CHAPTER 1

INTRODUCTION

In the changing business Scenario, every manufacturing company strives hard for survival in this growing era of core competence. The survival of manufacturing company in the domain of core competence is possible only when it rolls out the red carpet welcome to the state-of-the art world class manufacturing system. For going global, world class manufacturing system needs to be designed in a way to gain the driving force to do the best in the field of competitive priorities of quality, price, flexibility, delivery speed, innovation, and time. This study was designed to throw a light on the minds of the leaders of manufacturing companies in Chennai regarding WCM System and to assess their impressions of what world class manufacturing means to them, and how far they think they have come towards achieving that accreditation. This chapter comprises of a theoretical framework on World Class Manufacturing (WCM), the contributions of study to the current knowledge, the statement of problem, the research questions and objectives, the significance of research, the chapter scheme and summary.

1.1 THEORETICAL FRAMEWORK

This section consists of preamble of WCM, concept of WCM, the raise of WCM, Hayes and Wheelwright’s perspectives, recent perspectives, new manufacturing practices, trade-off perspectives, and definition of WCM.
1.1.1 Preamble

The rapid changes in business environment due to its unique characteristics, the increase of international competition among companies, shrinkage of markets, and diffusion of the information technology have put pressures on manufacturing companies to continually adopt world class manufacturing system. In fact, there is a constant search for new ways to achieve a competitive advantage through new manufacturing techniques. Therefore, increasing knowledge and coordination of the company’s processes that crosses its manufacturing functions becomes a main requirement of many companies seeking a competitive advantage. Undoubtedly, some developing countries such as India have, therefore, made manufacturing management their prime agenda. They are going through a process of restructuring their manufacturing systems to emphasize competition, integration with global markets and increasing level of privatizations.

Global competitors operating in global markets almost always tend to have world-class performance. World class manufacturing (WCM) has often been characterized by three core strategies of customer focus, quality, and agility (i.e., the ability to quickly, efficiently and effectively respond to changing requirements of the customers), and six supporting competencies: Employee Involvement (EI), Supply Management, Technology, Product Development, Environmental Responsibility and Employee Safety, and Corporate Citizenship (Kinni 1996). Thus, in order to compete in global markets, Indian manufacturing necessarily needs to acquire world-class performance.

World class manufacturing is an integrated approach required to gain a driving force in the competitive edge of every operation of the company, which is required for producing standardized products of
international repute to meet global requirements effectively. International competition for manufacturing companies has become more fierce throughout a couple of years. Despite the intense global competition, manufacturing companies need to adopt WCM technology to compete globally with more success for retaining both domestic and international markets. Manufacturing Companies that strive to meet their competition should integrate organizational resources (material, human, financial, technological and informational) effectively and efficiently to develop competitive advantages, which are required for improving efficiency and productivity, improving management control, or producing high quality products to meet global competitions successfully (Anand Sharma 2005).

This study taps into the minds of the leaders of manufacturing companies in Chennai to assess their impressions of what world class manufacturing means to them, and how far they think they have come towards achieving that accreditation. It is also designed to highlight the impact of WCM practices, Lean Initiatives, TQM Principles, IT Systems/Applications, and Maintenance Practices on the competitive advantage of the manufacturing companies and to explore the driving and resisting forces toward the effective implementation of WCM practices and principles.

1.1.2 Concept of World Class

World class sounds like an easy concept to understand. Everyone knows what world class means, but few are among the best in the world at what they do. Unfortunately for manufacturers, there is no universally accepted dictionary definition. Everyone has a different interpretation of what world class means in the world of business. World Class Company is a company that sells the most, makes the best, or makes it quicker than anybody else or it is a combination of these things. The whole concept started out when
Toyota was doing exceptionally well in the 1970s and 80s when everybody else was struggling. World class manufacturers are those that demonstrate industry best practices. To achieve world class status, companies should attempt to be the best in the field of quality, price, delivery speed, delivery reliability, flexibility and innovation. Companies should therefore aim to maximize the business performance in these areas in order to maximize their competitiveness in the market.

1.1.3 The Raise of World Class Manufacturing (WCM)

The term ‘World Class Manufacturing’ was first coined by Hayes and Wheelwright (1984). Since then, the concept has been embraced, expanded and enhanced by a number of authors, who have reinforced some of Hayes and Wheelwright’s ideas and added some new practices. Hayes and Wheelwright’s work on world class manufacturing is important to the field of operations strategy for several reasons. First, Hayes and Wheelwright were the first authors to use the term ‘world class manufacturing’, laying the foundation for the work of countless future authors. This is particularly important due to the credibility associated with the work of Hayes and Wheelwright because of their seminal work in the area of operations strategy (Hayes and Wheelwright 1979 and 1984).

Second, Hayes and Wheelwright described world class manufacturing as a set of practices, implying that the use of best practices would lead to superior performance. This practice-based approach to world class manufacturing has been echoed by numerous authors since then. For example, Voss (1995) describes world class manufacturing as a subset of the ‘best practices’ paradigm of operations strategy. Much of the study of Japanese manufacturing in recent years has also focused on the discernment and use of best practices. Third, Hayes and Wheelwright were among the first authors in the operations management arena to address the issue of tradeoffs...
vs. synergies in manufacturing performance, building on the earlier work of Skinner (1969). They made a substantial contribution to this debate by arguing that it was important to have a clear set of priorities between the dimensions of competitive performance because it was potentially dangerous to try to achieve superior performance on multiple dimensions simultaneously. This debate continues to rage, particularly in the strategic management field.

The term “world class manufacturing” was initially used by Hayes and Wheelwright (1984) to describe the capabilities which had been developed by Japanese and German companies, as well as the US firms which had competed equally with the Japanese and German firms. The term “World Class Manufacturing” was used because these firms have achieved an outstanding performance in their global competition, resulting in their being described as “World Class”. However, the term became popular only after Schonberger (1986) discussed it as “…the term nicely captures the breadth and the essence of fundamental changes taking place in industrial enterprises.”

1.1.4 Hayes and Wheelwright’s Perspectives

Although Hayes and Wheelwright are primarily known for their set of stages of manufacturing’s strategic role in the organization (1984), their framework for manufacturing strategy structure and infrastructure (1984) and their product-process matrix (1979), they were also the first to use the term ‘world class manufacturing’. Since then, the term has been used and popularized by many other authors. Hayes and Wheelwright’s description of world class manufacturing focuses on six practices, some of which are taken for granted today and others which seem fairly unique. There are marked differences between Hayes and Wheelwright’s set of practices and those described by recent researchers in this area. Given the dramatic changes
which have taken place in the global manufacturing arena since 1984, is Hayes and Wheelwright’s set of world class manufacturing practices still relevant? Will they be more effective if used in concert with additional, more recently popularized practices?

Hayes and Wheelwright (1984) developed their concept of world class manufacturing based on indepth analysis of the practices implemented by Japanese and German firms, as well as U.S. firms which had competed equally with the Japanese and German firms. The term ‘world class manufacturing’ was used because these firms were associated with outstanding performance in their global industries, resulting in their being described as ‘world class’. Hayes and Wheelwright found that there were many commonalities between these highly successful firms, arguing that the key to building competitive strength is related to six world class manufacturing practices, summarized in Table 1.1.

Hayes and Wheelwright found that, relative to firms in Germany and Japan, U.S. firms had neglected workforce skills and capabilities. They recommended a proactive stance on the part of U.S. manufacturers, focusing on apprenticeships, internal training institutes and cooperative arrangements with vocational technical institutes. They also found management technical competence lacking, relative to Japan and Germany, making management of cutting edge manufacturing a significant challenge. In addition to providing technical training for managers, they suggested developing more managers with engineering or technical degrees, and rotating managers through technical functions in their organizations.
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<th>Sl.No.</th>
<th>Dimension</th>
<th>Rationale</th>
<th>Practices</th>
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| 1.    | Workforce skills and capabilities       | U.S. firms have neglected development of workforce skills and capabilities; this should not be left to the schools | • Apprenticeship programs  
• Cooperative arrangements with vocational technical institutes  
• Internal training institutes  
• Extensive advanced training and retraining beyond entry level, focusing on skills, work habits and motivation |
| 2.    | Management technical competence         | U.S. firms experience technical weakness among their managers             | • Ensure a significant number of managers have engineering or technical degrees  
• Train potential managers, early in their careers, in a variety of technologies important to the firm  
• Rotate managers through various functions, to broaden their experience |
| 3.    | Competing through quality               | U.S. firms need to focus on what is important to customers                | • Seek to align products and processes to meet needs that are important to customers  
• Long-term commitment to quality  
• Strong attention to product design  
• Involvement of all functions in product design and quality improvement |
| 4.    | Workforce participation                 | Real participation is more than simply putting employees into teams       | • Develop a culture of trust between workers in various departments and between workers and management  
• Routine, close contact between management and workers  
• Develop participation policies to ensure that ‘We’re all in this together’ |
| 5.    | Rebuilding manufacturing engineering    | Unique capabilities of equipment can’t be copied                          | • Invest in proprietary equipment  
• Bolster ability to perform sophisticated maintenance, process upgrades and continuous improvement of existing equipment |
| 6.    | Incremental improvement approaches      | Win the race by creating a constantly escalating standard                | • Continuous improvement in small increments  
• Continually adapt to changes in customer needs |

(Adapted from Hayes and Wheelwright (1984), pp. 375–385)
Although Hayes and Wheelwright called the third practice competing through quality, their definition is substantially narrower than recent definitions of quality management, focusing primarily on the product design function, with customers as the drivers of quality. In terms of workforce participation, Hayes and Wheelwright emphasized that development of true worker participation moves beyond simply putting employees into teams, focusing on culture change and policies which support employee participation.

Hayes and Wheelwright’s fifth practice, rebuilding manufacturing engineering, describes the internal development of equipment with unique characteristics, which is difficult for competitors to copy. They also stressed the importance of developing employees’ ability to maintain and improve their own equipment. Finally, Hayes and Wheelwright speak of ‘Tortoise and Hare’ approaches to competition, or incremental improvement approaches. While U.S. firms have traditionally pursued strategic leaps as a means of manufacturing improvement, they suggest that world class competitors pursue continuous improvement in small increments, winning the race by creating a constantly escalating standard.

1.1.5 Recent Perspectives

More recent authors have developed their own descriptions of world class manufacturing practices, often building on new manufacturing practices, such as quality management and JIT. In the following section, we examine two recent descriptions of world class manufacturing, both based on extensive observation in world class firms, representing the state of the art in world class manufacturing practices. The first was developed by Schonberger (1986, 1990a,b and 1996), who provides a list of 16 principles of world class manufacturing. Many of these correspond to Hayes and Wheelwright’s practices, although not necessarily directly. A comparison of Hayes and
Wheelwright’s prescriptions with Schonberger’s principles is contained in Table 1.2. In addition, we consider the work of Giffi et al (1990), who summarizes the attributes of world class organizations. Those which are related to Hayes and Wheelwright’s practices are also summarized in Table 1.2.

1.1.5.1 Workforce Skills and Capabilities

Schonberger emphasizes the importance of employee development, focusing primarily on internal means of development, such as cross-training, job rotation and reinforcement of employee development accomplishments, through rewards and recognition. Giffi, Roth and Seal’s attributes are somewhat broader, suggesting that employee skill development should progress in tandem with technology development, and that rewards should be based on the ability to achieve meaningful goals. Thus, employee development continues to be an important part of world class manufacturing practices. However, its focus has moved beyond training to include job rotation, cross-training, rewards and recognition, and linkages with the firm’s strategy.

1.1.5.2 Management Technical Competence

Although Hayes and Wheelwright emphasize the importance of having managers with a technical background, this practice is largely ignored by Schonberger. Giffi, Roth and Seal approach this practice only in the broadest sense, stating that a new knowledge base is required as advanced technology is installed. Thus, recent descriptions of world class manufacturing practices lack the suggestion that management would benefit from an engineering or technical background, acquired through education, training or job rotation.
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<th>Sl.No.</th>
<th>Hayes and Wheelwright’s world class</th>
<th>Corresponding Schonberger principles</th>
<th>Corresponding Giffi, Roth and Seal attributes</th>
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| 1.    | Workforce skills and capabilities  | *Principle 8:* Continually enhance human resources through cross-training, job and career-path rotation and improvements in health, safety and security  
*Principle 9:* Expand the variety of rewards, recognition, pay and celebration—to match the expanded variety of employee contributions | • Promote and measure knowledge and skill development  
• Invest in people; develop a pattern for updating workforce skills and capabilities consistent with the evolution of technology within the organization  
• Seek ways to liberate the teams from traditional organizational controls, and reward and motivate, based upon ability to achieve meaningful goals |
| 2.    | Management technical competence  | —                                   | • Identify the competitive advantage of the knowledge base that advanced technology can create; simultaneously implement new technology and develop the new knowledge base |
| 3.    | Competing through quality         | *Principle 1:* Team up with customers, organizing by families of customers or products (what customers buy/use)  
*Principle 7:* Operate close to customers’ rate of use or demand | • Define quality in terms of the customers’ needs. Make customer closeness the number one priority  
• Integrate the concept of customer closeness into the organization so that everyone in the organization has a customer, and everyone’s goal is to provide quality product and service to his or her customer  
• Regard customers as the core of your existence |
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| 4.    | Workforce participation             | *Principle 4*: Frontline employee involved in change and strategic planning—to achieve unified purpose  
          *Principle 11*: Frontline teams record and own process data at the workplace | Dissolve the boundaries between management and worker and between functionally segregated staff units, to create dynamic cross-functional teams charged with resolving both strategic and operational issues  
          Empower teams of workers to carry out the mission of the organization  
          Eliminate the terms ‘supervisors’ and ‘supervision’. Develop leaders who can create and execute the strategic vision through the teams |
| 5.    | Rebuilding manufacturing engineering| *Principle 14*: Improve present equipment and human work before considering new equipment and automation  
          *Principle 15*: Seek simple, flexible, movable, low-cost, readily available equipment and work facilities—in multiples, one for each product/customer family | Develop an investment strategy for the continual enhancement of technology throughout the organization, based on a clearly defined vision of future competitive requirements  
          Carefully plan technological upgrades to be consistent with infrastructural upgrades. Benefits can be achieved only when the infrastructure is capable of integrating and exploiting the technology advantage offered |
| 6.    | Incremental improvement approaches  | *Principle 3*: Dedicate to continual, rapid improvement in quality, response time, flexibility and value  
          *Principle 5*: Cut to the few best components, operations and suppliers  
          *Principle 10*: Continually reduce variation and mishaps | Develop manufacturing operations that are flexible and able to respond rapidly to changes in products and markets  
          Develop measurement systems that encourage continual learning  
          Evaluate the success of your human assets on the basis of their ability to learn, adapt to change, and improve performance within their areas of responsibility  
          Develop accelerated and integrative learning programs |
1.1.5.3  Competing Through Quality

The maxim of designing for customer needs has become a cornerstone of most quality management approaches. Likewise, it is supported by recent descriptions of world class manufacturing. However, while Hayes and Wheelwright focus exclusively on developing products and processes that meet customer needs and involving all functions in product design, Schonberger adds the importance of producing at close to the customers’ rate of use. He also takes the concept of cross-functional design a step further, suggesting organizing the firm by families of customers or products. Giffi, Roth and Seal extend this to the notion of ‘customer closeness’, where every employee has a customer whom he or she personally relates to. They also emphasize the strategic goal of making customers the core of an organization’s existence. Thus, the concept of designing for customer needs continues to be an important world class manufacturing practice. However, it has moved beyond the design function to have organizational and strategic implications.

1.1.5.4  Workforce Participation

Hayes and Wheelwright express concern that many efforts at worker participation are superficial, stressing the need for culture change and policies to ensure that, ‘We’re all in this together’. Schonberger, however, remains at a fairly superficial level in discussing worker participation. He prescribes that employees should be involved in activities such as recording their own process data and in continuous improvement, but offers no suggestions for ensuring genuine involvement. Giffi, Roth and Seal are more specific, suggesting the development of cross-functional teams, elimination of supervisors and other practices for breaking down barriers between workers and management. They also emphasize the important role of good leaders in
the development of team members. Thus, worker participation remains intact in recent world class manufacturing practices. Like Hayes and Wheelwright, Giffi, Roth and Seal express concern that developing genuine worker participation is a challenge, moving beyond the implementation of superficial programs.

1.1.5.5 Rebuilding Manufacturing Engineering

Hayes and Wheelwright consider the development of proprietary equipment to be critical to becoming a world class manufacturer. In fact, it is one of their ‘litmus tests’ of whether an organization has truly achieved world class status, because organizations that develop and maintain their own equipment know more about what is critical to their business than their suppliers. Neither Schonberger nor Giffi, Roth and Seal explicitly address proprietary equipment. Both, however, do address issues related to technology. Schonberger has a strong bias against investments in overly-sophisticated equipment, suggesting investing in the simplest equipment possible and improving present equipment before considering new equipment and automation. This is somewhat consistent with Hayes and Wheelwright’s proprietary equipment practice; by developing proprietary equipment, a firm can customize it to its unique needs, rather than purchasing unneeded capabilities. Giffi, Roth and Seal, on the other hand, do not discuss the level of sophistication of technology investments. Rather, their attributes focus on appropriate ways for developing the infrastructure to support technology, at whatever level it may be. Thus, proprietary equipment, per se, is not a part of recent descriptions of world class manufacturing. This represents a major departure from Hayes and Wheelwright’s practices, since they consider it to be a cornerstone of world class manufacturing.
1.1.5.6 Incremental Improvement Approaches

Hayes and Wheelwright are quite vague in their discussion of incremental improvement approaches. Schonberger and Giffi, Roth and Seal build upon Hayes and Wheelwright’s foundation by providing very specific suggestions about ways in which improvement can be pursued. Schonberger focuses on the continuous improvement of information, performance improvements and quality. He also stresses the importance of simplification as a form of improvement. Giffi, Roth and Seal discuss improvement in terms of flexibility, rapid response, measurement systems, human assets and learning programs. Thus, both Schonberger and Giffi, Roth and Seal include incremental improvement approaches in their description of world class manufacturing, providing details about areas of implementation not described by Hayes and Wheelwright.

1.1.5.7 Summary

In looking at Hayes and Wheelwright’s practices, it is interesting to note that some continue to be integral to descriptions of world class manufacturing, while others have dropped out. In particular, workforce skills and capabilities, competing through quality, worker participation and incremental improvement approaches have been strongly supported by recent accounts of world class manufacturing, and in most cases, further elaborated upon. This is supported by numerous anecdotal accounts of the effectiveness of such practices. On the other hand, recent accounts of world class manufacturing have largely ignored prescriptions for management technical competence and rebuilding manufacturing engineering.

This is supported by recent empirical work. For example, Voss and his colleagues visited over 500 manufacturing plants to assess progress on
practices and performance measures (Hanson and Voss 1993; Voss 1995; Voss and Blackmon 1996; Voss et al., 1997). They list 46 practices and performance measures related to world class manufacturing, including practices related to workforce skills and capabilities, competing through quality and worker participation. Although they don’t explicitly include incremental improvement approaches as a practice, many of their practices are elements of incremental improvement, as well. However, like Schonberger and Giffi, Roth and Seal, Voss et al does not include practices related to management technological competence or rebuilding manufacturing engineering.

1.1.6 New Manufacturing Practices

Recent work by Schonberger, Giffi, Roth and Seal, and Voss et al differs from the work of Hayes and Wheelwright by its inclusion of two other key constructs, described by Clark (1996) as ‘new manufacturing practices’. Use of new manufacturing practices, such as quality management and JIT, has led to impressive results during the past decade (Clark 1996). Manufacturers which applied these approaches noted significant improvements in competitive position and increases in productivity and reliability of their products. ‘Concepts such as TQM, JIT and continuous improvement are not simply new techniques; taken together, they represent a new conceptualization of the manufacturing system (Clark 1996)’. Thus, the question of whether these new manufacturing practices have become elements of world class manufacturing can be raised.’

The first is a broader definition of practices associated with quality management. Although quality management has been defined many ways by various authors, the definitions appear to be coalescing into a three-pronged definition. Both academics and practitioners have described quality management as a set of practices related to three elements: customer focus,
employee involvement and process focus (Dean and Bowen 1994). Hayes and Wheelwright took a narrow approach, focusing primarily on customer focus in their definition of quality management. However, they also included employee involvement in their conceptualization of world class manufacturing. Thus, only process focus was notably lacking from Hayes and Wheelwright’s work.

Second, the use of JIT has become widespread in recent years. Its influence is particularly evident in Schonberger’s work on world class manufacturing. The domain of JIT practices can be divided into two sets: core JIT practices, such as use of a demand pull system and setup time reduction, and practices which comprise the infrastructure for supporting the use of those practices, such as workforce involvement in scheduling and improving the production process (Flynn et al., 1995). Infrastructure practices are well represented in Hayes and Wheelwright’s world class manufacturing practices, however this set lacks practices related to the core practices of JIT.

1.1.7 Trade-off Perspectives

Hayes and Wheelwright (1984) defined competitive priorities as the ways in which a firm chooses to compete in the marketplace and the types of markets it pursues, defined in Table 1.3. It is reasonable to infer that the use of world class manufacturing practices will lead to superior performance in some subset of these competitive priorities. Hayes and Wheelwright stress that, within an industry, different firms or business units differ in the emphasis given to each competitive priority, thus creating their own unique strategic profile. However, they explicitly advise against the pursuit of multiple competitive priorities, stating,
‘It is difficult (if not impossible), and potentially dangerous, for a company to try to compete by offering superior performance along all of these dimensions simultaneously, since it will probably end up second best on each dimension to some other company that devotes more of its resources to developing that competitive advantage (Hayes and Wheelwright 1984)’.

**Table 1.3 Operationalization of Dependent Variables**

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<tr>
<th>Sl.No.</th>
<th>Dependent Variable</th>
<th>Hayes and Wheelwright’s Definition*</th>
<th>Operationalization</th>
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<tr>
<td>1.</td>
<td>Cost</td>
<td>Unit cost</td>
<td>Cost improvement = two-year change in cost</td>
</tr>
<tr>
<td>2.</td>
<td>Quality–performance</td>
<td>High reliability or performance in a standard product</td>
<td>Mean of two perceptual items which measured perceived customer satisfaction with performance</td>
</tr>
<tr>
<td>3.</td>
<td>Quality–features</td>
<td>Features or capabilities unavailable in competing products</td>
<td>Percent of sales from products introduced in the last five years</td>
</tr>
<tr>
<td>4.</td>
<td>Dependability–specifications</td>
<td>Doing the work as specified</td>
<td>Percent of items shipped without requiring rework</td>
</tr>
<tr>
<td>5.</td>
<td>Dependability–on-time delivery</td>
<td>Delivery of products on time</td>
<td>Percent of deliveries shipped on time</td>
</tr>
<tr>
<td>6.</td>
<td>Dependability–service</td>
<td>Being ready to mobilize resources instantly to ensure that any failures are corrected immediately</td>
<td>Perception of customer relations, relative to the industry</td>
</tr>
<tr>
<td>7.</td>
<td>Product flexibility</td>
<td>Ability to handle difficult, nonstandard orders and to take the lead in new product introduction</td>
<td>Perception of plant’s product flexibility, relative to its global industry</td>
</tr>
<tr>
<td>8.</td>
<td>Volume flexibility</td>
<td>Ability to accelerate or decelerate production very quickly and juggle orders so as to meet demands for unusually rapid delivery</td>
<td>Perception of plant’s volume flexibility, relative to its global industry</td>
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Instead, they suggest that a firm must attach a clear set of priorities among the dimensions, which is supported over time by various decisions about resource allocation, rewards, competitive profiles, research and development, etc. The idea of tradeoffs among competitive priorities echoes the well-known work of Porter (1981 and 1985), who divided competitive priorities into cost and differentiation, which included quality dependability, flexibility and other attributes. He referred to attempting to simultaneously pursue both competitive priorities as being a ‘recipe for mediocrity’, describing such a firm as ‘stuck in the middle’.

Kotha and Orne (1989) attribute the lack of success of mixed approaches to two causes. First, firms which pursue multiple competitive priorities simultaneously lack critical focus, producing neither effective reduction in costs nor differentiation which is sufficient to attract a premium price. Second, organizations which follow a mixed approach are positioned in the middle of their industry, close to competitors which have strengths resulting from their product and process characteristics. Empirical support for Porter’s perspective is provided by Dess and Davis (1984) and replicated by Robinson and Pearce (1988), whose work provided construct validity of Porter’s typology. They found that firms which pursued generic strategies, rather than mixed strategies, exhibited superior performance.

The tradeoffs perspective can be traced back to the seminal work of Skinner (1969), who described the diversity of strengths and weaknesses of organizations and how they can be used as a means of differentiation from competitors. Likewise, production systems have different operating characteristics. Thus, Skinner states that the task of manufacturing strategy is to configure production systems to reflect the priorities and tradeoffs inherent in an organization’s competitive situation and strategy. Hayes and Pisano (1994) describe the fundamental robustness of the tradeoffs perspective over
time. Many common practices today can trace their roots to it. For example, the focused factory concept is based on the premise that no single organization can do all things equally well. Process choice (Hill 1989) which prescribes matching product and market evolution with manufacturing process characteristics, is based on the idea of shifting competitive priorities as a product matures.

Clark (1996) describes two central propositions of manufacturing strategy represented by the tradeoffs perspective. First, there are many ways for an organization to compete, including low cost, rapid delivery, superior performance, etc. Second, organizations cannot be all things to all people. While an organization must meet minimum standards on all dimensions of customer choice, ‘... firms that try to do everything exceptionally well and fail to develop competitive priorities will end up second best to those firms that concentrate their efforts (Clark 1996).’ The work of a number of more recent authors, including Hill (1989), Anderson et al (1989), and Miller and Roth (1994) continues to support these propositions.

1.1.8 What is World Class Manufacturing (WCM)?

WCM is one of the broadest philosophies focusing primarily on production. It includes, for example Lean Manufacturing, Just-In-Time (JIT), Total Quality Management (TQM), Total Productive Maintenance (TPM), Employee Involvement (EI) and Customer Focus to achieve continuous improvement of a business process. WCM also includes more structural changes such as new production technology (Schonberger 1986; Vokurka and Davis 2004).

Greene (1991) gave an in depth definition for WCM companies which could be described as follows:
“WCM companies are those companies which continuously outperform the industry’s global best practices and which know intimately their customers and suppliers, know their competitors’ performance capabilities and know their own strengths and weaknesses. All of which form a basis of – continually changing – competitive strategies and performance objectives”.

Although many writers have focused on the area of WCM since Schonberger’s work in 1986, very few of the studies have actually collected empirical evidence which would outline and highlight the important factors included within WCM. Furthermore, it was discovered that only a few studies on WCM implementation in developing countries have appeared recently (Salaheldin 2005; Saxena and Sahay 2000). With this perspective, the main task of the current empirical study is to investigate the critical variables that are driving and inhibiting the implementation of WCM techniques in Egyptian manufacturing firms. Moreover, this investigation is seen as a principal step towards formulating strategies and tactics that remove and avoid many of the severe obstacles that impede the successful implementation of WCM philosophy on the road to achieving its potential benefits.

WCM is a different set of concepts, principles, policies and techniques for managing and operating a manufacturing company. It is primarily driven by the Japanese manufacturing resurgence that adapts WCM technology in automotive, electronics and steel companies to gain a competitive edge. It primarily focuses on continued improvement in competitive priorities such as quality, cost, lead time, flexibility and customer service. Manufacturing companies are striving to meet their international competitions with WCM principles and technologies that foreign competitors used so successfully against them.
World class manufacturers are those that demonstrate industry best practices. To achieve world class status, companies need to implement WCM principles and techniques to do best in the field of competitive priorities of quality, cost, price, delivery speed, delivery reliability, flexibility and innovation. It is primarily driven by the Japanese manufacturing resurgence that adapts WCM technology in automotive, electronics and steel companies to gain a competitive edge. “If a manufacturing firm meets the following seven attributes,” says Sharma, “and it does that, not just in one quarter but year after year, that’s how it defines a world class manufacturer (Anand Sharma 2005). The most important thing in WCM is the visionary leadership that has unrelenting and constant focus on seven key attributes:

1) Absolute focus on satisfying the customer every day.
2) Motivating and treating employees like appreciating assets.
3) Constant innovation in the products and services you provide.
4) Providing seamless synchronization throughout the value chain.
5) Having a culture of continuous improvement.
6) Strategic agility to turn on a dime.
7) Achieve growth in top and bottom line and reduce trade working capital.

1.2 CONTRIBUTION TO CURRENT KNOWLEDGE

The contribution of this research study is threefold. First, the findings of this study contribute to operations/production management literature in general and to World Class Manufacturing (WCM) in particular. This may provide some ideas for other researchers to execute more research work in the field of implementation of WCM practices, philosophies and techniques in the manufacturing sectors to achieve a competitive edge in the business operations measured in terms of competitive business priorities such
as improvement of quality, reduction of costs, enhancement of efficiency/productivity, reduced time to market/delivery speed, constant innovation, having flexibility in manufacturing operations, and offering products at affordable price to the clients.

Second, there has not been any reported Ph.D research of the implementation of WCM practices, philosophies and techniques in well developed states in general, and in Tamil Nadu in particular. Chennai is amongst the well developed cities in the country in terms of industrial development. Thus, this research study represents a first endeavour at reporting a story of the driving and resisting factors toward the implementation of WCM practices, philosophies and techniques by the manufacturing sector in Chennai. Third, a very significant contribution of this research study is to provide guidelines and framework for the successful implementation of WCM practices, philosophies and techniques by manufacturers in Chennai for achieving a world class status in the global business environment, and which can be used as a template for other manufacturing companies located in other parts of the world.

1.3 STATEMENT OF THE PROBLEM

Every company knows what world class means but few companies are among the best in the world at what they do. It becomes a paramount importance for every manufacturing company to achieve a competitive edge at its business operations. WCM technology is a state-of-the manufacturing technology especially designed for producing standardized products of international repute to meet global standards. WCM is a competitive business in which a firm makes and sells the best quicker than anybody else. International competition for makers of manufactured products will be more fierce throughout a couple of years. Despite the intense global competition faced by the manufacturers, they are adopting WCM practices, principles,
techniques and tools to compete globally with more success against foreign competition for retaining domestic markets and meeting the global competition created by world class manufacturers.

Competition today is usually international. A world class manufacturing system helps companies meet foreign competition. Companies engaging in WCM strategies focus on improving operations, strive to eliminate waste and create lean organization. This often results in higher productivity. But these companies also focus on speed of total throughput from order capture through delivery setting new standards for delivery without the heavy dependence on inventory. In WCMS, sequential methods of performing work are being replaced with concurrent methods to compress time, and functional and hierarchical divisions of duties are being replaced by team-driven activities. Manufacturing companies in Chennai are striving to meet their international competitions with WCM practices, principles and technologies that foreign competitors implemented so successfully against them. Much of this study has been devoted to describing the WCM practices, principles and techniques currently used by manufacturers in Chennai to develop competitive advantages over foreign manufacturers.

1.4 RESEARCH QUESTIONS AND OBJECTIVES

To analyze the competitive edge of WCMS adopted by manufacturing companies in Chennai, the researcher has developed four major research questions:

i) What are the WCM practices, principles and techniques considered to be the key focus by Chennai manufacturers in their journey of world class manufacturing?

ii) What progress have manufacturing companies in Chennai made towards world class status and where are they currently?
iii) What are the drivers that encourage Chennai manufacturers to adopt the WCM principles and techniques in order to achieve the competitive advantage in the global market?

iv) What are the significant obstacles which may prevent Chennai manufacturers from embracing the WCM principles and techniques?

These were the overall questions to be answered by the current study and defined by the following five objectives:

i) To highlight the myopic impressions of manufacturing companies of what WCM means to them and how far they come towards achieving that accreditation.

ii) To explore the WCM practices, principles and techniques implemented/adopted by manufacturing companies in Chennai to achieve world class status in their business operations.

iii) To study the impact of WCM Practices, Lean Initiatives, TQM Principles and IT Systems/Applications on the competitive advantage of the manufacturing companies.

iv) To identify the critical driving and resisting forces toward the effective implementation of WCM principles and techniques by manufacturing companies in Chennai.

v) To offer guidelines for the successful implementation of WCMS (Practices, Principles, Techniques and Technologies) by Chennai manufacturers.
1.5 SIGNIFICANCE OF THE RESEARCH

Much of this study has been devoted to describing the WCM practices, principles and techniques that Chennai manufacturers considered to be the key in the journey of world class manufacturing to develop competitive advantages over foreign manufacturers. This study may help the manufacturing companies integrate and utilize the WCM practices, principles and techniques effectively to develop competitive advantages over competitors to meet global standards effectively. It would also focus on how WCM technology based systems provide the means by which production resources are feasibly integrated for producing customized products to meet different tastes and preferences of both international and domestic customers.

More specifically, this study also provides more significant insights about how advances in technology are changing and altering the way production resources are being effectively used to accomplish objectives of the firm. This survey taps into the minds of the Chennai manufacturers to assess their impressions of what world class manufacturing means to them, and how far they think they have come towards achieving that accreditation. This survey does reveal some rather myopic impressions of world class manufacturing. This study also tries to find out the WCM attributes that demonstrate industry best practices in Chennai. To achieve the status of WCM, each manufacturing company should attempt to be the best in the each field of competitive priorities i.e., quality, price, delivery speed, delivery reliability, flexibility and innovation.
1.6  CHAPTER SCHEME

The following is the chapter scheme charted out in such a manner that the research project can be carried out successfully.

Chapter 1: Introduction

This chapter comprises of a theoretical framework on World Class Manufacturing (WCM), the contributions of study to the current knowledge, the statement of problem, the research questions and objectives, the significance of research, the chapter scheme and summary.

Chapter 2: Review of Related Literatures

This literature review part of the study is segmented into the ten modules, which throw a lime light on both the extensive and diverse literatures pertaining to world class manufacturing and related best practices adopted by the manufacturing firms in the journey toward achieving world class performance. These modules include Preamble, An Overview of WCM, Manufacturing Operations, Lean Manufacturing (LM), Total Quality Management (TQM), Information Technology (IT), Maintenance Function, Competitive Advantage (CA), Drivers and Barriers to WCM Implementation and Summary.

Chapter 3: Research Methodology and Design

This chapter deals with the preliminary view of WCM, research framework, hypotheses formation, area of study, population overview, research instrument development, pilot survey, instrument validity and reliability, data source, sampling procedure, sampling frame, challenges encountered during the phase of data collection and summary.
Chapter 4: Data Analysis and Interpretation

This chapter of the research study comprises of three parts. The first part highlights the data analysis procedure; the second part discusses the WCM survey results and their inferences; and third part outlines four frameworks of Structural Equation Modeling (SEM).

Chapter 5: Executive Summary

This chapter of the study is segmented into two broad heads. The first head highlights the major findings of descriptive statistics and the second head throws a light on the major findings of statistical analysis.

Chapter 6: Hypothesis Testing and Discussions

This chapter is divided into two parts. The first part outlines hypotheses testing of the study and the second part deals with the major discussions of the survey findings.

Chapter 7: Suggestions and Conclusion

In this part of the report, the author has come to conclusions about the study and arrived at certain managerial implications which will hopefully create more awareness among management and employees about the strategic importance of WCM practices, principles and techniques to manufacturing operations in the Chennai manufacturers. Finally, the major limitations of the study and scope for future research are elaborately discussed in this chapter.
1.7 SUMMARY

The manufacturing industry has experienced an unprecedented degree of change in the last three decades, involving drastic changes in management approaches, product and process technologies, customer expectations, supplier attitudes as well as competitive behaviour. In a highly dynamic and rapidly changing environment, the global competition among organizations has lead to higher demands on the manufacturing organizations. The global marketplace has witnessed an increased pressure from customers and competitors in manufacturing as well as service sector. In today’s turbulent business environment, global competition characterised by both a technology push and a market pull had forced organisations to compete on various platforms, such as state-of-the-art manufacturing technology, quality improvement, cost reduction, faster delivery, constant innovation, flexibility in operations, improved productivity, employee involvement, continuous improvement in processes, price tags, and so on.

The manufacturing firms that would like to survive in today’s highly competitive business environment must address the need for state-of-the-art manufacturing facility toughed with the flexibility to produce a diverse product range, coupled with high quality and lower costs. In today’s fast-changing marketplace, slow and steady improvements in manufacturing operations do not guarantee sustained profitability or survival of an organization. Thus the manufacturing organizations need to improve at a faster rate than their competitors, if they are to become or remain leaders in the industry.