CHAPTER 1

INTRODUCTION

1.1 RATIONALE

Developing countries like India, where technological change is the thrust in manufacturing industries, have introduced advanced manufacturing technology (AMT) to have competitive edge in the global market. Though the ultimate goal of an AMT is the fully computer integrated, personless factory of the future (Wall et al, 1990) the application in India is currently at much more modest level. A few companies have introduced higher levels of AMT, but the majority has small-scale applications, like computer-numerical control machines (CNC), computer aided design (CAD) and so on, as stand-alone systems. Despite the claims that attractive benefits can accrue through the use of AMT in manufacturing firms, only modest benefits are reported (Virmani, 1990). The superior performance of AMT firm, even in higher levels of AMT, in terms of maximum labour productivity, superior quality and greater flexibility in response to changing market demand (Majchrzak, 1988) is still to be achieved. Firms, in which lower levels of AMT have already been introduced, are unable to progress to higher levels to achieve manufacturing prosperity (Nemetz and Fry, 1988; Virmani, 1990; Datta, 1990). High failure rate of AMT has been cited both in developed and developing countries (Chowdary, 1989; Gaynor, 1996; Mookherjee, 1997; Manik Kher, 1997).
One of the greatest challenges facing manufacturing firms in today’s business environment is the implementation of AMT in the existing environment. The implementation of AMT has effected a number of changes in the work place, but is unwary of the psychology of workers to accept new technology (Fallik, 1988). AMT will require substantial human support to operate effectively and will have made an impact on the nature of shop floor work, which accounts for the effects of systems on psychological outcomes (Wall et al, 1990). Technology used in an organisation has an effect on the individual through job characteristics. It affects the structure of work which in turn changes job characteristics. Any change in job characteristics of employees requires change in their abilities to carry out the tasks. Those employees who are unable to develop their abilities to cope with the change in demand of the new jobs resist new technology (Adler, 1986; Beatty and Gordon, 1988; Chowdary, 1989; Datta, 1990; Davids and Martin, 1992; Davis, 1994). There may be many other reasons to resist AMT. The resistance to new technology is the outcome of barriers to technological change among blue-collar employees which are mostly psychological. When new technology is introduced in an existing environment, the firm witnesses many problems. The foremost among them is the resistance to technological change. Why do employees resist new technology? What are the psychological barriers to technological change? What are the effects of change in technology on attitudes and consequently employees’ productivity?

Re-organisation of AMT firm consequent to implementation of AMT is usually feared because it means disturbance of the status quo, a threat to people’s vested interests in their jobs and an upset to established ways of doing things. For these reasons the needed re-organisation is often deferred, resulting in a loss of effectiveness and an increase in the cost of manufacturing (Kotter and Schlesinger, 1979). If the organisation’s design is not appropriate for the
work to be performed, behavioural problems can easily set in and the effectiveness of the decision making system can be seriously undermined.

Drucker (1988) has stated:

‘Organisational structure is an indispensable means and the wrong structure will seriously impair business performance and may even destroy it. Future organisations will be information based and composed largely of operation specialists and will have no middle management at all’.

The firm’s technology influences the organisational structure at operational and administrative levels and consequently the performance of the firm. (Parthasarthy and Sethi, 1992). The socio-technical systems (STS) approach has become a popular tool for organisational design to change the work place environment. There are evidences to show that STS design efforts have increased productivity through better utilization of human resources and capital equipment (Shani et al, 1992). What is the impact of new technology on organisational structure? Does the organisational structure remain the same or differ after the implementation of AMT? What are the implications of structural change on employees’ productivity?

New technologies are most likely to yield productivity gains when they are coupled with changes in the organisational and human behaviour (Kochan, 1988). The reasons attributed to the low performance of AMT firms are human factors in the implementation of AMT, which have been overshadowed and organisational structure of AMT firm which remains static in the changed environment. Irrespective of whether the focus is on relatively stand-alone systems like computer numerically controlled (CNC) machines, flexible manufacturing system (FMS) or fully computer integrated manufacturing (CIM), the psychological and organisational implications are
potentially far reaching (Wall et al, 1990). The most neglected factors during the implementation of AMT are overall strategic plan, organisational design, design of jobs, skills of blue-collar employees and their work attitudes (Bailey, 1993). In a developing country, the ability to adopt technological change is the measure of success (Noori, 1997), as the firms face many uncertainties. Hence a planned change approach is much more important than the technology itself.

There has been substantial research documenting the effects of AMT on worker, workplace, work attitudes and organisational structure, but much has been in a developed country’s perspective and less is known about the implications for a developing country. Hence a systematic empirical investigation of the effects of AMT on employees and organisational structure is required in a developing economy to understand the implications of AMT in the context of their socio-economic conditions. Such a study is important because many firms which have already implemented AMT and invested huge money in their manufacturing operations face problems and are unable to move up to higher levels of AMT. This has sent a red signal to those firms which would like to implement AMT. What we need is a systematic research study of the impact of AMT on blue-collar employees and their shop floor activities in terms of their psychological aspects such as work attitudes and their performance with the implications for organisational change. Hence this research is a more broad-based quantitative investigation of psychological and performance outcomes of blue-collar employees of AMT firms and change in organisational structure, consequent to technological change with a framework to implement new technology in the existing environment, following the behavioural school of thought.
1.2 THE SETTING

Manufacturing is a major economical activity in India. There are several manufacturing companies in the State of Tamil Nadu which contribute to the growth of the country. They manufacture and export a variety of products like heavy engines, heavy vehicles, machine tools, automobiles, cutting tools and so on. These companies employ thousands of blue-collar employees to carry out the machining operations which are part of the manufacturing. Most of these companies are private owned and the employees have trade unions for resolving conflicts. In order to improve the performance of the companies to compete in the global market, most of the firms have introduced in stages AMTs like computer numerical control machines, computer aided design, computer aided manufacturing, flexible manufacturing system, computer integrated manufacturing and so on over a period of time. Contrary to the expectations these firms report only modest benefits. A high failure rate of AMT has been noticed. With the intention of solving the issues of AMT firms in this region, this research study was carried out during 1995-2000.

1.3 IMPLEMENTATION ISSUES OF AMT

Implementation of AMT includes efforts to acquire, install and maintain and manage the consequent organisational and technical changes, and promote behaviours that would help the adopting unit achieve the targeted benefits. It is considered to be a much broader concept than mere installation wherein the ability to exploit the entire range of capabilities and to realize superior performance requires a long-term process of organisational learning and demands sustained commitment to change. (Ramamurthy, 1995). The success of implementation of AMT depends on the factors such as well-defined planned change process, adequate user involvement at various stages and commitment to change. (Ramamurthy, 1995). A variety of environmental, structural,
technological, individual and task related factors can inhibit implementation and successful management of AMT. Hence, it is important to identify and articulate primary antecedent factors, prior to implementation of AMT (King and Ramamurthy, 1992).

1.3.1 High failure rate

High failure rate of advanced manufacturing technologies has been reported. Several studies have documented that new technologies are most likely to yield productivity gains when they are coupled with changes in the organisational and human resource systems (Works, 1987; Kochan, 1988; Long, 1989; Ozan and Smith, 1990; Bessant et al., 1992). These studies suggest that the implementation of technology is more likely to be successful when the technology, the organisation and employees' issues have been designed to complement and integrate with each other. High failure rate of technological change can be attributed to the lack of understanding about the organisational and human resource changes that may be needed with new technology.

The following are the issues which are poorly understood:

1. Historically, the implementation of new work technologies has been broadly resisted rather than greeted due to the consequences of new technologies (Fallik, 1988).

2. Effective implementation of new technology demands sufficient advanced planning so that job redesign and consequent training of workers in conjunction with the technological change rather than after implementation.

3. Successful implementation of new technology needs a compatibility with organisational structure to ensure adequate
worker motivation, commitment and job satisfaction (Nemetz and Fry, 1988).

4. The long-term success or failure of AMT depends on the importance of human factor consideration in the implementation of new technology (Fallik, 1988)

These result in employees' resistance to the implementation of new technologies in their firms causing reduction in productivity which ultimately leads to failure of technology adoption.

1.3.2 The challenges

New technologies in Indian manufacturing firms have been implemented in different stages in the forms of computer aided design (CAD), computer numerically controlled machines (CNC-M), flexible manufacturing system (FMS) and computer integrated manufacturing (CIM). Implementation of the new technology in an existing firm presents a set of challenges to the management and hence cannot guarantee increased productivity. In some of the firms the new equipment lie idle for quite some time because employees refuse to operate them (Preece, 1995). The productivity of the firm at first drops because of resistance to accept the new technology (Gaynor, 1996). Although there are a few examples of success story as a result of technological change, firms that have implemented have reported only modest benefits. Many failures of AMT have been reported. Several firms are hesitant to invest in new technology and hence lose their competitive edge. Resistance to change is rational and it should be eliminated to achieve better performance of the firm (Barton and Kraus, 1985). The major concern of management in implementing the new technology is the attitude of the unions. Companies have to put in a tremendous effort to get the change accepted by the unions. Many employers oppose the participation of unions particularly in decisions about the new
technology. If the unions are not consulted in advance about the technological change, their initial response will be negative. It has been contended that Indian unions do not resist technological change but generally prefer to negotiate on its consequences and for sharing the benefits (Virmani, 1990).

Many implementation efforts fail because some underestimate the scope or importance of preparation or involvement of employees. Abundant resources have been deployed in the purchase of new technology equipment but very little has been done on its implementation. Davids and Martin (1992) have estimated that the firms introducing the new technology spend more than 90% of the resources on technology while less than 10% is attributed to human resource development for training and educating the work force. The issues of technological change were identified as apprehensions regarding job in security and job displacement. Employees, particularly operators, resist the technological change fearing that new technology would reduce or even eliminate the need for their particular skills. Marx (1976) best articulated technologies’ potential to de-skill the worker, to isolate him / her from the means of production and to diminish the worker power and influence. The demand for higher pay is another major issue in the implementation of the new technology. Practically most employers argue strongly that changing technology is not itself sufficient to justify more pay. Their argument is that newer technology usually makes jobs less demanding and that the increased flexibility enhances the ‘psychic’ reward through job enrichment. A closer inspection shows that the real upward pressure on pay comes from the labour market particularly for computer staff. Pay may be used to change attitudes and encourage self-development. Upgrading the skills to work in a new job requires a motivation towards training (Wilkinson, 1989).
1.4 CONCEPTUAL FRAMEWORK

The framework shown in Figure 1.1 describes a firm’s technology as an endogenous variable, following the evolutionary models that undergoes frequent adaptations to remain technically competitive. Any change in the market demand affects the product of a manufacturing firm and forces it to redesign the product. Many times the existing technology has been inadequate to incorporate the required changes in the products. Hence the firm is forced to introduce new technology to remain competitive in the market. The framework links the technology, the organisational structure, employees and the product of a manufacturing firm, providing for interactions between the four variables (Bailey, 1993). The degree of fit among these four affects the firm’s performance on various dimensions (Preece, 1995; King and Anderson, 1995; Ford and Saren, 1996).

The framework posits, *inter alia*, that

1. the adoption of AMT would suggest that a firm’s technology is evolutionary;
2. a firm’s technology would influence both its operational and administrative structures to change;
3. the technological change would affect and demand changes in design and manufacturing activities;
4. consequently jobs/tasks of employees have to be redesigned resulting in change in job characteristics;
5. superior performance may be achieved by maximum fit between technology, structure and employees;
6. implementation of new technology affects work and work place.
Figure 1.1 Conceptual framework of technological change and posited relationship
Technological change is necessary not only for the survival of business but also for maintaining its competitive edge and growth. The adoption of new technology has a significant bearing on human relations within the firm. A firm is recognized to be successful if it displays its ability to assimilate technological change without impinging on the harmony of human relations of its employees. The technological choice which is evolutionary in nature depends on the prevailing technological development in the industry. AMT has been introduced over the years in piecemeal fashion in Indian manufacturing firms.

Organisational structure has been classified into product, process or combination and tall or flat type. A typology that subsumes most classifications and that has become popular is the mechanistic-organic structure (Burns and Stalker, 1961) also referred to as bureaucratic – adhocratic (Parthasarthy and Sethi, 1992). A structure is considered mechanistic to the extent that its behaviour is standardised, but it is considered organic (or adhocratic) when standardisation is absent (Mintzberg, 1979). Organisational structure is considered as a function of the firm's environment (Lawrence and Lorsch, 1969) and technology (Woodward, 1965). Mixed results have been obtained in research pertaining to technology-structure relationship. However the body of literature involving technology-structure investigation is significant enough to warrant serious consideration while discussing structure (Parthasarthy and Sethi, 1992). The framework proposed in this research therefore includes technology relating to the structure.

Implementation of AMT in many organisations has failed mostly for reasons of organisational and human dimensions, regardless of technology level. Several studies suggest that technology implementation is more likely to be successful when the technology, the organisation and people related issues have been designed to complement and integrate with each other and that such
integrative planning is rarely done successfully (Preece, 1995; King and Anderson, 1995).

Employees' resistance to change can lead to work slowdowns, poor employee morale, high maintenance cost and even sabotages (Davids and Martin, 1992). When the new technologies are implemented "total productivity" at first drops because of natural response of employees' resistance to accept the new technology (Gaynor, 1996). However as employees get used to the new technology their acceptance rate improves and their attitude towards the new technology becomes more positive. As a matter of fact their proficiency and skill rate also return to normal levels. A proactive approach to minimise the resistance to change is to explain the benefits of the new technologies to both the company and the employees themselves (Chattopadhyaya and Pareek, 1982).

1.5 PROPOSED FRAMEWORK

Technology is not only artefacts of tools and machines but also a form of knowledge comprising the entire gamut of technologies as well as the management with their total hardware and software contents. Technological change, a dynamic and multidimensional phenomenon, is responsible for lasting social changes and rapid economic development. It is conceptualized within the framework of an evolutionary epistemology of technological knowledge. It can be a modification of the existing technology or emergence of new technology like computer based manufacturing technology (Parayil, 1991; and Lowe, 1995). AMT has emerged as new technology which is defined as a group of integrated hardware-based and software-based technologies which if properly implemented, monitored and evaluated will lead to improving the efficiency and effectiveness of the firm in manufacturing a product (Yousseff, 1992). It includes a variety of computerized technologies such as computer
aided design (CAD), computer aided manufacturing (CAM), flexible manufacturing system (FMS), automated material handling (AMH), automated storage / retrieval system (AS/RS) and so on (Hunt, 1987; Snell and Dean, 1992). In addition to machine tools for design and manufacturing, AMT includes computer aided techniques for plant management such as management information system (MIS), computer aided process planning (CAPP), material requirement planning (MRP), artificial intelligence (AI) and so on. Computer integrated manufacturing (CIM) which leads to personless factory has also been added to AMT (Hunt, 1987). For definitions of technologies under AMT see Appendix 1.

AMT has been viewed as a technological weapon to gain competitive advantage (Preece, 1995) as a process of innovative technology to replace existing technology (Boddy and Buchannan, 1986) and a technological change process to improve productivity (Fallik, 1988). AMT is a data driven manufacturing system to provide for control and communication in design, manufacturing and management systems. The use of data driven computer aided technology allows these machines to perform a greater variety of tasks. It has got a unique production capability as shown in Figure 1.2.

Figure 1.2 Unique production capability of AMT (Hunt, 1987)
The meaning and concept of AMT as described above have been used in several research studies (Meredith and Hill, 1987; Wall et al., 1990; Davids and Martin, 1992; Beatty, 1993; Ramamoorthy, 1995; Jackson and Martin, 1996; Noori, 1997). Implementation of AMT in the existing environment is illustrated in Figure 1.3 (Ghani and Jayabal, 1999). The adoption of AMT will not *if so-facto* guarantee superior performance but will further require changes in employees' work attitudes and organisational behaviour. Many firms which have implemented AMT followed evolutionary approach where the expected outcomes would be achieved over a period of time. A planned change process is required to prepare employees well in advance so that the psychological barriers can be minimised to implement new technology so as to achieve superior performance without much loss of time (Pareek, 1981; Beatty and Gordon, 1988; Davis, 1994).

1.5.1 AMT levels

An understanding of the typology of technology is much more essential before it is implemented. Technology has been classified for various reasons including empirical analyses. A scale was devised to measure automation, work flow rigidity and specificity of technology on the basis of work flow integration (Hickson, Pugh and Pheysey, 1969). Woodward (1965) classified technology as unit, mass and continuous production. Based on the firms, technology was classified into long-linked, mediating and intensive technologies (Thomson, 1967). There is another attempt by Slocum and Sims (1980) who classified into workflow predictability, task predictability and job interdependence.

The technological choice depends on the prevailing technological development in the industry and adoption by firms to achieve competitive capabilities in the areas of product design and manufacturing. Currently, based on the automation and integration of manufacturing activities AMT has been
Figure 1.3 Implementation of AMT with planned change process
classified into four levels. (Meredith and Hill, 1987; Snell and Dean, 1992) as indicated in Figure 1.4.

AMT level 1 is stand-alone machine tools or equipment which are controlled by self-contained computers. Numerically controlled machine tools (NC) and robots which are limited to local requirements are examples of AMT level 1. The purpose of level 1 equipment is to replace conventional machine tools in manufacturing to achieve better quality by reducing rework, rejections, down time and so on.

AMT level 2 is manufacturing cells based on grouping of machines to perform a variety of tasks to produce a family of parts. The objective of this type of production is to have new product mix in batches with high quality in response to change in needs of customers. Examples are group technology (GT), flexible manufacturing system (FMS), computer aided engineering (CAE) and so on.
In AMT level 3, cells (in level 2) are connected to form linked islands through computerised information network. This level of AMT offers production facility which integrates two or more cells to achieve competitive advantage such as generation of new products rapidly and enter into new markets. Examples are computer aided design / computer aided manufacturing (CAD/CAM), automated storage and retrieval system (AS/RS), group technology / computer aided process planning (GT/CAPP) and manufacturing resources planning (MRP II).

In AMT level 4, all the manufacturing activities including marketing of products are integrated through information network called computer integrated manufacturing (CIM). This level of automation is the ultimate in AMT and is a true competitive weapon in the market place (Meredith and Hill, 1987; Snell and Dean, 1992).

1.5.2 Impact of AMT

Technological change in any manufacturing firm affects jobs, workplace, organisational structure, work attitudes of employees and their productivity. New technology affects the structure of work which is normally opposed to employees and hence they resist. The change in jobs, its impact on employees, change in organisational structure and the combined effect on work attitudes of employees are discussed in the ensuing sections.

1.5.2.1 Impact of AMT on job

Technology used by the firm has an effect on the individual through job characteristics. It has an impact on psychological outcomes of employees. New technology affects the structure of work which in turn affects the employees' work attitudes. The key changes in job characteristics, job content, job control, cognitive demand, production responsibility and social interaction
(Jackson and Martin, 1996) affect blue-collar employees psychologically when AMT is implemented. The job content is different from conventional job, because of inherent properties of AMT (Clegg and Corbett, 1986). The AMT job demands higher skills as described by Hacker (1987). The implication of job content is the extent to which the employee has control in his work. AMT has the potential to reduce operator control and he no longer has intimate control over AMT jobs. (Blumberg and Gerwin, 1984; Wall et al., 1990). Change in cognitive demand is another aspect of AMT jobs. Mental work is dominated in new tasks rather than motor skills. AMT substitutes employees' mental capabilities, in contrast to mechanical technology which substitutes for physical capabilities (Child, 1984). Employees' role has been changed from an active manipulative work in conventional technology to a passive monitoring work in AMT (Perrow, 1983 and Van Cott, 1985). Production responsibility is another important factor in AMT. As the technology being expensive and can be severely damaged in case of an error by employee, leading to down-time, employee's responsibility for production will be subjected to heavier penalties (Martin and Wall, 1989). Social interaction in AMT jobs has been the most neglected. AMT affects social interaction in terms of social contact and social support which is of psychological importance (Jackson, 1988). The change in job characteristics of AMT in job content, job control, cognitive demand, production responsibility and social interaction affects blue-collar employees psychologically when AMT has been implemented. The psychological effects of change in the structure of work cause psychological barriers to technological change.

1.5.2.2 Impact of AMT on blue-collar employees

The human barriers that arise in most periods of change are psychological and they contribute toward employees' resistance to technological change. Introduction of new technology without the
involvement of employees leads to confusions and rumours on the shop floor. Blue-collar employees who are not identified in time to work with AMT do not have clear idea about their job role. This results in reluctance, lack of enthusiasm and less commitment among employees (Davids and Martin, 1992). Some employees feel that they are isolated and detached from the main activities. They are alienated and likely to retire at an early stage (Davis, 1994). Automated systems that alienate the workers have not been readily accepted (Turnage, 1990). Technology does not destroy jobs for all time, but it does create different jobs that workers often are not prepared to fill. Change in technology often changes job activities of individual employees. Therefore it produces anxiety, fear and tension among the blue-collar employees (Davis, 1994). De-skilling is another major factor contributing to employees' resistance to technological change. Learning new skills is coupled with de-skilling. For many of the old operators, learning has been a problem. New technology appears to be mysterious to them as their formal education is far below the required level. They are not confident of working with new technology (Wilkinson, 1989; Milkman and Pullman, 1991; Davis, 1994). Right perception of technological change in employees contributes to successful adoption of AMT. Employees' understanding of the need of technological change in the right perspective will solve many implementation problems and promote successful implementation to improve organisational performance. Mis-conception of technology must be eliminated before implementing new technology by educating the work force.

Stress in the blue-collar employees builds up because of the solitary nature of the work and of the pace of work in advanced technology which does not depend on the wish of the operator. This causes stress among employees. Introduction of AMT involves creation of jobs as well as displacement. Retrenchment is not a threat in most of the large manufacturing firms as a result
of technological change, but displacement is a problem for many employees who are old and less educated. Hunt and Hunt (1983) have stated:

‘If there is an increase in unemployment due to technological change, the burden will fall on the less experienced and less educated labour’.

Hence the feeling of job-in-security is one of the psychological barriers among the blue-collar employees. As the cycle time in AMT has been reduced, the employees are required to work on more than one machine. This has created a feeling of work-overload. The identity of a person is established by certain traits by which he is known among his colleagues. Employees who are known for specific skills do not want to lose their identity and hence resist change.

1.5.2.3 Impact of AMT on organisational structure

The organisational structure is defined as the formal allocation of work roles and the administrative mechanism to control and integrate work activities. Traditional structure based on the specialisation of task and hierarchical management may be inappropriate to the new technology and the changing internal environment in which they operate. Re-organisation of AMT is usually feared because it means disturbance of the status quo, a threat to people’s vested interests in their jobs and an upset to the established way of doing things. Many firms defer the re-organisation because of the disturbance which results in the loss of effectiveness and an increase in the cost of manufacturing (Kotter and Schlesinger, 1979). The structure of a firm is more difficult to alter since change involves redefining jobs, changing the reporting relationships and even eliminating some units. Inappropriate design of organisation may lead to behavioural problems. Studies on organisational theory assert that technology has an influence over organisational structure (Woodward, 1965; Harvey, 1968; Lawrence and Lorch, 1969; Reimann, 1980;
Singh, 1986). Many of the AMT firms operate under traditional structure which is mechanistic, more suitable for long runs of standardised production (Burns and Stalker, 1961). The models of organisational design are mechanistic or organic. The mechanistic design is synonymous with the bureaucracy, tall and centralised in that it has extensive departmentalisation, high formalisation, downward communication and little participation by low-level employees in decision making. The organic model is flat and uses cross hierarchical and functional teams. It has low formalisation, lateral and upward and downward communication networks and high participation in decision making (Burns and Stalker, 1961; Mintzberg, 1979). The determinants of organisational structure which decides an organisation as mechanistic or organic are strategy, size, technology and environment. In addition, the employees’ behaviour and their individual differences also have to be considered for organisational design (James and Jones, 1976; Dalton et al, 1980; Snizek and Bullard, 1983). Organisation literature asserts about the fit between technology and structure for better performance (Alexander and Randolph, 1985; Prasad, 1994). A wrong structure will seriously impair business performance and may even destroy it (Drucker, 1988). The characteristics of organisational structure may be explained in terms of division of task, job description, decision making, communication, control system, coordination, span of control at supervisory level, vertical levels and ratio of white-collar to blue-collar employees. The psychological characteristics are motivation, group relations, leadership style and reward. The skill characteristics are operators multi-skills, supervisory skills and skill distribution among the employees. The changes in the above characteristics of an organisation with reference to the change in technology determine the behaviour of organisation (Ghani and Jayabal, 1999)

**Division of task.** The classical view of this concept is to divide the job into a number of small steps, each being completed by a separate individual. This
approach of division of task makes use of diversity of skills and increases the skills through repetition significantly and hence the productivity of the plant. However, the contemporary view of the division of task does not seem as an unending source of increased productivity because it causes boredom, fatigue, stress, poor quality, increased absenteeism and high turnover (Robbins, 1996). The above factors exceed economic advantages claimed by classic theory. Jobs that offer skill variety, task identity, task significance, autonomy and feedback satisfy the individual goals of employees and motivate them to better their performance (Hackman and Oldham, 1976). The AMT jobs being fully integrated, many operations put together performed by AMT machines, the operator doing a variety of tasks like programming, loading and unloading the job and monitoring the machining satisfy the five core dimensions of job characteristics to motivate employees and improve their performance. Hence the division of task in AMT moves from a single task to a variety of tasks with functional specialisation to job enlargement.

**Job description.** Job description is less rigidly defined, allowing people to adjust to situational requirements. As the environment is dynamic requiring frequent changes in AMT organisation, the tasks are not routine to be well defined. The concept of fixed task in a fixed work station is changing. They are required to work anywhere in the systems. Hence the job description needs to be flexible enough to make the employees work in different situations (Bailey, 1993; Davis, 1994).

**Decision making.** To make the organisation more flexible and responsive, the trend has been toward decentralised decision making. In a decentralised organisation, action can be taken more quickly to solve problems, as more people participate in the decision making. In AMT organisation, all the information regarding manufacturing activities available on the desk, leading to decentralised decision making which is positively related to job satisfaction.
Again the individual difference plays a role. Those who prefer formal relationships are better suited to mechanistic structure and those who have less degree of bureaucratic orientation would probably prefer an organic structure (Mintzberg, 1979; Carnall, 1990).

**Communication.** The relationship between communication and employee satisfaction is positive. Distortions and ambiguities increase uncertainty and hence have a negative impact on satisfaction (Schuler, 1979). Extensive use of vertical, lateral and informal channels will increase communication flow, reduce uncertainty and improve group performance and satisfaction. There is evidence to suggest a positive relationship between effective communication and employee productivity (Liker, Roitman and Roskies, 1987).

**Control system.** This refers to bureaucracy in organisation characterised by formal rules, regulations and centralised decision making. In a bureaucratic organisation there is little need for innovative and experienced decision makers. This trend is changing as most of the organisations move toward decentralised decision making and the control system is so relaxed to have informal rules to regulate themselves (Mintzberg, 1979).

**Co-ordination.** Successful coordination between groups depends on interdependence, task uncertainty rules and procedures. Conflict between groups lowers the productivity and hence performance. When organisational performance depends on effective group relations, the management has to ensure proper integrative device. Group members can critically think and make a group more responsive by mutual adjustment through informal communication (Saal and Knight, 1988).

**Span of control.** There is no evidence to support any relationship between span of control and employee performance. The individual difference makes it not
possible to state any particular span of control as the best for high performance. However, the factors like employees' experience, abilities and the structure of tasks will explain whether narrow or wide span of control is likely to contribute to their performance (Nicholas et al., 1983).

**Vertical levels.** Generally organisations are categorised into tall and flat. In tall structure vertical levels are more and in flat structure they are less. Flat structure is more suitable for organic type where the vertical levels are minimised. For AMT plants, organic structure is preferable than mechanistic because of dynamic environment (Burns and Stalker, 1961).

**Ratio of white-collar to blue-collar employees.** The strength of blue-collar employees will decrease when technology level increases. Higher the level of AMT, the lesser will be the blue-collar employees. The ratio of white-collar to blue-collar employees in AMT plants will increase as the blue-collar employees' strength decreases when AMTL increases (Davis, 1994).

**Motivation.** The expectancy model states that motivation is a product of how much one wants something and the probability that a certain action will lead to it. Behaviour modification states that behaviour depends on its consequences. It is achieved through operant conditioning. Its approaches include positive and negative reinforcement, shaping and extinction. A combination of the two models is applied to AMT work environment (Davis, 1994).

**Group relations.** Intergroup conflicts between different groups cause problems. Group conflicts should be solved by win-win approach through informal and personal discussion which will benefit both groups (Mintzberg, 1979).
Leadership style (Supervisory). Supervisors form the point of contact between workers and managers. They have to perform different leadership roles in change situations. They have to persuade employees to accept the change in technology, provide task and support them psychologically. A participative and democratic supervisor tends to be more effective in AMT plants.

Reward. Economic reward will be a motivator if employees want more of it. Perceived equity of the reward influences employee choices. Performance appraisal provides a basis for both rewards and other actions such as coaching. Group rewards have become more effective than individual rewards which overcome many negative aspects of individual rewards (Nemetz and Fry, 1988).

Multi-skills. Technology, being a powerful tool to improve social life, brings substantial benefits to society. But it requires higher employee skills, more white-collar work and more multi-skills. As the jobs in AMT are more integrated with many tasks together performed by single machine, knowledge of different operations such turning, milling, grinding and so on is required to be possessed by the operator. Not only these machining aspects, but also skills in programming, loading and unloading of work pieces, operations of computer and related equipment must be possessed by the operator. Hence an operator in AMT machine would be a person with all the knowledge and skills grouped as multi-skills which are required for essential functioning as an AMT operator (Adler, 1986; Davis, 1994).

Supervisory skills. Supervisors in AMT plants are required to possess skills in programming - on line and off line, loading and unloading of work pieces, machine operations, diagnosing problems of computer and machining interface and so on. They have to guide the blue-collar employees in their operations.
Supervisors’ skills may vary from specific skills in conventional machining to multi and integrative skills in the advanced machining (Davis, 1994).

**Skill distribution.** Technology generally upgrades the skill and intellectual requirements of the total workforce. Technology tends to require a higher level of skill both in production work and in supporting services. The conventional technology organisation has a range of skills approaching a bell shaped curve A as shown in Figure 1.5. In an AMT organisation the skill curve moves towards the right and higher in skills as in curve B. It is a bimodel skill distribution curve indicates that many scientific and professional people are needed to design, implement and appraise the complex technology, creating the secondary bulge toward the end of the scale (Davis, 1994).

![Figure 1.5 Change in skill distribution consequent to change in technology (Davis, 1994, p.265)](image)

AMT organisation will be identified in terms of its characters moving towards organic having wider span of control, fewer vertical levels, a variety of tasks, high integration, decentralized decision making, vertical and horizontal communication, adaptive behaviour, group reward, self control and so on. A typology of organisation structure that subsumes most classifications and that
has become popular is mechanistic-organic structure which is measured in a bipolar-continuum also referred to as bureaucratic-adhocratic. The framework proposed in this research therefore includes technology as a determinant of structure. A firm's behavioural position can be identified on the mechanistic-organic continuum and measured by using a semantic differential scale comprising bipolar dimensions as discussed above (Parthasarthy and Sethi, 1992).

1.5.2.4 Impact of AMT on work attitudes

An attitude can be defined as a predisposition to respond to something in a particular way. An individual's behaviour in a group is strongly influenced by his or her personal attributes (Gannon, 1977). Worker attitudes are influenced by technology of production, job security, job training, work environment, technological change and so on. (Norsworthy and Zabala, 1985). Operators who work in AMT machines tend to have more favourable attitudes than those who do not (Martin, 1987). Workers who have positive beliefs about AMT have positive attitudes.

Work attitudes affect job behaviour. The job-related work attitudes in organisational behaviour are organisational commitment, job satisfaction and job involvement (Robbins, 1996). Among the three work attitudes, organisational commitment and job satisfaction were considered in this research (Lincoln, 1989). These job-related attitudes tap positive or negative evaluations that employees hold about aspects of their work environment.

The type of technology influences work attitudes of blue-collar employees by affecting their job satisfaction and commitment (Gamst and Otten, 1992). Technological change has increased job satisfaction and thus a positive relationship exists between them. (White and Ruh, 1973; Form and
McMillen, 1983). AMT has brought a shift in the organisation of work. As the nature of work in AMT is of operating and monitoring the CNC machines, the job satisfaction is expected to be high (Pestonjee, 1991). A person with high level of job satisfaction holds positive attitudes toward the job. Ineffective implementation of AMT could lead to negative attitudes and resistance by employees (Turnage, 1990).

The self-supervising nature of AMT job facilitates more commitment than control by supervisor (Walton, 1985). Commitment of an employee is influenced by planned change effort of the management during the implementation of AMT. Involvement of workers in technological change process reduces worker resistance and increases commitment. High organisational commitment means identifying with one’s employing organisation.

1.5.2.5 Impact of AMT on employees’ performance

As AMT machines are inherently designed to produce superior quality products consistently, the machine productivity is high. But the employees’ productivity may be low resulting from negative work attitudes of blue-collar employees which in turn affect organisational performance. Hence the reasons for low productivity of employees have to be analysed in the context of technological change. The industrial strategy is that probably no company can any longer hope to compete effectively in global market without increasing productivity through AMT.

The technology factor is credited with at least 40% of the growth in productivity (Arnold, 1991). Technological change has an impact on productivity at the time when new technology is put into place and efficiencies are achieved. Resistance to technological change and consequent negative
attitudes of blue-collar employees is one of the causes for declining productivity in firms (Mali, 1978). Norsworthy and Zabala (1985) have concluded that worker attitudes have negatively influenced productivity. Morrison and Mckee (1978) estimated the average contribution to productivity increase by labour, capital and technology as 14%, 27% and 59% respectively. No matter how sophisticated the technology, a firm has at its disposal, the human beings working for the company are its greatest asset for one reason that at least some human help is necessary in the design of such automated plants, let alone their operations (Sumanth, 1984).

Psychological barriers to technological change affect the job satisfaction and commitment of employees. Reduction in psychological barriers increases job satisfaction and commitment and hence develops a positive attitude among blue-collar employees. Vroom (1985) and Iffaldano and Muchinsky (1985) have concluded that there is a positive relationship between satisfaction and productivity. An employee’s productivity on machine-paced job is much more influenced by the speed of the machine than his level of satisfaction (Robbins, 1996). There are two theories on satisfaction – productivity: satisfaction leads to productivity or productivity leads to satisfaction (Greene, 1972; Ostroff, 1992). The theory that satisfaction influences productivity is followed in this research. A satisfied workforce leads to higher productivity.

The concept of organisational commitment has three components namely affective commitment, continuance commitment and normative commitment (Allen and Meyer, 1990). The meanings of the three components are a desire to maintain membership in the organisation, belief in and acceptance of the values and goals of the organisation and a willingness to exert effort on behalf of the organisation respectively. If a person is committed to an organisation, he or she has a strong identification with it, values membership,
agrees with its objectives and value system and finally is prepared to work on its behalf. Meyer et al (1989) found that workers with high affective commitment to their organisation have strong commitment.

1.5.3 Planned change process

Change is a complex process. Change activity which is intentional, goal oriented and purposeful is called planned change process (PCP). The purpose of PCP is to improve the ability of the organisation to adapt to changes in its environment and to change employees' behaviour. A PCP in the context of technological change is to overcome the PBTC and make changes in the structure of organisation. Planned change efforts are aimed to facilitate management support, nurture sustained commitment and positive work attitudes toward AMT to enhance implementation success. The ability of the planning system depends on how the management focusses its efforts successfully, passes through the preparation stage where appropriate skills, attitudes, procedures and structure of organisation could be built and moves on to harnessing the potentials of the AMT. Not only is the planning system important in motivating the initial process of strategic decision making, but it plays a central role in enabling firms to maintain a pro-active edge by anticipating problems of implementation. The dimensions of planned change efforts (PCE) are communication, training, involvement, employee counselling, facilitation and support, negotiation, incentives and manipulations (Pareek, 1981). The degree or the level of planned change effectiveness, which determines a firm as reactive or proactive can be measured by using an instrument.

Change is inevitable in the history of any organisation. Organisations that do not change or keep pace with the changing environment soon become defunct. To function effectively, organisations have to achieve an equilibrium
which is dynamic within the internal environment in terms of technology, structure, employees and the external environment in terms of social, political, economic and cultural factors. Hence organisations have to change, adapting to the changing environment. The change in technology affects any organisation when it is implemented. The change forces the organisations to cope with the environment to become more adaptive otherwise they become extinct (Kotter and Schlesinger, 1979; Levy, 1986). Technology changes faster than people's behaviour. Any attempt to change the organisation to meet changes in the technology generally takes place before the majority of people are ready for it. Thus, while the process of organisational change is going on, a parallel process of preparing employees to accept the change is necessary. In many ways the introduction of the new technology is as painful for traditional management as it is for traditional employees.

1.6 OBJECTIVES

The implementation of AMT in many organisations has failed mostly for reasons of human dimensions, regardless of technology level. New technologies are most likely to yield productivity gains when they are coupled with changes in organisational and human resource systems. Research studies suggest that technology implementation is more likely to be successful when the technology, organisation and employees' issues have been designed to complement and integrate with each other. High failure rate of technological change can be attributed to lack of understanding about the organisational and human resource changes that may be needed with new technology. Hence an analysis of psychological barriers to technological change (PBTC) among the blue-collar employees of AMT firms during and after the implementation of AMT would reveal the ways and means of overcoming the psychological barriers in the implementation of AMT.
A large number of studies on organisational theory literature assert that technology has an influence over organisational structure. If the organisational structure is not appropriate for the work to be performed, the wrong structure will seriously affect business performance. Hence a study of organisational structure of AMT firms after the implementation of new technology is necessary to suggest approaches to new organisational design.

Work attitudes of blue-collar employees of AMT firms are influenced by PBTC (Martin, 1987) and organisational structure (Robbins, 1996). The organisational literature has been concerned with three types of job related attitudes. They are organisational commitment, job satisfaction and job involvement. In this research two types of work attitudes – organisational commitment and job satisfaction have been considered. Hence measurement of organisational commitment (OC) and job satisfaction (JS) is required to correlate their relationships with PBTC and change in organisational structure.

Employees' productivity (EP) which depends upon the positive work attitudes of blue-collar employees, is influenced by psychological barriers and organisational structure. Any reduction in PBTC will improve the commitment of blue-collar employees and hence influence work attitudes positively. Job satisfaction has a role to play to change work attitudes of blue-collar employees which in turn will improve employees' productivity. Change in organisational structure consequent to the implementation of AMT will enhance the employees' productivity by influencing the work attitudes.

The main objectives of this research are:

♦ To analyse the productivity of the blue-collar employees of AMT plants consequent to the implementation of AMT over a period of time.
♦ To study the change in work attitudes of the blue-collar employees of AMT plants after the implementation of AMT.

♦ To analyse the psychological barriers to technological change among the blue-collar employees of AMT plants during and after the implementation of AMT.

♦ To study the change in organisational structure of AMT plants consequent to the technological change.

1.7 HYPOTHESES

The framework proposed in this research could be used to implement AMT in an existing environment and to propose hypotheses. Implementation of AMT will affect productivity of the blue-collar employees by influencing their work attitudes. Change in work attitudes of the blue-collar employees caused by the change in their organisational commitment (OC) and job satisfaction (JS) as a result of PBTC consequent to change in technology. Implementation of new technology will require an organisational structure compatible with the new technology. Inadequate change in organisational structure to make it more organic will also affect OC and JS of the blue-collar employees and hence their work attitudes.

1.7.1 Psychological barriers to technological change (PBTC)

The implementation of AMT in different levels in an existing manufacturing environment will affect blue-collar employees for the reasons explained and hence they resist technological change. Resistance to technological change which is the outcome of PBTC will affect the productivity
of employees through change in their work attitudes, by affecting the OC and JS. Hence the important task of the management in the implementation of AMT is to eliminate PBTC by means of planned change efforts. The reduction of PBTC depends on the level of planned change effectiveness (PCE). It was expected that PBTC among the blue-collar employees would increase with AMTL as higher levels of AMT would lead to less employees and hence job insecurity. The PBTC would also be decreasing over a period of time as they are evolutionary. It was expected that PBTC would be different between AMTLs and AMTYs.

PB 1.1:  *There will be significant difference in PBTC among the blue-collar employees of AMT plants (a) between the levels of AMT and (b) between the years after implementation of AMT, within the same level of planned change effectiveness.*

PB1.1.1:  *There will be a positive relationship between PBTC among the blue-collar employees of AMT plant and the level of AMT.*

PB1.1.2:  *There will be a negative relationship between PBTC among the blue-collar employees of AMT plant and the year after implementation of AMT.*

Planned change effort is an indispensable activity before and during the implementation of AMT to eliminate PBTC and improve work attitudes of the blue-collar employees. Planned change effectiveness level (PCEL) is the degree of the planned change effort in AMT plants which vary from plant to plant. For higher productivity of employees their work attitudes must be positive. To have positive work attitudes, the PBTC must be minimum which depends on PCEL. For AMT plants at the same level of AMT and AMTY, the PBTC will be different as PCEL vary from plant to plant.
PB 1.2: There will be a significant difference in PBTC among the blue-collar employees of AMT plants between the levels of planned change effectiveness (a) at the same year of implementation of AMT and (b) at the same level of AMT.

PB 1.2.1: There will be a negative relationship between PBTC among the blue-collar employees of AMT plants and the planned change effectiveness.

The PBTC among the blue-collar employees differ between the individuals as they are different in age, experience, educational background and technical qualifications possessed by them (Ghani and Sugumar, 1999). It was predicted that younger the age, the lesser will be PBTC among the employees. Also the higher the technical qualifications possessed by the blue-collar employees, the lesser will be the PBTC (Ghani and Sugumar, 1999). Hence it was hypothesised as

PB 1.3: There will be a significant difference in PBTC among the blue-collar employees of AMT plants (a) between the levels of their age i.e. < 30 yrs, 31-45 yrs and > 45 yrs and (b) between the levels of their technical qualifications i.e. no, less and higher qualifications possessed by them.

PB 1.3.1 There will be a positive relationship between PBTC and age of the blue-collar employees of AMT plants.

1.7.2 Change in organisational structure

The change in organisational structure from mechanistic to organic may be measured by organic index (OI) as explained earlier. The higher the
levels of AMT, the higher will be the productivity of AMT plant. Other things being equal, the higher the organic index, the higher will be the productivity. It was expected that higher the level of AMT, the higher would be the organic index for higher performance. The structure of the organisation is expected to change over period of time in reactive firms where change is evolutionary. Hence, it was proposed as

OI 2.1: *There will be significant difference in the organic index of AMT plants (a) between the levels of AMT and (b) between the years of implementation of AMT within the same level of planned change effectiveness.*

OI 2.1.1: *There will be a positive relationship between the organic index of AMT plant and level of AMT.*

OI 2.1.2: *There will be a positive relationship between the organic index and year after the implementation of AMT.*

The PCEL measures the pro-activeness of an AMT plant. Higher the level of PCE, the higher will be the organic index when the level of AMT increases. It was expected that the OI of AMT plant would vary with the level of PCE for a given level of AMT in the same year of implementation of AMT. Hence it was hypothesised as

OI 2.2: *There will be significant difference in the organic index of AMT plants between the levels of planned change effectiveness (a) at the same year of implementation of AMT and (b) at the same level of AMT.*

OI 2.3: *There will be a significant negative correlation between PBTC and organic index of AMT plants.*
1.7.3 Change in organisational commitment (OC)

The framework suggests that higher productivity of employees could be achieved through positive work attitudes of blue-collar employees of AMT plants. (Turnage, 1990). Positive work attitudes of employees could be developed by involvement of employees in technological change process (White and Ruh, 1973). The effects of AMT on OC (work attitudes) will determine the nature of work attitudes among the blue-collar employees. The planned change effort will influence work attitudes among the blue-collar employees of AMT plants. It was expected that the OC among the blue-collar employees of AMT plants would increase when AMTL increase within a PCEL. Hence it was hypothesised as

OC 3.1: *There will be significant difference in the organisational commitment of blue-collar employees of AMT plants (a) between the levels of AMT and (b) between the years of implementation at the same level of planned change effectiveness.*

OC 3.1.1: *There will be a positive relationship between the levels of AMT and organisational commitment of blue-collar employees of AMT plants.*

OC 3.2: *There will be significant difference in the organisational Commitment of blue-collar employees of AMT plants between the levels of planned change effectiveness (a) at the same year of implementation of AMT and (b) at the same level of AMT.*

Technology influences work attitudes (OC) through psychological barriers (Martin, 1987). The OC which is one of the dimensions of work attitudes will be higher when AMT is implemented with high planned change
efforts. For a given level of AMT, the higher the level of PCE, the lesser will be the PBTC among the blue-collar employees. The lesser the PBTC, the higher will be the OC. Hence it was hypothesised as

OC 3.3: *There will be a significant negative correlation between the PBTC and organisational commitment of blue-collar employees of AMT plants.*

Organisational structure has an important bearing on employee attitudes and behaviour (Robbins, 1996). Technology has an influence over structure. Hence the structure of AMT plant which undergoes change affects the OC of employees. It was predicted that the higher the organic index (organic structure) of AMT plant, the higher will be the OC of blue-collar employees.

OC 3.4: *There will be a significant positive correlation between the organic index of AMT plant and organisational commitment of blue-collar employees.*

1.7.4 Change in job satisfaction (JS)

The framework suggests that higher productivity of employees' will be achieved by positive work attitudes through higher JS. Technological change with computerisation has a positive relationship with JS (Gamst and Otten, 1992). It was expected that the JS would increase with AMTL and also it would be different between AMTYs. Hence it was predicted as

JS 4.1: *There will be significant difference in the job satisfaction of blue-collar employees of AMT plants (a) between the levels of AMT and (b) between the years after implementation of AMT at the same level of planned change effectiveness.*
JS 4.1.1: There will be a positive relationship between the job satisfaction of blue-collar employees of AMT plants and levels of AMT.

According to the framework, the job satisfaction (work attitudes) of employees could be enhanced by planned change efforts in the implementation of AMT. It was expected that JS would improve with AMTL/PCEL/ AMTY or the combination of these variables. Hence it was hypothesised as

JS 4.2: There will be significant difference in the job satisfaction of blue-collar employees of AMT plants between the levels of planned change effectiveness (a) at the same level of AMT and (b) at the same year of implementation of AMT.

Technology influences work attitudes through psychological barriers (Martin, 1987). The JS which is one of the dimensions of work attitudes (Robbins, 1996) will be higher when AMT is implemented with planned change efforts. For a given level of AMT, the higher the PCEL, the lesser will be the PBTC among the blue-collar employees. The lesser the PBTC, the higher will be the JS. Hence it was hypothesised as

JS 4.3: There will be a significant negative correlation between the PBTC and job satisfaction of blue-collar employees of AMT plants.

Organisational structure has an important bearing on employee attitudes (Robbins, 1996). Technology has an influence over structure. Hence, the structure of AMT plant which undergoes change affects the JS of employees. It was predicted that the higher the organic index (organic structure) of AMT plant, the higher would be the JS of blue-collar employees.
JS 4.4: There will be a significant positive correlation between the Organic Index of AMT plant and job satisfaction of blue-collar employees.

1.7.5 Change in employees’ productivity (EP)

The productivity of the blue-collar employees will be higher when the work attitudes among them are more positive after the implementation of AMT. AMT is a positive evolutionary process resulting in greater worker productivity (Zisman, 1978). It was predicted that employees’ productivity would increase with the increase in the levels of AMT. Technological change when it is implemented with planned change efforts, would develop positive work attitudes among employees (Turnage, 1990) and hence results in higher productivity. Hence it was expected that productivity of employees would increase with PCEL. Workers’ productivity is positively related to Job Satisfaction and workers’ commitment (Vroom, 1985 & Whitfield and Poole, 1997).

EP 5.1: There will be a positive relationship between the productivity of blue-collar employees of AMT plants and level of AMT.

EP 5.2: There will be a positive relationship between the productivity of blue-collar employees of AMT plant and level of planned change effectiveness.

EP 5.3: There will be a positive relationship between the productivity and organisational commitment of the blue-collar employees of AMT plants.

EP 5.4: There will be a positive relationship between the productivity and job satisfaction of the blue-collar employees of AMT plants.
1.8 SIGNIFICANCE OF THE RESEARCH

AMT is a factor to facilitate competitiveness of Indian manufacturing industry as it promises to revolutionise manufacturing processes. Though attractive benefits were claimed on behalf of the AMT’s potential by their proponents an issue of prime concern for many AMT firms has been their difficulty to successfully exploit the potential of AMT to get superior performance. This research would throw lights on how to implement AMT successfully in an existing environment through well designed planned change efforts to diagnose and overcome the psychological barriers to technological change and to change organisational structure compatible with new technology. The effects of AMT on work, worker, work place and work attitude in a developing economy would be the significant outcomes of this research. This research would provide valuable information on the effects of AMT on organisational structure and work attitudes of blue-collar employees of AMT firms during and after the implementation of AMT and the changes to be made to realise the superior performance. The findings of this research would be very useful to those AMT firms which have already invested huge money in the implementation of AMT in their manufacturing operations and are unable to move up to higher levels of AMT for manufacturing prosperity. There are several other firms which would like to implement AMT looking for this information which will help them to make strategic planning to implement AMT successfully to gain maximum benefits out of AMT.

1.9 ASSUMPTIONS

1. Through the AMT plants with AMTL 1, 2 and 3 at a PCEL and AMTY belong to different AMT firms, they are assumed to belong to one AMT firm.

2. Firms implemented AMT at different levels are assumed to have the same objective of getting superior performance.
3. Though the time of data collection at each AMT plant varies, it is assumed that the data collection made at different AMT plants is at the same time.

4. Though the years after the implementation of AMT in respect of AMT plants at the same level of PCE and AMT are slightly different, it is assumed as the same.

5. The sub-culture of the AMT plants is assumed to be the same as they belong to one region, mostly private owned, follow the same pattern of union activities and management practices.

1.10 PLAN OF THE REPORTING

The proceedings of this research have been reported in 6 chapters. The introductory chapter includes the rationale, the conceptual and proposed framework on the implementation of AMT, its effects on blue-collar employees and their work attitudes and organisational structure. The role of planned change efforts in the implementation of AMT, objectives and hypotheses framed based on the conceptual and proposed framework are also included in Chapter 1. Research studies reviewed pursuant to this research have been presented under studies related to failure of AMT, implementation of AMT, change in organisational structure, work attitudes and employees’ productivity in chapter 2 on ‘Review of the Literature’. Data required, variables and samples which are part of the research design, design of instruments, data collection and statistical measures have been presented in Chapter 3 on ‘Research Methodology’. Hypotheses tested by using ANOVA, correlational and graphical techniques and the results and graphs drawn have been included in Chapter 4 on ‘Testing of Hypothesis’. Results of the statistical tests performed on the hypotheses and analyses by using descriptive, inferential and correlational statistics are reported in chapter 5 on Results and Analyses. The findings, implications, limitations and suggestions for future research are presented in Chapter 6.