employees' Full Involvement:** The other core factor of TPM success, beside management support and commitment, is the involvement of all employees in adopting TPM through looking at working equipment from developing a sense of ownership.
- **Training and Education:** Successful implementation of TPM requires early and sufficient workforce preparation. Therefore, employees sufficient educating and training on TPM should be start as early as possible before implementing.

2.6.2. Process-Oriented Strategy and TPM

Like human-oriented strategy, process-oriented strategy effects TPM success vitally. It relates all technical activities aimed to improve availability and efficiency of machines and equipment. According to Seng *et al.*, (2005), supporting process-oriented strategy can be accomplished through three major steps: (1) analyzing failures to identify their causes, (2) eliminating of caught failures through improvements (3) getting feedback to evaluate and confirm results.

2.7. TPM 5Ss and 8 Pillars and their Roles in Achieving 3 Zs

2.7.1. The 5Ss and its Role in TPM Implementation

Implementing TPM begins with 5Ss which is a systematic housekeeping process that reflects the employee's commitment toward TPM implementation. It aimed to eliminate the majority of maintenance problems through organizing and cleaning of workplace. The majority of literatures positioned 5Ss as a base in implementing the 8 TPM pillars (Ngadiman *et al.*, 2012). 5Ss is an improvement technique that enables companies to increase their productivity and quality of their equipment's maintenance through ensuring more organized, clean and efficient environment. It requires the full manpower involvement and full management commitment. To gain more positive and effective results, the adoption and applying of such a technique need to be done gradually (Khokhar and Dhankhar, 2014).

Singh *et al.*, (2013) listed elements of 5Ss technique as follows:

- **Sort (Seiri):** Elimination of all things that aren't needed to ensure more effective organizing process. It need accurate analysis of all exists to determine which are needed and which should be eliminated from work. It relates to filtering to find out the frequently using items and extract unused items to get rid of.
- **Set in Order (Seiton):** Arranging and organizing all things properly to maximize efficiency. This phase could be carried out effectively, in relation to the previous

phase, by accurately labeling of each item and located it in the right place so that person can reach what needed easily.

- **Shine (Seiso):** Cleaning and polishing all exists in the workplace. This action should be a daily working habit to keep working tools in good condition to be ready for use at any time. Analysis of workplace to find sources of dirt to eliminate is very helpful in accomplishing such activity.
- **Standardize (Seiketsu):** Putting standards for cleanliness procedures to depend on in developing daily cleanliness check lists. It should be done simultaneously with the previous three steps.
- **Sustain (Shitsuke):** To achieve continuous commitment of adaption, all employees should be encouraged effectively to follow 5Ss rules. These elements can be illustrated clearly in figure (1).

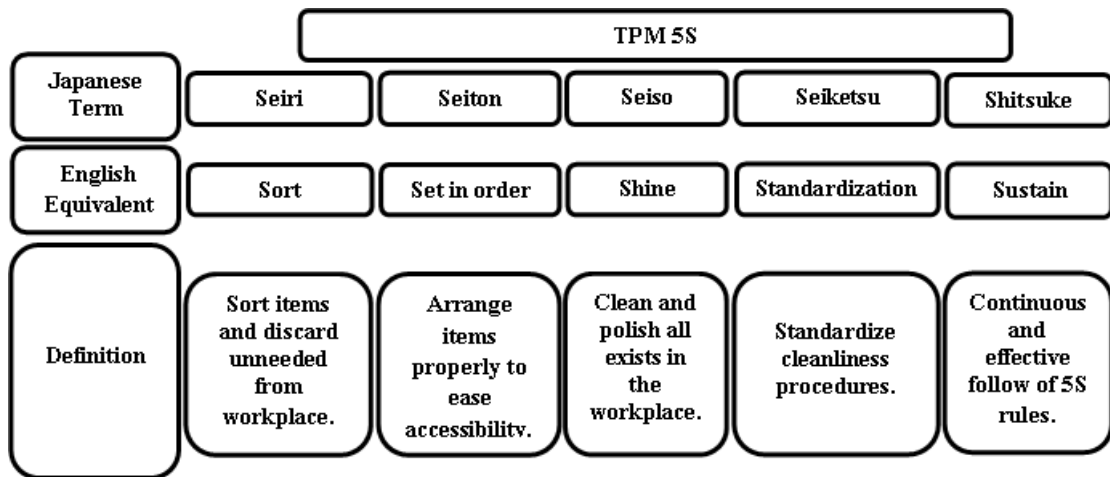


Fig.1. 5Ss Elements of TPM.

(Source: Prepared by the Author depending on: Mahajan, U. K., Adatiya, P., Badhe, P., Patsute, A. and Bhusnar, A. (2018),"Total Productive Maintenance to Improve Overall Equipment Effectiveness". *Global Journal of Researches in Engineering*, 18(3):20).

If these 5Ss aren't respected, the organization may suffer from the occurrence of 5Ds which are: delays, defects, dissatisfied customers, declining profits and demoralized employees (Mahajan, *et al.*, 2018).The most common obstacle of 5Ss successful implementation is centered on company's failure in conveying 5Ss concept and goals to their employees during the first phases of adoption and applying. Therefore, developing a group with sufficient theoretical and practical knowledge of 5Ss, gradually applying and spreading such technique through department by department are major aspects in the implementation success (Munir *et al.*, 2019).

2.7.2.TPM 8 Pillars and its Role in Achieving 3 Zs

The basic practices of TPM are defined as the TPM 8 pillars that suggested by Japan Institute of Plant Maintenance (JIPM) to domain the adoption and implementation of such approach. These Pillars can be discussed briefly as follows:

- **Autonomous Maintenance:** It aimed at increasing the personnel skills in field of equipment management to eliminate breakdowns and defects. According this pillar, simple maintenance activities and tasks, such as bolts tightening, visual inspection, lubrication and cleaning, should be done by operators to keep equipment in their perfect conditions by getting rid of predicted root causes of defects and adding flexibility to maintenance processes (Owen, 2014).
- **Focused Improvement:** This pillar emphasizes that simple continuous improvements are more effective than discontinuous massive improvement. Such pillar is centered on involvement of all employees in maintenance processes to achieve zero loss by analyzing of needed maintenance activities with strict commitment toward resources' saving and operational costs' reduction. It tries to eliminate equipment failures, setup and adjustments waiting time and warming-up looses (Shinde and Prasad, 2018).
- **Planned Maintenance:** Such a pillar assumes that reaching higher levels of customers' satisfaction requires trouble free machines that provide defect free products. It aims to improve quality of products through sustaining equipment availability. The importance of information system positioning and computerized maintenance applications are clearly appeared in planned maintenance improvement (Venkateswaran, 2017). There are four major parts that covered this pillar. Firstly, breakdown maintenance that deals after the occurrence of breakdowns, especially when doesn't related to any harmful effects on production or any valuable repair costs. Secondly, preventive maintenance such as lubrication and visual inspections that targeted prevention of machines failures. Preventive maintenance should cover both periodical preventive maintenance aimed to prevent sudden breakdowns and predictive preventive maintenance. Thirdly, corrective maintenance that aimed to remove the root causes of machine failures. Finally, maintenance prevention depending on record keeping of all breakdowns and failures to re-design a new more effective piece of equipment that is not suffer from the same problems of old piece with the past traditional design (Owen, 2014).
- **Quality Maintenance:** Achieving both higher quality and customer satisfaction through defect-free production by concentrating on equipment parts that related to product quality is the major target of this pillar (Venkateswaran, 2017).
- **Training:** By encouraging them to learn to improve their skills and knowledge, this pillar targeted multi-skilled employees. "Know-How" isn't sufficient to improve maintenance as "Know-Why" is also needed and essential (Andemeskel, 2013). Adopting TPM depends on the equipment's operator to set and maintain it. Therefore, training is an essential part in TPM implementation as it enables operators to understand and fix equipment problems to repair before they affected the production (Ngadiman *et al.*, 2012).
- **Office TPM:** Office TPM represents the logistic and administrative parts that aimed at improving production efficiency. Achieving such a goal can be done through this pillar by eliminating some unnecessary administrative process,

cutting-off of some ineffective communication channels, improving accuracy, effective dealing with customer complaints related to logistics, saving information retrieval time and decreasing some emergency and purchases expenses (Zlatić, 2019). This pillar helps organization reducing labor and labor costs, decreasing overheads, reducing paper works, improving works through both reducing repetitive actions and better utilization of sources, contracting supply chain and preventing logistics related complains (Owen, 2014).

- **Safety, Health and Environment:** This pillar does a vital role through all previous other pillars. TPM program can't be effective without concentrating on prevention of human errors, accidents and environmental pollution through improving safety, health and environmental issues. It aims at achieving the following three Zs: zero work accidents, zero workers' injuries and zero negative environmental impacts (Venkateswaran, 2017).
- **Development Management:** Successful implementation of TPM needs top management to believe in that TPM isn't just a maintenance program, but it's also an organizational culture transformation revolution (Vital and Lima, 2020). These eight pillars can be illustrated in figure (2).

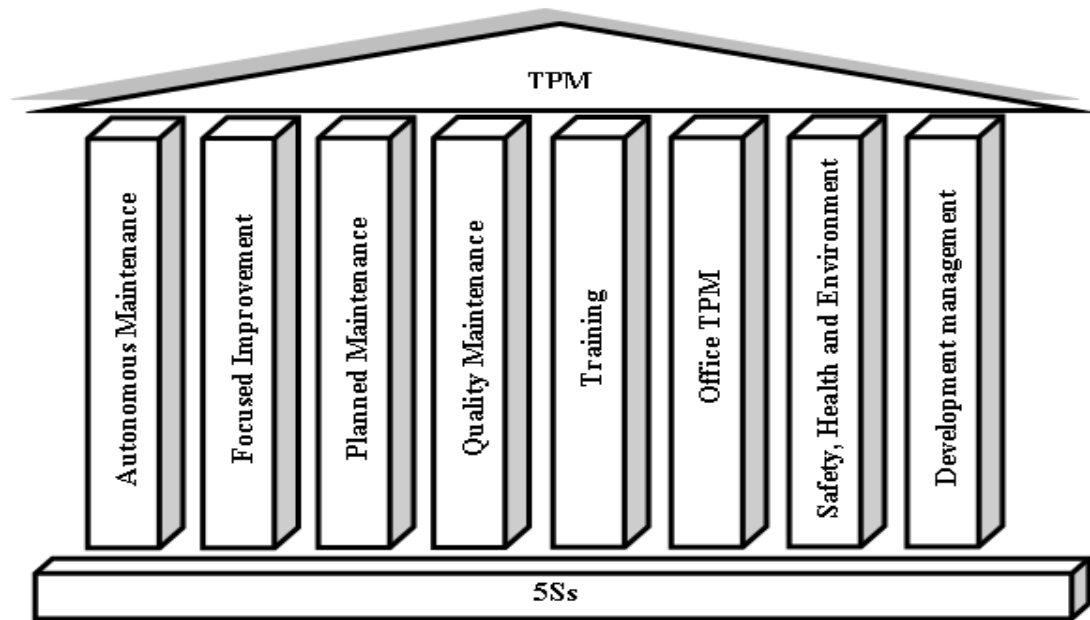


Fig.2.Eight Pillars of TPM.

(**Source:** Jain, A., Singh, H. and Bhatti. R. S. (2018), "An Evaluation of TPM Strategies for Enhancing Manufacturing Performance of Indian SMES", *Industrial Engineering Journal*. March, XI(3):22).

According to Sivaram *et al.*, (2013), implementation of TPM program depends on eight pillars to enable organizations reach world class level through achieving the following 3 Zs: zero breakdowns (zero failures), zero defects (zero quality losses) and zero accidents. Such a relation can be illustrated in figure (3).

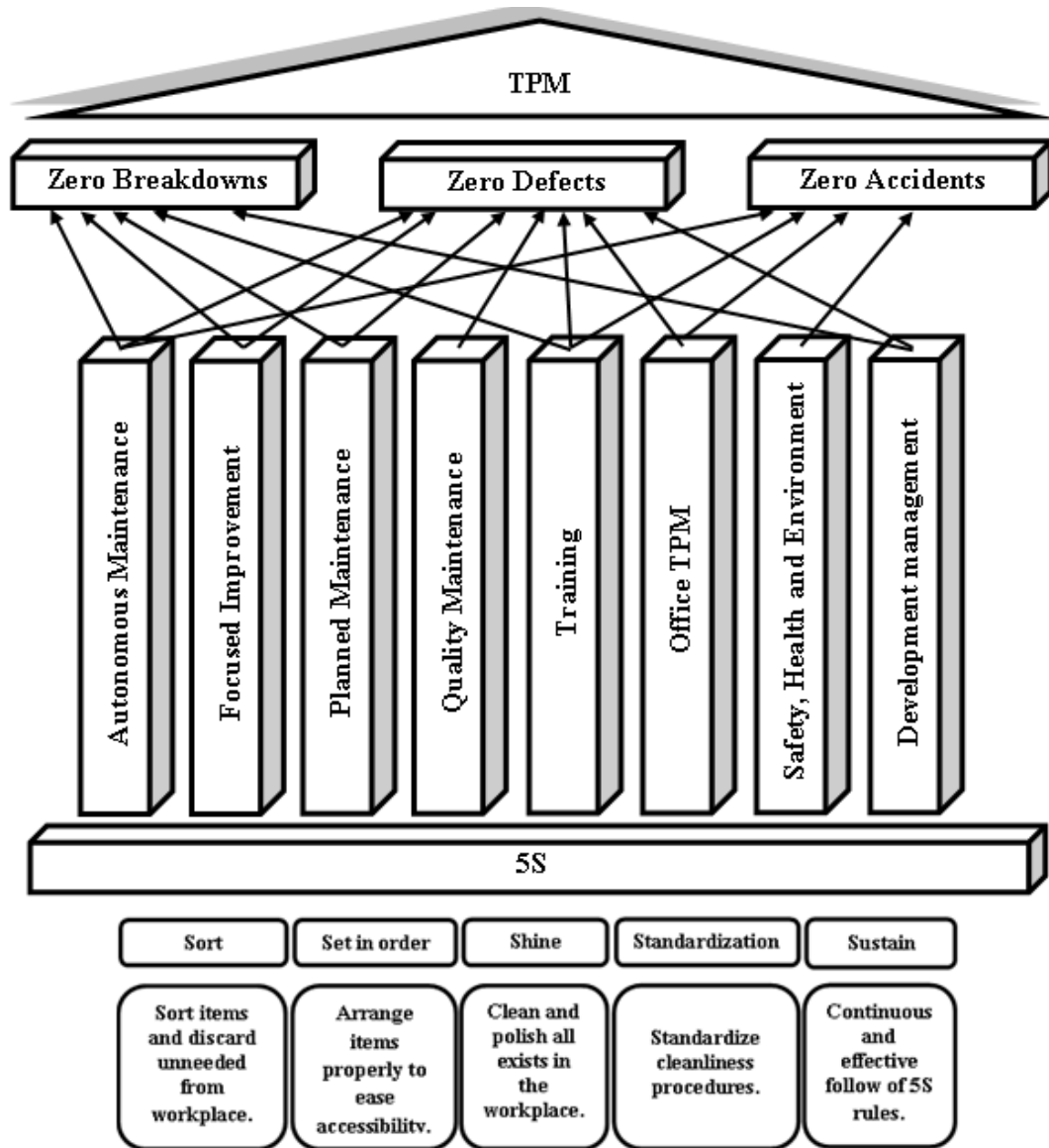


Fig.3.TPM 5Ss and 8 pillars and their roles in achieving 3 Zs.

(Source: Prepared by the Author).

According to figure (3), while all pillars (except safety, health and environment) enhance organization in achieving zero defects, pillars of autonomous maintenance, planned maintenance, focused improvement, training and development management helps in achieving zero breakdowns. Pillars of autonomous maintenance, training, office TPM and safety, health, and environment support zero accidents' objective.

2.8. Benefits of TPM Implementation

TPM, in general, provides the operation with the following benefits:

- **Safety Benefits:** It provides accident-free production environment (Graisa and Al-Habaibeh, 2011).

- **Quality Benefits:** Because both TPM and TQM aim to achieve the same objectives, many researchers try to combine both, while others look at TPM as a practical development of TQM principles related to employee involvement, continuous improvement and customer focus (Sivaram *et al.*, 2013). It provides defect-free production environment (Lazim and Ramayah, 2010) and leads to more product quality improvement (Amaruddin, 2020).
- **Productivity and Financial Benefits:** It achieves extensive productivity (Tsarouhas, 2007).
- **Employees' Morale Benefits:** It supports employees' morale through providing them by training and education to create multi-skilling employees (Eti *et al.*, 2007).

Therefore, and according to El-Maalem *et al.*, (2020), applying TPM in a successful way will result in the followings:

- Fewer defects.
- Reducing resources, energy and time needed for replacing defective products.
- Decreasing time and efforts needed for fixing defective products.
- Extending the life span of equipments.
- Efficiency of organizational capital directing, especially the part that specified to equipment as an important assets.
- Reducing the harmful impacts on both humans and environment through decreasing the need of hazardous cleaning materials and chemicals.
- Increasing productivity that translated in more return on investment (ROI).
- Giving chances to employees share knowledge and upgrade their skills to support job satisfaction and employees' self confidence.
- Lower maintenance expenses, especially on the long run.
- Decreasing costs of production.
- Reducing injuries and accidents.
- Supporting customer satisfaction by serving better quality and accurate quantity at the right time.

For more concentration, applying TPM enables organization to achieve the followings:

- **Error Proofing (Poka-Yoke):** It means avoiding electrical, mechanical, procedural and human mistakes to be repeated through the next operation or at least, if impossible, to decrease such mistakes as possible (Tommelein, 2008).
- **Just In Time (JIT):** It relates to the availability of the repairs or substitutes parts as fast as possible to fulfill customer demand (Tomar and Soni, 2016).

- **"Kaizen"**: It composed from two Japanese words. The word 'Kai' which means continuous and the word 'Zen' that means improvement. Thus, "Kaizen" means continuous improvement (Habidin, 2018).
- **Overall Equipment Effectiveness (OEE)**: TPM represented as advanced technique aimed at maximizing the overall equipment effectiveness (OEE) of utilized production equipment (Manjunatha *et al.*, 2018). According to Irawan *et al.*, (2020) and del Carmen *et al.*, (2020), OEE measures the overall performance of equipments. It deals with three major factors: (1) Machines and equipment availability which calculated by dividing the number of actual running hours of machine (operating time) by the number of machine planned hours (loading time). (2) Machine's performance rate which refers to the positive/negative gap between actual productivity of a machine in comparison with its nominal productivity (3) Machine's quality rate that refers to the approved amount of items generated by a machine in comparison to the total amount of produced items by the same machine.
- **"Kanban"**: It composed from two Japanese words. The word 'Kan' which means card and the word 'Ban' that means signal. Thus, "Kanban" refers to a record card that used to post any replacements to control the flow of maintenance materials and inventories (Warren, 2018).

2.9. Difficulties and Obstacles of TPM Implementation

Studies refereed that TPM needs between three to five years to gain its positive results (Munir, *et al.*, 2019). In fact, it is very difficult to carry out all the aspects related to the eight TPM pillars. When studying a number of companies that claimed they are applying TPM, results indicated that the level of applying of the eight pillars aspects is ranged from 32 to 62% which represented as an acceptable range to assume that the company is TPM one (Meng and Yusof, 2012). According to Okpala and Onyekachi (2016), There are some obstacles of TPM implementation that can be concluded in the followings:

- **Sensation Lateness of TPM Adoption Results**: Because managers may need to gain advantages of any adopted program immediately, vast of them don't care about applying TPM program as it is considered as a long-term program with a long run positive results.
- **Unreality**: In many cases, where managers and staff have no or lake experience, TPM scheduling would be unrealistic. To avoid that, good preparation and sufficient attention to training should be given.
- **Shortage of TPM Implementation Resources**: Many companies have no sufficient resources, neither financial nor personal, to apply TPM program.
- **Cost of TPM Implementation**: As TPM implementation costs the organization some considerable expenses and because it's positive results don't appear in the short run, many companies considered TPM as a load on their budgets.

- **TPM Implementation Opposition:** Like any essential change in working philosophy, changing from traditional approaches of maintenance toward TPM might faced by strong resistance.
- **Absence of Understanding the Benefits of TPM:** If TPM benefits aren't discussed and explained carefully with all employees, the majority of them might consider it as a single-sided benefit that only serves the company and hasn't any comebacks to them.
- **One Beat All:** Successful implementation of TPM need the involvement of all employees. Therefore, the dereliction of one employee might lead to waste of all efforts of their colleagues.
- **Continuation of TPM:** TPM should be a continuous duty that doesn't end. Therefore, succeeding in applying it at present time doesn't assure its succeeding in the future.
- **It Isn't a Show:** In many cases, companies may not serious in adopting TPM. They tend to make show rather than really focusing on applying.

3. Research Problem and Questions

The research problem could be illustrated in the following 2 questions:

- To what extent, hospitality employees can accept inserting TPM implementation procedures in their job description?
- What is the proposed impact of TPM adoption on productivity and performance efficiency, product quality, cost and profitability, guest satisfaction and employee morale and loyalty in hospitality premises?

4. Research Importance

As a result of globalization, there is no choice for companies in all industries rather than adopting and applying new trends related to their operations. It became a necessity not to compete but to still alive in global market (Tsarouhas, 2007). Simultaneously with technological advancements and transformation towards automation in all industries, the importance of equipment's maintenance as one of the most investment tools were increased (Venkateswaran, 2017).

TPM importance exceeds its vital role that played in the field of equipment effectiveness raising (Juric et al., 2006). It is represented as an effective improvement tool that prevents organization from failures (Eti *et al.*, 2006) as it ensures sustained flow of profit to the organization (Thorat and Mahesha, 2020) and saves millions of dollars annually by decreasing chances of breakdowns' occurrence (David and Moreno, 2020). It works also as an evaluation tool of production system (Juric *et al.*, 2006).Applying TPM represented as an evolution in the managerial organization mission that leads organizations to develop their departmental structure as it eliminates traditional limitations between production and maintenance processes, develops job specifications for all jobs from all levels, develops training programs to focus on equipment maintenance technical skills and inserts maintenance activities in employee daily tasks (McKone *et al.*, 2001).

TPM decreases Waste (Renganathan, 2014), enhances profits (David and Moreno, 2020) and supports TQM efforts as organizations with effective implementation of TQM also had effective applying of TPM programs (McKone *et al.*, 2001). There is an extensive amount of studies around the world that reflect the academic significance of researching in TPM topic. Seng *et al.*, (2005) found a significant positive relationship between TPM adoption and low cost, high quality and efficiency of delivery time. The results also showed a positive relationship between human-oriented strategy from one side and the extent of TPM implementation from the other side. Eti *et al.* (2006) found that TPM implementation adds a value from 20 to 40% to production process efficiency. Mfowabo (2006) studied the effects of TPM on the performance. He found that the support of top management and personnel training are fundamental in TPM successful implementation. Wagner and Harter (2006) found a direct positive impact of TPM implementation on employee loyalty and satisfaction.

Ahmed *et al.*, (2010) referred that TPM implementation helps in increasing time efficiency and reducing defects. Manu *et al.*, (2011) indicated that TPM contributes vitally to the organization strengths through enabling to performance improvement and resisting from failures. TPM is represented as a vital part of maintenance management evolution with the special concentration to its role in keeping the organizational assets at best condition to enhance performance. Gautam *et al.*, (2012) found that the successful implementation of TPM depends mainly on the extent of awareness and the level of commitment of all employees in the organization.

While Mwanaongoro and Imbambi (2014) observed the positive relationship between TPM and performance efficiency, Katkamwar *et al.*, (2013) indicated the relation between TPM implementation and improvement of machines' performance, effectiveness and availability. Singh and Bhatia (2013) linked between both TPM and overall effectiveness of equipment. The results showed that TPM implementation success depends on continuous applying and employees' interaction. Goyal and Jindal (2015) cited the overall equipment effectiveness (OEE) as a vital indicator of TPM implementation success. These results go with what referred previously by Wakjira and Singh (2012).

All these previous studies beside others reflect the importance of TPM as an academic research topic around the world and provide evidence on the vitality of this research. In addition, this research is especially important because of the significant lack of TPM studies in the Arab world in general and in Egypt in particular. Another aspect that reflects the significant of this research is related to its application field which is maintenance in hospitality.

5. Research Hypotheses and Variables

This research paper aims to test the following five hypotheses:

H₁: TPM adoption positively related to productivity and performance efficiency in hospitality premises.

H₂: TPM adoption positively related to product quality in hospitality premises.

H3: TPM adoption positively related to cost efficient and profitability in hospitality premises.

H4: TPM adoption positively related to guest satisfaction in hospitality premises.

H5: TPM adoption positively related to employee morale and loyalty in hospitality premises.

According to these hypotheses, dependent and independent variables of the research can be illustrated by the model shown in figure (4).

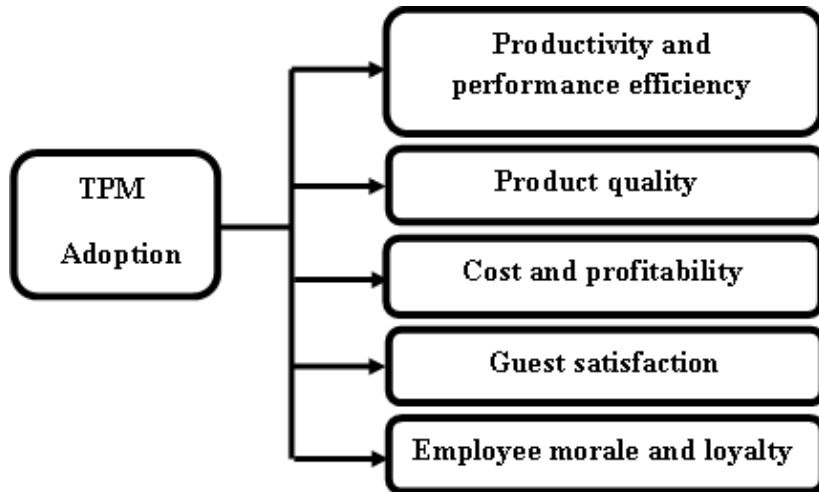


Fig.4. Dependent and Independent Variables of the Research.
(Source: Prepared by the Author).

6. Research Methodology

Depending on descriptive analytical method, the research was accomplished through interviewing of 77 employees from 5 hotels that classified as 5 stars in Alexandria. As shown in table (1), those employees are distributed on three departments: 18 of them are front office employees (23.37%), 30 of them are housekeeping employees (38.96%) and 29 of them are kitchen employees (37.66%). The research concentrated on investigating attitudes of employees from only such departments toward TPM adoption in hotel industry because of their extensive use of equipment and machines compared with employees from other hotel departments. The collected data were analyzed by using PASW Statistics version 18. The reliability of questionnaire was tested by calculating Cronbach's Alpha value (0.981). Statistical techniques of descriptive statistics and one-tailed sample t-test were used to achieve the research objectives.

Table 1
Research Sample Classification by Departments

Hotel	Front Office	Housekeeping	Kitchen	F	%	Mean	Std. Deviation	Range
A	4	7	6	17	22.07	2.14	0.773	2
B	3	5	7	15	19.84			
C	3	5	5	13	16.88			
D	4	6	6	16	20.77			
E	4	7	5	16	20.77			
Total	18	30	29	77	100			

7. Research Results

7.1. Data Presentation and Description

7.1.1. Ranking of Variables Related to TPM Implementation

Depending on data illustrated in table (2), productivity and performance efficiency is the major factor related to TPM (33.8%), followed by both product quality and cost and profitability (19.5%). While the third factor related to TPM is guest satisfaction (18.2%), the fourth one is employee morale and loyalty (9.1%).

Table 2

Factors Related to TPM Implementation

TPM Positively Related to: (Attention Please: Choose only the most important one).	Choices	F (77)	% 100	Mean	Std. Deviation	Range
	Productivity and Performance efficiency	26	33.8	2.49	1.363	4
	Product Quality	15	19.5			
	Cost and Profitability	15	19.5			
	Guest Satisfaction	14	18.2			
	Employee Morale and Loyalty	7	9.1			

7.1.2. Intention of TPM Commitment among Research Sample

As shown in table (3), 62.4% of research sample indicated that it is great to engage in training program to enhance their knowledge of equipment maintenance. 55.9% of them are ready to maintain their equipment if they know the necessary information about it as it is pleasure to be responsible for taking care of their equipment (58.5%) and see no problem to do daily maintenance tasks related to their machines (62.4%). They have no problem to share some maintenance responsibilities with maintenance personnel as long as this is allowed. 58.5% indicated that it is easy to accept adding autonomous maintenance to their responsibilities as they believed that TPM is a good maintenance approach (61.5%).

Table 3
Intention of TPM Commitment among Employees

Intention of TPM Commitment among Employees	Choice					Central Tendency Measures			Dispersion Measures	
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Median	Mode	Std. Deviation	Range
It is great to engage in training program that enhances my knowledge of equipment maintenance.	23 29.9%	25 32.5%	12 15.6%	13 16.9%	4 5.2%	3.65	4	4	1.222	4
If I know the necessary information about my job-related equipment, I would use it to maintain equipment.	15 19.5%	28 36.4%	14 18.2%	16 20.8%	4 5.2%	3.44	4	4	1.175	4
It is pleasure to be responsible for taking care of my equipment.	21 27.3%	24 31.2%	15 19.5%	12 15.6%	5 6.5%	3.57	4	4	1.229	4
It isn't bad for me to do daily maintenance tasks on my machines.	22 28.6%	26 33.8%	12 15.6%	13 16.9%	4 5.2%	3.64	4	4	1.213	4
I have no problem to share some maintenance responsibilities with maintenance personnel.	22 28.6%	26 33.8%	12 15.6%	13 16.9%	4 5.2%	3.64	4	4	1.213	4
I have no problem to maintain my equipment if it isn't forbidden.	23 29.9%	25 32.5%	12 15.6%	13 16.9%	4 5.2%	3.65	4	4	1.222	4
For me, it is easy to accept adding autonomous maintenance to my responsibilities.	19 24.7%	26 33.8%	13 16.9%	15 19.5%	4 5.2%	3.53	4	4	1.209	4
I think that TPM is a good maintenance approach.	20 26%	25 32.5%	15 19.5%	12 15.6%	5 6.5%	3.56	4	4	1.219	4

7.1.3. The Relation of TPM Adoption to Productivity and Performance of Hospitality Premises

Depending on the data of table (4), 39% of respondents indicated that TPM implementation will be reflected in a dramatic reduction of machines' breakdowns. It improves the condition of working equipment (49.4%), saves time (53.3%), increases the personnel productivity (54.6%), leads to the more market competitiveness (45.5%), reduces the overall waste and losses (53.3%) and enhances firm's reputation (41.6%).

Table4

Relation of TPM Adoption to Productivity and Performance of Hospitality Premises

Relation of TPM Adoption to Productivity and Performance of Hospitality Premises	Choice					Central Tendency Measures			Dispersion Measures	
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Median	Mode	Std. Deviation	Range
I think that TPM implementation will be reflected in a dramatic reduction of Machines' breakdowns.	12 15.6%	18 23.4%	24 31.2%	17 22.1%	6 7.8%	3.17	3.00	3	1.174	4
I think that TPM implementation will improve the condition of working equipment.	12 15.6%	26 33.8%	12 15.6%	22 28.6%	5 6.5%	3.23	3.00	3	1.213	4
I think that applying TPM will save time.	18 23.4%	23 29.9%	14 18.2%	17 22.1%	5 6.5%	3.42	4	4	1.250	4
I think that applying TPM will increase my productivity.	18 23.4%	24 31.2%	17 22.1%	13 16.9%	5 6.5%	3.48	4	4	1.210	4
Applying TPM leads to the more market competitiveness.	16 20.8%	19 24.7%	19 24.7%	19 24.7%	4 5.2%	3.31	3	2	1.206	4
Applying TPM reduces the overall waste and losses.	18 23.4%	23 29.9%	15 19.5%	17 22.1%	4 5.2%	3.44	4	4	1.219	4
Applying TPM enhances firm's reputation.	11 14.3%	21 27.3%	23 29.9%	18 23.4%	4 5.2%	3.22	3	3	1.119	4

7.1.4. Relation of TPM Adoption to Product Quality in Hospitality Premises

As shown in table (5), the majority of respondents indicated that TPM enables them to meet orders placed by customers promptly (62.4%) and effectively (53.3%). They believed that it enhances defect free product (41.6%) and raises the quality of provided products and services (55.9%).

Table 5
Relation of TPM Adoption to Product Quality in Hospitality Premises

Relation of TPM Adoption to Product Quality in Hospitality Premises	Choice					Central Tendency Measures			Dispersion Measures	
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Median	Mode	Std. Deviation	Range
I think that TPM enables me to meet orders placed by customers promptly.	23 29.9%	25 32.5%	12 15.6%	13 16.9%	4 5.2%	3.65	4	4	1.222	4
I think that TPM enables me to meet orders placed by customers effectively.	18 23.4%	23 29.9%	15 19.5%	17 22.1%	4 5.2%	3.44	4	4	1.219	4
TPM enhances defect free product.	11 14.3%	21 27.3%	23 29.9%	18 23.4%	4 5.2%	3.22	3	3	1.119	4
I think that TPM raises the quality of products and services.	15 19.5%	28 36.4%	14 18.2%	16 20.8%	4 5.2%	3.44	4	4	1.175	4

7.1.5. Relation of TPM Adoption to Cost and Profitability in Hospitality Premises

Depending on the data of table (6), 62.4% of respondents believed that applying TPM leads to the decrease of overall maintenance cost as doing simple cleaning, lubricating and tightening duties will decrease the operational cost (53.3%) and leads to the more profitability (41.6%).

Table 6
Relation of TPM Adoption to Cost and Profitability in Hospitality Premises

Relation of TPM Adoption to Cost and Profitability in Hospitality Premises	Choice					Central Tendency Measures			Dispersion Measures	
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Median	Mode	Std. Deviation	Range
Applying TPM leads to the decrease of overall maintenance cost.	23 29.9%	25 32.5%	12 15.6%	13 16.9%	4 5.2%	3.22	3	3	1.131	4
Doing simple cleaning, lubricating and tightening duties will decrease the operational cost.	18 23.4%	23 29.9%	15 19.5%	17 22.1%	4 5.2%	3.34	3	3	1.108	4
Applying TPM leads to the more profitability.	11 14.3%	21 27.3%	23 29.9%	18 23.4%	4 5.2%	3.22	3	3	1.131	4

7.1.6. Relation of TPM Adoption to Guest Satisfaction in Hospitality Premises

While the majority of respondents believed that defect free product achieved by TPM enhances guest satisfaction (53.3%), only 23.4% agreed that TPM focuses on guest satisfaction. This situation is illustrated by data in table (7).

Table 7
Relation of TPM Adoption to Guest Satisfaction in Hospitality Premises

Relation of TPM Adoption to Guest Satisfaction in Hospitality Premises	Choice					Central Tendency Measures			Dispersion Measures	
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Median	Mode	Std. Deviation	Range
Defect free product achieved by TPM enhances guest satisfaction.	18 23.4%	23 29.9%	15 19.5%	17 22.1%	4 5.2%	3.44	4	4	1.219	4
TPM focuses on guest satisfaction.	12 15.6%	6 7.8%	16 20.8%	17 22.1%	26 33.8%	2.49	2	1	1.429	4

7.1.7. Relation of TPM Adoption to Employee Morale and Loyalty in Hospitality Premises

By investigating the data of table (8), TPM implementation Raises the maintenance knowledge of employees and adds value to them (55.9%). It increases their overall skills (59.8), raises their moral (39%), supports their job satisfaction (59.8%), raises their loyalty to the organization (39%) and increases their creativity (62.4%). It enables them to apply more co-ordination, co-operation and problem solving skills (59.8%), enhances initiative, belongingness and commitment of them (62.4%) and makes them to enjoy more working authorities (62.4%).

Table8

Relation of TPM Adoption to Employee Morale and Loyalty in Hospitality Premises

Relation of TPM Adoption to Employee Morale and Loyalty in Hospitality Premises	Choice					Central Tendency Measures			Dispersion Measures	
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Median	Mode	Std. Deviation	Range
Raising maintenance knowledge adding value to me.	15 19.5%	28 36.4%	14 18.2%	16 20.8%	4 5.2%	3.44	4	4	1.175	4
When applying TPM, it is potential to increase my overall skills.	19 24.7%	27 35.1%	12 15.6%	15 19.5%	4 5.2%	3.55	4	4	1.209	4
TPM raises my moral.	12 15.6%	18 23.4%	26 33.8%	18 23.4%	4 3.9%	3.23	3	3	1.099	4
Caring of company's equipments reflects the extent of my satisfaction with my job.	19 24.7%	27 35.1%	12 15.6%	15 19.5%	4 5.2%	3.55	4	4	1.209	4
TPM raises my loyalty to my organization.	12 15.6%	18 23.4%	26 33.8%	18 23.4%	4 3.9%	3.23	3	3	1.099	4
Applying TPM gives me more chance to be creative.	23 29.9%	25 32.5%	12 15.6%	13 16.9%	4 5.2%	3.65	4	4	1.222	4
TPM enables me to apply more co-ordination, co-operation and problem solving skills.	19 24.7%	27 35.1%	12 15.6%	15 19.5%	4 5.2%	3.55	4	4	1.209	4
TPM enhances initiative, belongingness and commitment of employees.	23 29.9%	25 32.5%	12 15.6%	13 16.9%	4 5.2%	3.65	4	4	1.222	4
TPM enhances me to enjoy more working authorities.	23 29.9%	25 32.5%	12 15.6%	13 16.9%	4 5.2%	3.65	4	4	1.222	4

7.2. Data Analysis

Data analysis is summarized in the test of research hypotheses that could be illustrated in the following points:

8-2-1-H₁: TPM adoption positively related to productivity and performance efficiency in hospitality premises.

By using one sample t-test statistical analysis, the results showed that there is a statistical significant relationship (p-value= 0.003) between TPM adoption and productivity and performance efficiency in hospitality premises (See table 8). This relationship is positive (T=2.81) which means that the application of TPM adoption in hospitality premises leads to more productivity and performance efficiency. According to such positive significant relationship, the research accepts the 1st hypothesis.

Table 8

Testing of Research Hypotheses

Hypotheses		T	Sig. (one-tailed)	Result
H ₁	TPM adoption positively related to productivity and performance efficiency in hospitality premises.	2.81	0.003	Accepted
H ₂	TPM adoption positively related to product quality in hospitality premises.	3.56	0.000	Accepted
H ₃	TPM adoption positively related to cost efficiency and profitability in hospitality premises.	2.06	0.021	Accepted
H ₄	TPM adoption positively related to guest satisfaction in hospitality premises.	-0.32	0.624	Rejected
H ₅	TPM adoption positively related to employee morale and loyalty in hospitality premises	4.08	0.000	Accepted

8-2-2-H₂: TPM adoption positively related to product quality in hospitality premises.

By using one sample t-test statistical analysis, the results showed that there is a statistical significant relationship (p-value= 0.000) between TPM adoption and product quality in hospitality premises (retrieve table 8). This relationship is positive (T=3.56) which means that the application of TPM adoption in hospitality premises leads to improvement of product quality. According to such positive significant relationship, the research accepts the 2nd hypothesis.

8-2-3-H₃: TPM adoption positively related to cost efficiency and profitability in hospitality premises.

Depending on one sample t-test statistical analysis, there is a statistical significant relationship (p-value= 0.021) between TPM adoption and cost efficiency and profitability in hospitality premises (retrieve table 8). This relationship is positive (T=2.06) which means that the application of TPM adoption in hospitality premises

leads to more cost efficiency and profitability. According to such positive significant relationship, the research accepts the 3rd hypothesis.

8-2-4-H4: TPM adoption positively related to guest satisfaction in hospitality premises.

According to one sample t-test statistical analysis, there is no statistical significant relationship (p-value= 0.624) between TPM adoption and guest satisfaction in hospitality premises (retrieve table 8). According to such insignificant relationship, the research rejects the 4th hypothesis.

8-2-5-H5: TPM adoption positively related to employee morale and loyalty in hospitality premises.

Depending on one sample t-test statistical analysis, there is a statistical significant relationship (p-value= 0.000) between TPM adoption and employee morale and loyalty in hospitality premises (retrieve table 8). This relationship is positive (T=4.08) which means that the application of TPM adoption in hospitality premises leads to employee morale and loyalty improvement. According to such positive significant relationship, the research accepts the 5th hypothesis.

8.Recommendations

Depending on research results, it is recommended to introduce the following general TPM framework to be followed by hospitality premises:

- Improving overall equipment effectiveness by determining and monitoring all chances of losses to prevent them.
- Inserting maintenance activities in all employees' job description to be an essential part of their daily duties.
- Developing a systematic manual of maintenance activities by identifying the preventive activities needed for each unit of equipment that positioned in the organization. This principle aiming at standardizing activities of maintenance.

Such 3 points-TPM framework increases the opportunities of successful TPM implementation in hospitality industry.

9.Research Limitations

The research results is related only to 77 employees from only 5 hotels that classified as 5 stars in Alexandria; therefore, results couldn't be generalized to all hospitality premises neither in Alexandria nor in Egypt. It means that these results can be used only as indicators for hospitality industry. These results also are related to a sample of employees from only three departments: (front office, housekeeping and kitchen). Thus, investigating other employees from other departments might leads to different results.

10. Conclusion

This research paper aims to introduce TPM as a new maintenance approach to be adopted in hospitality Industry premises to eliminate traditional limitations between production and maintenance processes. While the results showed no statistical significant relationship between TPM and guest satisfaction in hospitality premises,

other results showed a statistical significant relationship between TPM adoption and all of productivity and performance efficiency, product quality, cost efficiency and profitability and employee morale and loyalty in hospitality premises.

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الصيانة الإنتاجية الشاملة: مدخل جديد للصيانة في صناعة الضيافة

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المفص

في ظل التغيير الشديد الذي طرأ على بيئة العمل الحديثة في مجال الضيافة، أصبحت أنشطة الصيانة داخل دائرة الضوء أكثر من أي وقت سابق، حيث يتطلب الحصول على ميزة تنافسية في عالمنا الحديث تطبيقات وأساليب صيانة خاصة، تعمل على تحسين كل من التكاليف والجودة. وفي هذا السياق، تبرز الصيانة الإنتاجية الشاملة في عالم الأعمال المعاصر كواحدة من أكثر الأساليب فعالية، حيث تمكن المنظمات من تحقيق مستوى عالٍ ومستمر من الإنتاجية لكل من السلع والخدمات. تهدف هذه الورقة البحثية إلى تقديم الصيانة الإنتاجية الشاملة كمدخل جديد للصيانة في صناعة الضيافة وذلك بغرض التخلص من القيود التقليدية القائمة بين عمليات الإنتاج وعمليات الصيانة. وإعتماداً على المنهج الوصفي التحليلي، تم إجراء الدراسة من خلال استطلاع رأي 77 مفردة من العاملين في 5 من الفنادق التي تنتمي لفئة الخمس نجوم بالإسكندرية. ولقد توزع العاملين محل الدراسة على 3 من الأقسام الفندقية: قسم المكاتب الأمامية، وقسم الإشراف الداخلي، وقسم المطبخ. وبينما أشارت النتائج لعدم وجود علاقة ذات دلالة إحصائية بين تبني المنشأة الفندقية لمدخل الصيانة الإنتاجية الشاملة وبين رضا العملاء، أشارت النتائج لوجود علاقة إيجابية ذات دلالة إحصائية بين تبني المنشأة الفندقية لهذا المدخل الحديث وبين كل من معدلات الإنتاجية وكفاءة الأداء، وجودة المنتج، وكفاءة التكاليف والربحية، والروح المعنوية للعاملين وولائهم للمنشأة الفندقية.

معلومات المقالة

الكلمات المفتاحية

الصيانة؛ الصيانة الإنتاجية الشاملة؛ صناعة الضيافة.

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