



An Analysis of Barriers and Enablers for Effective Implementation of Total Productive Maintenance (TPM) in Small and Medium Enterprises (SMEs) in India: Literature Review

Amber Gupta

*M.Tech. Research Scholar
(Industrial Engineering and Management)
Department of Mechanical Engineering
Takshshila Institute of Engineering and Technology,
Jabalpur (M.P.) India
Email: amber_gupta_2@yahoo.com*

I. K. Khanna

*Professor
Department of Mechanical Engineering
Takshshila Institute of Engineering and Technology
Jabalpur (M.P.) India
Email: ik_khanna@yahoo.com*

Abstract—The purpose of this research paper is to literature review on an analysis of barriers and enablers for effective implementation of total productive maintenance (TPM) in small and medium enterprises (SMEs) in India. In the modern competitive world, a superpower country is a revolutionary paradigm shift to achieve higher efficiency and effectiveness in his enterprises. They used different management maintenance concepts to improve his country's small and medium enterprises (SMEs) to achieve higher growth in his country. Because in modern times all large enterprises do not produce or focus to manufacture all parts of the product. They focus on his core competencies and outsource his other parts to other SMEs to increase production and productivity of his enterprises by maintenance management concepts like TPM etc. In India, SMEs are playing an important role in growth in-country and support other large-scale enterprises too. But in Indian SMEs are lots of barriers in light to effective maintenance management concepts like the effective implementation of TPM. So, in this research, we will analyse barriers for effective implementation of TPM in SMEs in India. And, analysis to enablers which enable these concepts in Indian SMEs to support to achieve world-class competition and ready to

India becomes a superpower in world level to Growth his SMEs.

This research has tried to find out all barriers to the implementation of total productive maintenance for SMEs. And find out enablers which are run this maintenance management concept to work as a paradigm shift.

Keywords:— TPM, TPM Implementation, TPM Barriers, TPM Enablers, Indian SMEs, Proposed TPM Framework for Indian SMEs, Statistical quantitative and qualitative Analysis, Questionnaires.

1. INTRODUCTION

1.1 Indian SMEs

This area covers the audit identified with the SSE literature which is very broad. To encourage a precise survey, the writing outlines and discoveries are sorted out by theme zones. The theme territories incorporate SSE area and its importance; Growth and Development of SSE; Organizational and Institutional support for SSE; Challenges ahead and affliction in SSE.

1.1.1 SMEs Sector and its Significance

The meaning of small-scale enterprise differs from nation to nation. While many

creating nations utilize capital venture as measuring stick, propelled nations by and large take after work as the criteria. Numerous nations have utilized a blend of speculation deals and work to characterize a small-scale enterprise.

In India, small and medium enterprise (SME) generally termed as small-scale unit (including small sector) is characterized by the criteria of size of capital venture. This is not at all like numerous different nations where they pass by various criteria for recognizing small and medium scale units.

Table 1: Classification of the MSME (New and Old)

Classification of the MSME	New Classification (Annual Turn-over) (In ₹)	Previous classification – Ceiling on Investment in Plant and Machinery (In ₹)
Micro Enterprise	Not exceeding ₹ 5 crores	Not exceeding ₹ 25 Lakh
Small Enterprise	Between ₹ 5 crores to ₹ 75 crores	Between ₹ 25 lakh to ₹ 5 crore
Medium Enterprise	₹ 75 to ₹ 250 crores	More than ₹ 5 crore to ₹ 10 crore

1.2 Total Productive Maintenance

TPM is a system focused on the availability of the equipment when they are required, with an optimal level of performance in terms of availability, performance and quality. This is accomplished with the participation of all of those involved, and with leadership from top management to keep the system alive. TPM is a company-wide system developed to maintain, monitor, and improve all capital assets of a company. It is an everyone involvement effort to build quality into equipment and to improve overall equipment effectiveness.

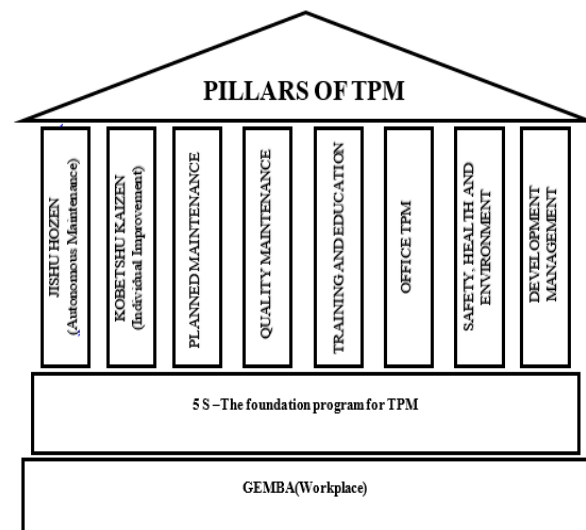


Figure 1: Pillars of TPM

2. LITERATURE REVIEW

The Review of associated literature includes the systematic identity, place, and evaluation of documents containing facts associated with the research hassle. The term is likewise used to describe the written component of a studies plan or report that discusses the reviewed files. These files can consist of articles, abstracts, critiques, monographs, dissertations, other studies report, and digital media. The literature evaluate has numerous critical functions that make it properly worth the effort and time. The essential purpose of reviewing the literature is to determine what has already been achieved that relates to this topic.

2.1 Abhishek Jain, Harwinder Singh, Rajbir and S. Bhatti (2018)

The motive of this paper is to become aware of the key enabler for Total Productive Maintenance (TPM) implementation in Indian Small and Medium Enterprises (SMEs) by way of using the Graph-Theoretic Approach (GTA). There are sure enablers for TPM implementation which helps the employer to enforce it effectively. It is very critical to pick out the character and effect of these key enablers. A massive variety of enablers (27) have diagnosed for TPM implementation in Indian SMEs from the available literature, questionnaire survey, and professional

opinion. These TPM enablers have classified into six essential classes. In this study's paintings, the Intensity of identifying enablers has been calculated to show their effect or have an effect on in TPM implementation. The value of the Intensity of TPM Enablers (IOETPM) indicates the position or impact of man or woman enablers within the implementation of TPM in Indian SMEs.

2.2 M. Nishal, K. Ramprasad, A. J. Arun Theja, S. Ajay Saravanan And S. Abhishek (2018)

Total Productive Maintenance is a renovation application which includes a newly described concept for retaining plans and device. TPM software permits production devices to search for evolutionary adjustments took place in enterprise surroundings. It is an evolving method that's observed within all organizations. This facilitates us to improve the important thing business method that is used to discover key performance signs. The goal of the take a look at is to know why its miles needed to be applied for small scale industries and the way efficaciously it will likely be to function after implementing total efficient upkeep. In this paper, it is also visualized the oblique advantages of TPM making the production smoother at a quicker price. To enhance system reliability, the TPM strategy become carried out in which the normal everyday renovation became completed by way of the operators at the same time as the mandate given to the maintenance team changed into to carryout specialized protection, upgrades and modification jobs to minimize disasters thereby growing system availability, decreasing fees and enhancing profitability of the employer.

2.3 Anita Sharma, Rajesh P. Mishra, Ayon Chakraborty and Gajanand Gupta (2017)

Total Productive Maintenance inside the corporations is a difficult difficulty for Indian manufacturing industries. There is a fast want to investigate the behaviour of the boundaries faced by Indian manufacturing industries for efficacious implementation of TPM. The

motive of this have a look at is to understand the mutual interplay most of the barriers of Total Productive Maintenance (TPM) and to develop a hierarchy of boundaries to TPM implementation. Interpretive structural modelling (ISM) - MICMAC technique is hired to perceive the inter-relationships among the obstacles of TPM implementation. A hierarchy model of those obstacles is evolved, through driving and dependence power of the boundaries. MICMAC technique determines to ride, and driven boundaries based totally on their riding and dependence power.

2.4 Prasanth S. Poduval and Dr.R. Karthikeyan (2017)

The authors purpose to spotlight how Interpretive Structural Modelling (ISM) can be used to investigate limitations in the implementation of Total Productive Maintenance (TPM). The paper starts with the aid of giving a brief description of ideas of TPM and ISM. It proceeds to explain the methodology of ISM step clever subsequently culminating in an Interpretive Structural Model and Mic-Mac graph to recognize the underlying interrelationship most of the inhibiting factors. Finally, the authors propose movement plan to mitigate those elements to be able to correctly implement TPM.

2.5 Saumyaranjan Sahoo, Sudhir Yadav (2017)

Indian production corporations operating in hastily converting and competitive market, over a previous couple of decades, have embraced enterprise-extensive transformation to gain cultural and operational excellence. In current years, several techniques were proposed to improve commercial enterprise and manufacturing performance. Lean practices especially, Total Productive Management (TPM) and Total Quality Management (TQM) have acquired sizable attention, as they're being followed and adapted for raising the overall performance widespread of Indian manufacturing corporations to international

class ranges. The complementary nature of TPM and TQM is being practiced in many organizations to achieve synergy.

2.6 Soumava Mandal, Dr. Rajeev Saha (2017)

The motive of this paper is to assess the intensities of numerous barriers in implementing Total Productive Maintenance in a company and force managerial insights. In this paper, a graph-theoretic method has been used to locate the intensity of the barriers via an index that's calculated via an everlasting feature attained from the digraph of TPM limitations. Four essential boundaries have been observed from literature- Cultural obstacles, Behavioural boundaries, Technical barriers and Strategic boundaries. The GTA approach additionally permits modelling of interactions amongst numerous sub limitations beneath each main barrier. It has been found that Technical boundaries have the best intensity in the case observe and strategic boundaries have the lowest depth. The intensities of each enabler are represented as a single numeric cost. As the depth of every enabler is known, managers can efficaciously make use of them for the duration of TPM implementation.

2.7 Ankur Roy, Chandra Sekhar, and Vishal Vyas (2016)

Small and medium businesses (SMEs) play a giant function inside the boom of the financial system. Many SMEs have set up activities past their home markets, and their function is greater important in contributing to the future boom. They are faced with global opposition and forced to compete in worldwide markets. In this examination, authors have categorized barriers to firm internalization as internal and outside barriers. The 3 dimensions of external obstacles include governmental and monetary political/legal boundaries, procedural, and forex obstacles, and venture and socio-cultural limitations.

2.8 Anshul Pachouri and Sankalp Sharma (2016)

Innovation performs a crucial role in shaping the economic and firm competitiveness of any state. Innovation is frequently discussed within the placing of developed countries, however, the upward push of rising economies consisting of India has generated a new interest in understanding innovation in developing economies. This paper pursuit to look at and present the cutting-edge country of innovation in small and medium-sized organizations (SMEs) in India. The focus of the paper is to convey out the important thing barriers SMEs face within the innovation technology in the context of the prevailing government policy. India, being a growing nation, has its personal set of particular situations and demanding situations that impede the innovation ability of SMEs working in it. Many of these barriers are related to public coverage, funding constraints, scarcity of skilled studies and improvement (R&D) personnel, and susceptible linkages among institutions and the firms, amongst others

2.9 Ashok Kumar, Rajesh Kumar Singh and Tasmeem Ahmad Khan (2016)

In current instances, many corporations enforcing overall efficient upkeep (TPM) have been failing in their tries because of special boundaries and demanding situations in TPM implementation. The purpose of this observe is to evaluate the limitations earlier than manufacturing corporations for adapting to proactive general effective protection (TPM) tasks. It is discovered that within the case of TPM, top management should be devoted to containing from the start to enforce and observe-up, as this decision is complicated and involve a large investment in a long time. Before beginning implementation, top management ought to be convinced of the necessary justification, which calls for an analysis of various obstacles which include loss of pinnacle control commitment, lack of human aid management, high turnover at top control

degree, loss of co-ordination between distinct departments. This paper has attempted to develop a framework for analysing the obstacles in TPM implementation.

2.10 Jyoti Prakash Majumdar (2016)

In the present scenario of relatively competitive commercial enterprise surroundings in domestic as well as international marketplace, implementation of Total Quality Management (TQM) concept has grown to be an vital commercial enterprise tradition and a key survival device, each for production and service industries, from large scale to small scale, for achieving the enterprise competitiveness. TQM has been adopted through an amazing quantity of big-scale industries. However, negligible units of Small and Medium Enterprises (SME) have adopted TQM. Especially in developing nations like India, though SMEs play an essential role inside the financial increase of us a SMEs are nevertheless reluctant to adopt TQM. Many Indian SMEs, beneath the pressure from the patron, have installation appropriate QMS (Quality Management System) for buying ISO 9001 certified leading to Quality Assurance but have now not adopted TQM.

2.11 Swapnil Raut and Niyati Raut (2016)

In these days' enormously aggressive and rapidly changing enterprise environment, industries must offer sort of products at an extraordinary stage, in the least time and for an acceptable price. Therefore, gadget renovation and in fashionable, imposing the correct renovation method has emerged as an increasing number of critical. Total productive upkeep (TPM) is one of the most famous maintenance techniques to ensure high system reliability, maintaining equipment in top working circumstances to avoid breakdowns and limit downtimes inside the manufacturing procedure. This paper evaluations the huge literature related to the implementation of TPM software in small and medium scale industries in an effort to reap boom in machine availability, performance & method best thereby increasing average

gadget effectiveness (OEE). Investigations consist of implementation of TPM pillars to lessen losses related to OEE.

2.12 Abhishek Jain, Rajbir Bhatti and Harwinder Singh (2015)

The cause of this paper is to introduce cell maintenance a new idea of general productive maintenance (TPM) implementation exercise, mainly in small and medium scale corporations (SMEs). This study tries to introduce this new idea for SMEs in SMEs to help conventional protection applications which is already to be had especially industries.

2.13 David Michael Feliciano, Bruce G. Cameron and Steven J. Spear (2015)

The 737 software is currently generating 42 airplanes in line with the month and will boom that production rate to 47 according to month by means of 2017 and 52 consistent with the month in 2018. In order to help meet these rates, Boeing plans to grow the quantity of automation in the shop that produces the front and rear spars for all 737 variations. To mitigate risks related to elevated automation, the automation design crew would really like to put in force a method to equipment renovation and operation referred to as Total Productive Maintenance (TPM). However, the justification for TPM become no longer clean and an implementation method did not exist. The consciousness of this thesis, therefore, is to clarify the justification for TPM, apprehend how TPM could impact the production system, pick out the barriers and enablers of TPM implementation at Boeing, and present a TPM implementation plan in order to be suitable and effective for the particular context wherein it will likely be completed.

2.14 Prasanth Sankar Poduval, V R Pramod Jagathy Raj V P (2015)

The reason for this paper is to spotlight the utility of Interpretive Structural Modelling (ISM) to investigate the obstacles in the implementation of Total Productive

Maintenance (TPM). TPM is defined in quick with emphasis on preservation programs to improve exceptional of merchandise, reliability of methods and discount in the fee. Barriers in the implementation of TPM are also mentioned. The concept of ISM and steps in developing ISM are described in detail. The authors then illustrate the studies technique which entails applying ISM to investigate limitations in TPM.

2.15 S. N. Waghmare, Dr. D. N. Raut, Dr. S. K. Mahajan and Dr. S. S. Bhamare (2015)

Despite their excessive enthusiasm and inherent abilities to develop, SMEs in India are facing some of the troubles like technological obsolescence, increasing domestic and worldwide competition, and trade in manufacturing techniques. To live to tell the tale with such issues and compete with large and worldwide organizations, SMEs need to adopt revolutionary procedures of their operations. Failure Mode and Effects Analysis (FMEA) is one of the only strategies to reap high reliability and Total Productive Maintenance (TPM) improves product nicely, lessen waste, lessen manufacturing cost, increase gadget availability. This paper investigates the impact of various lessons of disasters on the production method with the aid of the use of element analysis. A survey was achieved to acquire the statistics from special SMEs (473 industries) via a questionnaire provided to them.

2.16 Abhishek Jain, Rajbir Bhatti and Harwinder Singh (2014)

The structures like Total efficient renovation (TPM), Total satisfactory management (TQM) and just-in-time (JIT) have been carried out mainly in large industries. These structures also can be implemented in small and medium companies (SMEs) in growing countries. More than 75% of overall industries in India are of Small and Medium-size industries (Jutla et al., 2002). These are the heart of the large industries due to the fact large industries bought most of the components or elements from small and

medium-size industries. Nowadays, client pride is the task of big industries that may be executed whilst components produced in SMEs are of precise first-rate, to be had at the right time and at the low price. In this paper, the authors are discussing the wishes of TPM implementation in Indian SMEs and its outcomes on productivity, best of product, a subculture of the corporation, upkeep hobby and so forth. The outcomes of the literature of a few case studies have been kept in thoughts that all these displays that the implementation of TPM in SMEs remains very low or negligible in India. Therefore, more attempts should accept in developing a better model or there is a need to increase a proposed version for TPM implementation in SMEs. Finally, a TPM implementation methodology is proposed. In this paper, the authors have revised some pillars.

2.17 Manjinder Singh, Anish Sachdeva and Arvind Bhardwaj (2014)

To achieve success in contemporary production surroundings groups ought to be supported by means of both effective and efficient maintenance programmers. One technique to enhancing the performance of protection activities is to put in force and expand a complete effective maintenance (TPM) strategy. However, TPM implementation is adversely suffering from some factors, which might be referred to as TPM obstacles. The objective of this paper is to expand the relationships with the various recognized TPM obstacles. Further, this paper is also useful to recognize mutual influences of limitations and to identify the ones boundaries which help different obstacles (driving barrier) and also those boundaries which might be most inspired by means of different limitations (structured boundaries). The interpretive structural modeling (ISM) method is used to confirm mutual relationships amongst those limitations.

2.18 Masoomah Darabi, Ghasem Ebrahimpour and Baser Nina Sharifi (2014)

Total Productive renovation (TPM) is

an increasing number of conceded out by several businesses to get better their equipment competence and to gain competitive gain within the global market concerning cost and great. But, growing TPM is not a problem-unfastened undertaking. There are particular enablers, which help inside the performing TPM. The uppermost want is to analyses the conduct of these enablers for his or her a hit usage inside the acting of TPM. The reason for this takes a look at is to understand the shared contact of those enablers and be acquainted with the 'riding enablers' and the 'structured enablers. In this work, those enablers were documented all of the ways through the assignment their ranking is finished by a questionnaire-based totally evaluation and interpretive structural modeling (ISM) loom has been making the maximum of in reading their mutual contact. An ISM model has been authorized to be familiar with numerous extensive enablers and their choice-making implications within the performing of TPM.

2.19 Abhishek Jain, Rajbir Bhatti and Harwinder Singh (2013)

In this gift technology, to become

successful, the maximum of the industries including SMEs have understood that customer delight has a powerful effect on their commercial enterprise. Due to this purpose, lots of these aggressive companies continually boom their productivity & satisfactory requirements by means of adopting specific first-rate techniques which include general great control (TQM), just-in-time (JIT), Six Sigma, overall productive preservation (TPM) and so forth. Amongst the distinctive tactics, TPM is simplest the great business techniques that effect at once on production performance and continuous improvement of firms. The primary goal of this look is to identify the vital fulfilment factors of TPM implementation practices so that it will reap organizational effectiveness and productiveness. The critical success factors for TPM implementation are derived on the premise of realistic factors obtained from this empirical look at. This study emphasizes on troubles encountered at some point of TPM implementation are mentioned. In this paper, the direct and indirect advantages of the TPM implementation manner for production industries also are discussed.

3. RESEARCH IN BARRIERS AND ENABLERS FOR IMPLEMENTATION OF TPM BASED ON SMES

3.1 Current research in Barriers for Implementation of TPM based on SMEs

Table 2: Identified Barriers to Implementation of TPM based on SMEs

Perspective Barriers	Code	Barriers Criteria	Reference
Managerial	B1	Lack of top management commitment	Ahuja and Khamba (2008a, 2007), Mishra et al. (2008), Brah and Chong (2004), Hansson et al. (2003) and Bamber et al. (1999), Venkatesh (2007), Ireland and Dale (2001), Cooke (2000), Maggard and Rhyne (1992)
	B2	Insufficient understanding of the methodology and philosophy by middle management	Mishra et al. (2008), Venkatesh (2007), Rodrigues and Hatakeyama (2006) and Bamber et al. (1999)
	B3	Too much focus on output measures rather than the quality of the process input	Ames (2003), Gardner (2003), Tan, Hoh et al. (2003), Thomas (2003)
Organization	B4	Not enough resources (man, material, money, time, etc.)	Ahuja and Khamba (2008a, 2007), Venkatesh (2007) and Bamber et al. (1999)
	B5	Lack of alignment of TPM objectives with shop floor staff tasks	Ahuja and Khamba (2008a, 2007), Rajesh Attri, Rajesh (2013)
	B6	High leadership turnover	Rodrigues and Hatakeyama (2006), Bamber et al. (1999)

Perspective Barriers	Code	Barriers Criteria	Reference
Cultural	B7	Lack of Continuous Improvement in Organization Culture	Rajesh Attri, Rajesh (2013)
	B8	Departmental barrier existing within business unit	Venkatesh (2007), Rodrigues and Hatakeyama (2006) and Bamber et al. (1999)
	B9	Resistance to work cultural change	Venkatesh (2007), Ireland and Dale (2001), Cooke (2000), Maggard and Rhyne (1992) and Bamber et al. (1999), Lawrence (1999), Ahuja and Khamba (2008a, b), Crawford et al. (1988), Becker (1993)
Employee	B10	Lack of commitment of employees	Ahuja and Khamba (2008b), Riis et al. (1997), Cooke (2000), Lawrence (1999)
	B11	Unwillingness to commit resources	P.S. Poduval and V.R. Pramod (2013), R. Sandeep and N. Panwar (2016)
	B12	Lack of teamwork across department	C.J. Bamber, J.M. Sharp, M.T. Hides (1999)
Financial	B13	Financial constraints	Ahuja and Khamba (2008a), Baglee (2008)
	B14	High manpower costs	Suzuki T. (1994)
	B15	Lack of a suitable reward mechanism	Bamber et al. (1999), Ahuja and Khamba (2008a, b)
Strategical	B16	Poor Planning and Strategy Developed	Ahuja and Khamba (2008a),
	B17	Quick TPM implementation and omitting some consolidated steps	Mishra et al. (2008), Rodrigues and Hatakeyama (2006) and Bamber et al. (1999)
	B18	Inadequate use of manpower and teamwork	A Kumar, RK Singh, TA Khan (2016)
Operational	B19	Lack of understanding and knowledge of TPM	Ahuja and Khamba (2008b), McAdam and Duffner (1996)
	B20	Underestimating the task	Elliott (2001)
	B21	Failure to allow enough time for the evolution	Bakerjan (1994), McCarthy (1997), Bamber et al. (1999)
Technical	B22	Lack of TPM monitoring tools during implementation	Ahuja (2009)
	B23	Absence of Computer Maintenance Management System (CMMS)	Ahuja and Khamba (2008)
	B24	Accessible performance measures and actionable reliability, quality, and production data	Aditya Parida (2015)
Equipment	B25	Lack of maintenance management process	R. Moore (1997)
	B26	Lack of time for autonomous maintenance	Rodrigues and Hatakeyama (2006), Thun (2006), Ahmed et al. (2005) and Bamber et al. (1999)
	B27	Lack of proper handling of equipment	Suzuki T. (2017)
Customer	B28	SMEs goals for higher profit, not for customers oriented	Reijonen, H. & Laukkanen T. (2010)
	B29	Attitude towards manufacturing / production process	Suzuki T. (1994)
	B30	Lack of customer relationship management in SMEs	Özgener, Şevki and Rifat İraz (2006)
Informational	B31	Lack of effective communication from top management	Ahuja and Khamba (2008b), Crawford et al. (1988), Becker (1993)
	B32	Lack of Co-Ordination between Different Departments	Rajiv Kumar Sharma, Dinesh Kumar, and Pradeep Kumar (2006)
	B33	Poor relation between production and maintenance department	Ahuja and Khamba (2008a, b)
Government	B34	Lack of governmental regulatory policies in SMEs	A. Pachouri and S. Sharma (2016)
	B35	Higher rate of banking capital credit	A. Jain, R. Bhatti, & H. Singh, (2014), A. Pachouri and S. Sharma (2016)
	B36	Inappropriate government's health and safety policies implement in SMEs	P. S. Poduval & V. R. Pramod (2015)

Perspective Barriers	Code	Barriers Criteria	Reference
Infrastructural	B37	Lack of skilled employees	Ahuja and Khamba (2008a, 2007)
	B38	Lack of TPM monitoring tools during implementation	Rajiv Kumar Sharma, Dinesh Kumar, and Pradeep Kumar (2006)
	B39	Lack of Human Resource Management	Kulkarni & B.M. Dabade (2013)
Educational	B40	Lack of experienced TPM coordinator	Ng, K. C., Goh, G. G. G., & Eze, U. C. (2012)
	B41	Lack of TPM implementation knowledge	Elliott (2001)
	B42	Lack of training and education	Ahuja and Khamba (2008a, 2007), Mishra et al. (2008), Ahmed et al. (1997, 2005) and Bamber et al. (1999), Bakerjan (1994), Chan et al. (2005), Co et al. (1998), Rodrigues and Hatakeyama (Ahuja and Khamba (2008b), Crawford et al. (1988), Becker (1993) Suzuki T. (1994)
Physiological	B43	Lack of long-term commitment of management and employees to see result after TPM	Suzuki T. (2017)
	B44	Considering TPM activities as additional work/threat	Ahuja and Khamba (2008a, 2007), Rodrigues and Hatakeyama (2006) and Bamber et al. (1999)
	B45	Lack of management consensus	A. T Bon, L. P. Ping, B. M. Salleh, & A. Selamat, (2011)

3.2 Current research in Enablers for Implementation of TPM based on SMES

Table 3: Identified Enablers to Implementation of TPM based on SMEs

Perspective Enablers	Code	Enablers criteria	Reference
Managerial	E1	Top Management Commitment to involve all department and employees in TPM activates	Ahuja and Khamba (2008a, 2007), Mishra et al. (2008), Brah and Chong (2004), Hansson et al. (2003) and Bamber et al. (1999), Venkatesh (2007), Ireland and Dale (2001), Cooke (2000), Maggard and Rhyne (1992)
	E2	Participation in TPM Workshops and Training Programs	Ahuja and Khamba (2008a, 2007), Mishra et al. (2008), Ahmed et al. (1997, 2005) and Bamber et al. (1999). Bakerjan (1994), Chan et al. (2005), Co et al. (1998), Rodrigues and Hatakeyama (Ahuja and Khamba (2008b), Crawford et al. (1988), Becker (1993) Suzuki T. (1994)
	E3	Promoting quality management & planned maintenance Practices in organization	Ahuja and Khamba (2008a),
Organization	E4	Create enough resources forecasting on the bases on 9M's (man, machine, material, money, management, method, market, motivation, MIS)	P.S. Poduval and V.R. Pramod (2013), R. Sandeep and N. Panwar (2016)
	E5	Implementation of 5's on shop floor	Rajesh Attri, Rajesh (2013), Ahuja and Khamba (2007)
	E6	Effective implementation of TPM 8 pillars in organization	Ahuja and Khamba (2007, 2008), Rajesh Attri, Rajesh (2013)

Perspective Enablers	Code	Enablers criteria	Reference
Cultural	E7	Cultural paradigm shift to eliminate non-value adding (NVA) 3M's waste (3M's Waste-muri, mura, muda)	Ahuja and Khamba (2008)
	E8	Focus on TPM objectives (3 Z's- zero defect, zero breakdown, zero accident)	S., H. Ahmed, M. Hassan, & Z. Taha (2005), Ahuja and Khamba (2008)
	E9	Ready to accept work cultural change	Venkatesh (2007), Ireland and Dale (2001), Cooke (2000), Maggard and Rhyne (1992) and Bamber et al. (1999) Lawrence (1999), Ahuja and Khamba (2008a, b), Crawford et al. (1988), Becker (1993)
Employee	E10	Positive commitment of employees for TPM	P.S. Poduval and V.R. Pramod (2013), R. Sandeep and N. Panwar (2016)
	E11	Willingness to commit resources of 9M's	P.S. Poduval and V.R. Pramod (2013), R. Sandeep and N. Panwar (2016), Ahuja and Khamba (2008b)
	E12	Teamwork in cross function department	C. J. Bamber, P. Castka, J. M. Sharp, & Y. Motara, (2003)
Financial	E13	Optimizing Essential Resources for Investment for SMEs & TPM	A. Jain, R. Bhatti, & H. Singh, (2014)
	E14	Financial Assistance by Banks for Industrial Development of SMEs	A. K. Sharma, & A. B. Shudhanshu (2012)
	E15	Effective rewards mechanism, wages and incentive plans for SMEs & TPM	Ahuja and Khamba (2008)
Strategical	E16	SMEs based adopting TPM program and initiate strategic proactive initiatives toward implementation of TPM practices	Ahuja and Khamba (2008), C.J. Bamber, J.M. Sharp, M.T. Hides (1999)
	E17	In SMEs Calculating OEE before TPM implementation and then OEE improvement strategies	A. Jain, R. Bhatti, & H. Singh, (2014, 2015)
	E18	Prepare SMEs based master plan for TPM implementation	Rajiv Kumar Sharma, Dinesh Kumar, and Pradeep Kumar (2006)
Operational	E19	Focus for effective implementation of 5S and TPM Pillars on shop floor	A. K. Sharma & A. B. Shudhanshu (2012), C. J. Bamber, J. M. Sharp, & M. T. Hides (1999), A. K. Gupta & R. K. Garg (2012)
	E20	Calculating OEE regularly bases for before and after implementation of TPM; focusing on accomplishment of world class OEE	S. Gupta, P.C. Tewari, & A.K. Sharma (2006), A. Jain, R. Bhatti, & H. Singh, (2014)
	E21	Establishing the culture of Continuous Improvement (Kaizen)	Ahuja and Khamba (2008), Rajesh Attri, Rajesh (2013)
Technical	E22	Effective Implementing TPM monitoring tools during implementation	Ahuja (2009)
	E23	In SMEs Effective Computer Maintenance Management System (CMMS) based TPM	Ahuja and Khamba (2008)
	E24	Use effectively Internet of Things (IOT) and Information and Communication Technology (ICT) tools in SMEs for TPM	R. K. Singh, S.K. Garg, & S. G. Deshmukh, (2008)

Perspective Enablers	Code	Enablers criteria	Reference
Equipment	E25	Optimized maintenance management process	M. Pophaley, & R. K. Vyas (2010)
	E26	Focus on autonomous maintenance	Ahuja and Khamba (2008), C.J. Bamber, J.M. Sharp, M.T. Hides (1999)
	E27	Equipment Repair and planned maintenance before breakdown and downtime	Ahuja and Khamba (2008)
Customer	E28	Focusing on the Customer Need Assessment	M. Kaur, M. K. Singh, & I. S. Ahuja (2013)
	E29	Efficient Customer Feedback System and Information Support System in SMEs	R. K. Singh, S.K. Garg (2008)
	E30	Customer Demand Based Business strategy in SMEs	Ahuja and Khamba (2008)
Informational	E31	Effective communication from top management	C.J. Bamber, J.M. Sharp, M.T. Hides (1999), Rajesh Attri, Rajesh (2013)
	E32	Effective Coordination information flow between Different Departments	Ahuja and Khamba (2008), Suzuki T. (2017)
	E33	Real-time monitoring information exchange between production and maintenance department	A.C. Marquez , & J. N. Gupta (2006)
Government	E34	Government policies of financial subsidies and tax waiver schemes for SMEs development	S. Abdullah (2008)
	E35	Effective governmental regulatory policies in SMEs	F. Sulong, M. Sulaiman, & A. M. Norhayati (2015)
	E36	Government promoting for adopting Quality and maintenance management programmes (i.e. CII-TPM Club of India, JIPM etc.)	Ahuja and Khamba (2008)
Infrastructural	E37	Individual TPM pillars bases department formed in SMEs	R. Attri, S. Grover, N. Dev, & D. Kumar. (2013)
	E38	TPM Monitoring equipment infrastructure installed in SMEs	A. K. Sharma & A. B. Shudhanshu (2012),
	E39	Skilled employees for implementation of TPM	S. Ahmed, M. Hj. Hassan, Z. Taha (2005), Ahuja and Khamba (2008)
Educational	E40	Experienced TPM coordinator in SMEs	Ahuja and Khamba (2008)
	E41	Taking TPM implementation knowledge by workshop, conferences, TPM experts	S. Gupta,P.C. Tewari, & A.K. Sharma (2006), C.J. Bamber, J.M. Sharp, M.T. Hides (1999)
	E42	Play vital role Education & Training (E & T) pillar department for TPM in SMEs	A. Jain, R. Bhatti, & H. Singh, (2014)
Phycological	E43	Long-term commitment of management and employees to see result after TPM	Suzuki T. (2017)
	E44	TPM psychologically adopting in daily routine activity of work	Baldissarri, C. R. I. S. T. I. N. A., Andrighetto, L. U. C. A., & Volpato, C. H. I. A. R. A. (2014), Suzuki T. (2017)
	E45	Create consensuses and paradigm shift from old attitude to TPM attitude (i.e. TPM Attitude - "We are all responsible for our equipment, our plant and our future")	H.A. Tsang, & P.K. Chan, (2000), Suzuki T. (2017)

4. CONCLUSIONS

Now a day, in a competitive globalization the large enterprises are focusing on his core competencies activities products-services and outsourcing common products-services to small medium enterprises. This attribute due to the reason that small medium enterprises have become the backbone of the large enterprises due to increase in the outsourcing activities. Hence, it is the right time for SMEs to implement the competitive strategies. In the first part of the research the model for identifying the key barriers and enablers group and subgroups perspective factors for effective implementation of Total Productive Maintenance in small and medium enterprises were methodology developed. Based on the success factor model; factor analysis has been performed in the second part of research.

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