SUSTAINABLE PRODUCTION MANAGEMENT – A CASE STUDY OF A MAURITIUS COMPANY

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Abstract: *Sustainable production management is a challenging task. The personnel at all levels of a production system tend to become stereotyped, unless challenged by internal or external forces. In this context creativity at work place is essential. Stereo typed working introduces mental blocks that hinder creativity. This paper discusses the case of a company under the category of Small and Medium Enterprises (SMEs) situated at Mauritius and involved in the manufacture of plastic products. The use of simple tools and the resulting benefits helped in removing the mental blocks and improving the production. The researchers have observed similar tendency (stereotyped working) with Indian SMEs. Awareness of mental blocks and associated remedies will help in sustaining the productivity.*

Keywords : *Productivity, creativity, mental blocks, quality, production management.*

INTRODUCTION

Production management has to tackle a plethora of problems irrespective of the nature or size of a production unit. Small and Medium Enterprises (SMEs) often buckle under problems such as marketing, finance and supplies. Globalization and recession have aggravated the degree of these problems. Not only productivity but also quality and sustainability can effectively be addressed by the efficient amalgamation of people and processes. Companies need to focus on the available resources and incorporate innovative decision thinking through value management. It is necessary to use the inherent creative powers of employees' minds for the progress of the system.

Creativity plays an important role in every walk of life. Many SMEs believe that rejects and reworks in the system are unavoidable and is a part of the game. They are happy as long as they meet the schedules (which are planned and set loose) and customer demands. This is a hindrance for sustainable development and inhibits improvements in productivity. Effective understanding of creativity and elimination of mental blocks is essential.

Kao (1991) suggests that creativity may be defined as "a human process leading to a result which is novel (new), useful (solves an existing problem or satisfies an existing need), and understandable (can be reproduced)". Creativity can be associated with personal characteristics and attributes, intelligence (Barron and Harrington, 1981; Davis, 1989), conceptual skills, behaviors, abilities, organizational factors or external influences. Organizational factors such

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as empowerment, experience, job complexity and supervision style have a tremendous impact on creative performance. Effective organizations should be simultaneously efficient and creative. In this context, efficiency means optimizing, stabilizing, and polishing current methods and routines for highest quantity, quality, customer satisfaction, and at the lowest possible cost. Organizational creativity means deliberately changing current methods to reach new levels of quantity, quality, cost and customer satisfaction possible. New methods and new products result from creativity implying higher productivity, higher profitability, better quality and higher market share.

If managers want to benefit from the gains brought in by creativity, they should pinpoint the blockages to creativity and bring in a creative change to the benefit of the organization, the management, and the employees. Such a study has been made at Shamrock Plastic industry, categorized as an SME company involved in manufacturing consumer durable plastic products located at Mauritius.

At the beginning of the study, the shop floor personnel and managers have been asked to identify shop floor problems and their root causes. No doubt, problems were identified but many root causes were often quoted as "the usual behavior of the process". This has been challenged by the authors in the study presented below. This paper proves that simple analysis using scientific tools helps to improve the situation and overcome mental blocks. Some personnel admitted that 'fear of consequences' did not encourage them to attempt and solve problems.

Through simple discussions (mentioned below) the importance of elimination of mental blocks has been stressed.

Mental Blocks

Mental blocks hinder creativity and value addition in many organizations; leading to the wastage of the intellectual ability of the employees. These can be Cultural (tradition, taboos, temptation of pure reasoning, lack of humor etc.), Environmental (interference by noise, smell etc.), Sentimental (fear of consequences, fear of taking risks (making a mistake)), irritations by uncomfortable sensual stimuli, pressure, stress etc), and Realization (thinking in stereotype. inability to change point of view, too narrow perception of the problem etc).

Mental blocks are usually created by ourselves; it is a perception discouraging people from moving ahead or taking actions or decisions. Octavio, 2008 shared that whenever rational thinking has been replaced with misconceptions, prejudices or dogmas, the detrimental effects and the persistent influence of mental blocks have blurred analytical capacities, distorted rational thinking and affected logical reasoning, with visible repercussions on professional performance and negative effects on engagement toward the workplace.

Hence for higher performance, effective decision making, and analytical thinking one should overcome all sorts of mental blocks. In this context, one should instil confidence, self-awareness, and improve the communication line to overcome one's limitations and constraints leading to growth and progress.

This paper proves that simple analysis using scientific tools helps to improve the situation and overcome mental blocks.

Lateral and Vertical thinking for idea generation

The shared vision of the company can be achieved by promoting innovative and creative idea generation vertically through the ladder of management. Management should not work as an independent entity but it should be effectively supported by its employees. Employees should be inspired to be creative and incorporated in decision making. Fears like rejection of ideas should be eliminated with clear communication lines. Incentives and training can as well be provided to employees. Management can encourage and train employees to use simple tools such as cause and effect diagram and control charts to improve their processes. Control charts can be adopted in daily work to identify assignable causes and stop production to solve unaccepted conditions and continue production smoothly.

For lateral idea generation, one can introduce mechanisms to facilitate the transfer of knowledge between work teams. For example, quality circles can be created for idea generation in order to form part of a quality conscious organization. Interaction of different categories of employees can as well influence the learning capability of an organization, such as the interaction of mechanics and operatives to share the knowledge of effectively operating one's machine or even act as the owner of the machine with a philosophy of Total Productive Maintenance adopted.

Value engineering

Value engineering (VE) is a technique in which the value of a system's output is optimized by crafting a mix of productivity, quality and profitability. In majority of the cases this practice identifies and removes unnecessary costs and efforts, thereby increasing the value of the output delivered. VE is above all a structured problem solving practice whereby the focus is on critical analysis for generation of improvements in the process for better output with less waste.

Value analysis conducted in the company revealed inefficient use of materials. As such, alternative options of different material mix of polystyrene (virgin material) and regrind gave higher output and quality, and reduced waste.

Narayanaswamy 2009, advocating value engineering, emphasized on proactive involvement of every individual employee, rather than focusing exclusively on a specific department. To achieve value engineering and promote creativity, mental blocks of employees as well as managers have to be overcome.

One can focus on creativity and value engineering through means like advanced technology, automation but over viewing optimization of current processes and critical plant asset, manpower. Knowledge management and the potential of manpower remain untapped in many industries. To stimulate this creativity, barriers to creativity have to be explored and tackled and are enthused towards a learning organization. A learning organization is one skilled at creating, acquiring and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights (Garvin, 1993). Morrison and Rosenthal, 1997

opined that only true source of sustainable competitive advantage results by building learning organizations. Senge, 1991 states that "learning cannot exist apart from action. Learning is the process of enhancing our capacity for effective action."

Organizational learning is a long-term activity that will build competitive advantage over time and requires sustained management attention, commitment, and effort. A list of companies frequently cited as learning organizations confirms this fact. These companies include Motorola, Wal-Mart, British Petroleum (BP), Xerox, Shell, GE, Honda, Sony, Nortel, Harley-Davidson and Kodak.

Hence it is crucial to enthuse people at all levels of a company to learn and keep abreast with developments in knowledge and tools. Periodic brainstorming sessions should be conducted as well as training programs and soul searching even in the absence of sporadic or chronic problems. Knowledge should be well managed as an effective asset in companies, constant evaluation should be made and feedback obtained for continuous improvement.

CASE STUDY:

A survey of the SME under study showed increasing rates of defective injection molded products. The shop floor personnel and management considered them as 'fate accompli'. Pareto analysis revealed high occurrence of short shots, warpage followed by appearance defects, flashing, sprue sticking and products sticking to the mould. If quality consciousness is introduced, such defects can be reduced or even eliminated with creative tact from management and creative ideas from the employees. The main hindrance towards this achievement is found to be mental blocks.

Repetitive work all day and all year throughout causes operators to become passive. Non value adding work like inspection causes demotivation. This attitude should be discouraged. Proactively, critical thinking should be boosted. Inspection was found to be a repeated activity in the company. Elimination of this activity was not considered due to failure to critically analyze shop floor activities from management and passiveness of employees. Since inspection is a non-value adding activity, involving repetitive work, errors, time and consequently an additional cost, we can conclude that detection of poor quality by post-production inspection is unreliable, wasteful and uneconomical. By controlling the quality at the point of manufacture, we can minimize the need to inspect. But due to fear of consequences, there is much reliance on post-production inspection in the company.

Such an attitude acts as a mental block. Management should firstly be self critical and also encourage the employees to develop their critical thinking. This will be a definite motivation factor and lead to higher value added work.

Defects identified in the injection molding process were analyzed and predominant defects explored to be reduced or even eliminated. It was observed that due to perceptual barriers

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between management and operators, there was lack of communication and without any problem solving structure. If learning attitude was adopted in the organization, defects would certainly be reduced.

In such an attempt, we have analyzed the two predominant defects: short shots and warpage defects. Brainstorming sessions were held with top management, the supervisors and the shop floor operators. The environment was ensured to be receptive to ideas from all ends and indeed the inherent powers of the people's mind proved to be beneficial by highlighting the causes of defects as in Figures 1 and 2.

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Figure 1 - Cause-and-Effect Diagram for Short Shot

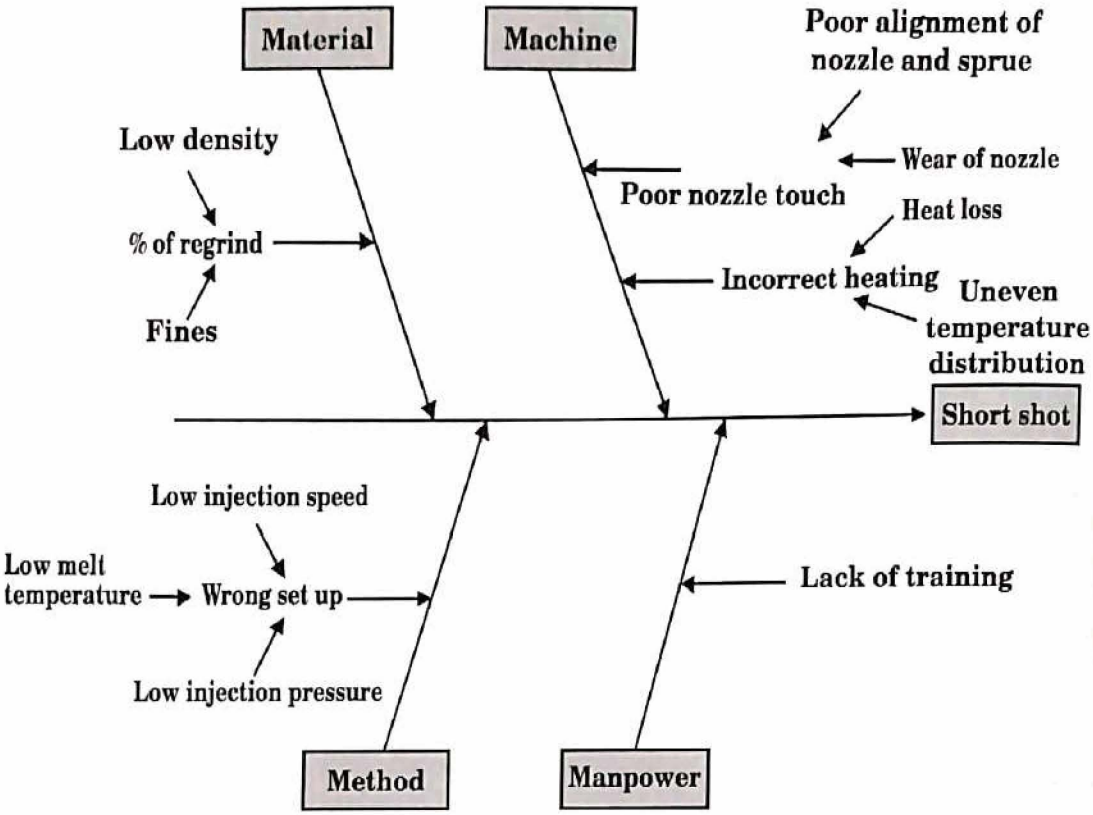
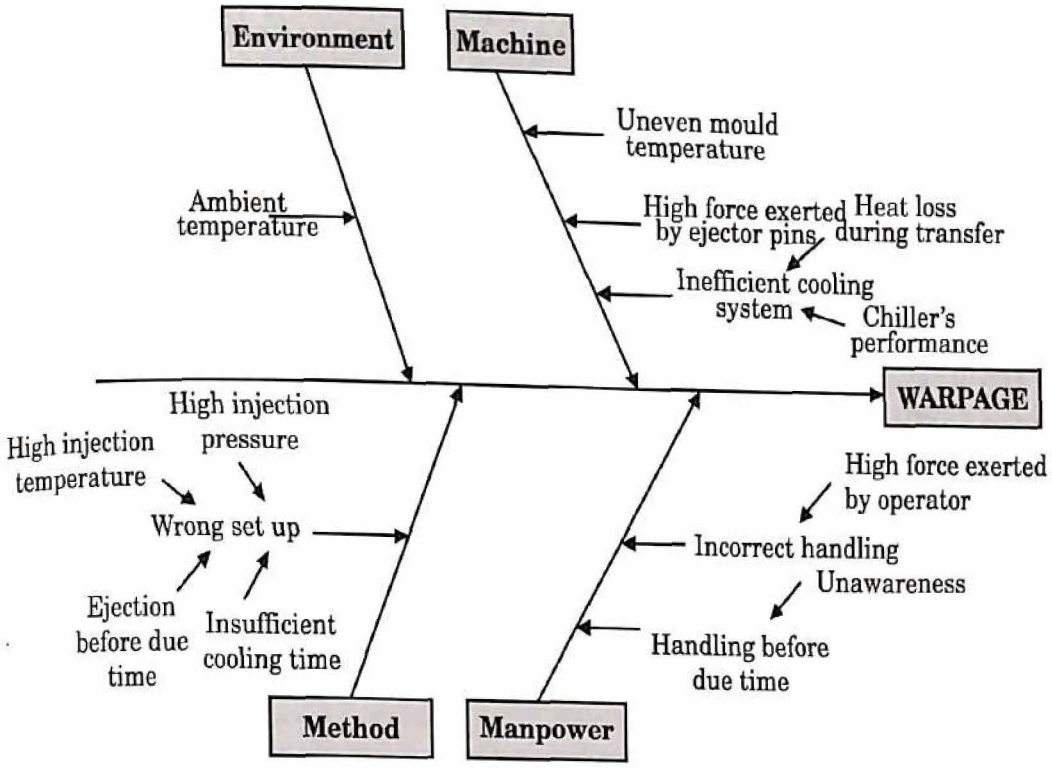


Figure 2 - Cause-and-Effect Diagram for Warpage



The causes of defects such as short shots, warpage etc were analysed. Melt freezing before reaching the ends of mould cavity and low mould temperature, uneven mould temperature were found to be the causes of short shots. Ambient temperature, high injection pressure, high injection speed, and incorrect handling were found to contribute to the warpage of products.

Two simple tools to help improve quality are described in the following lines. Cause and Effect diagram shows the effect at the head of a central spine along with the causes at the ends of the ribs that branch from it. The main factors or causes are listed first and then reduced to their sub-causes. This procedure is continued until all the causes have been included (using brain storming sessions). The factors are then critically analysed from the angle of their probable contribution to the effect. These crucial factors are then subjected to experimentation and thus validation.

Pictorial check sheet is a simple tool to map the concentration of defects. A two dimensional sketch of the product is prepared and used as a template. Samples from production process are collected and analysed for defects. The location of the defect on each sample is noted on the sketch. If sufficient number of products is anlaysed for each type of defect, the defect concentration of each defect can be visualized on the sketch. The design/production office can then find out the reasons (technical as well as non-technical) and take corrective action. In the present case, the defects such as short shots and warpage have been analysed. The analysis showed that short shots occurred most

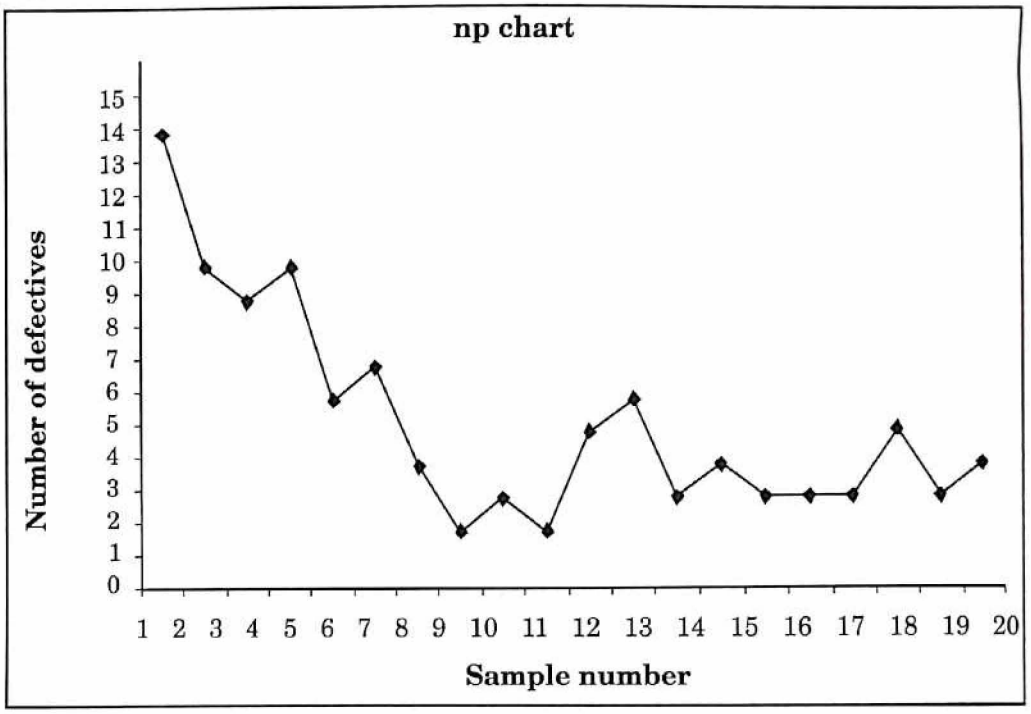
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frequently at the start of the process and the missing areas were larger. This indicates an initial low mold temperature during the transient time, causing freezing of the melt before filling the entire mould cavity.

These simple techniques can be adopted in the everyday life of the company for problem identification and solving. The resources are already available, but we need to explore and channel them in the right direction. This is possible with the elimination of mental blocks by being receptive to innovative ideas for analysis and implementation.

Real time data from the machine was collected to prepare the control charts and detect the presence of special (assignable) causes influencing the process. Only the machine element is considered in this phase. A sample is shown in Figure 3.

Figure 3 - Control chart for machine element for Day



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From a series of such control charts, it was observed that the first few samples were responsible for most of the out of control points; reinforcing one of the causes identified in the cause and effect diagram, i.e. low initial mould temperature. This is due to an unstable temperature distribution at the start of the process (transient state).

Control charts for samples were also constructed for the case of machine as well as manual element. Samples were taken after the operator removed the runner of the product and separated it into two parts, depicted in Figure 4.

Figure 4 - Control chart for machine and manual element for Day 1

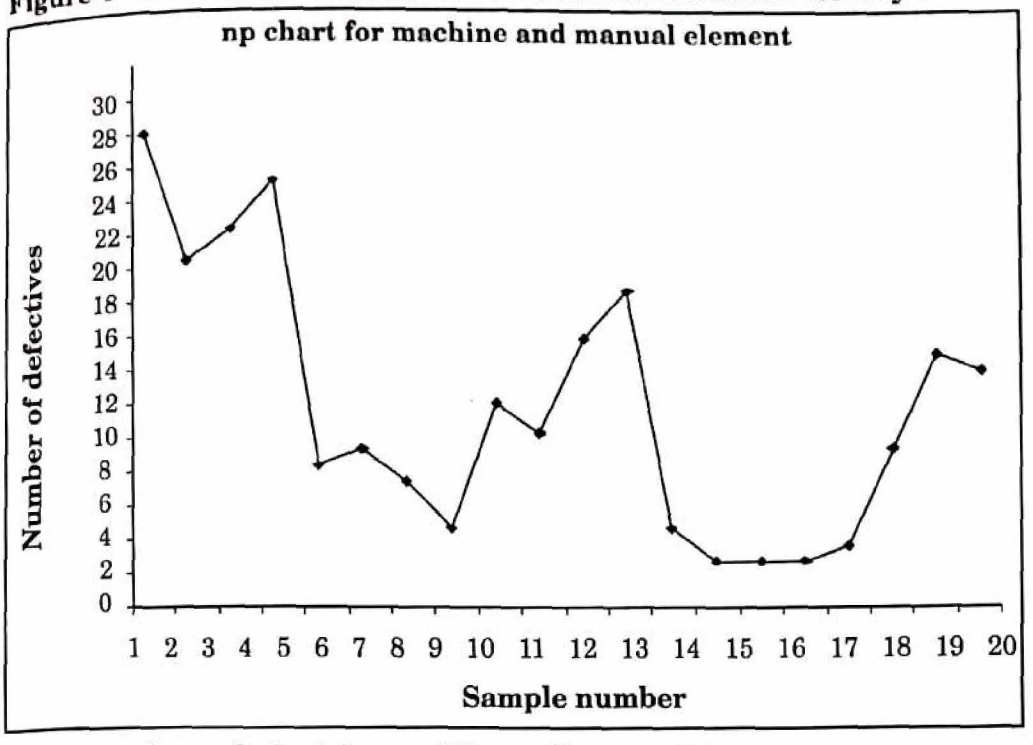


Figure 4 - Control chart for machine and manual element for Day 1

The subsequent set of control charts identified a drop in the number of defectives after the 4th sample (for subsequent six samples) and after the 12th sample (for all the remaining samples). This trend is associated with the operator's work as these samples were taken after the rest pause and lunch time. In the meantime when the operator was absent for collection and breaking of the parts, the ejected products would have more time for cooling before they were handled. Hence the cooled products have less probability of distortion when the operator resumes his work. Therefore, incorrect handling and/or handling before the due time is considered as the assignable causes for warpage of components.

Such assignable causes can be pinpointed if management wants to see it and the operators are critical to their work. With thoughts like 'it is the way that things have always been done', we will only remain trapped in mental barriers and will not be able to perform better until the philosophy is changed to 'the best way of doing things' by being quality conscious, critical of our own system's deficiencies and the confidence in the power of our people.

The above case is one of the many SMEs belonging to Mauritius. Similar case studies have been observed by the researchers in Indian counterparts. In a typical case of SME in India, the industry had considerable scrap resulting from a machining operation. A simple analysis using cause and effect diagram showed that the mental blocks of the designer coupled with that of shop floor manager have introduced redundancy in location of the parts resulting in oversized and undersized

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products. These cases indicate that mental blocks do occur with stereotyped working.

Conclusion

For a sustainable production management, it is essential to eliminate mental blocks and be creative. A regular focus on the production through the window of creativity will lead to an efficient and effective system. Games and other avenues such as improved training that enhance creativity must be built into the system.

The present case study involving an SME situated at Mauritius proves that a well directed plan and the use of simple, common sense approaches, effective quality tools, and procedures could lead to effective and efficient manufacturing. It would also imply minimum investment, a change in the management philosophy, and working attitude. Sporadic or chronic causes existing in the system could be easily brought to fore and avoided mental block formation. The savings resulting out of this study amounted to 10.62% reduction in time and a 5.62% reduction in defects. The experience of the researchers has indicated similar mental blocks with Indian SMEs and is attributed to stereotyped working.

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