THE HUMAN FACTOR IN JIT IMPLEMENTATION A CASE STUDY OF AMBRAKE CORPORATION

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During the past two decades Just-in-Time (JIT) manufacturing systems have emerged as a proven approach to the management of manufacturing enterprises. The most commonly cited benefits of successful JIT implementation include reduced inventory, reduced manufacturing costs, improved quality, and reduced lead time [2, 4]. More than a production control method, JIT is a general management philosophy. It is based on a system of beliefs and attitudes combined with a collection of methods and procedures [6].

Implementation of any new program in an organization requires support from most departments in the company. Implementation of a JIT system, however, requires complete support and understanding from *every* operational division in the organization, especially human resources. After much research on the subject, we have concluded that human resources are the backbone of any successful JIT system [5, 6, 7, 8].

In this article our purpose is to show the human factor in JIT implementation by highlighting the best practices in a successful organization, Ambrake Corporation. It is obvious that employee enthusiasm and excitement are an immediate, evident result of a well-designed and successfully implemented program. Thus, we acknowledge at the outset that this article bears a positive, enthusiastic slant because the techniques worked so well for Ambrake.

AMBRAKE CORPORATION: A CASE STUDY

Two world leaders in the design and manufacture of automotive brake components, Akebono Brake Industry Co., Ltd. of Japan and Delphi Automotive, formed a unique partnership and founded Ambrake Corporation to produce technologically advanced, high-quality precision brakes. Ambrake has been a success, reaping tremendous rewards from its efficient operations. It has maintained its position as a major force in the brake industry.

According to Mark Mahoney, Ambrake president, the three elements involved in JIT production are "hardware," "software," and "humanware." The hardware element covers the physical aspects of the plant, including equipment design and cellular manufacturing. The software focuses on product processing and systems, including material and information flow, pull systems, quick changeover, built-in quality, and workplace organization. Humanware, however, is the essential element that makes the organization operate as it should.

FOUR PILLARS OF JIT HUMANWARE

Several components are necessary to shape the human element in an organization so that JIT is a successful production philosophy. In general, the humanware technology of JIT consists of four components: (1) education and training program, (2) development of a cooperative environment, (3) rewards and incentives program, and (4) open communication and worker involvement. Table 1 shows how the main components of JIT humanware are approached at Ambrake. The company owes much of its success to the partnership between JIT and human resources.

Since Ambrake's manufacturing philosophy is consistent with the Just-in-Time philosophy, most segments of its operation complement the ideas surrounding JIT. In the next several sections, these philosophies are discussed and compared.

Education and Training Program

Training is the first component in implementing and maintaining a Just-in-Time manufacturing system. By incorporating an effective training system, the company ensures that both managers and workers understand the JIT approach and that a new culture and attitude evolve that are appropriate for JIT manufac-

TABLE 1: Components of JIT Humanware

JIT Humanware Components	*Ambrake Approach to JIT Humanware*
1. Education and training program	Continuous improvement
2. Development of a cooperative environment	Organizational structure (teamwork)
3. Rewards and incentives program	Work design (job enlargement)
4. Open communication and worker involvement	Respect and trust for all associates

turing. Education and training programs should maximize the potential of each individual employee as a productive resource in the organization [8]. Continuous training supplemented by formal classroom study is an innovative way to emphasize a long-term investment in human resources and its contribution to the company's success [1].

Training for Managers

In some successful organizations, key managers have been sent to Japan for a few weeks to observe JIT at its ideal level of operation. They worked side by side with management to learn the task and culture of JIT. They also learned what benefits can be expected if JIT is used properly and how JIT is important to a company's continued success [3].

When companies switch from traditional manufacturing to JIT, they must have some idea of the changes that will be required of them and their employees. When managers have been fully educated in the technical aspects of JIT, as well as the way the human element will be affected, they are in a better position to prepare their subordinates for the impending changes and formulate creative ways of smoothing the transition [3].

Training for Employees

Employees, too, must be trained to work well in an entirely new philosophy of manufacturing. Techniques that instill a philosophy of teamwork and collective effort should be used. Employees must understand what is required of them and why their actions are important for the long-run health of the company [9]. Trainers need to point out the fact that the JIT manufacturing environment is probably very different from ones that most employees have worked in before. Employees should be encouraged to view JIT as an opportunity to improve the company's competitive position as well as an opportunity to secure greater job security for themselves. Training methods used for workers at Toyota Motor Manufacturing include on-the-job training charts as well as classroom studies [9].

Ambrake Approach to Training and Education

Ambrake begins training at the very beginning. The company hires and subsequently trains multi-functional workers. Even before applicants are hired, they go through an assessment process that tests math skills, blueprint reading, and team-building skills as well as the ability to apply lessons in a workplace environment. Ambrake uses these tests to determine whether applicants possess the attributes that would make them successful in the Ambrake environment. Probably the most important characteristic an applicant could possess is the ability to work within teams [4].

Pre-employment training lasts for two weeks. If the associate is hired, on-the-job training is continued for approximately 16 weeks. All associates are cross-trained as time progresses. Ambrake offers management development as well as floor and office worker training. The company has recently changed pre-employment training through an action circle, with a target to make the process more consistent with work practice. With the continuing tight labor market, each portion of the selection process has become increasingly critical.

An interesting point is that new employees are not trained by managers or a trainer from the personnel department, but by group leaders and selected associates who have been designated as certified trainers. Mr. Mahoney feels that these associates provide more effective training because they work with the job every day and are intimate with the details of the job. He feels they are in a better position to train, and that employing them as trainers is more beneficial to the company.

Cooperative Environment

A cooperative environment is probably the most influential factor in the implementation and continuance of a thriving JIT system. Without the atmosphere the team concept generates, JIT could very well fail. In most of the literature, the importance of teamwork is heavily stressed [7, 9]. For JIT to be successful, the company

culture must engender teamwork, cooperation, and a partnership spirit within everyone in the organization. At first, this may not be as easy as it sounds.

Every man and woman in the United States is exposed to competitive performance very early in life. In school, good grades are demanded; sports teach that winning is all that's important; after college, students compete with one another for the "best jobs"; finally, managers and employees compete for better bonuses. All of these activities encourage individual achievement and discourage teamwork and cooperation. For employees in a JIT environment to participate effectively, they must be able to work together [3]. Specific emphasis must be put on teamwork so that people move away from deeply ingrained individualistic attitudes and toward a team focus.

To develop a team concept, the company must offer programs to create a cooperative environment. Effective techniques include the following:

- *Collecting diagnostic information*. Use methods such as administering questionnaires, conducting interviews, and so forth to collect information about current feelings and attitudes [3]. Managers can then work with the results to see what needs "fixing."
- *Employing team-building activities*. Use activities that help individuals who work in groups learn how to communicate and solve problems together [3].
- *Fostering a sense of equality*. Employees should feel they are equally as important as managers. Some methods for bringing this about are providing a common cafeteria, having no private offices or reserved parking areas for managers, and encouraging everyone to wear the same uniform [7].

Ambrake Approach to Developing a Cooperative Environment

Ambrake's entire production system is based on self-directed teams with managers in the role of resource providers, facilitators, and coaches. Mr. Mahoney comments that self-directed teams are a very effective way to encourage creativity and input, and essentially turn associates into entrepreneurs.

Ambrake fosters the cooperative environment through numerous techniques. Managers communicate to employees that they are all working for a common goal and that nothing in the organization can be achieved singly. Associates will succeed as a group, not as individuals [10].

One specific technique is the formation of task forces. Associates on the task forces volunteer their own time to help improve anything that affects all associates. Some issues are work related, but not all are. Family activities, ways to improve production workstations, or any concerns about uniforms or safety are examples of issues involved [10].

Ambrake provides uniforms for all associates to wear, including top management. Mr. Mahoney believes that this practice creates a sense of equality because there are no visible distinctions between people in the company. It also helps all employees feel that their ideas matter, that no one is more important to the company's continued success than they are [4].

Rewards and Incentives

Reward and incentive programs, the third component of a successful JIT implementation, are sometimes very controversial. Often, these programs can determine the degree of conflict or accord between units in the organization. For example, when employees receive rewards based on achieving a company goal, a cooperative environment is encouraged and harmony is more likely. However, if programs are based on output per person, competitiveness comes back into play and all efforts to support JIT teamwork are lost. Managers must be certain that reward systems are geared toward group activities and not toward individual ones [3]. When programs are being designed, the focus should be on group participation, contribution to problem solving, and attainment of company goals.

Ambrake Approach to Rewards and Incentives

Although performance-based pay programs are under evaluation, Ambrake has not previously tied compensation for all associates directly to the achievement of organizational goals. The motivation to achieve targets has been driven by the desire for job security and inclusion as a contributing member of a successful team. By providing a worthy culture and a fair working environment, Ambrake fosters continuous improvement and this, in turn, enables the associates to maintain their job security [4].

Open Communication and Worker Involvement

Communication and worker involvement together form the fourth essential component of JIT's success. In short, employees must feel appreciated, have pride in their work, and feel that the company would not be where it is today without them. Being able to voice their ideas as a part of the process makes it possible for employees to feel that way [3]. They must be active

in decision making and quality control and be able to contribute to any aspect of their jobs. Managers must create a climate in which their people are treated extraordinarily well.

Worker involvement brings pride to employees' work and helps provide a sense of job security. Companies see better results with better attitudes and initiatives. Employees are able to generate new ideas and enhance their problem-solving skills, and the level of responsibility for all workers is increased [8].

Ambrake Approach to Fostering Communication and Worker Involvement

Mr. Mahoney agrees that communication is a very sensitive aspect of the work environment. At Ambrake, associates have four different channels to consider for communicating their ideas:

- Ambrake has an *open door philosophy*. If associates have any problems or suggestions, they are encouraged to approach any level of management to review their concerns.
- The company sponsors a *hotline* that associates can call if they want to voice their opinions anonymously. The answer or solution is posted on a designated bulletin board.
- Associates are encouraged to use the *line performance board*. This bulletin board contains charts on which employees can write their ideas, which are then reviewed by the appropriate team leader.
- Ambrake uses *action circles*, synonymous with the *quality circles* already in use at many other companies. These circles gather, voice opinions, and solve concerns together. Mr. Mahoney estimates that at any given time four to seven action circles are active within the organization [4].

IMPORTANCE OF WORKER FLEXIBILITY

The flexibility of workers is also an influential part of JIT manufacturing. Schroeder defines *Just-in-Time* as the elimination of waste in the production process by *utilizing the full capability of the workers* [11]. Several authors agree that employing multi-functional workers proves advantageous in a JIT system. Quality is enhanced and the operating process is more flexible. Operating processes can be changed to meet demand requirements, and feelings of worker alienation and boredom as well as ergonomic problems can be reduced [2]. In addition, flexibility gives workers the opportunity to accept more job responsibility, increasing their feelings of value to the company. Since JIT is based on a cellular layout, each worker is able to do all the necessary tasks within a cell. The worker, therefore, controls volume, quality and, in some cases, financial performance [5].

Within Ambrake's continual training, cross-training also takes place. The job enlargement allows associates to prolong their employment and gain responsibility and a feeling of importance [4].

SUMMARY AND CONCLUSION

JIT emphasizes superior organizational values and philosophies, long-term strategic goals, a two-way communication system, cooperation, harmonious relationships, functional structures, strong commitment and loyalty to the organization on the part of its members, and a consultative decision-making process [1]. It is important to emphasize that the success of JIT is not the result of cultural, structural, or environmental factors, but rather success stems from planned management actions. It is the discipline, understanding, dedication, confidence, and continuous striving for improvement that make JIT successful. All of these qualities, which should be evident in every employee, can be engendered by proper human resource management.

The company continually develops the Ambrake production system (APS), which is modeled on the Toyota system. APS is the driving force in manufacturing, and it is how Ambrake defines work practice in the plant. Implementation of APS is a never-ending process: The company is "always looking for new ideas and special talents to maintain competitiveness" [10].

APS is designed to promote *kaizen*, the practice of continuous improvement. Kaizen helps to eliminate waste and, therefore, makes jobs easier and safer by eliminating anything that hinders work. The corporation's aim, using truly efficient work methods to produce zero defects, is thereby achieved.

In summary, Ambrake's manufacturing philosophy is based on three goals: flexibility, teamwork, and continuous improvement. By following a participative management style based on mutual respect, fairness, and trust, Ambrake is able to achieve these goals and create a truly "open" atmosphere that makes Ambrake associates want to contribute. They help to provide the motivation for everyone to work together to achieve a common goal of excellence [4].

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