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The Framework for Manufacturing Methods and Techniques

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Abstract

The concepts of quality management and productivity improvement have been practiced and implemented in manufacturing for over five decades. Various strategies and methods were developed to improve manufacturing quality and productivity during this period. This paper focuses on those various strategies which were developed to improve manufacturing around the past five decades. These include manufacturing strategies such as Lean Manufacturing, Just In Time Manufacturing, Holistic Manufacturing and Agile Manufacturing; business management strategies such as Business Process Re-engineering, Total Quality Management and Kaizen; and quality strategies such as Quality Management Systems and Six Sigma. But, there is also often misunderstanding between different strategies and their constituent techniques, tools and methods. Authors view different strategies in different ways, causing incorrect **implementation and confusion in their application.The crux of the work deals with designing a framework of the strategies, their methods and techniques, thus eliminating the confusion and ambiguity about these strategies. Strategies related to manufacturing are introduced along with their techniques and tools and compared with one another. These strategies are then inter-related by designing a framework of the strategies and their method**

I. INTRODUCTION

This technique consists of study and analysis of various quality, manufacturing and management strategies developed over the last five decades. These include the strategies mentioned above and others such as KAIZEN, Business Process Re-engineering and Holistic Manufacturing. These strategies are studied in depth using the perspective of different authors of books and journals. After these strategies are thoroughly understood, a critical analysis is carried out. After the analysis of these strategies, the techniques and tools used in them are studied and linked to these strategies. These strategies are then inter-related and examined such that a single definition/description might be possible to be given about them. The basic purpose behind these techniques is to eliminate the confusion behind these strategies developed and to show them to the reader in a framework with the help of diagrams, tables and figures.

1.REVIEW OF FRAMEWORK TECHNIQUES AND METHOD

1.1Scope of the framework- The framework is focused on the Manufacturing, Management and Quality Control activities of industry. It can be useful for any company or organization, be it large, medium or small scale who wants to develop its productivity and quality in the modern competitive scenario. Most of the important strategies have been studied and explained which are related to the manufacturing sector and discussions are done how they are interlinked to one another. These techniques are an effort in studying these strategies and to improve their use in manufacturing and quality control.

1.2Why this framework manufacturing strategies- Though various manufacturing strategies have been developed in recent decades, they have frequently not been accurately defined or only partly described by authors writing about them. This has often led to their being incorrectly implemented. There is a lot of ambiguity as far as the scope and elements of these strategies are concerned. There is also often misunderstanding between different strategies and their constituent techniques, tools and methods. This is not much helped by consultants regarding the names of these strategies as buzz-words to help them sell or market their expertise under the form of brand-names. So, many of these strategies have their definitions changed over the years by these processes. Since, all these strategies collectively cover much of manufacturing; this method has been carried out to establish clarity to the meaning and scope of these strategies and to develop a framework to show this and the inter-relationships and overlaps where these exist. The objective is to make it much easier to view and understand all these manufacturing strategies together.

1.3Development of new Strategies- Due to changes occurring in the nature and level of international competition, many companies have been resorting to new ways of manufacturing. This phenomenon has been called as ‘new wave manufacturing strategies’ (Storey, 1994). During the development of these various strategies, many ‘key-words’ were given to

these strategies by the companies which started the development of these strategies and began implementing them. Some of the strategies were Lean Manufacturing (LM), Just-In-Time (JIT), Total Quality Management (TQM), Computer Integrated Manufacturing (CIM), Cellular Manufacturing (CM), World Class Manufacturing (WCM), to name a few of the most significant ones (Storey, 1994).During the development and implementation of these strategies, many companies and countries began adopting the strategies and implementing them according their own requirements. During this period, according to Storey (1994), there was a fragmented, inconclusive, partial and often contradictory set of literature associated with the phenomenon. Much of the discussion in this literature addresses the issue as if it were a continuation of the problem of 'new technology'. But, the fact remains that many of the elements of the 'new manufacturing' are just partly connected with technology. They also happen to have a 'softer element' apart from the 'technical element' as is the contemporary belief. These 'softer elements' include internal customer supply chains, new ways of working, cellular factory lay-out to name a few (Storey, 1994).

II. DISCUSSION ABOUT FRAMEWORK

The diagram has been drawn in the form of a Venn diagram. This diagram distinguishes between all the strategies and identifies the overlaps. The methods of the strategies are as given below :(i) Waste Elimination, (ii) Problem Solving, (iii) Employee Involvement,(iv) Customer Orientation, (v) Innovation, (vi) Continuous Improvement, (vii) Automation, (viii) Quality Control and (ix) Maintenance.

By, studying the figure, one can observe two important areas of overlapping. This denotes that there is a lot common between other strategies along with Total Quality Management and Lean Manufacturing.Total Quality Management forms the first major overlap and combines and overlaps many of the strategies with its methods. It is totally devoted to customer orientation by producing quality in all areas of the organization which is also an important aspect in Quality Management Systems like ISO 9000. Similarly, it forms a very important overlap with the Six Sigma strategy with the view that both Six Sigma and TQM are oriented towards defect minimization and problem solving. For this purpose, both TQM and Six Sigma use Statistical Quality Control Tools known as the seven QC tools. The next important area of overlap is with TQM and Agile Manufacturing using Automation methods like Flexible Manufacturing Systems, Robotics and Computer Numerical Control for faster processing and developing products.

Agile Manufacturing, Holistic Manufacturing and Lean Manufacturing form a triangular overlap in automation and employee involvements such as team working. Lean Manufacturing uses the automation and team working methods to cut down on unnecessary production and waste reduction, and Holistic forms a combination integrating modern methods of manufacturing along with Lean Manufacturing and Agile Manufacturing.BPR, Agile Manufacturing, Holistic Manufacturing also form an overlap with each other as innovating strategies. All these three strategies are relatively new strategies and oriented towards redesign of organization and business processes. BPR though has employee involvement and team work in common with TQM, its way of working towards the objectives is completely different from that of TQM. TQM achieves improvement in gradual steps but BPR does it in

Figure 1:A framework Venn Diagram distinguishing between all the strategies and identifying overlaps

drastic changes. Hence, BPR has been shown with a '*'mark.The second major overlap is with Lean manufacturing along with other strategies and TQM. Lean Manufacturing shares common methods with TQM, Agile Manufacturing, Holistic Manufacturing(A. Gunasekaran) , Kaizen and JIT Manufacturing.Lean Manufacturing shares common methods of employee involvement, team work, continuous improvement and waste elimination along with Kaizen and JIT. Kaizen overlaps Lean and uses the methods for continuous improvement which is also a necessity in Lean Manufacturing. Similarly, Lean Manufacturing and JIT Manufacturing have an important overlap since both strategies are mainly oriented towards removal of

waste and making processes more efficient. Lastly, the two major players in this framework,

III. COMPARISION BETWEEN DIFFERENT STRATEGIES

Table 1 compares the different strategies with one another and shows a comparative result in the form of a table. The orientation of the strategies with its methods is denoted by the letter 'X' and if the orientation is high, it results in an increase in the number of 'X' till 'XXX'. The key to table 1. Shows the orientation of the strategies towards the improvement methods. After making the table, a flow diagram showing the flow between the strategies is designed (refer to figure 2.) The figure shows two major core processes which are Quality Control and self-assessment (which includes the personnel's confidence to improve self and organization through continuous change as in Kaizen, BPR and TQM). The red lines denote the flow and direct link between the methods, the green dotted lines show indirect link, and the blue rectangular entities show the methods.By comparing TQM and Kaizen and Business Process Re-engineering, it can be seen that these strategies are business management strategies oriented more towards employee involvement and team work, which means the main crux of these three strategies is towards the personnel working in the organization and completely depends upon their mindset. In these strategies, improvement can only be achieved if all people in the organization come together and work towards a common cause. Apart from team work, these three strategies are also related in terms of being customer oriented and providing quality awareness. Though, BPR and TQM work towards the same objectives, there is difference between their way of working, the former adopting a slow approach whereas the latter a drastic one. The second comparison can be that between Lean Manufacturing, Agile Manufacturing, Holistic Manufacturing and Just In Time Manufacturing. The major task in these strategies is elimination of unwanted processes and wastes and the means of obtaining this is automation. Lean Manufacturing and JIT are fully devoted towards waste elimination whereas Agile Manufacturing does the same objectives using more of automation to develop and produce products quickly. Holistic Manufacturing takes the specialist elements from these three strategies and uses them for its working. Holistic Manufacturing (Hardy, S. (HMC) 2007)is both in automation and team work and can thus match very well with Lean Manufacturing.Another comparison can be done between that of Quality Management Systems, Six Sigma and Total Quality Management. These three strategies can be said to go hand in hand considering they adopt a lot of techniques from each other. TQM and Six Sigma (Tennant, G. 2001) share the same orientation towards quality improvement for which they use statistical quality tools. This quality in turn is assessed and approved by QMS such as ISO 9000 using the same seven QC tools. Similarly, QMS ISO 9000 and TQM work towards benefitting the customer by providing better quality products using high standards of statistical control and inspection.

Key to Table 1 is as follows:
XXX → Is strongly oriented to
XX → Is oriented towards
X → Just uses, not much oriented

	Employee Involvement	Automation	Waste Elimination	Innovation	Continuous Improvement	Quality control	Customer Orientation	Maintenance	Problem Solving
BPR	XX	XXX	--	--	XXX	--	XX	X	--
HOL. MFG.	--	XXX	--	X	--	XX	XX	--	XXX
SIX SIGMA	XXX	X	--	XXX	--	X	XXX	XX	XX
ISO QMS	X	XXX	--	X	--	XX	XXX	XXX	XX
JIT MFG.	XX	X	X	XXX	--	X	XXX	XX	XX
AGILE MFG.	XX	XX	XXX	--	XXX	X	XXX	XX	X
LEAN MFG.	XX	XX	XX	XXX	--	XX	XXX	X	XX
KAIZEN	XX	XXX	X	XX	--	XXX	XX	XX	XXX
TQM	XX	XXX	X	XX	--	XXX	XXX	XX	X

Table 1: A table comparing all the strategies with their method

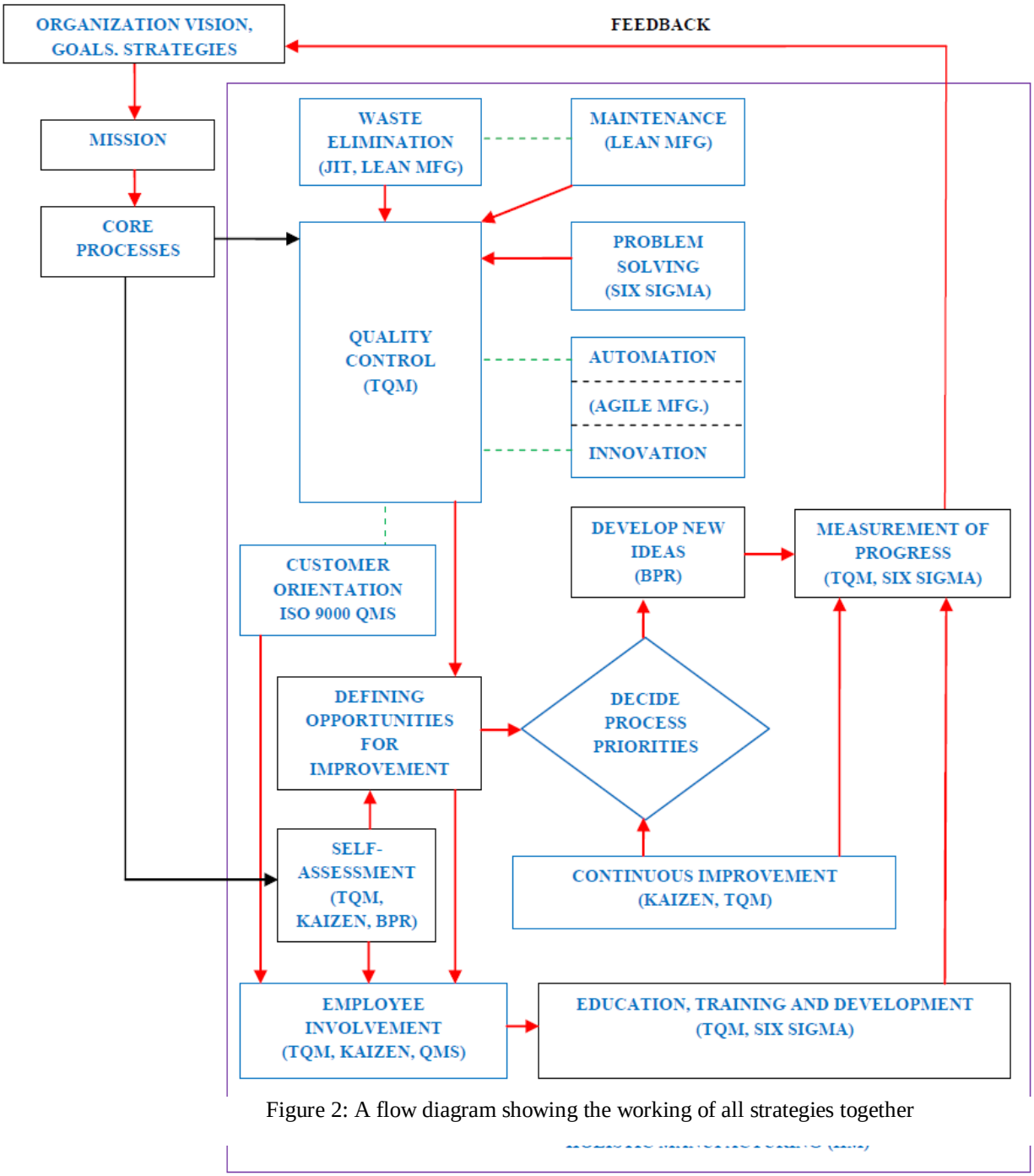

Figure 2: A flow diagram showing the working of all strategies together

IV.CONCLUSION

Most of the strategies though stated as buzz-words and brand-names by writers have more in them rather than just for advertising usage.Most of the authors according to Storey (1994) suggest that these new strategies help in reduction of inventory and work in progress, enhancement in quality, the technique of getting it right-first-time for components and assemblies will be successful, enhanced flexibility and improved productivity and reduction in all kinds of wastes with less or no defects. For example, Schonberger (1986) as cited in Storey (1994) views the new manufacturing strategies as a means "to cut defect rates tenfold and more, manufacturing lead-times twentyfold in some cases sales volume tripled in half the plant space."

Monden (1983), Cheng (1988) and Schonberger (1982, 1986) as cited in Storey (1994) have described the outcomes of JIT to improve supplier relations, improve productivity, increase savings due to reduction in inventory and most importantly elimination of problems due to the original means of production. Oliver (1989) as cited in Storey (1994) reports the outcomes of JIT in case studies which include improvements in quality and lead-times and cell operators displaying a sense of ownership and responsibility towards their part of the process. Meredith (1987) and Skinner (1985) report JIT to be involved with improved flexibility. Schonberger (1982) and Skinner (1985) see JIT as a means of cost reduction. Monden (1983) and Meredith (1987) state the benefit of JIT as a reduction of indirect labour (Storey 1994).

Similarly, TQM, and Kaizen (Mihail aurel titu, constantin operean and denial grecu2010) can be viewed as team-work and Quality Control building strategies, which have a strong overlap as shown in the framework. This is the same as in Lean Manufacturing and TQM with matching areas of work in controlling defects and reducing wastes.Lastly, it can be concluded that all strategies are developed for business improvement and each strategy has its own unique methods, techniques and tools. Yet, it needs good knowledge and experience by the company and its personnel to identify the necessary strategy and implement it for positive business use.

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