

## Making Total Quality Management + Just-in-Time Manufacturing Work

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The competitive benefits of just-in-time (JIT) manufacturing, including the key elements of cellular production along with empowered teams, are well documented in both academic and trade literature, such as in Costanza (1994), Deming (1982), Lahidji (1997), and Richardson (1997). Studies on these topics typically focus on benefits, management theories, and technical aspects of JIT. But to maximize success one must also consider the individual person who works in the newly modified environment.

Shop-floor personnel considerations differ considerably from those involved in more traditional manufacturing organizations (“Self-Directed Teams at XEL,” 1993). As described by Salas and Cannon-Bowers (1997), contemporary technical management methods often reflect change in culture more than technology. These cultural differences go beyond the basic need to cross-train personnel in the multiple process skills of a cellular operation. Certain practices must also accompany a successful shift to JIT. All the finalists for a leading industry magazine’s annual Best Plant Award (“Lessons from the Best,” 1996) included these features:

- Employee empowerment.
- Employee problem-solving teams.
- Self-directed work teams.
- Financial rewards for team-based performance.
- Employee involvement in benchmarking.

Simply being aware of total quality management (TQM) and JIT buzzwords is insufficient to make it happen; technology professionals need to know *how* to apply these concepts. In turn, significant changes in industrial technology curricula, especially in technical management courses, need to follow. “Supervision,” for example, might be better termed supervision and team build-

ing. The following two industrial case studies, conducted in 1997, illustrate essential considerations in building a team environment, including identification of skills needed by team members, new hiring process approaches, training and development approaches, and an incentives approach.

The first case describes the implementation of the team concept in the production operation environment at a newly designed and constructed facility. The second case describes the implementation of the team concept in the product development/product engineering function, an application of the team concept in an *ad hoc* project rather than in mainstream production. (At the request of their management, the firms are represented here with pseudonyms and are pointedly not listed in the references.) Both cases illustrate how TQM and JIT manufacturing work in typical work settings.

### Case One: MTC

The first firm, MTC, recently expanded its historic focus on smaller play products into larger-scale items such as plastic tricycles, playhouses, and other outdoor play equipment. Requiring additional capacity, MTC opted to build a new facility, with startup in 1995. As a “greenfield” operation, it was possible to incorporate the latest available management philosophies and methodologies as well as technical features.

MTC’s primary manufacturing process is rotational molding. Large three-station machines are operated by teams that pour powdered thermoplastic into the multiple cavities of the mold, close and clamp the mold, and then—while that “mold” sets in the oven and another is cooling—open the third set and remove the product components. These slide down a chute for minor de-flashing

and secondary operations. Products are placed directly into cartons, sealed, and moved by team members to finished goods storage. Additional processes include extrusion blowmolding and injection molding.

This operation is labor intensive, with 12-hour shifts alternating between three days and four days per week. As in any team concept, rewards and incentives must be linked to team output (vs. individual focus). When one team excels at MTC, everyone is rewarded plantwide, which promotes “global team” thinking. But incentive plans alone cannot ensure success in the unique team environment. The MTC workforce is truly multicultural in terms of ethnicity/race, gender, and age. Research, such as described by Brauchle and Evans (1998), indicates that such a heterogeneous group may be more successful than a very homogeneous group. However, it is the firm’s management philosophy that such conditions demand that individual team personnel must have certain personal characteristics that foster success. Workers need a strong work ethic, cooperative spirit, flexibility, attention to detail, and communications skills to prosper.

Applicants are screened for these elements through a unique process involving a group interview in which eight applicants are interviewed together. A unique phase of the initial interview process involves a timed simulated activity in which the eight applicants, working as a group but on an individual basis, must build a model log house and “sell” it to management for a fixed price. There are variations in the product specifications and in the quality of materials provided. Materials are “purchased,” and flawed materials can be exchanged for free if detected before installation or at a cost if detected after installation. Frustrations set in due to expectations and time limits, and the exercise is halted abruptly. Questions are addressed. Shifting to the next phase, applicants are now encouraged to work together as a team, given suggestions about how to do so, and begin again, yielding notable improvements and insight. Finally, they move on to a simulation involving an actual MTC product, again on a team basis.

Throughout this exercise, the interviewers observe body language, common sense, problem-solving and communication skills, and attention to instructions, quality, economy, and profit, in addition to whether people tend to be “loners” or poor contributors of individual effort. Those applicants who are successfully screened are

then invited back for a more traditional interview process. Those hired go through an established series of training sessions including teamwork, conflict resolution, safety, and process skills.

Team leaders receive additional training but no additional pay, and their tasks differ from those people focused on production output. Team leaders concentrate on problem solving, reporting, and coordination. In addition to individual responsibilities, at least one person is trained and partially dedicated to monitoring quality throughout the work cell to enhance customer satisfaction. Both the team leader and product integrity job assignments rotate every four months. Each team creates its own charter, value systems, and other guidelines which impact aspects such as their breaks and job rotation, and also have a direct, shared role with management in defining merit rewards.

What are the results of MTC’s unique approach to personnel selection and training for the cell/team environment? The careful selection of applicants who are a “best fit” along with purposeful, tailored training and development has measurable value. Morale is high, and with wages that are simply average for the area, turnover has leveled at about 2% across the first two years of operation. The venture into the market for large outdoor play equipment has been highly successful, having rapidly captured a major market share—now approaching 30%—with this facility as the sole plant dedicated to the product line.

### **Case Two: NTC**

The second firm, NTC, manufactures over-the-road trucks. In 1996 a new product was introduced at the existing production facility: a molded fiberglass and stamped aluminum cab body, representing a substantial departure from prior all-metal fabricated designs. Some apprehension existed in the workforce about the new skills and roles the workers would have to adopt, as well as from the perception that jobs would be lost.

To counteract this anxiety and to encourage an increase in productivity, NTC embarked on an experiment in workforce empowerment. Previously, there were few if any definitive examples of team activity. By forming a planning and implementation team involving the workers who would stay on, management hoped to minimize technical risk and enhance the acceptance of the new processes.

In managing the project, particular attention was given to forming a team with:

- interested, dedicated, and experienced workers;
- an engineering representative;
- a parts scheduler; and
- an employee knowledgeable in automated assembly systems.

Identification of the experienced workers was achieved through reviewing work skills, seniority, attendance, and company loyalty.

One of the most notable of the process changes was the three-dimensional “marriage” of the cab parts which results in the shell of the cab. The new process required a robotic machine that would replace the job of several workers. Similar processes were studied at other firms, and the team individually and collectively produced several ideas that allowed the process to be tailored and optimized for NTC’s application. Equipment was procured, delivered, and installed at the plant. Additional workers who made up the pilot assembly group were asked to volunteer for the new product line. Each volunteer was interviewed individually by the core team.

Periodic briefings provided management with an oversight of the activity. A strong, autocratic area manager limited the direction of and influence upon the work group by other managers, permitting relative team autonomy. The team informally selected and developed three key leaders: an arbitrator, a technical expert, and an expert in parts supply. Most decisions and suggestions came from group consensus or deference to the arbitrator. When the process was finally implemented, the remainder of the

workforce was invited to observe the team, make suggestions, and ask questions. The team had developed strong ownership in the product and its manufacture. For this firm’s environment, the empowerment of the team was a bold but successful experiment.

### Conclusions

Personnel considerations are an essential part of contemporary technical management and, in addition to general theory and technical detail, must be included in a systems approach to ensure a holistic, long-term success. These considerations are crucial:

1. Focusing on process technologies and management strategies such as JIT, while important, will not ensure effective implementation.
2. Workforce diversity can prove beneficial as well as desirable, as long as the individuals have personal traits that complement the team environment.
3. While these cases demonstrate the merits of the team concept, they also emphasize that focusing on the selection of an appropriate personnel mix is crucial in yielding any company’s hoped-for competitive benefits.

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