CHAPTER 2

LITERATURE SURVEY

2.1 INTRODUCTION

During the course of pursuing this research, the literature survey was conducted in four phases. In the first phase, the literature on KM was surveyed. In the second phase, the literature on QC was reviewed. In the third phase, the literature on FMEA was surveyed which was followed by studying the features of TFMEA technique. In the fourth phase, the trend in ISO 9000 certification in world organisations was surveyed. While conducting literature survey during these phases, efforts were made to locate any research linking KM with QC concept, TFMEA technique and ISO 9001:2000 standard. The findings and observations of this literature survey are presented in this chapter.

2.2 GROWTH PATTERN OF KM FIELD

Right from olden days, the world community has been adopting quality as a strategy to face competition (Mehra and Agrawal 2003). However during the recent years there has been a realization that besides quality, the knowledge through creativity and innovation is a necessity to face the competition. As a result of this realization, the field of KM formally evolved from 1990 (Peng et al 2007). The historical review of KM can be seen in Metaxiotis et al (2005). Quiet interestingly they have pointed out that KM emerged from the approaches like TQM, Business Process Reengineering
(BPR) and information systems. Thereafter KM has attracted the attention of both the researchers and practitioners.

For a little long period many researchers have been concentrating on evolving the definition of KM. All these definitions emphasize that KM is the process of creating and excavating knowledge and sharing the same within and outside the boundaries of an organization (Randeree 2006; Hicks et al 2006). During the process of defining KM, the research community had identified two types of knowledge namely tacit and explicit (Kreiner 2002; Mooradian 2005; Srdoc et al 2005; McAdam et al 2007). Tacit knowledge refers to the knowledge implanted in the minds of the people. Explicit knowledge refers to knowledge available in documents and other communication media. A common point revealed by the researchers is that knowledge is the advancement of information. Hence any KM programme shall have to pass through the three stages in succession namely data, information and knowledge (Tiwana 2005; Hicks et al 2006; Randeree 2006). This sequence is depicted in Figure 2.1. A KM programme will be successful if this sequence is incorporated in it.

![Figure 2.1 Stages of knowledge evolution](https://example.com/figure2.1.png)

Despite the fact that KM itself originated from TQM, some researchers have started to work in the direction of applying KM for achieving high degree of quality. For example Choo et al (2007), have demonstrated the method of applying KM in continuous quality improvement programmes such as TQM, ISO 9000 and Six sigma. Another paper by
Jones et al (2003) has indicated the use of the term knowledge champions in KM arena. The terminology ‘champion’ is familiar in ‘six sigma’ research and practice (Banuelas et al 2006; Lee-Mortimer 2007; Pandey 2007). This fact leads to an inference that KM field witnesses the shadowing of continuous quality improvement programmes on it. This development indicates that KM researchers are coming closer to continuous quality improvement programmes.

2.3 BIRTH AND GROWTH OF QUALITY CIRCLE PRINCIPLES

One of the fundamental tenets of TQM envisages the involvement of all personnel working in the organization, to achieve higher degree of quality (Dale et al 1997). In order to exercise this tenet, Ishikawa introduced the principles of quality circles into Japan during 1960s (Goulden 1995). In essence, quality circle principles call for creating an atmosphere in the organizations for enabling all levels of employees to volunteer and form groups to solve quality related problems and failures (Devadasan et al 1999). Each group is called as quality circle and the employees associated with these groups are known as members (Sillince et al 1996).

Before Ishikawa brought out quality circle principles, both managerial and non-managerial employees were physically and psychologically separated in organizations. Initially, there was resentment among managerial employees for enabling non-managerial employees towards participating in quality circle meetings for solving quality related problems and failures. Even there was a myth that quality circle principles would work well only in Japanese companies. In spite of these developments, quality circle principles spread across the world and to all types of organizations (Sillince et al 1996).
Quality circle principles were largely adopted in manufacturing organizations during the early years of their propagation. Later quality circle principles spread all over the world (Metri 2006). Despite this phenomenal growth, there has been no significant appreciation about the power of quality circle programme among both researchers and practitioners. Time and again quality circles were subjected to controversies regarding their success and failure (Millson et al 1996).

2.4 SUCCESS AND FAILURE TRENDS OF QUALITY CIRCLES

The success of quality circles in Japanese companies is attributed to cultural factors (population homogeneity and group mentality), human resources management practices (lifetime employment and use of employee participation in decision making), and production management techniques (the zero defect production system concept) (Sathasivam et al 1996). A comparison of the Fortune 1,000 studies done in 1987 and 1990 shows that quality circles were increasing during 1980s (66 per cent of organizations used them in 1990) (Lawler 1992). At the same time, the demerits of quality circles are also reported. For example, morale in Toyota’s QCs has been low due to increasing physical and mental strain on QC members (Cole 1979). Griffin (1988) and Lawler (1992) have also emphasized the importance of top and middle management support for a long-term survival of QC programme.

Frequent studies carried out by the experts indicate that many firms, located in different parts of the world, and especially other than Japan have experienced that, in all, about one third of QCs are outstanding, another one third perform with average success rate and the remaining often fail (Hutchins 1985; Ambali 1984 and Udpa 1986). Walker (1992) and Brennan (1992) have listed the following reasons for the failure of quality circles:
i. Not enough resources  
ii. Focus is only on production  
iii. Limited definition of improvement  
iv. Quality circles cannot be assimilated easily into existing power structure  
v. Middle managers see quality circles as a threat.

Walker (1992), Gray (1993) and Fabi (1992) have proposed the following requirements for successful quality circles:

i. Focus on educating workers about the organization  
ii. Focus on formulating goals  
iii. Focus on participation  
iv. Rewards integrated into organization reward system  
v. Top management support  
vi. Clear goals  
vii. Organizational communication system  
viii. Members’ commitment  
ix. Support of management  
x. Training  
xi. Organizational stability (absence of financial difficulties)  
xii. Briefing non-quality circles members about the work of quality circles.

Although it is reported that one third of quality circles has failed due to several reasons, its fast adoption in the world till 1980s indicate their prowess.
2.5 NEED OF APPLYING KM IN QUALITY CIRCLES

Because of its sustenance over five decades amidst the emanation of various philosophies, it can be inferred that quality circle model has been successful in organizational arena. Quality circles have been responsible for bringing non-managerial employees to the discussion tables and contributing practical knowledge through efficient communication media (Zetie 2002). Though this is a commendable development, it has become imperative to absorb the knowledge explosion that has been taking place throughout the world during the recent years.

Although quality circles have been instrumental in unearthing practical and theoretical knowledge, it should be noted that those knowledge emanate only from within the company who work in team (Zarraga-Oberty and Perez 2006). This is highly inadequate as today’s companies are nourishing knowledge and competing with each other to enter and sustain in global market (Bhatt 2002). Hence the quality circles must facilitate a process by which the knowledge from any part of the world is brought out to solve quality related problems. In order to meet this requirement, it is now required to infuse IT into the operational characteristics of quality circles. However the knowledge available in IT platforms is so exhaustive that a single and/or group of persons cannot appropriately shortlist and collect the most suitable one. Hence blind adoption of IT in quality circle programme will not meet the globally competitive knowledge requirements of today’s business. Therefore the principles of KM have to be incorporated with that of quality circles. Such kind of integration must allow the members who are dispersed around the world to share their knowledge towards solving quality related problems.
2.6 BIRTH AND GROWTH OF FMEA

A historical review of literature indicates that FMEA was developed at defense laboratory in the USA in early 1950’s (Dhillon 2003). Afterwards FMEA was applied by several companies situated in different parts of the world (Yang et al 2006; Teng et al 2006). The unique feature of FMEA is the quantification of failures using three aspects namely occurrence, severity and detection (Sharma et al 2007). The product of these quantified values in terms of the percentage is referred to as Risk Priority Number (RPN) (Dong 2007).

Actions have to be suggested to ensure that the RPN value is reduced to a minimum. Thus FMEA facilitates the recording of the failures and taking actions to reduce or eliminate their severity and occurrence (Tay and Lim 2006). No other technique has so far facilitated such kind of systematic approach for preventing the failures. Hence the organizational frontiers who had been thirsting for techniques to achieve continuous quality improvement were attracted to the FMEA technique during 1970’s. As a result a FMEA has penetrated into organizational scenario to some extent (Devadasan et al 2003).

At one point of time, Ford adopted FMEA as a continuous quality improvement tool (Teng et al 2006). At this stage, FMEA was included in QS 9000 standard (Stephens 1997; Fong and Antony 2001). Thereafter the momentum of FMEA implementation in organizations accelerated. During the early stage of FMEA’s emergence, its scope was restricted to design and production functions. Accordingly, during those days, professionals had identified only two types namely design and production FMEAs. Later on, both researchers and practitioners included the other functions such as marketing, finance and service under the purview of FMEA (Stamatis 1997).
2.7 EMANATION OF TFMEA TECHNIQUE

Although FMEA had been widely applied (Sokovic 2005), researchers and practitioners have time and again been questioning the credibility of FMEA. For example (Shahim 2004) has questioned the usefulness and correctness of RPN. Likewise non-consideration of relative importance of the factors while calculating RPN and non-consideration of the linearity of the scores are some of the drawbacks indicated by the researchers (Chang et al 2001). In this context, during this research work, it was decided to adopt a modified FMEA which would be simple and effective in preventing the failures and leading to continuous quality improvement. Accordingly TFMEA technique contributed by Devadasan et al (2003) was adopted. In TFMEA, RPN is replaced by the awarding of ranks to the failures using the Likert’s scale. FMEA table is replaced by TFMEA table. Each TFMEA table accommodates the associated departments and the ranking of their roles in overcoming the problems.

A unique feature of TFMEA is that, it facilitates spontaneous team formation. TFMEA enables the gathering of knowledge within the organization. During the past two decades, the world has experienced globalization which has envisaged the deployment of knowledge available throughout the world in local systems (Davis et al 2005). As a result the knowledge explosion has been occurring in the world (Randeree 2006). Hence TFMEA is also required to be designed to accommodate global knowledge for recording, analyzing and preventing the failures. For this purpose the contribution of researchers and practitioners in KM arena shall have to be suitably adopted and integrated with TFMEA.
2.8 RESEARCH ON LINKING TFMEA WITH KM

When the interest was developed to link KM to TFMEA, efforts were made to identify any research on failure prevention in KM field. To begin with, FMEA and KM based articles were searched. The result indicated the absence of any research linking FMEA and KM. Only exception to this claim is the appearance of the paper Ferrari and de Toledo (2004) in which the application of FMEA in KM process is recommended. Since TFMEA was a model of reference in this research, a search was made to identify any research linking TFMEA with KM. This research also showed that there has been no research pursued to link TFMEA with KM. In this background it was inferred that a research leading to the integration of KM with TFMEA technique would be useful to both theorists and practitioners.

2.9 BIRTH OF ISO 9000 SERIES QUALITY SYSTEM STANDARDS AND CERTIFICATION

The need for a system for achieving continuous quality improvement was emphasized as early as 1954 by Feigenbaum (Logothetis 1997). However, till 1980’s, the practitioners did not recognize the need for installing quality system. This trend totally changed when BS 5750 standard was released by British Standards Institution in the year 1979 (Zeng et al 2007). Subsequently British organizations started to adopt BS 5750 as a means to install the system for achieving continuous quality improvement (Patel 1994). Within few years, several researchers reported the benefits of implementing BS 5750 in British organizations (Patel and Randell 1994; Yusof 1995).

On observing the success of BS 5750, International Organisation for Standardization (ISO) released its ISO 9000 series quality standards in the
year 1987 (Quazi et al 2002; Tan et al 2003; Magd 2006; Zeng et al 2007). Because of this international standardization, many importing organizations began to insist their suppliers to obtain ISO 9000 certification (Kartha 2004). Due to this compulsion, the companies implementing ISO 9000 series standards increased phenomenally.

On seeing the tremendous growth of ISO 9000 certification, a large number of researchers began to work on examining the credibility of these standards (Conti 2004). Some of the researchers reported the benefits while the others pointed out the drawbacks of installing quality systems based on these standards (Gingele et al 2002; Pokinska et al 2002; Zeng et al 2007). This trend leads to an inference that ISO 9000 era has emanated in succession to quality era (Magd 2006).

Although scant reports on certain deficiencies of ISO 9000 certification have emerged in the literature era, the power of ISO 9000 certification in spreading its wings across the globe among any type of organization deserves special recognition and attention (Yahya and Goh 2001; Pokinska et al 2002; Coleman and Douglas 2003; Saraiva and Duarte 2003; Briscoe et al 2005).

2.10 TREND OF ISO 9000 RESEARCH

ISO revised its 9000 series standards in the year 2000 by clearly specifying the steps for achieving ‘continual’ rather than ‘continuous’ quality improvement (Tsim et al 2002; Chin et al 2004). Because of the clarity in presentation, ISO 9000:2000 series standards are lauded by the contemporary researchers. These researchers’ emphasis on the power of ISO 9001:2000 standard has been vociferous. (Boulter and Bendell 2002; Gotzamani and Tsitras 2002; Douglas et al 2003; Quazi et al 2004; Vouzas and Gotzamani
The practitioners also have been appreciating the latest version of ISO 9000:2000 series standards. As a result, during the recent years, the number of organizations going for ISO 9000 certification has been exponentially increasing (Pokinska et al, 2002).

The trend is reported by Saraiva and Duarte (2003), Briscoe et al (2005) who have traced the growth of ISO 9000 certification from the year 1993 to 2001. More recently, Chin et al (2004) and Singh et al (2006) have reported till the end of the year 2002, that little more than five lakhs companies throughout the world have obtained ISO 9000 certification. Hence, it appears that any research attempting to exploit the power of quality system will evolve good results if it is integrated with ISO 9001:2000 standard.

2.11 GROWTH OF ISO 9000 RESEARCH TOWARDS KM AND VICE VERSA

Presumably on realizing the power of KM principles and ISO 9001:2000 standard, very few researchers have started to work in the direction of integrating them. It appears that Heng (2001) is the first researcher who has emphasized the need of exploiting ISO 9001:2000 standard for evolving critical knowledge in an organization. He has tabulated twenty elements of ISO 9001:1994 standard and the critical knowledge and intellectual capital that arise from them. Although there has been no sign of any further research pursued in this direction, Hellstrom and Husted (2004) have referred the arguments of Heng (2001) while reviewing the literature. These two articles have not indicated the systematic conversion of data into information and then information into knowledge, which constitute the three stage process of KM (please see Figure 2.1) (Galliers and Newell 2003; Tiwana 2005). However this kind of emphasis is peripherally seen in Lin and Wu (2005). These authors have used quality information system and
enterprise resource planning as the pathways for integrating KM with ISO 9001:2000. Similar to this direction of research Heng (2001) has indicated the possibility of extracting knowledge and its management through ISO 9001:2000 standard. They have also indicated the need of IT infrastructure for managing knowledge through ISO 9001:2000 processes. Although Lin and Wu (2005) have reported advanced research on Knowledge Managed ISO 9001:2000, its development is not complete with the KM process and knowledge portal. Hence a research involving the advancement of ISO 9001:2000 by applying KM process and developing a knowledge portal has become a need of the hour.

2.12 CONCLUSION

During the beginning of literature survey reported in this chapter, the concepts and research trend of KM were derived. With this foundation, the birth and growth of QC concepts, TFMEA technique and ISO 9000 series standards were studied from the peer reviewed papers. Out of these three approaches, QC is the oldest of all. Once it was popular among the world community. Though today it is not visible remarkably in organizations, its principles are applied in the name of kaizen and self managing teams (Juran and Gryna 1997; Brunet and New 2003; Devadasan et al 2007).

The newest among all the three approaches is TFMEA technique. Though its adoption is seen in literature only in few papers, its capability in creating teams spontaneously for preventing the occurrence of failures is laudable. Among the three approaches, ISO 9000 certification is moderately new. However unlike QC and TFMEA, the pace of ISO 9000 certification keeps accelerating in the world. In this context, the research trend on integrating KM with these three approaches was studied in the literature.
It has been found that no research has so far been conducted integrating KM with QC concepts and TFMEA technique. This trend is slightly different in the case of ISO 9000 certification. In this case, it is found that the researchers have just started to realize the importance of developing Knowledge Managed ISO 9001: 2000 based Quality Systems. The fundamental work has been carried out in this direction by Lin and Wu (2005). However, no researcher has worked in the direction of amending the KM principles with ISO 9001: 2000 standard and examining its performance in real time scenario. The observations of the literature survey reported in this chapter are presented in a nutshell in Table 2.1.

**Table 2.1 Findings and inferences of the literature survey**

<table>
<thead>
<tr>
<th>Research area</th>
<th>Papers on QC</th>
<th>Papers on TFMEA</th>
<th>ISO 9000 Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papers on KM</td>
<td>No papers linking KM and QC are found</td>
<td>No papers linking KM and TFMEA are found</td>
<td>Paper by Lin and Wu (2005) links KM with ISO 9000 certification is found</td>
</tr>
<tr>
<td>Inference</td>
<td>No research linking KM and QC has so far been conducted</td>
<td>No research linking KM and TFMEA has so far been conducted</td>
<td>Research linking KM with ISO 9000 certification has just started</td>
</tr>
</tbody>
</table>

On the whole, the absence of any concrete research on integrating KM with QC concepts, TFMEA technique and ISO 9000 certification motivated the author of this thesis to proceed towards designing the three integrated models reported in this thesis and studying their implementation aspects.