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HIGHLIGHTS

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**Center for the Management of Technological
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Training Managers for Six Sigma Quality and Developing High Performance Work Teams

Carlton Braun
Motorola

Robert Galvin, the former CEO of Motorola, wanted to elevate the company's present education and training certification program to university status. He didn't know what this entailed, but he told his senior executives to find out. He believed that education and training was essential to Motorola becoming the best corporation in the world by the year 2000. As a result, the company has developed six objectives that are aimed at anticipating and meeting the education and training needs of all Motorola employees, suppliers and customers:

1. By 1992, all employees world-wide will receive five days of training per year. Each employee will develop a yearly training plan in consultation with his or her supervisor.
2. By 1994, all employees will have mastered and applied the job skills needed to meet all Motorola business and career plans.
3. By 1995, all employees will be competent in the language, math and reading skills needed for their work places and for cross-functional contributions.
4. Every year until 1994, there will be a 50% reduction in cycle time for administrative, design and delivery activities within the education and training organization.
5. By 1994, the education and training organization will operate world-wide as a single team with clear, non-redundant and supportive roles and responsibilities.
6. Local school systems will be targeted so that by the year 2000 they will produce a higher level of proficiency than now exists for entry level requirements at Motorola.

Mr. Galvin wanted to develop a new mission statement, one that would be much simpler and shorter than the previous one of seventeen pages. He visited ten key customers and learned that their problems with Motorola related to customer services such as notification of late shipments, fixing errors, etc. As a result, he established total customer satisfaction as the corporate mission. All education and training was to focus around this mission and related goals.

Organizational change to facilitate achievement of total customer satisfaction began around 1987. Besides efforts toward a cultural change, e.g., employee empowerment, listening skills, etc., the company focused on cycle time reduction at all levels. The goal was to be two to four times better than the competition on cycle time and twice as profitable. Efforts focused on administration and manufacturing. For example, the finance department can now close its books in five days instead of two weeks. Also, an administrative assistant led senior executives to submit errorless travel expense forms, thereby reducing cycle time from two months to five days.

Carlton showed research indicating that superior quality businesses have an average ROI of 32% and ROS of 13% compared to inferior quality businesses that have 12% ROI and 5% ROS. Superior quality businesses also had a higher relative market share.

The Motorola Management Institute (MMI) has a two week program that helps managers to develop a market-driven culture within their respective facilities. Carlton showed a videotape of the results achieved by the Sidearm team that manufactures a guidance control system for the Sidearm missile in Scottsdale, Arizona. In less than eight months, the team increased profits by 10%, reduced cycle time by 52%, improved yield by 14% and reduced defects by 75%. The team also delivered its product seven months ahead of schedule.

Carlton offered some guidelines based on Motorola's education and training experience. Every two hours of teaching should be followed by two hours of hands-on experimentation with the concepts taught. No one should flunk a course. The instructor should work with the trainee until he or she masters the material. Tough goals for cycle time reduction should be set with an immediate target of achieving 50% of that goal. When that target has been achieved, the old goal should be revised upward. The new goals are easier to achieve because of the insights gained from having reached the initial target. No improvement project should be considered too small to undertake, since each project helps approach the goal incrementally. Lastly, a climate to encourage risk and freedom to fail should be developed.

Carlton presented two examples of successful cycle time reduction. In one example, manufacturing cycle time was reduced from 5.8 days in 1985 to less than an hour in 1990. Another example occurred at their Boynton Beach, Florida facility that manufactures pagers. Cycle time from receipt of an order to manufacture of the product was reduced from ten weeks to 56 minutes.

Designing A New Plant Using Sociotechnical Principles: An HP-OKI Joint Venture in Puerto Rico

Stu Winby
Hewlett-Packard

Stu's Factory of the Future group carries out projects for HP on work and organization design. The group writes concept papers, carries out action research projects on metrics, rewards systems, and work design, and diffuses innovative work practices throughout HP. The group is involved mostly in factory work redesign, which is the focus of Stu's presentation, but has been involved more recently in cross-functional redesign to improve new product introduction and time to market. Stu cited a recent effort at an HP plant in Boise, Idaho in which concurrent product and process design has led to reducing ramp time from five months to three weeks.

The HPO printed circuit board factory in Puerto Rico is a joint venture. OKI provides the technology and engineering, HP provides the management. The president of the joint venture is from HP. HP and OKI are represented equally in the remaining management positions. An existing HP manufacturing facility on an adjacent site is being redesigned concurrently to be congruent in management style and pay system with HPO. This facility provides administrative services to HPO and will be a major customer for HPO's products.

The organization design for HPO was developed at a retreat where separate study teams initially focused on business, technical, support and people systems. The teams were guided by several key design principles. The main one was that all systems needed to fit or be congruent with each other. Each study team had representation on an integration team that worked to assure fit or

congruence between all of these systems. Other outcomes from the retreat included a Statement of Purpose and Operating Principles. The plant also sought to develop its culture consciously by selecting and orienting new employees toward adherence to four core values; continuous learning, continuous process improvement, team work, and flexible roles.

A sociotechnical analysis was used at the existing manufacturing facility to redesign and integrate the organization around business, technical and social objectives. Usually different teams do the business, technical, and social analyses. Each analysis consists of describing the current system, noting what goes wrong in the system and developing a plan for system redesign. Stu indicated that this exercise normally takes between six and eight months to complete, which is too long in today's competitive environment. To compress time, three groups were asked to perform all three types of analyses on a single line at the plant. This reduced the analysis time considerably.

HPO personnel traveled to Loveland, Colorado to study an existing printed circuit board factory. They analyzed this plant using sociotechnical principles and designed a three level organization for HPO, i.e., office of the president to focus on strategy, operating management to focus on coordination and integration, and work teams to focus on plant operations. Six to eight members belong to one of five work teams that are organized by major throughput steps, but each member also belongs to one of several focus groups that are organized by business functions such as leadership, training, maintenance, etc. This dual membership facilitates horizontal integration.

Much effort was devoted to clarification of roles and role relationships, especially between engineers and between engineers and work team members. OKI engineers will focus on technical matters only. HPO engineers from Puerto Rico and mainland U.S. will focus on process engineering and work team leadership, but will withdraw from the latter role as the teams mature. Team leaders will focus primarily on boundary management and training work team members.

The assessment center played a significant role in orienting new employees to the plant's four core values. HPO personnel visited Boeing's plant in Corinth, Texas as well as GM's Saturn plant for ideas on centers. The assessment center process lasts about two and a half days.

Stu's final comments focused on observations about differences in Japanese, American and Puerto Rican cultures. He believes the Japanese-American interface to be more challenging to manage than the Japanese-Puerto Rican interface. More attention needs to be devoted to understanding culture differences than has been devoted thus far.

A Joint Union-Management Program to Develop Problem-Solving Skills For Workers

Harold Booze, Bill Evans, Lee Frye and Mike Meyers
Caterpillar

Harold provided an overview of the Employee Satisfaction Program that began in 1986 at the Caterpillar plant in York, Pennsylvania. The program had its origin in an agreement between Caterpillar and the United Auto Workers in 1982-83. Corporate and union officials put a program framework together a few months later. A plant steering committee of five management and five union members provides administrative and policy guidelines. Two coordinators and six facilitators carry out the

program on a day to day basis. They facilitate weekly team meetings and train group leaders and secretaries. The teams receive sixteen hours of initial training and then periodically receive retraining and updates throughout the year. Seventy-six teams are active today, each having between seven and nine members.

Bill, Lee and Mike demonstrated some of the types of training that teams receive. They showed how the team might make an initial diagnosis of the type of problem it faced, such as whether to rely on hunches and intuition or use specific problem-solving techniques. They then asked all Forum participants to solve as individuals a problem facing a truck that was stuck in an underpass. All participants then were asked to break into small groups and tackle the problem in this setting. The results clearly demonstrated the superiority of the solutions developed by the groups.

Job Design and Reward Systems to Complement The Introduction of Manufacturing Cells

Jim Sheedy
Ingersoll-Rand

Ingersoll-Rand's plant in Athens, Pennsylvania produces a wide variety of air-driven tools such as pumps, chisels, angle wrenches, sanders and grinders. The plant is old, covers 450,000 square feet and employs 650 people whose average seniority is 24.5 years. The plant was originally laid out by process departments so that parts traveled complex routes and great distances during their manufacture. Seniority was department-based, meaning that a high seniority worker in one department could be laid-off before a low seniority person was laid off in another.

The old equipment and inefficient layout contributed to loss of market share for the plant's products. The Power Tool Division management decided to invest \$25 million in the plant by introducing CNC machines and manufacturing cells. They also modernized the area where the cells were to be placed and the assembly area. They invested in a mainframe computer, CAD/CAM system and built a training facility with programmable chip cutting equipment. The plant now has eighteen component part cells and three product cells. Jim provided some background on the communication practices used in the plant for the past six and a half years.

1. The Division General Manager makes presentations twice a year to all plant employees on the world competitive situation that Ingersoll-Rand faces.
2. Attendees at the plant manager's weekly staff meetings are requested to brief their employees about the meeting within twenty four hours.
3. The plant manager's staff holds quarterly meetings with groups of twenty to thirty employees at a time to discuss labor variance, safety, master schedule compliance, productivity, inventory, etc. All questions asked and answers given are recorded and distributed as a fact sheet.
4. The plant publishes a monthly newsletter.
5. Letters are sent to employees' homes at least three times a year to inform spouses about plant activities.

A Penn State professor conducted a needs assessment of current employee skills as well as skills required for the manufacturing cells. Fifty percent of the assessment's cost was funded by the State's Ben Franklin Partnership. The professor and four graduate students completed the assessment in six months. The employees took two reading tests and one math test and had to share the results with management only if they chose to be trained to work in a cell. A few people who wanted to be trained needed remedial courses prior to training. However, some people with adequate math skills took the remedial course to bolster their confidence. Twelve persons with poor to non-existent reading ability took the remedial reading course.

The professor designed several job training modules for workers who wanted to work in the manufacturing cells. Instructors who were affiliated with Penn State taught these modules. The instruction cost was subsidized in part by the Ben Franklin Partnership for three and a half years. The training has been focused on two hundred and fifty people. Supervisors are required to take the training also. Eighteen employees are studying to earn an associates degree in electrical and mechanical engineering technology through Penn State at no cost. Twenty employees have earned high school equivalency degrees through a local high school.

Eleven workers were elected by plant employees to a task force that was asked to recommend a new seniority and job classification system to complement the cells. They received eight hours of training in team-building and problem-solving skills and then worked for ten weeks. Their recommendations included reducing the number of departments from 39 to 4, reducing job classifications from 79 to 0, moving from department-based seniority to plant-wide seniority, and allowing flexibility in job assignments within and between cells.

Substantial pay differences exist among some workers who work in the cells. This is because high seniority workers who earned top pay rates had their pay frozen at these levels when they chose to work in a cell. Low seniority workers who perform the same tasks earn considerably less. The plant also implemented a gain-sharing plan that is based on achieving four goals; meeting the master schedule, cost of quality, number of months of inventory and cost of goods at 60% of sales. Management offered to put \$35,000 into a fund for each goal met and an additional \$14,000 for every percentage point each goal is exceeded. Division management added a bonus for meeting goals based on world-wide gross sales and return on assets. At the end of each year, the accumulated dollars are divided equally among all managers and employees. Each employee received \$920 at the end of the first year and \$225 at the end of the second year. The second year was lower because of the economic downturn and because the goals were reset at higher levels.

Developing the Sanction Group: A Key to Success in Employee Empowerment Initiatives

Bill Duffy
General Motors

The sanction group develops a vision for change, guides others toward change activities and works with stakeholders within and outside the plant to secure and maintain their support. The sanction group relates to core process personnel (those who work in the main value-chain) and support personnel. Change should be implemented by core process personnel with support personnel drawn in as needed. Too often support personnel try to push core process personnel into changing.

This can lead to resentment and resistance. Also, the sanction group tends to think that the burden of learning falls mainly on core process personnel. In fact, the sanction group has much to learn as well.

Bill believes that sanctioning is a skill that can be taught to the sanction group before core process personnel undertake any change. One of the first issues the group faces concerns its composition. When a plant is the change target, the plant manager and staff, senior union officials, and selected division staff are usually members of the sanction group. The sanction group may need to "manage upwards" to create a supportive environment among corporate function managers. For example, the sanction group may want strong cross-functional integration at the plant level, but face corporate function managers who want their respective subordinates to pursue incompatible goals. The sanction group members need the political skills to manage upward and the power to set policies at the plant level that will support change. An example of a supportive policy is that no employee will lose his or her job because of plant or work redesign.

Bill outlined several typical stages of work for the sanction group to complete. Examples include education of workers about the company's competitive environment, understanding the customers' business and needs, creation of a common vision and a strategy to reach the vision, etc. The learning that the sanction group needs before completing these stages successfully can be undertaken in manageable chunks with exit criteria established to judge whether the requisite learning has occurred.

A key issue concerns role negotiation between the sanction group and the design group. The design group includes representatives from the core process who diagnose their work and propose and execute specific changes. The sanction group often is tempted to get involved in execution and lose sight of its role as articulator of the vision that guides the execution. Also, the sanction group should focus on working with the plant's customers and senior company officials to create conditions within which the design group can work. For example, the sanction group should visit customers to find out what the company should be doing to satisfy their needs. The customer needs that are identified should be communicated to the design group so that they can redesign their work to meet those needs.