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The Integrated Between Total Production Maintenance Practices And Kaizen Event Practices In Malaysian Automotive Industry

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ABSTRACT

Successful modern manufacturing industry requires support by efficiently and effectively maintenance. One of effective maintenance approach is the Total Productive Maintenance (TPM) practice. TPM practice is also able to support to other practices such as Kaizen Event (KE) practice. The purpose of this paper is to examine the relationship of TPM practices and KE practices in Malaysian automotive industry. A conceptual model using Structural Equation Modeling (SEM) has been proposed. This model will be used to study the relationship between TPM practices and KE practices for Malaysian automotive industry. Based on the proposed conceptual model and reviewed, research hypotheses are being developed. The paper culminates with suggested future research work.

Keywords – Total Productive Maintenance, Kaizen Event, Automotive Industry, SEM

I. INTRODUCTION

Development of the automotive industry in Malaysia began more than 27 years ago with the establishment of PROTON followed by PERODUA. Automotive sector at Malaysia began with the importation of vehicles progressed to which the assembly operations and the development of the automotive component industry. Positive development in this industry is greatly influenced by Japanese automotive companies in many ways like management, engineering, technology, maintenance equipment and others. Automotive industry is the most industry highly involves quality effort, low production cost, efficiency equipment, continuous improvement activities, development supply chains, and adoptability advanced.

Even so, after a while efficiency in the using of equipment becomes to worsen because the cost to buying new equipment is increasing. Then, industry must choose to use the equipment at maximum levels and do maintenance on the equipment. However the cost to make maintenance is very crucial and costly to manufacturers. Many organizations began to think That there should be a practice or a tool to ensure the maintenance to be more efficient and effective.

Hence, the implementation TPM practice in the manufacturing industry is an important practice to be able to increase production and reduce inefficient equipment [1].

TPM focuses on maximizing Overall Equipment Efficiency (OEE) with the all employee involvement in the organization. It not only involves the maintenance practice, but it can also increase maintenance skills and employees knowledge as a whole [2]. Today, the competitions between organizations are increasing and organizations are working to achieve World Class Manufacturing (WCM) to maintain the quality of their production. TPM is seen as a complement to other WCM practices such as Total Quality Management (TQM), Just-In-Time manufacturing (JIT), Total Employee Involvement (TEI) and Continuous Performance Improvement (CPI) [60-63]. Therefore, organizations need to use some efficient maintenance and effective manufacturing practices such as TPM and KE. KE is also derived from the Japan practices involving continuous improvement in the organization. Effect of TPM execution will have an impact on organizational performance in general [3,4]. TPM is also effect on continuous improvement activities indirectly.

Therefore, in this study will examine the relationship between the TPM practices and KE practices in the automotive industry. In addition, this study was to see how execution of TPM in the automotive industry in Malaysia.

II. LITERATURE REVIEW

2.1 Total Productive Maintenance

The maintenance concept is important in the manufacturing environment and it provides support for productivity. Maintenance activities are important to increase level of readiness for face any eventualities, keep product quality and safety. It also will directly affect the cost of maintenance [5,6]. Therefore, the Japanese was introduced the concept of TPM began in 1971. TPM is a system that involves the systematic maintenance of all employees in reducing costs and improving economic efficiency [7]. TPM is includes all equipment in every division including planning, manufacturing and maintenance. It is fundamental

for the comprehensive maintenance, improvement, and participation of all parties through small groups' activities [8].

Seiichi [7] is the father of TPM has defined TPM as an innovative approach for maintenance system to eliminates breakdown and encourage the maintenance by employee through day-to-day activities [8-10]. Hence, according [11] TPM also affects activities competition to improve the company's structure as equipment improvement activities and increase the knowledge employee. In addition, the TPM describes the relationship between production and maintenance for continuous improvement of product quality, operational efficiency and security. Definition of TPM according [7] and [67]:

1. TPM fully utilize efficient equipment (i.e. OEE).
2. TPM includes maintenance prevention, preventive maintenance, improvement and maintenance related.
3. TPM involve all employees in the organization, such as equipment designers, equipment operators, and maintenance department workers.

But TPM is not just focused on purely maintenance concept, but it is also related to culture, philosophy and a new attitude towards maintenance [12]. TPM is a comprehensive policy for the organization to improve organizational performance. [13,14]. This also support by [15] studied that TPM can change the cultural of organization. TPM suggest a variety way to promote this cultural change with top management support and training and changes in reward systems. The three major concept of TPM is maximizing equipment effectiveness, autonomous maintenance by operators, and small group activities [7].

Table 1.0: A constructs proposed by other authors

Constructs	Related Constructs
Autonomous maintenance	Fostering operating skills, fostering operating ownership, perform daily maintenance on production equipment [16], detect and treat abnormal operating conditions and inspect and monitor the performance [17], keeping plant neat and clean, variety skill and task by employee, Problem solving teams have helped improve manufacturing processes [18].
Planned maintenance	Preventive maintenance, breakdown maintenance, corrective maintenance, maintenance prevention [8].
Quality maintenance	Achieving zero defects, tracking and addressing equipment problem, setting machine, man and material (3M) condition [8].
Education and training	Tools of concerned improvement strategy, improvement are made in the training system [19], imparting technological, quality control, interpersonal skills, multi-skilling of employees, periodic skill evaluation and updating [16].

Meanwhile, according to [20], TPM helps to maintain the asset and the latest equipment at the productive highest levels through the cooperation of all employees in the organization. It also helps to increase the motivation of the workers in carrying out their daily tasks and through adequate empowerment, training and felicitations, thereby enhancing the employee participation toward realization of organizational goals and objectives [8].

2.2 Kaizen Event (KE)

Kaizen is a Japanese word that has become common in many western companies. The word indicates a process of continuous improvement of the standard way of work [21]. It is a compound word involving two concepts: Kai (change) and Zen (for the better) [22]. The term comes from KE meaning 'Continuous Improvement' (CI). KE is one of the core strategies for excellence in production, and is considered vital in today's competitive environment [23]. KE focused on a structured improvement project, using the approach of "cross-functional team" to improve the target work area, with specific targets [24]. It calls for endless effort for improvement involving everyone in the organization [25].

Basically, the KE has been introduced and used by Imai in 1986 in Japan that aims to increase efficiency, productivity and competitiveness in the Toyota Company. Toyota is a car manufacturing company in Japan, which seeks to maintain the company's performance in the market. Since then, KE is one of the Japanese manufacturing systems and give a big impact in the success of the manufacturing industry [26]. In addition [27], KE also is an improvement process that involves all employees from subordinates to superiors and must be work together. Broadly defined, Kaizen is a strategy to include concepts, systems and tools within the bigger picture of leadership involving and people culture, all driven by the customer. There are many definitions related to the KE by previous authors. Therefore, below is a list of definitions of KE.

Table 2.0: Definition of KE

Definition
KE is more than just a way of improvement, but it is also the representative the employees' daily tasks who strive to improve product quality and can be applied to any area in need of improvement [28].
KE is to generate process-oriented thinking to focus any improvements in every decision [29].
KE be construed as a comprehensive process to the innovation process and sustainable improvement [30].
KE explains that the way to achieve fundamental improvement from the bottom is to enable employees to establish their own measures, to align business strategies and to use them to drive their KE activities [31].
Kaizen philosophy in the business management context is to give space to the management and employees to improve their creativity[32].
KE as a lean thinking that emphasizes to sistematic organization system and reduce wastage [33].
KE is the enhancement techniques that reduce the cost of production [34].
KE have an impact on work culture, processes and experience [24].
KE seen as one of lean tools that help to ensure that operations become more smoothly and efficient by removing wasteful activities that are of no value from a customer perspective [37].

Each practice that is created will have its own elements in its implementation. In this study, KE element is divided into just 3 parts to suit the automotive industry environment is the follow-up activities, working area impact and employee skill and effort. These elements are very important to the KE practice because it will affect the entire employee of the organization and these elements affect lower operating costs.

Table 3.0: Previous studies about KE's elements

Author	Follow up activities	Working area impact	Employee skill and effort
Anh et al. [17]	*		*
Doolen et al. [35]	*	*	*
Farris et al. [24]	*	*	*
Venkataiah and Sagi [37]		*	*
Van Aken et al. [39]	*		*
Recht, and Wilderom [40]		*	*
Glover et al. [41]	*	*	
Lyu [42]	*		*
Marksberry et al. [43]		*	*
Melnyk et al. [44]	*		*
Bateman and Rich [45]		*	
Patil [46]	*		*

Follow-up Activities

Follow-up activity is the action that reflects the KE. It involves the work area employees to complete the action. Follow-up activities also give freedom to the employees to make any changes and innovation. But all the changes and innovations made by employees will be related to KE goals [41].

Working Area Impact

KE activities affect the work area. Generally KE activities can help employees who are improving their work area [35]. Moreover, [24] states that the KE is a complex phenomenon organizational and has the potential to affect both systems, the technical system (work are performance) and social systems (participation employees and of work areas employees). Impact learning and stewardship when employees feel a shared of responsibility, freely share information, understand how their work fits into the experience and impacts experimentation when employee test new ideas to help themselves learn.

Employee Skill and Effort

Employee Performance fundamentally depends on many factors like performance appraisals, employee motivation, employee satisfaction, compensation, training and development, job security, organizational structure and other. KE can improve the employee knowledge in managing an organization with more systematic and successful [47, 48]. It also can be one of the platforms for knowledge employees in principles, tools and techniques for continuous improvement [49].

There are some practices that can support increased the KE practices. As in the study conducted by [50] describe that the simulation is a good tool to support the increase in KE practices. This study was carried out in two sectors, namely commercial and aerospace manufacturers who use simulation as a support to increase the KE practices. In summary, according to this study the simulation process can be used to support the KE practice, the simulation model can also be developed to help launch other practices, and interpreting the results with management can be beneficial. In addition, [51] describes the critical success factors of KE practices in Morris KE Electronics Limited, an Indo-Japanese joint venture firm is that the implimentation contributed concept to dramatic improvement in the productivity and sustained competitiveness.

2.3 Positive relationship between TPM and KE

TPM stands a close relationship between Maintenance and Productivity, showing how good

care and up-keep of equipment will result in higher productivity. It is a philosophy of kaizen event that creates a sense of ownership in the operators of each machine as well as in their supervisor [52]. It is a process of maintenance management that empowers the organization with a progressive, continuous philosophy of enabling all manpower resources to work together to accomplish the mutual goal of manufacturing efficiency. Hence, according [53] TPM is a systematic way to provide undisturbed processes by using every workers involvement in decreasing costs and increasing total economic effectiveness, through with following up process disturbances, improvement groups and independent maintenance by operators. Therefore, the TPM is seen indirectly connected kaizen event performance in any industries, especially in manufacturing industries.

Furthermore, Kaizen event involving employees at every level and it is based on the Total Quality Control (TQC) philosophy. The main thrust TQC is to increase the quality of management as a whole. While for TPM is the directly on the improvement of equipment. Therefore, the kaizen event practice can reduce breakdowns the equipment, reduce damage costs and enhance management efficiency [53-55]. Indirectly, TPM practices have effect on the KE practices. [55] Adds, TPM is the improvement practice that can be used alone and also together with the other improvement practices to enhance organizational performance.

Hence, the implementation of TPM practices is very important to improve the KE practices. This is because, according to [53] there are two distinct features in the philosophy of KE prolonged efforts and urgency for the improvement and changes gradually to make the equipment better. This feature is very important for the KE implementation. The next feature is the emphasis on process rather than on output. Meanwhile, [70] agree that KE in the manufacturing sector is driven by the efficiency of organizational practices that have been practiced for many years. It is important to know the basis of successful organizations, started from the manufacturing efficiency on par with other competitors in the market.

Beside that [57] suggests TPM is the practice improvement process in relation to many elements of a good maintenance programme to achieve high efficiency equipment including:

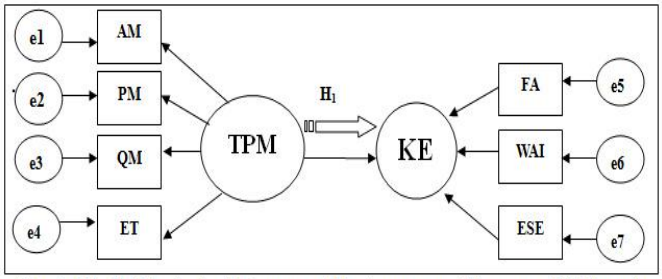
1) Improving equipment effectiveness by targeting the major losses;
2) Involving operators in daily, routine maintenance of the equipment;
3) Improving maintenance efficiency and effectiveness;
4) Training for everyone involved; and
5) Life-cycle equipment management and maintenance prevention design.

TPM based on the characteristics mentioned by [57] above, there are similarities with the KE practice as described by [58] and [11] KE practice try to eliminate 16 major loss, among them are failure losses breakdown loss, setup / adjustment losses, cutting blade loss, start up loss, minor stoppage / Idling loss, speed loss operating at low speeds, defect / rework loss and scheduled downtime loss.

Futhermore, [59] describe that OEE in TPM practices and set up reduction are actually used to drive KE practices in the development of a company. No appropriate measures of the process and equipment usage are available. Initially, six pilot areas have been identified, out of these three turned out to be successful. Setup reduction has been applied to reduce change over times, to meet the customer demand for greater product mix and to overcome the difficulties in machine loading. Both techniques are described in terms of how they help the company to drive improvement.

III. RESEARCH HYPOTHESES

To more understand the relationship between TPM practices and KE practices in Malaysia automotive industry, the following hypotheses will be used and tested. TPM practices give many affect on an organization's management as management efficiency, equipment efficiency, reduced maintenance costs and others. Thus, these hypotheses have been developed based on the proposed conceptual model and previous studies.



*Note: TPM=Total Productive Maintenance, AM= Autonomous Maintenance, PM=Planned Maintenance, QM=Quality Maintenance, ET=Education and Training, KE=Kaizen Event, FA=Follow-up Activities, WAI=Working Area Impact, ESE=Employee Skill and Effort,

Fig.1 A proposed research model

Autonomous maintenance

Autonomous maintenance process is very important to the organization because it will affect the culture and organizational efficiency [64]. There

are seven steps in the autonomous maintenance, initial cleaning, countermeasures for the causes and effects of dirt and dust, cleaning and lubricating standards, general inspection, autonomous inspection, organisation and tidiness, and full implementation of autonomous maintenance. This step will create a culture of the company in the daily maintenance activities. Based on autonomous activity, it can be attributed to the KE practices characteristics in terms of follow-up activities to emphasize the continuous concept in improve the maintenance and improvements quality. In addition, autonomous maintenance involves also the self management and control [65]. With the implementation of autonomous maintenance, the gradual change from breakdown maintenance, to planned, preventative and predictive maintenance was achieved, with consequential changes to the organisation, and operation of the maintenance function.

Planned maintenance

Planned maintenance is a proactive method that uses trained employee to assist the operator to ensure that the equipment in good condition [53, 66]. If planned maintenance carried out with continuously, it will improve the efficiency of the maintenance department [67]. The features in this planned maintenance, can improve in terms of employee skill and effort, where they will must to ensure that all equipment is at the satisfactory level. If the equipment should be repaired then the employee will use all their skills to maintain the equipment. It is indirectly meet the criteria in the KE practices. Each practice in KE is emphasize to employee performance is depend on many factors like performance appraisals, employee motivation, employee satisfaction, compensation, training and development, job security, organizational structure and others.

Meanwhile, planned maintenance usually involves employee and skilled technicians to handle maintenance. It requires specialized knowledge to maintain any equipment [18]. Proactive and efficient maintenance start from a disciplined plan to determine which areas should be reinstated. Employees or technicians will complete the planned maintenance schedule [7, 18, 68]. It also affects the KE practices that emphasize a systematic and continuous practice.

Quality maintenance

QM activities including prescribing the conditions to prevent damage, to maintain product quality with properly, check the equipment in accordance with standards established [8, 52, 53]. Then, according [55] QM aims to fulfil customer demand through high quality equipment production, it also ensures that the equipment used to meet set standards and maintenance carried out to improve the quality of equipment and maintain its perfection. In Addition, [52] also state that TPM implementation lead to higher efficiency equipment and increase productivity. [18] Also states that the effective implementation of TPM can enhance employee motivation and employee satisfaction. Besides, it can improve the performance of the organization to survive in the market.

Education and Training

This element aims to foster the workers to have different skills and motivated workforce to perform assigned duties [53, 69]. It can increase the value and quality of workers in doing their duties in the maintenance process. Therefore it affects the KE practice of emphasizing quality working environment using the cross functional team to improve and the target work area, with specific targets [24]. Positive impact on the work area will ensure the organization performance will improved.

Based on previous studies, therefore, a hypothesis has been issued:

H_1: There is a positive and direct significant relationship between TPM implementation and KE in Malaysian automotive industry.

IV. METHODOLOGY

In this study, sampling method by using structured questionnaire. The population of this study comprised in Malaysian automotive industry. Questionnaires will distribute to respondents from the listing of automotive industry obtained from Malaysian Automotive Component Parts Association (MACPMA), Proton Vendors Association (PVA), and Kelab Vendor Perodua. To analyze the data, one statistical technique was adopted. Structural equation modelling techniques was utilize to perform the require statistical analysis of the data from the survey. Exploratory factor analysis, reliability analysis and confirmatory factor analysis to test for construct validity, reliability, and measurements loading were performed. Having analyzed the measurement model, the structural model was then tested and confirmed. The statistical Package for the Social Sciences (SPSS) version 17 was used to analyze the preliminary data and provide descriptive analyses about thesis sample such as means, standard deviations, and frequencies. Structural Equation Modelling (SEM using AMOS 6.0) will use to test the measurement model.

This study is expected to arrive at the following conclusion: This study has important implication for TPM practice and KE practice in Malaysian automotive industry. As such, it is expected to benefit both researchers and practitioners.

V. CONCLUSION

Many previous studies indicate that the TPM is a practice that affects the organizational performance, but less research on TPM practices

indicate that TPM also had an impact on other practices such as KE practices in Malaysian automotive industry. Therefore, this study has been conducted based on the proposed conceptual model. It aims to identify the relationship between TPM practices and KE practices, especially in the Malaysian automotive industries. Based on the conceptual model and previous studies also, the hypothesis has been constructed. The next step is to design a quality questionnaire to ensure that research objectives are achieved. This questionnaire will be used on the future for pilot study data collection in the Malaysian automotive industry.

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REFERENCES

[1] C.F. Gomes, M.M. Yasin and J.V. Lisboa, Performance measurement practices in manufacturing firms: an empirical investigation, *Journal of Manufacturing Technology Management*, 17 (2), 2006, 144-67.

[2] P. Kumar, A. Wadood, I.P.S. Ahuja, T.P. Singh and M. Sushil, Total productive maintenance implementation in Indian manufacturing industry for sustained competitiveness, *34th International Conference on 'Computers and Industrial Engineering',* San Francisco, CA, November 14-16, 2004, 602-7.

[3] J. Dwyer, More than a maintenance technique, *Works Management*, 52(9), 1999, 15-16.

[4] T. Dossenbach, Implementing total productive maintenance, *Wood and Wood Products*, Vol. 111 No. 2, 2006, pp. 29-32.

[5] B. Al-Najjar, and I. Alsyouf, Selecting the Most Efficient Maintenance Approach using Fuzzy Multiple Criteria Decision Making, International *Journal of Production Economics*, 83(3), 2003, 81-96.

[6] I. Alsyouf, Measuring Maintenance Performance using a Balanced Scorecard approach, *Journal of Quality in Maintenance Engineering*, Vol. 12 No 2, 2006, pp133-149.

[7] S. Nakajima, *TPM Development Program: Implementing Total Productive Maintenance* (Productivity Press, Portland, OR, 1989).

[8] I.P.S. Ahuja and J.S. Khamba, An evaluation of TPM initiatives in Indian industry for enhanced manufacturing performance, *International Journal of Quality & Reliability Management*, 25(2), 2008a, 147-72.

[9] T. Conway, and E. Perry, Incorporating statistical process control into the team-based TPM environment, *Semiconductor Manufacturing Conference Proceedings, 1999 IEEE International Symposium, Santa Clare*, CA, 11-13 October, 1999, 281-4.

[10] B. Bhadury, Management of productivity through TPM, *Productivity*, 41(2), 2000, 240-51.

[11] L. Pintelon, S.K. Pinjala, and A. Vereecke, Evaluating the effectiveness of maintenance strategies, *Journal of Quality in Maintenance Engineering*, 12(1), 2006, 7-20.

[12] J.W. Patterson, W.J. Kennedy, and L.D. Fredendall, Total productive maintenance is not for this company, *Production and Inventory Management Journal*, 36(2), 1995, 61-4.

[13] R. Davis, and P. Willmott, *Total Productive Maintenance* (Alden Press, Oxford. 1999).

[14] F.K. Wang, Evaluating the efficiency of implementing total productive maintenance, *Total Quality Management & Business Excellence*, 17(5), 2006, 655-67.

[15] J.L. Lawrence, Use mathematical modeling to give your TPM implementation effort an extra boost, *Journal of Quality in Maintenance Engineering*, 5(1),1999, 62-9.

[16] I.P.S. Ahuja, andJ.S. Khamba, Strategies and success factors for overcoming challenges in TPM implementation in Indian manufacturing industry, *Journal of Quality in Maintenance Engineering*, 14(2), 2008b.

[17] P. C. Anh,, Z. Jing, and Y. Matsui, Empirical study on transferability of Kaizen practices. The 11th International DSI and the 16th APDSI Joint Meeting, Taipei, Taiwan, July 12-16, 2011.

[18] K.E. McKone, G.S. Roger, and K.O. Cua, Total productive maintenance: a contextual view, *Journal of Operations Management*, 17,1999, 123-44.

[19] D. Seth, and D. Tripathi, Relationship between TQM and TPM implementation factors and business performance of manufacturing industry in Indian context, *International Journal of Quality & Reliability Management*, 22, 2005, 256-77.

[20] D.H. Besterfield, C. Besterfield-Michna, G.H. Besterfield, and M. Besterfield-Sacre, (1999*), Total Quality Management, 2nd ed.* (Prentice-Hall International, Englewood Cliffs, NJ, 1999).

[21] J. C. Chen, J. Dugger, and B. Hammer, A Kaizen Based Approach for Cellular

Manufacturing Design: A Case Study, *The Journal of Technology Studies*, 27(2), 2000, 19-27.

[22] V. S. Palmer, Inventory Management Kaizen, *Proceedings of 2nd International Workshop on Engineering Management for Applied Technology*, Austin, USA, 2001, 55-56.

[23] M. Dean, and A. Robinson, America's Most Successful Export to Japan: Continuous Improvement Programs, *Sloan Management Review*, 3, 1991, 67.

[24] J. Farris, E. Van Aken, T. Doolen, and J. Worley, Learning from less successful Kaizen events: a case study. *Engineering Management Journal*, 20 (3), 2008, 10-20.

[25] S. A. Malik, L. Li-bin, T. YeZhuang, and S. Xiao-Lin (2007), Continuous Improvement Practices in Asian Developing Countries: A Comparative Analysis Between Chinese and Pakistani Manufacturing Industry, *14th International Conference on Management Science and Engineering*, Harbin, PR China , 2007,692-697.

[26] Ashmore C (2001), "Kaizen and the Art of Motorcycle Manufacture", *Manufacturing Engineer*, Vol. 80, No. 5, pp. 220-222.

[27] M. Imai, *Kaizen: The key to Japan's Competitive Success.* (Print location: McGraw-Hill, 1986).

[28] K. Teian, *Guiding Continuous Improvement Through Employee Suggestions* (Productivity Press, Portland, US, 1992).

[29] D.P. Hammer, H.L. Mason, R.K. Chalmers, N. G. Popovich, and M.T. Rupp, Development and testing of an instrument to assess behavioral professionalism of pharmacy students, *Journal of Pharmaceutical Education*, 64, 1996, 141–151.

[30] J. Bassant and S. Caffyn, Rediscovering Continuous Improvement, *Technovation*, 14(1), 1994, 17-29.

[31] R.C. Deniels, Performance measurement at sharp and driving continuous improvement on the shop floor, *Engineering Management Journal*, 5(5), 1995, 211-214.

[32] D.J.H Newitt, Beyond BPR and TQM—Managing the Processes: Is Kaizen Enough?, *Proceedings of Industrial Engineering, Institution of Electric Engineers*, London, UK, 1996, 1-5.

[33] J.P. Womack, and D.T. Jones (1996), *Lean Thinking* (Simon & Schuster, New York, 1996).

[34] M. Williams, Maximum Cost Reduction Minimum Effort, *Manufacturing Engineer*, 80 (4) 2001, 179-182.

[35] T. Doolen, E. Van Aken, J. Farris, J. Worley, and J. Huwe, Kaizen events and organizational performance: a field study. *International Journal of Productivity & Performance Management*, 57 (8), 2008, 637-58.

[36] J. A. Farris, *An empirical investigation of Kaizen event effectiveness outcomes and critical success factors*," Ph.D. dissertation, Virginia Polytechnic Institute and State University, 2006.

[37] C. Ventakaiah, and S. Sagi, Realtionship between Kaizen event and percived quality performance in Indian automobile industry, *International Journal of Management and Business Studies*, 2(1), 2012, 25-28.

[38] J. Farris, E. Van Aken, T. Doolen, and J. Worley, Critical success factors for human resource outcomes in Kaizen events: an empirical study. *International Journal of Production Economics*, 117 (1), 2009, 42-65.

[39] R.W.E. Van, and D. Lynn, Total productive maintenance in a South African pulp and paper company: a case study. *The TQM Magizine*, 14 (6), 2002, 359-366.

[40] R. Recht, and C. Wilderom, Kaizen and culture: on the transferability of Japanese suggestion systems. *International Business Review*, 7(1), 1998, 7-22.

[41] W.J. Glover, E. M. Van Aken, J. A. Farris, T.L. Doolen, and J. M. Worley, Kaizen Event Follow-Up Mechanisms and Goal Sustainability: Preliminary Results, *Proceedings of the 2008 Industrial Engineering and Research Conference*, Vancouver, BC, Canada, May 17-21, 2008.

[42] J.J. Lyu, Applying Kaizen and automation to process reenginering. *Jurnal of Manufacturing System*, 15(2), 1996.

[43] P. Marksberry,F. Badurdeen, B. Gregory, and K. Kreafle, Management directed kaizen: Toyota's Jishuken process for management development. *Journal of Manufacturing Technology*, 21 (6), 2010, 670-686.

[44] S. A. Melnyk, R. J. Calantone, F. L. Montabon, and R. T. Smith, Short-term Action in Pursuit of Long-Term Improvements: Introducing Kaizen Events. *Production and Inventory Management Journal*, 39 (4), 1998, 69-76.

[45] N. Bateman, and N. Rich, Companies' perceptions of inhibitors and enablers for process improvement activities, *International Journal of Operations & Production Management*. 2003.

[46] H. Patil, *A Standard Framework for Sustaining Kaizen Events*, Unpublished

Master's Thesis, Department of Industrial and Manufacturing Engineering, Wichita: KS, 2003.

[47] C. Butterworth, From value stream mapping to shop floor improvement: A case study of kaikaku.. *Manufacturing Operations and Supply Chain Management*: The LEAN Approach, Taylor, D, and Brunt, D., eds., London, UK: Thomson Learning, 2001, 185-193.

[48] C. Tanner, and R. Roncarti, Kaizen Leads to Breakthroughs in Responsiveness – and the Shingo Prize – at Critikon, *National Productivity Review*, 13 (4), 1994, 517-531.

[49] M. Watson, *The Deming Management Method* (Perigee Books, 1986).

[50] M. Adams, P. Componation, H. Czarnecki, and B. J. Schroer, Simulation as a Tool for Continuous Process Improvement, *Proceedings of Winter Simulation Conference*, Phoenix, USA, 1, 1999, 766-773.

[51] S. Chaudhari, Kaizen at Morris Electronics: Key to Competitive Success", *Portland International Conference on Management and Technology*, Portland, USA, 1997, 365.

[52] P.P. Gupta, M. W. Dirsmith, and T. J. Fogarty, Coordination and Control in a Government Agency: Contingency and Institutional Theory Perspectives on GAO Audits, *Administrative Science Quarterly*, 39, 1994, 264-284.

[53] C. Olivier, *A proposed strategy for the implementation of total productive maintenance at continental tyre South Africa*, Degree Thesis, South Africa, 2007.

[54] J. Venkatesh, *An Introduction to Total Productive Maintenance. Plant Maintenance Resource Center*. Print location: Plant Maintenance Resource Center. 1996 -2005.

[55] H. Yamashina, Japanese manufacturing strategy and the role of total productive maintenance, *Journal of Quality in Maintenance Engineering*, 1(1), 1995, 27-38.

[56] H. H. Samuel, P.D. John, J. Shi, and S. Qi, (2002), Manufacturing system modeling for productivity improvement, *Journal of Manufacturing Systems*, 21(4), 2002, 249-60.

[57] A. Williamson, Target and Kaizen Costing, *Manufacturing Engineer*, 76(1), 1997,22-24.

[58] R. W. E. Van, and D. Lynn, Total productive maintenance in a South African pulp and paper company: a case study, *The TQM Magizine*, 14(6), 2002, 359-366.

[59] A. Burns, Choosing the Right Tool from the Tool Box: Some Examples of Gemba Kaizen Practice", *IEE Seminar, Kaizen: From Understanding to Action*, London, UK. (Ref. No. 2000/035), 6, 2000, 1- 10.

[60] B. N. Maggard, C. L. Bailey, and D. Moss, Total productive maintenance: TPM that works, *Electronic Manufacturing Technology Symposium, Proceedings of the 7th IEEE/CHMT International*, 25-27 September, 1989,13-17.

[61] L. Schonberger, (1996), World Class Manufacturing: The Next Decade: Building Power, Strength and Value, *The Free Press*, New York, NY, 1996.

[62] A. Ollila, and M. Malmipuro, Maintenance has a role in quality, *The TQM Magazine*, 11(1), 1999, 17-21.

[63] K. O. Cua, K. E. McKone, and R. G. Schroeder, Relationships between implementation of TQM, JIT, and TPM and manufacturing performance, *Journal of Operations Management*, 19(6), 2001, 675-94.

[64] F. Ireland, and B. G. Dale, A study of total productive maintenance implementation", *Journal of Quality in Maintenance Engineering*, 7(3), 2001, 183-91.

[65] M. Rodrigues, and K. Hatakeyama, Analysis of the fall of TPM in companies, *Journal of Materials Processing Technology*, 179(1-3), 2006, 276-9.

[66] M.C. Eti, S.O.T. Ogaji, and S. D. Probert, Reducing the cost of preventive maintenance (PM) through adopting a proactive reliability-focused culture, *Applied Energy*, 83, 2006, 1235-48.

[67] C. J. Bamber, J. M. Sharp, and M. Hides, Factors affecting successful implementation of total productive maintenance: a UK manufacturing case study perspective, *Journal of Quality in Maintenance Engineering*, 5(3), 1999, 162-81.

[68] T. Suzuki, New Directions for TPM, (Productivity Press, Cambridge, MA, 1992).

[69] B. S. Blanchard, An enhanced approach for implementing total productive maintenance in the manufacturing environment, *Journal of Quality in Maintenance Engineering*, 3(2), 1997, 69-80.

[70] K.F. Pun, K.S. Chin, M.F. Chow, and H.C.W. Lau, (2002), An effectiveness-centred approach to maintenance management, *Journal of Quality in Maintenance Engineering*, 8(4), 2002, 346-68.