THE MODERATING EFFECTS OF LEADERSHIP ROLES BETWEEN TOTAL PRODUCTIVE MAINTENANCE (TPM) PRACTICES AND ORGANISATION PERFORMANCE IN POWER GENERATION INDUSTRY

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ABSTRACT

The importance of the energy industry motivated this research to be conducted, specifically to explore the Total Productive Maintenance (TPM) implementation in the power generation industry. TPM, as a part of management tools, has the proven capacity to improve the business performance of production in organizations. TNB Janamanjung Sdn Bhd (TNBJ) owned by Tenaga Nasional Berhad (TNB) has progressively implemented TPM since 2010. Therefore, there is a need for a research to be conducted to determine the relationship between TPM practices and the organization's performance. Organization performance, in this research context, refers to the performance in TPM, namely equipment effectiveness, efficiency and reliability. These three measures are considered highly significant to the key performance indicators. Hence, the primary aim of this research is to investigate the relationship between TPM practices and organization performance. TPM encompasses the maintenance practice, continuous improvement, resource management and training; meanwhile, organization performance includes equipment effectiveness, autonomous maintenance and planned maintenance. This research also examined the moderating effects of leadership between the TPM practices and organization performance. The research applied the quantitative approach where the survey which was conducted received a 76 percent response rate. The results showed a significant relationship between TPM practices and organization performance and found leadership roles only moderated between the relationship of TPM practices and the maintenance activities in organization performance. In sum, the findings support the TPM pillars model which can be the basis for TPM implementation in other industries. Besides, the findings also provide opportunities for future research to venture into different TPM practices and the effects to the organization performance.

Key words: Total Productive Maintenance (TPM), TPM Practices, Leadership, Organisation Performance, Energy Industry.

ABSTRAK

Kepentingan industri tenaga telah mendorong penyelidikan ini dijalankan, khususnya untuk meneroka pelaksanaan Penyelenggaraan Produktif Menyeluruh (TPM) dalam industri penjanaan kuasa. Sebagai sebahagian daripada instrumen pengurusan, TPM terbukti mempunyai keupayaan untuk meningkatkan prestasi perniagaan pengeluaran dalam organisasi. TNB Janamanjung Sdn. Bhd. (TNBJ) merupakan entiti milik penuh Tenaga Nasional Berhad (TNB) dan telah melaksanakan program TPM secara progresif sejak tahun 2010. Oleh yang demikian, satu kajian diperlukan untuk menentukan hubungan antara amalan TPM dengan prestasi organisasi. Dalam konteks kajian ini, prestasi organisasi adalah merujuk kepada prestasi TPM yang merangkumi keberkesanan, kecekapan dan kebolehpercayaan peralatan. Ketiga-tiga prestasi TPM ini dianggap sangat penting sebagai petunjuk prestasi utama dalam industri penjanaan kuasa. Justeru, matlamat utama penyelidikan ini adalah untuk mengkaji hubungan antara amalan TPM dengan prestasi organisasi. TPM meliputi amalan penyelenggaraan, peningkatan berterusan, pengurusan sumber dan latihan, manakala, prestasi organisasi termasuk keberkesanan peralatan, penyelenggaraan autonomi dan penyelenggaraan yang dirancang. Kajian ini juga berminat untuk mengkaji kesan penyederhanaan kepimpinan terhadap hubungan di antara amalan TPM dengan prestasi organisasi. Penyelidikan ini menggunakan pendekatan kuantitatif dan memperoleh kadar maklum balas sebanyak 76 peratus. Hasil kajian mendapati wujud hubungan signifikan di antara amalan TPM dan prestasi organisasi, dan hanya peranan kepimpinan dalam aktiviti penyelenggaraan dalam prestasi organisasi sahaja yang memberi penunjuk positif dalam prestasi organisasi. Kesimpulannya, penemuan ini memberi sokongan kuat terhadap model pilar TPM yang boleh menjadi asas bagi pelaksanaan TPM kepada industri lain, terutama bagi penyedia perkhidmatan. Selain itu, hasil kajian memberi peluang kepada penyelidikan lanjutan dalam meneroka amalan TPM lain dan kesannya kepada prestasi syarikat.

Kata Kunci: Penyelenggaraan Produktif Menyeluruh (TPM), Amalan TPM, Kepimpinan, Prestasi Organisasi, Industri Tenaga.

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LIST OF ABBREVIATIONS

AM	Autonomous Maintenance
AMOS	Analysis of Moments Structures
BPE	Business Process Engineering
BSS	Business Support Service
CCR	Centre Control Room
CEB	Central Electrical Building
CI	Continuous Improvement
CPI	Continuous Process Improvement
CSF	Critical Success Factor
EC	Energy Commission
ERP	Enterprise Resource Planning
GDP	Gross Domestic Product
HHI	Herfindahl-Hirschman Index
HRF	Human Resource & Finance
IPP	Independent Power Produce
JIT	Just in Time
KLSE	Kuala Lumpur Stock Exchange
LTM	Leadership Team Meeting
LOLE	Loss of Load Expectation
MD	Managing Director
MM	Maintenance Management
MMM	Monthly Management Meeting
MPC	Malaysian Productivity Company
MW	Megawatt
NEB	National Electricity Board
OEE	Overall Equipment Effectiveness
OP	Organisation Performance
PM	Planned Maintenance

PO	Planned Outage
QM	Quality Maintenance
RBV	Resource-Based View
SB	Single Buyer
SE	Shift Executive
SM	Senior Manager
SME	Subject Matter Experts
SPSS	Statistical Package for the Social Science
TNB	Tenaga National Berhad
TNBF	TNB Fuel Sdn Bhd
TNBJ	TNB Janamanjung Sdn Bhd
TPM	Total Productive Maintenance
TQM	Total Quality Maintenance
TSS	Technical Support Service
UOR	Unplanned Outage Rate
US	United State
VRIO	Valuable, Rare, Inimitable Resources and Organization

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Industries nowadays are searching for maintenance approaches to optimize the productivity and maximize the effectiveness of machine and equipment. The maintenance approaches implemented by the organizations are directly related to production as they enable the maximization of machines efficiency and productivity. Besides supports the growth of the organization by ensuring that product value increases, hence more competitive in the global market.

Numerous researchers believe that a developed maintenance approach is a better strategy for the organisation (Moubray, 1991; Kelly, 1997; Mckone and Wiess, 1998; Dekker, 1996; Sherwin, 2000; Swanson, 2001; Tsang, 2002; Alsyouf, 2007; Ahuja, 2010; Jasiulewicz, 2014; Juma, 2016). Maintenance approach strategize the work need to be done in various industry to ensure equipment availability and operating effectively. Besides that, the maintenance of the equipment activities involves with cost to the organisation. Supported by Ahuja and Khamba (2008), maintenance of equipment represents a significant component of the operating cost in transportation, utilities, mining, and manufacturing industries. The potential impact of maintenance on the manufacturing performance is substantial. In supporting the equipment availability and effectiveness, the maintenance activities functions to optimise the manpower cost, material cost, operational cost and overhead cost (Pintelon & Gelders, 1992; Foster and VanTran, 1990; Swanson, 2001; Sign & Ahuja, 2015).

From economics and financial terms reported, the maintenance activities recorded about twenty to forty per cent of the value added to the product and system if the maintenance activities follow the proper maintenance planning (Hora, 1987; Eti et al., 2006; Franciosi, Lambiase & Miranda, 2017). According to Reason and Hobbs (2017), the maintenance activities expenses vary depending on the type of industry and maintenance cost were roughly equal to the organization net income. This emphasized the importance of the maintenance planning that gives significant impact to the organization financial performance (Al-Najjar, 1997). In the same views, many claimed that the effectiveness of maintenance contributes to the performance of equipment, production and products (Macaulay, 1988; Teresko, 1992; Badli 2012; Nagaraj & Lewlyn, 2016).

Presently, maintenance approaches such as Total Productive Maintenance (TPM), Total Quality Maintenance (TQM), Enterprise Resource Planning (ERP), Business Process Engineering (BPE) and Just in Time (JIT) are commonly practiced in various organizations (Badli, 2012; Franciosi et. al., 2017). Besides, most companies have adopted maintenance approaches, namely preventive maintenance (PM), condition monitoring (CM), and condition-based maintenance (CBM) to suit the organisation requirement (Badli 2012, Al-Najjar & Alsyouf, 2003; Dhillon 2002). All these maintenance approaches provide a standardized guide on managing maintenance practice. In this research, the focus of interest is on TPM which integrates both operation and maintenance practices to meet the specific needs of the organization (Madanhire & Mbohwa, 2015).

According to Mendez and Rodriguez, (2017) the implementation of TPM programs depends on the environment factor, organizational behavioral and organizational culture. The processes of TPM implementation in organizations are obviously challenging and some organization not successfully implement the TPM practices (Parida & Kumar, 2006; McKonne, 1999). Maintenance strategy should be aligned with the corporate strategy to ensure that the values of deliverables in all activities encompassing the entire production and supply chain activities. Therefore, TPM in utilities industry is very essential and the organization must implement the TPM in driven the maintenance activities. Hence, it is important for a research to explore further on TPM practices, factors that contributed to the successful implementation and the challenges that might be encountered, particularly in the context of utilities industry (Agustiady & Cudney, 2016).

Realizing the crucial of utilities industry in supporting the national growth, TPM was selected as one of TNB initiative to strengthen the maintenance strategy and consequently increase extremely the organization performance (TNB Bulletin, 2011). Therefore, this research intent to examine the relationship between TPM practices and the organization performance during implementation of TPM initiative. Associated with TPM initiatives, the top management and employees must play the important roles in ensuring this initiative achieve the objective. Due to that, the research interest to investigate the relationship between TPM practices and the organization performance with leadership influence.

1.2 Background of Study

In 1949, the setting up of Central Electricity Board (CEB) in Malaya purposely in charge and manage the electricity industry for the country. In earlier stage, CEB also functions for generating, transport the electricity and distributing electricity to the end user which covers domestic area, internal and external usage. Subsequently, CEB was renamed as National Electricity Board (NEB) in 1965. The rebranding of CEB intentionally to strengthened the Malaysia electricity industry which covers the electricity business sector which is focus on managing power generation, transmission grid line and energy distribution. At the same time, NEB become as the sole provider which is dominant in the Malaysia market.

Following a corporatization and privatization exercise by the Malaysian Government in September 1990, NEB was transform as Tenaga Nasional Berhad (TNB). The transformation of NEB to TNB purposely to expand and enlarge the organization types of business and consequently improve organization financial performance. Subsequently after the TNB privatization scheme, TNB was prolifically registered on the Kuala Lumpur Stock Exchange (KLSE) Main Board. Logged by Malaysia governance, the company listed in KLSE's is firmly prominent in the local bourse (TNB Bulletin, 2012; TNB Bulletin 2015).

As the largest company supplying electricity in Malaysia, the asset value was approximated to be about RM110.7 billion. Listed at Bursa Saham Malaysia (BSM), the company employed about 36,000 people and provided service for 8.6 million customers in Peninsular Malaysia, Sabah and Labuan. Generation, transmission and distribution are the company's core business activities for Peninsular Malaysia and the state of Sabah. In addition, the other businesses include the power related services consisting of Operation and Maintenance (O&M), Research and Maintenance (R&M) and Energy Services. Besides that, TNB is involved in Electrical Equipment Manufacturing (EEM) which are related to switchgears, transformers and cables. Working towards advancement, TNB went global through the business in higher education and also research services (TNB Bulletin, 2016).

According to the Energy Commission (EC), TNB monopolized fifty-one percent of the total power generation capabilities of supplying electricity for the whole country (EC Report, 2015; The Sun, 2016; EC Report, 2018). Reported in TNB Bulletin 2016, TNB whole assets value reach about 500 trillion which is covering all the generating power plant located in Malaysia. Realizing the positive significant impacts supplying power to the industry, TNB top management decided to embark the TPM initiative strategically at power station (TNBJ Bulletin, 2010). Supporting to the EC policy, TNB initiated the TPM program since 2010 for all the power stations owned by TNB and it was organized under the Generation Division. According to Shamsul (2018), this TPM initiative helped the operation and maintenance department on managing their maintenance activities which is capable total implication to the organization.

TNB Janamanjung Sdn. Bhd. (TNBJ), a wholly owned subsidiary of TNB is a power generating utility company located in the district of Manjung, Perak. TNBJ previously name as Manjung Power Station (MPS) was financially operational according to Independent Power Producer (IPP) as single project generating electricity throughout thermal power plant concepts. Coal is the main fuel for this power plant. Recorded by Malaysia Energy Commission Report (2016), MPS is the largest coal-fired thermal power plant in Malaysia with a total installed capacity of 3100 Megawatts (MW) to the National Grid System from four biggest generating boiler operation. This thermal plant having three of the initial generating facilities with maximum capabilities of generating three-time 700 MW and an advanced boiler supercritical technology in Power Generating unit capable of generating 1000 MW. Hence with the high capacity, TNBJ is recognized as the largest utility supply to the country (The Star, March 2017).

In facts, is about twenty-five percent of the electricity power connected to the grid system is coming from TNBJ power plant and supporting the country demand (The Sun, May, 2016). In ensuring the power plants project comply with operational requirements, statutory obligations, environmental conditions and appropriate to the functions, the power plant is installed and designed by following the international standard. The preliminary design for this power plant is recognized by the British Standard (BS), America Standard for Mechanical Engineering (ASME), International Organization for Standardization (ISO), and German Institute for Standardization (DIN). As part from that, this power plant operation system involves with combination of sustain loading operation, multiple operation in pressure, responsive frequency, pattern wave loading, eliminating load and surplus to the operation. Indeed, the operation system followed the IPP requirement which is PPA. The maximum load generation for one unit is 700 MW net capacities and connected to the Bukit Tarik and Ayer Tawar substation located in Perak. The substation supplies to the Grid System which is controlled and manage by National Load Dispatch Centre (NLDC) Malaysia.

The TNBJ power plant is attached with sub-critical boilers concepts which performing with reheats processes. The plant is allowed for operating at hundred five percent from the total of Turbine Maximum Capacity Rate (TMCR). This power plant capable with continues running and operating between 48.5 Hz to 51 Hz frequency range. As main asset to the company, the asset value for this plant is approximately RM 11.5 billion. For financial company performance, the net total income for this power plant intimately about RM 250 million per year (TNB Financial Year Performance, Sept 2015; Operation and Maintenance Manual, 2001).

As the TNB subsidiaries, TNB management committed to launch the TPM initiative at the TNB Janamanjung Sdn. Bhd. (TNBJ) since 2013. With the highest capacity of supplying electricity to the country, the top management must ensure that the plant is running with high availability and reliability. Therefore, the top management set up the Key Performance Indicators (KPIs) for TNBJ on the implementation of TPM achievement to enhance the plant performance. Commonly, the KPIs for power generation industry includes the production availability rates, capacity factors, power generation sales, power rate for auxiliary consumption, heat rates value, percentage of unplanned outage and the number of plant tripping (Shrivastava, Sharma & Chauhan, 2012; Kaushik, Reddy & Tyagi, 2011; Lam, & Shiu, 2004). The TPM initiative was embarked at TNBJ in year 2010 and resulted in positive impacts in terms of power plant performance and financial growth (TNBJ MPC Report, 2011). After TPM was implemented in TNBJ, the organization performance as indicated by Equivalent Availability Factor (EAF) and Unplanned Outages Rate (UOR) measurement has increased since 2011. Figure 1.1 presents the TNBJ Equivalent Availability Factor from the year 2005 to the year 2016.

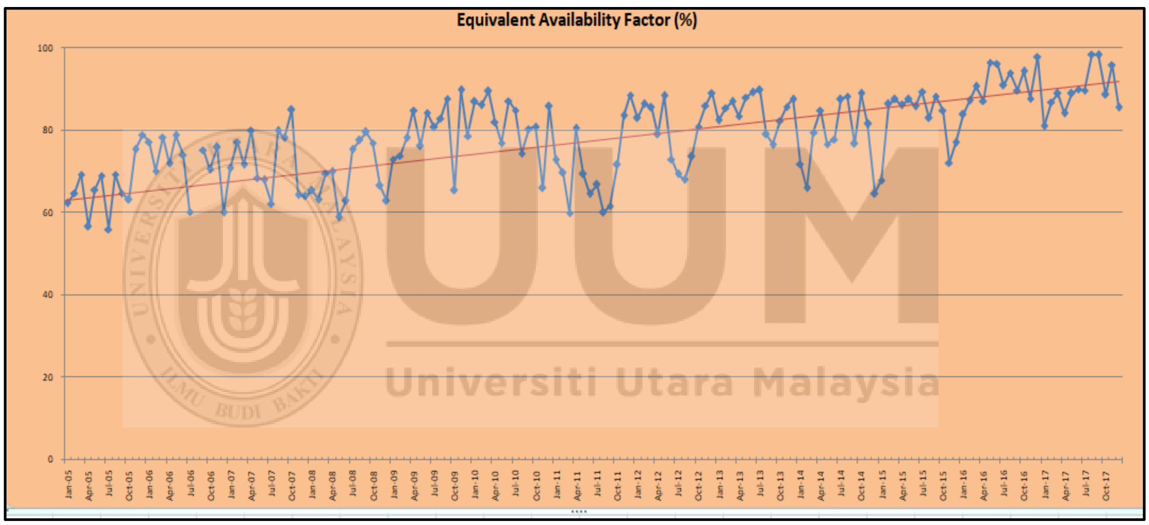


Figure 1.1
TNBJ Equivalent Availability Factor (EAF)
Source: Develop for this research

Equivalent Availability Factor (EAF) is one of the criteria indicated the power plant performance. EAF describes as the fraction of net unit full loading generation that could be produced with measuring the total time of outage and time of machine load derating are totally measure. The EAF measures the number of hours that the full capacity of a generating unit is available annually (Mogan & Ang, 2016; Kana, 2015; Edin & Tang;

2013; Siang, Weh & Torrest, 2011). Unplanned Outages Rate (UOR) were caused by the generating periodic maintenance work such as inspection, overhaul or other work that were unscheduled. UOR played dominant role to show that the equivalent availability factors can be raised or reduced (Johan & Hamdan, 2015; Sheikh & Mirreth, 2011). The graphs in 1.2 show the UOR respectively of a thermal power plant from the year 2005 until year 2017.

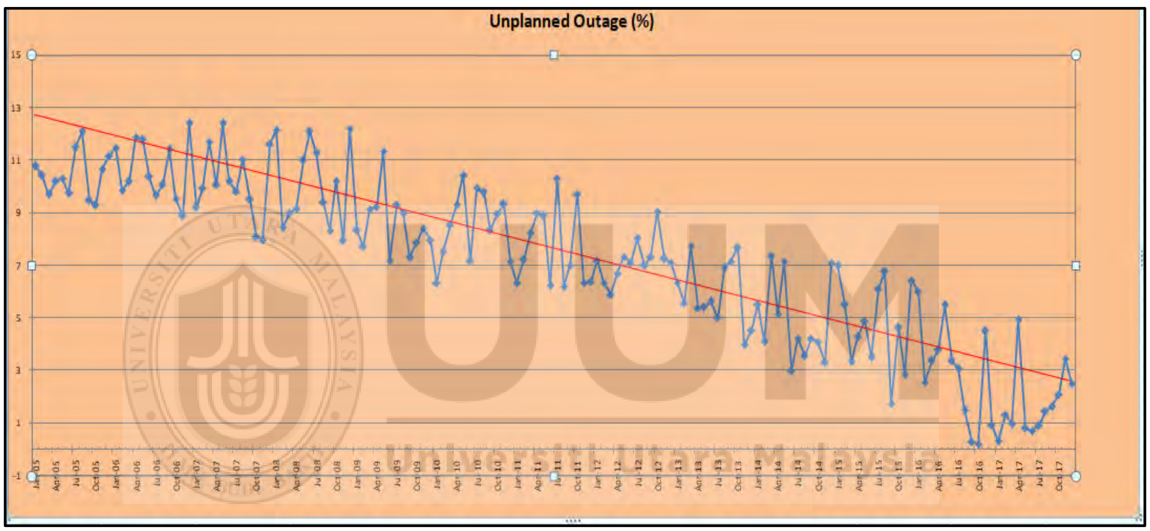


Figure 1.2
TNBJ Unplanned Outage Rates (UOR)
Source: Develop for this research

The highest unplanned outage was on December 2008 which is 12.22 percent and the lowest was on October 2016 which is 0.21 percent. In addition, comparing with the historical performance of thermal power plant after year 2010, EAF vigorously increased while the unplanned outage decreased (TNB Bulletin, 2011). This shows that after year 2010, there was good performance of plant, fewer breakdowns of machines, low equipment's fault and fewer inspections which causes the EAF to rise up and unplanned outage rate reduced (IHI Report, 2014; IHI Report 2010). In order to achieve high score for EAF, there is need to improve the plant management process. The plant management process also including the maintenance activities, spare part management, maintenance planning, material management, and manpower sources.

In a nutshell, the plotted graphs show that if the equivalent availability factors increase, the unplanned outage decreased. Thus, the power plant was running in a good condition, sustaining well in maintenance practices and showing that the profit of the plant can also be improved (Muza, 2014; Criss & Tan, 2011). In addition, understanding the relationship of the measurement to the organization performance can be useful in improving the power system operations and power system planning. In facts, it proves that TPM initiative implementation increases and gives positive impact to the power plant performance (Muller, 2015; Karisma & Mazza, 2015).

Furthermore, TNB management will extend the embarking of TPM since TNBJ has successfully implemented the initiative with their owned practices (TNBJ Annual Report, 2012; TNB Generation Division Management Community (GDMC) Report; 2017). Besides offering huge improvement and maintenance strategy, TPM as a tool corresponds to the plant maintenance, plant engineering and product design. In other words, these are essential key factors ensuring the successful of TPM implementation towards the organization performance (Zainuddin, 2010; Shamsul, 2018; TNBJ MMM, 2014). Due to that, TPM initiative will be part of TNBJ main activities and continuously implement every year (TNBJ LTM, 2014; TNBJ MMM, 2015). Therefore, this fuels the researcher's interest to investigate if there is relationship between TPM practice and organization performance in utilities industry which is focus at power generation industry.

1.3 Problem Statement

TPM is a holistic and systematic approach in process management. As a tool for management strategy of an organization, TPM has been successfully implemented in Japan whereby this has raised the popularity of TPM and motivates organizations to adopt the TPM managerial philosophy. The TPM Excellent Award has been introduced by Japanese Institutes of Plant Maintenance (JIPM) since 1964 to strengthen enterprise constitutions and contribute to the industry development. Besides, this award has promoted the modernization of plant maintenance and the development of plant maintenance technologies. Therefore, TPM played bigger roles in driving the business performance and development of the company in various aspects (Mobley, 2002; JIPM website, 2017).

Failures in implementing TPM lead to the eight major losses in the organization namely, shutdown loss, production adjustment losses, equipment failure losses, process failure losses, normal production losses, abnormal production losses, quality defect losses and reprocessing losses (Shen, 2015; Venkatesh, 2007; Freck, 2000; Suzuki, 1994). These losses contributed to negative implication to the organization financial performance. Therefore, it is essential to reduce these losses and prevent their occurrence (Sharma & Singh, 2015). Nevertheless, many companies are trapped in the maintenance traditional misconception where they viewed maintenance firmly reduce the operation expenses and avoid an investment. The saving can only be achieved by improving the advance monitoring activities and combination with reliability program which part of the maintenance approaches (Kocher, Kumar, Singh & Dhillon, 2012). Hence, there is an emerging need to develop TPM implementation practices and procedures further in realizing the organizational performance and excellence (Ireland & Dale, 2001; Ahuja & Khamba, 2008; Belekoukias, Garza-Reyes, & Kumar, 2014).

The TPM practices has been concretely discussed in selected types of industries (Jain, Bhatti, & Singh, 2014; Nguyen, 2011). Numerous study on TPM has been conducted in the manufacturing setting (Sivanantham & Sivaram, 2017; Wajira and Singh, 2012; Kumar et. al, 2012; Islam 2013 and Sethia, Sehnde & Dange, 2014; Narayan, 2010; Khuza & Aie; 2008). Djatna and Alitu (2015) studied the TPM application in wooden door manufacturing industry, while Ahmed, Ali, Allama & Parvez (2010) examined TPM approach in pharmaceutical industry. Gajdzik (2013) carried out a TPM research in metallurgical industry, while Mwanza and Mbohwa (2015) did their research in chemical manufacturing industry. Meanwhile, Kedar and Borikar (2016) found that there is a relationship between TPM and TQM in maintenance practices.

Local studies on TPM were performed in the automobile industry (Badli, 2012), fertilizer process plant (Norddin &Saman, 2012), electrical and electronic industry (Meng & Nordin, 2012) and manufacturing industry (Halim & Ramayah, 2010). Based on the previous literature, research in TPM mainly emphasized more on maintenance in goods producing machines and equipment. There is still lack discussion on TPM in the service industry particularly concentrate on the process industry. Hence, this motivate a study to be conducted in the public service deliveries. Furthermore, the study is formulated as a response to the criticality of the industry which firm supporting the national growth. Due to this limitation, there is a need to conduct a study on TPM practices in a public service industry. In facts, to date, there is still limited research investigating TPM initiative in the utilities industry, particularly in Malaysia. As highlighted in the previous section, utility industry performance is considered highly essential to the country in building up the growth of the nation (EC Yearly Report, 2014).

Commonly, the utility industry provides service to the community and fulfills human need. The utility industry includes power generation, water supply service, waste water management, hospitalities and infrastructures for public service. Being an enabler to other industries, the power generation industry seems as the most critical service providers that provide values to the community as a whole (EC Yearly Report, 2014). Hence, TPM research in the power generation industry is very crucial to boost up the service excellence and consequently, considered as a positive indicator to the Malaysian economic growth (TNBJ MPC Report, 2011; TNBJ MMM Report, 2012; Shamsul 2013; TPM MMM Report, 2013; TNBJ Emerson Reliability Report, 2016). Therefore, a study investigating the practical application of TPM practices in the utility industry can be beneficial in enhancing its successful implementation (Arslankaya & Atay, 2015; Sharma & Singh, 2015).

TNB, as the sole utility provider to the Malaysian community has always looked forward for further improvement in the maintenance operations. Previously, TNB applied six-sigma as the maintenance tools, yet it has not significantly give impacts to the assest management. TNB also has applied PASS 55 and Asset Management System (AMOP). However, this management tools focus on the asset risk management (TNBJ Emerson Reliability Report, 2016; TNBJ Annual Report, 2015). Apparently, the the top management in TNB has opted to choose TPM initiative to be implemented as one of the maintenance tools on managing the company assets. As mentioned earlier, TPM has been initiated in all TNB power stations since 2010 until now. However, to date only TNB Janamanjung (TNBJ) has progressively implemented the TPM as compared to the other power stations in TNB (MPC Report, 2015, 2016, 2017). Other power stations are still relying on the corrective maintenance and preventive maintenance as a tools on managing their assets. Hence, it is imperative to investgate to what extent TPM has contributed to the TNB performance particularly in TNBJ.

The successful implementation of TPM practices is claimed to give positive impact to organization performance (Belekoukias, Garza-Reyes & Kumar, 2014; Kaur, Singh & Singh Ahuja, 2012; Kedar et. al., 2008). Hence, it can be surmised that organizational performance can also be measured in the terms of TPM performance. However, numerous literitures has highlighted TPM performance interm of financial achievement (Vishnu, 2011). Other than financial measures, TPM performance should be assess in relation to the technical perspective (Brody, Stecula & Tutak, 2016). Equipment effectiveness, autonomous maintenance and planned maintenance are the most common indicators highlighted by previous literature on evaluating the TPM performance (Singh & Ahuja, 2013; Ramnath & Bharath, 2010; Sharma et. al., 2006). Nakajima (1962) promotes the equipment effectiveness method to evaluate the machine performance in terms of availability and reliability. As agreed by Anderson (2012), the equipment effectiveness is the special tool for measuring the TPM performance which correlated to the organization productivity. Besides, the autonomous maintenance explains the adaption and adoption of TPM practices such as initial cleaning activities implement by the employees. Autonomous maintenance shaped employee ownership, responsibility and create harmonize engagement between the employee and machine (Nzewi et. al., 2016). Meanwhile, planned maintenance is one of the indicator designate the TPM performance. TPM planned maintenance illuminates the maintenance activities in total (Kurma, 2014; Tripathi, 2005). The successful of the organization in managing the maintenance activities such as maintenance scheduling, inventory system, and attending repair work reveal to the TPM performance (Kline, 2011; Park & Han, 2001; McKone, 1998). Therefore, the TPM performance directly related to the organization performance in total.

Othman (2017) and Springer (2013), stated that the maintenance activities objectively not retaining and restoring equipment only, its required the actions include the combination of all technical and corresponding administrative, managerial, and supervision actions. Support to the ideas, Ahmed, Fatemah and Al-Hilmy (2015) stressed the need of additional approaches to support the limitation of preventive maintenance and corrective maintenance approaches. According to Santiago (2017), there is difficulty of finding a practical application to the types of maintenance to suit the equipment model. Santiago (2017) also suggested the organization should have mixture of different types of maintenance approaches in order to response appropriately to the need of a particular equipment. Hence, there is a need to further investigate how TPM practices correlated to the workplace, equipment and organization performance (Nieminen,2016; Attri et al., 2013; Graisa & Al-Habaibeh, 2011; Ahuja & Khamba,2008).

Most researchers claimed that the maintenance activities, continuous improvement, resource management and training and education are important practices that constitutes the eight pillars of TPM (Kamil et. al., 2017; Nobil & Ahamed, 2015; Ahuja, 2008; Turner & Müller, 2003). Maintenance activities refers to the initial cleaning, repair works, maintenance management, maintenance scheduling and improvise the standard operation (Adesta, Prabowo & Agusman; 2018; Badli, 2012: Ahuja et.al., 2008). Meanwhile, the continuous improvement is regarded as the activities to increase the availability and reliability of the system, machine and process (Badli, 2012). In the context of TPM practices, resource management related to the TPM activities that includes financial and budgeting, material and spare part management, inventory, information technology, staff employment, material planning, safety and environment (Kamil et. al., 2017; Noe, Hollenbeck, Gerhart & Wright, 2006; Turner & Müller, 2003). Training and education are the avenues that enable the enhancement of employee knowledge and competency. As dedicated pillars in TPM, training and education help to develop the employee skills and advance the employee awareness on TPM (Kamil et. al., 2017; Nzewi, Chiekezie & Arachie, 2016; Ahuja et. al., 2008). Hence, this research interested to investigate the TPM practices namely maintenance activities, continuous improvement, resource management and training and education relationship to the organization performance focused in utilities industry.

Leadership roles is responsible to bring up the organization in good track record in many areas such as financial, management, employee, operation and maintenance (Landini, Lee & Malerba, 2017). Nevertheless, there are researchers who argued that the role of leadership is less significant in achieving the organizational performance (Pfeffer 1977; Meindl, Ehrlich & Dukerich 1985; Epitropaki, & Martin, 2005 and Jong, & Hartog, 2007). These mixed views of leadership motivated a study to be conducted in order to further understand the effects of leaderships roles to the organization performance. Yet, there are still limited study on leadership roles that can be referred as guideline and applied in other organizations (Husin, Ahmed & Abdullah, 2016). The study on leadership roles is supposed to be explicitly and generally defined to avoid misunderstanding. Nonetheless, previous researchers were more keen to focus the role of leadership in specific industries. For examples, in restaurants sectors (Vanderslice 1988); education field (Bensimon 1989; Birnbaum 1990; Neuman 1992; Youngs & King 2002; Weinberg & McDemott 2002; Spinelli, 2006; Zeb, Saeed, Ullah & Rabi, 2015), service industry which the business involves with customer (Shamsul, 2015; Mazana, 2012; Kentz & Romoe, 2010); fishing industry (Wau & Kiterina, 2014) and SMEs industry (Husin, Ahmed & Abdullah, 2016). By looking at total angle of leadership roles, it concludes that there is limited understanding about the role of leadership on organizational performance in the context of managing firms in the utility industry and particularly at power plant.

1.4 Research Questions

Based on the discussion above, research questions were developed accordingly. As mentioned before, this study aims to investigate the relationship of TPM practices and organization performance moderated by leadership roles. The research questions highlight below is applied.

1. What is the relationship between TPM practices and organization performance in power generation industry?
2. What is the moderating role of leadership in the relationship between TPM practices and organization performance in power generation industry?
3. Which dimension of TPM practices contributes most to the organization performance?

The purpose of these research questions is to guide the researcher in carrying out the study and ensuring that the study is able to address the identified research gaps that were discussed in the problem statement. The research objectives were then developed based on the research question.

1.5 Research Objectives

After developing the research questions, the researcher establishes the research objectives that identify the researcher's interest in studying TPM practices and its relation to organization performance at the power generation industry in Malaysia. The objectives of the research are highlighted below.

1. To investigate the relationship between TPM practices and organization performance;
2. To determine the moderating effect of leadership in the relationship between TPM practices and organization performance; and
3. To examine the level of importance of TPM practices dimension that contribute to the organization performance.

1.6 Significance of the Study

As mentioned before, various industries have implemented TPM for better benefits to the organizations. TPM is able to enhance the organization's performance by improving the product quality, reducing waste, reducing cost on manufacturing, maximizing the equipment availability, intensifying the product quality and increasing the overall equipment effectiveness.

TPM implementation has started in the power generation industry in Malaysia and it is limited to several companies (MPC Report, 2015). Due to that, findings of this research could be used as references for other industries in implementing TPM. Besides that, TNB progressively drives to promote and extend the TPM implementation to other power stations (TNB Bulletin, 2012). Moreover, among the benefits and advantages of applying TPM, the study exposes the staff in applying the TPM activities in power station (TNBJ Emerson Reliability Report, 2016). As reported in TNB Bulletin 2015, TNB generation division encourage all power plants under TNB supervision to found out alternative initiative which is enhance the power plant performance. TPM is one of the initiative providing the technical people on managing assets, partial as turnaround program embarked at TNB since December 2017 (Zainuddin, 2010; MPC Report 2017; TNB GDMC Report, July 2018).

Eventually, it is desirable to investigate TPM practices for TPM implementation which could impact the power generation organization performance (Al-Refaie & Hanayneh, 2014; McKone et al., 2001) Besides that, the TPM practices outcome could be used as a guideline to the top management in resolving issues and challenges at the workplace. In fact, from the TPM practices analysis, the top management could identify the level of practice and importance during TPM implementing phase (Al-Refaie & Hanayneh, 2014; Badli, 2012; Ait-Kadi, Duffuaa, Knezevic & Raouf, 2009; Park & Han; 2001; Patterson, Kennedy & Fredendall, 1995). Having said that, the leadership and top management would be potential effect to the TPM practices during the implementation phases.

Furthermore, TNBJ was selected to implement TPM because it is the largest with high availability power plant in Malaysia and the plant is important for continuously supplying electricity to the country (The Sun, Oct 2017). According to MPC report (2015), among the power stations under TNB Berhad, TNBJ has already begun implementing TPM progressively. It is inspiring the study findings improve the TPM execution and applied successfully at the organization and relevant industry. The top management could revise the TPM current practices and strategies for future development. As an advantage, the study can be considered as one of the earliest studies to investigate TPM practices in the utility industry, particularly a power generation firm. Although it is specifically conducted in utility industry, it can also be applied in other services industry because TPM encourage constructive pillars in various area.

Significantly, this research promotes positive outcome to the industries, sustainability of TPM implementation. In general, the study committed to analyze positive benefit to the industry since this thermal power plant is one of the earliest firm that applied TPM as a part of maintenance practices in Malaysia (MPC Report, 2012). In fact, finding of the applicable tools for managing assets in a power plant is an essential strategy to ensure plant safely operate with high reliability.

1.7 Scope of the Study

This research was focuses on the TPM practices implemented in utilities industry. TNB Janamanjung Sdn Bhd (TNBJ), coal power plant located in Manjung, Malaysia choose as the main representative of the utilities industry in energy sector. This TNBJ power plant was officially commissioned in the year 2000 and the operational of this power plant is expected to run and be reliable to the maximum for the next thirty years. This organization was selected based on its TPM initiative purpose, to enhance the maintenance activities as optimum as possible. In this research, there are six measurement models: maintenance activities, continuous improvement, resource management, training and education, leadership roles and operation performance.

1.8 Organization of the Dissertation

The research was presented and divided in six chapters. General background of the study followed by the significance of the research work was elaborated in Chapter 1 Introduction. Then, this research continues discussed the problem statements on the research topic, followed with developing the research questions and continue established the objectives of the research for this study. This research also highlighted the significance of the study and study scope.

Literature review related to the thesis topic was enclosed and wrote in detail in Chapter 2. Previous literatures, scholars and authors was referred to deliver the general knowledge on the study topic. Relevant books, articles, journal and all reading material was collect to understand the research topic deeply. Latest issues for the study topic helps and guidance on doing this research. The important key words for the study are TPM and TPM pillars, TPM Goals, TPM Performance, TPM in industry, TPM practices in power generation industry, Leadership roles and responsibility, and moderating literature also describe in Chapter 2. In addition, Chapter 2 also discussed the related theories, philosophy and findings from the previous literature was referred and applied as a guideline during conducting this research. Furthermore, the theoretical framework, and hyphothesis development was elaborated detail at the end of Chapter 2.

There were selected methodologies and materials involved to meet the research objective which was explained in Chapter 3. The method used is deeply discussed in this chapter where it involves with quantitative method approaches. This chapter also explained the research approach, research design, population, unit of analaysis and research instrument. The pilot study, approach and the pilot test results also presented detail in this chapter. After completion of Pilot study, the data collection procedure and data analysis was presented as well. Discussion in Chapter 3 end with ethical consideration has been taken by the researcher during conduct this research.

Furthermore, the results and discussion were carried out in Chapter 4 that provides a detailed explanation of the phenomena. Besides, this research discusses the result from the analyzed data to answer the research objectives. Chapter 4 also discussed the results from data analysis presented in Chapter 3 before. Besides, the Chapter 4 elaborated the outcomes and finding which is firm from empirical analysis interpretation.

Finally, the descriptive conclusion and recommendation obtainable in Chapter 5, which is covers study ending. Implications of the research findings from theoretical, practical and methodological perspectives were discussed. Extend to the research implication to the industry, Chapter 5 also accessible platform to the other researcher in order to improvise the study topic for much better.

1.9 Summary

This chapter describes the basis of carrying out this research. Starting with an inclusive introduction to the research, its then explains the research background. From the background of the study, this research comes out with problem statements. The current

TPM topic and TPM issues were highlighted to ensure that the problem statements are realistic.

After clearly understanding the research problem in TPM, the research questions were established. Then, the research objectives are formed as a fundamental guideline for the study implementation. Additionally, this research determines the significance of the research is to highlight the benefits of the research to industries and the organization. As mentioned before, this research focuses on TPM implementation at a power generation company in TNB. To ensure that the research was conducted strategically, the scope of the research is firm accordingly. At the end of this chapter, this research explained the organization of the dissertation flow from Chapter 1 till completion.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter critically reviews this research that had been done by previous scholars which are related to TPM. Literature review for this research begins with understanding the body of knowledge in TPM research area. Then, this research clarified the key research issues in order to suit the issues to the proper concepts. This research found the relevant theoretical concepts once the issues are clearly understood. A related model was selected as the theoretical framework to suit the research requirement and environment. Finally, this research identified the problem statement which is significantly correlated to the research topic.

2.2 Power Generation Industry in Malaysia

The year 2013 has been a difficult year for Malaysia. The Government has gradually been reducing subsidies in the face of a mounting Government fiscal deficit, worsening debt and shrinking current account surplus (EC Annual Report, 2017). The huge subsidy bills have been a bone of contention over the last few year, its withdrawal causes a negative impact on consumption and prices, at least temporarily. Under those circumstances, Malaysia recorded a gross domestic product (GDP) growth of about 4.7 percent in 2013, lower than 5.6 percent growth recorded in 2012 or earlier target of between 5 to 6 percent. According to EC annual report 2016, the demand keeps increasing by 1 percent in 2014 and 0.8 percent in 2015. The prolonged weakness in external environments, which was similarly experienced by other export-oriented nations. Besides that, the negative growth of domestic demand also affecting the overall performance at the particular year (EC Annual Report, 2015). However, the increase of demand thru domestic industry program launched by the governance in 2017 affect positively to the TNB performance (TNB Bulletin, 2017).

Furthermore, by refer to the electricity growth, maximum demand of 16,562MW was recorded on 13th May 2013, exceeding the preliminary target of 16,324MW by 1.5 percent and the 2012 record of 15,826MW by 4.7 percent. The growth was by no means a blip as the system also registered a maximum daily energy of 344.42GWh against 328.72GWh recorded in 2012. In fact, the 2012 daily energy record was surpassed 54 times in 2013 indicating a sustained, high system demand profile. Sales of electricity rose from 97,243GWh in 2012 to 100,566GWh in 2013, 104,455GWh in 2014 and goes up to 110,324GWh in 2015. The cumulative growth of 3.42 percent was mainly driven by commercial and residential sectors that recorded annual growth rates of 4.42 percent and 6.02 percent respectively. While the growth in industrial sector was lower at 1.24 percent, but the sector remains the biggest consumer with market share sales of 43 percent followed by commercial at 35 percent and residential at 2 percent. As of 2016, Peninsular Malaysia alone is dealing with an electricity demand of up to 82 percent from Malaysia's population of 31 million, with an average increment at a 1.8 percent rate annually. Electricity generating capacity, on the other hand, is adequate with comfortable margin to meet demand. As reported in ENERGY 2017, the total of generation capacity peninsular Malaysia is about 22,919 MW and the average highest peak demand recorded is

17,788MW in 2017. As of November 2017, is about 29 percent electricity power available for reserve margin, peninsular grid systems.

Gas and coal remain as the command fuel for power generation at 49.4 percent and 42.6 percent respectively, followed by hydroelectricity at 4.8 percent and oil/distillate at 2.5 percent. Annual forecasting recorded the coal consumption is estimated about 21 million tonnes in 2013, 23 million tonnes in 2014 and 25 million tonnes in 2015. Through new projection project announced by Energy Comission (EC), coal is the main fuel source for the power generation with additional 5,000MW of thermal coal-fired capacity. The new projection project purposely to supply electricity from year 2015 to 2019 period to meet the country demand. Supply diversification initiative continues with more shipments coming from non-traditional suppliers and other potential suppliers also being looked into by TNB Fuel Services (TNB Annual Report, 2016; The Star, 2014).

In Malaysia, the coal power plant generating about one-third of the installed power generation capacity from the total power producer. In facts, the coal power plant interoperated for nearly 43 percent of the electricity produced from 2013 to 2016. Hence the performance and reliability of the coal-fired power plant have a significant direct impact on the electricity supply situation in Malaysia. Due to “gas supply crunch”, most coal-fired power plants were operated at the maximum level continuously since 2011 (EC Annual Report, 2014). The effect of such operation, coupled with lower quality coal and inadequate features in the boiler design have taken a toll on most coal-fired power plants, where in 2013 the reliability of the plants suffered heavily due to boiler tube failures which in turn contributed to significant reduction in the availability of the coal plants (TNBJ website 2017; EC website, 2016, TNB Bulletin 2012).

Generation capacity procurement program continues with the announcement of new coal-fired capacity of 3,000MW to be commissioned in stages in 2017, 2018 and 2019. The first 1,000MW project to be built next to existing plants in Stesen Janakuasa Sultan Azlan Shah, Manjung on a fast track basis was awarded to Tenaga Nasional Berhad (TNB) while the Greenfield 2,000MW project was awarded to Jimah East Power. Thus, to address the projected capacity shortfall and to ensure no interruption in electrical supply in the central region, a 384.7MW combined cycle gas turbine (CCGT) repowering project in S.J. Jambatan Connaught, Klang was awarded to TNB for commissioning in September 2015. Forecasting to the national demand, the procurement program announced it is requiring to diversify the power sources through add more power plant by 2020 (ENERGY, 2017; GDMC Report, 2017; KLSE Report, 2016)

In line with the subsidy rationalization and the gradual trimming of gas subsidies, a 14.89 percent tariff hike was announced by the Government on 2nd December 2013 and the hike is effective from first January 2014. This unprecedented high increase is due to the inclusion of LNG usage in the fuel component which accounted for 10 percent of the whole tariff increase. Similarly, about 15 percent tariff hike was announced for Sabah to partly offset the increase in cost of supply in Sabah. However, such increase is still not enough for Sabah Electricity Sdn. Bhd. to generate enough revenue to cover its costs, without assistance or subsidies from the Government (TNB website, 2017; TNBJ website, 2017).

For electricity tariff setting, implementation of incentive-based regulation (IBR) concept is to allow a more structured, transparent and informed way of tariff setting. Throughout this framework, average base tariff over a regulatory period of four years is set based on a forward-looking mechanism. This mechanism concerns on the equivalent income requirement where by invest in selected efficient cost projection (The Sun, 2015; TNB Bulletin, 2013). Directly, it means the authority intent to remain the electricity tariff to the consumer. In the past, tariff review processes were on ad-hoc basis as the utility provider would approach the regulator whenever there is a need for more revenue to cover increased costs (EC Annual Report, 2016).

Reported in Energy Commission Annual Report in 2017, Malaysia will continue to expand and optimize its fuel mix conscientiously as concerning operational security. The implementation of various diversification strategies will ensure sufficient procurement logistics, whilst under the 11th Malaysia Plan, a solid roadmap will set the nation to manage its apparent over-dependence on fossil fuel while gradually working towards reducing its reliance on energy imports. Razak (2017) mentioned that, the Malaysia electricity energy in secure mode because the system has a reserve margin of around 30 percent, on a total maximum demand of 17,788 MW. According to EC Report 2017, is deliberately acknowledged the need to multivariate the power generation sources and capacities. Directly, its balance the security on capacities of the different generation plant technologies installed in the system. This level of reserve margin ensures adequacy of generation capacity allowing for scheduled maintenance and unplanned outages too (EC Annual Report, 2017; ENERGY 2017). According to Mohd Rizal Ramli, the Head of Capacity Development Unit at the Energy Commission, “Energy security and reliability are among our topmost priorities. Reviews are continuously being conducted on a regular basis through various working groups and committees comprising of industry stakeholders. The primary criteria used to gauge energy security and reliability is the loss of load expectation (LOLE), reserve margin and Herfindahl-Hirschman Index (HHI). Currently, reserve margins are at 29 percent for Peninsular Malaysia, 35 percent for Sabah and 36 percent for Sarawak with LOLE criteria ranging from 1 day/year to 1.5 day/year depending on the system size and interconnectivity (ENERGY, 2017).

To further enhance the supply security, several strategic options may also be implemented. The main segment that would curtail the nation’s over-dependence on fossil fuel would be to diversify the nation’s energy generation mix. This may be done by intensifying local gas and hydro resources development, securing more gas from foreign sources, and strengthening supply infrastructure to facilitate regional interconnection. Therefore, the governments under EC control highlighted to develop more power plants by considering cost efficiency in order to fulfill the country’s energy demand. By doing that, the operation of the plant is expected to meet the tangible demand. The technology, process, manufacturing and environments must be taken into account during construction initiation of the power plant.

As expressed by Datuk Razak, Energy Commission Chairman in ENERGY 2017 the IPP must looking forward to enhance power plant operation in operation and maintenance methodology, as facing with global market wave. In the meantime, Datuk Zainuddin who is the TNB Generation Vice-President stressed the need of transformation initiative to rebranding the existing practice and procedure to be more competitive, reasonable and valuable to the organization, focus to proactive the power plant maintenance mechanism, preemptive facing with market demand and to be world class energy supply by 2020.

2.2.1 Steam Power Plant

Reform initiatives in the Peninsular Malaysia electricity supply industry continues with ring-fencing of Single Buyer (SB) and Grid System Operator (GSO). SB and GSO are responsible and accountable on managing power from power producers, which are TNB Generation and Independent Power Producer (IPP) and operate the National Grid power system respectively (EC Annual Report 2016).

The ring-fencing of a SB and GSO is to create a level playing field between TNB and other market participants, such as IPP (TNB Bulletin, 2012). As reported in ENERGY 2017, EC is looking to build more steam plant where the main fuel for this power plant is gas and coal. Malaysia currently owning the 14th largest gas reserve and 27th biggest proven crude oil reserve globally, Malaysia is undoubtedly blessed, not only with an abundance of conventional, but also renewable energy sources. However, as one of the global oil and natural gas suppliers, Malaysia is incessantly coping with huge domestic and international demands thus making the nation vulnerable to energy security issues.

Generally, forty percent of electricity produced is consumed in the central region. As the future biggest load center for the Peninsular, in addition to more local generation capacity, strengthening the transmission network remains a priority to the Grid Owner (EC Annual Report, 2014). The key to the initiatives is the Central Area Reinforcement project, which has suffered serious delay due to various impasses. Until the work can be resumed in order to catch up with the scheduled project, the central network will continue to be exposed to potential large disturbances as electricity demand rises every year (The Sun, 2015). To ensure balanced fuel mix while meeting future demand, announcement for 3,000MW capacity based on CCGT was made recently with the first 1,000MW expected to be commissioned by June 2018 followed by the remaining 2,000MW by January 2021. The energy projection includes economy growth in its consideration (EC Annual Report, 2014).

In addressing long term generation capacity requirement, pre-feasibility study on potential sites for gas-fired generation capacity was carried out in 2014. The emphasis of the study was on site suitability in terms of load requirement, access to existing gas pipelines and transmission network and land acreage. It is expected that this initial assessment will help in identifying potential sites together with required transmission system reinforcement (EC Annual Report, 2014). Looking deeply to the steam power plant process, its involves with thermodynamic concept and complexity of energy transfer conceptual. Generation of steam through steam power plant is proven efficient and economically good for the nation (Nuriani et. al., 2017). Provision to the EC policies, the development of steam power plant purposely to powering the nation is competitively support the national growth, profit indirectly to the nation, responding to the world demand and response to the EC transformation policies (Hanim, 2017; Wen & Chia, 2016; Shah, Amri & Johan, 2016).

After a period of decision, EC with government support decided to maintain, sustain and develop a steam power plant to complete the energy demand. They compromise in developing the steam power plant in order to maintain the tariff cost, guided by environmental policy. By using gas and coal as types of fuel, the fuel cost on generation power will be affected accordingly. The power plant life cycle is up to twenty-five years of service and it is a major asset to the country (EC Annual Report, 2014). Rizal (2017) also expressed a concern that currently, consumers' expectations are outgrowing the minimum criteria, thus necessitating the need for its review. He also added that "There needs to be a balance between security and reliability with the overall cost of supply. Due to the fast changing environment, supply system must be kept responsive to those changes in terms of price, technological advancement, market structure, society's needs and environmental obligation." One way to ensure flexibility is to keep supply cost structure lean and supply adequacy within the planning criteria, in that whatever equipment invested or will be invested must be put to effective and good use to serve its purpose during its lifetime (Rizal, 2017; Shamsul, 2017).

Respond to the EC recommendation, TNB start looking for better way to improve existing operational strategy. Therefore, TNB started to embark on TPM initiative in all power generations in order to support the government initiative and EC (TNBJ MMM, 2012; TNBJ LTM, 2010, TNBJ TPM MMM, 2010). By July 2009, TPM was born in TNB and became part of the company strategy. All power plants had to officially promote the TPM among the staff inclusive of all levels (Shamsul, 2017; Zaini & Kamil, 2010). As anxious by Datuk Zainuddin, TPM is belong to employees, top management and require fully support to this initiative, comprehensive, to strengthen power plant efficiency and reinforcement of employee mind set.

2.2.2 Coal Power Plant Process

Coal has been the fuel of choice for many decades because of its wide availability, and the relatively low cost in producing electricity in large coal-burning power plants (Kimi, 2016; Mogan & Ahsraff 2016). The low price and high energy content of coal enabled the building of power plants to take advantage of economies of large scale in steam-electric production (Nuraini et. al., 2018; Kimi, 2016; Mastura, 2014; Minchener, 2005).

Boiler system, turbine system, condensing and feed heating system, generator system and main transformer are the main system in coal power generation. Thermodynamically, the system of the boiler is to exchange the coal combustion, which is a chemical energy into the thermodynamic energy in the boiler, through generating the steam from the boiler drum. There are many boiler types such as a sub-critical boiler, boiler with reheater, single drum, and radiant and convectional of two-pass type superheaters, with controlled recirculation and normal circulation. (Wang, Ling, Peng, Liu & Tao, 2013; TNBJ Handbook Training, 2000).

Gazzino and Benelli (2008) and Wiser (2000) explains that the Rankine cycle is the idealized cycle for steam power plants, and could be described as a heat engine process with a vapour power cycle. Figure 2. 1 shows the process involved which are correlations with T-S diagram. The detailed process involved towards the energy transition on generating steam is also presented in the figure. Besides, its involves with energy transfer throughout all thermodynamic process which related to the pressure and temperature change.

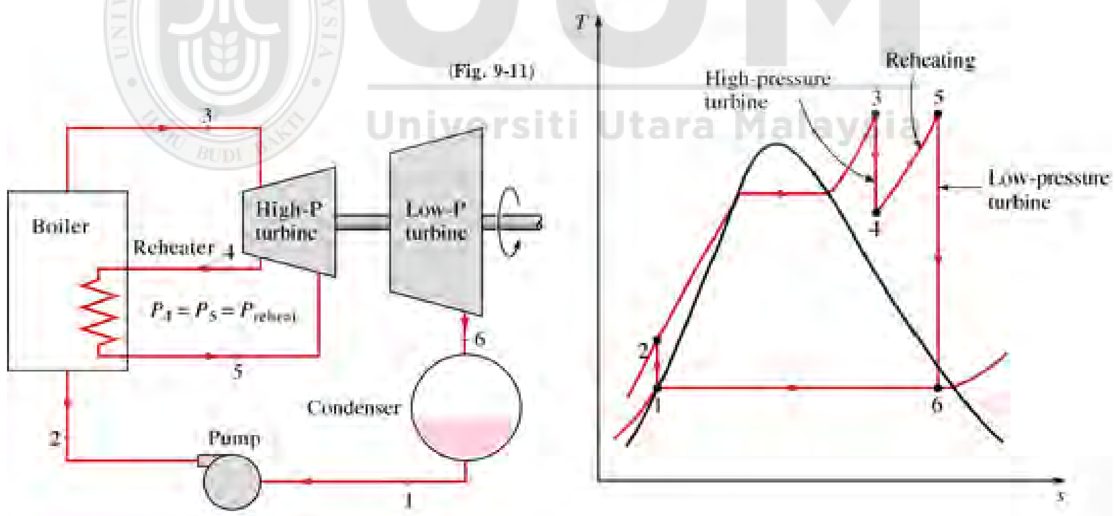


Figure 2.1
Process for Generating Steam
Source: Kapooria et al. (2008)

Kapooria, Kumar and Kasana (2008), described that the steam plant involves the process of isentropic compression, isobaric heat supply, isentropic expansion and isobaric heat rejection. The ideal processes of thermal plant were explained by Kapooria, et al., (2008). The process also mentioned the function of equipment and are correlated with Rankine Cycle. Table 2.1 is a summary of the thermodynamic process, where the temperature and pressure are the main characteristics. The description for process carries out by the equipment also deliberated in the table. Thermodynamically, the thermal power plant process involves with isentropic process which is perform by pump, isobaric heat supply which involve steam generation by boiler, isentropic expansion through steam turbine and isobaric heat rejection perform by condensate system.

Table 2.1
Rankine Cycle process

Process	Description
Process 1-2: Isentropic compression (Pump)	An isentropic process is the compression process from low pressure to high pressure by the external work force. The pump is used to form high pressure where the working fluid of the pump is working on it.
Process 2-3: Isobaric heat supply (Steam Generator or Boiler)	An isobaric process describes the form of superheated steam process by the heat source from the high temperature of the working fluid. The saturated vapour is formed when the pressurised fluids enter a boiler with constant pressure and high temperature.
Process 3-4: Isentropic expansion (Steam turbine)	An isentropic process designates the working fluid entropy remain constant during the process. The dry saturated vapours expand in the turbine and drive the turbine to work. The temperature of the working fluid that enters the turbine decreases and hence its pressure drops. In the meantime, the condensation process happened.
Process 4-1: Isobaric heat rejection (Condenser)	An isobaric process takes place when the pressure of working fluid remains constant. Condensing cycle occurs where the wet vapour enters a condenser and is condensed at a constant temperature. The end product will form as saturated liquid.

Source: Kapooria et al. (2008)

Wiser and Wendell (2000), clearly described the turbine system function to convert the thermodynamic to the mechanical energy. Thermodynamic energy performs in steam which heating boiler product and mechanical energy perform once steam is going to the turbine system. Generated steam with high pressure and high temperature from the boiler is separately goes to HP, IP and LP cylinders. Steam with low temperature dump to the condenser system which is connect to the LP cylinder. In general, power plant process is design as closed circuit system. Figure 2.2 shows the fundamental process for the power plant in generating electricity.

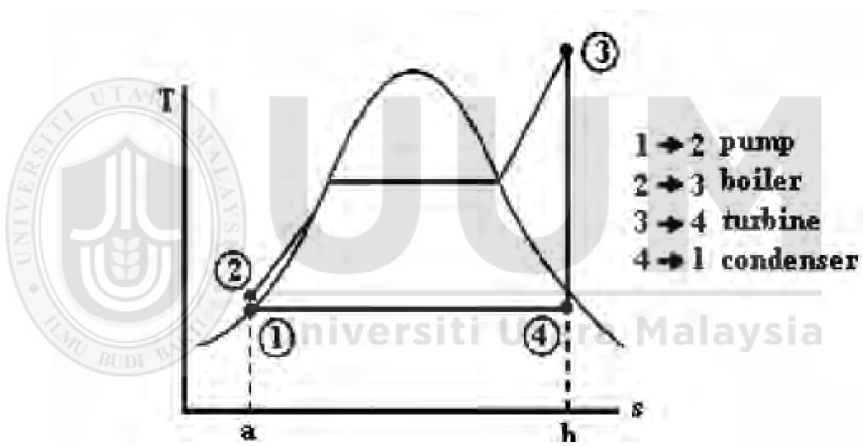


Figure 2.2
Power Plant Process
Source: Genesis et al. (2012)

Condensate system and feed heating system functions as a heating medium. In general, condensate and feed heating system designed to functions as heat exchanger concepts. Energy transfer also performs in this system where condensate pre heat the water through LP heaters, deaerator, HP heaters before goes up to the boiler. LP cylinder supply the heat from the bottom angle which is connected to the condenser. Cooling water system is installed and occupied to the all system in power plant purposely to release the heat. Thermodynamically, the power plant process performs as the Rankine Cycle which involves with energy transfer in between.

Genesis, Zimwara, Tumbudzuku, and Mhlanga, (2012), describe that the power plant process is about energy transfer and it is a closed process. Figure 2.4 shows the schematic process of coal power plant. Genesis et. al., (2012), carried out the energy assessment on each of the major components such as boiler, turbine, pump and condenser in order to improve the existing efficiency. Nuraini et. al., the major boiler, turbine, pump and condenser is the critical equipment performing Rankine Cycle, complexity of heat transfer process. Stated by Nazrin & Goven (2017), efficiency and heat transfer process involves with energy conversion, interrelated with temperature and pressure.

Figure 2.3 also explains the process that occurs in the thermal coal plant. The flow processes indicate the conversion of the energy involved. Kapooria et al. (2008), clearly synthesized that the power plant system ideally follows the Rankine Cycle theory. Supported by Naterer, Regulagadda, and Dincer (2010), the thermal power plant process includes the critical equipment where the boiler and turbine are the major components that contribute to the major fatalities and losses.

Energy transfer process happened through generator from mechanical energy which perform by the rotating turbine to the electrical energy perform by the electromagnetic processes (Breeze, 2014). In Malaysia, normal generator voltage was set up at 23kV with high protection system.

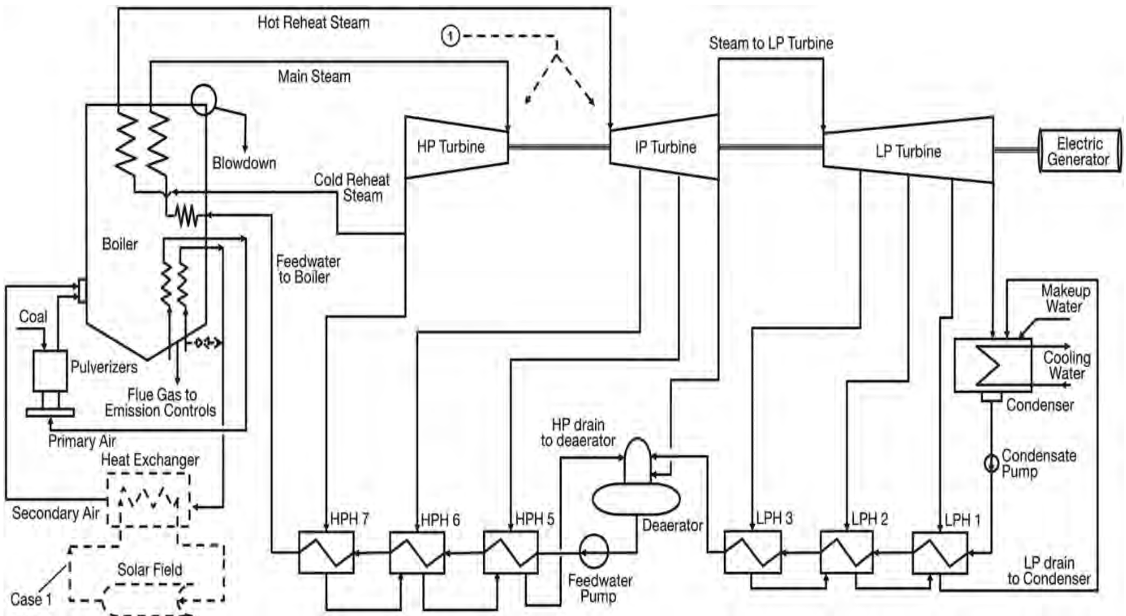


Figure 2.3
Schematic Diagram for Power Plant Process
Source: Nuraini et al. (2018)

The hydrogen system installed in close circuit and circulate between rotor and stator as a cooling medium. Water system also applied as cooling medium which is supply to the stator winding. Attached together to the generator, the generator Direct Current (DC) excitation system is abounding from static thyristors connected to an excitation transformer. The brushes and slip rings system used to excite the generator. According to Breeze (2014), the main transformer functions to transmitted the electrical energy before distribute to the grid system. It transforms the 23kV electrical energy delivered by the generator into 500 kV high voltage electrical energy. The electricity transmits through transmission line which is installed via double circuit line to the main power line (Chen, Lundqvist, Johansson & Platell, 2006; Singer 1981). This advance electricity transmits successfully perform to ensure high security to the country (Tan, 2016).

The environment of a coal power plant is slightly different from other steam plants, especially a gas power plant. Coal is the key player because its storage is in slightly open air direct to the environment (Suhaimi & Nin, 2015; Maeda, 1996; Carlson & Adriano, 1993). All the operation equipment is directly exposed to dust. Unfortunately, it will cause equipment failure and defect. Fly ash is a product from the combustion process of coal. The fly ash will fly over to the open air and land on the equipment around. Accumulation of dust will affect the performance and efficiency of the equipment (Goto, Yogo & Higashii, 2013; Benson & Orr, 2008; Mann & Spath, 2001).

Therefore, the operators need to do easy cleaning the equipment and machine during the checking period (Azizul & Tarmizi, 2013). Operators also need to check the integrity and the health of the equipment. The checking and inspection activities intentionally to ensure that there are no abnormalities and the equipment is in good condition. Abnormalities of the equipment will cause a big impact to the plant operation and hence affect the company's income. By doing preventive maintenance, the failure of equipment can be predicted earlier (Phoebe & Izhar, 2016). A contingency plan will be developed to cater the issues raised. Thus, TPM introduces Overall Equipment Effectiveness (OEE), a calculative method of measuring the equipment performance that affects power plant performance.

2.2.3 Power Plant Performance

The performance of a power plant can be expressed through some common performance factors; heat rate, energy efficiency, thermal efficiency, capacity factor, load factor, economic efficiency, and operational efficiency (Wood & Wollenberg, 2012; Sueyoshi, Goto & Ueno, 2010). All of the indicators mentioned are those that contribute to the business performance and company profit.

According to Cook and Green (2005), the performance of power plant could also be indicated through measuring the power plant availability and productivity. Availability of power plant is referred to the as the fraction of time a unit is capable of providing services, and accounts for outage frequency and duration. Meanwhile, power plant productivity is the total power produced by a plant with respect to its potential power production. At the end, the availability and productivity will affect the power plant efficiency (Suresh, Reddy, & Kolar, 2010; Bugge, Kjaer, & Blum, 2006).

Evaluation of a power plant availability is one of the most important tasks in any power station. It indicates the fraction of time that it is able to produce electricity over a certain period (Singh & Kaushik, 2013). To analyze plant availability performance, generation unit outages should be scrutinized in order to identify the causes of unplanned or forced energy losses and to reduce the planned energy losses. Reducing outages increases the number of operating hours, therefore increases the plant availability factor. By looking at all indicators, all factors contribute to the power plant equipment effectiveness. Therefore, it is important to measure the equipment effectiveness to achieve high plant efficiency, high capacity factors, and optimum heat rate where it is accounted to the organizational business performance and profit (Hanak, Biliyok, Yeung & Białecki, 2014; Suresh, Reddy, & Kolar, 2010).

The TNB power plant performance follows the same characteristic performance indicator. TNB measures Equivalent Availability Factor (EAF) which presents the power plant availability on producing power to the grid sector. According to Kimi (2016) and Remy (2015), the boiler efficiency is calculated to indicate the boiler performance during power generation. Meanwhile, the boiler heat rate indicates the boiler efficiency. Heat rate is defined as the energy input over the energy output. It is the amount of energy used by an electrical generator or power plant to generate one kilowatt per hour of electricity (Sivas & Jothi, 2017; Kimi, 2016; TNB PPA 2000).

In addition, TNB also examines the capacity factor as the performance indicator. The net capacity factor of a power plant is the ratio of its actual output over a period of time, to its potential output if it were possible for it to operate at full capacity continuously over the same period of time. In addition, the rate of unplanned outage (UOR) determine the unavailability of power generation loss on output. The low rate of unplanned outage indicates that the power generation is reliable and capable of producing the maximum capacity (Sivas & Jothi, 2017; Suresh et. al., 2010; TNB PPA, 2000).

Table 2.2 shows the TNBJ performance over five years. The results illustrate the increasing percentage of EAF year by year. The capacity factor of the power generation gives positive impacts as well. Supported to the results of UOR rate, the rate shows incremental reduction by the year. Consequently, the power plant performances of the power generation of TNBJ demonstrate the positive impact to the organization's financial growth. As mentioned by Johan & Hamdan (2015), the increase of UOR rate due to increase of equipment failure, reduce of equipment efficiency and less machine productivity. Kimi (2016) suggested to upturn the UOR rate, the available machine can increase the productivity up to the optimal level.

Table 2.2
TNBJ Power Plant Performance

Finance Year (FY)	**2009/ 2010**	**2010/ 2011**	**2011/ 2012**	**2012 /2013**	**2013/ 2014**	**2014/ 2015**	**2015/ 2016**	**2016/ 2017**
Equivalent Availability Factor (percent)	92.8	79.66	80.80	85.99	82.76	88.62	84.64	86.31
Efficiency (percent)	35.4	35.13	35.54	35.63	36.29	36.61	34.61	35.62
Heat Rate (KJ/MWh)	122	123	121	121	119	118	125	123
Capacity Factor (percent)	77.4	70.98	78.77	84.82	82.26	86.88	81.77	87.23
Number of tripping	9	28	33	10	7	3	21	6
Unplanned Outage (percent)	1.96	12.83	8.75	4.44	9.87	2.91	7.89	2.15

Source: Develop for this research

The major factor that affects the power plant performance is the machine and equipment effectiveness where it presents the machine and equipment reliability during the power plant process (Johan & Hamdan, 2015). Ergo, the machine and equipment must be healthy, capable, in high availability and good performance during service to ensure continuous productivity (Johan & Hamdan, 2015; Ahuja & Kamba 2008). To ensure the continuity of good performance of the machine and equipment, the TPM initiative comes in with the pillars. As mentioned by Kamil and Nazrin (2018) instead of OEE, the method chosen in evaluating the machine and equipment performance, the TPM performance indicates by TPM practice and procedure. Improvement of existing practicing, proper procedure on handling system significantly indicates the TPM achievement in such performance to the organization (Kamil & Nazrin, 2018; Ritz & Khaled, 2016).

2.3 Total Productive Maintenance (TPM)

Total Productive Maintenance (TPM) initiative was initiated in Japan in 1961, where the concepts and methods were introduced by Nippon Denso Co. Ltd., a supplier of Toyota Motor Company (Venkatesh, 2007). According to Robinson and Ginder (1995), the TPM concept was applied to the company with the theme 'Productive Maintenance with Total Employee Participant'. Japan Institute of Plant Maintenance (JIPM) PM awarded the company with JIPM PM prize since the company had successfully implemented TPM. Due to its positive impact to the industry in Japan, the implementation of TPM was extended to the automotive industries and manufacturing companies (Robinson & Ginder 1995). Thus, the TPM initiative and concept started to be adopted and adapted in various industries around the world.

The TPM concept is presented to assist an organization and management in managing assets of a company. TPM in industry brings a concept of sustaining and improving the veracity of production, operation, maintenance and quality systems. Therefore, the implementation of TPM on the machines, equipment, processes, and employees add value to an organization and business performance. Besides that, Bhadury (2000), stipulated that TPM is involved with an advanced methodology to preservation the enhances equipment value, abolishes failures and promotes autonomous maintenance by the employees throughout the daily accomplishments as a routine works. In the meantime, it's part of employee's total workforce while involves in TPM activities.

Other than managing assets, Johnson (2005) mentioned that TPM initiative is related to many other operation management initiatives which includes Zero Defect, Lean concepts in manufacturing, Total Quality Management (TQM), Preventive Maintenance (PM) and Corrective Maintenance (CM) mechanism, Continuous Process Improvement (CPI), Rapid Improvement Team (RIT), and other productivity philosophies with 5S concepts as the base of the TPM initiative. Ahuja et al. (2006), mentioned that the business industry has practiced an extraordinary transformation in the last three decades; radical vicissitudes in the organization methodologies, product and process of technologies, managing the customers' needs and wants, supplier market behavior as well as competitive attitude trend.

Oke (2005), highlighted that the need of TPM is due to the blooming of the marketplace, and unstable market prices. Hence, by having TPM, companies experience a steady improvement in manufacturing industry and thus causes the operations' market to have continued cost-effectiveness and still be competitive. Behind that, TPM promote total involvements in the organization as one team in order to complete the task. The total involvement results positive outcome and drive organization increase the productivity

(Kamil & Nazrin, 2018; Shamsul, 2017; Azizul &Tarmizi, 2013). Therefore, every industry has to strive for improving productivity in all spheres of activities to ensure survival in the global market.

Besides that, TPM is known as a fundamental improvement program to the maintenance functions in management because TPM encompasses total employees which is from top management to the lowest employee's level. By referring to the TPM objective itself, TPM initiative optimizes the overall efficiency and effectiveness by sustaining the life-cycle of the equipment. The TPM philosophy necessitates the development of a preventative maintenance (PM) program and it is a part of asset management strategy. Thus, with good practice of managing assets, TPM needs the operator's participation and involvement in order to maintain the equipment in optimum working order.

From previous literature, Productive Maintenance (PM) concepts was established in the United States (US) from late 1940s and early 1950s. The US team developed the PM schedule such that it increased the product life cycle and improved the equipment reliability in the manufacturing industry. According to Nakajima (1984), the PM activities conducted in the US were successfully performed and in order to suit the Japanese business environment, some modifications to the PM concept were carried out. Therefore, a TPM research group was formed which involved twenty Japanese companies in 1953. In 1962, the research on TPM implementation in the USA was started, resulting in the development of the Japanese Institute of Plant Engineers (JIPE), the predecessor of JIPM in 1969 (Ireland & Dale, 2001).

The TPM evolution in Japan is shown in Figure 2.4 where the TPM concept was extended in response to business growth. In the beginning of TPM implementation, only several companies participated in the initiative and were not successful (Tajiri & Gotoh, 1992). As TPM offered a better economy in the future, manufacturing companies started to implement the TPM concept in the early 1970's (Ireland & Dale, 2001). Therefore, the phase and structure implementation process in TPM was established by Nakajima as a guideline to the companies. Besides that, Nakajima offered a standard concept of TPM and the TPM methodology for Japanese industry (Nakajima 1984; Nakajima 1989).

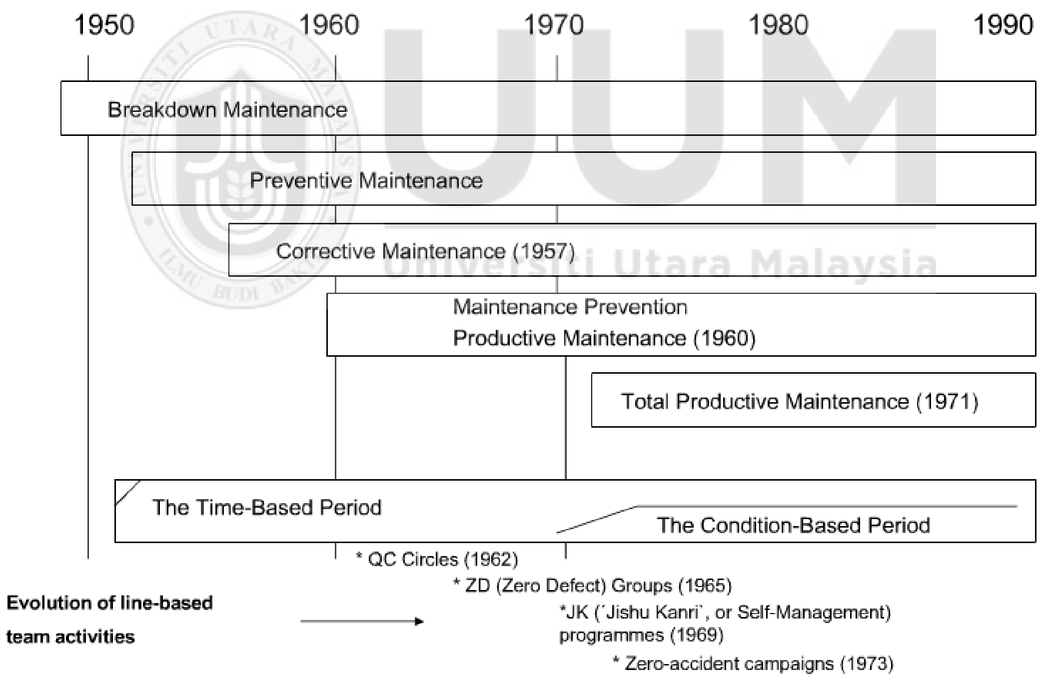


Figure 2.4
The TPM Development in Japan
Source: JIPM Website (2017)

According to Ireland and Dale (2001), between 1980s the TPM concepts and philosophy was slightly different between America and the western world. By year 1990s, most of the organization trendily looking to the quality concepts such as Total Quality Management (TQM) which is part of organization strategy. Sethia et. al., (2014) and Suzuki (1994) mentioned that, several companies in western countries such as Dupont, Exxon, Kodak, Alcoa, AT&T, Ford, Hewlett-Packard, and Proctor and Gamble started to initiate the TPM concept too. Supporting the excellent growth of TPM implementation in western manufacturing companies, several authors and researchers started to document the TPM for further improvement (Kumar, 2003; Willmott, 1994; Hartmann, 1992; Sekine & Arai, 1992; Nakajima, 1989; Nakajima, 1988). In facts, there is increasing on the number of researcher and writers documented the TPM story journey in western manufacturing enterprises (Kedaria & Deshpande, 2014; Muza & Hafez, 2010; Willmott 1994; Hartmann 1992; Sekine and Arai 1992;).

Furthermore, for better improvement in TPM, several literature studies were established for a clearer understanding to the industry. The TPM concept, TPM methodology, TPM framework, and TPM aims were widely discussed. Table 2.3 presents the TPM definition from several sources which are well-known in research areas.

Table 2.3
TPM Definition

Source	Definition
Society of Manufacturing Engineers. Slocum (1992)	TPM is a methodology and philosophy for strategizing the equipment management. TPM aimed on building capability of the equipment by improving product quality and maximizing equipment reliability. The equipment effectiveness and continuous improvement is the end results for the TPM program. TPM promotes total employees as contribution for continuous improvement to the equipment process.
Steinbacher and Steinbacher (1993)	TPM is about of the strategies needed to sustain a healthy maintenance log. TPM improve the current maintenance practices.
Robinson and Ginder (1995)	TPM is a methodology for organization on managing assets by improving the productivity. TPM also namely as method to optimizing the equipment reliability and maintaining the plant assets. As production-driven practice, TPM process designed to suit the organization requirement. Indirectly, TPM activities improve equipment availability and productivity.
Blanchard (1997)	TPM is related with life-cycle process by involving maintenance approach with respective supports. TPM develop the maintenance philosophy for handing maintenance activities.
McKone, Schroeder et al. (1999)	TPM is an alternative which promotes maintenance strategy. By carry out TPM initiative, maintenance strategy established accordingly and inclusive improve equipment life cycle. TPM also encourage all level of employees participate actively doing the TPM activities.
Lawrence (1999)	TPM is an initiative and tools for managing maintenance process. TPM also defines as the optimizing strategy in business common process at the organization.
Cooke (2000)	TPM is combination of both parties which are production and maintenance. Both parties' workings as team works on achieving the ultimate goal for the organization. TPM promotes organization looking to improve the good practices and proper procedure. Besides, TPM effectively need total involvements from various respective department.

Table 2.3 (Continued)

Source	Definiation
Robinson and Ginder (2004)	TPM is a process doing different maintenance method to the existing equipment. TPM firmly do in team with structured activities that can lead to improved management of plant assets. TPM requires involvement and supports from all level of employees.
Ahuja et. al (2008)	TPM require involvement from all level of employee. TPM as maintenance tools require total participant from various section in the organization on achieving goals and target. By having TPM, organization inspire to increase equipment availability and effectiveness.
Ajay (2005)	TPM promptly is the maintenance activities which is grounded with the TPM pillars. TPM activities driven the new culture to the employees and organizations.
Barson (2013)	TPM is the method to improve organization assets value by improvise maintenance activities.
Adnan (2014)	TPM firmly encourage all level of employees to do maintenance activities with the right mechanism. TPM promotes continuous improvement to increase equipment availability.
Ahmed (2015)	TPM as instrument to improve maintenance approach and TPM pillars support the maintenance activities.

Source: Develop for this research

As elaborated by the previous literature on TPM definition, most of the companies and scholars look towards an improvement of maintenance activities once TPM concept is introduced. As stated by Ruiz, Foguem & Grabot, (2014), Jain et. al., (2014) and Patterson and Fredendall et al. (1996), by improving the maintenance activities in the organization, significantly will reduce operational expense. Consequently, the organization reduce the investment in maintenance cost and minimal the maintenance repair cost. By having minimal maintenance activities, therefore increase equipment productivity and increase equipment performance. The effective equipment conception promotes production-driven for the organizations.

For example, the United States (US) semiconductor industry highly recognized the TPM prospective implementation among industry (Ron & Rood, 2006). The semiconductor industry implement TPM intentionally to enhance maintenance planning. Besides that, the organization emphasized to improve operation productivity with high quality. Acording to Ron and Rood (2006), the organization realized to optimum the machine efficiency with less defect. Surprisingly, the semiconductor industry adopts and adapts the TPM initiative which is commonly practicing on manufacturing industry. Thus, they organized and promote the organization an industry-wide effort to share TPM learning. In addition, they also standardized TPM implementation, management practices and methodologies.

Regarding its positive impact in industries, the effectiveness of implementing TPM must be evaluated for better improvement. TPM is also involved as a whole in which it deals with employees, plant maintenance, plant engineering, product design, administration, human resource, training, procurement, financial performance, equipment and machines (Acharya & Bhatt, 2014; Jardine & Tsang, 2013). TPM performance measurement must be carried out to ensure that the TPM program suits its concept. In addition, TPM requires a proper strategy and mechanism to enhance business performance. Due to that, the TPM pillars come in place as a framework and provide basic concepts on developing the TPM in total. (Ahmad, Zakuan, Jusoh & Takala, 2012; Sharma et al., 2012; Agustiady & Cudney, 2016; Gitachu, 2016).

2.3.1 TPM Pillars

Japan Institute of Plant Maintenance (JIPM) suggested the eight pillars of TPM implementation plan. The TPM pillars resulted in significant increase in labor productivity. This increment is obtained through controlled maintenance, reduction in maintenance costs, and shortened production stoppages and downtimes. Jain et. al., (2014), Ireland and Dale (2001), Shamsuddin et al. (2005) and Rodrigues and Hatakeyama (2006) identified that there are eight TPM pillars involved in completing TPM philosophy such as Autonomous Maintenance (AM), Focused Maintenance (FM), Planned Maintenance (PM), Quality Maintenance (QM), education and training, office TPM, TPM development and management, and TPM safety, health and environment. The pillars support the TPM concepts in implementing TPM in total for the company.

TPM paves the way for excellent planning, organizing, monitoring and controlling practices through its unique eight-pillar methodology. All the TPM pillars have their own functions and complement each other (Jardine et al., 2013). There are many versions of TPM pillars used by the organization to suit the company strategies. However, it is not a problem to select only part of the TPM pillars because the objective of implementing it is still the same (Gitachu, 2016; Kumar et al., 2016; Jardine et al., 2013; Moradi, Abdollahzadeh & Vakili, 2011; Bon & Ping, 2011). Some researcher believed the TPM pillars promote total enhancement which enrich the positive outcome to the organization, nothing will loss and all initiative have the own affirmative feedback (Maya, 2017; Lart & Maniam, 2013; Rich, Magun & Samba, 2010).

Figure 2.5 shows the eight pillars of TPM. The 5S philosophy is the foundation for the pillars. In order to maintain a harmonious environment at the work place, it is important to have employees who are obliged to sincerely implement and practice housekeeping, which requires a simple logical process. Housekeeping activities are to ensure that the work place is well organized and structurally managed as any abnormalities could be found during the activities (Jain et. al., 2014; Kulkarni & Dabade, 2013).

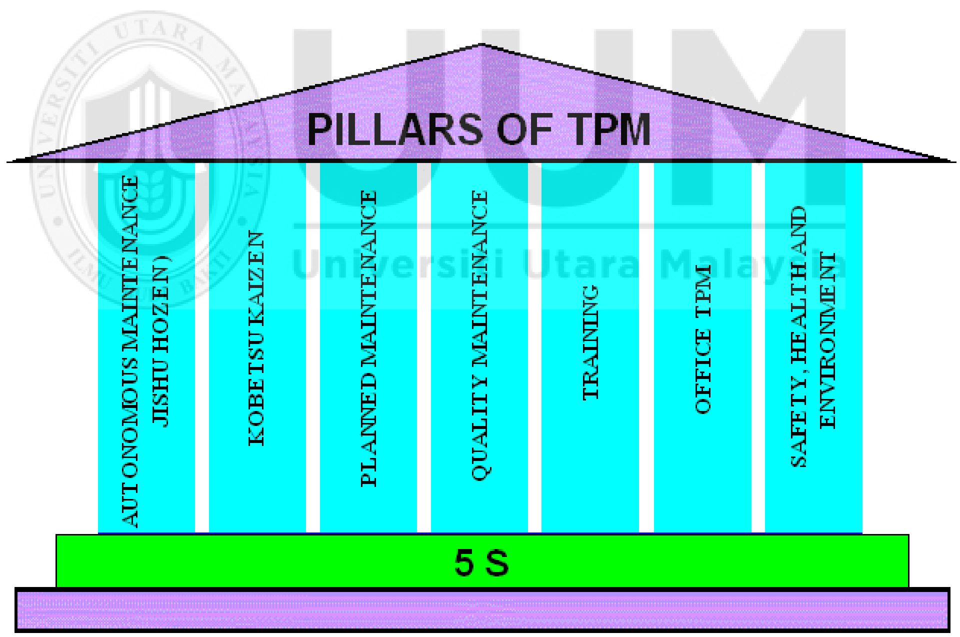


Figure 2.5
TPM 8 Pillars
Source: Jain et al. (2014)

The pillars make the TPM principle activities organized and structured. Subject to the scholar's understanding and TPM application in certain studies, the pillars could be different. However, the origin of the TPM pillars was based on the Nakajima's eight pillars (Nakajima 1984; Nakajima 1988). The Nakajima's eight pillars is presented in Figure 2.6 below.

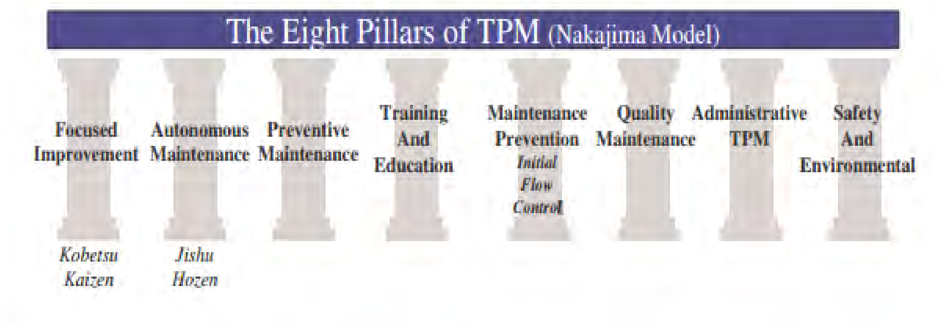


Figure 2.6
TPM Pillars by Nakajima
Source: Nakajima (1988)

2.3.2 TPM Pillar 1: Autonomous Maintenance

Autonomous Maintenance (AM), or in Japanese, *Jishu Hozen* describes the responsibility of the operators in handling basic maintenance activities. This pillar focuses on major maintenance work (Kunio, 2017). For example, operators may carry out the basic housekeeping, lubricating such as topping up lube oil, tightening of nuts and bolts, surveillances and examining equipment performance during operation. Through autonomous maintenance activities, operators can take prompt action and it may reduce machine downtime (Azizi, 2014; Robinson & Ginder, 1995). From here, it may develop the staff's responsibility and ownership. Moreover, AM is defined as, "the greatest requirements for operators are, first, to have the ability to 'detect abnormalities' with regard to quality or equipment, based on a feeling that 'there is something wrong'" (Farnsworth, Bell, Khan & Tomiyama, 2015; Vian et. al., 2014; Shirose, 1996).

In addition, the maintenance staff work load reduces accordingly. The maintenance staff can be more vigilant to the major issues which require high technicality and servicing. The maintenance and repair works can be scheduled and planned properly to ensure that no interruptions occur during the operation. Basically, the AM pillar contributes to the organization as it increases staff responsibility and ownership of the equipment among the operators due to routine checking and inspection (McKone et. al., 2001; Goto, 1989).

Besides that, this pillar develops the operator's level of skill and critical thinking by understanding the equipment technicality, equipment spares and critical parts, and understanding of the general operational concepts (Vian et. al., 2015). At the same time, staff concurrently optimizes the use of machine and equipment in service by carrying out regular monitoring, inspection and checking. The AM pillar also includes activities on identification and classifying the abnormalities of the equipment through preventive and corrective maintenance before breakdown (Suzuki, 2017; Komatsu,1999; Shirose, 1996). Before carrying out the AM pillar, the basic step of cleaning activities must be taken. The problem occurring at the machine could be detected earlier before it worsens. Hence, the life cycle of the machine could be prolonged and increases system availability.

2.3.3 TPM Pillar 2: Planned Maintenance

The objective of Planned Maintenance is to "establish and maintain optimal equipment and process conditions" (Suzuki, 1994 p. 145). The proper planning and scheduling of maintenance activities is guided by the Planned Maintenance (PM) pillar. This pillar looks at the machine failure mode and breakdown behavior before scheduling the maintenance work. The scheduling of maintenance work is presented in metrics, cycles, charts and tables where the maintenance work activities are stated (Vian et al., 2014; Robinson & Ginder, 1995).

The PM activity involves various sections such as production, inventory, finance, operators, and maintenance planner as the key players (Campbell et al., 2015: Duffuaa, Raouf & Campbell, 1999). The production section functions as a production planner in order to guide the team on the time factor. The maintenance planner produces a maintenance timeline for the maintenance staff during the maintenance repair works. The inventory section gets information from the maintenance planner on preparing the availability of spares. During PM activities, the teams must be cross-functional in order to get all the information required about the maintenance work and also to avoid any misunderstanding amongst them (Campbell et al., 2015; Jardine et al., 2014; Patel et al., 2014; Ireland & Dale, 2001).

The maintenance planner is the key player of this pillar (Suzuki, 2017). They must lead all the activities from the beginning till the end, which is completing the repair and maintenance works. The practice is slightly different where the maintenance personnel carry out the maintenance work before machine failure. It reflects on the negative impact; when the machine productivity decreases due to machine downtime (Parida, Kumar, Galar & Stenström, 2015). In future, the production personnel need not do extra work to find the root cause of the machine failure (Suzuki, 2017; May, Barletta, Stahl, & Taisch, 2015; Robinson & Ginder, 1995). By presenting this pillar, there are significant advantages to the organization on managing the assets, especially when technical issues are present such as the scheduling activities decrease the number of breakdowns because the maintenance work is predictable and well planned. Same time, the production section is continuously productive due to consistent activities in operation without any interruption. The maintenance works are properly organized, and the work is planned per order, thus there are no unexpected findings during the repair works. In mean time, the optimization of machine production due to proper maintenance planning and hence increasing the company benefits. For the spare part management, the high cost machine parts can be managed in balancing the profit to the company.

2.3.4 TPM Pillar 3: Quality Maintenance

During the commissioning period, the quality of the work will be measured before the machine is put into service. The Quality Maintenance (QM) pillar covers the work on detecting errors and abnormalities to ensure the machine is in normal condition. As agreed by Shen (2015), during the quality inspection activities, the personnel highlight the defective part and identifies the irregularities which can cause major damage to the machine (Suzuki, 2017; Shirose, 1996). Normally, quality inspection is carried out through Non-Destructive Testing (NDT) method. The available method to carry out NDT are Penetrant Inspection (PT), Magnetic Particular Inspection (MPI), Hardness Testing, Ultrasonic Testing (UT) and others in the market (Dogra et. al., 2011; Al-Najjar, 1996). The method used for inspection depends on the properties of the material, component or system without causing destruction.

The preliminary inspection is to ensure the machine availability and reliability. Beyond machine availability, the quality aspects mostly concern during maintenance activities. The maintenance quality aspect critically essential on preventing machine abnormalities and consequently reduce the value to the equipment. By carry out quality inspection it will reduce equipment failure, minimal defective equipment and avoid re-work activities. The abnormalities could be detected before the machine faces major problems and difficulties. Planning and mitigation strategy could be developed to ensure continuous operation (Ahmed, Hassan & Taha, 2005; Cua et. al., 2001; Shirose, 1996). By having the QM pillar, the staff can detect the problem before it occurs after commissioning the machine. The process of trouble-shooting can be done with tools such as Ishakawa diagrams and Five Whys root-cause-analysis.

According to Suzuki (2017) and Venkatesh (2007), quality maintenance offers some benefits where the machine can be sustained and maintains the maintenance work to ensure no re-work, where re-work is referred to as unexpected breakdown to the machine. Besides that, it is important in preventing and avoiding machine breakdown (Parida et al., 2015; Willmott, 1994). Basically, machine breakdown causes production limitation and decreases company profit. With the QM pillar, staff can eliminate the concurrent defects and minimize the machine breakdown during operation. Consequently, QM activities build up the repair works skill through maintenance works and develop the skills of the maintenance staff by attending to the repair works (Teeravaraprug, Kitiwanwong & SaeTong, 2011; Ben-Daya & Duffuaa, 1995).

2.3.5 TPM Pillar 4: Focused Improvement

The implementation of focused improvement pillar, it requires involvement from various field. A cross-functional team is firm which is similar to the PM pillar (Andersson & Bellgran, 2015). The cross-functional team is the key player in solving the problem occurring to the equipment and the time in coming up with the improvement proposal. The members of the team are from various skills and competencies. Experienced people who are directly involved with the equipment may also join this team. The cross-functional team will propose various solutions to cater to the problem. All concerns on the problem solving must be raised during the discussion period. Some companies develop their team with participation from the experts and skilled people. In this pillar, the people also take part in training sessions in order to maximize their knowledge (McCarthy & Rich, 2015; Suzuki 1994 p. 1992).

Normally, the management recognizes and qualifies all the team members to focus on improvement (Fraser, Hvolby & Tseng, 2015; Attri et. al, 2013). The management will hire the team for a pilot project to carry out their activities. They will set the goal and timeline when handling the issues given. Problems and issues happened to the equipment identified and attended urgently by the respective section. Systematically, this pillars promote improvement goals which is set in three to five days of in-house kaizen event (Al-Refaie & Hanayneh, 2014). The activities must be followed-up by the team to ensure it finishes within the agreed timeline. They work together from the initial stage, proposing solution, till the end of the activities. The success of the proposed solution is totally dependent on their teamwork and understanding (Netland, Schloetzer & Ferdows, 2015; Suzuki, 1994).

Therefore, the focused improvement pillar of TPM is a tool in developing skilled and competent staff. Brainstorming and discussion session during the pillar session makes them more responsive and open-minded. Thus, the organization is able to develop a skillful staff with marvelous experiences (Sharma et. al., 2015; Leflar, 2001).

2.3.6 TPM Pillar 5: Maintenance Management

The fifth TPM pillar is Maintenance Management (MM). Basically, the role of the MM pillar is to organize the maintenance works fully prepared. The MM pillar ensures that the new machinery deliver optimal performance as compared to the previous performance, where this pillar is not applied yet (Wordsworth & Lee, 2001). Other than that, maintenance management also cover the productivity, efficiency and output quality of the machines are also measure with guarantee to ensure equipment perform during commissioning period. Prior to that, maintenance management pillars critically complete the TMP pillars in total. As stipulated by Suzuki (2017), this pillar is involved and deployed after the first four pillars as it accumulates information from the other pillar teams, incorporating improvements into the next generation of product and equipment design (Rajput & Jayaswal, 2012; Garg & Deshmukh, 2006).

Basically, the Early Maintenance Pillar divided between two categories which is Early Equipment Management (EEM) and Early Product Management (EPM) (Sherwin, 2000; Shirose, 1996; Hartmann, 1992). The Early Equipment Management is the process on minimal the losses without equipment failure by reducing the equipment defect. The pillars target to achieve zero breakdown while highly consider on maintenance costs. Strategically, this pillars will avoid overhead cost by carry out optimize maintenance approach since commissioning onwards. Zero quality loss or namely as zero defects achieve thru Early Product Management pillars. This pillars purposely to shorten development lead times by carry out the maintenance work simultaneously. (Bakri, Rahim, Yusof & Ahmad, 2012; Garg & Deshmukh, 2006; Suzuki, 1994). Thus, this pillar strategically managing the process time so that the equipment effectively performs in high performance without defect.

In general, both MM methodologies focus on applying the lessons, experience and knowledge from earlier proficiencies and involvements to eliminate potential loss through the proper scheduling, work plan, execution, development and design stages (Bakri et. al., 2012). During the design stage, most of the factors that should be considered are the ease of inspection and lubrication, monitoring and cleaning activities, equipment accessibility and ergonomic specification to the end user. Besides that, the safety factor and environment care must be highly considered at this stage (Suzuki, 1994; Wireman, 1990).

As proposed by Peng (2016), Rastegari and Mobin, (2016) and Sharma et. al., (2012), before commissioning, the manufacturer and management must consider the entire concerns that have been raised up from previous experiences. The aim is to improve the existing system while increasing the productivity. In conclusion, maintenance management promotes the early inspection at the first stage before commission and installed the equipment permanence. Responsible staff must share the finding after complete carry out the inspection activities.

2.3.7 TPM Pillar 6: Education and Training

According to Borris (2006), education and training in TPM initiative become the most important pillar to ensure the staff are well educated and knowledgeable. Lack of training and knowledge will lead to improper implementation of TPM and the initiative becomes worse. As mentioned by Lande, Shrivastava & Seth, 2016, poor training causes misunderstanding among the staff resulting in them making mistakes, consequently affecting the company in a disastrous manner. Knowledge is the key in handling and managing assets. It is a vital part in the organization and makes the staff to perform skillfully (Venkatesh, 2007; Ho & Wearn, 1995).

TPM education and training pillar is the mechanism to increase the staff competency, working skill and knowledge (Attri et. al., 2013). In fact, all level of employees from top management to the bottom line must participate actively in the education and training pillars. This pillar enhances employee's competency and encourage employees to be expert in sentence area for TPM project. Thus, the skill level and competency of the staff will increase to the optimum level. According to Kedar et. al., (2016) and Abdallah (2013), staff confidence level gradually develops when carrying out basic maintenance. The technical staff are probably more pro-active in handling problems, especially during analyzing and trouble-shooting. Therefore, the organization will also be more competent when the staff are fully skilled in their work. Besides that, the coaching and mentoring approaches, that are being initiated along in the TPM, may improve the staff capability, motivation and morale (Kedar et. al., 2016; Kulkarni & Dabade, 2013; Abdallah, 2013).

2.3.8 TPM Pillar 7: Health, Safety and Environment

According to Ahuja et. al., (2008), the health, safety and environment pillar are established in order to ensure that all staff are working in a safe condition. The pillar also considers providing the staff with clean and safe environment. Fundamentally, safety become important issues highlighted during handling TPM project. The top management must ensure all conditions that are harmful to their well-being are eliminated in order to minimize the risk. (Ayob & Hisham, 2017; Sharma & Singh, 2015; Chan, Lau & Kong, 2005). Thereupon, the management must ensure the risk at the workplace is manageable and at a low level. This pillar functions on avoiding and minimizing any incidents that may happen during TPM implementation (Arslankaya & Atay, 2015). All the risks and potential risks must be avoided. Accidents and incidents cannot be avoided because they happen beyond expectation but can be minimized (Campbell et. al., 2015; Venkatesh, 2007; Ireland & Dale, 2001; Shirose, 1996).

The productivity and motivation of the staff will increase simultaneously due to the friendly environmental (Venkatesh, 2007; Borris, 2006). This is because the workplace is free of hazards and accidents. When the risk of injuries and fatalities is at minimum level, it makes the staff feel safe and productive. Peng (2016) and Borris (2006), mentioned that, staff attitudes and behavior gives positive feedback to the company performance. This pillar highlights that the health, safety and environment policy must cover the machine, people and working procedure with various aspects (Kulkarni & Dabade, 2013). The management must be able to handle any issues raised by the staff and people who are affected (Peng, 2016; Brah & Chong, 2004).

2.3.9 TPM Pillar 8: TPM Office

The TPM administration is organized by TPM office. The TPM office establishes and leads the entire TPM program as it is the center of all TPM activities. It covers the administration, human resource, finance, procurement, legal and other fields of work (Ahuja et. al., 2008). People of all skills play their roles by adopting and adapting the TPM and learning its concepts. The TPM office focuses on improving the supportive function which is a non-technical business. Procedures on purchasing spare parts, supply chain, engaging contractors on training are the examples of activities under TPM office supervision (Mishra, Tiwari, Aarif, & Jain, 2016; Rajput & Jayaswal, 2012).

As agreed by Saripalli (2016), all pillars have their own responsibilities and roles in order to fulfill the TPM philosophy and concepts. Each pillar supports one another. In other words, the TPM office must support and lead the other pillars activities. Biasotto, Dias & Ogliari (2012) stipulated that all procedures and processes must be workable and practical to the staff. Focused Improvement, Planned Maintenance, Maintenance Prevention, Autonomous Maintenance, and Quality Maintenance, TPM Safety and Environment are the TPM methodologies and are applied to administrative and support activities. Meanwhile the training and education pillars supports the administrative TPM pillars (Biasotto et. al., 2012; Kaur et. al., 2012; Ahuja et. al., 2008)

2.4 TPM Applications in Industry

From the literature review, the TPM was born from the manufacturing industry (Badli, 2012). According to Peng (2016), the TPM implementation was adopted and adapted by other industries. People in industry believe the main goal of TPM is still the same; guiding on managing assets and optimizing production. As time passes, the philosophy of TPM keeps expanding and growing to other countries. Consequently, many researchers study the TPM theoretically. They come up with different ideas, factors, and framework till the effectiveness of TPM become a reality (McKone et. al., 2001).

Chetan, Shende, and Swapnil (2006), carried out the research on TPM in the rolling mill industry which is located in India. This research covered the manufacturing process, working procedure and the problems faced during the production process which cause the negative impacts to the company production. For the research, they develop a model of Overall Equipment Effectiveness (OEE) to measure the TPM performance. Supported by Peng (2016) the OEE model is one of the tools in examining the TPM performance in mill industry by calculate the productivity. Chetan et. al., (2006) stressed the need of production team, operation and maintenance team to contribute to the OEE model in order to maximize the organization productivity.

Haddad and Jaaron (2012) presented TPM research in the healthcare industry. The researchers developed the methodology framework for the TPM program implementation in the healthcare industry. The study was carried out at a selected hospital in Jordan where the TPM implementation methodology has been developed for increasing medical devices utilization and decreasing their failures. The developed employees' working system and new responsibilities were explained through Autonomous Maintenance (AM), Preventive Maintenance (PM), and 5S Modeling. From the study, it's found most frequent causes in the hospital before the TPM implementation is due to to the lack of devices care and preventive maintenance activities. Proposed TPM system gives a high priority to improve employees abilities to accomplish small maintenance activities and upkeep their devices. Majority of these activities lies in the AM pillar which is a major concept in the TPM (Haddad and Jaaron, 2012).

Numerous research has been conducted to explore the applications of TPM in various industries. For example, in Malaysia, Norddin, Zameri and Saman (2012), executed a study in the fertilizer process plant industry. The organization embarked on the TPM initiative to cater the process planning problem faced by the fertilizer industry. Norddin et. al., (2012) also focused on developing a framework of maintenance management strategy as a guideline for the company in order to improve the company performance and productivity. End of the research, the researcher found the mechanism to reduce downtime by 50 percent for Bucket Conveyor (EL102) from 62.5 hours in 2010 to 31.25 hours in 2011 within 3 months' period (January 2011 to March 2011) via introducing 12 disciplines as a framework for Total Productive Maintenance (TPM) initiatives. Besides, the researchers propose some potential cost savings and improvement in terms of reliability of the equipment.

Mohammad Jafari, Lotfi, Felegari and Hosseini (2014), from Iran studied the TPM implementation for the steel industry. The research looked deeply into the effectiveness of TPM implementation by focusing on the safety scope and perspective. The research identified and introduced the basic concepts in accordance with three specifications in TPM which are directly and indirectly affect the industrial safety. The researcher recommends to established the three specification in TPM such as Total Effectiveness, Total Prevention and Total Collaboration and Cooperation to be more deploy in equipment and process. Believed to the TPM positive outcome, the researchers propose top management to leads this TPM initiative and encourage employee to effectively involves in TPM program. Jafari et al (2014) highlighted on the areas that can be improved such hazard in workplaces, process of cleaning, and housekeeping store area. Jafari et. al., (2014) mentioned the successful implementation can be realized with the top management involvement in the TPM initiatives and make a 5S system as one of the main foundations of TPM. Therefore, its causes workplace adornment and discipline and it direct result is work-related accidents reduction which happen because of disorderliness and workplace polluted with lubricants.

Sandeep Kumar and Pardeep Gahlot (2014) presented a study in auto-sector industry located in Gurgaon, Japan. It was observed that The TPM program was successfully implemented at Sona Koyo Steering System Limited since 2000. The objective of the research is to increase the availability of existing equipment hence, reducing the need for further capital investment. As additional value, the researchers carried out the research to understand in-deep the TPM implementation planning at Sona Koyo Steering, Gurgaon. Besides, the researchers emphasized the tangible impacts as well as intangible benefits derived at different stages during TPM operation. The research found tangible impact after implement TPM such as improving delivery rate by 15.4 percent, reducing customer complaints by 87 percent, improving equipment effectiveness by 28 percent, improving profit of the group by 100 percent, improving sales turnover by 60 percent and reducing breakdown frequency by 21 percent.

Besides, Sandeep et. al., (2014) recommended the TPM initiative should be implement effectively in the organization in various industry due to positive intangible impact after implementing TPM. For the research, the intangible impacts are the increase in team spirit and group behavior in operators and staff, development of clean, dry, bright, visual and likely work places, appreciation from customers and other visitors during plant visits, multiskilling abilities done by operators, increase in the ownership of equipment and workplace by the operator and increase in confidence of their ability to perform complex jobs/problems by operators and staff.

Based on the results of TPM applications in different industries, it can be seen that the ideal concepts of TPM are still the same. TPM is an essential tool in handling and managing assets to develop the company performance. Although TPM has been reported widely in various industries, yet, to date, there are still limited attention been paid to TPM implementation in the utility industry, particularly in the power generation company. The researcher believes that the utility industry is one of the key players that contribute to the country's growth.

2.5 Organisation Performance in TPM

Organization performance, generally measures the success of a group of people in the organization in meeting the objectives and goals. Organization performance is defined as the organization's outcome as results when the company performs the task and function (Gollenia, 2016; Heracleous, 2001; Hana & Emirate, 1999). The outcomes to the organization performance within corporate organization is measured through financial performance, market performance and shareholder value performance. There are many factors contributing to the high performance to ensure the effective ways for organizations in carrying out the tasks and functions. High performance organization so-called total organization performance involves various contribution such as company policy, mission and vision, employee's involvement and financial strength (Schaltegger, Hansen & Lüdeke-Freund, 2016; Uhlenbruck, Meyer, & Hitt, 2003; Kaka, 2000).

Although there are set of performance measures that have commonly recognized and applied in an organization, yet, the measures can be customized according to the needs of the organizations. For instance, the organization performance is determined by calculating the ratio of the input to the output which can presented in financial term (Tushman & Romanelli, 2008). The performance measures allow the companies to stress on the areas needed to recover further for better future. Organization performance assesses how excellent the task had been done by a group of people (Terziovski & Samson, 1999;

Heracleous, 2001; Hailey, Farndale, & Truss, 2005; Muduli, 2015). As stressed by Muduli (2015), the activities, initiative and program embarked by the organization have the particular goals and organization inspire to achieve desire objective. Consequently, each of the initiative have original target for the organization performance to achieve.

The performance measures should be subjected to the organization target, or in other words, the things to be achieved in a particular period (Chrits, 2015). Consistently, Rahman and Eravindran (2015), suggested the industry and organization must have their own key indicators which indicate their achievement. Different industry should have different achievable value to meet. Bell (2016), also agreed on the need of setting up the key performance as an insight for the managements to measure the organization outcomes. Hence, it is essential to study the organization's specific performance measures in different types of industry (Kamil & Nazrin, 2018; Bell, 2016; Ananda & Crish, 2007; Govin, 2001).

As deliberated before, organization performance for various types of industry is slightly different. Salman (2013) mentioned the performance for hospitalities industry is referring to the customer satisfaction, less negative complaining and organization branding. Meanwhile, Sapura, Ern and Crock (2015) claimed that the organization performance for supply chain industry was expressed through the ability of the organization in ensuring the continuity material supply throughout the quality supplying management system. In Jordan, Hamed (2015) measured the organization performance in the milling industry which is applied the Total Quality Management (TQM) as a maintenance strategy. According to Steiner (2000), organizational performance for utilities industry in power generation is the capabalities of the power plant continiously generate the electricity to meet the country demand which is consequently meet the stakeholder expectation (Lombert, 2015; Rettab, Brik & Mellahi, 2009; Rahman, 2001). Indeed, the availability and reliability of the power generation impact on the production activity and consequently influence dramatically on financial performance.

In the perspective TPM, Soon (2010) emphasized that the performance measures should reflected the maintenance practices. Organizations objectively required to transform the existing maintenance practice, so the TPM performance indicates through right maintenance policy, establish suitable procedure and the change of employee work culture. As mentioned by McDone (2014) and Badli (2012) the successful of TPM implementation is by looking at the TPM level of practices. The adaption and adoption of TPM activities by the employees also indicates the TPM performance. The TPM performance is elaborated further in Section 2.5: Organisation Performance in TPM.

As discussed before, TPM is tentatively a part of a management system which is applicable to practice among the companies in this industry (Peng, 2016). The execution of TPM is to ensure the company is still economical and relevant to the market workplace. Eti, Ogaji, and Probert (2006), wrote that to prevent the organization failure in competing in the market workplace, the organization must implement TPM initiative as part of the organization strategy. Moreover, the TPM could be defined as a structured equipment-centric continuous improvement process that strives to optimize production effectiveness by identifying and eliminating equipment and production efficiency losses throughout the production system life cycle through active team-based participation of employees across all levels of the operational hierarchy (Campbell, Jardine, & McGlynn, 2016; Heizer, 2016). In addition, the key elements in having TPM is to have continuous improvement of the equipment, optimization of the production, improvement of maintenance activities, the involvement of all levels of employees during TPM activities, the employee roles and responsibilities and also enhancing the business performance (Turanoglu, Cakmakci & Kahraman, 2016; Lycke, 2000; Willmott, 1994).

Sahin (2000) explained that the TPM was idealized from the Lean initiative common element where it covers the process of production in industry, flexible equipment and machine conducted by employees. The employees in the organization are closely in touch with the program and the key person of the program. Thus, the sense of belonging and responsibility to the equipment is developed in the operator and staff. Consequently, the staff is engaged directly to the equipment and takes full responsibility in ensuring that the equipment performs well (Ahuja & Khamba, 2008; Ireland & Dale, 2001). Having said that, the TPM pillars clearly encourage the roles and responsibilities of the management and staff to the equipment and machine owned by the company (Sallis, 2014).

However, there are negative views from employees' perspectives pertaining the TPM initiative. Patterson (1995) claimed that the employees reject the TPM initiative due to the perception of additional work and being comfortable with the existing routine. Employees believed the autonomous maintenance practices loom and overwrite their current task and at the same time break their working skill capability (Ahuja et. al., 2006; Wang, 2006; Blanchard, 1997). Because of too many complaints, the issues were raised up by the employees to the union to reconsider the TPM program (Sallis, 2014; Lee Cooke, 2000). McAdam and Duffner (1996) stipulated that most of the issues are raised by the union during TPM initiation at the workplace. The union believes that the TPM initiatives will burden on the employees' current work scope. Employees have a mind-set that the only way to gain profit to the company is to increase production efficacy and effectiveness, reduce labor cost, and upsurge the employee work load (Lee Cooke, 2000). Thus, the organization and union need to understand of the TPM implementation. Some people in industry believed, instead of saving money TPM is also a philosophy on guiding people to feel belonging and responsibility to the machine performance and equipment effectiveness (Sharma & Singh, 2015; Wireman, 2004).

Indeed, TPM presents the OEE model to demonstrate the outcome of the program (Attri et. al., 2013; Wireman, 2004; Hansson et al., 2003). Basically, there are many researchers who have carried out OEE activities to evaluate the effectiveness of the TPM program embarked by the company. Almeanaz (2010) presented the aims and profits of applying TPM. The researcher focuses on manipulating the overall equipment effectiveness in one of the steel companies in Jordan and it also deliberated the losses contributed to the industry. Ron and Rood (2006) studied the TPM overall equipment effectiveness where it performs the efficiency OEE in metric form in the semiconductor industry. In facts, most of researcher notice that OEE was performed and well established in the industry (Gupta & Vardhan, 2016; Kamath& Rodrigues, 2016; Tomar & Bhuneriya, 2016; Mansur, Rayendra, & Mastur, 2016; Vijayakumar & Gajendran, 2014; Ng, Chong & Goh; 2014).

According to the JIPM which was established in 1989, commonly the TPM aim is to develop the corporate culture through optimizing the production effectiveness. In addition, the TPM also aims in promoting that employees attend to the minor maintenance activities or namely self-maintenance. The TPM activities promotes to prevent losses by achieving zero accidents, zero defects and zero breakdowns (JPIM website, 2017). JIPM mentioned, TPM is the tools for improving maintenance strategy, increase equipment life cycle, reduce maintenance cost, optimal equipment productivity and consequently increase organization profit. As reported in JPIM website, the TPM includes the organization productivity, development of the business, and increasing sales profit. In total, the TPM intend to achieve zero losses by carrying out the TPM activities. supported by Ritz and Khaled (2016), TPM initiative is comprehensive program which perform in technical philosophy and firm in management science.

According to Wireman (1991), there is no stringent method for implementing the TPM activities because the TPM concepts are exposed to various industries. So that, the TPM performance could be evaluate in many ways subject to the industry types (Abdallah, 2013; Dora, Kumar, Goubergen, Molnar & Gellynck, 2013). Supported by Campbell and Reyes-Picknell (2015) and Bamber (1999), the TPM program is challenging and involves complex processes. Due to that, Bamber (1999) proposes to examine the TPM practices and TPM success factor in ensuring that the TPM is successful in meeting the company goal. Many researchers carry study the mechanism to evaluate the outcomes of TPM after implementation phase (Jardine & Tsang, 2013; Brah & Chong, 2004; McKone et al., 2001).

As stipulated by Kamil and Nazrin (2018), there is many ways in measuring the TPM performance, subject to the organization ultimate goals. Inconclusively, the TPM performance could be firm and indicates in many method, subject to the organization need and want. Table 2.4 below represent the previous literature discuss for TPM performance which is subsequently related to the organization performance.

Table 2.4

TPM Performance towards Organization Performance

Measurement of TPM Performance	Kedar, & Borikar, (2016)	Nagaraj & Lewlyn (2016)	Sethia, Shende, Dange (2015)	Abhishek, Rajbir & Harwinder (2014)	Jain, Bhatti, & Singh, (2014).	Boban and Jenson, (2013)	Aspinwall and Elgharib (2013)	Kaur, Singh, Ahuja, & Singh, (2014)	Jain, Bhatti, & Singh, (2013)	Ohunakin and Leramo (2012).	Maletic, and Gomiscek, (2012),	Kumar, Varambally and RodrigueL. (2012	Rolfsen and Langeland, 2012).	Singh and Singh, 2012).	Sivakumar and Saravanan, 2011).	Sharma and Trikhab (2011)	**Total score**
Equipment Effectiveness/Availability	/		/	/		/		/	/			/			/	/	9
Autonomous Maintenance	/			/			/		/		/		/	/	/		8
Machine/Equipment Efficiency	/	/	/	/													4
Planned Maintenance/ Maintenance Strategy		/		/	/		/				/	/			/	/	8
Process & Continuous Improvement							/				/			/			3
Productivity/ Performance Delivery					/					/					/		3
Machine/Equipment/ Product Quality		/			/			/	/					/	/		6
Cost / Financial Measurement					/												1
Employee Morale/Job Satisfaction					/					/							2
Safety & Hazard Improvement					/												1
Modernization & Product Sustainability																	0
Competitive Environment/ Culture																	0

Table 2.4 (Continued)

Measurement of TPM Performance	Eugen (2010)	Almeanazel (2010).	Garza-Reyes, Eldridge, Barber Kevin, and Soriano-Meier, (2010),	Lazim and Ramayah (2010)	Cesarotti and Spada, (2009)	Shahanaghi and Yazdian, 2009).	Ahuja and Khamba (2008)	Garg and Deshmukh (2006)	Sharma et al. (2006)	Gupta,, Tiwari, and Sharma, (2006)	Eti, Ogaji, and Probert, (2004)	Hansson, Backlund, and Lycke, (2003)	Wal and Lynn (/2002)	Chand and Shirvani, 2000).	Ben-Daya, (2000),	Roup, (1999).	**Total Score**
Equipment Effectiveness / Availability	/				/		/	/	/			/		/	/	/	9
Autonomous Maintenance		/		/	/		/			/		/		/	/		8
Machine/Equipment Efficiency			/		/		/		/								4
Planned Maintenance/ Maintenance Strategy	/	/		/	/		/	/				/			/	/	9
Process & Continuous Improvement							/				/						2
Productivity/ Performance Delivery			/						/					/			3
Machine/Equipment/ Product Quality				/					/								2
Cost/ Financial Measurement																	0
Employee Morale/Job Satisfaction																/	1
Safety & Hazard Improvement																	0
Modernization & Product Sustainability	/																1
Competitive Environment/ Culture											/						1

Source: Develop for this research

From the Table 2.4, the equipment effectiveness, autonomous maintenance and planned maintenance recorded the highest top three from the total score measuring the TPM performance. Therefore, these three element measure the performance in TPM which is expected gives significant impacts to the organization performance aimed in power generation industry. This TPM performance is indicating the organization performance which is reflecting from the TPM practices whereby applied thru the TPM program in the organization (Kedar & Borikar, 2016; Bong & Ping, 2011).

2.5.1 Equipment Effectiveness

In the 1960s, Nakajima formulated the term overall equipment effectiveness or namely call as equipment effectiveness as indicator on evaluating how effective the operation of manufacturing equipment. According to Neely, Gregory and Platts, (1995), defines performance measurements as the process of quantifying the efficiency and effectiveness of action. The equipment effectiveness evaluation is significantly different which regard to the equipment types, industry productivity and end product of the manufacturing (Anderson, 2012; Abdullah, 2003; Bamber, Sharp & Hides, 1999). Agreeing with Blanchard (1997), the equipment effectiveness activities totally discovered to the process performance improvement and identify scope how to get the equipment improvement.

Kamil et. al., (2018), Graisa and Al-Habaibeh, (2011) and Parida and Kumar (2006), agreed where the overall equipment effectiveness is the tools to indicate performance in TPM. Explained by Raj and Malini (2014), equipment effectiveness represents the fraction of definite equipment productivity to its theoretical maximum productivity or actual design theory. By looking at the goals of TPM, it purposely to mobilize the optimum performance and the Zero loss related to means no interruption in production where it involves scrap or defect, no breakdown, no accident, no waste in the process running or changeover. The quantification areas of these accumulations of waste in time and its evaluation to the entire obtainable time can give the production and the maintenance management a general perspective on plant availability and equipment life cycle (Kaur et. al., 2014; Hashim, Habidin, Conding, 2012; Shulver, 2010).

According to Parida & Kumar (2006), the efficiency and effectiveness of the equipment and system plays an important role in an organization's success, which is directly describes the contribution of TPM initiative to the organizational growth. Therefore, the performance in TPM in such equipment availability, machine capability, needs to be measured by applying the performance measurements in total with the special tools, mechanism by reflecting to the organization management philosophy. Anupindi (2008), supported that the needs of equipment effectiveness for measuring and improving required system, thus a feature that the customer does not value is a waste of time and resources.

Arunraj and Maran (2014), found that the evaluation of equipment effectiveness consequently increases the equipment improvement and it is the major assistances in TPM implementation and has been discussed in most of the literature. The equipment effectiveness evaluation mechanism calculation helps the organization on evaluation of the equipment effectiveness. Due to that, equipment effectives is the rights mechanism in measuring the performance in TPM because this mechanism considering with measurable component consists of the availability, performance and quality of the equipment. Each of the components is response to the total productivity process (Kamil et. al., 2017). Regards to the three components, its broken down into losses whereby breakdowns, changeovers, minor stoppages and speed loss usually being the largest contributors (Badli, 2012, Suzuki 1994). Thus, TPM implementation methodology is suggested for improvement in the availability, performance efficiency and the quality rate, results in improvement of the overall equipment effectiveness of the equipment.

According to Camelia (2016), measuring the equipment effectiveness of the machine would be applied as key performance indicator (KPI) in conjunction with the lean manufacturing effort to provide an indicator of success. Supported by Eric and Caroline (2015), the equipment effectiveness is indicating throughout measuring, observing with detail inspection of the equipment performance which has become an industry standard. Therefore, the organization must be setting up the target to achieved at TPM performance once implement the TPM initiative.

2.5.2 Autonomous Maintenance

Autonomous maintenance is maintenance strategy wherein machine adjustments and minor maintenance is performed by operators who are deemed to have unique knowledge about the equipment. According to Ahuja et. al., (2008), the autonomous maintenance demonstrate the capability of operators do the easy maintenance such as appliance initial cleaning to the machine, topping up the lubricant, carry out the minor repair work; adjusting screw, tightening the bolts and nuts and improving the operation procedure.

Some of researchers claimed the autonomous maintenance is a principal pillar of TPM (Kamil et. al., 2018; Mior & Amirol, 2017, Teeravaraprug, Kitiwanwong & SaeTong, 2011; Al Najmi & Fahida, 2010; Venkatesh, 2007; Ahuja et. al., 2008; Suzuki, 1994).

As described through the website by France Industrial Forum 2018, TPM activities concluded is about seventy percent of the major losses is cause by the breakdowns, minor and speed losses as the accelerated deterioration of the equipment. Due to that, the website promotes the autonomous maintenance in order to reduce the equipment losses rate and consequently preventable deterioration of equipment (Muller, 2017; Kamisi & Norin, 2012). According to Chris Hohmann (2017), the autonomous maintenance also encourage employees increase the sense of belonging to the equipment, in such ways aims to give both competence and responsibility for routine maintenance, such as cleaning, lubricating, and inspection to employee.

Chris Hohmann (2017) explained the autonomous indicated the employee capability and should be indicate the successful of TPM initiative. According to the researchers; Kamil et. al., 2018; Kulkarni & Dabade, 2013; Wee and Nordin, 2012; Ahuja et. al., 2012; Söderholm, Holmgren & Klefsjö, 2007; Wood, 2005; McKone et. al., 1999; Yamashina, 1995; the successful of autonomous maintenance is indirect indicator to the performance in TPM. The successful of autonomous maintenance is imitate to the simple mundane tasks with respect to the expected outcomes such as operators' greater "ownership" of their equipment, increased operators' knowledge of their equipment, ensuring equipment is well-cleaned and lubricated, identification of emergent issues before they become serious failures and freeing maintenance personnel for higher-level tasks (Chris Hohmann, 2017).

As stipulated by Chriss Hohmann, (2017) autonomous maintenance put simply is the restoration and prevention of accelerated deterioration and has a major positive effect on equipment effectiveness. It is a step by step improvement process, rather than production teams taking on maintenance tasks. While visitors to TPM Prize Winning plants may be impressed by the operator maintenance standards displayed in the workplace, and the condition of the equipment and OEE performance, these are all the effects or endpoints of autonomous maintenance, and to reach these endpoints companies must follow the step by step process defined by the Japan Institute of Plant Maintenance (JIPM).

Kamath and Rodrigues, (2016) explained the autonomous maintenance is belonging to the operators which is involves in TPM activities. However, the maintenance technicians prompt to assist with regards to the sufficient activities improving the maintenance activities. As mentioned before, the autonomous maintenance encourages to provide the operators with more responsibility and allow them to carry out preventive maintenance tasks. According to Ahuja et. al., (2012) (2008), the conventional maintenance programs, a machine can run until it breaks or reaches its maintenance date. The maintenance department is then responsible for handling/fixing it. In contrast, autonomous maintenance allows machine operators to carry out directly simple maintenance works (lubrication, bolt tightening, cleaning and inspection) to prevent breakdowns and react faster if a certain failure has been detected.

As agreed among researchers, TPM was developed by Japanese companies, trying to extend the existing concept of Total Quality Control (TQC) with the ideas of preventive and predictive maintenance programs (Kamil et. al., 2017; Jain et. al., 2014; Sallis, 2014; Kalili, 2013; Graisa & Al-Habaibeh, 2011; Eric et. al., 2010; Ismail, 2009; Ahuja et. al., 2008; Suzuki, 1994; Nakajima, 1965). Since TPM gives operators much more responsibilities, a dedicated training is required as well as some modifications on the machines to ease operations of cleaning and maintenance. This will significantly increase the operators' skills level and helps them better understand how to maintain and even improve the equipment.

Respond to the growing demand in various industries, the top managements reflect in action to escalate the production activities by increasing the machine performance. In such formal method available in the market, its significantly not meet the significant growth in the field, with regards to the organization demanding. Therefore, autonomous maintenance comes as additional methodology to facilitate and achieved an increment in efficiency and productivity in a historical brisk pace. Beside indicate the performance in TPM, autonomous maintenance could be indicator to the organization management improve the current TPM practicing.

2.5.3 Planned Maintenance

Planned maintenance or specifically call as schedule maintenance is explicated the maintenance strategy as indicated the performance in TPM implementation in the organization (Kamil et. al., 2017; Kamath & Rodrigues, 2016; Ahuja et. al., 2008). The planned maintenance indicates how success the performance of the organization in managing the assets throughout planned maintenance (Shamsul, 2015; Badli, 2012; Omar & Al-Najmi, 2006; Miame, 2004). Basically, the planned maintenance is roles up by maintenance teams. The initial phase prioritizes equipment and involves evaluating current maintenance performance and costs to set the focus for the pillar activity. Support is provided to the autonomous maintenance pillar to establish a sustainable standard basic condition and the team focusses on eliminating the causes of breakdowns.

According to Wood and Brian (2003), planned maintenance covered the planned preventive maintenance by carried out proper maintenance scheduling to ensure that an item of equipment is operating correctly and to therefore avoid any unscheduled breakdown and downtime. Preventive, or seasonal maintenance activities performed prior to structure, system, and component failure which may be initiated by predictive or periodic maintenance results, through vendor recommendations, or by experience and lessons learned (Aspinwall & Elgharib, 2013; Grade, 2006). These include actions such as scheduled cold weather protection, valve repacking, replacement of bearings as indicated from vibration analysis, major or minor overhauls based on experience factors, or vendor recommendations and replacement of known life-span components (Zainuddin, 2015; Badli, 2012; Ahuja et. al., 2012). For example, repacking a valve due to packing leakage would be corrective maintenance, but scheduled repacking prior to leakage would be planned maintenance (Hashim et. al., 2013; Wood & Brian, 2003; Becker, 2001; Bamber, Sharp & Hides, 1999).

Stipulated by Ahuja et. al., (2012) the planned maintenance also involves with resourcing activities, handling stock and inventory processing, managing supply chain, employee and manpower scheduling, procurement processing, preventive maintenance and performance measurement for equipment improvements. Agreed with Chert (2013), along with condition-based maintenance, planned maintenance comprises preventive maintenance, in which the maintenance event is preplanned, and all future maintenance is preprogrammed. Planned maintenance is created for every item separately according to manufacturer recommendation or legislation. Plans can be date-based, based on equipment running hours, or on the distance travelled by the vehicle. Consequently, planned maintenance encourages management to do maintenance strategy in advance by minimizing any losses to equipment (Omar & Al-Najmi, 2006; Kamsia, 2003).

According to Steve Stephenson (2018), besides indicate the performance in TPM, planned maintenance is a proactive approach to maintenance in which maintenance work is scheduled to take place on a regular basis. The type of work to be done and the frequency varies based on the equipment being maintained, and the environment in which it is operating. The primary objective of planned maintenance is to maximize equipment performance by keeping equipment running safely for as long as possible, without that equipment deteriorating or having unplanned outages (Steve Stephenson, 2018; Brian

2003; Ahuja et. al., 1998). The prior equipment to be taken off for service for maintenance is decided within the planned maintenance program. Due to that, the maintenance, operation, and employee in support service in the organization is directly involves to give input of the equipment performance (Arshida & Agil, 2013; Berry et. al., 2007).

Planned maintenance activities include any maintenance work scheduled in advance. For example, changing the oil in a vehicle because the oil light came on is not planned maintenance. Changing the oil because the vehicle had gone 3,000 miles would be planned maintenance. Some researchers clarified the planned maintenance is a standard scheduled maintenance activity for the organization, or service visit, that is done to ensure that the equipment, or equipment components, are operating correctly in normal and within the manufacturer recommendations (Bon, 2011; Bonavia & Marin, 2006; Chan, 2005; Ben-Daya, 2000). In advance planned maintenance, the organization well-being prepares the needs such as budgeting, manpower, expert and organizing productivity in facing with the predicted maintenance to the equipment (Steve Stephenson, 2018; Ahuja et. al., 2012; Robin 2003; Seth & Sing 2000).

As indicator to the performance in TPM implementation, planned maintenance evaluates in many ways. The schedule for planned maintenance tasks can be based on equipment running hours, number of items produced, distance traveled, or other measurable factors. Besides, McCarthy and Rich (2015) and Rama (2007) explained there is indirect benefits through planned maintenance which includes, improved workplace safety, procedures are established to plan the use of, monitor, and control maintenance resources, improves the communication between maintenance and operations, provides a daily plan for maintenance supervisors such that employees have a full day of work every day. In addition, planned maintenance establishes a performance monitoring system that allows maintenance activities to be better evaluated and improved (Steve Stephenson, 2018; Wendy, 2015; Azizul & Tarmizi, 2013; Kern & Woollen, 2004).

By looking at the previous researcher's findings, most organizations have the same goal embarking the TPM initiative. According to Sallis, (2014), TPM is about managing the company assets. It gives guidance to the management and staff on handling assets. Through the TPM pillars, it drives supervision of the staff accordingly. All the pillars also aimed the to the TPM key activities, roles and responsibilities of the person in charge during the TPM implementation (Oakland, 2014: Ahuja et. al., 2013). Beyond that, the need of organization to measure the TPM performance for better improvement also discussed among the researchers. Instead of driven equipment, TPM promotes the better future on planning and sustaining the assets of the organization (Oakland, 2014). Therefore, from time to time the organization require for measuring the TPM performance to ensure the TPM practice is effective and reasonable enough (Kamil et. al., 2018; Shamsul, 2015; Okland, 2014; Baluch, Abdullah & Mohtar, 2012; Azizul & Tarmizi, 2013; Meng & Chia, 2011; Ahuja et. al., 2008; Bamber et. al., 1999).

2.6 TPM Practices and Critical Success Factors

TPM practices describe the methodologies applied during implement the TPM activities (Kamil & Nazrin, 2018; Camelia, 2016). According to Zime (2016), the TPM practicing embarked in the organization could be different between each industry, factors of business environment. Adaption total TPM practicing from JIPM more challenges and difficult due to complexity of process and ridiculously involves total change organization culture (Kioto, Miamie & Joun, 2016). Systematically, the organization top management prerequisite to study the TPM practice which is appropriate to the organization business environment. In deep, Zarikh (2015) promoted the relationship between TPM practices and Critical success factors (CSFs). CSFs are a means the critical factors facing by the organization to meet the goals for success. Scientifically, the organization must look into the important factors and practices which is obstacle during the implementation period. This is the right ways on handling and cater all the problem for better success (Al-Refaie, & Hanayneh, 2014). Likely, most researcher agreed that the purpose of carried out CSFs and best practices study is to identify the best action to be taken by the organization (Al-Refaie, & Hanayneh, 2014; Axelsson, Melin & Soderstrom, 2011). By doing that, the organization got the opportunities to improve the current practice and tackle the problem and issues effectively.

According to Esptin and Buhavac (2014), the CSFs and best practices concepts could be similar which is objectively to meet the success at the end. However, both concepts determine the need of action to be taken by improves the organization program or project to meet the goals. Throughout this method, the organization can find and promote to the project successfully by providing the right methodologies. By firm the right methodologies, the origination of maintenance practice improves accordingly. Al-Refaie, and Hanayneh (2014) agreed that the best practices and CSFs encourages the management on handling the problem and issues faced during the implementation period. By eliminating the critical issues, the organization can focus to expand the initiative to the optimum limit and advantage to the organization (Kamal & Endy, 2015; Epstein & Buhovac, 2014; Li, Hu, Zhang, Deng, & Mahadevan, 2014).

Therefore, the best ways can express as the right methodology for organizing the process which is applicable in various situation such as conducting projects, organizing procedure, managing productivity, operating machine and handling equipment. The best ways must come with good results and comprehensive work (Epstein & Buhovac, 2014; Timenes Laugen, Acur, Boer & Frick, 2005; Camp, 1989). Supported by Wagner et al. (2006), there is no short package for achieving organizational success, organization require to do homework working for the best way and come out with best practices. Timenese et. al., (2005) the best ways is not only considering the proper procedure, its involves with safety, environment, time constraint and people. Besides, the best ways promote the employees to enhance their skill, knowledge and expressively increase the competency (Ahmed & Muzakka, 2014; Timenese et. al.,2005).

However, some researcher debate where CSF could diffuse to be critical element for the organization succeeding (Kioto et. al., 2016; Al-Refaie, & Hanayneh, 2014; Wallin & Hussi, 2011; Timenese et. al.,2005; Aishah (2004); Husin & Bakar, 2000). The organization must be able to list out the factors and determine the risk facing, which reduce the momentum of the organizations. Additional value to the CSFs, the organization prospect to evaluate and identify the fuel of success. Thus, most researcher recommend which factors influence the organization success is subject to the organization capabilities; determine the CSF, multi various of discipline, define proficiency (Aishah, 2004; Husin & Bakar, 2000). With criticizing the best practice meaning, most researcher is willingness to interoperate best practices implication with meaningful to the industry. However, Wagner et al. (2006) claimed the organization require do researcher for deeper understanding on managing the best practices issues. The fact that practices that have been modified still are marketed and sold as "best practice" makes the authors question the ethical dimension of best practice (Epstein & Buhovac, 2014: Wallin & Hussi, 2011).

Wagner et al. (2006) and Clarke (1999) explored and extremely research to find out the best practice resources. The best practices potentially questioned by the people if the organization wrongly interoperate the best practice means. In facts, Wagner et al. (2006), study found-there is slightly misunderstanding on standardizing the best practices and routine works. Besides, the best practices might be the guidance to the employees to do better in such activities. Consequently, employees freely choose the best way to achieve the target set by the organization (Ramesh, 2015; Lwoga, 2014; Clarke, 1999). Ramesh (2015) stipulated the best way or best practices is not significantly meaningful if the organization failed to reach their target. Besides, the best practices are the platform to the employees to show their competency, technical knowledge, innovative mindset and the extreme competency which are polish the employee talent.

Supported by Badli (2012), in order to ensure that the project or program achieved the main goal, there are needs of a measurable element called Critical Success Factor

(CSF). The CSFs describe the factors that influence the success of the project, program, business, and activities with proper data analysis. One of the pioneers in CSF research, Rockart (1979), defined that CSF is a managerial and directional method for managers to identify the information needed to ensure that the organization meets the main goal. CSFs could be used as basics needs that are vital for a strategy to be successful and achievable. Instead of focusing on the relevant performance measures, Johnson, James and Michael Friesen (1995), also figured out that CSFs involve various factors that are subjected to the organization key performance indicator. Therefore, the CSFs need to be understood when embarking on the TPM initiative (Kamil et. al., 2018; Shamsul, 2015; Catz, Rony, & McLenr, 2013; Rasse, 2010).

According to Rockart (1979), the CSF works as a guidance to the conceptual antecedent, "success factors," introduced by D. Ronald Daniel in 1961. Daniel discussed the problem of inadequate management information for setting objectives, shaping strategies, making decisions, and measuring results against goals. Daniel asserted that organizational planning information should focus on "success factors," which he described as "three to six factors that determine success…key jobs [that] must be done exceedingly well for a company to be successful" (Daniel, 1961). Agreeing to Boynton, and Zmud (1984), the critical factor is a management term for an element that is necessary for an organization to achieve their program objectives.

"Critical success factors are those few things that must go well to ensure success for a manager or an organization, and, therefore, they represent those managerial or enterprise area, that must be given special and continual attention to bring about high performance. CSFs include issues vital to an organization's current operating activities and to its future success."

Source: Boynton and Zmud (1984)

Boynton and Zmud (1984) conclude that the weaknesses attributed to CSFs can be overcome through careful application of the method, while CSF strength as a structured design process for eliciting organization initiative and managerial information needs is key to its success. Ika et. al., (2012) and Ismail (2009) stressed that most researcher resume that the different TPM practices is practicable for the particular businesses, selective industries. The restriction factors that contribute to the TPM practices and TPM CSFs are clearly identified and positive action must be taken accordingly (Maran, 2013; Sofea, Hanim & Maira, 2010; Selim, 2007).

Lwoga (2014) and Daniel (1961) reported the factors must be improving for better future to the company and factors will change with times. Culture and the organization need change with time, organization need to reform and firm responsive to the advance challenges (Alreemy, Chang, Walters & Wills, 2016; Mir & Pinnington, 2014; Mozek, 2014). Literature on the TPM practices and TPM CSFs had been done by previous scholars. Having said that, TPM practices and TPM CSFs must be examined in order to identify the weakness and success of the implementation which is as part of the implementation strategy (Marzagão & Carvalho, 2016; Ika, Diallo & Thuillier, 2012;

Aksorn & Hadikusumo,2008; Sabherwal & Kirs, 1994). Table 2.5 presents the summary of literature emphasized the TPM Practices within the industries.

Table:2.5
Summary of Literature Emphasize the TPM Practices

Literature Source	Research Topic
Kamil et. al., (2018)	The study indicated the appropriate TPM practicing as maintenance practices in utilities industry. The researcher lists the Critical Success Factors (CSFs) which is affects to the TPM activities, sustaining and challenging of the TPM program.
Kentz and Maria, 2017	The study carries out in mining industry located in Java East which is implement autonomous maintenance, basic cleaning stated in TPM. Indeed, the practicality of TPM was argued by the researcher on appropriateness of this program to the industry.
Robert, Wong and Ann (2017)	The study prioritized the TPM practices in manufacturing industry by measuring the criticality. The researcher highlighted the several factors influence TPM effectiveness during implementation period; motivation, reward, working hours and competency.
Harith, Grill and Govinda (2016)	The study examines TPM practices in terms of issues, challenges and barriers during the TPM implementation phase. The study also indicated TPM performance measurement which is includes; maintenance managements, autonomous maintenance and product management.
Azizul (2014)	The study investigates the relationship between TPM critical success factors and organization performance thru qualitative method. The study emphasis TPM practices; engineering equipment, managing resources and cleaning effectiveness.
Linden et. al., (2015)	The study is exploring the industrial maintenance performance analysis routine which investigated the risk of human error during maintenance work. The activities explore the best practices such as; maintenance planner, education, and competency
Sari et. al, (2015)	The study is about TPM implementation, TPM philosophy, adaption and adoption of TPM in the project carried out in Iraq. The study stressed the recommendation need to be done to improve the TPM implementation at the organization.

Table 2.5 (Continued)

Literature Source	Research Topic
Renganathan (2014)	This study examines the impact of TPM practices on manufacturing performance through SEC/GEM standard for electronic contract manufacturing companies. The study realized the total involvements to improve TPM implementation.
Julius Induswe (2013)	This study was done in large manufacturing firms in Kenya to establish the challenges, success factors and benefits of implementing TPM. The research also recommends to widely investigate the TPM practices in various industry.
Badli (2012)	The study measured TPM practices and the level of importance of TPM CSFs in Malaysia's automotive SMEs. The study indicated the level of TPM practicing such as training and education, autonomous maintenance and maintenance planner.
Meng and Woon (2011)	This study focuses on TPM practices and TQM initiatives embarked in electrical and electronic industry in Malaysia. The study criticizes the TPM implementation which is indicates selective TPM practices.
Zainuddin (2010)	TPM improves employee current practice, change the existing employee culture by establishes the standard operating procedures. TPM practices is hands on by operators and study emphasis evaluate the employee adaption and adoption.
David, Lee and Amida (2008)	The purpose of the study is to clarify the justification for TPM, understand how TPM could impact production system, and identify the barriers and enablers of TPM implementation. The researcher addresses the practicality of TPM implementation at production line/system.
Rama, Ginta dan Bawang (2005)	The study evaluates the TPM practicing applied in service industry, tourism industry in Bali, Indonesia. The study also examines the difficulties and challenges facing by the industry introduce the TPM initiative against the employee culture.
Mabunda (2003)	The study evaluates the impacts of TPM implementation in manufacturing industry in South Africa. The selected TPM practicing must suit to the employee culture and behavior.

Source: Develop for this research

As highlighted by Carrijo et. al., (2014) and Lima (2014), the TPM practices and TPM CSFs are categorized between managerial level and operational level. The success factors in each level are slightly different between the organizations. Carrijo et. al., (2014) observed various feedback and response from both the top management and employees when implementing TPM. From previous studies, those factors contribute to the TPM relevancy and impact the organization. Supported by Ikhwan (2015), the TPM practices and TPM CSFs contributed to the organization success, the TPM program and the organization readiness facing with the issues. The organization was recommended to single-mindedness stress on the issues that makes conflict, doing engagement, researching the sources, eliminated the problem and promptly take action (Ikhwan, 2015: Shuk & Dell, 2014).

According to Ireland and Dale (2006), the organization managerial level is related to the high administration commitment and management involvement towards the achievement result. Besides, Ireland and Dale (2006) also elaborated that the TPM operational level consists of personnel development and motivation, work environment, communication and interactive growth; these are the major characteristics contributing towards the program excellency. As stipulated by Oliveira, Muniz and Marins (2014), the TPM practices and TPM CSFs of embarking on TPM comprises of Top Management Commitment, Leadership, Management Dedication, Indicator and Targets, and Step Planning. A study by de Oliveira et al., (2014), also presents the intelligible relationship in top management contribution between the scrutinized company in the relation with its TPM success.

Chan, Lau, and Kong (2005), clearly mentioned the need to identify the practical and key success factors in implementing TPM program in an electronics manufacturing company. Chan et al., (2005), tried to find out the gap between the TPM theory, complications in the adoption of TPM and the problems faced by the company in order to fulfill customers' focus on product quality, product delivery time and cost of product. Shrivastava and Ganguly, (2014), examine and analyzed the TPM practices and TPM CSFs for the cement industry in India where originally it directly involves TQM. Shrivastava et al., (2014), described the study results is indicates that seven scales, which are top management for process cement plant; human capital; organizational practices and culture; customer requirements; green infrastructure; policies and practices; process management; green manufacturing in terms of legal and regulatory framework; suppliers involvement; and supply chain management and technology management are the most important practices and CSFs to be measured in order to accomplish optimal quality in the manufacturing industry.

According to Jain et. al., (2014) and Vanessa (2008), in TPM initiative, like many research methods, the practice and CSF method has both its supporters and critics. Almost thirty years on, most researchers keep investigate the comprehensive review of the original CSF method and of subsequent adaptations (Nicole 2017; Andri 2017; Aksorn, & Hadikusumo, 2008. Ehie & Madsen, 2005; Mabunda 2003; Rockart, 1979). The primary contributions and criticisms of the method are synthesized for better improvements. Table 2.6 below is list of TPM practices and TPM CSFs according to the scholars in various industries and research areas.

Table 2.6
TPM Practices and CSFs during TPM implementation.

Elements of TPM Practices and CSFs	Windle (1993)	Bamber et al. (1999)	Ahire, & Dreyfus, (2000).	Yusof, Aspinwall, (2000)	Hannson & Backlund (2002)	Katila (2000)	Chan & Shirvan (2000)	Cua et al. (2001)	McKone, Schroeder, & Cua, (2001).	Hale, (2002)	Christiansen, Berry, Bruun, Ward, (2003).	Kaynak, (2003).	Brah & Chong, (2004).	Nasurdin, Jantan, Peng, & Ramayah,	Seth & Tripathi, (2005)	Dale (2006)	Rodrigues & Hatakeyama, (2006)	Abdallah & Matsui, (2007).	Siong & Ahmed, (2007)	Ahuja & Khamba, (2008b)	Ismail Salaheldin, (2009)	Turkyilmaz, Tatoglu, Zaim, Ozkan,	Score
Leadership/Top Management	/	/		/		/						/			/	/	/		/	/			10
Organisation Strategy & Policy	/	/	/		/						/		/		/		/		/		/		10
Process Quality Management			/				/			/		/						/				/	6
Training and Education	/		/	/		/		/		/	/		/	/	/	/	/		/	/	/		15
Employee Involvement	/	/			/			/	/		/	/		/					/	/	/		11
Employee Empowerment																					/		1
Work Culture & Environment Factors				/			/	/	/		/		/	/		/		/		/	/		11
Maintenance Activities	/	/	/		/	/	/					/					/	/	/	/		/	12

Elements of TPM Practices and CSFs	Windle (1993)	Bamber et al. (1999)	Ahire, & Dreyfus, (2000).	Yusof, Aspinwall, (2000)	Hannson & Backlund (2002)	Katila (2000)	Chan & Shirvan (2000)	Cua et al. (2001)	McKone, Schroeder, & Cua, (2001).	Hale, (2002)	Christiansen, Berry, Bruun, Ward, (2003).	Kaynak, (2003).	Brah & Chong, (2004).	Nasurdin, Jantan, Peng, & Ramayah, (2005).	Seth & Tripathi, (2005)	Dale (2006)	Rodrigues & Hatakeyama, (2006)	Abdallah & Matsui, (2007).	Siong & Ahmed, (2007)	Ahuja & Khamba, (2008b)	Ismail Salaheldin, (2009)	Turkyilmaz, Tatoglu, Zaim, Ozkan, (2010).	Score
Focused Production & Productivity									/											/			2
Customer Satisfaction & Delivery							/		/						/							/	4
Performance Management				/	/		/		/			/			/						/		7
Continuous Improvement	/		/	/			/	/		/	/			/	/	/	/	/	/			/	14
Supplier Quality Management				/					/			/									/	/	5
Resources Management	/			/		/				/	/	/	/		/			/		/	/	/	12
Equipment and Assets Management						/								/	/						/		4
Financial and Budgeting												/			/								2

Elements of TPM Practices and CSFs	Windle (1993)	Bamber et al. (1999)	Ahire, & Dreyfus, (2000).	Yusof, Aspinwall, (2000)	Hannson & Backlund (2002)	Katila (2000)	Chan & Shirvan (2000)	Cua et al. (2001)	McKone, Schroeder, & Cua, (2001).	Hale, (2002)	Christiansen, Berry, Bruun, Ward, (2003).	Kaynak, (2003).	Brah & Chong, (2004).	Nasurdin, Jantan, Peng, & Ramayah,	Seth & Tripathi, (2005)	Dale (2006)	Rodrigues & Hatakeyama, (2006)	Abdallah & Matsui, (2007).	Siong & Ahmed, (2007)	Ahuja & Khamba, (2008b)	Ismail Salaheldin, (2009)	Turkyilmaz, Tatoglu, Zaim, Ozkan, (2010).	Score
Technology and Information system					/	/		/								/	/		/		/		7
Inventory Management									/	/		/											3
Communication & Promotion					/	/		/								/							4
Recognition & Reward									/	/													2

Source: Develop for this research

Elements of TPM Practices and CSFs	Suzailtuladwini, Nurul, Juriah, Anis & Nurzatul	Harsej & Yusof, (2011)	Jirarat, Ketlada & Nuttapon (2011)	Vishnu, Keshav & Shrikant (2011)	Hashim, Habidin, Conding, Zubir, & Jaya, (2012)	Damjan, Matraj & Bostan (2012)	Badli (2012)	Arshida & Agil, (2013)	Lazim, Salleh, Subramaniam & Othman, 2013).	Sivaram, Devadasan, Murugesh, 2013).	Haddad & Jaaron (2014)	Jain, Bhatti & Sign (2015)	Madanhire & Mbohwa, (2015)	Ahmad, Nor Aziati, Bon, Ngadiman & Chan (2015)	Ahmad, Zakua, Raja Zuraidah, Hisyamudin (2015)	Sharma & Singh (2015)	Singh & Ahuja (2015)	Pai, Srinivas, & Raghavendra, (2016)	Brodny, Stecula & Tutak, (2016).	Score B	Score A	Total Score
Leadership / Top Management	/	/			/		/	/		/	/		/		/					9	10	19
Organisation Strategy & Policy	/	/			/						/	/		/			/	/		8	10	18
Process Quality Management			/							/		/			/					4	6	10
Training and Education	/	/			/		/	/			/	/	/	/	/	/		/		12	15	27
Employee Involvement		/									/	/					/	/		5	11	16
Employee Empowerment		/						/				/	/							4	1	5
Work Culture & Environment Factors	/	/			/			/			/	/						/		7	11	18

Elements of TPM Practices and CSFs	Suzailtuladwini, Nurul, Juriah, Anis & Nurzatul	Harsej & Yusof, (2011)	Jirarat, Ketlada & Nuttapon (2011)	Vishnu, Keshav & Shrikant (2011)	Hashim, Habidin, Conding, Zubir, & Jaya, (2012)	Damjan, Matraj & Bostan (2012)	Badli (2012)	Arshida & Agil, (2013)	Lazim, Salleh, Subramaniam & Othman, 2013).	Sivaram, Devadasan, Murugesh, 2013).	Haddad & Jaaron (2014)	Jain, Bhatti & Sign (2015)	Madanhire & Mbohwa, (2015)	Ahmad, Nor Aziati, Bon, Ngadiman & Chan (2015)	Ahmad, Zakua, Raja Zuraidah, Hisyamudin (2015)	Sharma & Singh (2015)	Singh & Ahuja (2015)	Pai, Srinivas, & Raghavendra, (2016)	Brodny, Stecula & Tutak, (2016).	Score B	Score A	Total Score
Maintenance Activities	/	/	/	/		/	/		/			/		/	/	/		/	/	12	12	25
Focused Production & Productivity												/		/	/					3	2	5
Customer Satisfaction & Delivery							/													1	4	5
Performance Monitoring			/	/				/		/	/	/		/		/	/	/		10	7	17
Continuous Improvement	/		/	/	/	/	/	/		/	/	/	/	/	/	/	/			15	14	29
Supplier Quality Management								/		/						/				3	5	8
Resources Management	/		/		/	/	/			/		/			/	/	/	/	/	12	11	24

Elements of TPM Practices and CSFs	Suzailtuladwini, Nurul, Juriah, Anis & Nurzatul (2011)	Harsej & Yusof, (2011)	Jirarat, Ketlada & Nuttapon (2011)	Vishnu, Keshav & Shrikant (2011)	Hashim, Habidin, Conding, Zubir, & Jaya, (2012)	Damjan, Matraj & Bostan (2012)	Badli (2012)	Arshida & Agil, (2013)	Lazim, Salleh, Subramaniam & Othman, 2013).	Sivaram, Devadasan, Murugesh, 2013).	Haddad & Jaaron (2014)	Jain, Bhatti & Sign (2015)	Madanhire & Mbohwa, (2015)	Ahmad, Nor Aziati, Bon, Ngadiman & Chan (2015)	Ahmad, Zakua, Raja Zuraidah, Hisyamudin (2015)	Sharma & Singh (2015)	Singh & Ahuja (2015)	Pai, Srinivas, & Raghavendra, (2016)	Brodny, Stecula & Tutak, (2016).	Score B	Score A	Total Score
Equipment and Assets Management								/												1	4	5
Financial and Budgeting							/		/											2	2	4
Technology and Information system											/	/								2	7	9
Inventory Management												/		/						2	3	5
Communication & Promotion												/			/		/			3	4	7
Recognition & Reward	/							/					/							2	2	4

Source: Develop for this research

As presented in Table 2.6 the highest score on the elements of TPM practices and CSFs are continuous improvement, maintenance activities, resource management and training and education. By looking at all of the TPM practices and TPM CSFs mentioned by the scholars, there are essential things to look deeply and study the TPM element. TPM practices and TPM CSFs indicate the willingness of various factors which contribute to the achievement of TPM inventiveness (Remys, Corro & Muller, 2016; Corn, 2015; Attri et al., 2013; Axelsson et al., 2011). A proactive action must be taken to compensate the weaknesses that existed during TPM program and hence to ensure that the objective is achievable. As stipulated by Attri et al., (2013), different organization will have different difficulties and restrictions, subjected to the type of industry. Recently, the TPM which was initiated at manufacturing companies has expanded to the process industry, such as TNB in Malaysia. Due to this, the researcher is interested to assess the practices as it could contribute to the TPM implementation process (Remys et. al., 2016; Patel & Thakkar, 2014; Rahman & Hoque, 2014; Zabib & Ahmad, 2010, Ahuja et. al., 2006; Badgril, 2000).

2.6.1 Maintenance Activities

The main purpose of maintenance activities is to ensure that all equipment required for production is operating at hundred percent efficiency at all time. According to Eti et. al., (2004), maintenance activity in TPM consist of a set of actions performed in the product development process to solve user and market problems, arising from the introduction of a new good or service. Agreeing with Garg and Deshmukh (2006), maintenance activities include partial or complete overhauls at specified periods, oil changes, lubrication, minor adjustments, and so on. In addition, workers can record equipment deterioration so they know to replace or repair worn parts before they cause system failure. In TPM contexts maintenance activities is dedicated to maintenance team, where expertise and competent at the particular area (Ahuja et. al., 2012; Yusof, 2010; Ho & Wearn, 1995). Meanwhile, according to Ahuja et. al., (2008) and Khaidir (2007), maintenance team as employees implicates in general maintenance and repair workers fix and maintain machines, mechanical equipment, and buildings. For an example, the construction employee carries out painting activities, repair flooring, and work on plumbing, electrical, and air-conditioning and heating systems.

However, some researcher agreed the maintenance activities also involves with maintenance management which particularly focus on managing the maintenance program for the particular machine and equipment. (Jain et. al., 2014; Ruiz, Foguem & Grabot, 2014; Harsej & Yusof, 2011; Abdallah & Matsui, 2007). Criticized by Jeff (2015), the maintenance activities to the Lean concepts; Lean maintenance practices cut costs and improve production by minimizing downtime. But the reality is that for many U.S. manufacturers, up to ninety percent of the maintenance they perform is conducted on a reactive rather than proactive basis. Further investigation, some organization blame the age of their equipment, the absence of spare parts and the rapid pace of manufacturing (Jeff, 2015). Consequently, it is possible to implement production maintenance best practices, and doing so will save time and money while increasing production in the long run (Bortolotti, Boscari & Danese, 2015; Jeff, 2015; Doolen & Hacker, 2005).

According to Jain et. al., (2015), the maintenance is activities carried out in all sectors and all workplace with regards to the TPM pillars. Working in the maintenance trade often means working during stop, start-up, shut-down, or disrupted operating phases, giving rise to potential risks in terms of accidents or exposure to many hazards (Nizam & Bell, 2017). The work often requires maintenance workers to remove or dismantle collective protective equipment; as such equipment is not effective for their type of work (Pain et. al., 2016; Damjan et. al., 2012). Employee involves in maintenance TPM practices have more serious and more frequent accidents than production employee. Therefore, then for any other activity, maintenance-related accidents are characterized by their many different causes.

As mentioned by Sharma & Singh (2015), the maintenance is essential to keep equipment, machines, buildings and structures as well as the work environment, safe and reliable. Significantly, the maintenance activities work during TPM implementation includes a variety of activities across very different sectors and types of working environments (Nizam & Bell, 2017; Afefy 2013). It typically comprises servicing, repairing, inspecting, testing, adjusting or replacing parts and may involve, for example, opening closed production systems, exchanging filters, removing paint layers, blasting, grinding, sanding, applying fillers, applying paint, insulating, and repairing a power grid, gas supply or water supply (Kamil et. al., 2018; Safuandy, 2015; Jerry & Wong, 2011; Vishnu, 2011; Bamber et. al., 1999).

According to the European standard EN 13306 maintenance can be defined as a "combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function". It implies a differentiation between preventive maintenance and corrective maintenance. Therefore, the maintenance activities as TPM practices significantly results the performance positively supporting the organization extent. Besides through TPM implementation, the maintenance activities encourage organization improves the current maintenance practices, enhance the employee competency and increase the availability and reliability of the machine and equipment.

2.6.2 Continuous Improvement

Continuous improvement, sometimes called continual improvement, is the ongoing improvement of products, services or processes through incremental and breakthrough improvements (Sharma & Singh, 2015). According to Tapping, Luyster, and Shuker (2002), continuous improvement is a method for identifying opportunities for streamlining work and reducing waste. The practice was formalized by the popularity of Lean, Agile, and Kaizen in manufacturing and business, and it is now being used by thousands of companies all over the world to identify savings opportunities (Damjan et. al., 2012; Badli, 2012; Chan & Shirvan, 2000). Many of these ideologies can be combined for excellent results. For example, Kaizen and Kanban can go hand-in-hand to facilitate continuous improvement (Robinson, 1991).

As mentioned by Jain et. al., (2015) continuous improvement can be viewed as a formal practice or an informal set of guidelines. Many companies have shifted focus to more formal approaches to project and process. As such continuous improvement in TPM context core related as mechanism working to constantly improve is the number one way in which many businesses reduce operating overhead. Continuous improvement or namely as rapid improvement is a Lean improvement technique that helps to streamline workflows. As reported by Hale (2002), the Lean way of working enables efficient workflows that save time and money, allowing to reduce wasted time and effort. Same goes to the TPM practices, the continuous improvement is an ongoing effort to improve products, services or processes. These efforts can seek incremental improvement over time or breakthrough improvement all at once (Kamil et. al., 2018; Seth & Tripathi, 2005; Yusof, 2000; Windle 1993)

Besides, Gupta and Garg (2012) described the Continuous improvement means to consistently strive to improve your products or service according to the highest standards. Cua, McKone and Schroeder (2001) agreed that, the continuous improvement can achieve through the TPM activities, initial cleaning, easy maintenance, improving mechanism procedure and establish the maintenance cultural. Meanwhile, according to Singh and Ahuja (2015), the continuous improvement is the on-going effort to improve products, services and processes by making small, incremental improvements within a business. It is based on the belief that these incremental changes will add up to major improvements over time and it is as much about tactics focus to the specific improvements as it is about changing the culture of the organization to focus on opportunities for improvement rather than problems (Kamil et. al., 2018; Hashim et. al., 2012; Jirarat et. al., 2011).

Therefore, continuous improvement or called as Kaizen is a concrete TPM practices. Kaizen is an approach to creating continuous improvement based on the idea that small, ongoing positive changes can reap major improvements (Vishnu et. al., 2011; Siong & Ahmed, 2007; Nakajima, 1965). Typically, it is based on cooperation and commitment and stands in contrast to approaches that use radical changes or top-down edicts to achieve transformation. Kaizen is core to lean manufacturing, or The Toyota Way. Significantly, it was developed in the manufacturing sector to lower defects, eliminate waste, boost productivity, encourage worker purpose and accountability, and promote innovation (Madanhire & Mbbohwa, 2015; Kaynak, 2003). Besides, the continuous improvement is impact to the organization performance in general, however there still necessity for deep understanding enhance the relationship in between (Ahuja et. al., 2008; Chan & Shirvan, 2000).

2.6.3 Resource Management

In today's environment, companies are under increasing pressure to deliver innovative, technologically advanced products and services with shrinking budgets. As a result, resources must be fully utilized and focused on the highest priorities at any given time. Definitely, the term resources can refer to a number of different types of assets, but here we're focused on the most important type, your people. Unfortunately, ineffective or suboptimal resource management will certainly lead to negative consequences such as poor productivity, delays, decreased quality, increased costs, missed opportunities, and low morale (Sharma & Singh, 2015; Windle, 1993). Due to that, in TPM A key part of the challenge is recognizing that high resource utilization is not an indication of good resource management. The key is ensuring that your resources are working on projects aligned to strategic corporate goals, that match their skill sets and where they have adequate bandwidth. Indeed, organizations continually overcommit their people resources, limiting growth and innovation (Jason, 2017; Zainuddin, 2012; Dale, 2006). Determining what work or demand to undertake next and when resources will be available are huge challenges as well.

As highlighted by most of the researchers, the resources management is critically affects the performance in TPM in various ways, reinstated to the TPM roles in the organization (Brodny, Stecuła & Tutak, 2016; Pai, Srinivas, & Raghavendra, 2016; Singh & Ahuja, 2015; Sharma & Singh, 2015; Ahmad, Zakua, Raja Zuraidah & Hisyamudin, 2015; Jain et. al., 2015; Hashim et. al., 2012; Jirarat et. al., 2011; Abdallah & Matsui, 2007; Kaynak, 2003; Katila, 2000; Windle, 1993). The resource management is the important mechanism organizing the material, human resource and budgeting in order to ensure the successful of implementing the TPM initiative. As defined by Jason (2017), large organizations usually have a defined corporate resource management process which mainly guarantees that resources are never over-allocated across multiple projects. Peter Drucker (2015), wrote of the need to focus resources, abandoning a less promising initiatives for every new project taken on, as fragmentation inhibits results.

From technical perspective, this activity also involves in supporting the equipment performance, reliability and engineering of the machine (Bordny et. al., 2016 & Hashim et. al.,2012). Therefore, the resource management activities contribute to the business performance and power generation performance in term of efficiency. In TPM contexts, resource management consist of the tangible resources such as goods and equipment, financial resources, and labor resources such as employees. Resource management can include ideas such as making sure one has enough physical resources for one's business, but not an overabundance so that products won't get used, or making sure that people are assigned to tasks that will keep them busy and not have too much downtime (Kamil et. al., 2018; Jason, 2017; Pai et. al., 2016; Windle, 1993). The resource management process of using a company's resources in the most efficient way possible.

2.6.4 Training and Education

Training and education is one of crucial elements in the CSFs and practicing in TPM, aggressively mentioned by most of the researchers. The training and education of TPM is the first step organization must have carried out before embark the TPM initiative (Kamil et. al, 2018; Hashim et. al., 2012; Ahuja et. al., 2008; Dale, 2006). Therefore, the researcher would like to deeply investigate the correlation between training and education practicing conducted by the organization in order to achieve the organization performance (Madanhire & Mbohwa, 2015; Haddad & Jaaron, 2014; Ahire & Detyfus, 2000; Windle 1993). Thus, the researcher could evaluate on how important of the training and education to the employees during implementing the TPM.

According to Ahuja et. al., (2006), Every individual within the organization needs to be fully trained in their job role. Supported to that, Shamsul (2015) stressed the training and education It’s not just the practical skills of equipment operators that are vital in eliminating loss across the company. The managerial, technical and administrative skills for all roles must be raised, enhance the competency to the maximum level. In facts, the training and education practices in TPM purposely to ensure that staff are trained in the skills identified as essential both for their personal development and for the successful deployment of TPM in line with the organization’s goals and objectives (Jason, 2017; Sivaram et. al., 2013; Seth & Tripathi, 2005).

According to Jason (2017), the benefits of training and education in TPM practices encourages the employees faced with world where technology, materials and competitors are changing at an increasing rate, training for the right skills is continually identified and provided. Besides, throughout training and education, its allow the company to plan for long term goals such as the caliber of individual employees required at certain times. Agreed by Hashim et. al., (2012) thorough training needs analysis results in a company succession plan, individual career plans and personalized training programs. In addition, the resulting training opportunities make employees feel valued and ensure the succession plan is fulfilled internally. Employee turnover is reduced as well as the need for recruitment (Jain et. al., 2015; Azizul & Rosni, 2010).

Therefore, the researcher is interested to find out and analyzed the fissure in implementing TPM between industries (Kamil et. al., 2018; Jain et al., 2014; Afefy, 2013;

Badly 2012). The main gap of this TPM implementation initiative is: it is being implemented at the manufacturing industry but not at the process industry. As claimed by the MPC (2011), TNB is the only generating power plant company that has embarked on the TPM initiative. Ergo, the researcher takes the opportunity to study the critical factors on implementing TPM initiative in order to ensure that the TPM program is effective to the company (Jardine & Tsang, 2013; Jerry & Wong, 2011).

2.7 Leadership Roles

Unpredictability of market growth and economic wave make top management more conscious on the business performance. In facts, global market growth is uncertainty and reluctant to continuously change. However, the complexity of business performance could be resolves with the right methodologies. It's required top management and all level of employees facing the global market challenge together. Supported by Peter (2016), the total involvements from the top management and all level of employees in the organization positively can handle the business performance. Having said that, human resources is the main assets to the organization beside the organization capital. According to Asrarulhaq (2012), to ensure the organization achieving the goals smoothly, the top management and employees must realize both responsibilities. Prudently, the team work culture between top management and employees is the key roles for success. Thus, human resource which consist of all level of employees must effectively manage by the organization in facing with competitive global market. In deep investigating the organization and top management, the leadership skill plays the important roles.

Besides facing the uncertain economic to meet the organization goals, the top management must aggressively improve the organization performance. To ensure the organization can sustain and compete in competitive market with the storm environment, the organization firstly must ensure business performance increase accordingly (Arslan & Staub, 2013). Consistently, many researchers agreed the leadership have significant affect to the employees and subordinate. Positively, it's also reflect to the organization performance. (Asrar-ul-Haq & Peter, 2016; Andersen, 2016; Asrarulhaq, 2012; Bushra, Usman & Naveed, 2011; Bommer, Rubin, & Baldwin, 2004).

According to Doucet, Fredette, Simard & Tremblay (2015), there is relationship between leader profile and their effectiveness on employee's outcomes. The behavior and practices carry out by the employees during doing the job significantly will affect the outcome and end performance. However, the influence of the leaders drives the motivation and emotional of the employees on delivering the desire result (Bronkhorst, Steijn, & Vermeeren, 2015). Therefore, there is a need to examine the influence of leadership in ensuring the effectiveness of implementing initiative in the organization. Supported by Saari and Judge (2004), the leadership intervention can boost up the employee's morale, increase employees job satisfaction and result the positive outcomes.

2.7.1 Leadership and Performance Outcomes

Due to the complexity of business and fluctuating the market trend in global, leadership is the common topic debate widely among the organization (Asrar-ul-Haq & Peter, 2016).

Leadership in organization is the driving factor in ensuring the organization performance at optimum level and can bit the business and economy issues globally. Facing with the current challenge in the business world, leadership is the person responsible on delivering the desire result and make profit to the company without sacrifice the employee.

According to Jong and Hartog (2007), the process to meet organizations goals by influencing the employees achieve thru leadership. Supported by Andersen (2016), leader's characteristic must inspire, encourage, persuade and satisfy their employees to meet the organization goals. Leaders encourage employees to ensure the work done successfully with desire results. Due to that, leaders must professionally have learnt and applied multiple leadership styles to suit the employees need, culture and business environment. Consequently, the top management leadership in the organization could describe the successful of organization performance (Lok & Crawford, 2004).

Stipulated by Asrar-ul-Haq and Peter (2016), different style of leadership will bring the different outcome which have direct and indirect impact to the behavior of the employees. Some of the researcher explained that the transformational leadership behavior is positively related to outcome variables, while transactional leadership behavior is usually negatively related to the long-term performance. However, transformational leadership have positive influence on employee self-efficacy, motivation, creativity and organizational performance (Bronkhorst, Steijn & Vermeeren, 2015; Bronkhorst et al., 2015; Newland, Newton, Podlog, Legg, & Tanner,2015; Kim & Yoon,2015; Jyoti & Bhau,2015). Furthermore, transactional leadership is found to enhance the job satisfaction and organizational identification as compared to transformational leadership (Epitropaki & Martin, 2005; Le Pine, Zhang, Crawford & Rich, 2015).

Most researchers have agreed that the employee leader skill is directly influence the employee behavior (Doucet, Fredette, Simard & Tremblay, 2015; Bushra, Usman, & Naveed, 2011, Boston 2009, Kamaran 2007). It leads them to exert extra effort on their jobs and perceive their leaders as effective. According to Hamid, Mahdi, Masoud and Assadollah (2014), the organizations need effective and efficient managers and employees to achieve their goals on multilateral growth and development. As the official representative of the organization to coordinate and to improve the productivity, the manager is always in the top level of the organization. In facts, the organizational success owes managers' effective managerial acts and leadership styles (Khalighi, 2003; Stoner & Freeman, 2002).

As discussed earlier, most literatures have highlighted the leadership skill influence positive outcomes between the relationship of employee's willingness to do extra work from their own task (Spano-Szekely, Griffin, Clavelle, & Fitzpatrick, 2016; Yahaya & Ebrahim, 2016). With this positive relationship, followers make additional efforts and work more than their scope and responsibilities. Subsequently, the productivity for the organization is increase and firmly compete in global market (Zeb, Saeed, Ullah, & Rabi, 2015; Tajasom, Hung, Nikbin, & Hyun, 2015; Hunjra, Kashif-Ur-Rehman, Chani, Aslam, & Azam, 2010). Likewise, there are research conducted by

Kuchinke (1998) found the level of employee's readiness doing extra task is significantly reflecting to the different leadership styles. Thus, different leadership styles result different outcomes to the employee's response.

Organizational changed from time to time and it is highly relying on the leadership roles in supporting individual to cope with the changes (Bommer, Rubin & Baldwin, 2004; Packard & Kauppi, 1999) Apparently, leadership styles govern employee attitude towards their leaders, job performance and organizational productivity. The underlying assumption of Full Range Leadership (FRL) model is that leaders are perceived effective, if they adopt effective leadership styles. However, some literatures support that leaders are perceived effective when they use transformational and transactional leadership styles together. Contrary, the leaders who are passive or use laissez-faire leadership style are considered least effective and have negative impact on followers' performance outcomes and productivity (Avolio & Bass, 2004; Yahya & Ebrahim, 2016). As mentioned by Avolio and Bass (2004), the most effective leadership styles are collectively coming from the combination of transformational and transactional leadership styles.

According to Yulk (2008), interest in strategic leadership has been increasing in recent years and several researchers also involves exploring the leadership study such as Boal & Hooijberg, (2000), Canella and Monroe (1997), Finkelstein and Hambrick (1996), Hitt and Ireland, (2002) and Zaccaro and Klimoski (2001). One of the most important research questions is how top executives influence the financial performance and survival of an organization. Relevant research has been conducted by scholars in several distinct subfields, including leadership, strategic management, human resource management, and organizational change. According to Fitzpatrick (2016) and Yulk (2008), the literature on strategic management, strategic human resource management, and organizational change provides additional insights about the influence of top executives on firm performance. Succession studies find evidence that a CEO can have a moderate amount of influence on the financial performance of an organization (Giambatista, Rowe, & Riaz, 2005; Lord & Maher, 1991; Thomas, 1988).

Agreeing to Harms et al. (2011) and Yukl (2012), to survive and prosper in today's inconsistent market wave, unbalance environment, organizations critically need leaders who are proactive, adaptive and strength enough. These leaders must be able to comprehend the complicate relationships among performance factors and satisfy the critical factors which could affect the organizations performance in different ways. Daft (2014), explained top management level must well prepare to change their leadership styles, the competitive strategy, and the formal programs and strategic behaviors to suit the challenges that challenge them in extreme environments, reluctant employee culture and uncertain global market (Hersey et. al., 2007; Collins, 2001). To become more comparative in the global market, the leader must develop the special skill, adaptive to the employees need and critically expert managing the organization performance. Thus, leader must suit the proper leadership skill to suit the organization environment.

Therefore, it’s essential the need of research activities to investigate leader’s skill which can influence the employees and consequently improve organization performance.

By doing the research, its develop the new leader theory for the special case and positively benefits to researchers and practitioners (Chemers, 2014; Ciulla, 2014; Yukl, 2008). Furthermore, the new leadership theory could be applied and guide the people which involves actively in any organization.

In addition, the successful of TPM practices in the organization rely on the top management and leadership roles (Shamsul; 2018; Kamil et. al., 2017; Richard & Kell, 2015; Mumtaz & Rina, 2012). As mentioned by Kamil et. al., (2017), the top management and leadership is required for supporting the TPM activities. The top management and leadership involvement in TPM activities gives positives perception from the employees (Kamil et. al., 2017; Panneerselvam, 2012). As supported by Ahuja et. al., (2010), throughout TPM activities, organization create good effort in the environment between top management and employees.

As discussed earlier, to ensure that TPM program practices are adapted in the organization, top management and leaderships play important roles in the implementation phase. Leadership drives TPM practices towards organization performance. According to Michael and Germano (2010), leadership has a direct cause and effect relationship upon organizations and their success. Leaders determine values, culture, change tolerance and employee motivation. They shape institutional strategies including their execution and effectiveness. Supported by Ayman and Korabik (2010), successful leaders do, however, have one thing in common. They influence those around them in order to reap maximum benefit from the organization's resources, including its most vital and expensive (Adam 2009; Amabile & Khaire, 2008).

2.7.2 Leadership as Moderator

Leadership intervention is seeming to be of instantaneous significance for what happens in the relationship between employees which is involves with the leader and the subordinate. The relationship comes with smooth communication between both parties. According to Romanowska, Larsson and Theorell (2013), the subordinate will kindly allow a leader's interference when needed with could be considers it as a tool on achieving the organization and team goals. The right intervention between both parties consider highly necessary once both parties are needed as a team works and team members in the organization (Romanowska et. al., 2013; Vries, Roe and Taillieu, 2002). Critically, in ensuring the smooth communication, both parties must recognize each responsibilities and roles. In facts, it will result positive outcome to the organization performance.

Stipulated by Martin, Liao and Campbell (2013), minimal studies have been organized to measure on constructs that resemble need for leadership. Most of these have provided incomplete, limited with no information explaining and slightly lack for these constructs item content and some have used unreliable scales, small samples, and inadequate statistical techniques (Bernhardt & Hebert, 2014; Harms, Spain & Hannah; 2011). From previous researcher, there is minimal research carried out to investigate the need of leadership between the relationship. Additionally, the subordinate leadership necessities have usually been discovered in such research. Although these studies have been precursors of what may be considered a promising area of research, they have not been integrated in the mainstream leadership research. In other words, there is limited research carry out from previous literature which appointed the leadership in between the relationship of organization performance.

Bernhardt and Hebert (2014) explained the essential advantage for leadership concept there is relationship between diversity of personal, dynamic works, and organizational philosophy at the particular time. Supported by Elo, Ervasti, Kuosma and Mattila-Holappa (2014), a specific constellation of such factor which consist of a high degree of personal competence, a job with partial variety and autonomy, little task-provided response, and a heavy reliance on written procedures which may produce a certain level of need for leadership. Instead of investigating the moderating effects of all proposed situational factors separately as well as in their interaction, one might study how these factors relate to need for leadership and concentrate on the moderating effect of this variable only (Elo et. al. 2014; Ryan, Kaffenberger & Carroll, 2011; Vries et. al., 2002). Such an investigation would not only make sense theoretically, as one would like to understand how the subordinate responds to his/her work setting as a whole, but also methodologically, since a simultaneous test of multiple moderating effects is almost impossible to conduct (Caza & Jackson, 2011).

The literatures and research on leadership was tremendously discussed from year 1950 to year 1999 with the following closely related concepts which is subordinates' leadership expectations (Foa, 1957; House, Filley, & Gujarati, 1971; Mannheim et al., 1967), leadership preference (Hunt & Liebscher, 1973; Yukl, 2012), need for closer supervision (Ashkanasy & Gallois, 1994), need for supervision (De Vries, Roe, & Taillieu, 1998; Martin, 1983), and leadership need strength (Seers & Graen, 1984). Leadership studies that used more generalized ‘‘needs’’ include studies on need for clarity (Ivancevich & Donnelly, 1974; Keller, 1989), need for structure (Stoker & De Jong, 1996), need for autonomy (Emans & Radstaak, 1990; Landeweerd & Boumans, 1994), and need for independence (Kerr & Jermier, 1978). In addition, studies that explicitly posited and tested the moderator hypothesis using a variable resembling need for leadership (De Vries et al., 1998; Emans & Radstaak, 1990; Keller, 1989; Landeweerd & Boumans, 1994; Stoker & De Jong, 1996) have provided some empirical support. In those cases, in which a significant moderator effect was detected, i.e., whenever employees needed clarity in their job (Keller, 1989), needed more structure (Stoker & De Jong, 1996), or needed less autonomy (Emans & Radstaak, 1990; Landeweerd & Boumans, 1994), leadership was more strongly related to subordinate outcomes than in cases in which employees did not need clarity or did need autonomy.

Facing with organization challengers and the needy of leadership intervention in various field, the research on leadership roles as moderator extent till the date. James and Ruttze (2018), was conducted the study in manufacturing industry which indicates the challenges and sustainability of Reliability Program during implementation period. The study scrutinized the factors influence the extent of reliability program implementation, facing with organization policy, top managements rules, budget utilization, and employee behaviors. The study proposes the contenders and mitigation plan to the organization in order to improves the reliability implementation. Qualitative method and quantitative method was applied for this study which are comprises with structural interview and survey questionnaires. The research study found the leadership skill critically essential to increase the employee adaption and adoption of new initiative, reliability program in such change the existing work culture. The research study recommended to multiple carry out the leadership study in various industry which is outfit the organization desirable.

Shamsul, Ahmed, Hisham and Hanif (2017), explored the moderating effects of the leader roles between the relationship of Corporate Social Responsible (CSR) program to the employee's involvement at utilities industry. Besides that, the research securitized the need of leadership intervention between the relationship in order to has a good outcome. The research successfully proves the need of leadership intervention between the employee satisfaction, employee involvement, employees reward and employee contribution. The research also indicates the external factors which is influence leadership decision on deciding CSRs program such as environment, people, corporate governance and organization stake holders. The research found the highest score on the relationship of CSR program to the corporate governance with leadership as moderator.

Meanwhile, Maran and Sathia (2017) carried out the study to investigate the leadership roles as moderator in relation to the employee's job satisfaction and organization performance. Research also highlight the critical success factors influence the relationship. The study was conducted in service industry which is involves with hospitalities and manpower contract service. It was found about 85 percent of the employee attached to the organization is contented with job satisfaction with leadership roles as moderator towards organization performance. Meanwhile, is about 15 percent of the employee is not rely to the leadership intervention during execution the job. The research also indicate the leadership style needed to suit the employee behavior in the service industry.

Besides, research done by Chin, Wong and Alice (2016) found the high score on leadership moderator to the relationship between employees practice and job satisfaction. The research also found there is necessary to introduce the employee reward system to motivate employees performing good in the current practice. Therefore, to increase the employee motivation and satisfaction, leadership intervention is requiring to enhance the productivity. Chin et al (2016) also highlighted the intervention of leadership encourage employee to work hard and do extra work. Significantly, leadership touch brakes out the management gaps, communication with less conflict.

A survey conducted by Benji, John and Marthew (2016) show the leaders as moderator positively influence the relationship on the employee productivity. The research was conducted in manufacturing organization which is examining the moderating affect to the relationship between lean initiative and employee productivity. Therefore, to ensure the lean initiative implement effectively in the organization, the leaders intervention is required. Benji et. al., (2016) found the autocratic leadership and transformational leadership is the most effective leadership style to drive the employee in manufacturing industry.

In addition, Berd, Jothinadhan and Nanda (2015), conducted a research on the moderating effects of leadership roles in the relationship between management culture, management behavior and business achievement. There are significant affects between the relationship and proven the need of leadership intervention to improve the business performance. The research found 67 percent from the total respondent agreed the business goals can be achieving with leadership intervention in between, 71 percent a The research demonstrates that leadership drive business performance and employee work culture. Leadership encourage followers to meet the organization mission and goals which support the business achievement.

Meanwhile, Maniam, Shah and Azah (2015) present the leadership research in quantitative method which is indicated the leadership factors could influence the relationship between lectures involvement in investigation activities and high education achievement. Besides that, the research quantifies the weighted between the factors influence the leadership interventions. The research found the level of high education institute increase in the relationship of research productivity with moderates by leadership roles. The research was conducted within Asian high education institute which involved with 500 lectures as respondents.

Besides, the leadership study was conduct and focus to the leadership skill. For an example, Victor Seco, Miguel Pereira Lopes (2013), study the Authentic Leadership (AL) relationship among the employee. According to Victor et. al., (2013) AL literatures support the existence of a positive relationship between perceived AL, follower work engagement, and positive attitudes like calling. The research doesn't confirm that relationship and fosters the possibility of AL influence could not be felt by employees. It was also expected, theoretically, a positive effect of Calling as well as with trust. The research found a significant negative effect on the relationship between AL and calling. However, the findings brought some positive insights. There was a positive significant relationship between calling and work engagement. Therefore, the finding for this research is; Leaders' Authentic leadership is positively associated and moderates with teachers' work engagement, teachers' calling and teacher's work engagement.

In 2012, Denti and Hemlin, investigates the need of leadership and innovation in organization as moderator and mediator in evaluating the relationship. This research realized that the need of leadership in supporting teams and individuals as their creative effort into innovations and manages the organizations goals and activities in innovations. The research found about 76 percent of employee satisfied with the leadership intervention during the innovation process. This research concludes that the relationship between leadership and innovation appears strongest in organization that have a supportive de-formalized and de-centralized. In conclusion, this research investigates when and how leadership relates to innovation; factors that moderate the relationship between leadership and innovation.

Luft (2012), investigated the relationship between two elementary building administrators and the teaching faculty with regard to leadership styles of the principal. In this research, leadership was measured as a moderator in the relationship between the independent and dependent variables. Besides, the research focused on differences in perceptions and attitudes of teachers who worked in a building with a principal who used a transformational approach compared with a principal who used a transactional approach. This research concluded the need of various leadership skill such as leadership by examples, motivational leadership, leadership exchange, autocratic leadership and transformational leadership is demanding to increase the employee enthusiasm in teaching industry.

Curseu, (2011) conduct the study to evaluate the relationship on the impact of task and impact of conflict to the teamwork quality. The study examines the roles of leadership styles as moderator between the intra-group conflict and teamwork quality. The results reveal a positive impact of relations-oriented leadership on the quality of interactions processes in teams. In a sample of 37 teams, the research result shows that relationship oriented leadership is beneficial for dealing with relationship conflict, but it does not have the expected positive interaction effect with task conflict. Besides, the two styles of leadership are not independent, and it might be that their impact on the interplay between intra-group conflict and group processes is different in a setting in which group leaders exhibit more differentiated behavioral patterns with respect to relations or task orientation.

Moreover, Zacher, Rosing, Henning and Frese (2011) conduct a research to scrutinize the relationship with the intervention of leader generativity as a moderator of the relationships between leader age, leader-member exchange with the leadership success criteria; follower perceptions of leader effectiveness, follower satisfaction with leader and follower extra effort. Results shows that positive relationships between leader age and leader generativity, and negative relationship between leader age and follower perceptions of leader effectiveness and follower extra effort. The research concludes a leader age is positively related to leader generativity and leader generativity moderates the relationship between leader age and leadership success such that leaders high in generativity are better able to maintain high levels of leadership success at higher ages than leaders low in generativity. In addition, the research confirmed the LMX exchange mediates the moderating effects of leader generativity on the relationship between leader age and leadership success.

According to Pieterse, Knippenberg, Schippers, and Stem (2010), the transformational leadership, in contrast to transactional leadership, has been argued to be particularly effective in engendering follower innovative behavior. However, empirical evidence for this relationship is scarce and inconsistent. Addressing this issue, the research propose that follower psychological empowerment moderates the relationship of transformational and transactional leadership with follower innovative behavior. Therefore, the researchers found about 63 percent of respondent have innovative behavior and significantly results the organizations' survival and organization performance. In addition, this research examines the moderating role of psychological empowerment with leadership styles for transformational and transactional leadership and innovative behavior. This research also mentioned that the need of leadership diversity in the organization to achieve the employee’s performance in good behavior.

Kearney, Gebert and Voelpel, (2009) carried out the research with involved 83 teams from eight organizations to examined team need for cognition, the tendency to engage in and enjoy effortful cognitive endeavors as a moderator of the relationships between both age diversity and educational specialization diversity, and elaboration of task-relevant information, collective team identification and, ultimately, team performance. Age and educational diversity were positively related to these outcomes when team need for cognition was high, rather than low. Both the elaboration of task-relevant information and collective team identification mediated a moderating effect of need for cognition on the relationship between both types of diversity and team performance. Kearney et. al., (2009) mentioned the inevitably rising levels of diversity, organizations must find ways to prevent differences among employees from disrupting communication and cooperation and in turn impeding performance. Even more importantly, in the interest of bolstering their competitiveness, organizations must find ways of turning diversity into an asset.

Beside, Gebert and Voelpel, (2009) also conduct the research on leadership as moderator in R&D working environment. In a sample of 62 research and development (R&D) teams, the authors examined transformational leadership as a moderator of the relationship of age, nationality, and educational background diversity with team outcomes. When levels of transformational leadership were high, nationality and educational diversity were positively related to team leaders' longitudinal ratings of team performance. These relationships were no significant when transformational leadership was low. Age diversity was not related to team performance when transformational leadership was high, and it was negatively related to team performance when transformational leadership was low. Two mediated moderation effects help explain these findings. Transformational leadership moderated the relationship of the 3 examined diversity dimensions with the elaboration of task-relevant information, which in turn was positively associated with team performance. Moreover, transformational leadership moderated the relationship of the 3 diversity types with collective team identification, which in turn was positively related to the elaboration of task-relevant information

Buisman (2009) conduct the study to analyzed the moderating effects of leadership styles on the relationship between hierarchical conflicts and employee satisfaction. The hierarchical conflicts consist with task, relationship and process and leadership styles as moderator; charismatic leadership, transactional leadership, passive leadership and autocratic leadership are measured as perceived by 254 employees. The results indicate that, charismatic leadership and transactional leadership have a moderating effect on the relationship between conflicts and employee satisfaction. With low levels of conflict passive leadership has a negative effect on satisfaction. The effect is such that high levels of passive leadership go together with low levels of satisfaction. Regardless of the amount of passive leadership shown, high levels of task conflict go together with low levels of satisfaction. In addition, Busiman (2009) mentioned the organization in respective industrial significantly drive the organization performance once successfully tackle the employee satisfaction.

Jansen, George, Van den Bosch and Volberda (2008), was explored the roles of senior team attributes such as shared vision, social integration and contingency rewards towards the leadership behavior. The research found about 63 percent of respondent agreed there is reconciling conflicting interest among senior team members and achieving organizational ambidexterity. Results shows that transformational leadership add value to the effectiveness of senior team attributes in ambidextrous organizations which is recorded high rated score, 73 percent. Accordingly, transformational leadership moderates positively the effectiveness of senior team social integration and contingency reward. In addition, the end results show the intervention of leadership emphasize the organizational ambidexterity. in addition, transformational leadership definitely moderates the influence of senior team share value, senior team social integration and senior team contingency rewards on organizational ambidexterity.

Due to complexity of suitability of mediate and moderator factor for leadership relationship, the researcher Ng, Ang, and Chan (2008) do the deep research at the first place. Consequently, the research about the trait theory of leadership is advanced by a joint investigation of the mediating and role of (a) leadership self-efficacy, LSE leader's perceived capabilities to perform leader roles in linking neuroticism, extraversion, and conscientiousness with leader effectiveness and (b) the moderating role of job demands and job autonomy in influencing the mediation. The research results show about 70 percent tendency score to the relationships between neuroticism, extraversion and conscientiousness with leader effectiveness is mediator and moderator by LSE. Supported to that, the research also explores the relationship between leadership behavior of LSE between on job demand and high job autonomy. The research also proves the need of leadership in between to ensure the employees performance and achieved the organization goals.

In different application, Erdogan and Enders (2007) stressed that the need of support from the top managements such as supervisor to achieve the organization goals. The researchers explained that supervisors perceived organizational support (POS) and leaders moderate the relationship between leader-member exchange (LMX), job satisfaction and job performance. From the research, supervisor POS should enhance the relationships between LMX and job satisfaction and LMX and job performance for subordinates. The research found there is positive relationship between LMX and job satisfaction and was stronger when supervisors had high POS. Supervisor POS affected high and low LMX members differently. Moreover, for job satisfaction and job performance, the nature of the moderation was slightly different. High LMX members were more satisfied, but low LMX members were least satisfied with their jobs when their supervisor had high POS. High POS supervisors may provide more information, resources, and other tangible benefits to high LMX members, leading to higher satisfaction.

Shin and Zhou (2007) explained the requirement of transformational leadership between the relation educational specialization heterogeneity and creativity in research and development teams. The researcher found that transformational leadership and educational specialization heterogeneity interacted to affect team creativity;

transformational leadership was high, teams with greater educational specialization heterogeneity exhibited greater team creativity. In facts, team's creativity efficacy mediated this moderated relationship among educational specialization heterogeneity, transformational leadership and team creativity. The research found there are positive weighted of the relationship between educational specialization heterogeneity and team creativity is moderated by transformational leadership in such a way that teams' educational specialization heterogeneity is more positively related to team creativity when transformational leadership is high than when transformational leadership is low. Research also found there is a three-way interaction involving team tenure, transformational leadership, and educational specialization heterogeneity in such a way that the positive moderating role of transformational leadership on the relation between educational specialization heterogeneity and team creativity will be stronger for teams with shorter tenure than for teams with longer tenure. Besides, is about 67 percent respondent agreed the team creative efficacy is related to team creativity and is about 71 percent of respondent agreed that the team creative efficacy mediates the moderated relationship among team educational specialization heterogeneity, transformational leadership, and team creativity.

In United State (U.S), Cole and Bedeian (2007) the research discovered investigation on the leadership influence between emotional exhaustion and work commitment relationship. The research was conducted to U.S Air Force personnel, studied the degree to which consensus in group member's perceptions of various leadership-climate constructs moderated the relationship between emotional exhaustion and work commitment. From the research, there is group member's consensus concerning transformational leadership and laisses-faire leadership were both cross-level contextual moderates that interacted with individual member's emotional exhaustion to explain individual-level work commitment event after controlling for mean group-level ratings of leadership climate. The research found there is Group member's consensus about effective leadership (transformational leadership, contingent reward reinforcement behavior, active and passive management-by-exception and laissez-faire leadership) moderate the positively the relationship between emotional exhaustion and commitment, such that when consensus is low, there will be a strong inverse relationship between emotional exhaustion and commitment, and when consensus is high, this relationship is weakened.

In China, Lee and Feng (2007) suggested that interactional jus-tice, procedural justice and distributive justice have positive influence on employees' organizational commitment, with the effect of interactional justice being the strongest and the effect of distributive justice being the weakest. In particular, the researchers mentioned the transactional leadership was moderate positively the relationship between organizational justice and organizational commitment. Implications for both organizational jus-tice and transactional leadership in transition of Chinese economy are discussed. Theoretically, this research found the creatively considers team leadership as a pre-existing phenomenon, verifies the moderating effects of transactional leadership on organizational justice and organizational commitment, extending current research and enrich leadership theories.

Sosik and Dinger (2007) reconnoitered the relationship between leaders' personal attributes, leadership style and vision content. One hundred eighty-three corporate managers from six industries, who completed a 14-week leadership development course, provided self-reports of their need for social approval, self-monitoring, and need for social power by the second week of the course. Eight hundred and nine subordinates provided ratings of their manager's leadership style by the third week of the course. The relationship between vision strength, leadership style, and content. Charismatic leadership was most positively associated with inspirational vision themes, whereas contingent reward leadership was most positively associated with instrumental vision themes. Leaders' need for social approval, self-monitoring, and need for social power moderated these relationships. The research demonstrates that need of leadership to ensure organization achieve the mission and vision. In conclusion, this research discovers how a leader's personality can interrelate with his or her behavior to help develop vision sharply. Such an illustration can spur future research investigative how the self-concept potentially influences by leaders into their communications in ways that permit followers to recovering recognize between them.

In South African, higher education (HE) sector has been criticised for an apparent lack of leadership, calling into question the leaders' ability to manage change as a result of the recent mergers of HE institutions. Therefore, the research conducted by Vinger and Cilliers (2006), was carried out to establish the frequency of exhibition of transformational leadership as change agents in manage the HE sector. The organization proposes preference leadership style require by the employees. The research performs in the communication and digital industry employee throughout survey questionnaires. The research intent to find out the effectiveness of employee performance facing with the global digital challenge and leadership is moderate in between. The researcher found in HE, the leadership roles which is recorded 90 percent score for transactional leadership behavior which is performing as change agents, educate the employees and transform the organization inspiration to the bottom line.

Razif, Camelia and Hisham (2004) measured the weighted of leadership responsibilities and roles as moderator between the reward mechanism to the employee's satisfaction. The research also securitized the leaders perform in handling the employee's issues in civil industry. Leadership intervention as moderate between reward mechanism and employee which is foreigner satisfaction record high score about 67 percent. The variance for leadership intervention in the relationship shows 28 percent gap only. Facing with foreigner issues as employees with different culture, and behavior, the supervisor as leadership skill plays the critical roles. Insight the relationship, the researcher proposes there are different leadership skill is most requiring to perform instruction to the employee which is working at different environment.

Vries, Roe and Taillieu (2002) carried the research to indicate the need of leadership styles as moderator in the relationship between leadership and individual outcome. The individual outcomes consist of job satisfaction, organizational commitment, work stress, role conflict and self-rated performance. The need for leadership was paired with three leadership factors and five outcome variables, generating

15 possible moderating affects. The researcher found the need of leadership styles intervention in guaranteeing individual outcome with positive effects. The researcher found and confirmed there is positive moderating affects to the relation between leadership characteristic and individual's outcome. The research also demonstrates there is low need for leadership in the relation between leadership and outcome is weaker compared with high need for leadership.

From previous research, most researcher agreed that the need of leadership interference drive the organization performance. Leadership roles is accepted among the countries, adapted and adopted widely in various industry, facing with multiple working environment and fronting with people behavioral. Therefore, leadership roles is essential to ensure the organization performance extremely at optimum level.

2.8 Underpinning Theory: Resource-Based View

Nowadays, the sustainability of the utility industry, especially for the power generation business, becomes an important topic because this sector contributes to the country's development and the energy demand increases yearly. As reported by Malaysia Energy Commission, the demand for electricity increases about three to four percent per year and this is a challenge to the unit to fulfill the community request (EC Annual Report, 2014). In order to ensure the sustainability of the power sector, the power generation company needs to have better strategies and work for improvement. The company success can be obtained by effectively using resources, developing new markets, retaining favorable market positions, shielding their market positions, and achieving long term sustainability by developing appropriate strategies and being present in the global business environment (Kim & Min, 2015; Wade & Hulland, 2004; Foss & Eriksen, 1995; Conner, 1991). Consequently, the industry must establish their strategic management with comprehensive strategic advantage in the global market. Therefore, the resource based view (RBV) of the company contends that the competitive advantage of a company relies on the resources (Barney, 2001; Priem & Butler, 2001; Wernerfelt, 1984; Rumelt, 1984; Penrose, 1959).

Most researchers discussed broadly on the RBV roles in the organization and consequently RBV philosophy is extended to such topics. For example, RBV is directly related to the Selznick's (1957) idea of an organization's 'distinctive competence'. This idea lead to identification of distinctive competencies which was supported by Barney, (2001) and Chandler's (1962), idea of 'structure follows strategy', as well as Andrew's (1971) proposal of an internal appraisal of strengths and weaknesses. The RBV as strategic management tools was manifested in its rapid diffusion throughout the strategy literature in order to respond to the business global demand (Wernerfelt, 1984; Rumelt, 1984; Barney, 1986, 1991; Dierickx & Cool, 1989; Mahoney & Pandian, 1992; Amit & Schoemaker, 1993; Peteraf, 1993; Maijoor & Witteloostuijn, 1996; Ruivo, Oliveira & Neto, 2015). Besides, the RBV offers inclusive strategic management for better future to achieve competitive advantage. Theoretically, the basic question of why firms are dissimilar and how firms achieve and sustain competitive advantage by deploying their resources was addressed in the RBV.

According to Helfat and Peteraf (2003) and Rao and Stekel (1998), the basic strategy firm is subjected to the resources and capabilities of the firm managing the asset. The tangible resources, intangible resources and organizational capabilities are three essential resources that mutually create distinctive competitiveness in a firm (Hinterhuber, 2013; Thompson, Strickland & Gamble, 2007). The primary point in devising strategies that guide to sustainable competitive advantage are the mix, type, volume and the composition of the firm's internal resources (Barney, 2001; David, 2003; Dierickx & Cool, 1989). The significance of the resource perspective as a new direction in the field of strategic management was broadly recognized with the path-breaking article by Wernerfelt (1984). In addition, Lin and Wu (2014) and Wernerfelt (1984), suggested that evaluating the firms, in terms of their resources, could lead to insights that differ from traditional perspectives.

2.8.1 Resources and Capabilities

The development and exploitation of the firm's innovation activities were one of the RBV proposition which challenged the organizational resources and capabilities taking into account the necessary input (Lin and Wu, 2014; Chien and Tsia, 2012). Subsequently, the focal point of RBV is not only on how twelve outputs of the organizations are innovatively squeezed, but also on how to make priority the first step of providing the fuel for innovative activity. As mentioned by Lin and Wu (2014), heterogeneous approaches are the resource-based research in a firm in terms of the strategic resources they own and control. According to Grant (2016) and Hinterhuber (2013), an outcome of resource-market imperfections resource immobility and firms' inability to alter their accumulated stock of resources over time were generally the heterogeneity suggested (Lin and Wu, 2014; Carroll, 1993; Barney, 1991). Each firm can be conceptualized as a unique bundle of intangible and tangible resources and capabilities in this vein (Wernerfelt, 1984).

Undeniably, resources are a fundamental analysis to the unit of RBV analysis which well-defined as those assets are tied semi-permanently to the firm (Maijoor & Witteloostuijn, 1996; Wernerfelt, 1984). Resources to the firm includes; financial, physical, human, commercial, technological, and organizational assets used by firms to develop, manufacture, and deliver products and services to its customers (Lin & Wu, 2014; Barney, 1991). Having said that, the tangible resources are classified as financial or physical; land, buildings, machinery, equipment and capital. Physical resources can easily be bought in the market, so they confer little advantage to the companies in the long run because rivals can soon acquire the identical assets. However, employee's knowledge, experiences and skills, firm's reputation, brand name, organizational procedures and policy are the intangible resources (Grant, 2016; Vogel & Guttel, 2013; Makadok, 2001).

As mentioned by Schneider and Spieth (2013), intangible assets are everything else that has no physical presence but can still be owned by the company. Supported by Hunt and Davis (2012), the brand reputation, product specification, trademarks, intellectual property are all intangible assets. Unlike physical resources, brand reputation is built over a long time and is something that other companies cannot buy from the market. Intangible resources usually stay within a company and are the main source of sustainable competitive advantage (Argyres & Zenger, 2012; Ravichandran, Lertwongsatien, & Lertwongsatien, 2005; Yiu, Bruton, & Lu, 2005).

Meanwhile, a firm's capacity to deploy and coordinate different resources and also usually in combination, using organizational processes, to affect a desired end are capability means (Priem & Swink, 2012; Amit & Shoemaker, 1993; Grant, 1996; Prahalad & Hamel, 1990). Capabilities also mean information-based, intrinsically intangible processes that are from specific and complex interactions among the firm's resources that were developed over time (Amit & Shoemaker, 1993; Conner & Prahalad, 1996; Itami & Rohel, 1987; Kogut & Zander, 1992; Leodard-Barton, 1992; Winter, 1987). They can provide enhanced productivity of its resources, as well as strategic flexibility and protection for its final product or service and is regarded as 'intermediate goods' generated by the firm. In this definition, there are two key features that distinguish a capability from a resource (Peteraf, Stefano & Verona, 2013; Amit & Shoemaker, 1993). First, an ordinary resource is not firm specific since it is embedded in the organization and its processes was a capability (Wang & Feng, 2012; Makadok, 2001). If an organization is completely dissolved, then its capabilities would also disappear, while in contrast, its resources could survive in the hands of a new owner.

Looking at this the RBV resources when the power plant sustaining generating power to the grid system and continuously generating fulfill the consumer demand. Work by doing maintenance on the equipment and machine is the preserving process which is purposely to ensure the optimum productivity can be achieve. The skill, competency, knowledge and procedure development are the capability would probably disappear. Enhancing the effectiveness and productivity of resources that a firm possesses in order to finish its targets, acting as 'intermediate goods' is the second feature that distinguishes a capability from a resource, which is the primary purpose of a capability (Chien & Tsia, 2012; Wang & Feng, 2012; Teece, Pisano & Shuen, 1997; Amit & Shoemaker, 1993).

2.8.2 RBV Model

From the view of power generation industry, the RBV is a management tool for maintaining the management assets in a power plant which has competition in the global business. In essence, resource-based view means the effective and efficient application of every inch of useful resource, that the company can congregate, helps determine its competitive advantage. It is much more feasible to exploit external opportunities using existing resources in a new way according to RBV proponents rather than trying to gain new skills for each dissimilar opportunity. In RBV model, in helping companies to achieve higher organizational performance, resources were given the major role to accomplish it (Kim & Min, 2015; Lai, Zhang, Lee & Zhao, 2012). Looking at this research, the organization fully exploit all resources, such as assest, equipment, and machine attached at the power plant to optimize the productivity.

As discussed before, the tangible and intangible are the two types of resources (Armstrong & Taylor, 2014; Rothaermel, 2013). Moreover, heterogeneous or immobile resources are the two critical assumptions of RBV categories. Skills, capabilities and other resources that organizations possess vary from other companies is a heterogeneous assumption. They might not employ diverse strategies to outcompete each other if organizations have similar amount and mix of resources (Lin, Chang & Dang, 2015). For The other organization could simply follow and hence no competitive advantage could be achieved. Real world markets are far from being perfectly competitive, which is a scenario of the perfect competition. Some organisation are able to apply different strategies and outperform each other because they are exposed to similar external and competitive forces with the same external circumstances. Therefore, RBV assumes that companies use their different bundles of resources to achieve a competitive advantage (Rothaermel, 2013; Lai et al., 2012).

According to Rothaermel (2013), the resources that are not movable from company to company, at least for a short-run is called as immobile resources from the second assumption of RBV. Companies cannot duplicate rival resources and put into practice the same strategies due to this immobility (Wei, Samiee & Lee, 2014; Rothaermel, 2013). Examples of immobility are intangible resources; brand equity, processes, knowledge or intellectual property. It is critical and not enough for the firm if it wants to sustain itself by having heterogeneous and immobile resources to achieve a competitive advantage (Pearson, Carr & Shaw, 2008; Rosenberg Hansen & Ferlie, 2016).

In advanced RBV, the VRIO framework has been introduced to the industry which offers the organization a strategized process. Cardal, (2017) and Barney (1991) has identified the VRIO framework that examines if resources are valuable, rare, costly to imitate and non-substitutable. The framework purpose is to respond on resources and capabilities. The respond must be a ‘Yes’ for all questions in order to sustain the competitive advantages. The framework was later improved from VRIN to VRIO by adding the following question: “Is a company organized to exploit these resources?” Rothaermel (2013) improvised the VRIO framework where the question asked regarding the organization’s resource and capabilities in value, rarity, imitability, and organization.

In the context of value resources, the organization increases their value based on the offer to the customer or community. The added value to the existing product or service could be achieved by reducing the operating cost and cost of production (Cardal, 2017). According to Newbert (2007), resources are more valuable if the organization can increase the value and this leads to competitive advantage in the business performance. The rarity factor becomes an important resource where certain companies could develop the resources into a rare resource. Competitive parity takes place when a few companies have the same capabilities to improvise the resources. Imitability in a company is a valuable and rare resource, this company can achieve at least a temporary competitive advantage (Rosenberg Hansen et al., 2016; Rothaermel, 2015). However, the resource must also be costly to imitate or to substitute for a rival, if a company wants to achieve sustained competitive advantage.

As for the last VRIO framework, the organization must ask whether any resources have not been explored as an advantage to the organization (Balashova & Gromova, 2016; Mahoney & Pandian, 1992). Looking at the overall VRIO framework, sustainable competitive advantage is achieved if the organization is capable of exploiting the valuable, rare and imitable resources (Schneider & Spieth, 2013; Newbert, 2007). Figure 2.7 shows the VRIO framework to achieve the competitive advantage.

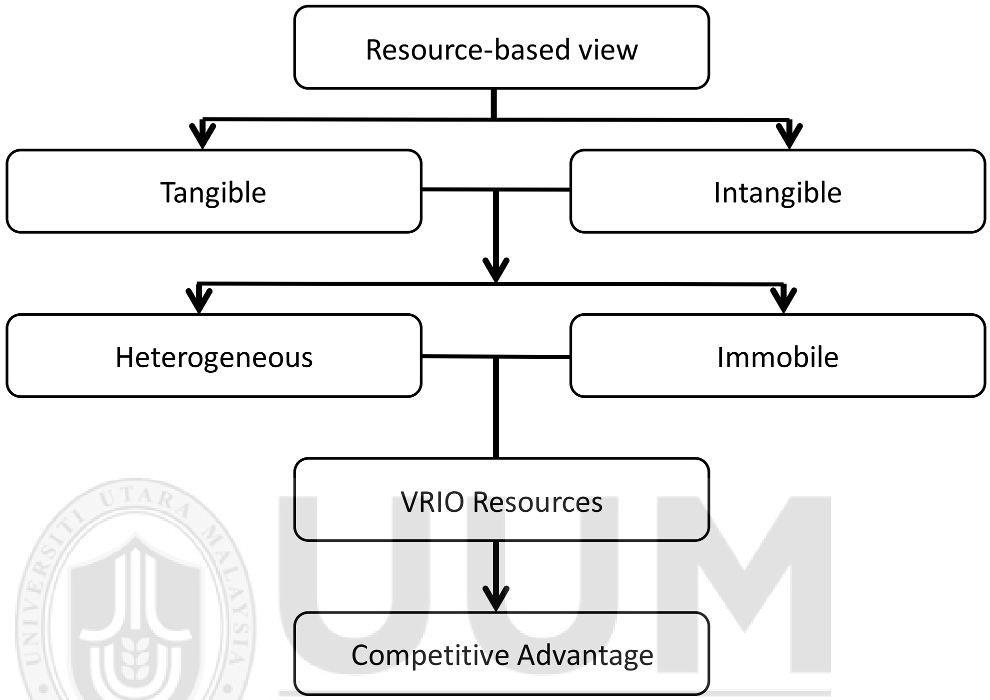


Figure 2.7
VRIO Framework
Source: Newbert (2007)

Definitely, the awareness towards the firm and its unique characteristics has shifted resource-based view of the firm to offer new directions for strategic management (Rothaermel, 2015; Sun & Tse, 2009; Morash & Lynch, 2002). In this vein, especially in terms of the factors that determine firm-level in resources and capabilities to do better, RBV redirects organizational innovation research as well. Exploiting internal rather than external factors as compared to industrial organization view is the method of RBV to hold that continued competitive advantage (Peteraf, 1993; Ray, Barney & Muhanna, 2004; Hinterhuber, 2013). In addition, this method can be achieved more easily. Furthermore, this is accurate to some measure; there is no clear-cut answer to which strategic management is more significant to approach.

2.9 Theoritical Framework

The process to develops the theoretical framework for this research is particularized detail in this subchapter. The theoretical concept to be used in the research area is mentioned and gives an overview of the research approach practices in this research. As mentioned in Chapter 1, TNBJ was selected as represent organization in the power generation industry which has embarked on the TPM initiative in order to identified to participate in this research. Neck (2008) mentioned, the framework purposely explained to ascertain key variables, topics, problems and ideas which creates the research matter to meet the potential solution. The theoretical framework develops the research domain, established the research gap and consequently promotes the possible method on covering the problems and issues. Moreover, the research framework will generally give specific idea with evidence to response to the question research, objective of the research and analyses the constraint of the research study (Luciani, 2015; Epstein & Zin, 2013). The research philosophy, relevance theories related to the research topic highlighted in this chapter as well. As agreed by Baker (2000), Cavana, Delahaye and Sekaran, (2001), Leedy (2001), and Perry (2002), the theoretical framework offers the idea of research concepts, research problematic and recurrence issues. From that, it shapes the gap and cause consequently recommends the possible solution on improving the research subject matter.

As explained before, the theoretical framework is the application of a theory or contains interrelated of concepts to guide researchers, determine what things to be measured and offer clarification of an occasion or shed some light on a particular phenomenon or research problem (Imenda, 2014; Borgatti, 1999). Based on the discussion in Chapter 2, a research framework has been developed to investigate the relationship between TPM practices, organization performance and the moderating roles of leadership. In order to strengthen and ensure sustainability of TPM programs, the research essence to measure the level of important of the TPM practices dimensions to the organization performance in power generation industry. Perhaps, the research framework proposes the possible solution and give positive significant impact on the TPM program implemented in the such organization

In present research, its cover the holistic view which all levels of employees participate. The top management, members from the steering community, and operators are all involved in this research. Details for the research approach is discussed in Chapter 4. The research framework was adapted and adopted from previous study; Badli (2012), Linden, (2015); Kamil et al. (2016), Meng (2011), David (2008), Julius and Ewe (2013), Soon et al. (2010) and Razak (2011).

From the previous study, there are four critical TPM practices that could influence the success of TPM implementation and consequently gives a significant impact to the organization performance (Ahuja, 2015; Boban & Jenson, 2013; Badli, 2012). As discussed in Chapter 2, several TPM practices in implementing TPM were identified by the previous studies. From those studies, the most discussed TPM practices were top management engagement, organizational policy, continuous improvement program, employee involvement, preventive maintenance, maintenance practices, resource managements, training and work culture. However, from the highlighted TPM practices, the most score is from maintenance activities, continuous improvement, training and education, and resource management. Figure 2.8 shows the research framework model for this research.

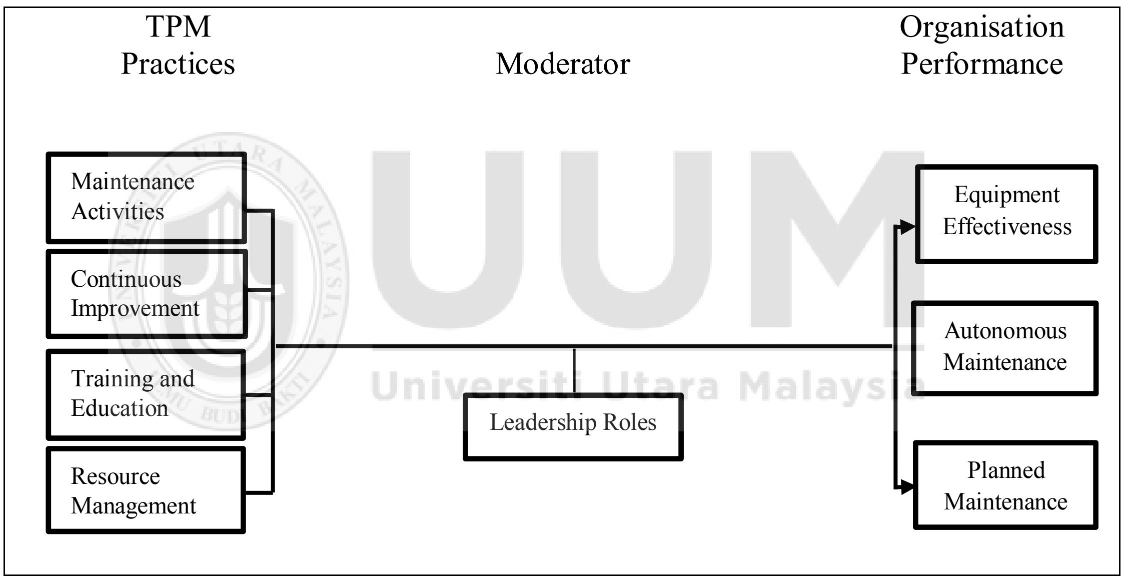


Figure 2.8
Research Framework Model for the Relationship between TPM Practice and Performance Measure
Source: Develop for this research

2.9.1 Hypothesis Development

The research hypothesis development is to explain the correlation stated in the research objective which consists of concepts (Badli, 2012). For this research study, the researcher develops the hypotheses for the Research Question 1 and Research Question 2.

Furthermore, the research hypotheses are developed to carry out the empirical testing which is explained in detail in Chapter 4. The research hypothesis is developed based on previous literature to meet the research objectives. The stated TPM practices and organization performance are frequently highlighted by the scholars during the implementation of the TPM program in various industries around the world.

From the previous literature, there is much research carried out to investigate TPM implementation in various industries by referring through many sectors (Badli, 2012, Ahuja 2008). Most of the researchers intend to study TPM performance and indicate the effectiveness of the program. However, there are few researches conducted to investigate TPM implementation in the power generation industry (Kamil et. al, 2018). To ensure that TPM is successfully implemented in the power generation industry, the management must play their roles and responsibilities. The involvement of top management will give an impact to the TPM implementation. The mechanism for introducing the new initiative must be done correctly to ensure a positive outcome after the implementation. From the period of having TPM in the workplace, there are issues and challenges faced by the employees. The issues arise when the concepts of embarking the TPM is slightly different between industries. The business behavior and environment of business is different and become the biggest challenge to the organization and employees.

The practices of the TPM implementation has been identified and established by previous researchers (Nagaraj & Lewlyn, 2016; Shamsul, 2015). Consequently, the TPM constructive question is used to detail the TPM practices by carefully examining the TPM program adapted and adopted in the industry. In order to ensure the research is aligned with the research framework, the researcher develops the research questions. The researcher extends the gap of the research program in the form of research questions.

2.9.2 The relationship between TPM Practices and Organisation Performance

As discussed before, TPM is a structure methodology of sustaining and improving the integrity of product quantity and quality systems by involves with machines, equipment, processes, and employees which is additional business value to an organization for all industries (Eugen, 2010). In addition, the TPM could be as management mechanism organizing the material, human resource and budgeting in order to ensure the successful implementation of the TPM initiative (Nagaraj & Lewlyn, 2016).

In a technical perspective, this activity also involves supporting the equipment performance, reliability and engineering of the machine (Ohunakin & Leramo, 2012). Therefore, in various industries the TPM activities can contribute in growing the business performance in general. Having said that, different industries have different perspectives and motivation in implementing TPM. Thus, the researcher's interest is to understand the relationship between TPM practices and organization performance. For this research, the organization performance is indicating by equipment effectiveness, autonomous maintenance and planned maintenance. Therefore, the research hypotheses are develop based on the previous literature finding.

The global marketplace has witnessed increased pressure from customers and competitors in manufacturing, as well as the service sector (Basu, 2001; George, 2002). Today is the era of globalization, and to compete with other industries like those in Japan, Korea, China, etc., it is necessary to move our industries toward modern development in all sectors, including the department of maintenance. TPM practices one of the best tools for making our industries competitive and effective in the field of maintenance (Hanged and Kumar, 2013a, 2013b). In today's fast-changing market environment, slow and steady improvements in manufacturing operations do not guarantee sustained profitability or an organization's survival (Oke, 2005). In an increasingly global economy, cost-effective manufacturing has become a necessity to remain in the competition. The rapidly changing market requirements call for improvements in a company's performance by focusing on cost cutting, increasing productivity levels and quality and timely delivery to satisfy customers. Due to that, the hypothesis H1: TPM practices are significantly related to organization performance

As discussed before, maintenance activities are part of TPM pillars which is involves the functional checks, servicing, repairing or replacing of necessary devices, equipment, machinery, building infrastructure, and supporting utilities in industrial, business, governmental, and residential installations (Berendsen, 2013). Supported by Badli (2012), maintenance activities in TPM reflect the organization performance interm of equipment effectiveness, equipment realiablity and productivity. However, the impact to the need of maintenance activities could be different to different types industry (Mogan, 2014). Due to that, there is need to evaluate the relationship between the engagement employees did the maintenancactivities that contibute to the organization performance in TNBJ. Thus, the H1a: Maintenance activities significantly related to organization performance.

Many companies have adopted continious improvement techniques as a standard by which all projects and work are done. Continuous improvement is the process to improve the existing practice, procedure, product for better perspective. As mentioned by Cua, McKone and Schroeder (2001) continuous improvement in TPM can be delivery through the TPM activities such as develop procedure, work plan scheduling and easy maintenance. Supporting to the continuous improvement initiatives, TPM promotes the employees to the enhancement of the existing system for better performance (Hailu & Mengstu, 2018; McCarthy & Rich, 2015; Robinson 1991). In facts, continuous improvement helps organization save money by identifying inefficiencies in activtities with many layers of management or process teams whose motions equate to money. Due to that, there is essential to investigate the significant impact of continuous improvement in TPM to the organization performance in generation power industry. Thus, the hyphotesis for H1: Continuous improvement significantly related to organization performance.

In general sense, the term training implies the act of imparting a special skill or behavior to a person, which is commonly offered to employees of operational level. It is not exactly same as education, which is a process of systematic learning something in an institution that develops a sense of judgment and reasoning in employees (Tsang & Chang, 2000). The training and education of TPM is the first step organization must carry out before embark the TPM initiative (Surbhi, 2015). Though with the changing environment, the approach towards training and education is also getting changed. Normally, it is presumed that every employee who is going to take training, has got some formal education. Moreover, it is also true that there is no training program which is conducted without education. Therefore, the interest to determine the significant impact of the Training and Education to the TNBJ employees during implementing the TPM? Thus, the H1c: Training and Education is significantly related to the organization performance.

TPM in resource management is guilty in supporting the TPM activities. Resource management has been defined as the efficient and effective development of an organization's resources when they are needed (Barney, 2001; Wright, & McMahan; 1992). The resource management is the important mechanism organizing the material, human resource and budgeting in order to ensure the successful of implementing the TPM initiative. In technical perspective, this TPM resource management activities also involves in supporting the equipment performance, reliability and engineering of the machine (Seth & Tripathi, 2005). In total, resource management is managing the TPM practices which concealment the TPM resourcing before initiate the TPM initiative (Nieminen, 2016; Mwanza & Mbohwa, 2015). Besides that, resource management is more than just managing individuals and their tasks, or creating reporting tools and reports. Acquiring, allocating and managing the resources required for a project is a specific task that ensures that internal and external resources, especially those that are scarce, are used effectively, on time and to budget (Lee, 2010). Consequently, the resource management activities contribute to the business performance and power generation performance in term of efficiency (Kumar, Kumar Soni, & Agnihotri, 2014). The researcher interest to investigate on "How important the resource management in TPM contributes to the business performance for utilities industry?". Thus, H1d: Resource management significantly related to organization performance

2.9.3 The relationship between TPM Practices and Organization Performance with Leadership Roles as moderator

As a key player to ensure the sustainability of TPM initiative in power generation industry, there is need leadership influence during the TPM program. Addressed by Andersen (2016), the leaders are responsible to stimulate, encourage, and recognize the employees works and responsibilities in order to succeed the good results. Besides that, leaders adopt multiple leadership styles with promotes, motivate and stimulate the employees (Landini, Lee and Malerba (2017). Reflectively, leaders show the good example to employees and directly represent good image to the organization. As mentioned before, Lok and Crawford (2004) the success or failure of an organization performance subject to the leadership style. Supported with the statement, Shamsul (2015) elaborated the important of engagement between leadership skill and employees.

In addition, researchers agreed that leadership roles are the main factors influence the organizations performance and reflect to the organization capabilities compete in the world market (Kamil et. al., 2017; Peterson, Smith, Martorana & Owens, 2003; Boal & Hooijberg 2000;). In facts, some researcher found there are mix factors influence the organization performance which is subject to the business environments. For example, previous studies conducted by Finkelstein and Hambrick (1996), Katz and Kahn (1978) and Peterson et. al., (2003) suggested that the leadership roles is firmly vital for an organization in making decision to deliver top performance. As stated by Landini et. al., (2017), its essential requirement to do research in leadership roles and responsibilities to suit the organization environment. Supported by Wang Tsuil, and Xin (2011), the successive changes in industrial performance in several common sectors due to leadership influences whereby involving top management in the organisation.

Agreeing by Tajasom, Hung, Nikbin and Hyun (2015) and Rouche, Baker and Rose (1989), and leaders support their followers to complete the organizational goals and mission by employed together. Hasnee and Azizul (2014), also agreed the need of leadership intervention to ensure the program effectively implement in the organizations. Indeed, the leadership intervention and involvement result the good outcomes to the organization and established positive relationship among employees (Amirul & Meng, 2017). By looking at the TPM initiative itself, its required the involvement from top management and all level of employees. Having said that, there is essential to determine the leadership roles intervention in the relationship between TPM practices and organization performance (Kamil & Nazrin, 2018; Abdallah, 2013; Ahuja, Khamba & Choudhary, 2006; Brah & Chong, 2004). Supported by Kamil and Nazrin (2018), top management and leader involvement in TPM initiative influence the TPM progress in the industry. Prior to that, this research critically important on recognizing the TPM practicing to the organization performance with leadership roles as moderator in between the relationship.

Therefore, the second hypotheses identify the moderating role of leadership on the relationship between TPM practices and organization performance.

H2: Leadership roles moderate the significant relationship between TPM practices and organization performance

H2a: Leadership roles moderate the significant relationship between maintenance activities and organization performance

H2b: Leadership roles moderate the significant relationship between continuous improvement and organization performance

H2c: Leadership roles moderate the significant relationship between training & education and organization performance

H2d: Leadership roles moderate the significant relationship between resource management and organization performance

2.9.4 The level of importance of the TPM Practices dimension contribute to the Organization Performance

TPM encourages managing and sustaining assets, technically hands on, increase employee competencies and required total involvement from various department. The investment in TPM initiatives, consequently correlate to the organization achievement in financial performance, unlocking the rigorous work culture, and transforming the employee assets (Kamil et. al., 2018; Halim et. la., 2012; Badli, 2012; Ahuja et. al., 2008). TPM is supporting by another factors mainly the effectiveness of the initiative during implementation period.

Identification of TPM practice within industry is essential to the organization to improve the existing performance of the program initiated (Shamsul, 2017; Badli, 2012). TPM practices are the elements which contribute to the success or failure of the program and impacts the business performance. Identification of the TPM practices in industry will determine the element which limits the extent of TPM implementation (Kamil et. al., 2018). Having said that, the organization could investigate and examine the practices and come out with solutions and consequently cater to the problem. As example, MPC (2015) claimed that the enforcement of initial cleaning which is part of the TPM initiative was implemented successfully, supporting 5S culture and aiming to the equipment at site; critical machine, instrument with high sensitivity, luxurious assets and highest top management is encourage to enrich the organization performance, sophistication the employee competency and assertive for better environment. For a better strategy, the organization can prioritize the actions to be taken in solving the issues.

With advancements in technology all industries firms moving towards automation centralizing their plants for survival by maximizing productivity levels by reframing their all legacy applications. The concepts of TPM helping firms to maximize the equipment effectiveness till the expiry of the equipment. Maintaining equipment throughout its lifetime requires larger amount of time effort. TPM helps organizations in maintaining equipment to protect from quality defects, speed losses and also prevent unexpected breakdown because of accidental and incidental losses (Venkateswaran, 2017). Supported to Badly (2012) and Ahuja (2008), there is different level of important on the TPM practices applied in the organization. As such, the researcher is interested to investigate the level of importance of TPM practices dimension to the organization performance in the power generation industry.

2.10 Summary

This chapter explains the theoretical foundation for the main variables of the research. The analysis of literature and past studies has also been executed comprehensively to assess the current research topic. The chapter begins with discussion on organizational performance, followed by overview of TPM, the evolution of TPM and the TPM philosophy; the pillars included in the TPM initiative; and the adaption and adoption of TPM in various industries. Based on the previous studies related to the TPM, a set of factors that can give significant impact to the TPM performance was derived. Although extensive research has been carried out on TPM practices and CSFs, it has been noticed that the factors can be differ among industries. The listed TPM practices and CSFs, act as the basic input for the study to assess and evaluate the practices CSFs for TPM implementation in the power generation industry. In addition, this chapter discussed the resource-based views (RBV) which are theoretically related to the TPM program implemented in the power generation industry. The RBV theory explains the need of organization to utilize the resources effectively and serve as the foundation for research framework.

In addition, this chapter defines the theoretical framework for this research. The researcher started this chapter with a theoretical introduction for this research and followed with the research question development. The research proposition and research hypothesis were identified corresponding to the research question. Besides, this chapter explores the previous research had been done by the researcher in the area related to the topic purposely to develop hyphotesis. This chapter also provide the deep knowledge on the current issues faced in the industry with relevant solution. Moreover, this chapter is a platform to found previous literatures correlated to the topic and unswervingly support the research problem. In summary, chapter 2 critically discussed the research topic in comprehensive way, continue talked on issues from previous research and end with the theoretical framework which is providing the guidance to the researcher for conducting the research.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Chapter 3 describes the methods applied in this research. The essence of this chapter is to explain the method applied and to provide a better understanding of the purpose of this research. Based on the theoretical framework discussed in Chapter 3, this chapter elaborates further research approach applied. Hence, this chapter explained the research approach, research design and the unit of analysis. In addition, the research sample and sampling procedures. The development of the research instrument, the questionnaire is also explained in detail. Pilot study which was carried out to determine the reliability and validity of the developed questionnaire is also presented in this chapter. Data collection and data analysis procedures are also explained. Ethical consideration was given emphasis in deliberating the research methodology and therefore, this is also discussed in this chapter.

3.2 Research Approach

As described by Maxwell (2012) and Berg (2001), the choice of qualitative and/or quantitative method in doing research by the researcher depends on the research purpose. According to Wahyuni (2012) and Mack (2005), qualitative method and quantitative method research approaches are slightly different and subjected to the purpose of the research. The difference between both methods is detected in areas such as objectives, analysis, research problems and research questions, source of data collection, the type of information generated from acquired data and the significance and degree of flexibility in the research design. Bryman and Bell, (2015) and Berg (2001) mentioned that qualitative research is subjected to the process of understanding the meanings, conceptions, characteristics, descriptions, signs and codes, and explanations of things. In quantitative research, the methodology is concerned with the process of measuring, indicating and computing things numerically.

Snape and Spencer (2003) specified that qualitative method research is a representational, realistic and more-to-life approach by understanding the community phenomena and social life meaningfully. A number of key elements distinguishes the qualitative approach (Clark, 2012; Snape & Spencer, 2003). They propose that this approach delivers a deeper understanding of the social world which it is based on a small-scale sample. Besides that, qualitative approaches include interactive data collection methods such as interviews and also cover new issues, concepts and terminologies (Frels & Onwuegbuzie, 2013; Ritchie, Lewis, Nicholls & Ormston, 2013). From previous research, TPM implementation is widely well-known in various industries and TPM research topic was discussed among researchers from time to time (Kedar, & Borikar, 2016; Kamil, 2016; Jain et. al., 2014; Soon, 2010; Badli, 2012; Nazrin, 2011; Ahudja et al., 2008).

In contrast, Smith (2015), Punch (2013) and Blaxter, Hughes and Tight (2006) explained that quantitative research emphasizes on the collection and examination of data in numerical form and stresses on relatively large-scale and representative sets of data. Supported by Hoy and Adams (2015) and Zikmund (2006), the results and findings from the quantitative approach focuses more on a specific target. Smith (2015), Domhoff (2013) and Stokes (2000) further mentioned that most of the researchers commonly choose quantitative studies to gain a deeper understanding of theoretical analyses in areas of literature such as in management, business, administration and the environment.

From the above discussion, it is decided that a quantitative method is more preferable to be applied in order to gain more insights into the theoretical aspects of TPM. Besides, the quantitative method is practical and comprehensive in understanding the TPM implementation practices at the workplace towards the organization performance.

3.3 Research Design

According to Ritchie et. al., (2013) and Burns and Grove (2001), research design is an instrument to manage, guide and advising the researcher to do the research. Besides, research design helps on improving quality and increasing the validity of the research study through a systematic investigation of the research problem. The researcher has to consider a number of factors on deciding the research design to be used in order to resolve the research problem (Schwartz-Shea & Yanow, 2013). As stated by Cormack (1996), the research design process represents the major methodological core of the research, being the idiosyncratic and definite approach, which is best suited in answering the research questions. Indeed, the processes of research design offer a solution to cater to the research problem (Richey & Klein, 2014; Bryman & Bell, 2007; Babbie & Mouton, 2002; Leedy, 2001; Ritchie, 2001; Burns & Grove, 1993).

Figure 3.1 represents the research design for this research which identifies the way that the research is conducted to meet the research objective. Refer to the Figure 3.1, this research started with the research design which involved with identified problem statement and followed by developing research objective. Literature reviews was done effectively in Chapter 2 to investigate and explore previous research and current research related to the topics. Methodology was described in detail together with research design in the Chapter 3, where it also promotes the research solution method. After research design, the next process is doing the statistical analysis, discussion and follow with conclusion.

Quantitative analysis involved with descriptive process in order to express the outcome of the hypotheses (Flick, 2014; Mitchell & Jolley, 2012). The research started with the process of developing the research questionnaire and determining the questionnaire's reliability and validity using a pilot test (Vaus, 2013; Hakim, 2012). To ensure that the right person responses to the distributed questionnaire, the relevant respondents for data collection was also identified (Vaus, 2013). In addition, a pilot test will be conducted for better quality research data, respondent and analysis. Once the questionnaire is considered as reliable and valid, the actual research was conducted, and data gathered from the questionnaires were analysed and used in developing the conclusion and recommendations of this research.

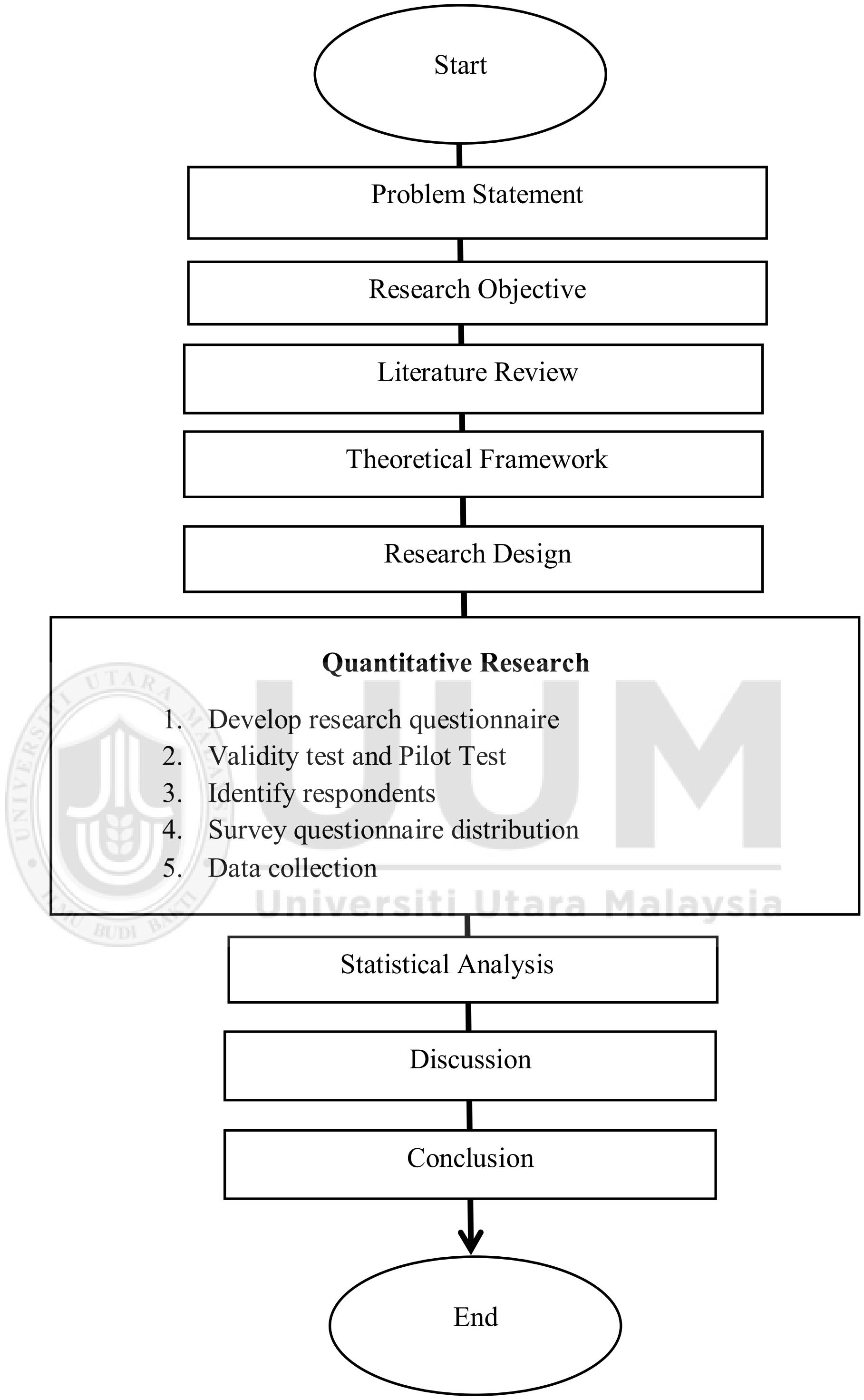


Figure 3.1
Research Design
Source: Develop for this research

3.4 Unit of Analysis

Unit of analysis is described as the single element or group of elements subjected to selection in the sample. Unit of analysis is defined as 'the level of aggregation of the data collected during the subsequent data analysis stage' (Richey & Klein, 2014; Cavana, Delahaye & Sekaran, 2001). Moreover, unit of analysis describe the participants involves as respondent to the research objective. As mentioned before in the Chapter 1, TNBJ is progressively implementing TPM program since 2010 and this research is carried out at the TNBJ workplace located in Malaysia. Therefore, the unit of analysis for this research is the employees attached with TNBJ who are directly involved in TPM activities.

3.5 Population, Sample and Sampling Technique

According to Polit and Hungler (1999), selection of a portion of the population in representing the entire population is called sampling process. Thus, Neuman and Robson, (2014) and Brink and Wood (1998), stipulated in the exploratory design the sample is for small samples that are chosen through a deliberative process to represent the desire population. According to Kumar (1996), there is a need of sampling design selection to ensure a suitable sample before launching and distributing the survey questions. Reasonably, it is to reduce the gap between the values gained and minimise error from the sample and the population. As stated by Zikmund (2003), sampling is a crucial part in managing a survey where it measures the characteristics of all elements in the population. Therefore, it is important to analyse the selection criteria through sampling method and appraise the virtual significance of each criterion to make the comprehensive sample design and determine the population accordingly.

The population of this research is identified as employees attached to the TNBJ. The total population is 370 employee consisting of 150 employees from the Operation department, 100 employees from the Maintenance department, 50 employees from the Technical Support Service (TSS) department, 30 employees from Human Resource & Finance (HRF) department and 40 employees from Business Support Service (BSS) department. Table 3.1 show the distributed percentage of questionnaire to the populations.

Table 3.1
Questionnaires Distributed

Department	**Population**	**Questionnaire Distributed**
Operation	150	130
Maintenance	100	80
Technical Support Service (TSS)	50	40
Human Resource & Finance	30	20
Business Support Service	40	30
Total	370	300

Source: Develop for this research

A purposive sampling method is used to select the participants. The questionnaires are distributed to all male, executive and non-executive staff. The reason for selecting all male respondents is to ensure that to control the effect of gender variable as there is an imbalance of male and female ratio among staff in the research, with female being a minority number. The limitation to non-executive staff to focus on TPM practices among this group of staff. Hence, the selection of respondents was purposive based on the criteria of gender, which is male, and position, which is executive and non-executive. As mentioned before in Chapter 2, this research holistic view with involved all level of employees. Table 3.2 shows the population to the all level of employees attached to TNBJ.

Table 3.2
Level of Employees

Department	Population	Questionnaire Distributed
Top Management	15	12
Manager & Senior Engineer	30	25
Executive & Engineer	80	70
Non – executive	245	193
Total	370	300

Source: Develop for this research

The determination of sample size adequacy uses the statistical tool, G*Power 3.1.2 (Faul et al., 2009). A power analysis is required to determine sample adequacy due to the use of large complex model that identifies the interrelationships of variables in this research on the portion of the model with the largest number of predictors (Chin & Newsted, 1999). G*Power 3.1.2 is a statistical tool that is more reliable compared to the use of power charts (Scheffe, 1959) and power tables (Cohen, 1988).

The general assumption in sample size adequacy states that a statistical test should be 0.80 or more (Chen, 1988: p. 56). A higher power indicates that there is a higher degree of probability to obtain significant results when the relationship is indeed significant. Other considerations given in determining sample size adequacy include the use of a significance level (α) at 0.05, moderate effect size of 0.15 and number of predictors. In this case, there are five predictors pointing to the dependent variable. Hence, for this research, a power of 0.95, significance level of 0.05, effect size of 0.15 and testing five predictors resulted in a total of 138 sample to represent adequacy. Figure 3.2 shows the output of this analysis.

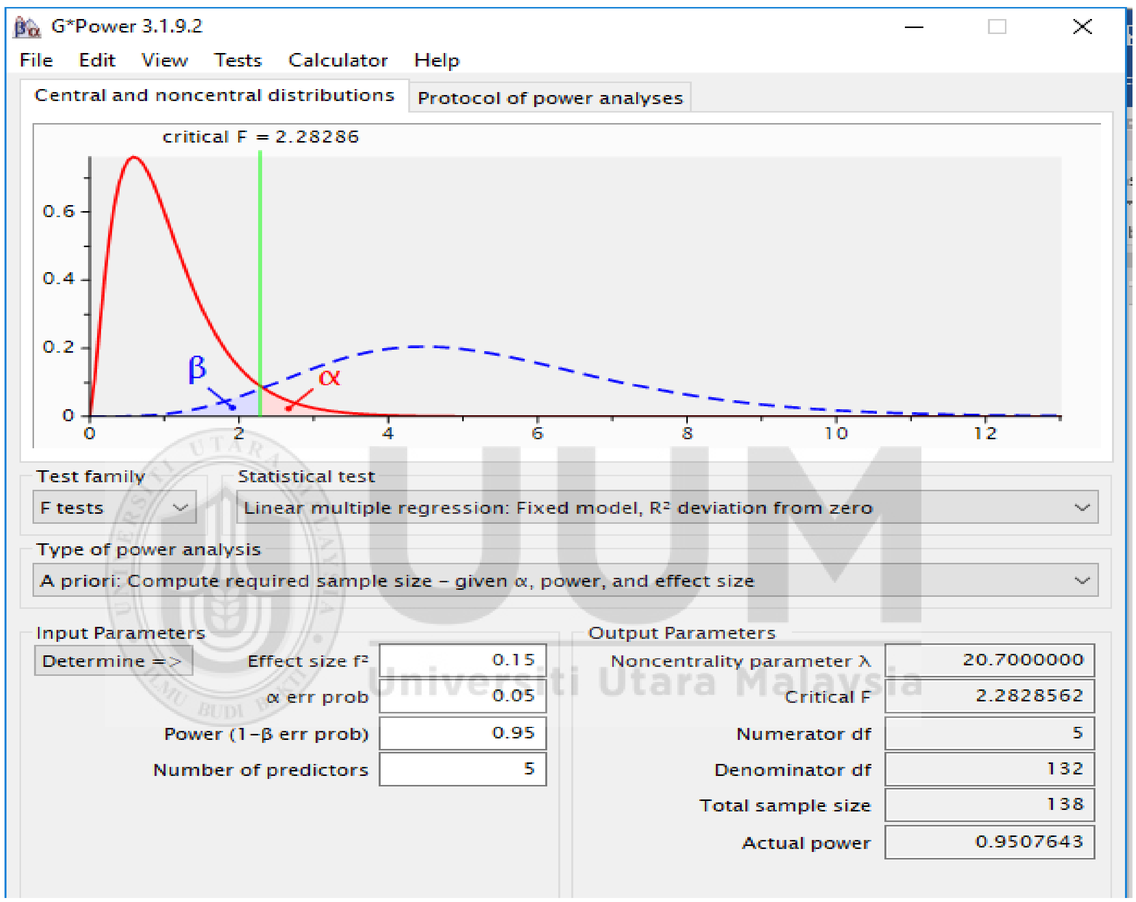


Figure 3.2
*Output from G*Power 3.1.2*
Source: Develop for this research

Based on the output in Figure 3.2, the minimum sample to show adequacy is 138. Compared to the sample requirement based on total population proposed by Krejcie and Morgan (1970), for a population of 370, the sample size required in 189. Therefore, a sample size that is more than 189 is considered adequate to represent the population.

Hakim (2012) and Sekaran (2003) described the respondents to the survey questionnaire is enough if the sample size is from 50 to 500 respondents and is sufficient to review but depends on the population of the state.

3.6 Research Instrument

In this research, questionnaire is used to gather data to represent the selected population (Hakim, 2012; Zikmund, 2003). Cooper and Schindler (2003) explained that sample population is the total elements of group behaviour that is related in making some inferences and implications to the society. As highlighted by Zikmund (2003), the main source of quantitative data research is conducting a self-administered questionnaire survey. Essentially, the questionnaire is a tool where the respondent has full responsibility of interpretation and response to the questionnaire survey (Richey & Klein, 2014). Further to that, Vaus (2013) and Zukman (2003) stated that a questionnaire survey is a set of good questions to ask those who are related to the subject research. Consequently, the design of the questionnaire must be great and emphasizes the aim of accomplishing relevancy, and accuracy (Neuman, 2006).

3.6.1 Questionnaire Item Relevancy

Besides establishing the factors to represent the content of the questionnaire, the relevancy of the items in the questionnaire must be without prejudice. Hair and Lukas (2014) and Zikmund (2003) clearly explained that, if no needless information and material is composed and if the information required in solving the problem is achieved, the questionnaire is considered as having high relevancy. Sarantakos (2012) and Singh (2000) explained that, to ensure that only suitable questions are put in the questionnaire, the researcher must carefully consider the research question to be addressed. As stipulated by Fink (2013) and Singh (2000), justification is compulsory for the items and the statements in these items must relate directly to each of the research questions and research objectives.

For this research, a series of revision and editing was done during the questionnaire construction phase. The researcher referred to the personnel experts in the TPM field such as TPM consultant, TPM facilitator and TPM coordinator. To avoid any sensitivity and breach of confidentiality, the questionnaire has been reviewed by the top management and representatives of the Human Resource and Administration (HRA) department in the focus organization involved in this research. Their comments and feedback were incorporated into the questionnaires to ensure improvement of the questionnaire.

Besides, the questionnaire was also sent to academicians who are experts in TPM topic, familiar with power plant workplace, involve and understand the maintenance work and activities well. Based on these inputs, the phrasing, number arrangement and the sequencing of the items, and the questionnaire dimensions were determined for better improvement in order to strengthened the questionnaire (Bryman, 2015; Vaus, 2013; Groves, Fowler, Couper, Lepkowski, Singer & Tourangeau, 2011; Blaxter, 2010).

3.6.2 Questionnaire Item Phrasing, Wording and Lenght

According to Dimaggio (2013) and Kunnan (2013), language is an important element in getting information through communication with people. Neuman (2016), Birley and Moreland (2014), and Lietz (2010 cautioned that the researcher must pay specific attention to the wording, phrasing and sensitivity of the questionnaire items. Thus, the questions and statements given were therefore obtainable in carefully chosen words clearly stating the meaning without confusion to the respondents. The final questionnaire was checked by the TNBJ HRA department to ensure no sensitive issues, wording and phase used at the questionnaire. For this research, the researcher explained and brief the purpose of the questionnaire to the participant before they start answer all the questionnaire. The briefing session session took only two to three minutes to ensure the participant clearly understand the purpose of the research.

Neuman (2006) stated that a good questionnaire should be presented in two or three pages. Neuman (2014) explains that a 45-items can be compressed into a 3-page questionnaire. Systematically, all the pages are organised with numbering and the questionnaire is printed in 12-point Times Roman font for ease of reading. Spacing of the questionnaire is also considered in order to ensure the questionnaire is in good arrangement.

3.6.3 Sequencing of Questionnaire Item

Neuman (2016), Litz (2010) and Festinger and Katz (1966) stated that the questionnaire form should be arranged into sections that are in line with the research objectives. In this research, the arrangement of questionnaire is subjected to variable choices. There are six variables (maintenance activities, continuous improvement, training and effectiveness, and resource management under the grouping variable of TPM practices, leadership roles and organizational performance) with about five to twenty items for each of the variables. The questionnaire starts with items pertaining to the general background of the respondent and followed by items in three separate sections that represented the grouping of the research variables, namely, TPM practices, leadership roles and organizational performance.

3.6.4 Measurement and Scaling

In terms of the measurement and scaling aspects, Malhotra (1999), explained that measurement can be defined as 'the assigning of numbers or other symbols to characteristics of objects according to certain pre-specified rules'. According to Lietz (2010) and Malhotra (1999), the cohort of a range which measures the location of objects is called scaling. Quantifiable data is collected through survey questionnaires. To measure attitude responses, the survey items must follow the adoption of a fitting evaluation scale. Some types of evaluation in rating scales are available in the research field, but only three of them were considered for this research study.

The first scale is a simple attitude scale where respondents are required to state either their agreement or disagreement to a question or statement (Bernard, 2012). In line with that, the said scale is considered as not appropriate to be used in this research as the scale does not cater for fine dissimilarities in the respondent's behaviour. Therefore, the second category of scales which can provide several answers was considered. However, this scale will only be effective if the answers truly depict the respondents' behaviour because the answers are dependent on the wording used to phrase them. Taylor, Bogdan and DeVault (2015) and Cavana et. al. (2000) proposed that each of the statements would necessitate the use of a dissimilar descriptive measurement to ensure that the scale is suitable and valuable to the researcher. Hence, this type of scaling was also considered as not appropriate to be used in this research.

Thus, the third category which is the Likert scale is considered. The scale indicates and involves summated weighting method. The Likert scale allows respondents to designate their degree of arguments from a five-point scale with scores being assigned to alternative responses. Commonly, the five points of arguments are called 'strongly disagree', 'disagree', 'uncertain', 'agree', and 'strongly agree' (Sarantakos, 2012; Bernard, 2012; Cooper, Schindler & Sun, 2006).

Besides the configuration of the survey model, the Likert scale is preferred as most suitable for this research since it permits some of the respondents to freely choose and accept an indeterminate position on issues that they consider to be complex and sensitive (Taylor et. al., 2015; Lietz, 2010). Standing on this concrete reason, the five-point Likert scale containing an ascending order of agreement from "1" as 'strongly disagree', "2" as 'disagree', "3" as 'uncertain', "4" as 'agree', and "5" as 'strongly agree' was selected to represent the scaling of the items in the questionnaire (Sarantakos, 2012; Bernard, 2012; Cooper et. al., 2006).

3.6.5 Questionnaire Sections

The questionnaire used in this research incorporated a number of measurement scales through which quantitative data is collected to represent the variables of interest (Neuman, 2016; Taylor et. al., 2015; Lietz, 2010). The measurement scales comprise of previously validated instrument which were adapted in this research like TPM practices (Baldi, 2012) and Organization Performance (Meng, 2011) and newly constructed measurement scale, the Leadership Role Scale. The questionnaire adapts a multi-item context which had been modified accordingly to suit the context of this research. TPM Practices comprises of four sub-sections which are: maintenance activities, continuous improvement, resource management and training and education. Organization Performance consists of three sub-sections which are: equipment effectiveness, autonomous maintenance and planned maintenance. Leadership role is a unidimensional variable. Overall, the questionnaire consists of 60 items which are divided into four major sections, as stated below:

i. Section A: Background Information

ii. Section B: Total Productive Maintenance (TPM) Practices

   a. Section B-1: Maintenance Activities

   b. Section B-2: Continuous Improvement

   c. Section B-3: Resource Management

   d. Section B-4: Training and Education

iii. Section C: Total Productive Maintenance (TPM) Performance

   a. Section C-1: Equipment Effectiveness

   b. Section C-2: Autonomous Maintenance

   c. Section C-3: Planned Maintenance

iv. Section D: Leadership Roles Measurement

3.6.6 Measurement Items

The measurement item for the questionnaire was adapted and adopted from previous researcher. Table 3.3 shows the items that represent TPM practices while Table 3.4 illustrates the items for Organization Performance and Table 3.5 exhibits the items for Leadership Roles.

Table 3.3
Measure Items for Independence Variables - TPM Practices

No	Items	References
Maintenance Activities		
1	TPM activities support the maintenance work that is being done necessarily.	Badli (2012)
2	TPM activities assist operation staff in identifying abnormalities towards the plant and equipment.	Linden et. al., (2015)
3	TPM program develop the employee's specific skills in conducting maintenance activities.	Soon et. al (2010)
4	Preventive maintenance practices such as vibration monitoring and bearing inspection supports the TPM activities	Kamil (2016)
5	By executing TPM activities, the number of maintenance activity in a week has slightly reduce.	Renganathan (2014)
6	TPM activities helps in guiding the current maintenance practices on handling repair works.	Nazrin (2017)
7	Ever since TPM was implemented, operation staff have been carrying out light maintenance practice such as topping lube oil and cleaning spillage.	Cooke (2000)
8	Through TPM program the operation staff have been involved in maintenance activities during their spare time.	Nazrin (2017)
9	Both operation and maintenance staff have been directly involved in carrying out maintenance activities.	Renganathan (2014)

Continuous Improvement		
1	TPM practices emphasized on 5S, Kaizen and other improvement initiatives.	Badli (2012)
2	TPM activities encourage staff to do improvement projects at the plant and machines.	Renganathan (2014)
3	TPM activities incorporates effective suggestion scheme from all departments.	Nazrin (2017)
4	TPM activities increase the machine and equipment reliability and availability accordingly.	Venkatesh (2007)
5	TPM activities mainly focus on prevention improvement rather than restoration.	Raou & Daya, (1995)
6	TPM activities standardize the tagging and marking at the machine and equipment.	Kamil (2016)
7	The staff's competency on the plant system has increased since TPM was implemented.	Nazrin (2017)
8	Since TPM was implemented, staffs have generally realized the need of improvement towards the machine.	Wal & Lynn (2002)
Resource management		
1	The organisation provides adequate resources during implementation of the TPM program.	Renganathan (2014)
2	The current strategic planning is well organised to support TPM practices.	Badli (2012)
3	The organisation provides sufficient budget during implementation of the TPM activities.	Kamil (2016)
4	The TPM committee supports the employees by solving all the related issues and problem faced during TPM program.	Gitachu (2016)
5	Employees are given enough time allocation during the implementation process.	Linden et. al, (2015)
6	TPM strategically encourages the management to prudently handle the spare parts supply.	Renganathan (2014)
7	The cleaning material for TPM activities is sufficiently provided by the Top management.	Meng (2011)
8	Top management systematically plan the TPM activities for every financial year.	Linden et. al, (2015)

Training & Education

1	Staff are aware on the TPM behavioural aspects	Sari et. al., (2015)
2	Staff are well trained to support the TPM practices	Linden et. al, (2015)
3	The organisation provides regular training at the workplace.	Razak (2011)
4	The top management encourage employees to be multi skilled.	Ahuja et. al (2008)
5	Staff proficiencies and skills are periodically evaluated.	Gitachu (2016)
6	The organisation provides good facilities when conducting TPM training at the workplace.	David (2008)
7	The staff competency has increased accordingly after being involved with TPM activities.	Razak (2011)
8	Staff have gain both technical knowledge and concepts of the plant operation through the TPM activities.	Nazrin (2018)
9	The TPM activities is part of the hands-on training related to the system available at workplace.	Attri et. al. (2013)

Source: Develop for this research

Table 3.4
Measure Items for Dependence Variables - Organization Performance

No	Items	References
Equipment Effectiveness		
1	The overall equipment effectiveness in operation has increased accordingly.	Meng (2011)
2	Implementation of TPM initiative have reduced the equipment downtime.	Shamsul (2015)
3	Equipment with high reliability and availability reduces unit load deration.	Linden et. al., (2015)
4	TPM activities encourages optimization of the performance rate (cycle time, production rate).	Venkatesh (2007)
5	Carrying out self-maintenance reduces the number of defect frequency or failure.	Attri et. al. (2013)
6	Planning for equipment in operation increases the equipment availability	Renganathan (2014)
Autonomous Maintenance		
1	The ability of maintaining basic equipment conditions (cleaning, lubricating, etc.) has improved.	Mabunda (2003)
2	The ability of conducting basic equipment inspection has increased.	Badli (2012)
3	Abnormalities found while the equipment is in operation can be detected at earlier stages.	Wal & Lynn (2002)
4	Workplace condition (cleanliness, tidiness, etc.) has been better compared to previous conditions.	Azizul (2014)
5	The organisation culture has successfully developed a sense of belonging and responsibility.	Mabunda (2003)
Planned Maintenance		
1	Proper work plan for maintenance activities has successfully reduced maintenance cost.	Linden et. al., (2015)
2	The preventive maintenance achievement rate has increased since implementation of TPM.	Meng (2011)
3	The availability and effectiveness of the equipment in operation has been increased.	Kulkarni & Dabade (2013)
4	Pro-active maintenance and performance measurement are in place and effectively used.	Wal & Lynn (2002)
5	Unplanned maintenance works has been reduced ever since the implementation of TPM.	Nazrin (2017)

Source: Develop for this research

Table 3.5
Measure Items for Leadership Roles as Moderator

No	Items	References
1	Has a clear understanding of where we are going.	Robert & Baverly (2000)
2	Paints an interesting picture of the future for our group.	Kellerman (2012)
3	Inspires others with her/his plans for future.	Northouse (2017)
4	Is able to get others committed to his/her dream.	Lee & Wei (2017)
5	Leads by “doing” rather than simply by “telling”.	Wilson (2013)
6	Provides a good model for me to follow.	Barbara (2012)
7	Leads by example.	Saleem (2015)
8	Encourages employees to be “team players”.	Cremer & Van (2008)
9	Gets the group to work together for the same goal.	Avolio & Bass (2004)
10	Develops a team attitude and spirit among employees.	Yukl (2012)
11	Shows us that he/she expects a lot from us.	Kellerman (2012)
12	Insists on only the best performance.	Yukl (2012)
13	Will not settle for second best.	Hoyle & Wallace (2008)
14	Acts without considering my feelings.	Northouse (2017)
15	Shows respect for my personal feelings.	Saleem (2015)
16	Behaves in a manner thoughtful of my personal needs.	Ronald (2013)
17	Challenges me to think about old problems in new ways.	Kellerman (2012)
18	Asks questions that prompt me to think.	Lee & Wei (2017)
19	Has stimulated me to rethink the way I do things.	Avolio & Bass (2004)
20	Has ideas that have challenged me to re-exam some of the basic assumptions about my work.	Vinger & Cilliers, (2006)

Source: Develop for this research

3.6.7 Finalized Questionnaire

The validation of the content of the survey questionnaire was determined by using a panel of experts which is listed in Table 3.6 to ensure that the questionnaire has high consistency with minimum bias and error. Ritchie (2001) and Tabachnick and Fidell (1996) explained that validity in the research world means that the particular selection of instrument to measure the concepts and theories are to be valued in the research study. Three factors were considered to ensure the validity of the questionnaire contents. Firstly, the issues covered in the questionnaire were confirmed as pertinent to the research study and are workable. Secondly, the sample size, target population and the completion rate of the questionnaire feedback were considered. Lastly, the content validity requires the presence of subject-matter experts (SMEs) or skilled people to be in the focus group to validate the questionnaire. The questionnaire was subjected to feedback from representatives that comprises of TPM experts, TPM steering committee and TNBJ top management. Table 3.6 represent the position and number of validator for questionnaire contents. All comments were taken note and considered in the further improvement of the items in the questionnaire. The final version of the questionnaire is shown in Appendix B.

Table 3.6
Validator for questionnaire content

No	Position	No of Validator
1	TNBJ Management	2
2	TNBJ Human Resource & Administration	1
3	TNBJ Legal & Contract	1
3	TPM Steering Community	2
4	TPM Expert (Consultant)	2
5	Senior Manager (Shift Operation)	1
6	Lead Engineer (Maintenance)	2
7	Academician	2

Source: Developed for the research

TNBJ Management represent the TNBJ top management which is play role responsibilities as decision makers. Two out of eight TNBJ top management was invited to check the final questionnaire. One representative from TNBJ Human Resource &

Administration department and TNBJ Legal & Contract Management department also selected to check detail of the questionnaire. Non Discloser Agreement (NDA) was signed between both parties agreed on the questionnaire contents. In addition, two academicians were referred to validate and certify the questionnaire contents. Selected academician has high profile background in mechanical and expert in maintenance activities. Besides that, the academician has super knowledge and critically expert in TPM area. This is important to ensure the questionnaire is good and relevant to cater the hypothesis.

3.7 Pilot Study

The main aim of a pilot study is to ensure that the survey items in the questionnaire is capable of measuring the domains of interest in a reliable and valid manner when used in real situations (Etchegaray & Fischer, 20110. In other words, a pilot study is conducted to ensure that the instructions, items and scale used in the questionnaire are clearly understood (Lee, Chang & Chen, 2013; Pallant, 2005). The instrument used in this research is a questionnaire that consists of three measurement scales: TPM practices, leadership roles and organization performance. As mentioned before, the items used in this questionnaire research are adopted and adapted from previous literature.

In pilot study, a total of 100 set of questionnaires was distributed and collected from the respondents to test the internal consistency, reliability and validity of the measurement scales in the questionnaire. Internal consistency was determined based on

Cronbach's Alpha while Exploratory Factor Analysis was carried out to determine the reliability and validity of the measurement scales.

3.7.1 Internal Consistency

Table 3.7 presents the result of scale analysis to determine the internal consistency of the measurement scales based on Cronbach's alpha values. Nunnally and Bernstein (1994) stated that Cronbach's alpha coefficient of 0.70 is the cut-off point of acceptance indicating good internal consistency.

Table 3.7
Internal Consistency of the Measurement Scales

Variables	Cronbach's Alpha	Conclusion
1. TPM Practices		
a. Maintenance Activities	0.890	Acceptable
b. Continuous Improvement	0.896	Acceptable
c. Resource Management	0.902	Acceptable
d. Training and Education	0.884	Acceptable
e. Overall TPM Practices	0.933	Acceptable
2. Organization Performance		
a. Equipment Effectiveness	0.927	Acceptable
b. Autonomous Maintenance	0.912	Acceptable
c. Planned Maintenance	0.879	Acceptable
d. Overall Organization Performance	0.938	Acceptable
3. Leadership Roles	0.973	Acceptable

Source: Develop for this research

The result shows that for each dimension of TPM Practices, Maintenance Activities, Continuous Improvement, Resource Management and Training and Education, as well as overall TPM Practices, all values of Cronbach's alpha exceeded 0.700.

Therefore, TPM practices measurement scale has good internal consistency. Organization Performance which is represented by Equipment Effectiveness, Autonomous Maintenance and Planned Maintenance, as well as overall organization performance, all values of Cronbach's alpha also exceeded 0.700. Therefore, the measurement scale for organization performance has good internal consistency. Leadership roles also yielded a Cronbach's alpha value of more than 0.700, thus indicating good internal consistency. All measurement models used in this research have good and acceptable internal consistency. Appendix C presents the SPSS output of the scale analysis.

3.7.2 Exploratory Factor Analysis

Exploratory factor analysis (EFA) was used to determine the validity and reliability of the measurement scales. An exploratory factor analysis is used to search for latent patterns present in the data without any previous knowledge about how these variables are related (Hair et al., 2014). According to Kelloway (1995), EFA is often considered to be more appropriate than confirmatory factor analysis (CFA) in the early stages of scale development because CFA does not show how well your items load on the non-hypothesized factors. Unfortunately, there are no generally accepted decision rules and there is continuing discussion about appropriate use of the two methods (Crowley and Fan, 1997). However, as mentioned before the questionnaire applied for this research is adapted and adopted from previous researcher where its is sourcing from more than one questionnaire. Due to that, there is consider developing the new set of questionnaire to suit the emeployees acttached at this types of industry, power generation. As agreed by Cabrera-Nguyen (2010), when developing new scales, researchers should conduct an

EFA first, followed by CFA fo further analysis. EFA should be followed by CFA using a different sample (or samples) to evaluate the EFA-informed a priori theory about the measure's factor-structure and psychometric properties (Cabrera-Nguyen, 2010).

Therefore, the purpose of an EFA in this research is to identify the set of underlying items which can best explain the variables in the questionnaire. EFA is also crucial to ensure that common method variance is reduced (Podsakoff et al., 2003). The basic assumption states that common method variance is high either when there is only a single factor that emerges from the factor analysis or that one general factor accounts for the majority of the covariance among the measures (Podsakoff et al., 2003). Hence, principal component analysis was carried out with varimax rotation to determine the factors for each variable. The purpose of the principal component analysis is to summarize the items into fewer components (Henson & Roberts, 2006). EFA is able to reduce the large number of items into dimensions (William, Brown & Onsman, 2012). In other words, the principal component analysis either support or not support the distribution of the items into sub-dimensions. In this research, TPM practices have been divided into four dimensions, organization performance as a three-dimensional variable while leadership role is unidimensional.

Before the principal component analysis is carried out, the Kaiser-Meyer-Olkin (KMO) value and Bartlett's test of sphericity are determined to ensure that the data is suitable for running factor analysis (Lepparvirta, 2011). Field (2005) stated that the acceptable limit for KMO value is 0.50 while Bartlett's test of sphericity must obtain a p value that is less than 0.05. KMO value implies that the sample size is adequate while Bartlett's test of sphericity implied that the correlation matrices were not identity matrices (Field, 2005).

The first step in factor analysis is the determination of factors or dimensionality. This is based on the Eigenvalues whereby values greater than one indicates significant factorisation or dimensionality (Hair et al., 2010). Wachira (2005) also stated that the number of dimension can be accepted based on the cumulative explained variance whereby a value of 40% and above is acceptable. Next, the factor loadings are examined whereby items with loadings less than 0.40 can be omitted. Ho (2006: p. 207) explained that a factor loading of 0.33 represents approximately 10% of the variable's total variance is accounted for by the factor.

3.7.2(a) KMO and Bartlett's Test of Sphericity

Table 3.8 presents the values of KMO and Bartlett's test of sphericity of the measurement models in this research. Appendix C presents the SPSS output of the factor analysis. The result shows that KMO measures for the three variables exceed 0.500, thus indicating that sampling adequacy is met. The Bartlett's test of sphericity given by the significance value was also less than 0.05 for each of the variables. Therefore, there are no identity matrices among the correlated matrices. The measurement scales are ready for factor analysis.

Table 3.8
KMO and Bartlett's Test of Sphericity

Variables	Measurement		Values
TPM Practices	KMO Measure of Sampling Adequacy		0.840
	Bartlett's Test of Sphericity	Approx. Chi-Square	2249.733
	df		561
	Sig.		0.000
Organization Performance	KMO Measure of Sampling Adequacy		0.895
	Bartlett's Test of Sphericity	Approx. Chi-Square	1310.696
	df		120
	Sig.		0.000
Leadership Role	KMO Measure of Sampling Adequacy		0.949
	Bartlett's Test of Sphericity	Approx. Chi-Square	1932.224
	df		190
	Sig.		0.000

Source: Develop for this research

3.7.2(b) Factor Analysis for TPM Practices

Factor analysis was carried out for TPM practices. Factor analysis is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors.

Table 3.9 presents the output of SPSS that shows the total Eigenvalues and the number of components identified for the variable, TPM practices. The result shows that the cumulative percentage of the Rotation Sums of Squared Loadings is 57.457% which is adequate to create four dimensions for TPM practices. The scree plot for TPM practices is shown in Appendix D. Therefore, the distribution of item in four dimensions of maintenance activities, continuous improvement, resource management and training and education is supported.

Table 3.9
Total Variance Explained for TPM Practices

Comp	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %
1	11.008	32.376	32.376	11.008	32.376	32.376	5.120	15.060	15.060
2	3.399	9.997	42.373	3.399	9.997	42.373	4.935	14.515	29.575
3	2.871	8.444	50.817	2.871	8.444	50.817	4.933	14.509	44.084
4	2.258	6.640	57.457	2.258	6.640	57.457	4.547	13.373	57.457
5	1.280	3.764	61.221						
6	1.180	3.470	64.690						
7	1.130	3.324	68.015						
8	1.026	3.018	71.032						
9	.895	2.632	73.664						
10	.815	2.398	76.062						
11	.755	2.220	78.282						
12	.750	2.205	80.487						
13	.641	1.887	82.374						
14	.607	1.786	84.160						
15	.568	1.671	85.831						
16	.541	1.590	87.421						
17	.471	1.384	88.805						
18	.417	1.227	90.032						
19	.392	1.152	91.184						
20	.386	1.136	92.320						
21	.361	1.063	93.382						
22	.313	.921	94.304						
23	.303	.891	95.195						
24	.258	.759	95.953						
25	.231	.680	96.634						
26	.208	.610	97.244						
27	.184	.541	97.785						
28	.160	.470	98.255						
29	.134	.393	98.647						
30	.124	.364	99.012						
31	.108	.317	99.328						
32	.093	.273	99.601						
33	.083	.244	99.845						
34	.053	.155	100.000						

Source: Develop for this research

The rotated component matrix using Varimax with Kaiser normalization was generated in factor analysis as shown in Table 3.10 Varimax rotation attempts to increase the variances of the factor loadings so that there are both large and small factor loadings (Kaiser, 1958). Varimax is a popular method of rotation in EFA (Howard, 2015).

Table 3.10
Factor Loading of Items in Every Components of TPM Practices

Items	Component			
	1	**2**	**3**	**4**
MP1	.613			
MP2	.780			
MP3	.753			
MP4	.752			
MP5	.698			
MP6	.761			
MP7	.495			
MP8	.711			
MP9	.669			
CI1				.631
CI2				.829
CI3				.732
CI4	.311			.596
CI5				.847
CI6			.353	.538
CI7				.740
CI8				.551
RM1		.667		
RM2		.871		
RM3		.579		
RM4		.574		.338
RM5		.877		
RM6		.741		
RM7	.300	.768		
RM8		.754		
TE1			.701	
TE2			.553	
TE3			.734	
TE4			.761	
TE5			.646	
TE6			.671	
TE7			.746	
TE8			.708	
TE9			.641	

Source: Develop for this research

As shown in Table 3.10, in Component 1 (Maintenance Activities dimension), all factor loadings were more than 0.600 except for item MP7 with a factor loading of 0.495. However, according to Hinkin (1998), Costello and Osborne (2005), Yong and Pearce (2015) and Howard (2015), the cut-off for "good" factor loading is 0.40 while other authors proposed 0.45 (Tabachnick & Fidell, 2007). Therefore, all items in the Maintenance Activities dimension is retained.

In Component 2, (Continuous Improvement dimension), two items, CI4 and CI6 show cross loading with both loading yielding more than 0.32. Tabachnick and Fidell (2001) used 0.32 as a good rule of thumb to determine the minimum loading of an item. A "cross loading" item is regarded as one that loads 0.32 or higher on two or more factors. In this situation, the cross-loading item should be dropped from the analysis. In this case, both items, CI4 and CI6 were dropped, thus reducing the number of items representing Continuous Improvement to six.

As for the third component (Resource Management dimension), two items, RM4 and RM7 exhibit cross loading situations. In this situation, item RM4 was dropped as the loadings yielded 0.574 and 0.338, which are not far apart. However, item RM7 was retained as the loading of the item in Component 3 was high at 0.768 compared to 0.300. Furthermore, the loading of RM7 in Component 2 did not exceed 0.32. The number of items representing Resource Management is reduced to seven.

Component 4 (Training and Education dimension) did not have any items that cross load and all the items loaded more than 0.40. Therefore, all items in Training and Education were retained.

3.7.2(c) Factor Analysis for Organization Performance

Factor analysis was also run for organization performance. Initially, the development of the measurement model for this variable which are equipment effectiveness, autonomous maintenance and planned maintenance. The result of the factor analysis indicating the Eigenvalues are shown in Table 3.11 The scree plot for organization performance is shown in Appendix F.

Table 3.11
Total Variance Explained for Organization Performance

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.450	52.814	52.814	8.450	52.814	52.814	4.481	28.005	28.005
2	1.790	11.188	64.002	1.790	11.188	64.002	3.832	23.947	51.952
3	1.460	9.125	73.127	1.460	9.125	73.127	3.388	21.174	73.127
4	.733	4.584	77.710						
5	.632	3.949	81.660						
6	.550	3.438	85.098						
7	.417	2.605	87.702						
8	.385	2.405	90.107						
9	.358	2.238	92.345						
10	.287	1.793	94.138						
11	.240	1.497	95.635						
12	.215	1.343	96.979						
13	.190	1.190	98.169						
14	.140	.875	99.044						
15	.084	.523	99.567						
16	.069	.433	100.000						

Source: Develop for this research

The result shown in Table 3.11 implies that organization performance can be categorized into three components. The cumulative percentage of rotation sums of squared loading is 73.13%, implying that these dimensions can explain organization performance adequately.

The rotated component matrix is presented in Table 3.12 to show the loadings and cross loading among items. Varimax with Kaiser normalization was also used to rotate the items for this variable.

Table 3.12
Rotated Component Matrix for Organization Performance

	Component		
Items	**1**	**2**	**3**
EE1	.756		.318
EE2	.796		
EE3	.752		.322
EE4	.852	.314	
EE5	.756		
EE6	.805		
AM1		.857	
AM2		.801	
AM3	.477	.645	
AM4	.302	.784	
AM5		.862	
PM1			.758
PM2			.807
PM3			.800
PM4	.325	.324	.604
PM5		.417	.737

Source: Develop for this research

The result shows that for Component 1 (Equipment Effectiveness dimension), all outer loadings yielded high value of more than 0.700. However, three items, EE1, EE3 and EE showed cross loadings. Item EE1 which loaded at 0.756 and 0.318 and item EE4 which loaded at 0.852 and 0.314 were retained as the loads in other components did not exceed the cutoff point of 0.32. Item EE3 with loadings of 0.752 and 0.322 was dropped as it exceeded the cut-off point of 0.32. Hence, for Equipment Effectiveness, the number of representing item is reduced to five.

For Component 2 (Autonomous Maintenance dimension), all factor loadings were high. However, items AM3 and AM4 exhibited cross loading situations. Item AM4 which loaded at 0.302 and 0.784 was retained because the loading in the other component was less than 0.32. Item AM3 which loaded at 0.477 and 0.645 was however, dropped as its loading in the other component exceeded 0.32. Hence, Autonomous Maintenance is represented by four items after dropping item AM3.

For Component 3 (Planned Maintenance dimension), all items yielded highly at more than 0.60. However, item PM4 cross loaded across three components with loadings of 0.325, 0.324 and 0.604. Hence, this item is dropped as the loadings all exceeded 0.32. Item PM5 was also dropped as its loading was 0.417 in component 2 and 0.737 in component 3. Thus, for Planned Maintenance, the number of representing items is reduced to three.

3.7.2(d) Factor Analysis for Leadership Role

Factor analysis was also run for leadership role, the mediator in this research. Initially, the development of the measurement model for this variable indicated that it is a unidimensional variable. The result of the factor analysis indicating the Eigenvalues are shown in Table 3.13. The scree plot for leadership role is shown in Appendix G.

Table 3.13:
Total Variance Explained for Leadership Role

	Initial Eigenvalues			**Extraction Sums of Squared Loadings**		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.296	66.478	66.478	13.296	66.478	66.478
2	.933	4.665	71.143			
3	.793	3.963	75.106			
4	.566	2.832	77.938			
5	.519	2.595	80.533			
6	.482	2.409	82.942			
7	.468	2.341	85.283			
8	.397	1.985	87.268			
9	.383	1.914	89.182			
10	.322	1.610	90.792			
11	.302	1.512	92.305			
12	.258	1.289	93.594			
13	.234	1.171	94.765			
14	.226	1.129	95.894			
15	.214	1.068	96.962			
16	.161	.804	97.765			
17	.128	.638	98.404			
18	.126	.632	99.036			
19	.103	.516	99.552			
20	.090	.448	100.000			

Source: Develop for this research

The extraction sums of squared loadings showed that the cumulative percentage is 66.478 with only one factor. Therefore, leadership role is confirmed as a unidimensional variable and based on the total variance explained, the use of only one factor or dimension is enough to represent the variable.

Rotation matrix was not performed for leadership role as it is a unidimensional variable. The component matrix which is shown in Table 3.14. The result shows that all factor loading of the items were satisfactory with all of the items exceeding 0.70. Therefore, there is no item deletion for this variable.

Table 3.14:
Component Matrix for Leadership Role

	Component
Item	**1**
LR1	.802
LR2	.822
LR3	.763
LR4	.803
LR5	.743
LR6	.823
LR7	.833
LR8	.834
LR9	.811
LR10	.796
LR11	.827
LR12	.854
LR13	.780
LR14	.830
LR15	.838
LR16	.899
LR17	.847
LR18	.836
LR19	.790
LR20	.759

Source: Develop for this research

3.8 Data Collection Procedures

Data for this study was collected using questionnaire which was distributed to the staff in TNBJ individually. The operation department comprises of four units which are the Daily Operation Unit, Main Plant Operation Unit, Coal and Ash Operation Unit, and Common Plant Unit. The Maintenance Department comprises of six units which are the Boiler Maintenance Section (BMS), Turbine Maintenance Section (TMS), Mill Maintenance Section (MMS), Coal & Ash Maintenance Section (CAMS), Electrical Maintenance Section (EMS) and Instrument & Control Section (INCS). The Technical Support Services Department has three units which are Reliability & Engineering (R&E) Unit, Continuous Based Monitoring (CBM) Unit and Maintenance Planning Unit. The respondents were given ten to fifteen minutes to answer the entire questionnaire with in present of researcher. Once the questionnaire is returned, it is immediately checked for completeness and if there were any items unanswered, the researcher helps to clarify the questionnaire. This ensures that none of the questionnaire has missing data.

3.9 Data Analysis Procedures

Data from the questionnaire were analysed using two statistical tools. The statistical software includes the IBM SPSS 23.0 and SmartPLS3.0. the IBM SPSS 3.0 is a statistical package for social science which is used for data entry and running descriptive analysis and factor analysis. It is also used for transforming the database in ".sav" format to comma delimited format (.csv) which is read in SmartPLS3.0. On the other hand, SmartPLS3.0 is a software that runs partial least square-structural equation modelling (PLS-SEM). This approach assesses the inter-relationship among the variables and determine the moderation effect of a variable on the relationship between two other variables.

3.9.1 Rationale of Using PLS-SEM

Structural Equation Modelling (SEM) is a family of statistical model that is able to explain the relationships among multiple variables (Hair et al., 2014). In this study, it measures the interrelationships of four TPM practices with organization performance which are moderated by leadership roles. SEM is similar to multiple regression in SPSS as it assesses a series of equation at one time. Principally, SEM combines both factor analysis and multiple regression. Thus, it becomes a means of estimating a series of inter-related causal relationships simultaneously (Gefen, 2000; Hair et al., 2014). Kline (1998) stated that SEM is used to comprehend the correlational patterns that exist among the variables and to explain as much as possible, their variance within a specific model.

In this research, a variance-based structural equation like PLS-SEM is opted as the choice of data analysis because it can increase the explained variance of independent variable, or more specifically, the endogenous latent construct (Hair, Ringle & Sarstedt, 2011). PLS is used for two possible reasons. Firstly, for theory confirmation and secondly, developing existing theories. In developing theories, PLS is used to provide recommendations based on empirical evidences gathered from an investigation of the relationships among variables (Urbach & Ahlemann, 2010).

PLS-SEM is often selected as the statistical means of testing structural equation models because normal-distributed input is not a mandatory requirement. There is also ease in its application particularly when working with a complex structural equation models with large number of constructs and indicators. Further to that, it is suitable for theory development and prediction purpose (Hair et al., 2014; Urbach & Ahlemann, 2010). These conditions reflect the current study as purposive sampling is used which might result in a non-normal distribution of data. There are also six distinct variables with indicators ranging from five to twenty for each variable to investigate TPM practices and its relationship with operation performance under the moderation of leadership roles. In addition, this research contributes toward development of theory to relate TPM practices to operation management as well as determining the extent to which TPM practices based on maintenance activities, continuous improvement, resource management and training and education can predict operation management. In PLS-SEM, it is able to maximise the explained variance of endogenous or independent construct, in the case of this research, operation performance (Hair et al., 2011).

3.9.2 Stages in PLS-SEM

The analysis of data in PLS-SEM follows a systematic procedure. The procedure started with Stage 1: Determining the Structural Model, Stage 2: Determining the Measurement Model, Stage 3: Data Collection and Determination, Stage 4: PLS Path Model Estimation, Stage 5: PLS-SEM Results of the Measurement Model Assessment, Stage 6: PLS-SEM Results of the Structural Model Assessment, Stage 7: Advanced PLS-SEM Analyses and Stage 8: Interpretation of Results and Drawing Conclusion.

The PLS-SEM approach comprises of two main stages: the assessment of the measurement models and the assessment of the structural model (Urbach & Ahlemann, 2010). Figure 3.3 shows the stages of analysis in PLS-SEM using the SmartPLS3.0 tool.

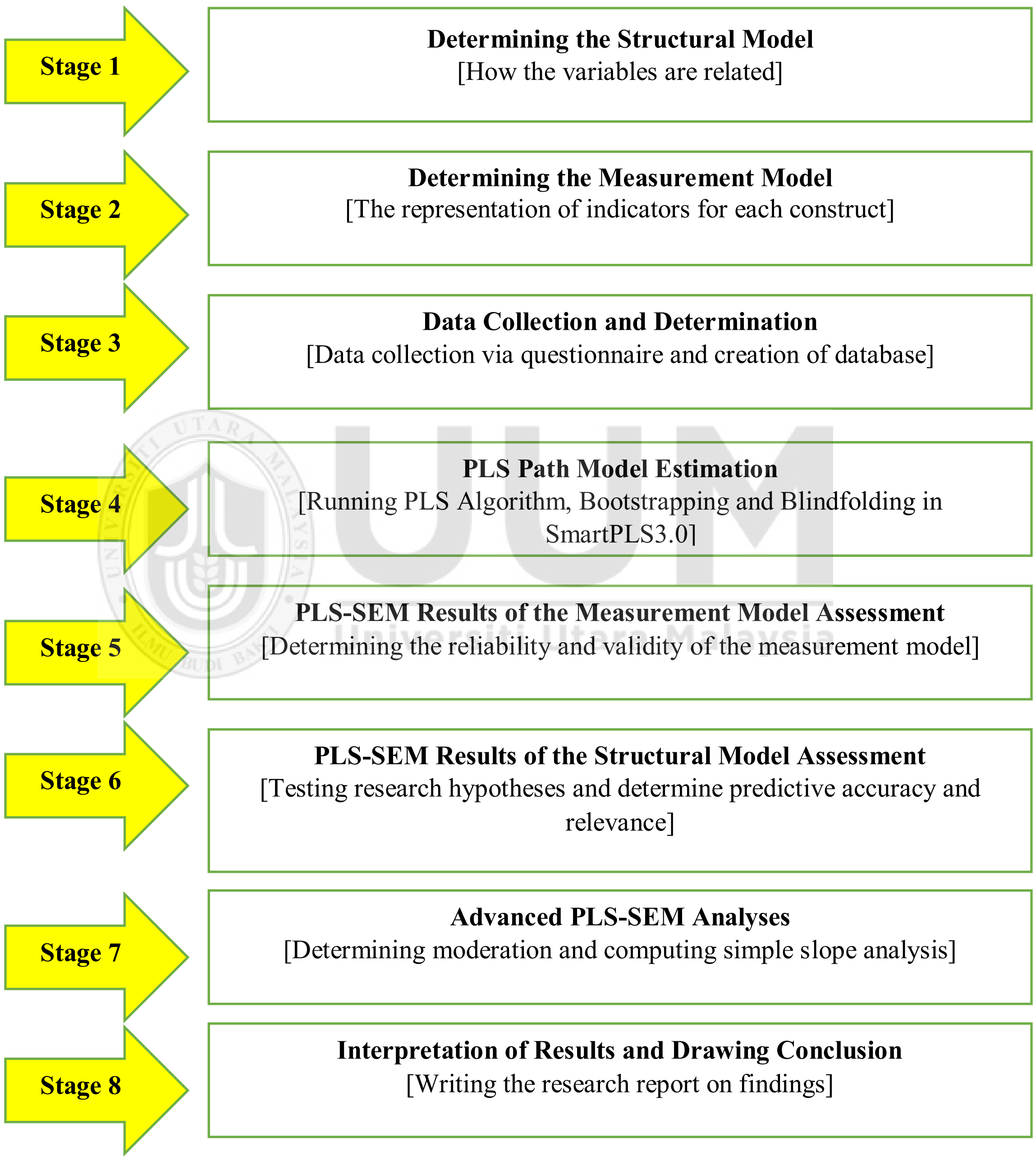


Figure 3.3
Systematic Procedures in PLS-SEM Application
Source: Hair et al. (2014)

3.9.2(a) Determination of the Structural Model

The structural model of this research is based on the theoretical and conceptual framework that were discussed in the previous chapters. Figure 3.4 presents the structural model which is used in this research. Based on the result from EFA, maintenance activities (Code: MP) retains all nine reflective indicators; continuous improvement (Code: CI) has six indicators with the deletion of one indicator, CI4; resource management (Code: RM) has seven indicators with the deletion of one indicator, RM7; training and education (Code: TE) retains all nine indicators. Leadership role (Code: LR) acts as a moderating variable with 20 reflective indicators which are hidden in the model. Operation performance (Code: OP) is regarded as a unidimensional construct in this model with 12 reflective indicators from autonomous maintenance (Code: AM) whereby one indicator, CI3 was dropped; effective maintenance (Code: EE) one indicator, EE3 dropped; and planned maintenance (Code: PM) where two indicators, PM4 and PM5 were dropped.

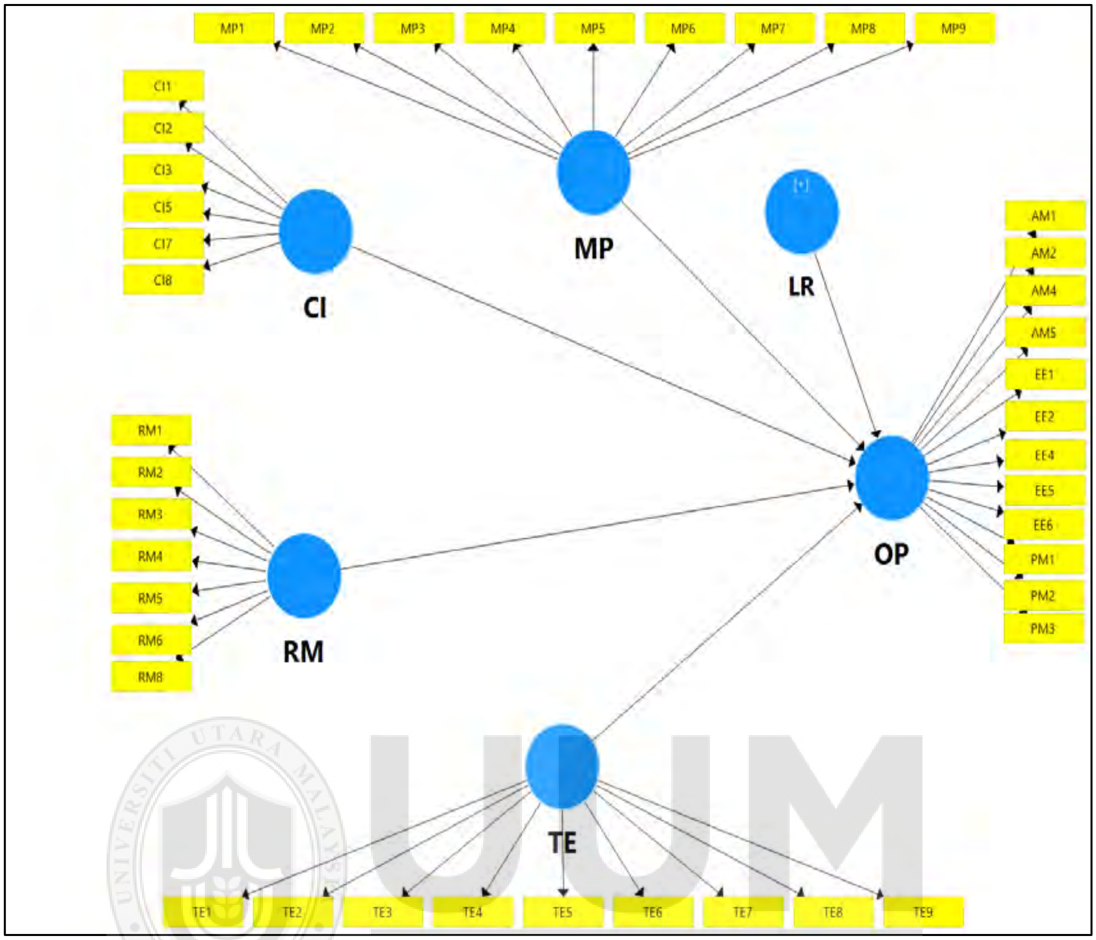


Figure 3.4
The Structural Model of This Research
Source: Develop for this research

3.9.2(b) Measurement Model Assessment

The measurement model refers to the relationships among the measured variables and their respective latent constructs (Hair et al., 2014). In this research, there are six measurement models: maintenance activities, continuous improvement, resource management, training and education, leadership roles and operation performance. These constructs are represented by their own indicators. Sarstedt and Schloderer (2010) explained that there are two types of indicator, reflective and formative.

Formative indicators are indicators that form or cause the latent construct and in SmartPLS3.0, these indicators are represented with an arrow pointing from the indicator to the construct (Urbach & Ahlemann, 2010). Formative indicators do not need to be correlated as it represents different dimension of the latent construct (Chin, 1998; Gefen, 2000). It is assumed that all the indicators have an effect on a single construct and therefore a change in one or more of the indicators will cause changes in the latent variable. Therefore, formative indicators are not interchangeable (Javis, 2003). The removal of an indicator will likely result in the change in the meaning of the variable (Bollen, 2011).

The reflective indicator is a situation where the indicator represents the effect that is caused by the latent variable and represented in SmartPLS3.0 as indicators with arrows pointing outward from the construct to the indicator (Gefen, 2000; Urbach & Ahlemann, 2010; Hair et al., 2014). Reflective indicators are assumed to be correlated in a unidimensional manner as they measure the sample underlying construct (Hair et al., 2014). Hence, whenever the latent variable changes, all reflective indicators of the latent variable change s accordingly (Urbach & Ahlemann, 2010). This implies that reflective indicators are essentially interchangeable, and the removal of an indicator does not alter the gist of the latent variable (Bollen, 2011).

These explanations led to the conclusion that the indicators used in the current research are all reflective in nature. Therefore, the measurement models in this research undertake that the indicators are a representation of the construct that they are assigned to

(Urbach & Ahlemann, 2010; Hair et al., 2014). The assessment of the reflective measurement model is based on the following criteria which are summarized in Table 3.15. The measurement models are assessed based on indicator reliability, internal consistency, construct reliability, convergent validity and divergent validity.

Table 3.15
Assessment Criteria for Reflective Measurement Models

Indices	Measurement	Statistical Requisites
Outer loading	Indicator reliability	Absolute standardized outer loading is advised at 0.7 or higher. Loading between 0.4 and 0.7 can be considered for retention or deletion depending on whether composite reliability and validity has been met. Indicator is retained if there is composite reliability and validity (Hair et al., 2014).
Cronbach's alpha	Internal consistency	The cut off value of 0.70 is acceptable in early phase but in later phase, 0.8 or 0.9 is more desirable (Nunnally, 1978; Nunnally & Bernstein, 1994)
Composite reliability	Construct reliability	Composite reliability should be 0.7 or higher to show acceptable construct reliability (Hair et al. 2014).
Average variance extracted (AVE)	Convergent validity	AVE should be 0.50 or higher (Hair et al. 2014)
Fornell-Larcker criterion	Discriminant validity	Fornell-Larcker criterion is a discriminant validity measure at construct level. Square of AVE which is indicated as the value in the SmartPLS3.0 table on the top and uppermost right is higher than the correlations of the latent variables which are values under the square of AVE value.
Heterotrait-monotrait ratio (HTMT)	Discriminant validity	HTMT is also a discriminant validity measure at construct level. The threshold for acceptance is 0.85 and below (Clark & Watson, 1995; Kline, 2011). HTMT close to 1 indicates lack of discriminant validity.

Source: Develop for this research

3.9.2(c) Structural Model Assessment

The structural model or often referred as the inner model reflects the relationship among the latent variables. The assessment of the structural model is done once the measurement model has been accepted as satisfactory. The assessment of the structural model includes the evaluation of the path coefficient in terms of significance and also the determination of predictive accuracy (R^2), the predictive relevance (Q^2) and their respective effect size, f^2 and q^2 (Hair et al., 2014). Table 3.16 shows the criteria for assessing the structural model.

Table 3.16
Assessment Criteria for Structural Model

Indices	Measurement	Statistical Requisites
Path coefficient, β, significance, p and T statistics	Positive/negative relationship, significance of relationship	If p-value is less than 0.05, it is assumed that there is a significant relationship, thus the corresponding research hypothesis is supported (Hair et al., 2010)
Coefficient of determination (R^2)	Predictive accuracy	Should be greater than 0.2 (Hair et al. 2014) Rule of thumbs: 0.26 substantial 0.13 moderate 0.02 weak (Cohen, 2013)
Q^2 value	Predictive relevance	Using Stone-Geisser test: a value above zero indicates that the model has predictive relevance (Geisser, 1975; Stone, 1974; Fornell & Cha, 1994; Hair et al., 2014)
Effect size f^2	Effect size for R^2	Rule of thumb: 0.02 small effect 0.15 moderate effect 0.35 large effect (Cohen, 2013)

Source: Develop for this research

3.10 Ethical Consideration

Bouma (2000) and Hussey (1997) explained that research programs involves moral and ethical issues. The researcher has to clearly identify the significant impact of the research program to the parties involved. During conduct this research, the ethical matters involves with four parties including the researcher, Universiti Utara Malaysia, the selected power generation company which is TNB Janamanjung Sdn Bhd and the respondents. As refer to Appendix A, written approval has been given by the organisation to carry out this research which is including case writing and data collection.

Zikmund (2003) elaborated that the need of all parties involves concerning on the ethical issues and ethical questions. Therefore, for this research the interaction between four parties mutually agreed with respect. Due to that, TNBJ representative during develop the questionnaire consist of TNBJ top management, Legal Contract Service department and Human Resource Administration department. Potential ethical issues and potential risk discussed and elaborated among four parties. Since the research involves the acquisition, analysis and distribution of information, it ought to be done deprived from triggering harm to the research respondents (Rubin & Rubin, 1995; Ticehurst & Veal, 1999; Zikmund, 2003). Consequently, the researcher planned and strategized the mechanism on getting information from the four parties with a high consideration on ethical issues. Therefore, the researcher seeks for approval from the four parties. Through official letters and formal communication channels such as email, the researcher had the permission granted before the launch of the research program. Therefore, the researcher need to have authorization from respective parties before start the research to meet the compulsory requirements such as voluntary participation, informed consent, privacy or autonomy and confidentially (Neuman, 2006; Zikmund, 2003; Burns & Grove,1999).

According to Neuman (2006), the respondents have the right to reject the participants which actively involved in data collection process. Having said that, the respondents free to choose on giving feedback. The researcher explains the rules to the participant at the beginning of the session to ensure that the survey goes smoothly. Besides that, the researcher informed the participants two week before the event, so that the participant could arrange their schedule and availability. Through systematic follow up, the researcher contacts the participants by phone call and text messaging. In case that the participant could not attend, the researcher does not force them to. The researcher needs to find an available replacement who could participate accordingly. The researcher has secured the informed consent of intended respondents in writing. The researcher keeps the record in a safe condition and manages the entire record in the filing system.

In addition, Zikmund (2003) described that all participants' identities were protected from disclosure and remained confidential. To preserve anonymity in this research, participants were assigned with a respondent code and no names were used. Besides that, the researcher respected the privacy or anonymity of the participants. In term of confidentiality, the researcher presented the data in aggregate form only. The method is supported by Burns & Grove (1999), where in a quantitative survey, the respondent and the participants' information is not disclosed to the public.

3.11 Summary

This chapter has provided a detailed explanation about the research methods that were employed to ensure appropriate and adequate data was collected to represent the population and at the same time addresses the identified research gaps, fulfilled the research objectives and answered the research questions. The methods employed in this research were explained from various perspectives beginning with the approach and design used, the unit of analysis and the determination of population, sample and sampling technique. A detailed explanation of the research instrument indicates that there was a strong and careful consideration to develop a questionnaire that has high content reliability and validity.

The pilot study also explored and indicated that the questionnaire was also examined from a statistical perspective to indicate its reliability and validity. Further to that, the data collection procedures were explained and followed by the procedures used to analyse data using PLS-SEM. In a nutshell, this chapter indicates that the research has been implemented based on a robust methodology to provide findings that can be relied upon.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the result of the analysis for this research. As mentioned before, the result analysis applied IBM SPSS 23.0 and SmartPLS3.0. The statistical tool, IBM SPSS 23.0 was used to create the database whereby information from the questionnaire was transferred to SPSS template. For the actual research data, IBM SPSS 23.0 was used to carry out descriptive statistical analysis to generate the frequency and percentage from the data to describe the demographic profiles of the respondents. In addition, the software was used to generate a descriptive analysis result of the research variable whereby the mean scores were computed for each of the dimensions in TPM and Organization Performance, as well as for Leadership Roles. The mean scores provide the distributive pattern of the responses given by the respondents in terms of their agreement to the stated items in each research variable. Inferential analysis to test the research hypotheses was carried out using SmartPLS3.0 which is a combination of a factor analysis and regression analysis procedures.

4.2 Demographic Profiles of the Respondents

A total of 283 sets of questionnaires was collected from male staff of TNBJ. The response rate for this research is 76.0 % which is acceptance. As mentioned in Chapter 4, the sample requirement based on total population proposed by Krejcie and Morgan (1970), for a population of 370, the sample size required in 189. Due to that, a sample size that is more than 189 is considered adequate to represent the population for this research. Figure 4.1 shows the tabulation of the respondents based on their level of education. A total of 212 respondents or 74.9% have Diploma while 23.7% or 67 respondents have SPM qualification and only 1.4% or 4 respondents have Bachelor's degree qualification.

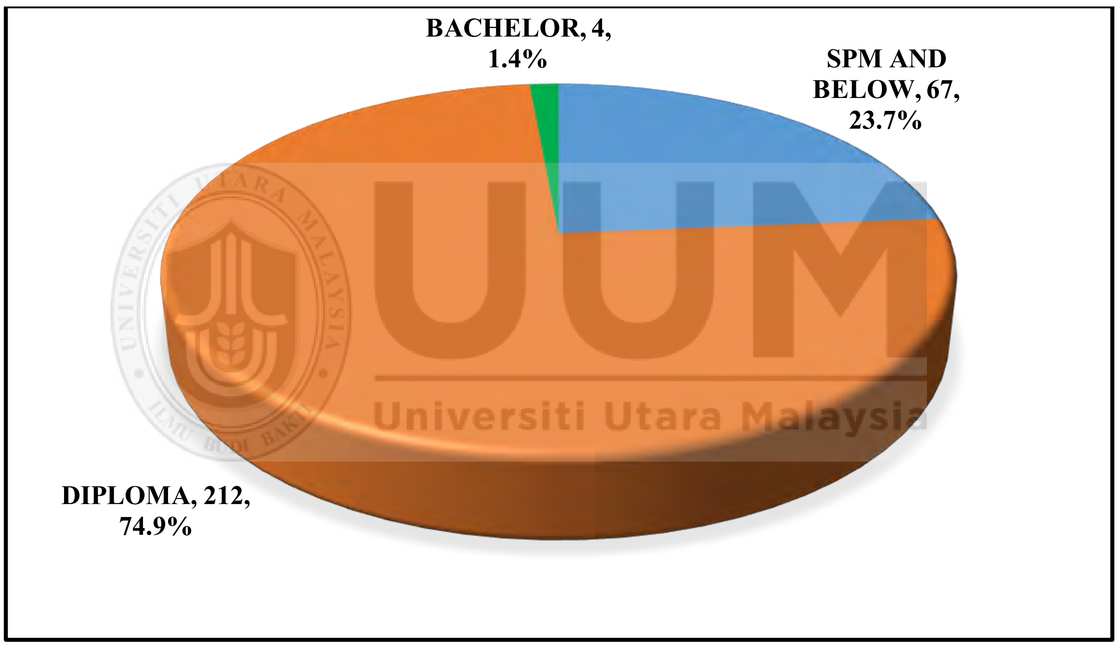


Figure 4.1
Tabulation of Respondents Based on Education Level
Source: Develop for this research

Figure 4.2 shows that 84 of the respondents or 29.7% have less than five years of working experience whereas 132 respondents or 46.6% have between six to ten years of experience and 55 respondents or 19.4% with 11 to 15 years of experience while those with more than 15 years of experience totaled 12 respondents or 4.2%.

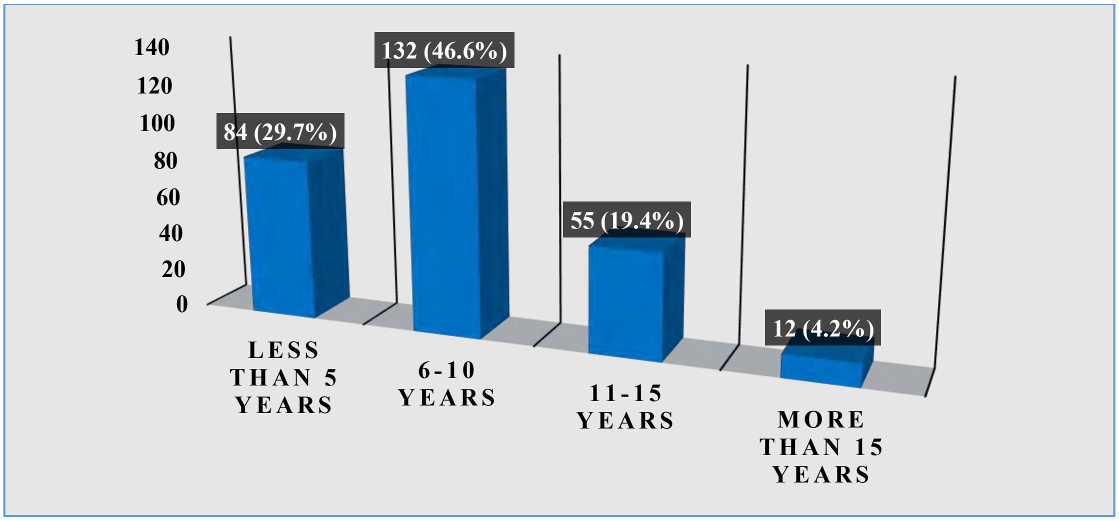


Figure 4.2
Tabulation of Respondents Based on Length of Experience
Source: Develop for this research

4.3 Measurement Models

Based on the research objectives and the theoretical framework, two measurement models were used in this research to ensure that analysis of data can lead to the fulfilment of these objectives. The first measurement models relate TPM practices and organization performance as first order constructs and the second measurement models relate the four dimensions of TPM practices to organization performance as first order constructs. The use of two models was necessary because in the first measurement models of TPM practices and organization performance, TPM practices regarded as a unidimensional construct was related to organization performance. Therefore, all three constructs: TPM practices, leadership roles and organization performance are reflective unidimensional first order constructs.

The second measurement models assess the relationships between each dimension of TPM practices with organization performance. Therefore, maintenance activities, continuous improvement, training and education, and resource maintenance are reflective first order constructs related to the unidimensional reflective first order construct of organization performance. Leadership roles are also regarded as unidimensional reflective first order construct.

4.4 Descriptive Analysis Result of the Research Variables

Table 5.1 shows the descriptive analysis result of the research variables, TPM practices and its sub-dimensions: maintenance activities (MP), continuous improvement (CI), resource management (RM) and training and education (TE); organization performance (OP) and its sub-dimensions: autonomous maintenance (AM), equipment effectiveness (EE) and planned maintenance (PM); and leadership roles (LR).

The level of respondents' perception about the research variables is determined based on the mean score. The 5-point Likert score was divided into three categories based on the mean score with low for a mean score between 1.00 to 2.66, moderate when mean score is 2.67 to 3.66 and high for a mean score of 3.67 and more (Hardre et al.,2006). The result shows that the respondents perceived TPM practices (mean = 3.627) moderately. Maintenance activities (mean = 3.536), resource maintenance (mean = 3.480) and training and education (mean = 3.524) were perceived moderately but continuous improvement (mean = 3.993) was perceived highly. Organization performance (mean = 3.870) was perceived highly. Each of its dimensions: equipment effectiveness (mean = 4.034), autonomous maintenance (mean = 3.717) and planned maintenance (mean = 3.825) were perceived highly. Leadership roles (mean = 3.928) was also perceived highly.

Table 4.1:
Mean and Standard Deviation of Research Variables

Variables	Mean	Standard Deviation	Level of Agreement
Overall TPM Practices	**3.627**	**0.558**	**Moderate**
Maintenance Activities	3.536	0.791	Moderate
Continuous Improvement	3.993	0.624	High
Resource Maintenance	3.480	0.749	Moderate
Training & Education	3.524	0.830	Moderate
Overall Organization Performance	**3.870**	**0.555**	**High**
Equipment Effectiveness	4.034	0.653	High
Autonomous Maintenance	3.717	0.704	High
Planned Maintenance	3.825	0.708	High
Leadership Roles	**3.928**	**0.569**	**High**

* Mean score determines low perception (1.00 – 2.66); moderate (2.67 – 3.66); high (3.67 – 5.00)

Source: Develop for this research

This result implies that continuous improvement is perceived more important than other aspects of TPM practices. Additionally, in terms of organization performance, equipment effective is considered better compared to autonomous maintenance and planned maintenance. The leadership roles in this company is also perceived highly by the non-executives. Nevertheless, the use of central tendency measurement to determine the importance of each component is not accurate. Central tendency is "the statistical measure that identifies a single value as representative of an entire distribution" (Gravetter & Wallnau, 2000). Mean score is a good measurement of central tendency but can be influenced by extreme values or outliers (Dawson & Trapp, 2004). Although the mean scores indicated above provides some insight to the importance of each dimension of TPM practices on organization performance, the findings are inconclusive. Further analysis with inferential statistics is required.

4.4.1 Assessment with TPM Practices and Organization Performance

Figure 4.3 shows the outer models depicting the measurement models of three research variables: TPM practices, leadership roles and organization performance. Based on the result of the EFA in the pilot study, TPM practices is represented by 32 reflective indicators, leadership roles by 20 reflective indicators and organization performance by 12 reflective indicators. These outer models will be labelled Model A in this research.

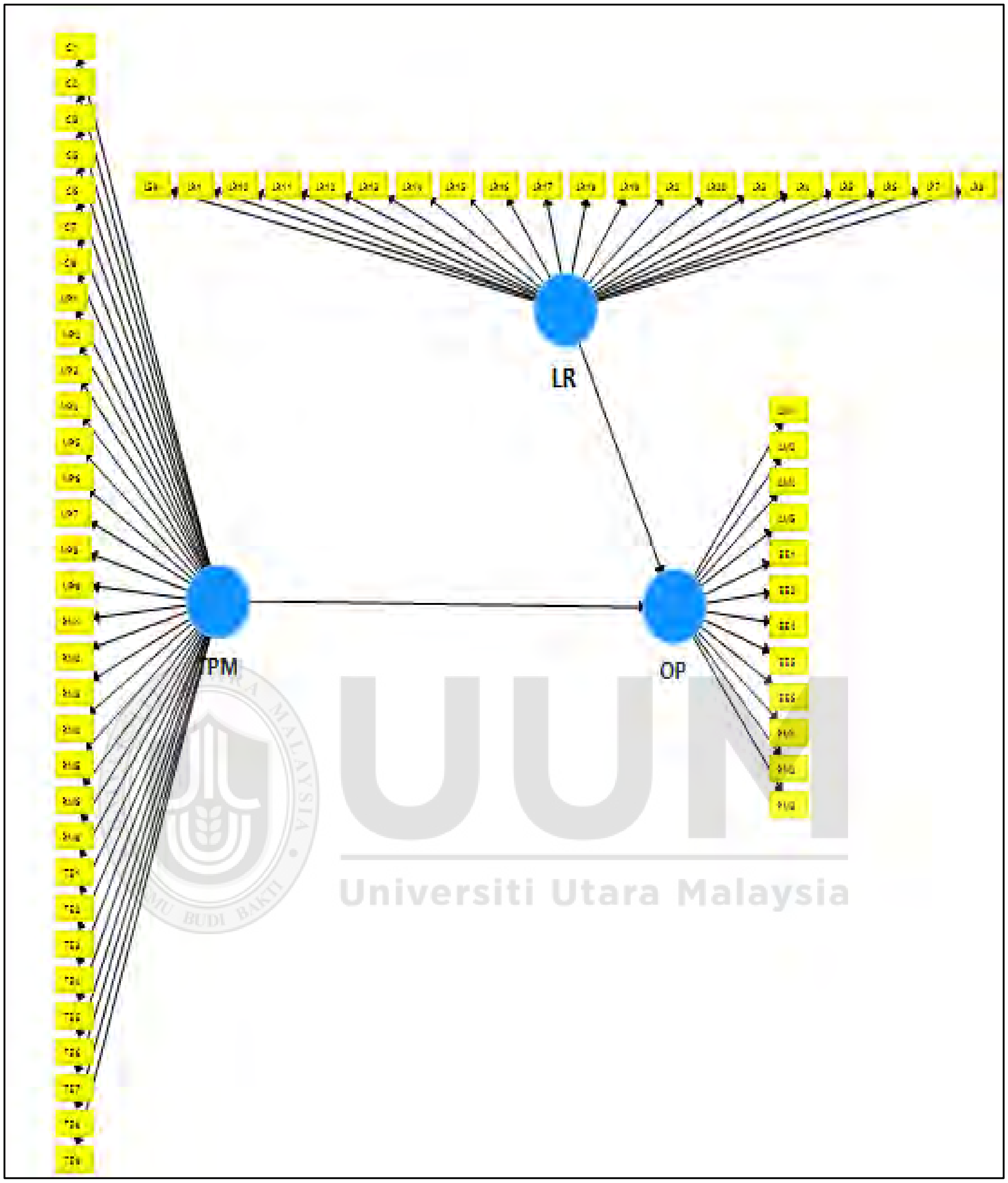


Figure 4.3
The Measurement Models of the Main Research Variables
Source: Develop for this research

4.4.2 Measurement Models Assessment with TPM Dimensions and OP as First Order Constructs

The measurement models associating the four TPM dimensions or sub-constructs and organization performance in the presence of the moderating variable, leadership roles are presented in Figure 4.4. The sub-construct, maintenance activities (MP) is represented by nine reflective indicators, continuous improvement by seven reflective indicators, resource maintenance by seven reflective indicators and training and education by nine reflective indicators. Leadership roles (indicators not shown in Figure 4.4) are represented by 20 reflective indicators while organization performance is represented by 12 reflective indicators. These outer models will be labelled as Model B in this research.

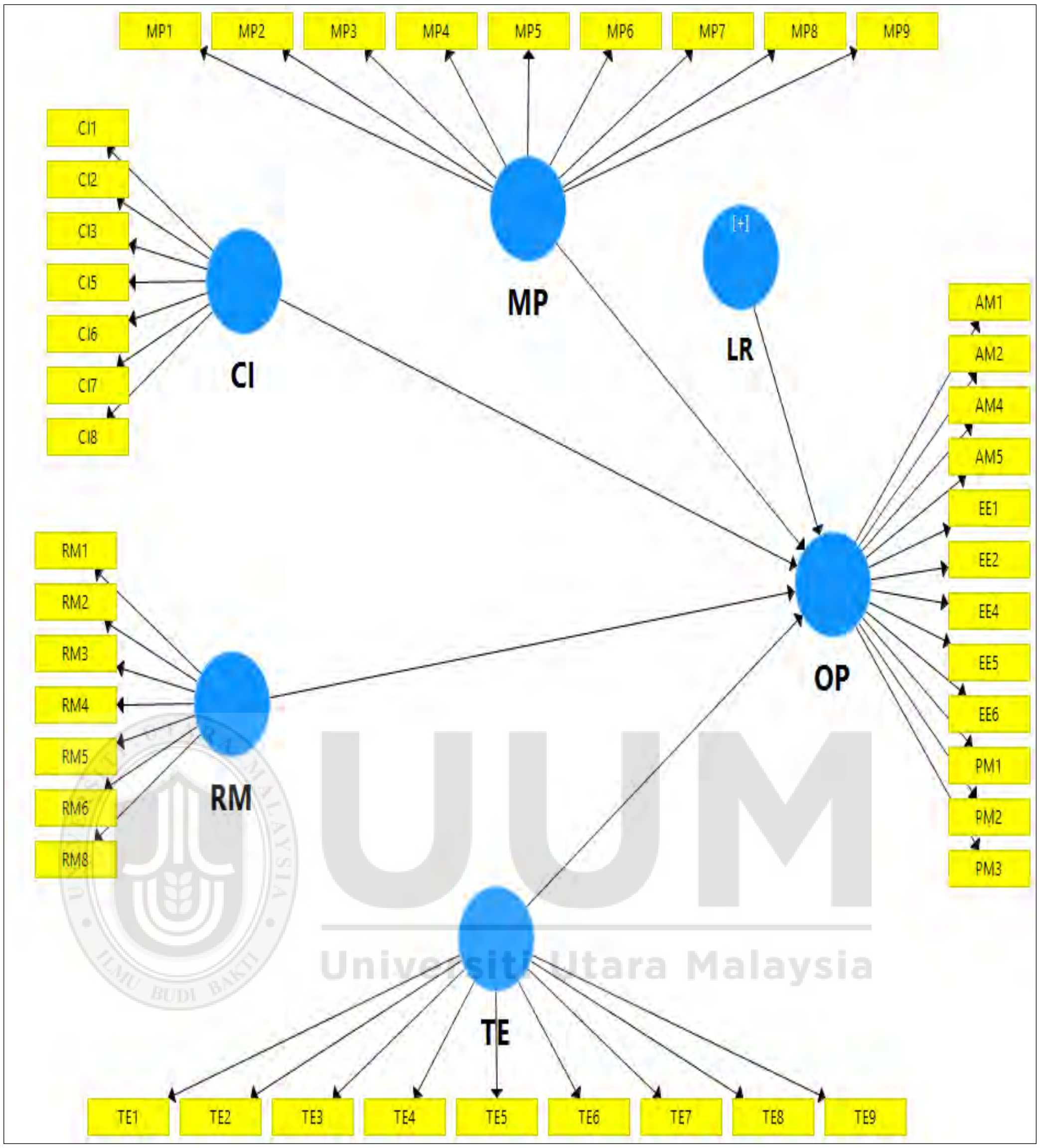


Figure 4.4
The Measurement Models of the Sub-Constructs of TPM Practices with Leadership Roles and Organization Performance
Source: Develop for this research

4.5 Measurement Models Assessment

The assessment of the measurement models determines the reliability and validity of the indicators and the constructs. For this purpose, indicator reliability, construct reliability and validity, convergent validity and divergent validity are reported. Indicator reliability is based on the value of the indicators' outer loading (OL) whereby Hair et al. (2017) suggested that the cut-off point of acceptance is 0.708. However, in initial study such as this current study, a threshold of 0.600 is acceptable (Hair et al., 2014). Construct reliability is given by Cronbach's alpha which specifically determines the internal consistency of the construct and composite reliability (CR). The threshold of acceptance is 0.708 (Hair et al., 2017). Construct validity is provided by the average variance extracted (AVE) whereby acceptable value is more than 0.50 (Wong, 2013).

As discussed before, the convergent validity is reflected by the achievement of acceptable AVE with all indicators having acceptable outer loadings. Divergent validity is determined using two main measures: Fornell-Larcker criterion and Heterotrait-Monotrait ratio (HTMT). Fornell-Larcker (1981) proposed that the square root of AVE in each latent variable can be used in discriminant validity determination whereby this value which is placed on the top of the column in reporting table in SmartPlS result output is larger than the other values of correlation among the latent variables. (Hair et al., 2017). HTMT ratio is advised to be more than 0.850 to indicate divergent validity (Hair et al., 2014; Wong, 2013).

4.5.1 Assessment of Measurement Models in Model A

Figure 4.5 gives the result of the path algorithm which shows the path coefficient (β) and the outer loadings of each indicators. All outer loadings were more than 0.60 and based on Hair et al. (2014), these values indicate acceptable indicator reliability.

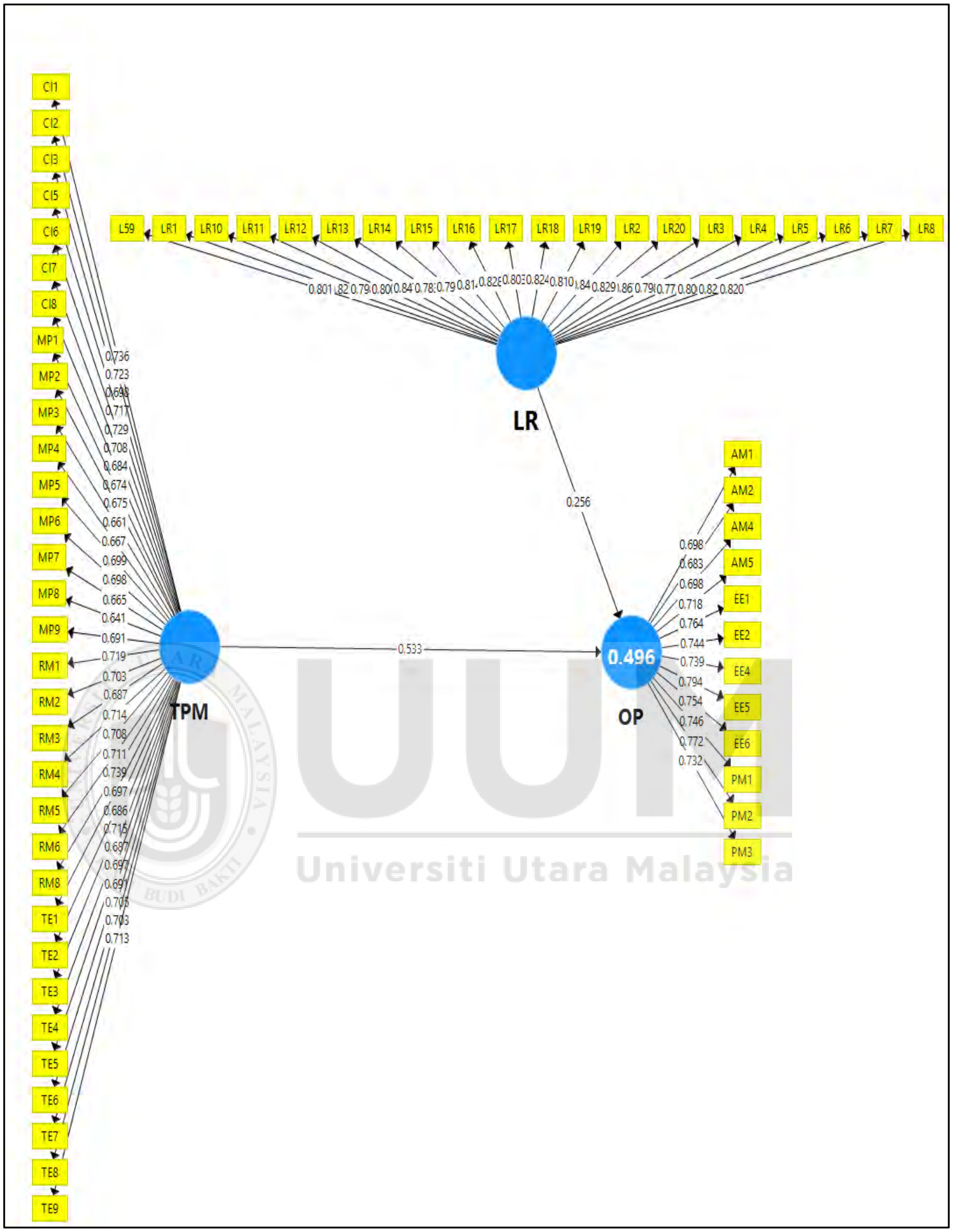


Figure 4.5

Output of the Path Algorithm for Model A

Source: Develop for this research

Table 4.2 presents the indicator reliability and construct reliability and validity and convergent validity which were acceptable after deletion of four indicators from TPM practices. The four indicators deleted is coming from maintenance activities which are MP3, MP4, MP7 and MP8. Hair et al. (2014; 2017) and Wong (2013) stated that outer loading between 0.40 and 0.60 can be retained if the AVE value is more than 0.50. In this case, AVE is 0.506 for TPM practices after deletion of the four items. For the construct, leadership roles and organization performance, the indicator reliability, construct validity and reliability and convergent validity were all satisfied. Therefore, no indicators were removed from these two constructs. Detailed construct for the leadership roles and organisation performance represent in Table 4.3 and Table 4.4.

Table 4.2
Indicator Reliability, Construct Reliability, Validity and Convergent Validity for TPM Practices

Construct	Indicators	OL	Cronbach's Alpha	CR	AVE	Assessment
TPM Practices	CI1	0.736	0.966	0.968	0.488 (0.506)	Indicator reliability acceptable; Internal consistency acceptable; CR acceptable but AVE not acceptable. Four indicators, MP3, MP4, MP7 and MP8 were deleted one by one to reach the AVE threshold. The deletion of these indicators increased AVE from 0.488 to 0.506. Convergent validity is acceptable.
	CI2	0.723				
	CI3	0.698				
	CI5	0.717				
	CI6	0.729				
	CI7	0.708				
	CI8	0.684				
	MP1	0.674				
	MP2	0.675				
	MP3	0.661				
	MP4	0.667				
	MP5	0.699				
	MP6	0.698				
	MP7	0.665				
	MP8	0.641				
	MP9	0.691				
	RM1	0.719				
	RM2	0.703				
	RM3	0.687				
	RM4	0.714				
	RM5	0.708				
	RM6	0.711				
	RM8	0.739				
	TE1	0.697				
	TE2	0.686				
	TE3	0.715				
	TE4	0.687				
	TE5	0.697				
	TE6	0.691				
	TE7	0.705				
	TE8	0.703				
	TE9	0.713				

Source: Develop for this research

Table 4.3 represents the indicator reliability and construct reliability and validity and convergent validity for leadership roles and the results shown were firmly acceptable. According to Wong (2013) the acceptable value for the outer loading must between 0.40 and 0.60. The highest outer loading for leadership roles is 0.847 recorded at LR12 and the lowest outer loading recorded at 0.773 at LR5. Meanwhile, AVE value for Leadership roles is 0.664 is acceptable which is higher than 0.5 (Hair et. al., 2014; 2017). As mentioned before, there are no indicators removed from the construct.

Table 4.3
Indicator Reliability, Construct Reliability, Validity and Convergent Validity for Leadership Roles

Construct	Indicators	OL	Cronbach's Alpha	CR	AVE	Assessment
Leadership Roles	LR1	0.825	0.973	0.975	0.664	Indicator reliability acceptable; Internal consistency acceptable, CR acceptable; construct validity acceptable. Convergent validity is acceptable. The result shows that all factor loading of the items were satisfactory with all of the items exceeding 0.70. Therefore, there is no item deletion for this variable.
	LR2	0.842				
	LR3	0.867				
	LR4	0.798				
	LR5	0.773				
	LR6	0.806				
	LR7	0.825				
	LR8	0.820				
	LR9	0.801				
	LR10	0.798				
	LR11	0.800				
	LR12	0.847				
	LR13	0.783				
	LR14	0.796				
	LR15	0.814				
	LR16	0.828				
	LR17	0.803				
	LR18	0.824				
	LR19	0.810				
	LR20	0.829				

Source: Develop for this research

Table 4.4 represents the results for organisation performance which indicate the reliability, construct reliability and validity and convergent validity. In total, the results were firmly acceptable where the highest outer loading recorded for organisation performance is 0.794 and the lowest outer loading is 0.683. As supported by Wong (2013) the acceptable value for the outer loading must between 0.40 and 0.60. The AVE value for organisation performance is 0.544 which is higher than 0.5 and this value is acceptable and within limits. Therefore, there are no indicators removed from the organisation performance construct.

Table 4.4
Indicator Reliability, Construct Reliability, Validity and Convergent Validity for Organisation Performance

Construct	**Indicators**	**OL**	**Cronbach's Alpha**	**CR**	**AVE**	**Assessment**
Organization Performance	AM1	0.698	0.924	0.935	0.544	Indicator reliability acceptable; Internal consistency acceptable, CR acceptable; construct validity acceptable. Convergent validity is acceptable. For AM3, EE3, PM4 and PM5 was excluded before during the Rotated Component Matrix
	AM2	0.683				
	AM4	0.698				
	AM5	0.718				
	EE1	0.764				
	EE2	0.744				
	EE4	0.739				
	EE5	0.794				
	EE6	0.754				
	PM1	0.746				
	PM2	0.772				
	PM3	0.732				

Source: Develop for this research

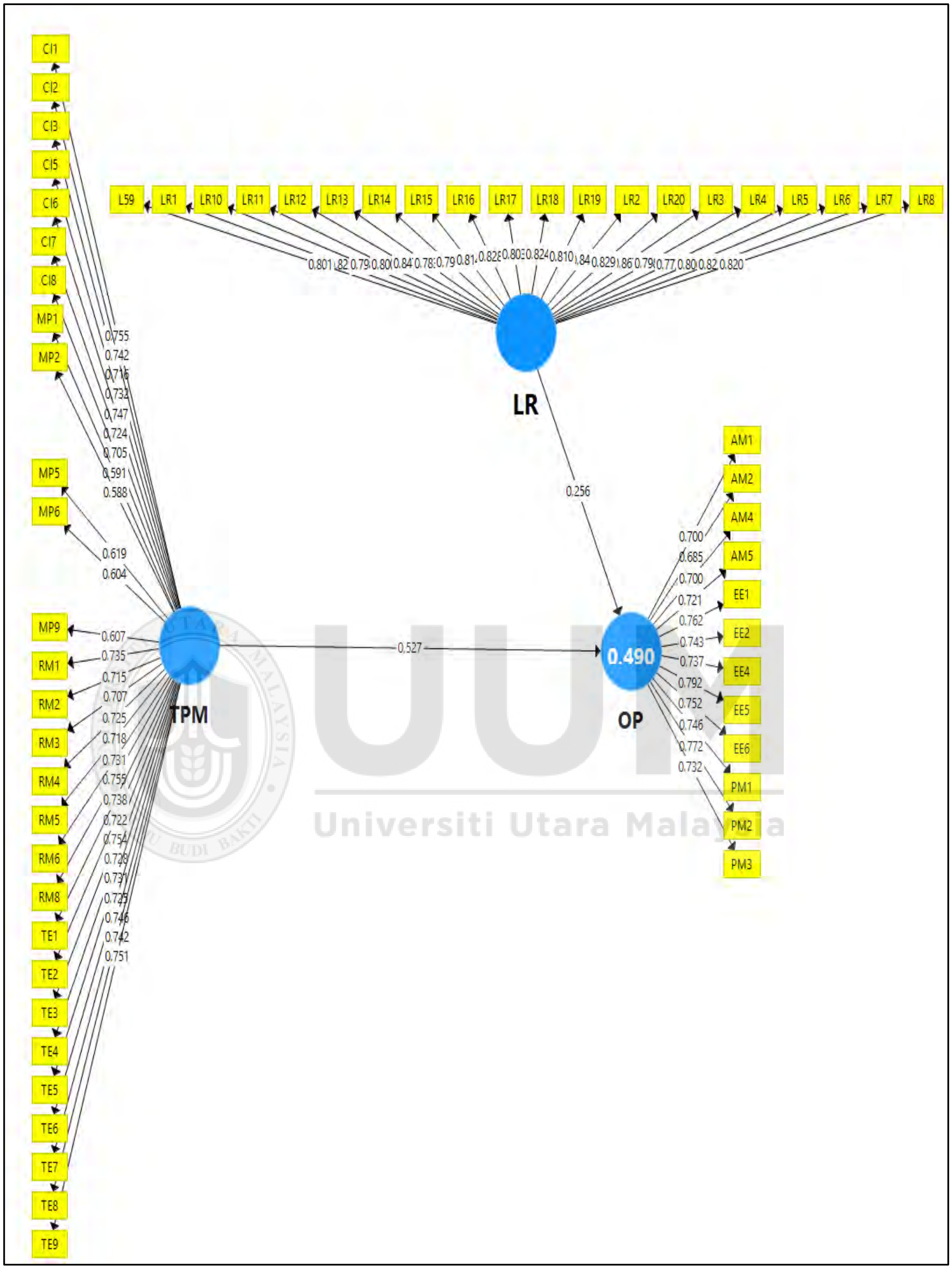


Figure 4.6
Output of the Path Algorithm for Model A After Deletion of Four Indicators
Source: Develop for this research

Table 4.5 presents the Fornell-Larcker criterion of the measurement models in Model A. The result shows that the number on the top of the column (the square root of AVE of the construct) is always higher that the correlations between the constructs (values below the square root of AVE of the construct). Hence, there is discriminant validity of the three constructs.

Table 4.5
Fornell-Larcker criterion of the measurement models in Model A

	Leadership Roles	**Organization Performance**	**TPM Practices**
Leadership Roles	**0.815**		
Organization Performance	0.543	**0.738**	
TPM	0.544	0.666	**0.711**

Source: Develop for this research

Another measure of discriminant validity of the research measurement model is by using HTMT ratio. As shown in Table 4.6, HTMT ratio in Model A met the requirement acceptable values of less than 0.850. Therefore, the measurement models in Model A have acceptable reliability and validity.

Table 4.6
HTMT Ratio in Model A

	Leadership Roles	**Organization Performance**	**TPM Practices**
Leadership Roles			
Organization Performance	0.593		
TPM	0.559	0.696	

Source: Develop for this research

Multicollinearity issues were also determined using the Variance Inflation Factor (VIF). Hair et al. (2014, 2017) stated that a value of less than 5.0 indicates the absence of multicollinearity issues. Table 4.7 presents the VIF values in Model A., indicating values less than 5.0 and therefore, concluding that there are no multicollinearity issues in research Model A.

Table 4.7
VIF in Model A

	Leadership Roles	**Organization Performance**	**TPM Practices**
Leadership Roles		1.421	
Organization Performance			
TPM Practices		1.421	

Source: Develop for this research

4.5.2 Assessment of Measurement Models in Model B

Path algorithm analysis was carried out using Model B in SmartPLS3.0 and the following result in Figure 4.7 shows that outer loadings of the corresponding constructs and the path coefficient (β) of the paths linking these constructs. All outer loadings were above 0.60, indicating acceptable values (Hair et al., 2017).

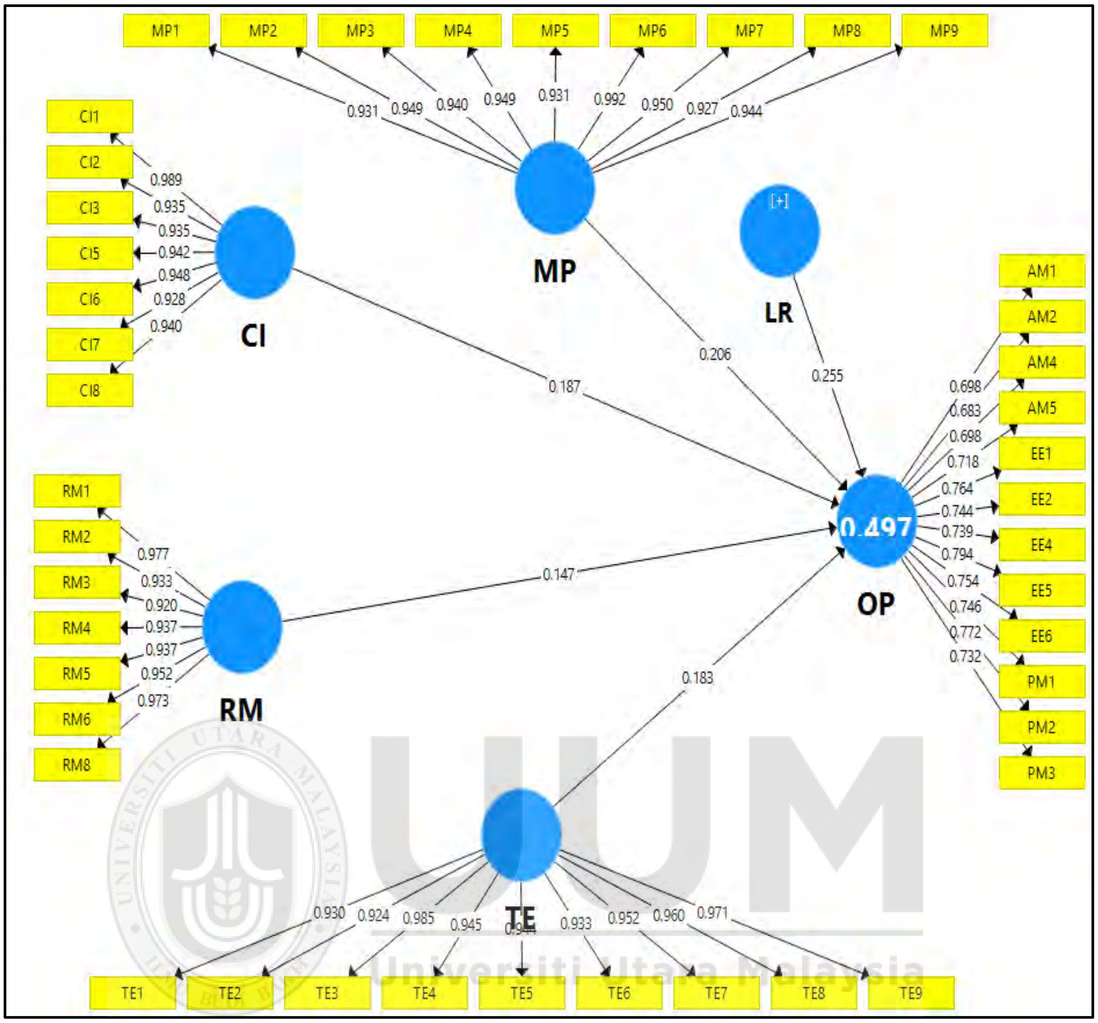


Figure 4.7
Output of the Path Algorithm for Model B
Source: Develop for this research

The indicator reliability, construct reliability and validity and convergent validity given in Table 4.8 and Table 4.9 showed that all values of outer loadings exceeded 0.60, all Cronbach's Alpha and composite reliability (CR) exceeded 0.70, and all AVE exceeded 0.50 for each of the constructs. Therefore, it is concluded that the measurement models in Model B has acceptable indicator reliability, construct reliability and validity, and convergent validity.

Table 4.8
Indicator Reliability and Construct Reliability and Validity and Convergent Validity for TPM Practices

Construct	Indicator	OL	Cronbach's Alpha	CR	AVE	Assessment
MP	MP1	0.931	0.985	0.987	0.895	Indicator reliability acceptable; Internal consistency acceptable; Composite reliability acceptable; construct validity acceptable, convergent validity acceptable
	MP2	0.949				
	MP3	0.940				
	MP4	0.949				
	MP5	0.931				
	MP6	0.992				
	MP7	0.950				
	MP8	0.927				
	MP9	0.944				
CI	CI1	0.989	0.98	0.983	0.894	Indicator reliability acceptable; Internal consistency acceptable; Composite reliability acceptable; construct validity acceptable, convergent validity acceptable
	CI2	0.935				
	CI3	0.935				
	CI5	0.942				
	CI6	0.948				
	CI7	0.928				
	CI8	0.940				
RM	RM1	0.977	0.981	0.984	0.897	Indicator reliability acceptable; Internal consistency acceptable; Composite reliability acceptable; construct validity acceptable, convergent validity acceptable
	RM2	0.933				
	RM3	0.920				
	RM4	0.937				
	RM5	0.937				
	RM6	0.952				
	RM8	0.973				
TE	TE1	0.930	0.986	0.988	0.901	Indicator reliability acceptable; Internal consistency acceptable; Composite reliability acceptable; construct validity acceptable, convergent validity acceptable
	TE2	0.924				
	TE3	0.985				
	TE4	0.945				
	TE5	0.944				
	TE6	0.933				
	TE7	0.952				
	TE8	0.960				
	TE9	0.971				

Source: Develop for this research

Table 4.9
Indicator Reliability and Construct Reliability, Validity and Convergent Validity for Organisation Performance and Leadership

Construct	**Indicator**	**OL**	**Cronbach's Alpha**	**CR**	**AVE**	**Assessment**
OP	AM1	0.698	0.938	0.924	0.935	Indicator reliability acceptable; Internal consistency acceptable; Composite reliability acceptable; construct validity acceptable, convergent validity acceptable
	AM2	0.683				
	AM4	0.698				
	AM5	0.718				
	EE1	0.764				
	EE2	0.744				
	EE4	0.739				
	EE5	0.794				
	EE6	0.754				
	PM1	0.746				
	PM2	0.772				
	PM3	0.732				
LR	LR1	0.825	0.973	0.975	0.664	Indicator reliability acceptable; Internal consistency acceptable; Composite reliability acceptable; construct validity acceptable, convergent validity acceptable.
	LR2	0.842				
	LR3	0.867				
	LR4	0.798				
	LR5	0.773				
	LR6	0.806				
	LR7	0.825				
	LR8	0.820				
	LR9	0.801				
	LR10	0.798				
	LR11	0.800				
	LR12	0.847				
	LR13	0.783				
	LR14	0.796				
	LR15	0.814				
	LR16	0.828				
	LR17	0.803				
	LR18	0.824				
	LR19	0.810				
	LR20	0.829				

Source: Develop for this research

Table 4.10 presents the Fornell-Larcker criterion of the measurement models in Model B. The result shows that the number on the top of the column (the square root of AVE of the construct) is always higher that the correlations between the constructs (values below the square root of AVE of the construct). Hence, there is discriminant validity of the six constructs.

Table 4.10
Fornell-Larcker criterion of the measurement models in Model B

	CI	LR	MP	OP	RM	TE
Continuous Improvement (CI)	0.945					
Leadership Roles (LR)	0.472	0.815				
Maintenance Activities (MP)	0.401	0.326	0.946			
Organization Performance (OP)	0.533	0.543	0.473	0.737		
Resource Maintenance (RM)	0.444	0.397	0.411	0.496	0.947	
Training & Education (TE)	0.424	0.404	0.266	0.484	0.435	0.949

Source: Develop for this research

Table 4.11 presents the HTMT ratio of the measurement models in Model B. The result shows that all constructs have values less than 0.850. Hence, the discriminant validity of the six constructs is further confirmed with HTMT ratio.

Table 4.11
HTMT Ratio of the measurement models in Model B

	CI	LR	MP	OP	RM
Continuous Improvement (CI)					
Leadership Roles (LR)	0.482				
Maintenance Activities (MP)	0.406	0.331			
Organization Performance (OP)	0.552	0.553	0.487		
Resource Maintenance (RM)	0.452	0.404	0.418	0.514	
Training & Education(TE)	0.431	0.411	0.27	0.501	0.442

Source: Develop for this research

Table 4.12 presents the VIF values in Model B. The result shows that all values of VIF are lower than 5.0. Therefore, there is no multicollinearity issues in Model B.

Table 4.12
VIF in Model B

	CI	LR	MP	OP	RM	TE
Continuous Improvement (CI)				1.563		
Leadership Roles (LR)				1.435		
Maintenance Activities (MP)				1.311		
Organization Performance (OP)						
Resource Maintenance (RM)				1.504		
Training & Education(TE)				1.399		

Source: Develop for this research

4.6 Structural Model Assessment

The assessment of the structural model was carried out to test the relationship between the research constructs and to determine whether leadership roles moderates any of the relationships between TPM practices with organization performance. The structural model assessment also identifies the predictive accuracy and relevance of the research model.

4.6.1 Significance of Relationships among the Research Constructs

The assessment of the significance of relationship between TPM practices and organization performance was carried out by running the bootstrapping analysis using Model A. Figure 4.8 result of the bootstrapping analysis of Model A whereby the path coefficient (β) and significance value (p) are shown. The result shows that both paths: the relationship between TPM practices and organization performance ($\beta = 0.527$, $p = 0.000$)

and between leadership roles and organization performance (β = 0.256, p = 0.000) are positive and significant.

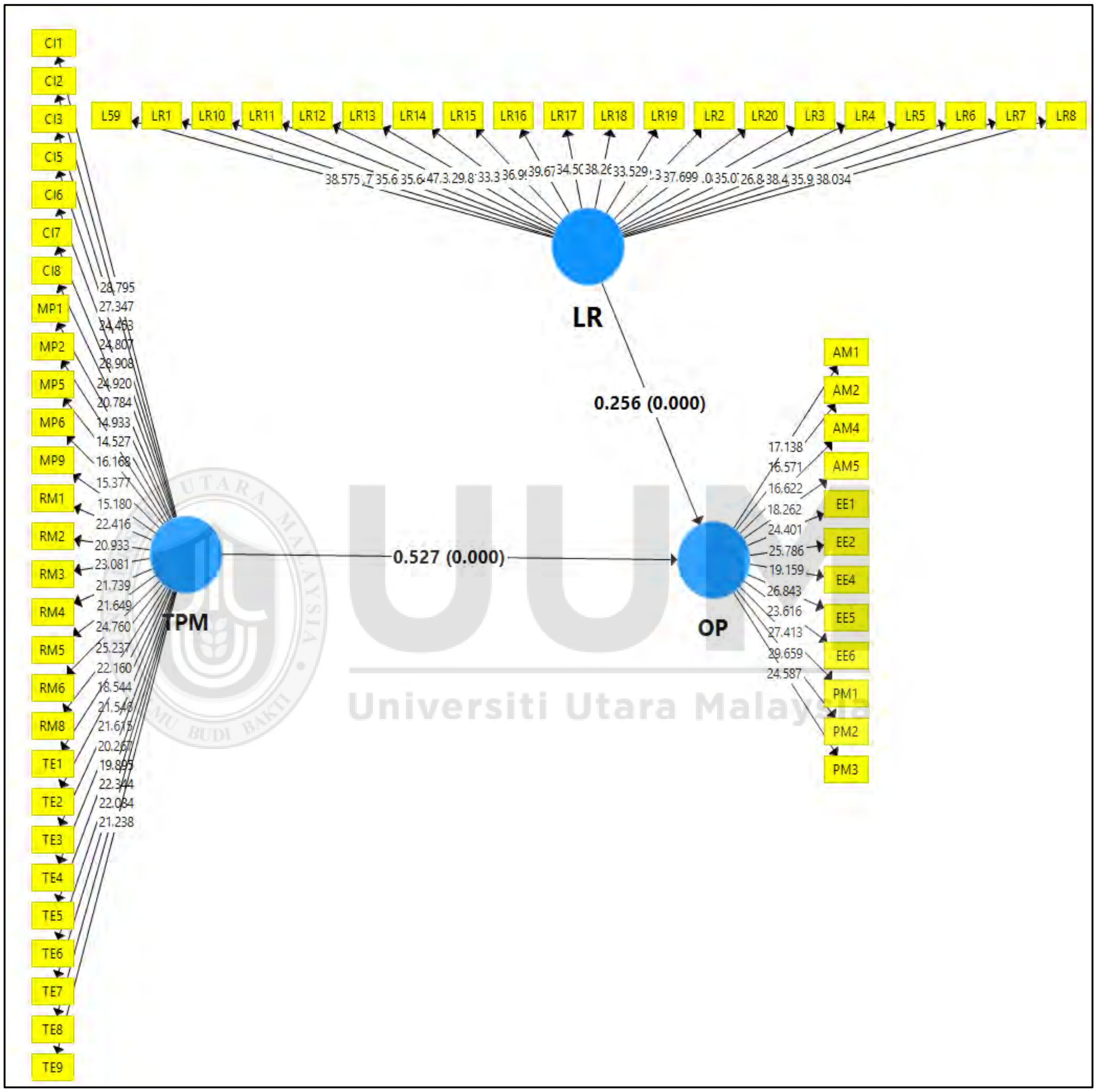


Figure 4.8
Output of the Bootstrapping Analysis for Model A
Source: Develop for this research

The assessment of the significance of relationship between each of the dimensions (sub-constructs) of TPM practices and organization performance was carried out by running the bootstrapping analysis using Model B. Figure 4.9 result of the bootstrapping analysis of Model B whereby the path coefficient (β) and significance value (p) are shown. The result shows that all paths: the relationship between maintenance activities (MP) and organization performance ($\beta = 0.206$, $p = 0.000$); the relationship between continuous improvement and organization performance ($\beta = 0.187$, $p = 0.001$); the relationship between resource maintenance (RM) and organization performance ($\beta = 0.147$, $p = 0.010$); the relationship between training and education (TE) and organization performance ($\beta = 0.183$, $p = 0.001$); and the relationship between leadership roles and organization performance ($\beta = 0.255$, $p = 0.000$) are positive and significant.

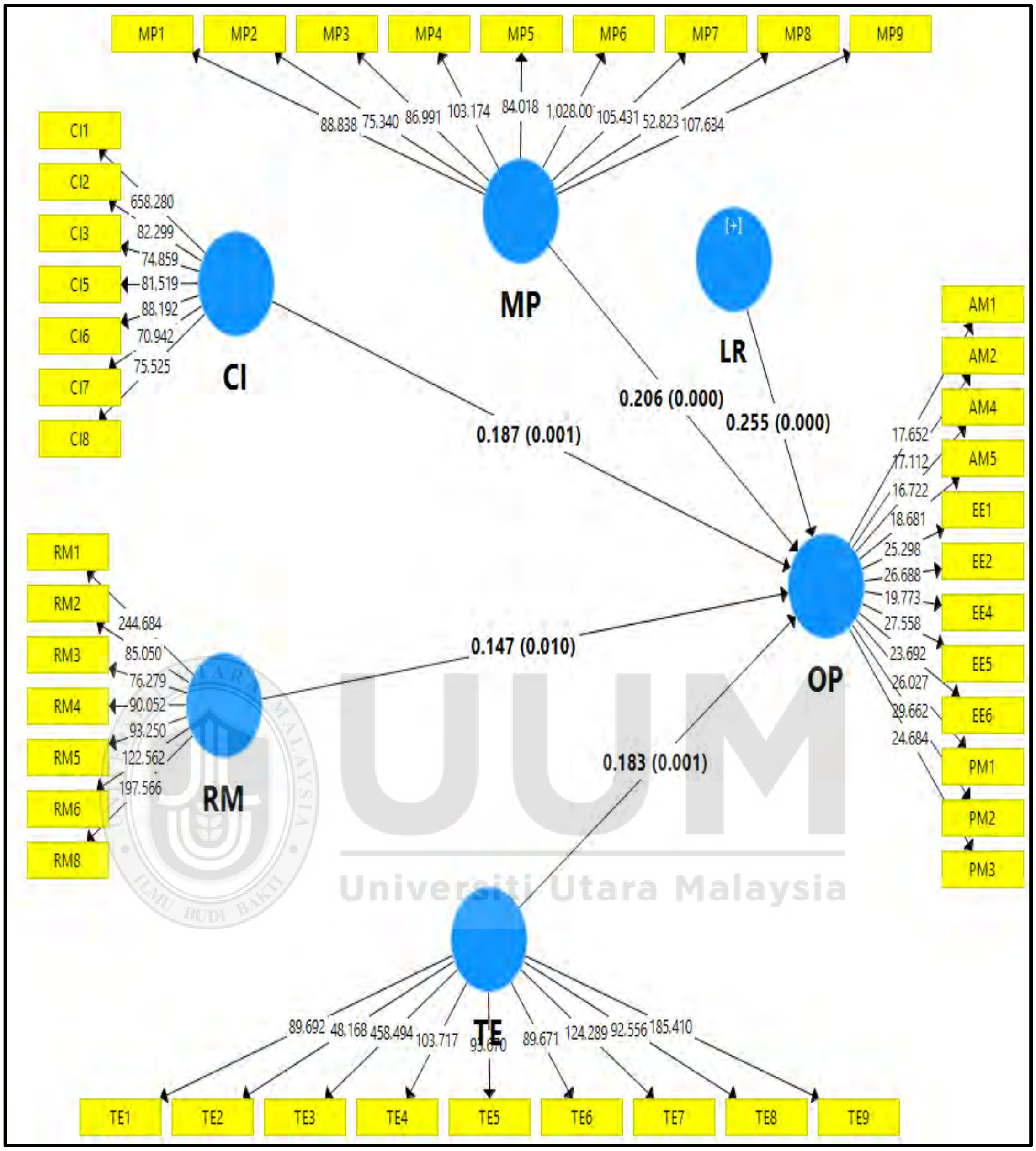


Figure 4.9
Output of the Bootstrapping Analysis for Model B
Source: Develop for this research

Table 4.13 summarizes the result of the bootstrapping analysis to show the testing of the research hypotheses. Hair et al. (2014, 2017) and Wong (2013) stated that the values of supporting a research hypothesis which is run on a one-tail test in path analysis are: T statistics should be more than 1.64; significance, p is less than 0.05; and confidence interval must not have a zero value in between the lower and upper values.

The result shows that the first research hypothesis, H1 indicates the relationship between TPM practices and organization performance. The path yielded a path coefficient of 0.527, a T statistic of 10.994, a p value of 0.000 and a confidence interval between 0.431 and 0.619. Thus, this hypothesis is supported. There is a positive and significant relationship between TPM practices and organization performance. This finding supports similar findings in past studies like Hamid, Ramayah and Norzieiriani (2008) who conducted the relationship between TPM and performance in Malaysian SME. However, in their research, TPM was represented by autonomous maintenance and planned maintenance only. Brah and Chong (2004) who did their research on the impact of TPM on organization performance also showed similar findings. However, in this research, TPM was represented by corporate planning, top management leadership, human resource focus, process focus, total quality management focus and information system focus, as well a TPM strategies, TPM team and TPM process focus. Findings from Lazim, Salleh, Subramanian and Othman (2013) in their study of manufacturing organizations in Malaysia also indicated similar result.

For the second research hypothesis, the beta coefficient is 0.255, T-statistics is 4.899, p value is 0.000 and confidence interval is between 0.093 and 0.319. Therefore, the second research hypothesis, H1a is supported. There is a positive and significant relationship between maintenance activities and organization performance. Hence, this suggest that TPM activities are crucially needed to ensure organization performance. Badli (2012) stated that the commitment of top management to ensure that maintenance activities are performed is necessary to drive positive performance in the organization. As explained by Mwanza and Mbohwa (2015), TPM maximizes equipment effectiveness by ensuring that there is a comprehensive productive-maintenance system that covers the entire life of the equipment and covering all equipment-related filed such as planning, use and maintenance, as well as having the participation of all employees from top management down to the workers.

For the third hypothesis, the beta coefficient is 0.187, T statistics is 3.336, p value is 0.001 and confidence interval is between 0.074 and 0.292. Therefore, the third hypothesis, H1b is supported. There is a positive and significant relationship between continuous improvement and organization performance. Past studies like Chang (2005) and Terziovski and Power (2007) had shown the positive impact of continuous improvement on organization performance. Continuous improvement which relates the principle of Kaizen in the organization the source of key competitive advantage for the company (Singh, Gohil, Shah & Desai, 2013). The idea that continuous improvement practices which is employed at various environments in the organization do lead to performance as supported in this research (Goetsch, 2013). As Niven (2012) explained, a continuous improvement culture leads to more success and reduces failure. Porter (2014) also added that with continuous improvement, there is elimination of waste and therefore, contributing to equipment effectiveness. The direct effect of continuous improvement on organization performance has been confirmed in this research.

For the fourth hypothesis, the beta coefficient is 0.147, T statistics is 2.602, p value is 0.010 and confidence interval is between 0.033 and 0.252. Therefore, the fourth hypothesis, H1c is supported. There is a positive and significant relationship between resource maintenance and organization performance. As explained by Halim and Ramayah (2010), TPM is a resource-based approach and employees are responsible to contribute towards maintenance activities to avoid equipment deterioration, breakdowns, failures and stoppages. Simoes, Gomes and Yasin (2011) stated that for industries like petrochemical, mining and electrical power, maintenance related costs can be greater than operational costs. Therefore, it is necessary for the management to utilise the maintenance resources in a more effective manner so that this can improve the overall organizational efficiency and effectiveness. Resources which include technical, economic, safety and human resources must be managed in order to minimize cost and ensure better organization performance (Simoes et al., 2011). This research supports the contribution of resource maintenance on organization performance.

For the fifth hypothesis, the beta coefficient is 0.183, T statistics is 3.295, p value is 0.001 and confidence interval is between 0.077 and 0.288. Therefore, the fifth hypothesis, H1d is supported. There is a positive and significant relationship between training and education and organization performance. As stated by Thiagarajan and Zairi (1997), training and education are the single most important factor in order to obtain aspirations and skills. As one of the eight pillars of TPM, the importance of training and education cannot be denied. Ajay et. al., (2016) mentioned that the successful implementation of the other pillars is dependent on effective training and education as it provides the operational and maintenance skills as well as other aspects pertaining to the implementation of TPM. The finding in this research agreed with finding from Wee and Noordin's study (2012) which investigated TPM effects on manufacturing performance in Malaysia electrical and electronics industry. Their study also concluded that education and training contribute significantly towards manufacturing performance. Thus, the importance of training and education towards organization performance has also been confirmed in this research.

Table 4.13
Significance of Relationships among the Constructs

Hypotheses	**Path**	**β**	**T Statistics**	**Significance, p**	**Confidence Interval (CI)**	**Acceptance of Hypothesis**
H1	TPM → OP	0.527	10.994	0.000	0.431-0.619	Supported
H1a	MP → OP	0.255	4.899	0.000	0.093-0.319	Supported
H1b	CI → OP	0.187	3.336	0.001	0.074-0.292	Supported
H1c	RM → OP	0.147	2.602	0.010	0.033-0.252	Supported
H1d	TE → OP	0.183	3.295	0.001	0.077-0.288	Supported

Source: Develop for this research

4.6.2 Moderation Effect Analysis

For this study, the moderation affects of leadership on the relationship between TPM Practices and Organization Performance was examined. In addition, for Model B the moderation affects of the leadership on the relationship between Maintenance Activities and Organization Performance.

4.6.2(a) Moderation on the Relationship between TPM Practices and Organization Performance

In this research, leadership roles are considered as a moderator to the relationship between TPM practices and organization performance. The moderation of leadership on the relation between TPM practices and organization performance uses the structural model in Model A. The assessment of the moderation effect of leadership roles is based on the two-stage process whereby in this approach, the latent variable scores of the TPM practices as the latent predictor and leadership roles as the latent moderator from the main effects model (without using the interaction term) is used. These latent variable scores were then saved and used to calculate the product indicator for the second stage analysis whereby in this stage, the interaction term is used in addition to TPM practices and leadership roles (Hair et al., 2017). Bootstrapping analysis is run to determine the relevance, significance and direction of the relationship. Figure 4.10 presents the result of the analysis. The result shows that the direct relationship between leadership roles and organization performance is positive and significant ($\beta = 0.280$, $p = 0.000$) and the indirect relationship between TPM practices and organization performance with moderation of leadership roles is negative but significant ($\beta = -0.119$, $p = 0.000$). This led to the investigation with simple slope analysis to further understand this phenomenon. A simple slope analysis is able to clarify the moderation effect of leadership roles on the relationship between TPM and organization performance (Matthews, Hair & Matthews, 2018).

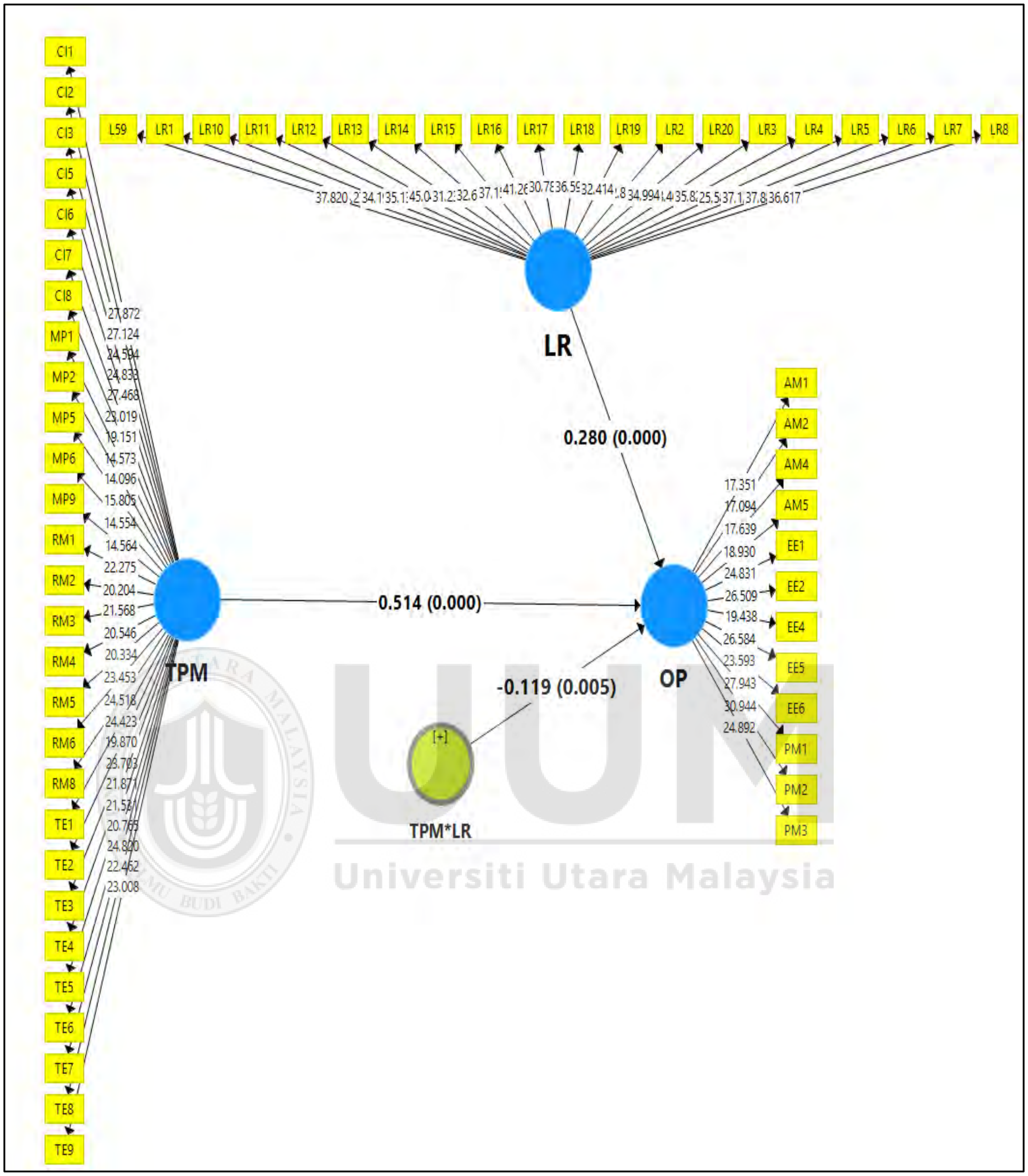


Figure 4.10
Bootstrapping Result for the Moderation Effect of Leadership Roles on the TPM Practices and Organization Performance Pathway
Source: Develop for this research

The simple slope analysis given in Figure 4.11 shows that TPM practices is strengthened by leadership roles in its effect on organization performance. However, in situation where TPM practices are low (SD below 0), stronger leadership roles (LR at +1 SD) will lead to more effect on organization performance whereas when TPM practices are low (SD below 0), weaker leadership roles (LR at -1 SD) will lead to less effect on organization performance. When TPM practices are high (SD above 0), the effect of strong leadership roles (LR at +1 SD) and weak (leadership roles LR at -1 SD) however, does not differ much although strong leadership roles still resulted in higher organization performance compared to weak leadership roles.

Therefore, this research suggests that leadership roles are a great booster of weaker TPM practices to ensure high performance. Leadership can change the mindset of the people particularly relating to quality and maintenance (Seth & Tripathi, 2005). The effort to change the people's mindset should be greater during weaker period of TPM implementation compared to peak TPM performance. Hence, this research implied that leadership roles work effectively to ensure efforts in TPM resulted in greater organization performance when TPM implementation is weaker. However, once, TPM implementation is stronger, the moderation of leadership roles is lessened.

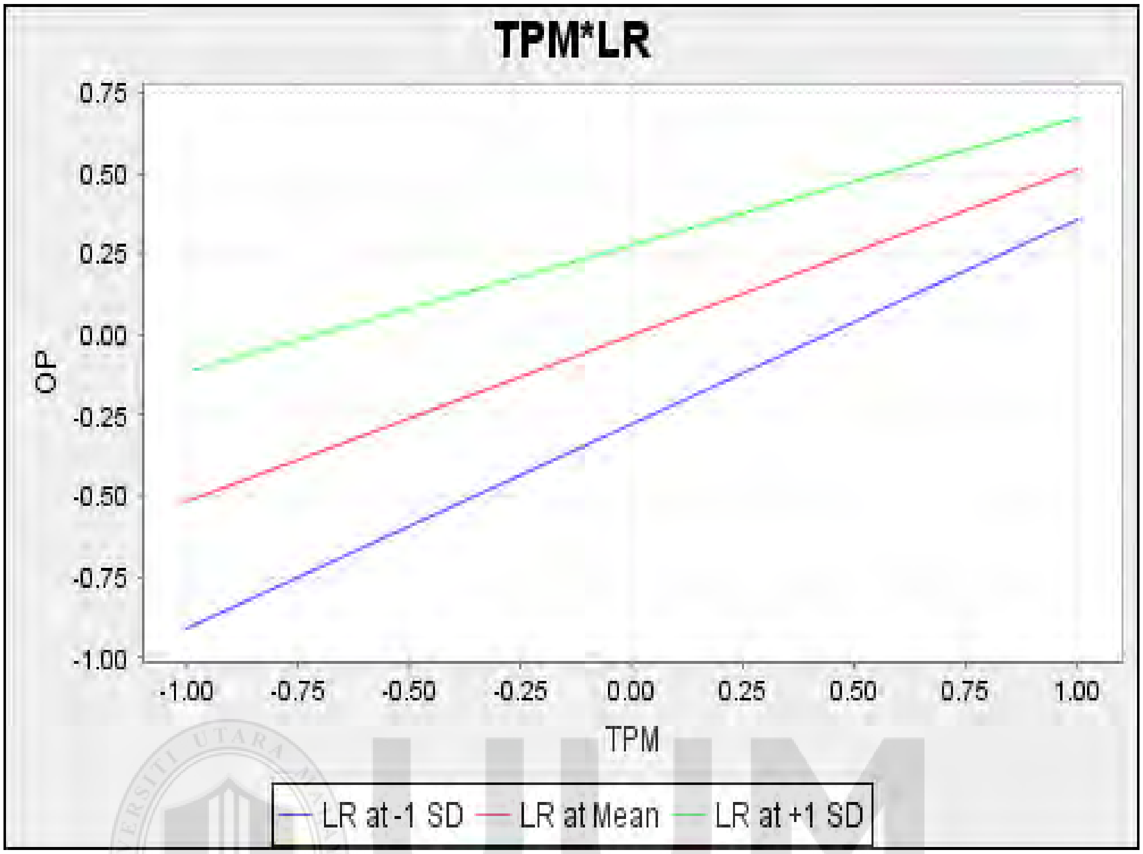


Figure 4.11
Simple Slope Analysis for the Moderation of Leadership Roles on the Relationship between TPM Practices and Organization Performance
Source: Develop for this research

4.6.2(b) Moderation on the Relationship between Maintenance Activities and Organization Performance

The moderation effect of leadership roles on the relationship between maintenance activities and organization roles was also examined. Bootstrapping was carried out on Model B using the moderation effect analysis. It is shown in Figure 4.12 that leadership roles have a positive and significant relationship with organization performance (β = 0.313, p = 0.000). The moderation of leadership roles on the relationship between maintenance activities and organization performance is negative but significant (β = -

0.199, p = 0.000). This shows that leadership roles moderate the relationship between maintenance activities and organization performance.

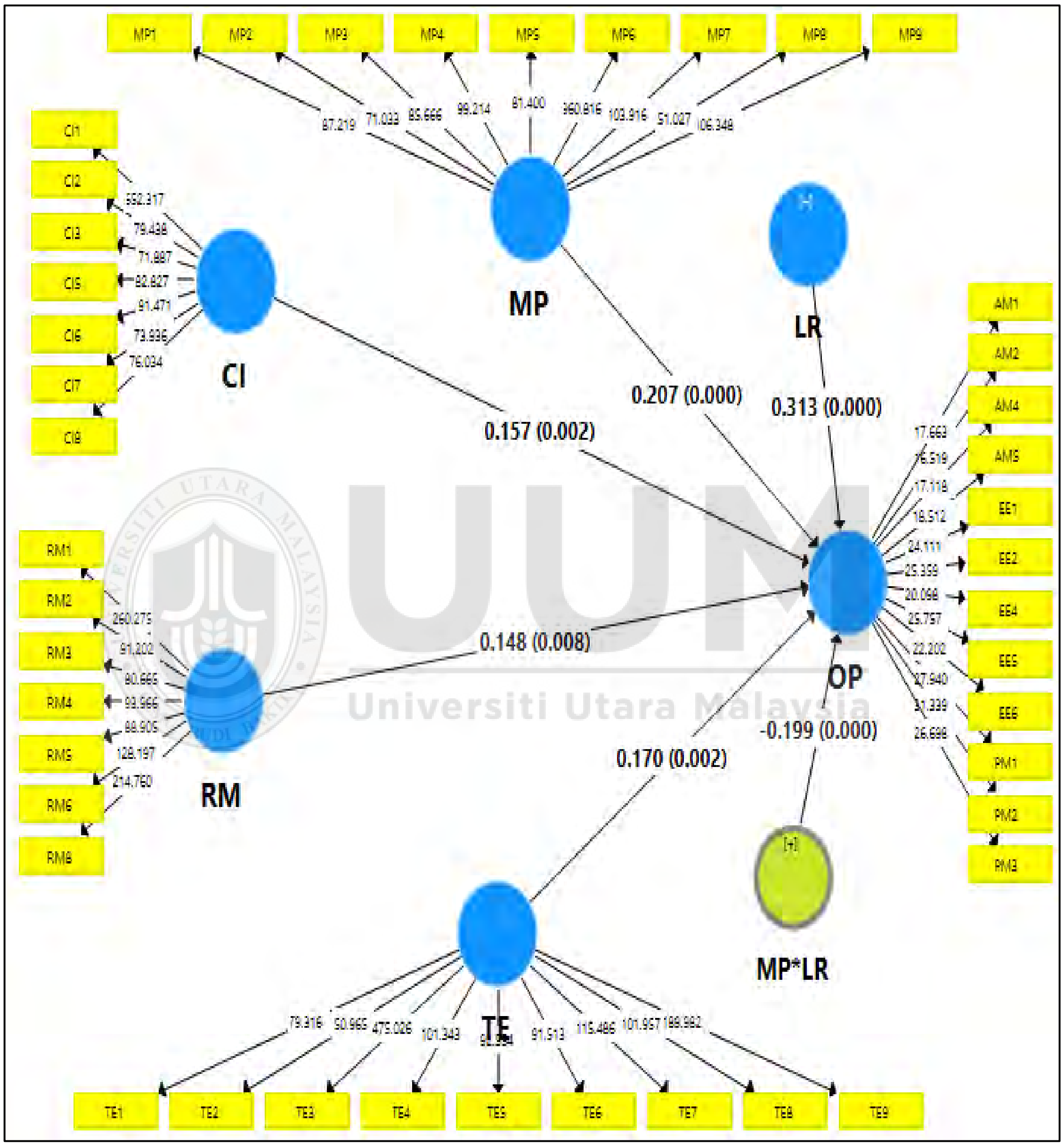


Figure 4.12

Bootstrapping Result for the Moderation Effect of Leadership Roles on the Maintenance Activities and Organization Performance Pathway

Source: Develop for this research

The simple slope analysis to determine the how leadership roles moderate the relationship between maintenance activities and organization performance is shown in Figure 4.13. The result shows that when leadership roles are strong (LR at 1 SD), maintenance activities regardless whether it is high or low, will lead to high organization performance. When leadership roles are weak (LR at -1 SD), low level of maintenance activities will result in low level of organization performance and high level of maintenance activities will result in high level of organization performance. Therefore, this research maintains that leadership roles strengthens low and high TPM practices towards organization performance. The morale and performance of employees are another aspect of TPM (Brah & Chong, 2004). Leadership particularly top management leadership can lead to the holistic adoption of TOM plans to achieve maximum impact.

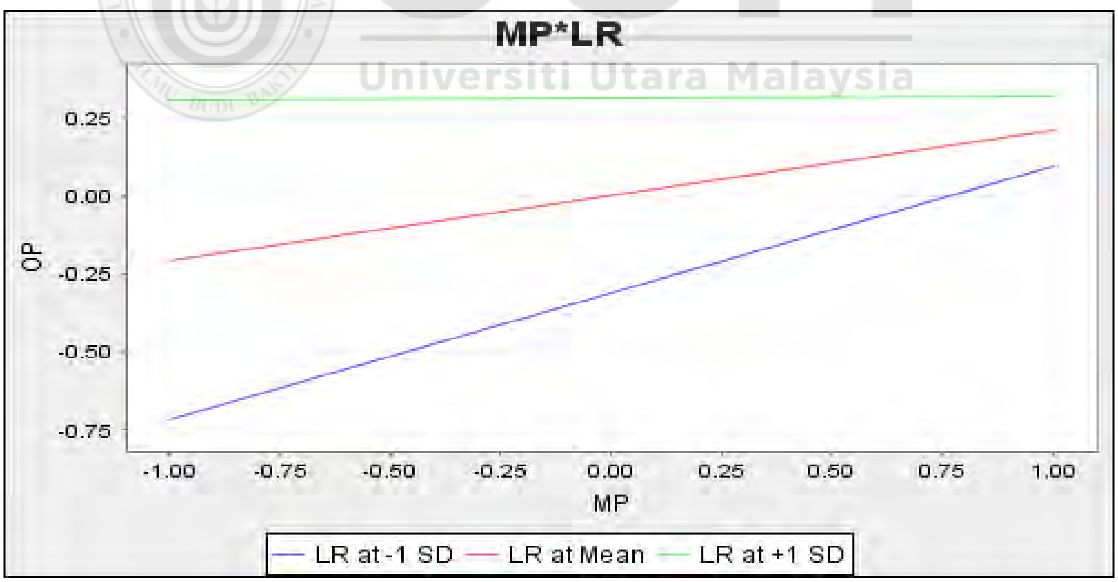


Figure 4.13
Simple Slope Analysis for the Moderation of Leadership Roles on the Relationship between Maintenance Activities and Organization Performance
Source: Develop for this research

4.6.2(c) Moderation on the Relationship between Continuous Improvement and Organization Performance

The moderation effect of leadership roles on the relationship between continuous improvement and organization roles was also examined. Bootstrapping was carried out on Model B using the moderation effect analysis. It is shown in Figure 4.14 that leadership roles have a positive and significant relationship with organization performance (β = 0.257, p = 0.000). The moderation of leadership roles on the relationship between continuous improvement and organization performance is negative and not significant (β = -0.075, p = 0.096). This shows that leadership roles do not moderate the relationship between maintenance activities and organization performance. Leadership is considered as the "soft" aspect of management while continuous improvement is the "hard" aspect of the organizational system (Maletic, Maletic & Gomiscek, 2012). Therefore, the impact of leadership role might not affect continuous improvement as in the firm, continuous improvement comprises of a particular set of routines that can lead to performance (Bessant et al., 2001). Leadership would play a more effective role in more dynamic situations (Crossan, Vera & Nanjad, 2008). Leadership is involved in the alignment of three interrelated areas of environment, strategy and organization. It involves the mechanism of interpersonal influence of the leader to his followers. Therefore, this might serve as a reason to explain the insignificant moderation effect of leadership role on the relationship between continuous improvement and organization performance.

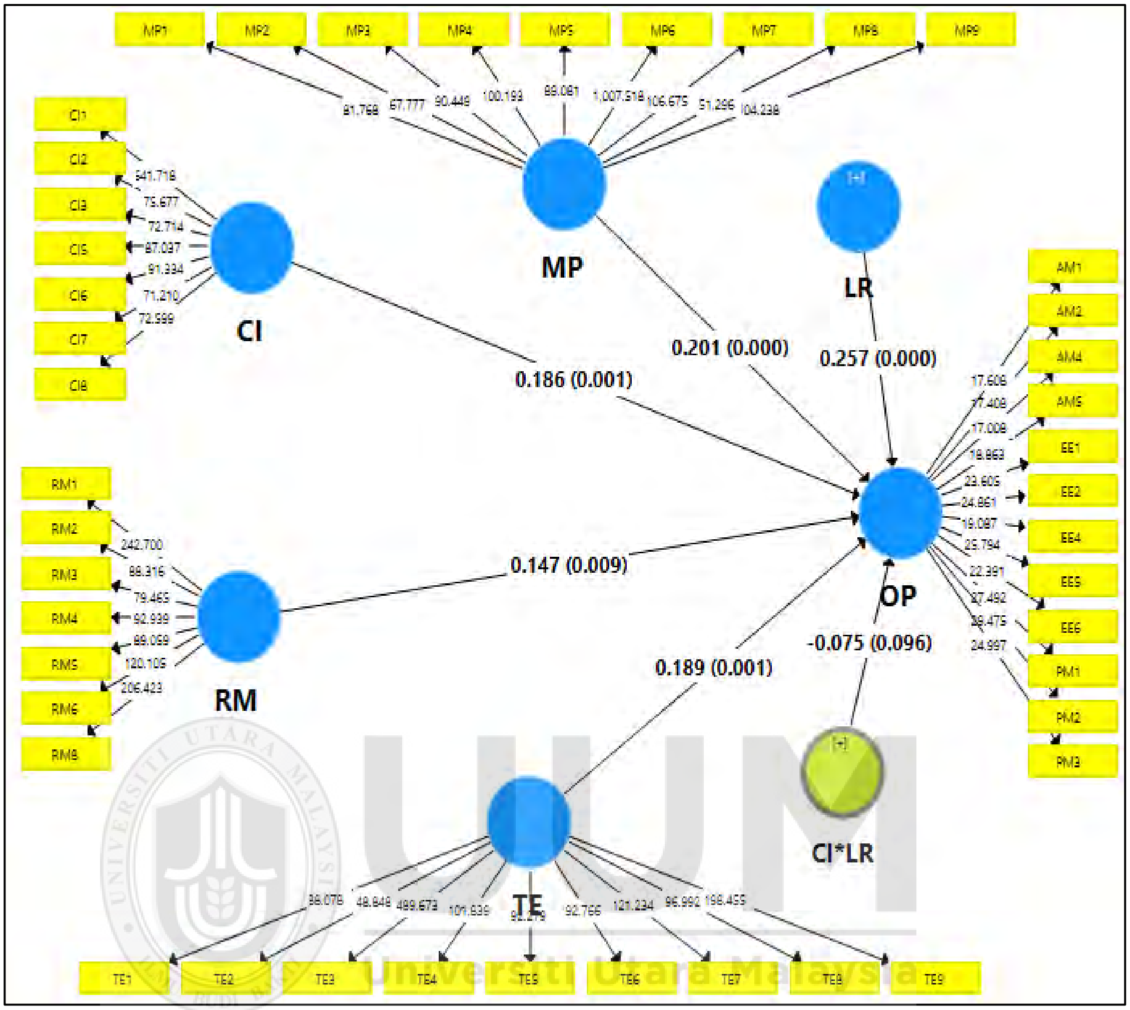


Figure 4.14

Bootstrapping Result for the Moderation Effect of Leadership Roles on the Continuous Improvement and Organization Performance Pathway

Source: Develop for this research

4.6.2(d) Moderation on the Relationship between Resource Maintenance and Organization Performance

The moderation effect of leadership roles on the relationship between resource maintenance and organization roles was also examined. Bootstrapping was carried out on Model B using the moderation effect analysis. It is shown in Figure 4.15 that leadership roles have a positive and significant relationship with organization performance (β = 0.273, p = 0.000). The moderation of leadership roles on the relationship between resource maintenance and organization performance is negative and not significant (β = -0.078, p = 0.083). This shows that leadership roles do not moderate the relationship between resource maintenance and organization performance. Similarly, as implied with continuous improvement, resource maintenance refers to a set of routine practices where leadership roles might not provide significant contribution to boost resource maintenance in driving performance.

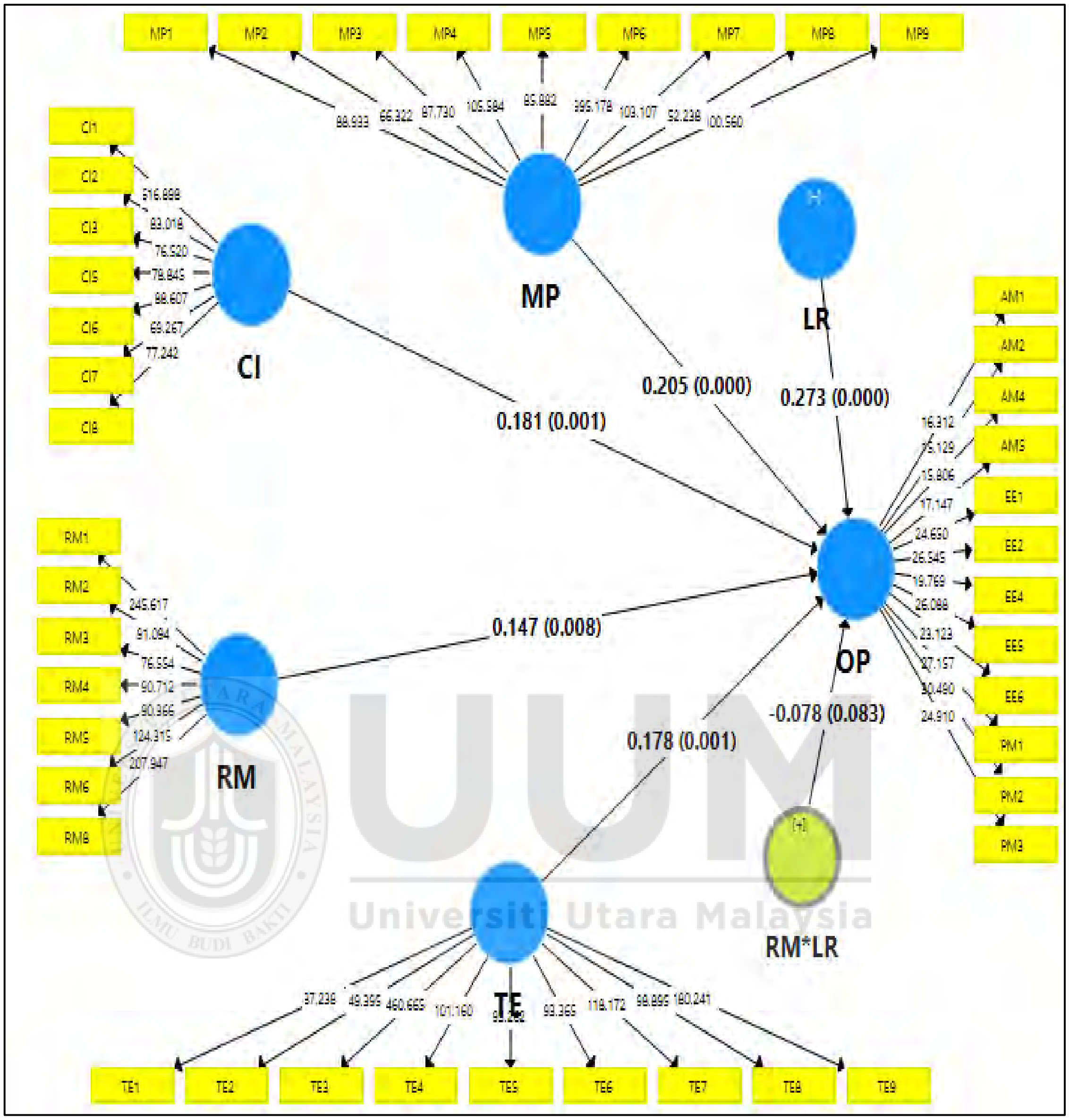


Figure 4.15

Bootstrapping Result for the Moderation Effect of Leadership Roles on the Resource Maintenance and Organization Performance Pathway

Source: Develop for this research

4.6.2(e) Moderation on the Relationship between Training and Education and Organization Performance

The moderation effect of leadership roles on the relationship between training and education and organization roles was also examined. Bootstrapping was carried out on Model B using the moderation effect analysis. It is shown in Figure 5.16 that leadership roles have a positive and significant relationship with organization performance (β = 0.263, p = 0.000). The moderation of leadership roles on the relationship between training and education and organization performance is negative and not significant (β = -0.075, p = 0.087). This shows that leadership roles do not moderate the relationship between training and education and organization performance. Leadership plays a role of empowering people so that the employees can take ownership and contribute individually and as a team to the goals of the organization (Kolzow, 2014). Therefore, leadership role would and should have work well to strengthen training and education towards organization performance. Thus, the insignificant moderation of leadership role on the relationship of training and education with organization performance might be due to the influence of other unknown factors.

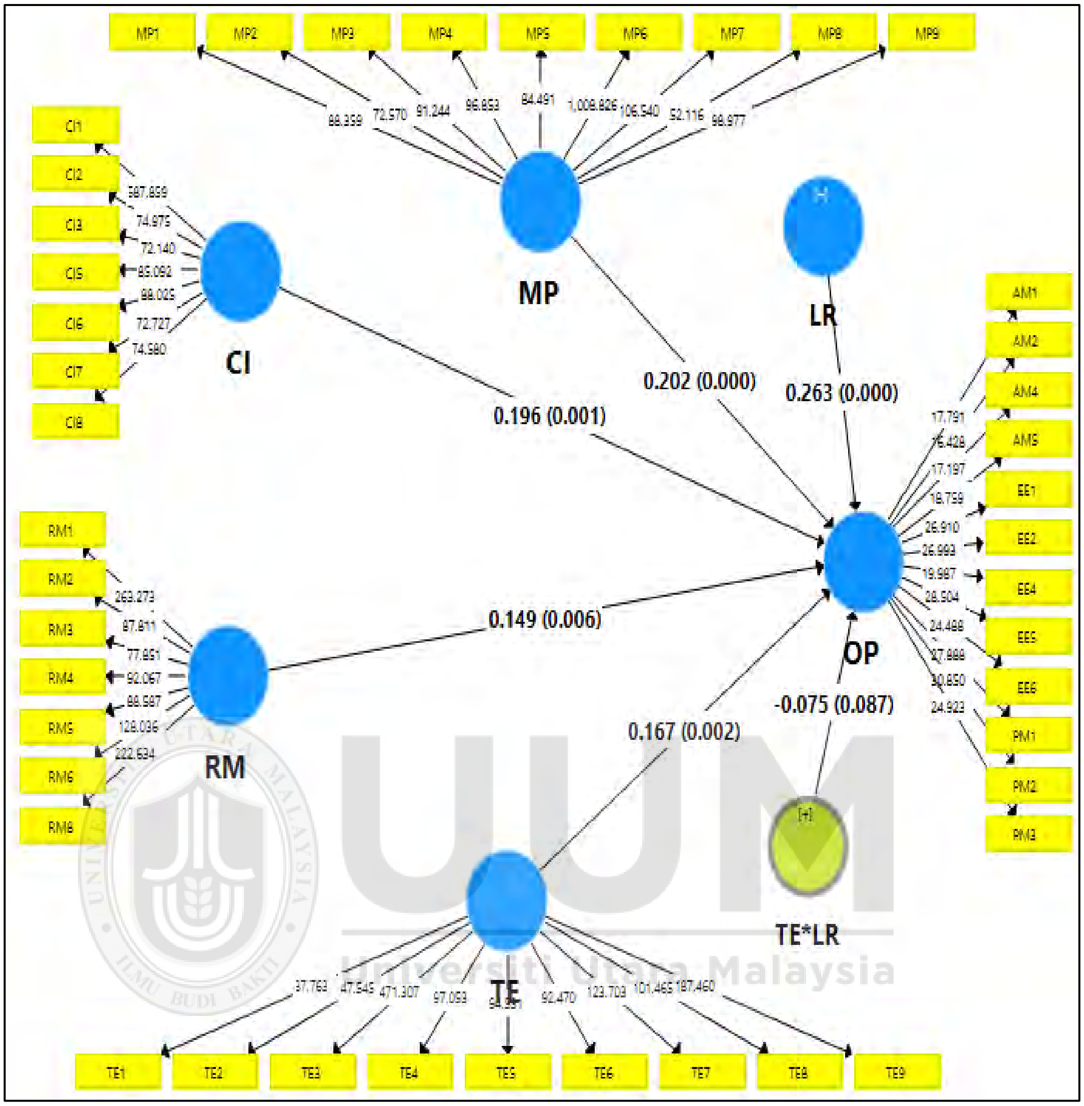


Figure 4.16
Bootstrapping Result for the Moderation Effect of Leadership Roles on the Training and Education and Organization Performance Pathway
Source: Develop for this research

4.6.2(f) Summary of Moderation Analysis

Table 4.14 presents the result of the moderation analysis in this research. The result show that there are negative but significant moderation effects of leadership roles on the relationship between TPM practices and organization performance (β = -0.117, T = 2.823, p = 0.005) and on the relationship between maintenance activities and organization performance (β = -0.199, T = 4.256, p = 0.000). However, there are no significant moderation effects of leadership roles on the relationship between continuous improvement and organization performance (β = -0.075, T = 1.750, p = 0.081), between resource maintenance and organization performance (β = -0.078, T = 1.583, p = 0.114), and between training and education and organization performance (β = -0.075, T = 1.618, p = 0.108). Two of the research hypotheses, H2 and H2a were supported but the other three research hypotheses, H2b, H2c and H2d were not supported.

Table 4.14
Moderation Analysis Results

Hypotheses	Path	β	T Statistics	Significance, p	Confidence Interval (CI)	Acceptance of Hypothesis
H2	TPM*LR → OP	-0.117	2.823	0.005	(-0.203) -(-0.033)	Supported
H2a	MP*LR → OP	-0.199	4.256	0.000	(-0.287) -(-0.098)	Supported
H2b	CI*LR → OP	-0.075	1.750	0.081	-0.157-0.010	NS
H2c	RM*LR → OP	-0.078	1.583	0.114	-0.186-0.021	NS
H2d	TE*LR → OP	-0.075	1.618	0.106	-0.164-0.015	NS

* NS – not supported

Source: Develop for this research

4.6.3 Predictive Accuracy and Relevancy of the Structural Model

As shown in Figure 4.17, the predictive accuracy of the structural model based on Model A is given by the R^2 value and the predictive relevancy is given by the Q^2 value which are 0.490 and 0.243 respectively. This indicates that the combined effect of TPM practices and leadership roles can explain 49.0% of variance in organization performance. According to Cohen (2013), a coefficient of determination, R^2 with a value of more than 0.26 is considered substantial. The Q^2 value which is positive indicates that there is predictive relevancy of this model. Hair et al. (2014) stated that Q^2 value above zero indicates that the model has predictive relevance. The effect size (f^2) of TPM practices is 0.383, which is a large effect size. An effect size of more than 0.35 is considered large (Cohen, 2013). Therefore, TPM is indeed a critical success factor of the organization as it can explain almost half of the variance in organization performance. This is in tandem with most past studies which indicated the positive and significant relationship with performance (Pham & Phan, 2017; Foon & Terziovski, 2014; Salim & Norlena, 2017; Hudgikar & Rao, 2011; Brah & Chong, 2004; Kithinji, 2014).

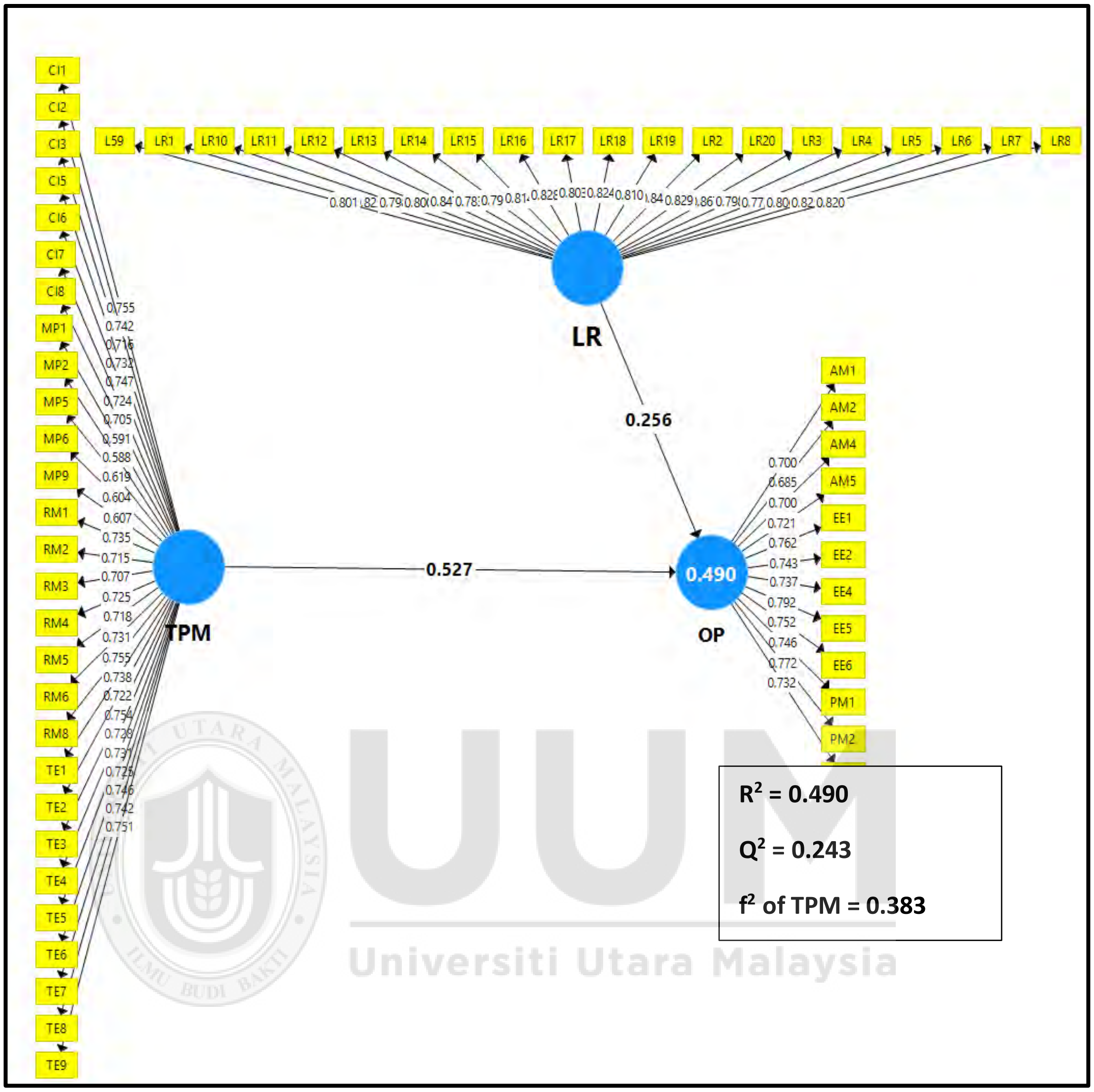
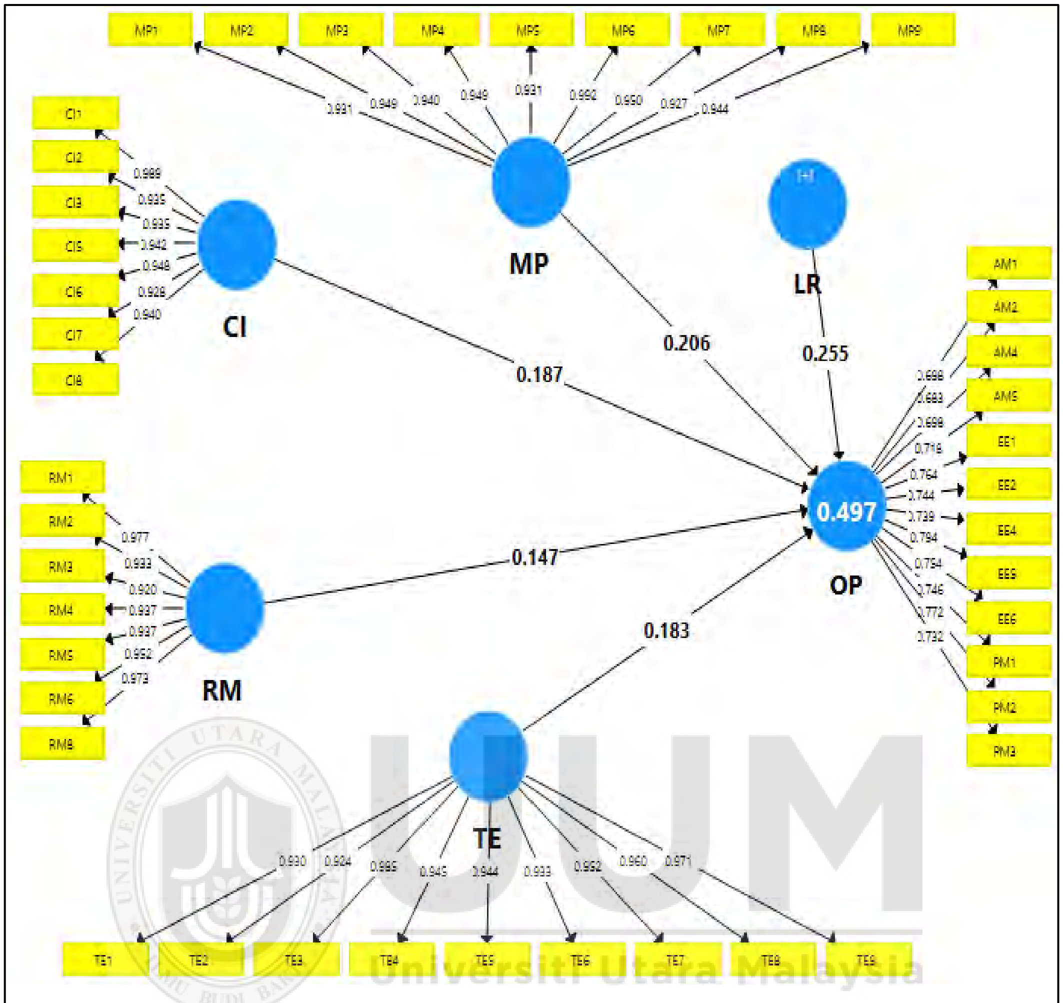


Figure 4.17
The Predictive Accuracy and Relevancy of Model A
Source: Develop for this research

Figure 4.18 shows the predictive accuracy and relevancy of the structural model based on Model B. The result shows that the combination of maintenance activities, continuous improvement, resource maintenance and training and education, and leadership roles contributed to 49.7% of variance in organization performance (R^2 =

0.497). The Q^2 which shows a positive value indicates that the model has predictive relevance. As shown by the beta coefficient of the paths in the model, maintenance activities have the greater relevance ($\beta = 0.206$), followed by continuous improvement ($\beta = 0.187$), then training and education ($\beta = 0.183$) and last, resource maintenance ($\beta = 0.147$). Based on the effect size, it is shown that all the effect sizes are small. Cohen (2013) stated that a small effect size is indicated when the f^2 is 0.02 and moderate when the f^2 value is 0.15. Thus, this research model was able to predict almost half of the variance in organization performance. As shown by the beta coefficient values, maintenance activities are the main driver of organization performance, followed by continuous improvement and training and education. These are the main pillars of TPM and critical success factors of organization performance (Ahmad & Md. Shahwaz, 2015). The effect sizes were considered small, and this implies that consideration of other factors driving TPM should also be considered to be included in the research model.



R^2 = 0.497

Q^2 = 0.246

f^2 of MP = 0.064; f^2 of CI = 0.044; f^2 of RM = 0.029; f^2 of TE = 0.048;

f^2 of LR = 0.09

Figure 4.18

The Predictive Accuracy and Relevancy of Model B

Source: Develop for this research

4.7 Summary

This chapter has provided the result of the statistical analysis which was carried out using IBM SPSS 23.0 for descriptive analysis and SmartPLS3.0 for inferential analysis. The summary of the result is shown in Table 4.15.

Table 4.15
Summary of the Research Result

Research Question/Research Hypothesis	**Findings**
1. To investigate the relationship between TPM practices and organization performance H1: TPM practices are positively and significantly related to organization performance H1a: Maintenance Activities are positively and significantly related to organization performance H1b: Continuous Improvement is positively and significantly related to organization performance H1c: Resource Maintenance is positively and significantly related to organization performance H1d: Training and Education are positively and significantly related to organization performance	All research hypotheses, H1, H2, H3, H4 and H5 are supported. There are positive and significant relationships between TPM practices and organization performance (β = 0.527, T = 10.994, p = 0.000), between maintenance activities and organization performance (β = 0.255, T = 4.899, p = 0.000), between continuous improvement and organization performance (β = 0.187, T = 3.336, p = 0.001), between resource maintenance and organization performance (β = 0.147, T = 2.602, p = 0.010), and between training and education and organization performance (β = 0.183, T = 3.295, p = 0.000).
2. To determine the moderating effect of leadership roles on the relationship between TPM practices and organization performance H2: Leadership roles moderate the relationship between TPM practices and organization performance H2a: Leadership roles moderate the relationship between maintenance activities and organization performance H2b: Leadership roles moderate the relationship between continuous improvement and organization performance	Leadership roles significantly moderate the relationship between TPM practices and organization performance (β = -0.117, T = 2.823, p = 0.005) and the relationship between maintenance activities and organization performance (β = -0.199, T = 4.256, p = 0.000). The research hypotheses, H2 and H2a are supported. A low level of TPM practices can predict higher organization performance in the presence of stronger leadership roles compared to weak leadership roles. This difference is more apparent in low TPM practices but less apparent when TPM practices is high. When there are high leadership roles, low or high

H2c: Leadership roles moderate the relationship between resource maintenance and organization performance H2d: Leadership roles moderate the relationship between training and education and organization performance	maintenance activities still lead to high organization performance. However, when leadership roles are weak, low maintenance activities lead to low organization performance, but high maintenance activities lead to high organization performance. However, Leadership roles do not significantly moderate the relationship between continuous improvement and organization performance (β = -0.075, T = 1.750, p = 0.081), resource maintenance and organization performance (β = -0.078, T = 1.583, p = 0.114), and training and education and organization performance (β = -0.075, T = 1.618, p = 0.106). The research hypotheses, H2b, H2c and H2d are not supported.
3. To examine the level of importance in the relationship between TPM practices and organization performance	Maintenance activities have the highest relevance to organization performance (β = 0.206, f^2 = 0.064) followed by continuous improvement (β = 0.187, f^2 = 0.044) and training and education (β = 0.183, f^2 = 0.029) and least of all, resource maintenance (β = 0.147, f^2 = 0.048). However, the effect sizes are small.

Source: Develop for this research

CHAPTER 5

RECOMMENDATION AND CONCLUSION

5.1 Introduction

The final chapter presents a recapitulations of research objectives and findings. Therefore, the findings are revisited to determine whether the research objectives have been met. Implications of the research findings are discussed based on three perspectives: theoretical implications and practical implications. The limitations of this research are also discussed and lastly, this chapter ends with recommendation for future direction and conclusion.

5.2 Overview of Research

The research objectives and the research questions as in Chapter 1 were posed as a guideline for the researcher to carry out the research on TPM practices in a selected company, TNB Janamanjung Sdn. Bhd. Their critical role as supplier of electrical power to the country, particularly in Peninsular Malaysia has prompted the need to ensure that the company practice TPM so that there is high performance by the company.

As explained from the descriptive analysis of the TPM practices in the previous chapter, it is shown that on overall, TPM practices are at a moderate level, and at dimensional level, maintenance activities, resource maintenance and training and education are at moderate level too (Suzaidatulawin et. al., 2011; Arshida & Ajil, 2013; Jain et. al., 2015; Zakuan et. al., 2015; Pai et. al., 2016 and Brodny et. al., 2016. However, this research found that continuous improvement in this company is high. In addition, this research has also shown that the overall organizational performance is high, and in each aspect: equipment effectiveness, autonomous maintenance and planned maintenance were recorded as high. Further to that, leadership roles within the company was perceived by the staff as high.

These findings are evidence of the successful effort by TNBJ to initiate TPM since 2010 (TNBJ MPC Report, 2011). As seen from the Equivalent Availabality Factor (EAF) and Unplanned Outage Rate (UOR) graphs that were presented in the first chapter, these figures indicated that TNBJ has improved in their performance and this was validated with the findings from current research whereby the staff perceived highly on their TPM performances particularly equipment effectiveness and planned maintenance. These findings and tallying with the EAF and UOR figures implied that the plant showed good performance, and there are lesser machine breakdowns, lower level of faulty equipment and lesser inspections required. Thus, the implementation of TPM that corresponds to plant maintenance, plant engineering and product design in this company has resulted in high organization performance (Shamsul, 2013; TNBJ MMM, 2014).

In deep focus, this research was established with three main objectives. The first objective for research is to indicate the relationship between TPM practices and organization performance. The second of objective is to evaluate the moderating effects of leadership roles in the relationship between TPM practices and organization performance. The third objective for this research is slightly extent the second research objective which is to measure the level of important in the TPM practices dimension that contribuate to the organization performance.

5.2.1 Relationship between TPM Practices and Organization Performance

The first research question in this research focuses on determining the relationship between TPM practices and organization performance. As shown in the previous chapter, TPM practices on the overall was positively and significantly related to organization performance. In addition, all the four dimensions of TPM practices, maintenance activities, continuous improvement, resource maintenance and training and education were positively and significantly related to organization performance. Halim, Ramayah and Norzieiriani (2008) explained that TPM is a comprehensive, resource-based maintenance management system and as shown in this research, the provision of four dimensions of TPM lead to performance measured in equipment effectiveness, autonomous maintenance and planned maintenance (Bhadhury, 2013).

TPM practices including, maintenance activities, continuous improvement, resource management, training and education is part of critical activities. Supported to the previous finding, this research found the TPM practices recorded the highest factor loading in the relationship. The TPM practices recorded the path coefficient (β) is 0.527 with 0 for the significant value (p) to the relationship between organization performance. Sustained with previous finding by Jain et. al., (2015), the TPM maintenance activities throughout the scheduling repair work, quality maintenance, checking and inspection activities highly influence the organization performance. Besides, the maintenance activities which include oil check, cleaning and greasing machines, changing of worn-out parts, replacement of machineries, and checking of the operating parameters have also been identified as significant contributor to equipment effectiveness, autonomous maintenance and planned maintenance (Sharma & Kumar, 2012).

Besides, resource management is also contributing to the highest score for TPM practices whereby all the resources are coming from. As agreed by Vishnu et. al., (2011) and Pai et. al., (2016) resource management supported the TPM practices by providing the TPM material, managing spare part, management of supply chain and providing consultancy. Therefore, the resource management is one of the critical pillars supporting the TPM practice in the organization. Moreover, the continuous improvement pillars are responsible to do TPM continuous improvement activities to the system attached at the organization. According to Jirajat et. al., (2011) the continuous improvement pillars is conducting the earlier detection activities by monitoring the equipment performance. In addition, continuous improvement can be viewed as a formal practice or an informal set of guidelines where many companies have shifted focus to more formal approaches to project and process management such as Lean / Agile methodologies (Ahuja, 2008).

Furthermore, with maintenance on a continuous basis, this leads to a culture of putting quality in operation and production on daily basis (Nzewi et al., 2016). Another pillar of TPM that was assessed in this research is training and education which was found to be a significant predictor of organization performance. Some of these initiatives include the sharing of skills, developing various skills of employees and aligning the employees to organizational goals (Singh & Bhatia, 2015). These activities in TPM were perceived by the respondents in this research as important to ensure performance in their firm.

5.2.2 The Moderating Effects of Leadership Roles

In this research, leadership roles were found to be a moderator in the relationship between TPM practices and organizational performance. It was identified that when TPM practices are low, the presence of strong leadership roles can promote higher organization performance. Wakjira and Singh (2012) stated that effective leadership from the top management is required for TPM practices to be successful. As found in this research, transformational leadership is acutely needed when TPM practices are low. Management leadership is capable of convincing the employees regarding the importance of TPM (Brah & Chong, 2004). As a company-wide initiative, top management need to show high quality of leadership so that employees who perceive maintenance in a negative manner can be prompt to do maintenance work after being influenced through such leadership (Lai & Tat, 2017). Thus, this research confirms that leadership roles to boost performance is indeed critical particularly when TPM practices are low.

This research has also shown that maintenance activities and its relationship with organization performance is moderated by leadership role. Maintenance activities that are done on daily basis means regular checking of equipment so that there is detection of faults which can then be rectified before it creates losses to the organization (Nzewi, Chiekezie & Arachie, 2016). When there is high level of leadership role, this ensures that maintenance activities whether low or high will subsequently lead to high performance.

However, when leadership role is low, low level of maintenance activities will result in low performance but when there is high level of maintenance activities in the presence of low leadership, performance is still highly attained. Therefore, this suggests that the company need to always maintain a high level of leadership roles because it automatically leads to high performance regardless whether maintenance activities are low or high. The risk is presented to the company when both leadership and maintenance activities are low. Birasnav (2014) explains that the roles of leadership provide a supportive culture that enables employees to understand the impact of organizational change as they continuously improve performance. Among others, transformational leadership provides a common vision of the future, encourages employees to take risk, motivates workers to achieve goals and take risks, and provides them to solve job problems innovatively (Balaji & Krishnan, 2014). Thus, it relates the importance of having high leadership at all time in the organization.

Contrastively, this research found that leadership role did not moderate the relationship between continuous improvement, resource maintenance and training and education with organization performance. The insignificance of leadership role as a moderator can be possibly explained in several ways. Firstly, with regards to continuous improvement, the most crucial factor that ensures its practices is the ability of the employees to be their own leaders in making empowered decision to find minor defects in equipment and machines before they lead to major defects or failures (Nieminen, 2016). Therefore, in this case, it is not the leadership of the top management that is of concerned but leadership of the employees themselves to ensure they are capable of making decision on their own to deal with problematic equipment and machines.

Secondly, resource maintenance is also similar to continuous improvement whereby the main focus is on ensuring all resources are in tip top condition before being utilized for production. Lastly, training and education are concerned with the provision of skills and knowledge to the employees on the effective utilization of equipment in terms of availability, output quality and operating speed (Ajay, 2016). It is required in tandem with leadership role to bring high performance for the organization, but their relationship is parallel. In other words, both leadership and training and education are directly related to organization performance, but these two variables act separately to bring positive change to the organization.

5.2.3 The level of importance of TPM Practices dimension to the Organization Performance

This research showed that TPM practices as an overall and based on its dimensions are significant predictors of organization performance. The combination of maintenance activities, continuous improvement, resource maintenance and training and education was able to explain almost half of variance in organization performance. In terms of importance, this research showed that maintenance activities have the highest relevance to explain organization performance, followed by continuous improvement, then training and education and least of all, resource maintenance.

The higher relevance of maintenance activities and continuous maintenance in determining organization performance as compared to the other two variables can be logically explained. Maintenance activities and continuous maintenance are daily operational activities that ensure the running of equipment, tools and machines are efficient and effective, whereby without which, operation and production cannot run smoothly (Adnan, Abdul Rahman & Noordin, 2014). When equipment management is not efficient, this could significantly impact on organization's performance (Ahuja & Khamba, 2004). Maintenance activities and continuous improvement are quick response on the part of the organization to ensure smooth daily operations and mitigate problems before they become a critical issue to jeopardize success (Halim, Mohamed Najib, Chandrakantan & Siti Norezam, 2013). Thus, it makes sense why these two constructs were the more relevant ones to determine performance of the organization.

Training and education are also relevant to drive performance as these are the avenues for enhancing human capital of the organization. As explained by Sharma, Kumar and Kumar (2006), training and education nurture necessary maintenance skills among the staff to solve daily problem without causing any further delays. Sharma and Trikha (2011) also stated that training and education enable the employees to understand the effort of TPM. The critical need of training and education is felt when the company realizes that the technology of production is becoming costly (Kulkarni & Dabade, 2013). Therefore, a high level of activities in teaching and education means that the employees are more skillful and knowledgeable and are capable of working effectively and efficiently towards high performance.

Least of all is resource maintenance whereby in this research, it is still considered as a significant contributor to ensure performance but in comparison with the other dimensions, it is less important. This could be due to the fact that resource is mainly equated with production while maintenance activities and continuous improvement cover both operation and production. Therefore, the effect of maintenance activities and continuous improvement would be more compared to resource maintenance.

5.3 Implications of the Research Findings

The research findings brought several implications which are discussed from two main perspectives: theoretical and practical.

5.3.1 Theoretical Implications

The research findings confirm that TPM practices in the form of maintenance activities, continuous improvement, resource maintenance and training and education brings positive outcome in organization performance. In the interplay, leadership of top management is regarded as an asset to boost performance even more. These findings presented a strong support of the model of TPM pillars which encompasses the variables investigated in this research. Findings of this research agreed with the notion presented by previous scholars and researchers (Gitachu, 2016; Kumar et al., 2016; Jardine et al., 2013; Moradi, Abdollahzadeh & Vakili, 2011; Bon & Ping, 2011) that the objective of implementing any part of these TPM pillars is the same, which is ensuring productivity and profitability of the firm.

The concept of TPM in this research holds true to the fact that TPM encourages preventive maintenance measures which is more proactive than reactive when in contact with issues and problems. The significance of maintenance activities, continuous improvement and resource maintenance to drive equipment effectiveness, autonomous maintenance and planned maintenance found in this research indicated an integrated approach of TPM to ensure productivity and profitability of the organization (McKone, Schroeder & Cua, 1999; Kumar, 2009; Brah & Chong, 2004). Studies which related the importance of TPM in manufacturing industry (Wakira & Singh, 2012) and the current findings of TPM practices in the power industry implied that TPM practices are as much important and critical for determining success in the organization.

The RBV model discussed in Chapter 2 which significantly related to this research. The organization success can be obtained by effectively explore the resource and capabalities of the organization in detail. As mentioned before, the RBV roles in the orgnanisation developing the new strategies in managing assest for the organization which content with competitive advantage. According to the VRIO model for this research, TPM is one of the strategic management tools in managing and handling asset for the organization. Due to that, TNBJ top management required to give full commitment to the TPM practices to ensure the TPM initiative embark successfully.

In detail, VRIO framework which are consist with valuable, rarity, imitability and organization was applied to the industry which is significantly offers the orgnisation a stratergy process. As discussed before, the resource-based view means the effective and efficient application of all resources to determine the competitive advantage. For this research, the equipment at the TNBJ power plant as resources in supplying power to the grid system, however the increase of power consumption by consumer impact to the increase of demand for supplying power. Due to that, ornamental the effectiveness and sustain productivity of the resources that a firm possesses in order to finish the target as capability (Helfat and Peteraf, 2003).

During the TPM activities such as initial cleaning, easy maintenance, repair work; all activities is developing employees' skill which is part of capabalities of the organization. Besides that, the employee with lower skill will impact to the organization productivity and affect to the orgnisation performance. Therefore, there are need of leadership and top management to support and monitor the employee performance. The existing assest, equipment, machine, turbine system, boiler system and machine attached to the power plant become the resources to the organisations. The resources attached at the TNBJ power plant is consider ciritical equipment and main asset to the organization. In facts, the continuous operation of this power plant is subject to the equipment availabality and equipment effectivenss. As mentioned by Wernefelt (1984) and Grant (2016), the development and combination of reseource and capabalities is more challenging nowdays, becouse its involves with such activities with critical demanding.

TPM implementation improves productivity and working efficiency of employees and also improves equipment effectiveness and a positive inclination toward organisation is registered (Jain at. al., 1014). Therefore, equipment maintenance is an indispensable function in a manufacturing enterprise. In this highly competitive environment, manufacturing organizations should consider maintenance function as a potential source for cost savings and competitive advantage. In addition, this TPM implementation strategy can help to save huge amounts of time, money and other useful resources in dealing with reliability, availability, maintainability and performance issues. On the basis of available literature, it can be understood that all industries should change their maintenance strategies to cope up with global competition so that a lot of resources can be utilized in a better direction.

5.3.2 Practical Implications

Ruiz et al. (2014), Jain et. al. (2014) and Patterson et al. (1994) mentioned that some companies perceive maintenance as an operational expense and might make a decision to minimize its cost. However, as indicated by this research, the implementation of several TPM practices relating to maintenance activities continuous improvement, resource maintenance and training and education has subsequently led to performance of the organization. Therefore, it brings awareness and acknowledgement that practicing TPM at the workplace is an investment that should be readily taken by companies.

In the case of a power plant like TNBJ, the smooth running of its equipment, tools and machines are critical to ensure that consumers are not subjected to power failure at any time, and if it does happen, the occurrence should be rectified immediately or within a very short time period. The philosophy of 5S which is the foundation of the TPM pillars and practiced in many industries (Jain et al., 2014) including in this company implied the acquired benefits from such practice. Therefore, this research and its findings provided a strong reason for practitioners particularly in any firms that rely heavily on machines, tools and equipment to invest in TPM as it brings about significant outcome in terms of efficiency and effectiveness. This research strengthens the need for operation and production to work in tandem with maintenance to achieve the same organizational goals.

Besides that, the core aim during implementing TPM is to improve production by reducing downtime, increasing speed and reducing defects. TPM enables the traditional maintenance practices to change from reactive to pro-active. In adiditon, TPM provides a number of mechanisms whereby to analysed the breakdowns, investigate causes and plan the actions to be taken to prevent further breakdowns. In facts, TPM emphasizes proactive and preventative maintenance to maximize the operational efficiency of equipment. It blurs the distinction between the roles of production and maintenance by placing a strong emphasis on empowering operators to help maintain their equipment (Badli, 2012; Meng 2014). The implementation of a TPM program creates a shared responsibility for equipment that encourages greater involvement by plant floor workers. In the right environment this can be very effective in improving productivity (increasing up time, reducing cycle times, and eliminating defects).

Engaging employees is important for both short-term and long-term success of initiatives. A powerful technique for engaging employees is creating a shared vision of the future "improved" state of the company – and clearly outlining how it will benefit employees. This will create a strong, broad-ranging motivation to succeed. Another powerful technique is recognizing and rewarding desired behavior. In the context of TPM, this may include providing a monthly rotating trophy for the Best 5S Area or awarding gift certificates each month for the Biggest Kaizen Improvement.

Succeeding early helps to ensure long-term success by building momentum behind the initiative. By way of contrast, if an initiative is perceived as having been tried and failed, it will be much harder to successfully implement that initiative in the future. Providing active leadership is one of the primary responsibilities of senior management (up to and including the Plant Manager). It means regularly demonstrating the importance of TPM activities through words and actions. Active leadership combats the natural tendency of employees to drift back into old patterns of behavior and old ways of working. It continually feeds new energy into the initiative, which over time is absorbed by employees in the form of new engrained behaviors.

5.4 Limitations of the Research Findings

Although this research has explored and lifted a large number of ambiguity pertaining to TPM practices and its impact on performance, there are also a few limitations that need to be highlighted and considered. First of all, this research is exclusively focused on one company only and therefore, the findings may be subjected to influences from specific internal cultural environment of the firm. Although various studies have reported similar findings relating to the effectiveness of TPM practices to yield success, there are discrepancies in the current results with findings from past studies. The insignificance of leadership role to moderate the relationship between continuous improvement, resource maintenance and training and education with organization performance might be due to internal cultural effects. As explained by Badli (2012), Ahuja (2008) and Merissa (2005), the successful implementation of TPM can be hindered by various factors like lack of senior management support, tight budget, pressure of work load and contradiction of management initiatives. Thus, this calls for different TPM approaches. It highlighted the initial problem posed by Jain et al. (2014) and Nguyen (2011) on lack of practical guideline and practices in implementing TPM processes.

Secondly, this research has discovered that leadership roles drives low maintenance activities to reach higher performance, and thus implied on its importance. Yet again, the framework employed in this research had only managed to explain almost half of the variance in TPM performance. It suggests the inclusion of other variables on the research. These limitations push the need for recommendations in future research practices to ensure that the highlighted gap would be addressed, and more understanding can be gained from future empirical studies.

5.5 Recommendations

The limitation in terms of research sample as highlighted above implores the need to extend the research to more companies in the power and energy sector, either operating in different area of business or in other region in Malaysia. The expansion of research sample might bring more insight to understand TPM unique practices within this industry or universal practices among other industries. It is also recommended that the extent of variables to be studied is expanded. In this research, only four areas of TPM practices were explored and there are other areas of the TPM pillars that could be explored as well. The strength of SEM approach to study the interrelationships of variables in a simultaneous setting provides the means of gaining richer knowledge about TPM practices in the target industry.

Moreover, it is recommended to extent this research with applied qualitative method. The qualitative method could be conduct between TPM practitioners in the respective industry. In deep, the qualitative method supposed to gain an understanding of underlying reasons, opinions, and motivations. It provides insights into the problem or helps to develop ideas or hypotheses for potential quantitative. Therefore, it is suggested to carry out this TPM research by doing comprehensive qualitative method.

5.6 Conclusion

On overall, this research concludes the importance of TPM practices to ensure success in terms of performance. it has highlighted that operation and production should not neglect the area of maintenance so that performance in both productivity and profitability is assured. In this research, maintenance activities and continuous improvement are considered as critical TPM practices that drive success. Training and education also ensures the provision of skilful and knowledgeable staff to carry out maintenance job. Resource maintenance although being the least relevant among the investigated TPM practices is still a significant contributor of performance. Additionally, this research has shown the critical role of leadership to support low maintenance activities to drive performance. Conclusively, this research provided a rich collection of empirical evidence that had contributed significantly to confirm the benefits of TPM practices in power and energy industry.

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APPENDICES

Appendix A: Approval Letter from TNB Janamanjung Sdn Bhd

TNB JANAMANJUNG

TNB Janamanjung Sdn. Bhd.

Ref. No : TNBJ/SJM 15.5.34 (07/2017)

Date : 10 October 2017

Director of DBA Program,
Othman Yeop Abdullah Graduate School of Business
Universiti Utara Malaysia
06010 Sintok,
Kedah

Sir,

APPROVAL FOR CASE WRITING AND ANALYSIS
NAME : MR. SALMI BIN SAMSUDIN
COMPANY : TNB JANAMANJUNG SDN. BHD.

This is to clarify that your student has approached us regarding permission to write case on our organization as a part of UUM academic requirements. We understand that you and your student will use only public/published information by way of brochures, annual reports, our website/news feed.

2. It is understood by our organization that the purpose of the case writing is pure academic. By this letter, we authorize you to write case on our organization for purpose of completing this PHD course but subject to the term and condition as stated in the Non-Disclosure Agreement.

2. If we have any doubt, we can approach you on your contact numbers and email provided in your request letter.

"BETTER. BRIGHTER."

Yours Faithfully,

DATUK [illegible]SUL BIN AHMAD
Pengarah Urusan
TNB Janamanjung Sdn. Bhd.

Copy : *En. Salmi Bin Samsudin*
Please submit the Non-Disclosure Agreement (NDA) to Contract & Legal Department, TNBJ

Appendix B: Final Questionnaire Survey

The Moderating Role of Leadership in The Relationship Between Total Productive Maintenance (TPM) Practices and Organisation Performance at Power Generation Industry

Dear Sir/Madam

Introduction to the Survey

I am a doctoral candidate engaged in research at the Othman Yeop Abdullah, Graduate School of Business. Currently I am doing a study on:

"The Moderating Role of Leadership in The Relationship Between Total Productive Maintenance (TPM) Practices and Organisation Performance at Power Generation Industry"

Total Productive Maintenance (TPM), is a management system that has the proven capacity to improve the business performance of a production organization by the implementation of a safe, pleasant and productive workplace through the optimization of people and equipment. TNB Janamanjung Sdn. Bhd. (TNBJ) is a wholly owned entity of Tenaga Nasional Berhad (TNB), which has progressively implement the TPM program since the year 2010. In ensuring the sustainability of TPM performance, it is important to determine the relationship between TPM practices and the organization's performance. In addition, this research will examine the moderating effects of leadership for TPM practices during TPM implementation.

The survey is completely anonymous. All individual data will be kept strictly confidential and will be used for academic purposes only. Please do not hesitate to contact me at nasmiesan@gmail.com or call +60192932042 should you have any inquiries or require further information.

A good response rate is critical in ensuring the success of the doctoral thesis, so your time and effort is highly appreciated.

Thank you.
Salmi bin Samsudin
No Matrix: 99118

Appendix B: Final Questionnaire Survey (Continued)

The following survey will take approximately 15 minutes to complete. It is divided into three sections, and cover questions on:

- **Section A: Background Information**
- **Section B: Total Productive Maintenance (TPM) Practices**
- **Section C: Total Productive Maintenance (TPM) Organization Performance**
- **Section D: Leadership Roles**

Section A: Background Information

Kindly, tick one of the boxes that best describes your answers.

1. I am presently occupying the position of

	Executive		Non-Executive

2. Your highest educational qualification is

	SPM and below
	Diploma
	Bachelor
	Post Graduate

3. Your working experience spent at TNB Janamanjung Sdn Bhd. is

	Less than 5 years
	6 to 10 years
	11 to 15 years
	More than 15 years

Appendix B: Final Questionnaire Survey (Continued)

Section B: Total Productive Maintenance (TPM) Practices

Kindly indicate the level of agreement towards the implementation of the following items in your firm based on the given scale.

1	2	3	4	5
Strongly Disagree	Disagree	Normal	Agreed	Strongly Agree

NO	Maintenance Practice	1	2	3	4	5
1	TPM activities support the maintenance work that is being done necessarily.					
2	TPM activities assist operation staff in identifying abnormalities towards the plant and equipment.					
3	TPM program develop the employee's specific skills in conducting maintenance activities.					
4	Preventive maintenance practises such as vibration monitoring and bearing inspection supports the TPM activities					
5	By executing TPM activities, the number of maintenance activity in a week has slightly reduce.					
6	TPM activities helps in guiding the current maintenance practices on handling repair works.					
7	Ever since TPM was implemented, operation staff have been carrying out light maintenance practise such as topping lube oil and cleaning spillage.					
8	Through TPM program the operation staff have been involved in maintenance activities during their spare time.					
9	Both operation and maintenance staff have been directly involved in carrying out maintenance activities.					

NO	Continuous Improvement	1	2	3	4	5
1	TPM practices emphasized on 5S, Kaizen and other improvement initiatives.					
2	TPM activities encourage staff to do improvement projects at the plant and machines.					
3	TPM activities incorporates effective suggestion scheme from all departments.					
4	TPM activities increase the machine and equipment reliability and availability accordingly.					

		1	2	3	4	5
5	TPM activities mainly focus on prevention improvement rather than restoration.					
6	TPM activities standardize the tagging and marking at the machine and equipment.					
7	The staff's competency on the plant system has increased since TPM was implemented.					
8	Since TPM was implemented, staffs have generally realized the need of improvement towards the machine.					

NO	**Resources Management**	1	2	3	4	5
1	The organisation provides adequate resources during implementation of the TPM program.					
2	The current strategic planning is well organise to support TPM practices.					
3	The organisation provides sufficient budget during implementation of the TPM activities.					
4	The TPM committee supports the employees by solving all the related issues and problem faced during TPM program.					
5	Employees are given enough time allocation during the implementation process.					
6	TPM strategically encourages the management to prudently handle the spare parts supply.					
7	The cleaning material for TPM activities is sufficiently provided by the Top management.					
8	Top management systematically plan the TPM activities for every financial year.					

NO	**Training and Education**	1	2	3	4	5
1	Staff are aware on the TPM behavioral aspects					
2	Staff are well trained to support the TPM practices					
3	The organisation provide regular training at the workplace.					
4	The top management encourage employees to be multi skilled.					
5	Staff proficiencies and skills are periodically evaluated.					
6	The organisation provide good facilities when conducting ~~the~~ TPM training at the workplace.					
7	The staff competency has increased accordingly after being involved with TPM activities.					
8	Staff have gain both technical knowledge and concepts of the plant operation through the TPM activities.					
9	The TPM activities is part of the hands on training related to the system available at workplace.					

Appendix B: Final Questionnaire Survey (Continued)

Section C: Total Productive Maintenance (TPM) Organisation Performance

Kindly indicate the level of agreement towards the following items in your firm based on the given scale.

1	2	3	4	5
Strongly Disagree	Disagree	Normal	Agreed	Strongly Agree

NO	Equipment Effectiveness	1	2	3	4	5
1	The overall equipment effectiveness in operation has increased accordingly.					
2	Implementation of TPM initiative have reduced the equipment downtime.					
3	Equipment with high reliability and availability reduces unit load deration.					
4	TPM activities encourages optimization of the performance rate (cycle time, production rate).					
5	Carrying out self-maintenance reduces the number of defect frequency or failure.					
6	Planning for equipment in operation increases the equipment availability					

NO	Autonomous Maintenance	1	2	3	4	5
1	The ability of maintaining basic equipment conditions (cleaning, lubricating, etc.) has improved.					
2	The ability of conducting basic equipment inspection has increased.					
3	Abnormalities found while the equipment is in operation can be detected at earlier stages.					
4	Workplace condition (cleanliness, tidiness, etc.) has been better compared to previous conditions.					
5	The organisation culture has successfully develop a sense of belonging and responsibility.					

NO	Planned Maintenance	1	2	3	4	5
1	Proper work plan for maintenance activities has successfully reduced maintenance cost.					
2	The preventive maintenance achievement rate has increased since implementation of TPM.					
3	The availability and effectiveness of the equipment in operation has been increased.					
4	Pro-active maintenance and performance measurement are in place and effectively used.					
5	Unplanned maintenance works has been reduced ever since the implementation of TPM.					

Appendix B: Final Questionnaire Survey (Continued)

Section D: Leadership Roles

Kindly indicate the level of agreement towards the following items in your firm based on the given scale.

1	2	3	4	5
Strongly Disagree	Disagree	Normal	Agreed	Strongly Agree

My supervisor(boss, manager, department head or personnel to whom you report directly)….		**1**	**2**	**3**	**4**	**5**
1	Has a clear understanding of where we are going.					
2	Paints an interesting picture of the future for our group.					
3	Inspires others with her/his plans for future.					
4	Is able to get others committed to his/her dream.					
5	Leads by "doing" rather than simply by "telling".					
6	Provides a good model for me to follow.					
7	Leads by example.					
8	Encourages employees to be "team players".					
9	Gets the group to work together for the same goal.					
10	Develops a team attitude and spirit among employees.					
11	Shows us that he/she expects a lot from us.					
12	Insists on only the best performance.					
13	Will not settle for second best.					
14	Acts without considering my feelings.					
15	Shows respect for my personal feelings.					
16	Behaves in a manner thoughtful of my personal needs.					
17	Challenges me to think about old problems in new ways.					
18	Asks questions that prompt me to think.					
19	Has stimulated me to rethink the way I do things.					
20	Has ideas that have challenged me to re-exam some of the basic assumptions about my work.					

THANK YOU FOR YOUR TIME

Appendix C: Scale Analysis Output

Scale: Maintenance Practice (MP)

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.890	9

Scale: Continious Improvement (CI)

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.896	8

Appendix C: Scale of Analysis Output (Continued)

Scale: Resource Management (RM)

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.902	8

Scale: Training and Education (TE)

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.884	9

Appendix C: Scale of Analysis Output (Continued)

Scale: TPM Practices

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.933	34

Scale: Equipment Effectiveness (EE)

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.927	6

Appendix C: Scale of Analysis Output (Continued)

Scale: Autonomous Maintenance (AM)

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.912	5

Scale: Preventive Maintenance (PM)

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.879	5

Appendix C: Scale of Analysis Output (Continued)

Scale: TPM Performance

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.938	16

Scale: Leadership Roles (LR)

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.973	20

Appendix D: Equivalent Availability Factor (EFA) Output

(a) For TPM Practices

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.840
Bartlett's Test of Sphericity	Approx. Chi-Square	2249.733
	df	561
	Sig.	.000

Communalities

	Initial	Extraction
MP1	1.000	.455
MP2	1.000	.653
MP3	1.000	.630
MP4	1.000	.665
MP5	1.000	.584
MP6	1.000	.608
MP7	1.000	.379
MP8	1.000	.542
MP9	1.000	.455
CI1	1.000	.524
CI2	1.000	.758
CI3	1.000	.722
CI4	1.000	.509
CI5	1.000	.872
CI6	1.000	.433
CI7	1.000	.579
CI8	1.000	.440
RM1	1.000	.462
RM2	1.000	.795
RM3	1.000	.366
RM4	1.000	.448
RM5	1.000	.854
RM6	1.000	.604
RM7	1.000	.715
RM8	1.000	.674
TE1	1.000	.568
TE2	1.000	.352
TE3	1.000	.589
TE4	1.000	.588
TE5	1.000	.469
TE6	1.000	.520
TE7	1.000	.627
TE8	1.000	.584
TE9	1.000	.512

Extraction Method: Principal Component Analysis.

Appendix D: Equivalent Availability Factor (EFA) Output (Continued)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.008	32.376	32.376	11.008	32.376	32.376	5.120	15.060	15.060
2	3.399	9.997	42.373	3.399	9.997	42.373	4.935	14.515	29.575
3	2.871	8.444	50.817	2.871	8.444	50.817	4.933	14.509	44.084
4	2.258	6.640	57.457	2.258	6.640	57.457	4.547	13.373	57.457
5	1.280	3.764	61.221						
6	1.180	3.470	64.690						
7	1.130	3.324	68.015						
8	1.026	3.018	71.032						
9	.895	2.632	73.664						
10	.815	2.398	76.062						
11	.755	2.220	78.282						
12	.750	2.205	80.487						
13	.641	1.887	82.374						
14	.607	1.786	84.160						
15	.568	1.671	85.831						
16	.541	1.590	87.421						
17	.471	1.384	88.805						
18	.417	1.227	90.032						
19	.392	1.152	91.184						
20	.386	1.136	92.320						
21	.361	1.063	93.382						
22	.313	.921	94.304						
23	.303	.891	95.195						
24	.258	.759	95.953						
25	.231	.680	96.634						
26	.208	.610	97.244						
27	.184	.541	97.785						
28	.160	.470	98.255						
29	.134	.393	98.647						
30	.124	.364	99.012						
31	.108	.317	99.328						
32	.093	.273	99.601						
33	.083	.244	99.845						
34	.053	.155	100.000						

Extraction Method: Principal Component Analysis.

Appendix D: Equivalent Availability Factor (EFA) Output (Continued)

Rotated Component Matrix[a]

	Component			
	1	2	3	4
MP1	.613			
MP2	.780			
MP3	.753			
MP4	.752			
MP5	.698			
MP6	.761			
MP7	.495			
MP8	.711			
MP9	.669			
CI1				.631
CI2				.829
CI3				.732
CI4	.311			.596
CI5				.847
CI6			.353	.538
CI7				.740
CI8				.551
RM1		.667		
RM2		.871		
RM3		.579		
RM4		.574		.338
RM5		.877		
RM6		.741		
RM7	.300	.768		
RM8		.754		
TE1			.701	
TE2			.553	
TE3			.734	
TE4			.761	
TE5			.646	
TE6			.671	
TE7			.746	
TE8			.708	
TE9			.641	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 6 iterations.

Appendix D: Equivalent Availability Factor (EFA) Output (Continued)

(b) For Operation Performance

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.895
Bartlett's Test of Sphericity	Approx. Chi-Square	1310.696
	df	120
	Sig.	.000

Communalities

	Initial	Extraction
EE1	1.000	.735
EE2	1.000	.689
EE3	1.000	.732
EE4	1.000	.911
EE5	1.000	.607
EE6	1.000	.760
AM1	1.000	.787
AM2	1.000	.741
AM3	1.000	.696
AM4	1.000	.744
AM5	1.000	.828
PM1	1.000	.662
PM2	1.000	.720
PM3	1.000	.737
PM4	1.000	.575
PM5	1.000	.776

Extraction Method: Principal Component Analysis.

Appendix D: Equivalent Availability Factor (EFA) Output (Continued)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.450	52.814	52.814	8.450	52.814	52.814	4.481	28.005	28.005
2	1.790	11.188	64.002	1.790	11.188	64.002	3.832	23.947	51.952
3	1.460	9.125	73.127	1.460	9.125	73.127	3.388	21.174	73.127
4	.733	4.584	77.710						
5	.632	3.949	81.660						
6	.550	3.438	85.098						
7	.417	2.605	87.702						
8	.385	2.405	90.107						
9	.358	2.238	92.345						
10	.287	1.793	94.138						
11	.240	1.497	95.635						
12	.215	1.343	96.979						
13	.190	1.190	98.169						
14	.140	.875	99.044						
15	.084	.523	99.567						
16	.069	.433	100.000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

	Component		
	1	2	3
EE1	.756		.318
EE2	.796		
EE3	.752		.322
EE4	.852	.314	
EE5	.756		
EE6	.805		
AM1		.857	
AM2		.801	
AM3	.477	.645	
AM4	.302	.784	
AM5		.862	
PM1			.758
PM2			.807
PM3			.800
PM4	.325	.324	.604
PM5		.417	.737

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 5 iterations.

Appendix D: Equivalent Availability Factor (EFA) Output (Continued)

(c) Leadership Roles

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.949
Bartlett's Test of Sphericity	Approx. Chi-Square	1932.224
	df	190
	Sig.	.000

Communalities

	Initial	Extraction
LR1	1.000	.644
LR2	1.000	.675
LR3	1.000	.582
LR4	1.000	.645
LR5	1.000	.552
LR6	1.000	.677
LR7	1.000	.694
LR8	1.000	.696
L59	1.000	.657
LR10	1.000	.634
LR11	1.000	.684
LR12	1.000	.730
LR13	1.000	.609
LR14	1.000	.688
LR15	1.000	.703
LR16	1.000	.809
LR17	1.000	.718
LR18	1.000	.699
LR19	1.000	.624
LR20	1.000	.576

Extraction Method: Principal Component Analysis.

Appendix D: Equivalent Availability Factor (EFA) Output (Continued)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.296	66.478	66.478	13.296	66.478	66.478
2	.933	4.665	71.143			
3	.793	3.963	75.106			
4	.566	2.832	77.938			
5	.519	2.595	80.533			
6	.482	2.409	82.942			
7	.468	2.341	85.283			
8	.397	1.985	87.268			
9	.383	1.914	89.182			
10	.322	1.610	90.792			
11	.302	1.512	92.305			
12	.258	1.289	93.594			
13	.234	1.171	94.765			
14	.226	1.129	95.894			
15	.214	1.068	96.962			
16	.161	.804	97.765			
17	.128	.638	98.404			
18	.126	.632	99.036			
19	.103	.516	99.552			
20	.090	.448	100.000			

Extraction Method: Principal Component Analysis.

Appendix D: Equivalent Availability Factor (EFA) Output (Continued)

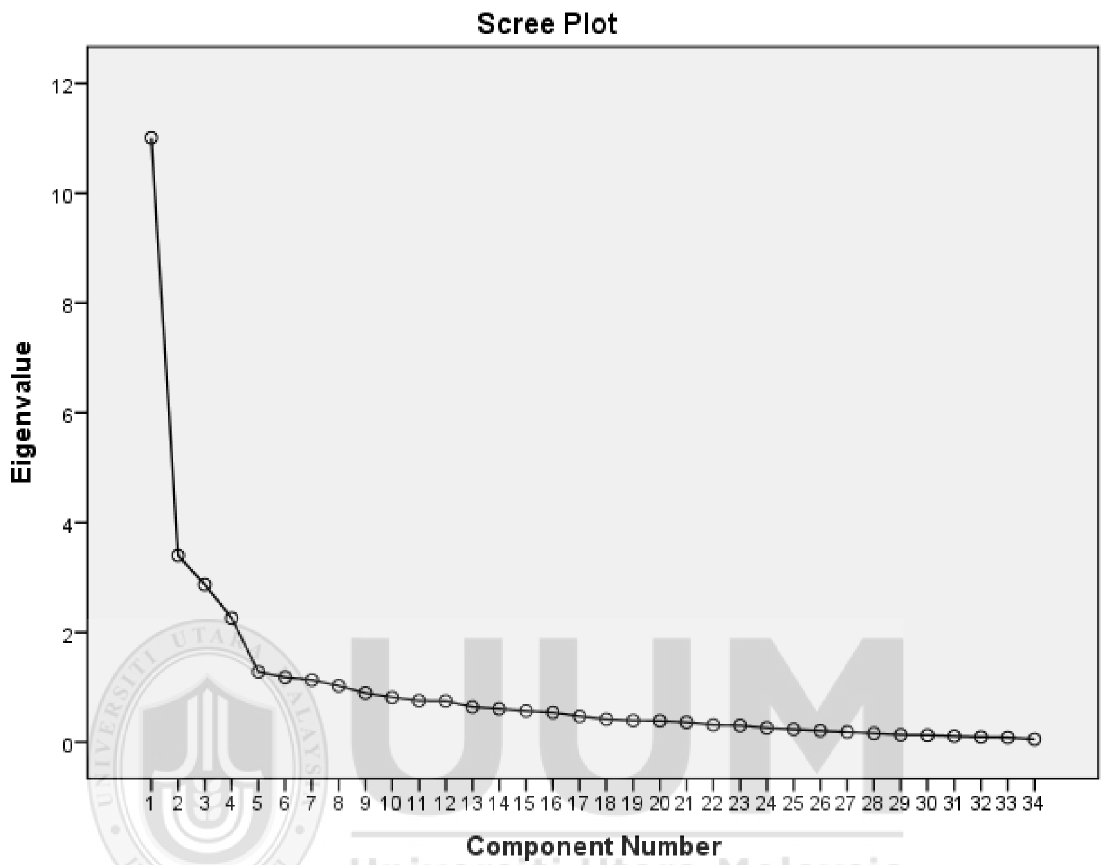
Component Matrix[a]

	Component
	1
LR1	.802
LR2	.822
LR3	.763
LR4	.803
LR5	.743
LR6	.823
LR7	.833
LR8	.834
L59	.811
LR10	.796
LR11	.827
LR12	.854
LR13	.780
LR14	.830
LR15	.838
LR16	.899
LR17	.847
LR18	.836
LR19	.790
LR20	.759

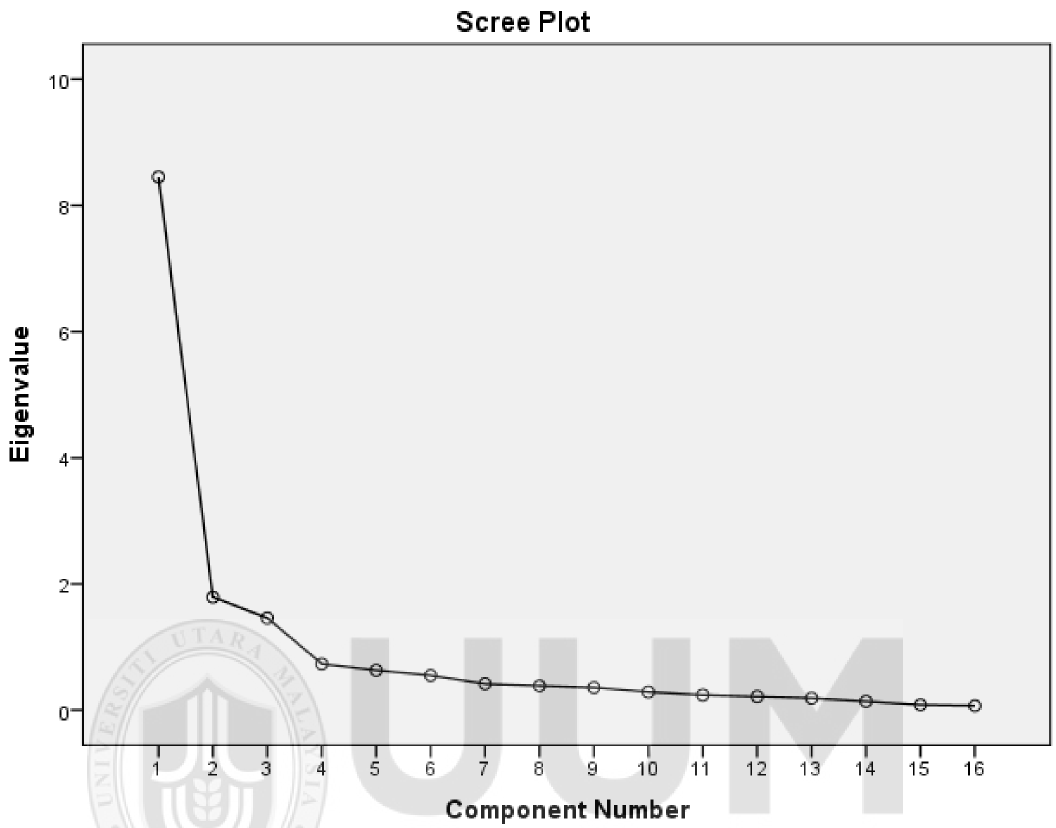
Extraction Method: Principal Component Analysis.

a. 1 components extracted.

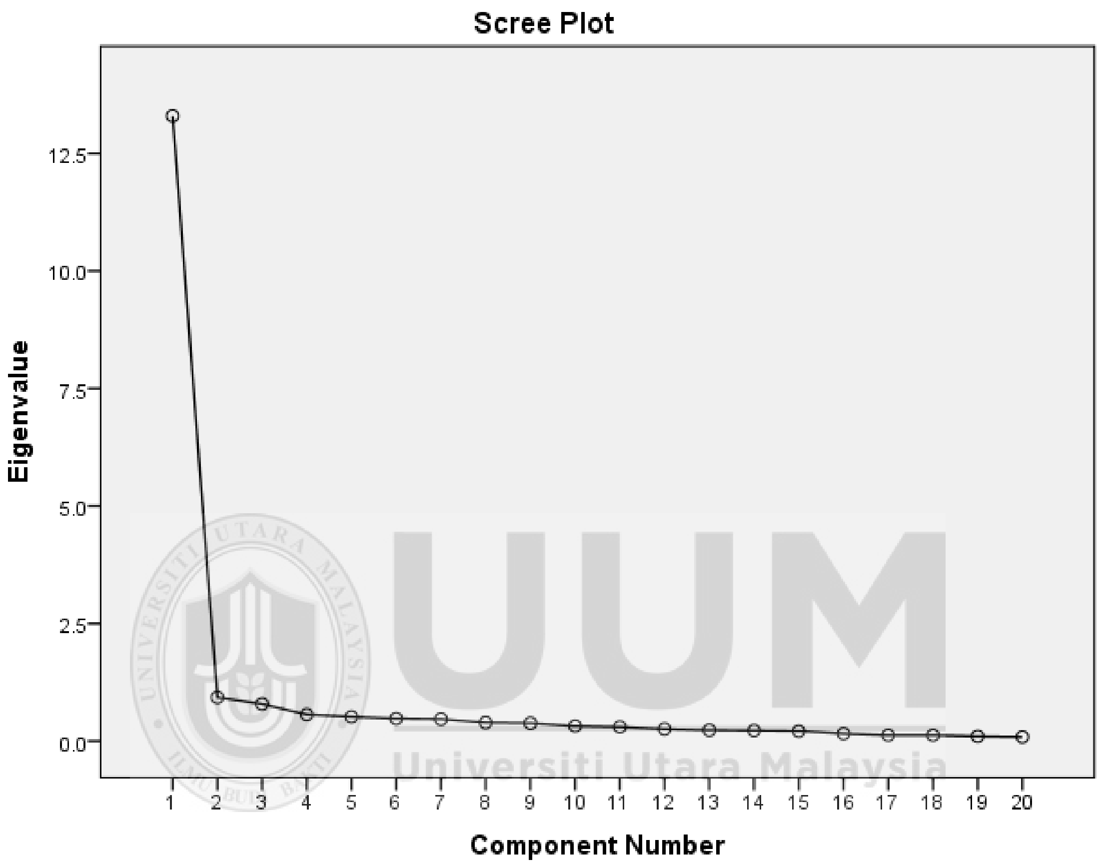
Appendix E: The Scree Plot for TPM Practices



Appendix F: The Scree Plot for Operation Performance



Appendix G: The Scree Plot for Leadership Roles



Appendix H: Outer Loadings for Reflective Unidimensional Constructs

Unidimension Construct			
	LR	OP	TPM
AM1		0.700	
AM2		0.685	
AM4		0.700	
AM5		0.721	
CI1			0.755
CI2			0.742
CI3			0.716
CI5			0.732
CI6			0.747
CI7			0.724
CI8			0.705
EE1		0.762	
EE2		0.743	
EE4		0.737	
EE5		0.792	
EE6		0.752	
LR1	0.825		
LR2	0.842		
LR3	0.867		
LR4	0.798		
LR5	0.773		
LR6	0.806		
LR7	0.825		
LR8	0.820		
LR9	0.801		
LR10	0.798		
LR11	0.800		
LR12	0.847		
LR13	0.783		
LR14	0.796		
LR15	0.814		
LR16	0.828		
LR17	0.803		
LR18	0.824		
LR19	0.810		
LR20	0.829		

Appendix H: Outer Loadings for Reflective Unidimensional Constructs (Continued)

Unidimension Construct			
	LR	OP	TPM
MP1			0.591
MP2			0.588
MP5			0.619
MP6			0.604
MP9			0.607
PM1		0.746	
PM2		0.772	
PM3		0.732	
RM1			0.735
RM2			0.715
RM3			0.707
RM4			0.725
RM5			0.718
RM6			0.731
RM8			0.755
TE1			0.738
TE2			0.722
TE3			0.754
TE4			0.728
TE5			0.731
TE6			0.725
TE7			0.746
TE8			0.742
TE9			0.751

Appendix I: Outer Loadings for Reflective Unidimensional Sub-Constructs

	CI	LR	MP	OP	RM	TE
AM1				0.698		
AM2				0.683		
AM4				0.698		
AM5				0.718		
CI1	0.989					
CI2	0.935					
CI3	0.935					
CI5	0.942					
CI6	0.948					
CI7	0.928					
CI8	0.940					
EE1				0.764		
EE2				0.744		
EE4				0.739		
EE5				0.794		
EE6				0.754		
L59		0.801				
LR1	0.825	LR1				
LR2	0.842	LR2				
LR3	0.867	LR3				
LR4	0.798	LR4				
LR5	0.773	LR5				
LR6	0.806	LR6				
LR7	0.825	LR7				
LR8	0.820	LR8				
LR9	0.801	LR9				
LR10	0.798	LR10				
LR11	0.800	LR11				
LR12	0.847	LR12				
LR13	0.783	LR13				
LR14	0.796	LR14				
LR15	0.814	LR15				
LR16	0.828	LR16				
LR17	0.803	LR17				
LR18	0.824	LR18				
LR19	0.810	LR19				

Appendix I: Outer Loadings for Reflective Unidimensional Sub-Constructs (Continued)

	CI	LR	MP	OP	RM	TE
MP1			0.931			
MP2			0.949			
MP3			0.940			
MP4			0.949			
MP5			0.931			
MP6			0.992			
MP7			0.950			
MP8			0.927			
MP9			0.944			
PM1				0.746		
PM2				0.772		
PM3				0.732		
RM1					0.977	
RM2					0.933	
RM3					0.920	
RM4					0.937	
RM5					0.937	
RM6					0.952	
RM8					0.973	
TE1						0.930
TE2						0.924
TE3						0.985
TE4						0.945
TE5						0.944
TE6						0.933
TE7						0.952
TE8						0.960
TE9						0.971

Appendix J: Construct Reliability and Validity

a) For Constructs

Contructs	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
LR	0.973	0.974	0.975	0.664
OP	0.924	0.928	0.935	0.544
TPM	0.963	0.964	0.966	0.506

b) For Sub-Constructs

Sub-Contructs	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
CI	0.98	0.981	0.983	0.894
LR	0.973	0.974	0.975	0.664
MP	0.985	0.986	0.987	0.895
OP	0.924	0.928	0.935	0.544
RM	0.981	0.982	0.984	0.897
TE	0.986	0.987	0.988	0.901

Appendix K: Discriminant Validity

a) For constructs

	LR	OP	TPM
LR	0.815		
OP	0.543	0.738	
TPM	0.544	0.666	0.711

b) For sub-constructs

	CI	LR	MP	OP	RM	TE
CI	0.945					
LR	0.472	0.815				
MP	0.401	0.326	0.946			
OP	0.533	0.543	0.473	0.737		
RM	0.444	0.397	0.411	0.496	0.947	
TE	0.424	0.404	0.266	0.484	0.435	0.949

Appendix L: VIF Factors

a) For constructs

	LR	OP
LR		1.421
OP		
TPM		1.421

b) For sub-constructs

	CI	LR	MP	OP	RM	TE
CI				1.563		
LR				1.435		
MP				1.311		
OP						
RM				1.504		
TE				1.399		

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