CHAPTER 2

LITERATURE SURVEY

2.1 TOTAL QUALITY MANAGEMENT

Amar and Mohd Zain (2002) examined the barriers faced by Indonesian manufacturing organisations of TQM. The barriers are related to human resource, management attitude towards quality, organisational culture, interdepartmental relations, raw materials, machines and equipment, information, methods and training.


Ismail (2003) identified the salient factors affecting TQM implementation in Egypt using field force analysis to identify the critical success factors of TQM implementation in small and medium-sized enterprises (SMEs) in the Qatari industrial sector.

Raju (2002) made an attempt to formulate a workable TQM model for the benefits of industries. Consequently a TQM model has been developed to suit the Indian conditions.

Ajit Singh (1991) analysed the concept and practices of Total Quality Management in the Indian organizations by means of semi structured questionnaire survey.
Vikas Kumar (2002) analysed the status of JIT/TQM Quality Techniques in India through a survey of Indian Industries and concluded that the Indian Industries need to do cautious planning and full team work.

Rajkumar (1994) concluded that TQM cannot be implemented without the help of top management commitment and leadership.

Revanna (1995) carried out a survey to assess the understanding amongst the Indian executives, related to the top management and commitment, Quality improvement, Team participation, application of Statistical process control, Quality training, Motivation & Rewards and Customer satisfaction.

Mohanty (1997) analysed the sixteen variables affecting TQM implementation, such as organisation size, top management support, Team building approach, communication, flexibility, organisation goal, structure of planning frame work, infrastructure, management risk taking ability, competitive strategy, Technology policy, customer interaction, employee relation, product design, Vendor relation and compatibility and co-ordination.

Dalu (2000) carried out to investigate quality management in small and medium scale (SMEs).

Sahni (1996) conducted cost/benefit analysis of implementing TQM in the operation of division of biomedical device manufacturing company.

Bayazit (2003) found that important factors for a successful implementation process of TQM are upper management support, employee involvement and commitment, customer focus, quality education and training, teamwork, and use of statistical techniques.
Yassor Al-Zamany (2002) focused on the difficulties and the barriers to the introduction and improvement of TQM.

Eldon (1992) discussed the essences of Total Quality Management (TQM) concept and identifies the principles of successful TQM implementation. It contrasts the Quality Seven (Q7) and the Management Seven (M7) tools commonly used in the TQM process.

2.2 FMEA

Yang and Kapur (1997) noted that FMEA typically simplifies a system into two binary states, success and failure. They pointed out that FMEA does not consider variation in performance and failure times.

Price and Taylor (1998) noted that FMEA is not conducive to the analysis of multiple simultaneous failures.


LT Robb Wilcos (1998) stated that one of the techniques that have been applied in both national and international marine regulations is Failure Mode and Effects Analysis (FMEA).

Huang et al (2000) stated that FMEA is one of the formal techniques for effective product development. Its main purpose is to avoid as many potential failures as possible by identifying them and taking appropriate actions in the early stages of design and development.

Bluvband, ALD Ltd., Beit-Dagan (1998) stated that the main FMEA objective is the identification of the ways in which a product, process
or service fail to meet the critical customer requirements, as well as the ranking and prioritisation of the relative risks associated with specified failures.

Cherrill, Menlo Park, (1999) noted that FMEA is risk identifying technique, which involves life cycle costs, from design to operation. A team of engineers following the traditional FMEA process consider all the possible failure modes of a system component, from design through operation, identify all their causes, and rank their severity, expected frequency and likelihood of detection and calculate the RPN.

Papadopoulo and Grante (2004) described the failure of a component through a network of automatically created fault trees. A fault tree reveals that functional failures or the malfunction at the output of the system are caused by logical combination of failure.

Cherrill and Seung (2002) developed a new methodology called “Life cost based FMEA” to overcome the shortcomings of traditional FMEA. It measures the risk of failure in terms of cost. They carried out a FMEA of a standard electromagnet and identified ten design changes that would improve its reliability. They suggested to measure failure rates and typical fixing times using historical data on systems of components.

Kevin et al (2001) illustrated the characteristics of the process FMEA through a case study of manual application of wax inside the car door. They also described a detailed methodology for conducting PFMEA.

The task of providing error free services is highly challenging because of their intangible nature renders subjective perceptions of quality. FMEA is one of the modern tools to develop such an error free service. Debbie Vermillion (2002) discussed a case where FMEA is adopted for the
service industries like investment management firm. He pointed out the advantages of FMEA.

Zakarjsek and James (1989) performed a study in which several gear failure prediction methods were investigated and applied to experimental data from a gear fatigue test apparatus. Heavy wear, tooth breakages, single pits and distributed pits were the failure modes observed by them. Their results show that prediction methods were able to detect only those gear failures which involved heavy wear and distributed pits.

Kai Xu (2001) presented a FMEA of diesel engine turbocharger system and Lawrence P. Chao and Kosuke Ishii (2004) developed product development worth to illustrate the feasibility of such techniques.

FMEA plays an important and vital role in medical field. Medical devices should be free from defect and the severity should be low. Daniel Kamn (2005) proposed a new methodology of FMEA. He analysed the risk involved in defective medical devices. He divides the risk into three categories such as intolerable risk, alarm risk and broadly acceptance risk. The author found that the broadly acceptable risk is in very high proportions compared to the other two.

2.3 LEAN MANUFACTURING

Fawaz and Rajagopal (2007) described a case where lean principles were adapted for the process sector for application at a large integrated steel mill. Value stream mapping was the main tool used to identify the opportunities for various lean techniques. They also described a simulation model that was developed to contrast the “before” and “after” scenarios in detail, in order to illustrate to managers the potential benefits such as reduced production lead-time and lower work-in process inventory.
Narasimhan et al (2006) have sought clarification and empirical validation of lean manufacturing and agile manufacturing paradigms in manufacturing plants. Through analysis, they have identified plant groups whose characteristics accord well with the descriptions found in the lean and agile manufacturing industries. The data distinguishes the lean performing plants from low performing plants based on performance. Agility appears to represent a higher state of plant performance. The results of this study provide a foundation on which the strategic roles and impacts of lean and agile plant types can be assessed.

Ahlstrom (1998) examined whether any sequence of manufacturing improvement initiatives exists and what these sequences are. The author groups the principles of lean production into four categories, depending on when management devoted effort and resources to the principles.

Van Aken et al (2002) described the application of VSM to analyse and redesign a project-based engineering process in the technical studies and installation department in the Belgian armed forces. VSM provides a framework to operationalise lean manufacturing concepts to reduce lead-time and improve workflow. They have demonstrated how VSM can be applied to engineering design process.

Bicheno et al (2001) pinpoints wasteful activities in the supply chain and in later stages have developed solutions for this.

Implementing lean manufacturing systems has become a driving force for achieving low cost production in today’s manufacturing environments. The goal of lean manufacturing systems include reducing work-in-process, reducing non-value added production time, and reducing total operating costs to achieve a more agile and flexible production system.
Converting processes from ‘mass’ to ‘lean’ systems can reduce excessive WIP and increase process flexibility (John 1998)

Van Till (2005) had presented the development and implementation of lean manufacturing in the manufacturing facility of Nustep, Inc., USA. Several sources of waste in the manufacturing system were identified and suggestions for reducing them were presented. The solutions were more focused on continuous improvement, rather than recommending major redesigns of the manufacturing system.

Shah and Peter (2007) addressed the confusion and inconsistency associated with ‘lean production’. They have attempted to clarify the semantic confusion surrounding lean production by conducting an extensive literature review using a historical evolutionary perspective in tracing its main components. This research takes an initial step toward clarifying the concept of lean production and develops and validates a multi-dimensional measure of lean production. Further the authors also postulate four ‘bundles’ of inter-related and internally consistent practices viz., JIT, TQM, TPM and Human Resource Management (HRM). They empirically validate these bundles and investigate their effects on operational performance.

A central tenet in the theory of lean production is that the implementation of lean practices will reduce waste and thereby decrease costs. However, not all lean implementations have produced such results. Browning and Heath (2008) explored how novelty, complexity, instability and buffering affect the relationship between lean implementation and production costs. Elimination of tasks will not guarantee cost reduction, and lean may provide even greater value by incorporating some aspects of agile manufacturing.
Rubio and Corominas (2008) analysed a production management model that considers the possibility of implementing a reverse logistics system for remanufacturing end-of-life products in a lean production environment (as opposed to models that use EOQ approaches).

Lean production not only successfully challenged the accepted mass production practices in the automotive industry, significantly shifting the trade-off between productivity and quality, it also led to a rethinking of a wide range of manufacturing and service operations beyond the high-volume repetitive manufacturing environment. The book “The machine that changed the world” authored by James et al (1990) has become one of the most widely cited references in operations management. This book played a key role in disseminating the concept worldwide.

Holweg (2006) sets out to investigate the evolution of the research at the MIT International Motor Vehicle Program (IMVP) that led to the conception of the term “lean production”. Furthermore, the paper investigates why despite the pre-existing knowledge of JIT, the program was so influential in promoting the lean production concept. Based on the iterating series of interviews with the key authors, contributors and researchers of the time, this paper presents an historical account of the research that led to the formulation and dissemination of one of the most influential manufacturing paradigms of the recent times.

The North East Productivity Alliance (NEPA) has disseminated selected lean manufacturing tools and techniques into companies in the North East of England. The aim of NEPA is to help companies improve productivity through applying lean manufacturing management practices and knowledge. The NEPA programme has enabled companies to significantly improve their performance and competitiveness (Colin and Christian 2008).
2.4 QFD AND FMEA

Shahin (2004) explained about the integration of FMEA and the Kano model in which, he proposed to enhance the FMEA capabilities through the integration with Kano model. This involves the current approaches for determination of severity and risk priority number through classifying severities according to customer perceptions. The proposal approach enables designers to prevent failure at an early stage of design based on customer’s requirements.

Barnard (1996) explained about the linkages between QFD and FMEA and he made an emphasis on linkages of these tools. It was explained how these linkages will help to improve the quality of the product.

Mcelroy (1989) explained about the construction of house of Quality which transforms customer requirements into technical descriptors. The various steps for the construction of house of Quality were discussed.

Mill (1994) discussed the Enhancement of quality function deployment in Quality improvement of the product. QFD can be a powerful technique if appropriately applied. However it can generate a great deal of paper work and sometimes the benefits are disappointing. It presents a number of analysis tools which should be used in conjunction with QFD. These tools provide enhancements which help to understand the nature of the product and demonstrate how to use QFT more effectively.

Brown (1991) emphasised on the voice of customer which echoed in the product development. It was discussed how the voice of the customer will be addressed properly by clearly identifying the various customer requirements in order to improve the Quality of a product.

Ginn and Jones (1998) explained about the interface of QFD/FMEA and placed an emphasis on their common features. They concluded that QFD and FMEA are more than just technical tools, but are in practice communication tools that act as the catalysts to spark off teamwork and in doing so enable a companywide cross functional multidisciplinary network of teams that share likeminded goals that in turn foster a broader
TQM culture. The specific benefit of QFD and FMEA team cross functionality is the ability to step outside the organization structure and look at new product planning and problem solving issues.

Majed Al-Mashari (2005) explains the essential linkages between external and internal customers to suppliers. The author tells about the linking of some seven-quality tool techniques including QFD as the core link.

Braglia (2007) explains the extension of QFD or house of quality concepts to reliability. The author explains about the translation of customers’ requisites into functional requirements for the product in a structured manner based on FMEA. It then allows it to build a completely new operative tool named ‘house of reliability.’

Bill Gaw (2001) stated that now-a-days companies feel the need to right size, become leaner, be more agile, time-based, faster, stronger, smarter, cheaper and better than their competitors.

2.5 ISO 9000

Hoyle (2000) mentioned about ISO that for some it conjures up mountains of paper work, bureaucratic procedures, form filling and non-value added activities and to others it is just a common sense merely codifying principles that have been applied by successful businesses for generations.

Dennis (2005) stated that the viewing of lean implementation across the entire enterprise minimises the possibility of overlooking opportunities for further performance improvement. A silo view of lean implementation may allow gaps in performance to persist with no one assuming responsibility for the entire enterprise. Employing lean principles can improve performance through quality, on time delivery and customer satisfaction.
Freire et al (2002) mentioned that an improvement methodology is proposed for the design process in construction projects. Based on concepts and principles of lean production, the methodology considers the design process as a set of three different models—conversion, flow, and value. According to the authors, the four stages necessary to produce improvements and changes are (i) diagnosis/evaluation (ii) change implementation (iii) control and (iv) standardisation. The methodology suggests the application of the seven tools in accordance to their specific needs (detected and desired) on five potential areas of improvement viz., client, administration, project, resources and information.

Marshall (2002) had undertaken a study on quality and lean in which he discusses the backgrounds and contents of the ISO standards and lean initiatives. In his findings, there are certain characteristics of both tools that would leave one believing that a conflict would arise that could lead to discrepancies in quality audits or slowness in implementation of lean-driven change.

One potential conflict of considerable interest is how the quick changes resulting from kaizen events in lean would exist with the traditional documentation and heavy requirements associated with ISO certification. From the case studies, it is noteworthy that none expressed any conflict between their ISO certification and lean initiatives. In fact, all the companies discussed how the two tools complemented each other. The companies did, however, express common hurdles that had to be overcome through proper approach.

Anagappa et al (2003) asserted that productivity and quality are an integral component of organizations’ operational strategies. Productivity continues to play an important role both at the macro and micro levels. At the micro-level, firms continue to use productivity as a performance measure to
benchmark against the best-in-class companies with the objective of identifying best practices. Quality management has become an important part of management culture, particularly in new enterprises which are characterised by supply chain, e-commerce and virtual enterprise environments.

Shao et al (2006) claim that to prosper in today’s fiercely competitive global marketplace, enterprises especially small and medium-sized ones must strive to provide products with shorter time to market, lower cost, higher quality, and better customer satisfaction. Quality management plays a vital role in achieving these goals.

Stanley et al (2003) the authors of the book on ‘Fusion management’ state that companies can eliminate wide variation in quality program results by fusing strategic, tactical, and operational elements of the previously proposed quality disciplines. The synergies evolve to drive success. The book dissects the major quality management strategies used by these companies today. Fusion management attempts to specify a continuous, ever evolving management system that uses the best of past strategies in a new way, a way that won’t fall into disuse over time. Theories suggest that certification with a management standard may reduce information asymmetries in supply chains and thereby generate a competitive advantage for certified firms.

Terlaak (2006) indicated that the eleven year panel of US manufacturing facilities was assigned to test whether certification with the ISO 9000 quality management standard generates a competitive advantage. Results suggest that certified facilities grow faster after certification, and those operational improvements do not account for this growth. Results also indicate that the growth effect is greater when buyers have greater difficulty acquiring information about suppliers.
James and Daniel (2003) described that lean manufacturing is a
generic process management philosophy derived mostly from the Ford
Production System (FPS) and Toyota Production System (TPS) and also from
other sources. It is renowned for its focus on reduction of the wastes in order
to improve overall customer value. Lean is often linked with six sigma
because of the methodology’s emphasis on reduction of process variation.

Joe Lissenden (1999) a major account manager and BSI EMS
assessor for BSI Inc., the North American division of the British Standards
Institution, a leading registrar of quality management systems had proposed
that by integrating ISO 9001 and ISO 14000 there will be less documentation
and lower implementation cost.

To summarise, it is understood that for the implementation and
application of systems such as TPM/TQM/LM/QMS, many tools which may
be categorised under Quality tools or Management tools are being used. Many
of these tools are used in isolation. Also while the above systems are
implemented separately, some of the steps are to be repeated. Over the last
two decades, good design practices have been formalised into a suite of
techniques, methods and design tools. Examples include QFD, FMEA, fault
tree analysis (FTA).

Hence it will be a worthwhile attempt (i) to fuse some of these tools
and (ii) to integrate some of the systems such as TPM/TQM/LM/QMS.