

**SOME MANAGERIAL ISSUES CONCERNING
IMPLEMENTATION AND MAINTENANCE OF FLEXIBLE
MANUFACTURING SYSTEMS-AN INDIAN PERSPECTIVE**

by

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Implementation and Maintenance of Flexible Manufacturing Systems
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Abstract

For reasons well known, change has always been uncomfortable to business systems. There is some resistance and resentment whenever changes are made in the existing setup more so in the case of technological change. New technologies have often brought structural changes to the business systems which affect their cultural complexion as well. In recent years, there has been a stream of new innovations in manufacturing and management such as Just In Time (JIT), Flexible Manufacturing Systems (FMS), Computer Integrated Manufacturing (CIM), and Total Quality Management (TQM) that promise to bring about a competitive edge in the market place. This paper studies the implications of one such innovation, viz., FMS to a developing country such as India. The management issues crucial to the successful implementation and maintenance of such systems have been broadly identified.

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1. Introduction

Manufacturing has once again been recognized as a potential choice to provide a strategic advantage in the market. The Japan and the European countries such as Germany have made significant impact in the global markets, be it consumer or industrial goods. We have often been hearing a lot about the success of these nations, which are attributed to the way the manufacturing has been organized, to the innovations made in manufacturing management and to the revolutionary ideas pertaining to quality and consumer satisfaction. The off shoot of these endeavours, to name a few, are the concepts of Just In Time (JIT), Flexible Manufacturing Systems (FMS), Computer Integrated Manufacturing (CIM), Total Quality Management (TQM), Kanban, Zero defects, etc. Considerable published material is now available on these concepts that it does not warrant any detailed explanation in this writing.

There is considerable documented evidence pointing to the fact that the American automobile industry and other sectors such as consumer electronics started losing substantial market share to the Japanese manufacturers. This sent shock waves and the American manufacturers began applying the Japanese concepts straight into their factories. Some of them were successful, others met with failures. The impending threat to snatch the market both domestically and at a global level forced the researchers, industry experts and federal representatives at US to investigate the reason for this phenomenon. There has been an overwhelming evidence which suggests that unless the manufacturing function is "re-engineered", the competitive edge will be lost for ever. The series of articles that have appeared in many journals such as Harvard Business Review [1,2,3,4], Industrial

Engineering [5,6], Management Accounting [7,8,9] and Sloan Management Review [10,11] establish this fact well.

What does all this mean to a country like India? What is the impact of these recent phenomenon to the domestic market? Are we to passively look at these signals or to react to them? What kind of activities have we been doing during these turbulent times? Are we in a position to adopt these new manufacturing innovations? This paper addresses some of these issues in detail. This paper specifically address these issues with respect to Flexible Manufacturing System (FMS) concept. Although it would have been desirable to look at all the manufacturing innovations in this context it requires enormous effort. Moreover, many of the issues are common with the other concepts such as JIT. Hence it was decided to focus on the new manufacturing innovation viz., FMS.

2. Flexible Manufacturing Systems

Flexibility seems to be another key word for providing a competitive edge now a days. Customers are looking for more and more varieties and features in the products. The tastes change continuously and only those manufacturers who respond to these attributes have the leading edge in the competition. This means that we need a system which could operate profitably in the *mid-volume, mid-variety* range and allows us to quickly vary the production volumes and product mix without substantial increase in the cost of operation, in response to the immediate market needs. Adopting to FMS is one method that provides this required flexibility. By means of tying together a set of *high profile machine tools* (such as CNC machine centres and CNC turning centres) and an equally *high profile material handling system* (such as automated guided vehicles, robots etc.) by means of a *high power computer system*, the required flexibility is obtained. A network of computers and the associated software allows the machine tools and the Material Handling System (MHS) entities to *talk* to each other and do

the assigned task in a coordinated fashion. Figure 1 shows a schematic representation of FMS.

Since it is completely computer controlled, alternative parts can be manufactured by simply changing the part programmes and tools. Jobs can be routed through alternative locations by simply telling the MHS entities to do so. Everything in the shop floor starting from the machine tools, MHS entities, tools, chips and coolants, materials, inventory, scrap and work holding devices are watched, directed, and monitored electronically by the computer control system. Library of scheduling and planning algorithms ensures that things happen "almost" to plan.

3. Globalisation and Liberalisation of the Indian Economy

Ever since 1987, the status of the Indian economy has undergone changes which are significant in their impact to the business. Responding to the growing need for a market system with less regulations and controls, the government has looked into possibilities of making our economy more vibrant. The emphasis for these reforms increased even further since 1991, when the economic performance nose dived. The far reaching changes introduced in the country's industrial and trade policies since July, 1991 include virtual scrapping of the industrial licensing and Monopoly and Restrictive Trade Practices (MRTP) regulations, liberalisation of the Foreign Exchange Regulation Act (FERA), narrowing down areas reserved for public sector from 17 to 8, downward adjustment of the rupee value by over 21 percent and so on. There is more talk and action in the area of liberalisation and globalisation of economy. Delicensing of many industries, broad base licensing, full rupee convertibility, excise and custom reliefs are some of the most recent steps in this direction to do away with the *licence raj* and the *permit raj* eventually.

It has been felt, for sometime, that the protectionist policies of the government such as entry barriers for multinationals, and high

duties on imported goods have been responsible for the lack of enthusiasm in the domestic corporate sectors to innovate and invest rapidly in new technologies. Dr. Raja Chelliah in his tax reforms exercise suggested a mechanism through which the custom duty on many items are cut drastically by 1997-98 [12]. Table 1 gives a selected list of items and the proposed custom tariff structure. In fact the process has already begun since 1992-93. The tariffs for machinery were reduced from a maximum of 80-100 % in July 1991 to 50-70 % in 1992 and then to 35% in this year's budget. Along with other reductions this has meant a reduction of the import weighted tariff in India from 87% (1990-91) to 47% (1993-94). The objective now is to reach an import weighted rate of 25% in about three years.

A cursory look at table 1 shows that the effects are likely to be far reaching. The machine tools and the iron & steel industries have to look at modern methods of manufacture. It has been reported that the import of capital goods grew from Rs. 428 crores in 1960 - 61 to Rs. 10,357 crores in 1989-90 while the export figures for the corresponding two periods are Rs. 22 crores and Rs. 3,284 crores [13]. The productivity has to be stepped up and the over all cost of manufacture should be comparable to the international standards. Failure to do this would worsen the already existing bad scenario with respect to the import - export of capital goods.

What is the implication of all these recent events? Reduction in custom duty means that to be competitive, Indian industry will have to plan to produce goods and services at prices that are the best at the global level. As a consequence of the reduction in the entry barriers, the multinationals will be allowed to set up and operate business and manufacturing units in our country. The Japanese have proved more than once that they can offer high quality goods at a relatively low price, than that of their competitors in other countries. If the on going trend is any indication of the events to come, then in less than a

decade the domestic industry should match the international standards in terms of quality and value of the goods and services offered. The other alternative is one of the winding up of the business interests.

We have recognized the need to alert ourselves to this phenomenon of globalisation. A case in point is the recent attempts by many industries to obtain the ISO 9000 Certification. In order to supply goods and services to the member countries of the European Economic Community, adherence to the ISO 9000 standards is mandatory. Recognizing this many Indian industries are striving to obtain the ISO 9000 certification. The central issue now seems to be, how to gear up our manufacturing systems to ensure that the international levels of quality and value are offered through our goods and services. It is not a question of choice, since any decision to stay clear of this would lead us to bankruptcy sooner or later. Instead it is a great opportunity to reap wind fall profits. The traditional idea that "high quality means high cost" is outdated, incorrect and useless. The immediate question that sets in our minds is how we can offer high quality goods and services without increasing the cost appreciably.

Among the many possibilities for improvement, manufacturing provides ample scope. The domestic industries are now looking at methods for cutting down the lead time, cutting down the inventory investments (leave alone eliminating inventory holdings altogether), and improving the quality. There are reports of companies trying to implement JIT concepts, there seems to be more emphasis on worker participation, the number of quality circles in operation are swelling day by day and many industries are engaged in developing long term relationships with the suppliers. Industries have reconfigured their layouts into cellular layouts. A few companies have acquired FMSs, and many more are studying the benefits that FMSs and CIM can bring to the business. Preliminary results have been encouraging and much more are to follow.

4. Impact of the FMS technology

With all its technical superiority, and excellence, not many installations are found to be working even in industrially advanced countries such as US and UK. One reason could be the very high cost associated with these systems. There are success stories of FMS installations and equally failures of FMSs installed world wide. In India, there are a few organizations who "claim" to have the expertise to manufacture and install FMS. Although not much has been reported about the working of such systems in India, there are indications that the utilization of the machines are far from satisfactory. There are many more interested in getting one but are reluctant to move forward.

Ironically on one hand we want to be more competitive, we want to excel in terms of quality and value of the goods and services that we offer and we want to be flexible enough to respond quickly to the market needs, and on the other hand are reluctant to adopt new technological innovations. This is more significant when it involves risky investments in labour and capital. Talking specifically in terms of FMS technology why is it that there is a greater reluctance in the minds of our decision makers? There may be many technical details that may constrain the use of FMSs. For example, the specifications of the machine tools, the rpm of the machine spindle, the type of material that could be cut and the versatility and power of the control system demanded may all pose problems which may be detrimental to adopt FMSs. However, there are other problems which are non-technical in nature and which require a managerial perspective to analyze the problem. Hence, apart from the technical details of the system, a clear understanding of the managerial issues concerning the acquisition and implementation of FMSs is a crucial input for the decision makers. I feel that this would clear the many misapprehensions and provide a sound frame work to look at the issue.

I would broadly classify the problems and issues which inhibit the

domestic industries from using FMS technology under four categories. The classification is not meant to be water tight. It merely serves to bring out the various problems the Indian managers may face and possible precautions that can be taken. Financial issues are those that may generally relate to the economic well being and performance of an organization. Organizational issues relate to the organizational culture, value systems and strategies and the impact of FMS on these. Personnel issues address the problems arising out of the human system, in an organization consequent to choosing to use FMS and finally infrastructural issues are the macro-economic and broad factors that interact mutually with an organization adopting FMS technology.

4.1 Financial Issues

Perhaps the most significant impact on an organization deciding to go in for FMS technology is the very high cost of the system. Recently an executive from a well known machine tools manufacturer mentioned about a four machine FMS for a defence establishment which will cost about Rs. 60 crores. If such huge investments are warranted, the managers would like to ask a series of questions. Do we have the required market to break even in a reasonable period of time? What happens to the return on investment? What is the risk the management is taking in such investments? As we would see in the discussions that follow, many business decisions follow a vicious circle. For example, if you don't have a large market you will neither be able to breakeven in a reasonable period of time nor will have the required cash generated to invest in new technologies. On the other hand if you do not invest in superior technology and processes, you may have little hope of improving your market share. What is required is to come out of the vicious circle either by *leapfrogging* the technology or by investing in a piecemeal fashion. With this perspective in mind, the decision makers need to tackle problems of this nature.

Another related problem is the method we use for investment

justification. Traditional ideas of investment justification demand that every benefit and cost be well measured in rupee terms. If the same rules of the game are used for FMS, we will not be able to justify investments [11, 14]. Superior technology and process builds quality and hence the corporate image. It allows for simultaneous manufacture of a variety of products. Scrap and rework come down. This releases more productive time for regular manufacture. Lead times come down and industries become more responsive to the market needs. Inventory investments are also cut down. Some of these benefits are intangible in nature. These have to be measured in non-rupee terms and included in the justification process. Are our managers ready for this? Once the conviction is there, it does not take much time to devise methods of incorporating them.

The *spin off* effects of FMS technology are numerous. There will be a major impact on the corporate cost accounting system. Experiences in other countries clearly show that the cost structure will change significantly. Direct labour component will continue to fall and the share of the overhead will go up in the total cost of the manufactured goods. Machines will replace skilled labourers. A few operators may be able to tend to a group of machines. All these will demand two important things. Firstly, we may need better overhead pools. Department wise overhead pools will be grossly misleading. Secondly, the basis for allocation of overheads can not be direct labour hours.¹

¹During a discussion with a chartered accountant, it was found that an automobile manufacturer who owns manufacturing units at two different locations uses two different overhead pools and charging basis. In one unit, which is old, the manufacturing set up consists mainly of traditional machines with an average age of 20 years. The department wide overhead pools are allocated based on the direct labour hours. In the second unit, the machines are

There is a greater necessity for incorporating systems and procedures that will help trace the costs specific to the end products. Unless the cost accounting system takes note of these, cost accounting information will not reflect the reality. Instead it will provide erroneous figures for managerial decisions such as pricing, budgeting etc. The Indian managers will need to get acquainted with the recent concepts such as Activity Based Costing (ABC) systems.

The management accountants are likely to face a few other problems. In modern manufacturing systems, the most valuable inventory is the software. The programs and algorithms are responsible for the successful conduct of the show at the shop floor level. Does it not make sense to assess the value of this and show it as an asset? How to include this electronic inventory along with the regular class of inventories? What kind of valuation procedures are to be adopted? The management accountants would as well prepare themselves for these issues in the years to come.

The Indian market is soon expected to become global where in the customer will dictate the price and features that he will be looking for. This would mean that the traditional methods of costing require a different approach to meet this challenge. Target costing is a new attempt in which cost is the difference between the price expectations of the customers and margin expectations of the corporate entities. In other words:

$$\begin{array}{rcl} \text{Cost} & = & \text{Price} & \text{Margin} \\ & & \text{(expectations of} & \text{(desired by the} \\ & & \text{the customer)} & \text{organization)} \end{array}$$

Management accountants will be called upon to work closely with design and engineering personnel to achieve this target.

mostly numerically controlled and machine hour rate is used for charging the overhead.

4.2 Organizational Issues

In my opinion, the organizational issues are difficult to quantify and measure, yet significant in their impact in the implementation and use of FMS technology. There has been considerable discussion elsewhere, with regard to whether investments in FMS and other high-tech systems, which generally have a large rupee outlay are strategic or operational. If we enquire into the process of diffusion of new technologies in any country, there is a greater consensus that such technologies are acquired primarily in a strategic context. Only when the technology diffuses sufficiently, it loses its strategic flavour. The vicious cycle theory applies even here. If we don't invest in new technologies, we don't seem to gain substantial knowledge about the technology. On the other hand whenever we want to invest in new technologies, we will be less reluctant if we know the risks, limitations, and benefits of such technologies.

Unfortunately business systems can not stay in such dilemma for long. Strategic outlook is the need of the hour to break the impasse. In other words, the Indian corporate executives need the gut feeling to lay their hands into these areas and reap the fruits of such actions. If this is not forthcoming, we will not be able to see any significant improvement in the competitive flavour of our domestic industries. The economic, government, and trade policies in recent times have sought to encourage our decision makers to take more risks. Are we going to see a turn around? How long is it going to take? What is the process? All these need to be answered.

If we are able to sail through these uncertainties and decide to invest in FMS technology, it results in a few other complications. Basically, any effort made in the direction of investing in FMS technology clearly assumes that the organizational personnel are ready to play the *integration game*. Integration is a difficult concept in the light of the history of manufacturing. Dominant management and organizational theories are centred around specialization and division

of labour. Majority of the manufacturing organizations in this country are built on these principles. When an age old infrastructure which was designed to support specialization as opposed to integration and when marketing, manufacturing and engineering design departments rarely needed each other how is this integration likely to be brought about in the system? Functional managers may react adversely, they may feel that their authority is eroding. There may be a widespread feeling at the middle management level that too much of interference is there in the name of new systems and technology. All these issues will hamper the success of implementation. How to overcome these problems? Do we need to educate and train these executives? At what cost will we be doing this?

Another aspect of the FMS technology is that the organization moves towards a "high tech" culture. Whether the strategists like it or not, "high tech" becomes the buzz word. Such systems promote employing more personnel of high technology backgrounds such as computers, micro processors, software engineering, controls and drives. It requires a high technology maintenance system as well. ²

4.3 Personnel Issues

A recent report in Business Today estimates that there is an

²I was told that many of the adjustments in Kinetic Honda scooter require some gadget or machine. For example, to adjust the carburetor for idle speed a tachometer would be used to check the idling condition (1800 plus or minus 100 rpm). Earlier scooter models did not require this kind of gadgets. The machine/gadget based adjustment may be more consistent, but it does not escape the fact that we may need more gadgets, checking devices and machines, and workers who are skilled enough to use these machines and perform the maintenance.

immediate need for retrenching about 4.2 million work force [15]. (see Table 2 for more details) Government, public and private sectors have been working on schemes such as "Golden Hand Shake" and "Voluntary Retirement Schemes" to accomplish this task. Preliminary experiences of a few organisations indicate that such schemes instead of weeding out the less skilled and unwanted work force, flushes out the "creamy" layer. A recent report [16] has estimated the growth rates of employment during two five year periods viz., 1978-1983 and 1983-1988. It has been found that in the organized sector, manufacturing recorded growth rates of 2.07% and - 0.09% respectively in the two periods. The growth rates for public sector employment are 2.99% and 2.17%, while the corresponding figures for private sector are 1.41% and - 0.43%. The study has also indicated that there is an overall decrease in growth rate in eight major categories of employment in the organized sector during the period 1983-88 compared to 1978-83. In spite of these reports, there are expectations that the economic reforms currently underway would result in greater employment opportunities in the long run [17]. Against this background, what will be the scenario if the FMS technology is adopted by the manufacturing industries?

Perhaps the significant impact of FMS could be on the work force. Atleast, that is how the unions perceive technologies which have a higher flavour of automation. Recent experiences in our country with respect to introduction of computers in the banking industry has met with a similar perception. There was resistance from the unions and employees. Resistance to change is the natural way by which the social system of any organization reacts. But in the case of a technology like FMS, which attempts to perpetuate the concept of automation, the severity is expected to be more.

Let us first look at the arguments in favour of the work force opposing the introduction of FMS in an organization. It has been established even in industrialized western countries that the work

force perceives a threat in the context of labour savings the automation systems bring forth [18]. When more capital intensive machines are installed, the role of direct labour comes down and the companies may be forced to lay off workers. Every organization that plans to introduce such labour saving technologies need to answer this crucial question in order to ensure successful implementation.

There has been efforts to convince the unions that the net effect of implementing FMS is in fact to maintain and sometimes even to increase the work force in an organization. The supportive argument runs as follows: when such technologies are implemented the productivity goes up, investments in inventory come down, quality and customer satisfaction goes up and due to this the market expands and more business is expected. Increased operations in the organization is expected. This would result in absorbing the displaced work force. Studies have been made to investigate the labour saving versus the work amplifying characteristics of such systems [18].

The foregoing argument has a basic assumption about the flexibility of the work force. This raises a basic question: Can the displaced operators who were working in the existing setup still continue to work in an FMS? To put it in a different manner, will a worker who has been operating say, a turret lathe be in a position to tend to a CNC machining centre? The point is, previously the workers were physically operating the machines with the best of the skills they have acquired. But in an FMS the physical drudgery is replaced by mental alertness. The worker is expected to monitor the working of the machine rather than operating the machine himself. If the traditional worker can still operate an FMS, which is very unlikely, then what kind of training does he need? What would be the new role that he will play?

The foregoing discussion highlights another *spin off* effect of the FMS technology. FMS forces an organization into *deskilling* and *reskilling* phases. The traditional skills of the operators to work on

say, a gear hobbing machine is no longer required. In an FMS there will be one class of workers who will be just confined to loading and unloading of jobs at the load/unload station. This is perceived as the deskilling of the work force.

At the shop floor level, there will be a second class of workers whose role will be one of overall control and supervision of the functioning of the machines and detection, interruption, and correction of the malfunctioning of the machines and the control system. In addition, there will be another class of employees required for preparing part programmes and for planning and scheduling of the system. In order to perform these tasks, the new skills required include knowledge of Computer Aided Design (CAD), Computer Aided Process Planning (CAPP) systems, working with machine controls, skills in program debugging, program maintenance, computer architecture, network and manufacturing automation protocol. Thus the organization need to be "re-skilled" along these lines. This has a tendency to create a "new class" of employees. Those who claim to have expertise in computer systems, who talk in the language of computers. How are these new class of employees expected to fit into the overall system? What are their work norms, work culture and wage structure?

Another issue of concern is the training efforts required. The displaced workers, are to be suitably trained and reabsorbed into other areas of the system. But that is only a minor point. The entire work force associated with FMS, may need intensive training in effectively using the new system. Work methods will be new. The diagnostic capabilities expected on the part of the worker will be more. On hand experience of using the computers and the software developed for the system will be required. The "high-tech" maintenance personnel will have to be trained to trouble shoot and rectify the system using a combination of software and hardware. The supervisory and managerial personnel would require training to monitor and control the system

using the developed software. All these would require considerable time, effort and money. Without proper training the full benefits of the system will hardly be realized. This may require a huge budget.

4.4 Infrastructural Issues

There are many issues at the macro level, which would influence the success of the implementation of FMSs. Many of them relate to the infrastructure and hence I have chosen to group them together and discuss it here. It is a fact that huge investments running to several crores of rupees is the major stumbling block to acquire and use FMSs in a country like India. This has been due to the size of the market we have. Although India is the second largest populated country, the market for many industrial and consumer goods is relatively small. This is directly related to the standard of living, the poor per capita income, the high commodity prices and the economic growth. If the onslaught of globalisation and liberalisation of economy could also open up new markets then investments in such technologies are much more easier.

Again the vicious circle theory holds good. We really do not know which should happen first; Is it the investment in such new technologies or the opening up of the new markets? Gut feeling and innovative approaches are required with respect to investing in such systems. Efforts have to be made to investigate the possibility of investing in a piece meal basis, without seriously affecting the financial viability of the operations. Over a period of time, the experience acquired in the use of such systems would come handy to develop a full fledged system when the market eventually begins to expand. What is required is a trade off between economies of scale and economies of scope.

In the recent budget some downward revisions have been made in the custom and excise duties. However, if the anomalies arising due to instances of multiple point taxation (of raw materials and of finished

goods) are not removed the goods and the services offered will be costlier. Infact, the Confederation of Indian Industries have been insisting that reduction of custom duties should be matched with corresponding efforts in rationalizing the excise duty structure also. Only this would ensure a level ground for competition with the global industries. If this is not forthcoming soon, the domestic industries may be forced to look for cost cutting methods in the manufacture.

Even when the best efforts are made internally in an organization to implement FMSs, the systems do not work continuously due to lack of infrastructural support facilities such as materials, spares and qualified maintenance personnel. Non availability of certain special class of materials, have often resulted in shutting down the system. When the control system fails, the qualified personnel to rectify it may not be readily available. The power supply requirements of an FMS are stringent. These factors might have been responsible for the poor utilization of the few working FMSs in our country.

The nature of the impact FMS could bring on the work force has been discussed earlier. The labour saving aspect of the automation based technologies and the de- skilling and re-skilling requirements have some implications at the macro level. Firstly the problem of man power management becomes critical. The demand and supply gap will be wide if the government does not take immediate steps. There will be considerable demand for work force with skills in data handling, programming, system maintenance and Numerical Control (NC) machine operations. The ministry of human resources has already recognized that there is shortage of personnel skills in some of these areas due to an all round growth in the information technology and communication systems sectors.

The second problem will be to address the problem of unemployment. Even prior to the use of labour savings technologies such as FMS, the current estimates are that nearly 4.2 million workers will have to be

retrenched (Table 2). If many more workers are displaced and recruitments are stopped, it will create social tension and unrest amongst the unemployed masses. With very less budgetary allocation for the National Renewal Fund, how does the government expect to tackle this problem? Will there be any unemployment premium or support funding? What are the new areas in which employment will be created? To what extent self employment programmes will be supported?

5. Conclusions

The recent trends in the globalisation and liberalisation of the Indian economy has forced the domestic manufacturers to adopt new innovations in manufacturing and management. Recognizing the need for better ways of organizing and managing the work place, there is a renewed interest in the recent innovations and automation based technologies. This study has looked at the various aspects of the FMS technology and raised several issues. In order that the diffusion of FMS technology be smooth, rapid and timely, it is important to study these issues in detail.

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Table 1

Proposed custom tariff structure by Chelliah committee.

Item name	Existing rate	proposed (1997-98)
	(All values are in percentages)	
<i>Petro chemicals</i>		
PVC	41	25
LDPE/HDPE	63/64	25
Polypropylene	78	25
Polystyrene	53	25
Propylene	80	15
Isobutane/Isoprene	110	20
<i>Iron and Steel</i>		
Sponge iron	35	10
Pig iron	30	15
CR coils/sheets	94	20
Stainless steel	110	20
<i>Machinery</i>		
Machine tools (peak rate)	110	20
Other machine tools	60	20
Power project imports	30	20
Normal project imports	55	20
Electronic projects	50	20
<i>Electronics</i>		
Raw materials	40	20
Piece parts	60	30
Consumables	60	30
Components	80	30
Sub assemblies	110	30

* Source: Business Today, March 7, 1993.

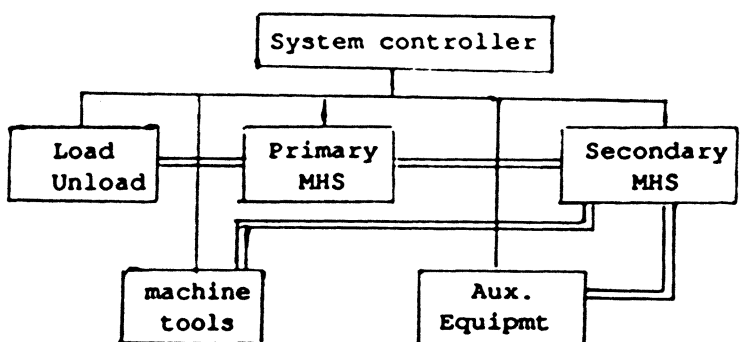
Table 2

Current Employment status in India and the level of retrenchment required.

(a) Total employment	: 358 million
1. Agricultural workers	: 219 million
2. Non-agricultural workers	: 139 million
2.1 Unorganized sector	: 111 million
2.2 Organized sector	: 28 million
2.21 Public sector	: 19.9 million
2.22 Private sector	: 8.1 million
<hr/>	
(b) Number of workers to be retrenched	: 4.20 million
1. Workers in sick private sector	: 1.30 million
2. Workers in sick public sector referred to BIFR	: 0.45 million
3. Workers in sick state sector units	: 0.65 million
4. Excess government staff	: 1.80 million

* Source: Business Today, Apr.22 - May 6, 1993.

Figure 1 - Structure of an FMS



— information flow. == material flow.