10

The Place of the Human Worker in the Manufacturing Plant of the Future

PERSONNEL IN THE PLANT OF THE FUTURE

CIM often is considered in a technical context (computers, networks data and software). However, these are only tools. Unless an enterprise is organized, trained and has the mindset to use these tools, they will not generate the anticipated results. If nothing else, early experience has taught us that the human and organizational side of CIM is extremely important.

The place of the human plant operator, the supervisor, and the engineer in a future plant controlled by such a computer system as is being discussed here is a vital part of the study of any such system. We will now present one view of how the human might best be integrated with such a system to achieve the best synergism of the capabilities of each.

In discussing the probable place of operational personnel in the industrial plant of the future one must bear in mind that there are two major considerations at work here. The first of these is that of the "quality of working life" of plant production personnel. They must be relieved of dirty, undesirable, and monotonous tasks; their health and safety must be strenuously protected; and the salary awarded must be high enough to assure a certain standard of living. The second or counter factor to this is, of course, the economic one, that of the capital and operating cost of a mechanical and/or electronic device capable of carrying out those functions now assigned to these personnel. At the plant floor level these decisions can be made "ad hoc" for each situation as it arises since the proposed control system described here can operate regardless of its actual plant production interface provided the necessary communications is established and maintained. That is, a process can either be manually operated or it can be completely computer controlled in the broadest sense, provided the necessary reporting is assured.

At the upper levels of the hierarchy there is a natural allocation of tasks among plant and company supervisory personnel as noted in Figure 10-1. The distribution of tasks almost exactly corresponds to that assigned within the hierarchical computer system as amply shown by Figure 10-2 [44]. Thus a one-to-one relationship must exist between the tasks of the plant production supervisory personnel and the functions of the computer integrated manufacturing system operating the plant in order to obtain the potential synergism that exists.

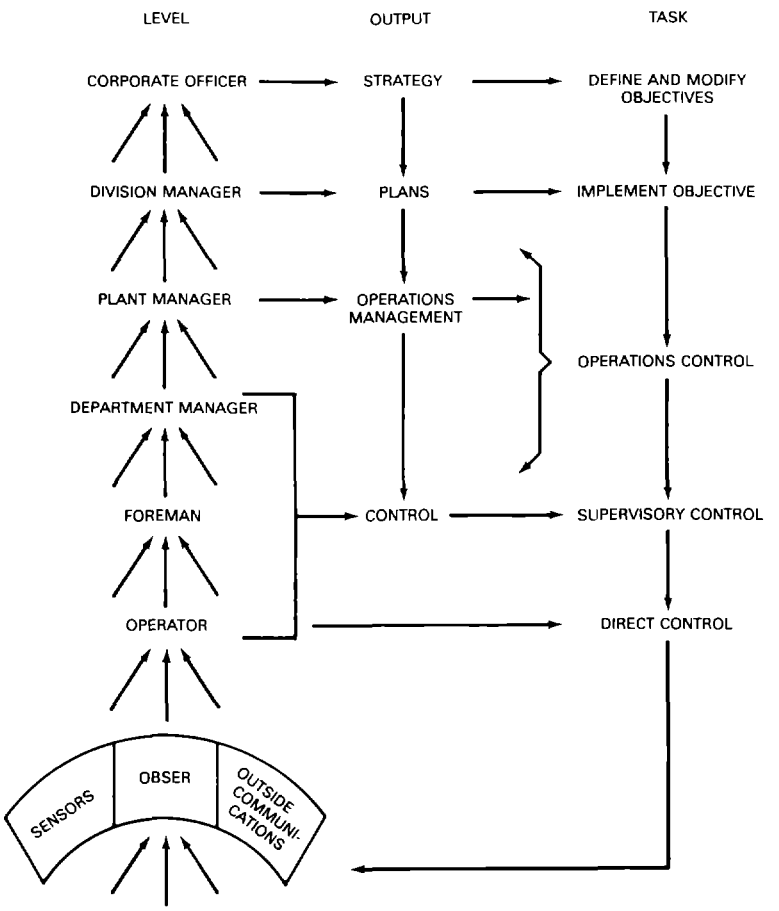

Figure 10-1 Personnel task hierarchy in a large manufacturing plant.

MILL CULTURES AND HUMAN RESOURCES

A committee of the Manufacturing Studies Board of the National Research Council [39] found that certain basic characteristics of this new technology (CIM) are fundamental to identifying human resource practices that are effective in implementing it. When compared with the technologies the CIM replaced, the applications were characterized by:

1. Greater interdependence among work activities;
2. Fewer employees in a group responsible for each product, part or process;
3. Higher capital investment per employee;
4. More immediate consequences of the failure of part of the system on the whole production system;
5. More costly consequences of malfunctions in the system; and,

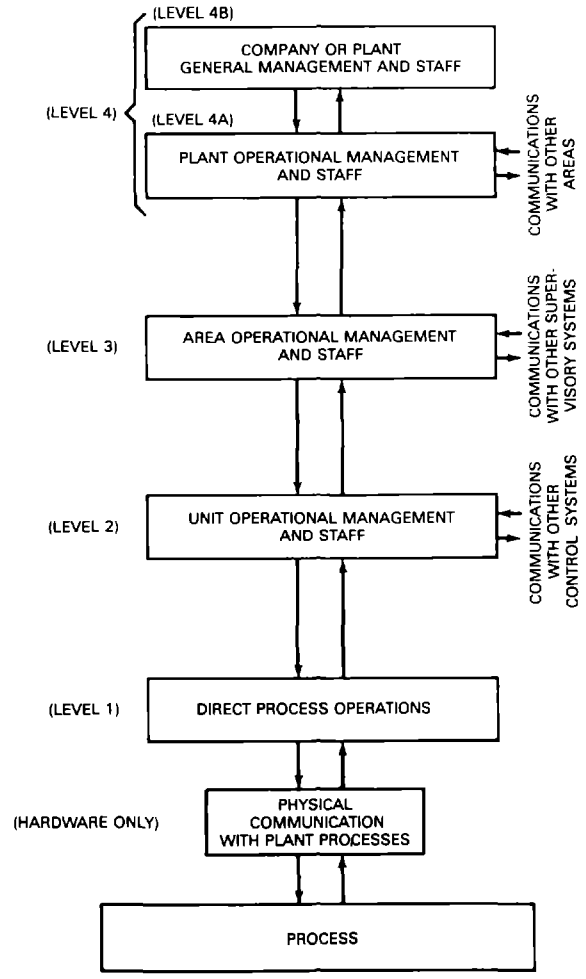

Figure 10-2 Plant operational management hierarchical structure to match the computer hierarchy.

6. More sensitivity of process or plant output to variations in human skills, knowledge, and attitude, and to mental rather than physical effort.

These characteristics of CIM have caused many manufacturers involved with implementing it to initiate or expedite pursuit of the following interrelated organizational objectives:

1. A highly flexible, problem-solving, interacting and committed work force to permit the optimum use of the automation tools;

2. A flexible human and innovative management organization with fewer levels and job classifications to accommodate the employees needs to relate to cultural aspects of the system;

3. A high retention rate of well-trained workers to maintain in the work force; and,

4. A strong partnership between management and the work force representatives (unions, where they represent the work force) to ease the adjustments to changes brought on by the new technology.

Thus, the human resource aspects of plant modernization are a significant dimension of the overall implementation task.

MAN-MACHINE INTERFACES

The operator's and supervisor's consoles in the distributed computer system are almost always of a common basic design. Likewise, they are of a standard pixel addressable color CRT variety which is also usable in a wide range of other computer system applications in order to keep their costs as competitive as possible. They are, of course, customized to a particular process control application by the programming applied by the vendor to each unit. As with the basic set up of the unit for control operations, implementations of the CRT based, operator's or supervisor's console by the user is readily done by means of a "configuration" method rather than by general programming - again greatly easing the task involved. The vendor had previously provided the programmed menu which made the set-up by configuration noted above possible. Here, the industrial control vendors have admirably answered an obvious need, adapting the same CRT interface design by menu programming to satisfy a set of widely varying needs among a large variety of processes and industries [84,114,117].

In fact, if future man-machine duties work out as just described they may have done an even better job than expected. Because, as indicated in Figure 10-3, the new console systems, when properly coordinated with the distributed microprocessor control systems of Levels 1 and 2, really have the potential of moving the plant operator's task from Level 1 to Level 2 or 3. That is, the present day process control operator can easily become a true process supervisor and thus make a much more effective use of the capabilities of the human in the process control hierarchy structure as a monitor and overseer rather than a machine-paced participant. A whole new order of magnitude of reliability is necessary for the above to become established practice. However, as discussed above, these new systems have the potential (not yet completely exploited by most vendors) to indeed achieve these required reliabilities or better availabilities.

Situated as it is at Level 1 of the hierarchy, the microprocessor-based, distributed digital control system thus becomes the "control enforcement" medium for the plant.

INNOVATION IN THE WORKPLACE

As noted in Appendix IV under the definition of [policy implementors] the primary task assigned to most manufacturing plant personnel is that of a policy implementor, i.e., to carry out in the most expeditious manner possible the task or instruction assigned them by other plant entities, usually higher in the hierarchy. Personnel are usually assigned to such tasks because the actions involved are: (1) too complex in terms of dexterity, sensory information or intelligence required for machine implementation, or (2) humans are more cost effective in carrying out the task, or (3) the necessary machines are economically and technically feasible but have not yet been developed or procured for social or political reasons.

As noted under the above definition, the substitution of a human worker for a machine, and vice versa, in no way subverts the definition of the CIM Reference Model for the resulting factory, provided only that the required information concerning the implementation of the task involved as needed by adjacent and upper level entities is provided in a timely and accurate manner by either.

The difficulty in defining the role of the human worker in the manufacturing plant arises when they have been assigned both an implementor and a policy role in the same task, i.e., some of the decisions assigned to them are pro forma and can be described by an algorithm and can potentially be carried out by a computer or other device, but others do require true innovation that must be captured in terms of a new policy (i.e., they become [policy makers]) or the resulting innovation will be lost.

Again, where the requirement for such actions on the part of the human worker are known, such a

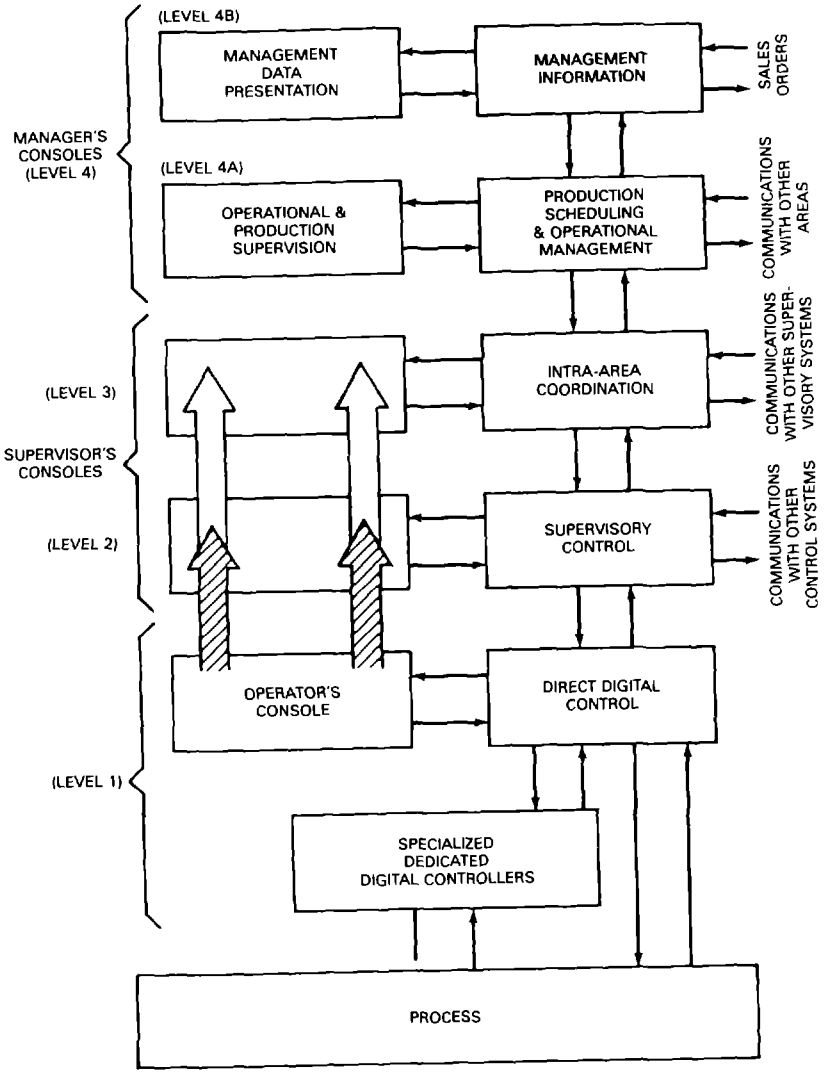

Figure 10-3 Potential future use of the plant operator as a process supervisor rather than a control manipulator.

dichotomy can be readily provided for by defining the workers' assigned job as two tasks: one (the policy implementation part) will be within the plant's information and control hierarchy as described herein and will be so treated; the other, the part requiring innovation will be treated as an external entity and will be considered as part of engineering, marketing, etc., where it best fits.

The major requirement here is to provide the necessary information gathering and transmission facilities so that the resulting innovative decision and its corresponding actions are recorded and made available to all those plant entities which are affected by or need information concerning that decision or action.

SOME NOTES ON HUMAN ORGANIZATION IN THE FACTORY

It is noted that there is a definite movement in some social quarters to proscribe a one-level or minimum number of levels of management organization on the factory. This is carried out by one or more of the following methods:

1. By limiting the usual perquisites of management (status symbols, dress code, etc.) without really decreasing the levels of authority, i.e., a policy of personnel eqalité. This does not affect the CIM Reference Model representation or the resulting organization.

2. By truly distributing innovation demanding decision-making as low in the organization as possible, or,

3. Assigning the necessary innovative decision-making to committees composed of both management and worker personnel. It must be noted that this stratagem merely substitutes the committees for the usual individual assigned the task in question and does not invalidate the normal CIM Reference Model allowance for the resulting decision.

Thus Items 1 and 3 above represent no real change of the CIM Reference Model presented here even though the cosmetic appearance to the personnel involved is considerably different. Item 2 is a fundamentally different organization unless it is handled as discussed in the previous section by defining each worker so involved as having two separate tasks - one innovative and one algorithmic.

Again the key to an effective CIM architecture is the provision and use of the requisite communications facilities for all tasks within the CIM structure.

AN EXAMPLE OF PARTICIPATIVE MANAGEMENT

Like all American manufacturing companies the Monsanto Chemical Company [71] has been impacted by a global economy that has seen faster technological change and obsolescence in products. This led Monsanto's corporate management to a fundamental reexamination of the various businesses that comprised the corporation. The result was a clear decision that if corporate growth was to come from the biological sciences of agriculture, nutrition and health-care, the traditional parts of the corporation must be able to provide the cash to fund the future growth. It was imperative that the cash generator be capable of performing its mission. Therefore, traditional businesses were examined with a very critical eye and those that were weak or marginal were divested as were those that did not fit the strategic direction.

The Fibers Division of Monsanto produces products at four manufacturing sites with approximately 6500 people. It comprises about 40% of the Chemical Company in people, sales and assets. The Division has existed in one form or another since the mid 50's. Its newest manufacturing site began operations in the early 1960's.

The Fibers Division's business was such that if they were to fulfill their role, they had to reexamine the way they would operate in the future. Indeed, if they could not meet their financial targets, then their survival over the long term was questionable.

Since they were so heavily leveraged by manufacturing, it was obvious that they had to focus efforts on establishing a strategy characterized by quality of product and service, flexibility, action and low cost. In essence, they were talking about an organization renewal in their manufacturing function.

Organization renewal can occur in a number of ways. It is unusual for it to occur other than be imposed from above. Of course when this happens, the organization seldom renews itself in the sense that its people do not become truly committed to its goals, and the new leadership needed to guide the organization according to the new and different precepts of action seldom develops.

The organizational renewal now being experienced in fibers manufacturing may well turn out to be different because it was begun with a simple directive from the general manager of manufacturing—improve productivity by 50% in three years as measured by very specific indices, or the Company would seriously investigate selling the Division.

The challenge to improve productivity by 50% required a new way of thinking. The organization had to examine old paradigms and question the way it did everything. A step change was required, not an incremental change. The Division named this consolidated effort the *Plant of the 90's*.

The manufacturing staff developed a broad framework over a nine month period in 1985 in which to accomplish the directive. Originally, the framework focused on application of technology such

as computer integrated manufacturing, just in time (JIT) inventory systems, electronic linkages to our customers, distributed process control, artificial intelligence and robotics. This technology, *CIM*, became the first cornerstone of the plan. However, two additional opportunities soon emerged as having significant impact.

A process to be called *Total Quality* quickly established itself as a second cornerstone for our Plant of the 90's.

Total quality within the Monsanto Chemical Company is a defined process and key concept by which constant improvement is sought in every aspect of the Company's business. It is heavily dependent on developing and sharing information and on employee involvement and thus is a natural fit in the Plant of the 90's effort.

It was during the discussion of the generic CIM model that it was realized that the application of this technology would have significant human resources impact. One issue that quickly emerged, for instance, was the question of where various types of work would be performed. How much lab work would be pushed out to the production units? Would the plant maintain a centralized cadre of engineering talent? Would maintenance be integrated under the production umbrella? Etc. etc. This issue was prompted by the approach to information systems which was selected.

Prior to the CIM approach, information systems were developed in the plants—one area at a time. Where it was necessary to link systems, specific programs were written to provide the bridge.

Should the Company continue to automate in this fashion, it would forego many of the organizational benefits from integration within manufacturing and find it very difficult to link manufacturing with other parts of the business, to their suppliers and to their customers. It became clear that unless an integrated organization was used, having integrated information made little sense.

It was at this point that the Division decided to engage in a parallel *Human Resources Planning* effort.

Thus while the effort initially focused on computer integrated manufacturing, it was now only one of three cornerstones in the vision of the Plant of the 90's.

The human resources study opened new vistas about employee involvement, job responsibility and organization design as well as challenging the established power bases in the plant's traditional organizations. An integrated information database cuts across functions so that new and or different players can fulfill the same functional role now claimed by someone in accounting, in quality control, in engineering or in personnel, for example.

The human resources function, therefore, was given the charter to examine the plant culture—that is, how tasks were accomplished—and to suggest changes that made sense in light of the implications of the technology being discussed. It was believed that through careful integration of the three cornerstones (CIM, Total Quality, Human Resources Planning) a plant would gain maximum benefit from the renewal effort and would thus drive the organization beyond the financial targets set.

The following is a brief description of the Human Resources Planning that occurred as part of the Plant of the 90's process.

Seven key questions were used (Table 10-I) to guide this planning effort—the same questions used by the manufacturing management staff when they developed their vision for the application of computer technology. The idea was to take a blinders-off approach to creating a vision of what the Division wanted its plants to look like in the 90's and in particular, to identify the step changes needed in policies and practices that had to occur to achieve the established productivity goals. These questions provided the framework for examining where we were, where we wanted to go and how to get there.

The Human Resources Planning effort was organized as a mirror image to the manufacturing staff effort. Representative of each site was given the responsibility to put in place a team to do their individual work to implement the vision.

The result of examining those questions was a strategy to support manufacturing's mission. There was little doubt that the Division had to

TABLE 10-I

QUESTIONS USED IN THE HUMAN RESOURCES STUDY

1. WHERE ARE WE? (TODAY)
2. WHERE DO WE WANT TO GO BY 1990?
3. HOW ARE WE GOING TO GET THERE? (ORGANIZATION AND TECHNOLOGY)
4. WHEN WILL IT BE DONE? (SEQUENCING AND EVENTS)
5. WHO IS RESPONSIBLE FOR WHAT?
6. HOW MUCH WILL IT COST AND WHAT ARE THE FINANCIAL BENEFITS?
7. HOW WILL WE KNOW WHEN WE ARE THERE?

TABLE 10-II

KEY POINTS IN THE HUMAN RESOURCES STRATEGY

1. ORGANIZATION
2. WORK ENVIRONMENT
3. COMPENSATION/RECOGNITION
4. COMMUNICATIONS
5. MANAGEMENT STYLE
6. TRAINING

push the organization faster to engage all employees in the attainment of the organization goals.

The motivating force to get everyone's attention was continued economic viability—survival.

The strategy developed includes the following major points (Table 10-II):

Strategies/organizaton—It was desired to place responsibility, authority and decision making lower in the organization. The vehicle to accomplish this was self-managed teams of employees. To create self-managed teams required a significant change in organization structure and job responsibilities.

Strategies/work environment—A highly flexible work environment that provided employees the ability to change their own work practices to better accomplish goals was needed. Restrictive work practices and functional barriers were to be eroded.

Strategies/compensation—Elements of performance and knowledge were to become part of the compensation equation as well as ability to pay and competition. In addition, it was necessary to minimize differences in compensation and benefit practices between wage and salary employees to foster team behavior.

Strategies/communications—The whole purpose of Total Quality and CIM is to provide and use information to achieve improved results and less hassle. Therefore, it was imperative that employees at all levels be dealt into the information loop to promote employee involvement. Because survival was paramount, business direction and results information was important. But, information about what the customer said and wanted was also important to maintain any momentum established. Employees do not get involved just because it is decreed that they should. Something must convince them that it is in their own best interest. Economic survival can get things going, but something else must keep the ball rolling. The only thing that makes sense is what the customer says and wants. Thus direct customer interfaces with employees at every level of the organization is a key element of the communications strategy.

Strategies/management style—In order to accelerate employee involvement, it was necessary to replace the traditional boss/subordinate relationship with a facilitator/ employee relationship. Some individuals adapt very easily to this role. Others, however, find it very difficult, and some find it impossible. Therefore, training was the last key point.

Strategies/training—To shift the organization would require unprecedented levels of training. Management and employees had to define and adopt new roles as well as learn new organization and job skills. In addition, training the organization in the concepts of total quality and making

employees computer literate would be massive undertakings.

To sum up, the Division had to achieve an employee involvement as a process and on a scale beyond anything previously known.

To implement the human resources strategies, the Division personnel staff became part of the Plant of the 90's organization structures at each site working to implement the vision.

At each plant site a steering committee was named which was generally the same group that developed each plant's model of the vision. Its responsibilities include, direction setting, project prioritizing, resourcing and capital, and benefits approval.

A Plant of the 90's coordinator was designated who reported to the Site Steering Committee. This individual coordinated the three efforts of CIM, Total Quality and Human Resources, monitored results, reported on project status and coordinated with other sites.

These duties for the Plant of the 90's effort are in addition to the normal job duties of these individuals.

Thus the human resources strategy of employment involvement was integrated into the Plant of the 90's effort.

TABLE 10-III

THE EMPLOYEE INVOLVEMENT PROCESS

1. RECOGNIZE THE NEED TO CHANGE
2. SHARE INFORMATION
3. CREATE THE EMPLOYMENT INVOLVEMENT STRUCTURES
4. SKILLS IMPROVEMENT
5. TEAM BUILDING (INCLUDING MANAGEMENT ACCEPTANCE)
6. REFINE STRATEGY AND STRUCTURE
7. REWARD/RECOGNITION

Strategies and plans are great, but one must translate them into action. There is a process to follow to accomplish employee involvement, and the staff carefully set about making it happen in each of the plants. The process is shown in Table 10-III.

It should emphasize that this is not a quick fix program. It is a process that must be managed almost in a sequential mode.

A brief scenario will show what is happening at one plant to show the application of the above process.

This is a plant that is going through a complete transformation in its management style. It was previously a very traditionally managed organization with what we call a "mill culture", as it is known in the textile industry. Employees were very much task oriented and a we/they attitude prevailed. Today it is 90% team based. This change did not occur overnight. Indeed, it is not yet complete. The change that is occurring began in earnest in 1979.

The viability of the plant was in question all throughout this period. Thus a need to change (survival) was clearly recognized. The effort to begin employee involvement began with the sharing of information, not only negative information but also positive information about plant performance.

Most companies are good at using negative information as a springboard to get action, but they seldom share hard data about how well the plant or business is doing or other information employees could use to do their jobs better. Direct communication with customers was unheard of below the second level of supervision.

In addition to simply providing information, the plant management communicated why they felt a change in style was needed. Each employee participated in an eight hour training program on the need to increase productivity, improve product quality and how the plant could address the quality of work life, almost a small business economics course.

It was during this period of time that the quality circle concept was adopted throughout the division. Quality circles provided a structure that allowed the plant to further experiment with the

mechanics and techniques of employee involvement.

From there, the plant evolved to special issue resolution teams—groups of employees that come together to address special problems and then disband once the problem is solved. These teams still function and have been the real forerunners of the plant's current team based management style. They emphasized statistical process control training and the developing of closed loop computer technology to control their processes.

Planning for team based management began in January 1985. It was prompted again by the perceived need to accelerate employee involvement as one of the major strategies to insure economic survival. It seemed to be the natural way of doing business, particularly when two voluntary termination programs (one for the Fibers Division and one a corporate restructuring program) resulted in the loss of about 60% of the plant's first line supervision.

The planning addressed the subjects or organization structure, job tasks, communication issues and the types of training necessary to implement this approach. It was accomplished by design teams for each function made up of a cross section of employees with input from others as needed.

Such planning is not easy to accomplish because it covers changes to the basic structure of the organization and threatens the current jobs of many of the remaining employees rather than just allocating the work to be done. Organizations will either get tacit agreement or real commitment depending on how they approach questions of this kind.

The team based management concept was implemented as follows: Design team members attended three days of training and discussions with the plant manager and staff in which the vision for the plant was presented and issues were discussed and concerns vented. Part of the time spent was to identify and assess the culture that existed in the plant.

The issue of culture is important because one has to know whether the current culture is conducive to carrying out the vision. There must be a critical mass that believes and trusts in the vision. If not it will be doomed to failure.

Culture as used here simply refers to the way employees perceive things to be that result in behaviors. A more practical definition is simply that it is what employees talk about in the cafeteria or at the bowling alley.

Employees identified the various subcultures and management styles in the plant and what was needed for change. Some of the subcultures identified were—good ole boy—Rip Van Winkle—hippopotamus. The last referred to the behavior of the hippopotamus when threatened by the approach of strangers or outsiders. They sink to the bottom of the river and only rise after the disturbance has passed.

Some of the management styles identified included Sherman tanks, hand wringers and exploders. There probably is no need to explain those.

The purpose of identifying the cultures and styles is to identify new skills and roles that have to be performed in the team based environment.

For supervision, the old role was to maintain the status quo and control everything. The new role is to take a greater leadership approach, control things and gain a commitment from people. It requires different skills. Supervisors must expand their database for decision making by involving more expertise. They must lead change and project ideas for teams to implement.

Other team members must expand their accountability and responsibility and become more proactive.

Following the discussion of the vision and employee concerns, the design teams went to work to look at how the work could be restructured. The teams were given considerable freedom.

The design teams eliminated the job of first line supervisor, restructured the work in the department and developed new communication roles and requirements. Coordinators were created to handle paperwork and administrative duties—make assignments, schedule vacations, schedule overtime, coordinate major maintenance, get and dispense supplies and communicate between shifts. The coordinator role is rotated among the operators.

The first line supervisor became a resource person to help the coordinator and other team members perform their jobs.

The first attempt at team design centered around employees doing a common job. This quickly evolved to teams that follow the product line, from raw material to finished product and shipment—the concept of a plant within a plant. Much of this becomes possible, of course, as you apply computer technology to consolidate control rooms, etc.

This plant is expanding its views of integration and moving forward to fully integrated, multifunction/ multiskilled teams, the members of which now perform production, maintenance and quality control duties. Integration of support services into the production line organizations is the key to moving responsibilities lower in the organization and broadening the scope of responsibilities of Fibers Division employees. The plant will soon have a team based environment that is structured like a natural work group with all functional areas folded under a product team umbrella and small core groups to provide plant-wide assistance. The goal is to have these natural work groups take the responsibility for running their own business by giving them control for such areas as quality assurance, maintenance planning and execution, safety, customer/supplier relationships, training, cost control, etc.

Figures 10-4 and 10-5 illustrate what is wanted in the way of behaviors associated with each shift in organization toward the multiskill, multifunction teams. As people gain more confidence in their abilities and in the motives of management, they begin to question other aspects of the organization and what can be done to achieve additional improvement. It is this process that causes new leaders to develop and emerge. It happens at all levels of the organization. For instance, the real leaders of the CIM effort are people who prior to 1985 were good solid folks but who did not receive the recognition they get today and who did not have the impact on the organization they have today.

Of course all of this creates issues that must be addressed. How will we pay employees, what about job security, what policies and procedures will become incompatible with the team environment, what happens to employees that cannot adapt to the team environment, etc., etc.?

One of the most important aspects of moving to a team based environment that must be addressed is that of eliminating differences in the way groups of people are treated. An equity mentality must be established otherwise the team environment will be weakened. Several items have been identified that signal the existence of different classes of people and steps are being taken to eliminate those differences. Those differences include such things as the terms hourly and salary employees; different

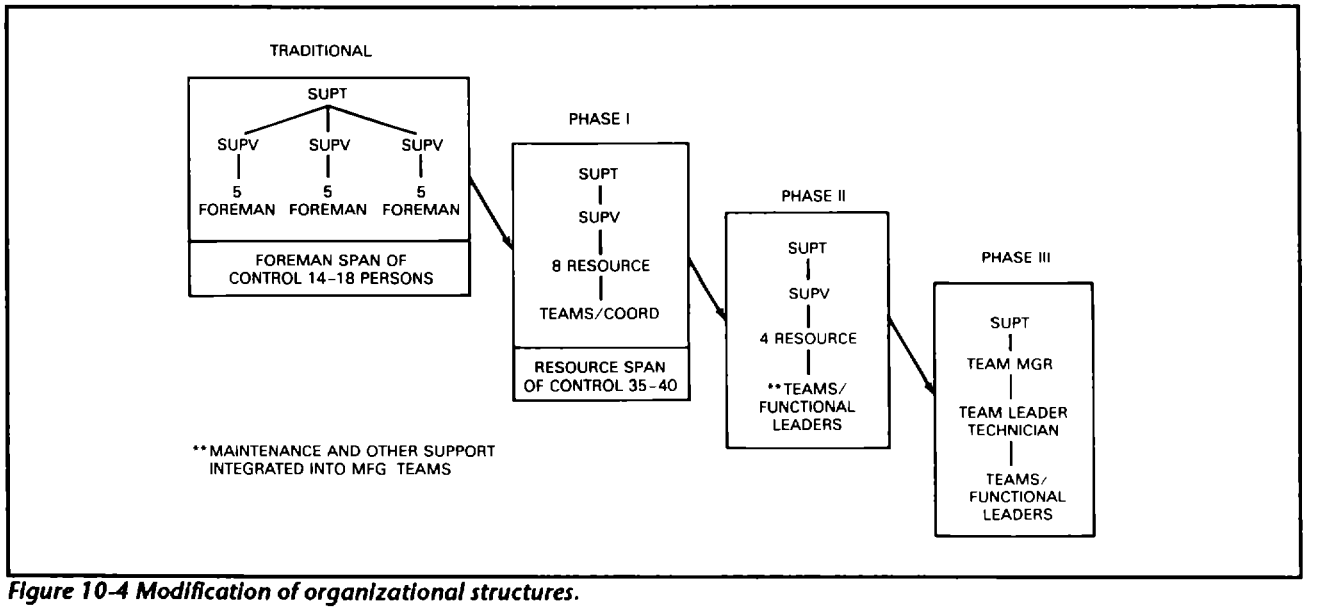

Figure 10-4 Modification of organizational structures.

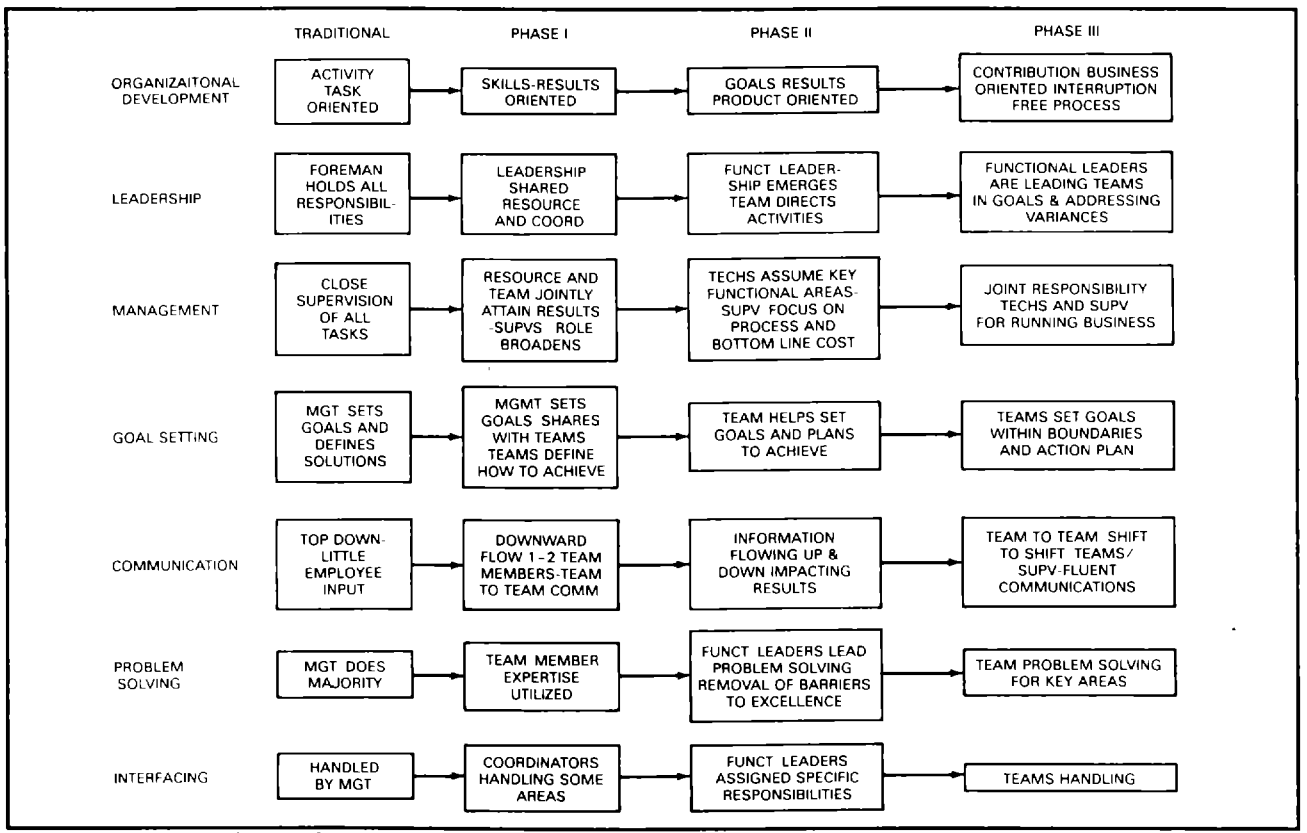

Figure 10-5 Culture phases of team-based management.

treatment in benefit items, such as waiting days for accident and sickness pay; delivery of paychecks in an envelope vs no envelope; training classes held off site vs on site; and the list goes on and on. One plant identified some 40 differences.

Many of these elements are easy to correct and really don't cost anything to change. On the other hand, there is cost, and potentially substantial cost associated with others. In one case, there were different pension plans for salary employees and hourly employees. The Division is seriously considering moving to an all salary workforce and will face significant short term increases in pension costs because of the different funding assumptions involved.

Another issue is that of job security. Obviously anticipating that and implementing a fully integrated, multiskill, multifunction team environment will allow us to reduce headcount substantially. The Division has committed to reduce headcount through attrition and believes that it is possible. However, if attrition does not occur as anticipated they may have to consider other means of reducing headcount either through fewer contract employees or by the use of creative voluntary termination programs. They are committed not to lay off just because employee involvement allowed them to eliminate jobs.

Next is the issue of reward and recognition. Most pay systems to not reinforce a team environment. It must change to incorporate an element of variable compensation based on performance against goals. Gainsharing is a term often used. It is the Division's belief, based on their own research, that the gainsharing plan to be used must be homegrown. It will, however, be the last major element to be implemented as part of the team based environment.

Too often money is used to help achieve gains that one could otherwise achieve through the application of good management practices. Therefore, it is intended to have a good experience base in the Plant of the 90's concepts before turning to gainsharing to drive the business for the last bit of improvement. The estimate is that the project is about two years away from considering any type of gainsharing plan.

In the meantime, issues of "What will I be paid for all this effort?" must be addressed. An approach to be used is called *learn and earn* (see Figure 10-6).

For completion of Module I, there will be a one-time payment of $400, for completion of Module II, a one-time payment of $800, and when requirements are satisfied for the product line technician, movement to the salary workforce with a merit and progression compensation system.

The overall results from the Plant of the 90's efforts includes the ability to operate with fewer people. From January 1985 until now the salary workforce has been reduced 23%, with a much more substantial reduction in first line supervision. The wage workforce has been reduced 11%. These reductions have occurred in light of a 30% increase in volumes and they are in addition to the cutbacks that resulted from discontinued businesses.

The cost of goods has been pushed down an experience curve comparable to that of a growth industry even though the plant manufactures very mature products.

The process has influenced allocation of capital investments that allow them to implement computer-based technologies.

The Total Quality Index has seen significant improvement. This index measures how well our fiber performs on customer equipment.

The Division will be very close to accomplishing their required 50% increase in productivity by the end of 1988. The labor portion of that index will be at 150%.

Given all the foregoing, is there anything which should have been done differently?

In general, everyone is quite pleased with the results. People in the manufacturing function are turned on. They receive a lot of attention. Some have broadened their careers finding new interest and recognition as leaders of the effort.

From the macro Division standpoint a better position for the future would have been possible if the entire Division had engaged in a visioning process before any one function began its effort. It might eliminate some of the confusion and retrofitting that will be faced later. On the other hand, fibers manufacturing has acted as a change agent. The results achieved and the recognition gained has had a significant impact on the other functions of the Division. Sales is now beginning to do similar conceptual thinking as a result of examining EDI concepts to help build customer partnerships.

From the plant standpoint, it might have speeded results if the visioning process had been conducted for each plant as a whole rather than by approaching a vision for each department/function in the plant and then trying to integrate those visions into one for the plant. They could have moved to the broader concept of natural work groups faster.

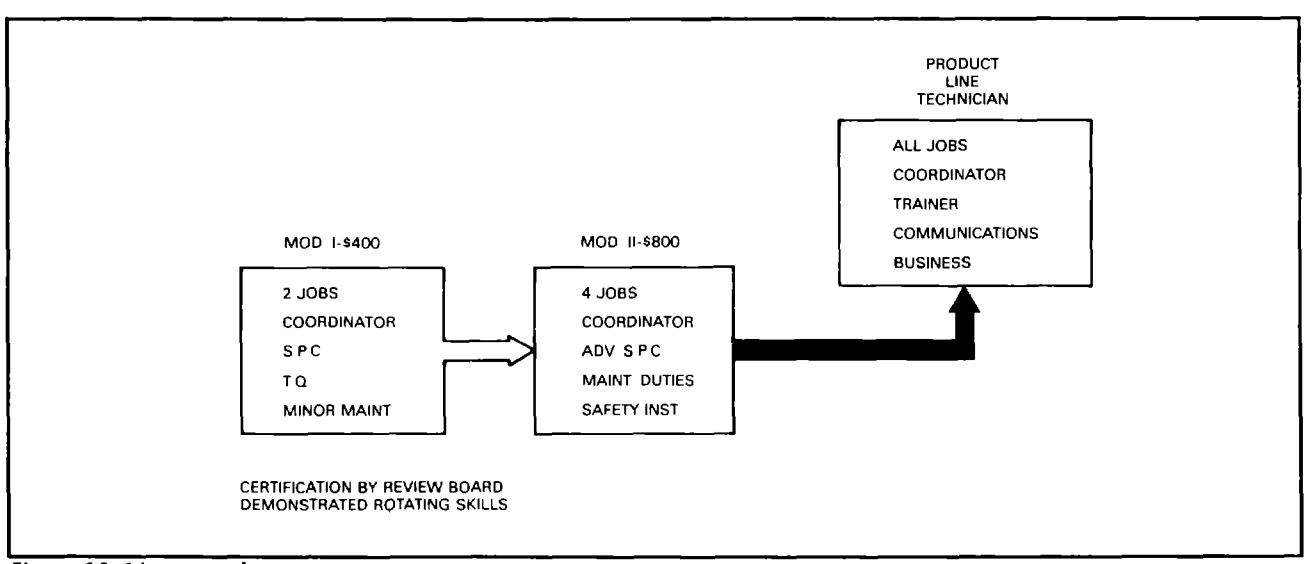

Figure 10-6 Learn and earn program.

However, as one plant coordinator put it, "We could not achieve a vision of a team on a plant-wide concept." They were content to let that evolve. The results have been quite satisfactory.

The heavy training load that accompanies this kind of style should have been anticipated. Line management has now agreed that a commitment of what amounts to 25% of overall payroll costs is a worthwhile expenditure to implement and maintain employee involvement. The results have been worth it, but it has been a major burden to accomplish the needed training as well as to meet production commitments and occasionally the temptation is present to slip back into the old style of management.

Each of the Division's four plants has a slightly different approach to the Plant of the 90's, and some are farther along than others. All are committed to the team approach and the use of natural work groups, and all are rapidly employing the technology associated with computer integrated manufacturing.

They continue to expand their horizons as they consider the impact of integrated computer technology and information. While the team efforts have begun at the lowest levels in the plants, it will not be long before a blurring of job distinctions and functions at the middle and higher levels will be seen. Already design teams are at work to identify how teams will impact the next level up. It doesn't take much imagination to realize that if one gets teams fully operational and functioning smoothly in the plants, that the role of the plant manager and his staff can change substantially. What is happening in manufacturing will also happen in every function of the Division. In fact, as a result of the Plant of the 90's effort, the Division is now adopting a *Business of the 90's* effort for the Division to determine what will be needed and how they will operate in the future considering the possibilities that arise from application of computer technology and information integration.

(Editor's Note: In view of the previous section of this Chapter entitled, "Some Notes in Human Organization in the Factory," it is interesting to discuss the Monsanto development in this light. It is easy to see that the Monsanto plan comprises implementation of Items 1 and 3 of the list in the noted section, i.e., the policy of personnel equality in terms of perquisites and the substitution of committees or task groups for individual managers or supervisors as is well shown by Figure 10-4. Note that this does not affect the hierarchical management structure (as noted in Figure 10-4) except for the substitution of committee or task group for the individual manager. The workers are responding because of the attention they are getting, almost a Hawthorne effect [93].

The major accomplishment of the Monsanto project and related developments is its restoration of teamwork in the workplace to replace the autocracy of previous management practices and the adversarial relationship between management and unionized workers. This is effectively a return to the cooperativeness that existed in the industry before the Industrial Revolution separated management and the worker).