IMPROVING PRODUCTIVITY WITH MAINTENANCE FUNCTION IN MANUFACTURING INDUSTRY OF SRI LANKA: LITERATURE REVIEW

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ABSTRACT

Whatever the level of competition exists in manufacturing industry of Sri Lanka the performance greatly affects the survival and prolong life time in industrial scenario. In measuring the corresponding level of performance of a particular organization, the term "productivity" becomes vital. It entails achieving of productivity improvement with new strategies and techniques hence all the processes, people, goods and information within the work floor would be enhanced by providing a good performance. In term of assuring a better performance of such an organization the role of maintenance accounts to a great extent. According to the past researches, the performance of a productivity improvement strategy is affected by the maintenance practices established by the maintenance management of the organization. In response, the combination of these maintenance practices; called as maintenance function would optimize performance of the applied productivity improvement strategy.Since maintenance also has a strategic dimension, its performance measurement system should be linked to the espoused strategy of the function in order to get the maximum impact. This paper therefore comprehends some literature reviews of an empirical study done emphasizing theeffect of the maintenance functionin improvingof productivity in manufacturing industry of Sri Lanka.

Key Words: *Productivity Improvement Strategy, Maintenance Function, Performance Measures*

INTRODUCTION

During the last two decades, productivity research and applications have not been given adequate importance when trying to attain excellence in the management of manufacturing enterprises (Murugesh, Devadasan and Natarajan, 1997, pp. 310-320).Grunberg (2003, pp. 89-93)has identified such an initiation to improve the manufacturing productivity on the start of industrial era. With this origination, the demand of the customers has been long-drawn-out unlimitedly creating more and more challenges over the manufacturing industry in an increasing competitive environment. It has made the manufacturers eager to open up their windows toward new productivity improvement strategies enhancing their performance to successfully meet with the challenges.Most ofthe manufacturing industries are currently encountering a necessity to respondto rapidly changing customer needs, desires and tastes (Singh and Singh, 2009, pp. 51-72). They have experienced an unprecedented degree of change in the past, involving drastic changes in management approaches, product andprocess technologies, customer expectations, supplier attitudes as well as competitivebehaviour (Ahuja, Kamba and Choudhary, 2006).

The performance and competitiveness of manufacturing companies is dependent on the reliability and productivity of their production facilities (Coetzee, 1997; Madu, 2000; Fleischer,

Weismann and Niggeschmidt, 2006).Productivity of an organization expresses to which extent it extracts the output from the given input. Inputs can be labour skills, technology and innovations etc. In order to achieve world-class performance, more and more companies are undertaking efforts to improve quality and productivity and reduce costs (Swanson, 2001). The improved productivity provides a strengthen basis for improving real income and economic wellbeing by improving the quality and quantity of the output. It motivates the employees to work for longer while giving means to the managers to ascertain, plan, control and improve efficiency at different levels of organization. In this scenario, the productivity improvement strategies such as Total Productive Maintenance (TPM), Kaizan, 5 S, Lean and Six Sigma are coming into the play inthe industry.An aggressive strategy like TPM focuses on actually improving the function and design of the production equipment (Swanson, 2001).Implementing of such maintenance strategies further require a better level of training and sufficient amount of resources to provide a higher level of performance in the plant and equipment.

The old models of productivity improvement strategies do not longer perform because of the technological advancements and competitive environment of the business world. In order to achieve the competitiveness and other goals of an organization, it is very important to the workers to be in line with the forthcoming trends and techniques of the business world.The highly dynamic and rapidly changing environment has made the industry well aware of the global competition leading to a higher demand (Miyake and Enkawa, 1999, pp. 243-269).To meet the challenges posed by the contemporary competitive environment, the manufacturing organizations must infuse quality and performance improvement initiatives in all aspects of their operations to improve their competitiveness (Daya and Duffuaa, 1995, pp. 20-26).

Outcome of the past researches has become an evident emphasizing the importance of having a good understanding of the changes that manufacturing industry should have on implementation of new production technologies (Nemetz and Fry, 1988, pp. 627-638).Further Dean and Snell (1991, pp. 776-804) have found that there is a positive effect of new production technologies for the success of an organization.

In response to this matter concerned, in facilitating the organizations and in achieving the set goals, many of them areimplementing new productivity improvement strategies for gaining sustainable competitive advantages and enhanced performance so that the failure of new implementations are apparent instead of keeping up their sustainability in the industrial context.

However comparing those successes of implementations it is well experienced that the implementation of a new productivity improvement strategy is very difficult and in most cases they are failed (Swanson, 1999, pp. 849-869). As well, one may concluded that the implementation of new performance measurement system can have few problems (Business Intelligence, 20000). But more literature reviews make evidence of their success such as in Kaplan and Norton (2000) and Mobile case. Further Bourne et al. (2002) have reviewed that the growing literature is now well addressing the difficulties of implementation and it is claimed by some that 70 percent of performance measurement initiatives fail as McCunn (1998). Also though Bitton (1990), Dixon et al. (1991), Kaplan and Norton (1993), Neely et al. (1996), Bitici et al. (1998) and Krause and Mertins (1999) have explained different management processes for the design of performance measurement, there has been less researches carried out for the success and failure of performance measurement initiatives. These have further motivated the researchers to do research related to this area.

The organizations adopt new procedures to resolve old problems when the actual tools do not work (Nuslund, 2008, pp. 269-287). It will create unsuccessful results of the applied productivity improvement techniques. Competitive pressures in the global manufacturing

environment are forcing manufacturing organizations to re-engineer in order to become more competitive in the marketplace. Toward that end, management of these organizations is paying closer attention to the changing nature of manufacturing performance, and the systems, processes and measures used in its evaluation.

PERFORMANCE MEASUREMENT

Performance measurement is vital in management. The operating performance is a direct result of detailed technical knowledge and performance discipline while the daily production performance is a direct result of each employee's personal and collective knowledge and experience (Kepner-Tregoe, 2000).Moreover this supports in improving the morale of employees and their job satisfaction. Tangen (2003, pp. 726-737) has defined the performance measurement as the process of quantifying the efficiency andeffectiveness of action and has further mentionedthat performance measure criteria must be driven by strategicobjectives and the measures must provide timely feedback.As Wikipedia (2013) has described the performance measurement estimates the parameters under which programs, investments, and acquisitions are reaching the targeted results. This supports the organization to identify where it is in the presence and further explains the followable actions toward the set goals.In addition, performance measures provide an important link between the strategies and management action and thus support implementation and execution of improvement initiatives (Kaplan, 1983, pp. 685-705; White, 1996, pp. 42-61; Neely, 1999, pp. 205-228; Neely, Gregory and Platts, 2005, pp. 1228-1263).

Factory performance remains unpredictable in spite of theconsiderable literature on manufacturing productivity improvement, and thelong history of manufacturing as there is no widespread agreement on how bestbe performed (Gershwin, 2000, pp. 891-906). Past researches have shown that, through appropriate measurement and management ofperformance, organizations can greatly benefit in formulation, implementation and review of organizational strategy (e.g. Ahn, 2001;Butler, Letza and Neale, 1997; Campbell et al., 2002; Euske, Lebas and McNeir, 1993; Lingle and Schiemann,1996; Veliyath, 1992).This implies the importance of researching the performance measurement related to the productivity improvement strategies applied in the work floor.

There are many performance measurement systems presently used in the industry as a team based activity. Among them, Business wide implementations have been designed with Balanced Scorecard (Kaplan and Norton, 1993, 1996, 2001), Cambridge Performance Measurement Process by Neely (1996) and Performance prism of Neely (2002) have provided more about this matter. Further Jones and Schilling (2000) have mentioned about the approaches of the TPM Process and Zigon(1999) has mentioned 7-step TPM Process. The Total Measurement Development Method (TMDM) has been described by Tarkenton Productivity Group (2000). These attempts have made some significant achievements in performance measurement with related to the productivity improvement in manufacturing environment.

Wireman (1991) has observed that there has been a general lack of synergy between maintenance management and quality improvement strategies in the organizations, together with an overall neglect of maintenance as a competitive strategy. It creates the failure of the applied productivity technique so that different techniques have been implemented by the manufacturing industry leading to certain changes in the manufacturing environment. Gomes, Yasin and Lisbao (2006, pp. 144-167) have stated that these changes have left their unmistakable on the different facets of the manufacturing organizations. Thus the inadequacies of the maintenance practices in the past, have adversely affected the organizational competitiveness thereby reducing the throughput and reliability of production facilities, leading to fast deteriorations in production facilities, lowering equipment availability due to excessive system downtime, lowering production quality,

increasing inventory, thereby leading to unreliable delivery performance (Ahuja and Khamba, 2008, pp. 709-756).This emphasizes the importance of identifying a proper maintenance function composed of the best maintenance practices related to any implemented productivity improvement strategy.

MAINTENANCE FUNCTION AND ITS RESPONSE

The role of maintenance in modern manufacturing is becoming ever more important, with companies adopting maintenance as a profit-generating business element. As a result, traditional terms used to describe maintenance such as "necessary evil" seem to be obsolete(Kutucuoglu et al. 2001). It would appear that the aim of the maintenance function is to contribute towards an organization's profit, clearly bringing the need for maintenance operations to be in harmony with corporate business objectives. As the measurement activity provides the link between the actual output and the desired results, performance measurement systems are crucial to those who have a stake in maintenance, to ensure that they are not in conflict with the overall business needs.

Ward et al. (1992 cited in Swanson 1999, pp. 849-869) has identified the problem as the priority given to the impact on direct work force through the new productivity technologies hence less consideration on the changes required to occur throughout the organization supporting the new productivity technologies. In order to improve the performance of a manufacturing system, a good maintenance management should be there in the organization.Muchiri et al. (2010) states that maintenance managers need a good track of performance on maintenance process and maintenance results to ensure the plant to achieve the desired performance. Therefore the maintenance becomes the key of sustainability of any system.The remarkable improvements have occurred recently in the maintenance management ofphysical assets and productive systems, so that less wastages of energy and resourcesoccur (Eti, Ogaji and Probert 2004, pp. 385-401).One such a change is that identifying the proper maintenance function related to the applied productivity technique.

Maintenance is defined as a combination of all technical and associated administrative activities required to keep equipment, installations and other physical assets in the desired operating condition or restore them to this condition (BSI 1984; Pintelon et al. 1997; Pintelon and VanPuyvelde 2006 cited in Muchiri et al. 2010).

Good maintenance assumes that maintenance objectives and strategies are not determined in isolation, but are in some way derived from factors such as company policy, manufacturing policy and other potentially conflicting demands and constraints in the company (Swanson 1997, pp. 191-207; Johnsson and Lesshamar 1999, pp. 55-78; Swanson 2001, pp. 237-244; Pinjala et al. 2006, pp. 214-229).

Assuming that the maintenance objectives persued at a given plant influence the kind of performance indicators used Muchiri et al. (2010) has summarized the maintenance objectives under five headings: ensuring the plant functionality (availability, reliability and product quality etc.), ensuring the plant achieves its design life, ensuring plant and environmental safety, ensuring cost effectiveness in maintenance and effective use of resources (energy and raw materials). Some authors of Kelly (1989), MESA (1995), Tsang, Jardine and Kolodny(1999, pp. 691-715), andVisser and Pretorious(2003, pp. 83-97) have mentioned that the maintenance objectives are related to attainment of production target at required quality, and within the constraints of the system condition and safety.

Once the maintenance objectives are outlined, maintenance strategy formulation (Pinjala 2008 cited in Muchiri et al. 2010) is necessary to help decide which type of maintenance needs to be done, when to do it, and how often it can be done. According to Pintelon and Puyvelde (2006 cited

in Muchiri et al. 2010), maintenance decision making can be broadly explained in terms of maintenance actions (basic elementary work), maintenance policies and maintenance concepts.

It is in the interest of asset managers to know the relationship between the input of the maintenance process and the outcome in terms of total contribution to manufacturing performance and business strategic objectives (Dwight 1995; Tsang 1998, pp. 87-94; Parida and Chattopadhyay 2007, pp. 241-258). This relationship is finely explained by its maintenancefunction which is composed of the related maintenance practices followed by the implemented productivity improvement strategy. Therefore the maintenance function would emphasize the maintenance practices that should be followed by the workers in the organization. The effectiveness of the outcome can be increased by including the most effective maintenance practices in the maintenance function and by continued practicing it in the work floor. This leads toward the importance of identifying an effective maintenance function for any applied productivity improvement strategy and for its further existence.

Many of the firms are only worrying on the major changes that they require for further existence of new technology within the work floor (Ward, 1992 cited in Swanson 1999, pp. 849-869). But that should not be the principle. Some maintenance decision elements are carried out at the operational level, for example the basic maintenance interventions done by technicians. Other decision elements, for example the maintenance policies and concepts, apply to strategic level (Muchiri et al., 2010).Once the objectives and strategies have been established, the success of the maintenance function is dependent on the maintenance work management (Muchiri et al., 2010). Hence another perspective of looking at maintenance function is not only to maintain but also to enhance the process or the plant operation system as a result of turnaround planning (Jabar, 2003).

Difficulties arise when quantifying and measuring the input and output of the maintenance process (Muchiri et al., 2010).There is a consensus among authors that there is a need for a holistic performance measurement that assesses the contribution of the maintenance function to manufacturing and business strategic objectives (Tsang, 1998, pp. 87-94; Muthu et al., 2000, pp. 292-303). Literature reviews some insights and framework in the complex environment under the maintenance function presuming that these elements are essential ingredients for developing maintenance performance measurement system and indicators.The different categories of measures show different areas of interest in maintenance performance in both literature and practice(Muchiri et al., 2010).This can be realized through development and implementation of a rigorously defined performance measurement system and indicators that are able to measure important elements of maintenance function performance (Muchiri et al., 2010).

Weber and Thomas (2006) have developed a framework of defining the key performance indicator for managing the maintenance function based on physical asset management requirements and asset reliability process.Key performance indicators (KPIs) help an organization define and measure progresstoward organizational goals (Sawang, 2011, pp. 23-29) and Cox, Issa and Ahrens (2003, pp. 142-151) have defined KPI as quantifiable measurements to examine the improvement in performing an innovation implementing activity that is critical to the success of a business. According to the previous researches (e.g. Cox, Issa and Ahrens, 2003, pp. 142-151; Kaplan and Norton, 1993, pp. 71-79), there is a positive relationship between the use of key performance indicators and managerial perception within the organization. Well defined performance indicators can potentially support identification of performance gap between current and desired performance and provide indication of progress towards closing the gaps (Muchiri et al., 2010). Thus the past researchesmake evidences infurtherfinding ofpertinent indicators to measure the components of the maintenance function.

Based on these reviews of the literature the following hypothesis can be elicited.

H_0 = The maintenance function improves the productivity in manufacturing industry of Sri Lanka.

CONCLUSION

This paper presents a review of literature in brief on improving productivity with maintenance function in manufacturing industry of Sri Lanka. The literature related to this focus has been clearly reviewed the research findings and conclusions of the past researches emphasizing the importance of having improvements in productivity, identifying of a proper maintenance function composed of the performance measures related withthe implemented productivity improvement strategy. Also this paper suggests some arguments related to the field of productivity improvement strategies in manufacturing industry of the country.

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