HIGHLIGHTS

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The Pennsylvania State University
College of Business Administration
406 Beam Building
University Park, PA 16802
(814) 863-2382

PENNSTATE

A Strategy For Developing Self-Managed Work Teams

Mark Mitchell, George Armstrong, and Jill Close
Corning-Asahi Video Products

The Corning-Asahi plant in State College, PA makes color television glass (front panels and funnels) to producers of 19" to 32" tubes/sets. The plant was built in 1967, but expanded considerably in the mid-1980s to its present 495,000 square feet. The plant employs 1100 people; 800 are hourly employees. Corning licensed its glass-making technology to Asahi in 1953, and formed a partnership with them for U.S. production in 1988. Asahi is the minority partner. The plant produces a variety of shapes and sizes of tubes for customers such as Sony, Mitsushita, Philips and Thompson. The color TV market is growing at a rate of 10% a year. The plant's customers now also include Koreans, Chinese, Europeans, etc. Its major U.S. competitor is Owens-Illinois which produces the same type of tube glass in Pittston, PA. Owens-Illinois also has a Japanese partner.

By 1983, the State College plant was the last of five Corning plants to produce TV glass. It was widely assumed that Corning would abandon the TV tube market to the Japanese. However, as the size of TV sets began to increase, the high shipping costs made it economical for the Japanese to begin producing sets in the U.S. Sony did this first with a plant in San Diego. Although Japanese companies ship most of their electronic components from Japan, they now produce or purchase most of their TV tubes in the U.S.

Mark Mitchell, the plant manager, admitted that Corning had unimpressive quality and productivity statistics five years ago, but these statistics have improved dramatically since then. Quality, in particular, has improved by 50%. They launched a quality program and broadened union (United Flint Workers of America) participation in decision-making so that union officers could understand the business better. Corning corporate officials agreed to invest $150 million in the State College plant. Most other U.S. tube makers have sold out to the Japanese.

George Armstrong, the union president, commented on some of the developments that have occurred over the last five years. He said the plant always has had good labor relations and probably was why Corning let this plant remain open when the others were closed. Management now shows him the plant budget and operating expenses, as well as shrinkage (yield) and productivity figures. George thinks that investment in new technology has been good for the plant because it means long-term job security.

Mark commented that the plant used to be organized traditionally, e.g., many managerial layers, executive parking spaces, one narrowly defined job per worker. Five to six percent of the total manhours worked is now spent on education and training. He said that union and management always have respected one another, but are now beginning to trust each other. This is true at the top levels of union and management, but it is starting to change at the rank and file and middle managerial levels also. Managerial roles have changed from supervisor to coach and facilitator. No new managers have been hired even though the number of workers at the plant has doubled since the mid-1980s. The managerial structure is flatter and more tasks have been delegated to work teams, e.g., no separate quality assurance department. Six weeks notice is given on any impending lay-offs, which are infrequent, however, because business is currently good. The change in the work organization has been guided by a steering committee composed of top managers and union officers. Work design teams analyze work according to social, technical and business criteria and then design the work accordingly. Their designs are reviewed by the relevant stakeholders. A new gain-sharing program was negotiated recently that will reward both managers and workers by the same criteria, e.g., profits, quality and shrinkage. The program will start next year. The entire process is guided by a vision statement with six components (see Corning slides).

Jill Close, training coordinator, gave an overview of work design at the plant. Work design teams were formed for funnel finishing and panels in 1988. Each team had nine to twelve workers who met forty hours a week every other week for eight to nine months. Each team started with a blank sheet, but members attended a number of work shops and visited a number of plants for ideas. Each team made proposals to the steering committee in the spring of 1989.

Their proposals were approved and implementation began in the early summer. By September 1989, a funnel finishing team had been formed with 27 members. They had elected a team leader and began to implement a pay for skills system. Four panel teams also had been formed, each with nineteen members. They had selected their team leader, but had not implemented a pay for skills system yet.

Jill presented some slides showing the new roles in the plant organization. The department head is now a team coordinator, and the section supervisor is now a resource person. Quality assurance is performed within the team. The original plan was to eliminate the role of first line supervisor, but that step has not been taken yet. Management believes that the first line supervisor role is still necessary, at least for now. Team members can learn to perform five levels of technical and business skills and earn higher pay, if they choose. Participation in the pay for skills program is voluntary. Jill's remaining slides covered team training, the certification process and a review of what has been learned so far about the implementation of work teams.

The work teams have been implemented in the newest production area in the plant where 31 and 32 inch panels and funnels are made. Smaller and easier to make tubes are produced in other areas of the plant. Performance comparisons between areas are discouraged because the products in each area are so different from each other. Instead, each team is encouraged to compare its current performance against its own prior performance or against outside competitors who produce the same product. The plant management sold its program to corporate management on the basis of quality improvement and what such improvement would do for market share and competitive position, not solely on the basis of cost reduction. Mark and George thought that the biggest challenge they faced was to get the rest of the plant committed to this process and to transform its work structure and practices.

Creating A New Organization and Culture Through A Union-Management Partnership

Nancy Brown-Johnston
Saturn Corporation

Nancy discussed the challenges facing GM and the initiatives it has undertaken to meet them. The Saturn Corporation was one of these initiatives. Saturn's primary objective is to develop and produce a domestic car that can compete successfully against foreign cars, primarily those imported from Japan. Two models will be produced initially. The four door model is targeted for competition against the Honda Civic, Toyota Corolla, Nissan Sentra and the Mazda Protege. The two door model is targeted for competition against the Toyota Celica, Mitsubishi Eclipse, Ford Probe (Mazda designed) and the Acura Integra.

Saturn built a 1.9 billion dollar factory in Spring Hill, Tennessee that consists of four million square feet. It is a highly integrated factory, in that most of the major car components are made at the site. The plant is divided into four areas that are approximately equal in square feet. The power-train area produces engines and transmissions and contains an air-conditioned foundry. The body systems area stamps body parts, welds them and paints car bodies. The two remaining areas are interior systems and general assembly. The plant is built twelve feet below ground level to minimize its impact on the surrounding rural environment which includes rolling hills and pre-civil war mansions.

Trucks can deliver supplies at numerous points at the factory, close to where they will be used for assembly. The truck route is separate from the routes used by employees to travel to and from work. Employee parking is located on all four sides of the plant to minimize walking time to the plant. There are no special parking spaces for managers. The training facility is located nearby on the same site as the factory. Human resources, finance, marketing, etc. are located in this building also. Each major factory area has its own space within this building for training.

The United Auto Workers International in Detroit initially appointed all of the UAW representatives who worked at the Saturn factory during its planning and start-up. All of them were elected recently to three year terms by the Saturn

workforce. There are now approximately 2100 employees at the plant, but the number will grow to 3000 by 1991. About 950 employees are at Saturn headquarters in Troy, Michigan. These include persons in marketing, engineering, and research. Manufacturing is located in Spring Hill as are support services such as human resources, information systems, engineering for the model year, and finance.

The key decision-making body for Saturn is called the Saturn Action Council. Its management members include the president and managers of sales, service and marketing, human resources, finance, engineering, manufacturing and organization development. Each manager has a union partner who works closely with the manager (a few managers "share" a union partner). Only the union president is a formal member of SAC. He votes on all key decisions. Below SAC is the Manufacturing Action Council. In addition to the vice president for manufacturing and the union president, the MAC includes managers and union counterparts from the four business areas. These union partners participate in all business area decisions. At these two levels and at lower levels, managers and union officer partners share responsibilities by dividing tasks between them. Some tasks are done separately and some are done together. The distribution of tasks may change over time, however, as the partnership is viewed as "living" and subject to development over time.

Both union officers and managers are paid salaries, but the union members' salaries are lower than those of their management counterparts. The union members are not expected to have the same level of expertise as their functional counterparts, although the education process should strive continuously to reduce the knowledge imbalance between them. Their contributions are meant to be complementary in that management decisions will be informed by the insights of union officers regarding employee reactions to these decisions. At some future date, 20% of the salary of union officers and managers will be based on company profits. This will not occur until GM has recovered its initial investment and Saturn starts to produce a profit.

The hourly employees at Saturn are called operating technicians. Their jobs are broader than is typical. They are expected to know the business, their customers and suppliers. It can take up to three months to select candidates for these positions. These candidates are current UAW members. Forty five percent of the current 2100 employees worked previously at other GM plants, the remaining 55% were laid-off workers. Fifteen thousand UAW members applied for jobs at Spring Hill. After an intensive screening process, the remaining candidates and their spouses were invited to Spring Hill. The candidates were interviewed about interpersonal skills, communication skills, technical skills, basic reading and math, etc. About 75% of these candidates were accepted. They can take up to six months to relocate in Spring Hill.

New operating technicians are trained for four to eight weeks depending on their initial job assignment. Training covers team and job related skills. There are support groups to help spouses and teenagers adjust to the relocation and assistance to help spouses find employment. Spring Hill is about 35 miles from Nashville, so most employees live there, rather than in Spring Hill.

Nancy reviewed some of the core values guiding problem-solving and decision-making at Saturn, e.g., commitment to customer enthusiasm, team work, trust, etc. She mentioned how leadership styles are expected to change over time as employees become more skilled and involved in the Saturn community. The leadership style for new employees is directive, but decisions are delegated to them as their training progresses. Six to fifteen workers are assigned to a work unit. Work units are organized, in turn, into modules. The boundaries of work units and modules are set by technical and process criteria as well as by membership size. Each shift has a pair of module advisors, one from management and the other from the union. Each new work unit is developed by a "charter member." The charter member's job is to train each new member of the unit until everyone has equal skills. The charter members work with module advisors to develop team members until work unit members are trained. Although charter team members are paid the same as any other work unit member, the experience can prepare them to become module advisors at some future time.

The module advisors are Saturn's middle management. They receive training in leadership, personal growth, team building, and business skills such as planning and goal setting, etc. They are trained for one week a month for twelve months. Charter team members receive a similar training program. Twenty OD consultants are available to

help with the development of teams at every organizational level. The number of OD consultants will be reduced within about a year as the various levels of the organization continue to develop.

Identifying And Developing The Work Force Skills Needed For Transition To A "Factory With A Future"

Dave Drosner, Jeff Stump and Mike Mettley
Caterpillar, Inc.

Dave described the Caterpillar-York plant as essentially a job shop that makes hose couplings, oil coolers, precision hydraulics for pumps, etc. The plant has 2100 employees. Caterpillar recently made substantial investments in computer numerical controlled (CNC) machines and has begun to organize these machines into manufacturing cells. A consultant helped them to analyze and group 9000 parts into eleven product families. These manufacturing cells require workers with higher level skills as well as workers who are multi-skilled and self-directed. Their jobs include support work such as quality assurance, expediting, lubrication, etc. Maintenance is still performed by separate personnel. Products can be bar-coded and shipped directly from the cell. Each operator has a desk with a computer and a phone. The average age of workers in the plant is forty-six.

The York Area Vo-Tech school helped provide training for operators in basic CNC fundamentals, and Penn State University at York helped develop a 55 credit program for apprentices in electrical and mechanical engineering. The philosophy of the trainers is that they will work with any operator until he or she gets it right. The plant needs maintenance people and programmers, but since these people are very difficult to hire, management hopes to develop these people internally. Management has been able to preserve qualification as a basis for selection, while the union has been able to preserve seniority as a basis for job bidding. The training department has grown from 3 to 22 people. That includes eight exempt, eight hourly trainers, two apprentices, and two outside trainers. Training costs have increased ten-fold since their modernization effort began. They have received grants from the Ben Franklin Foundation and the UAW. Jeff Stump, the training director, described the plant's Manufacturing Skills Upgrade Program. The program is guided by an implementation team including two manufacturing engineers, the union president, the superintendent of adult education at York Area Vo-Tech, two or three representatives from the training department and two or three UAW committeemen. The implementation team developed the program curriculum. Four hundred and fifty operators have enrolled in the program so far. Instruction takes place off shift on the worker's own time.

The program has three phases. Phase I consists of fundamental theory and practice of machine shops. Trainees complete eight "hands-on" machining projects at York Vo-Tech's machine shop. Five self-paced courses are undertaken at Caterpillar's Learning Center. Trainees take between four weeks and seven months to complete this phase. Phase II introduces trainees to NC/CNC machining technology. The training includes five projects on NC/CNC lathes and mills, as well as five self-paced courses in the Learning Center. This phase includes a 42 hour course that is offered in three hour segments, two days a week for seven weeks. Phase III requires operators to apply Phase I and II techniques within Caterpillar's CNC Training Lab. The course includes 160 hours of instruction. The training includes use of CNC machinery, control simulators and interactive video training and is delivered by eight full-time hourly instructors over three shifts. The Training Lab cost 1.25 million dollars to equip.

Mike Mettley is one of the eight hourly CNC instructors. He was selected for this job by a joint training committee. He teaches five days a week. His wages are paid from a UAW training fund which is subsidized by a contribution of 10 per cent of the employees' cost of living allowance. Mike received instruction on developing teaching plans and materials and went to vendors' sites to better understand their equipment. Mike co-instructs with a partner. He and

his partner develop the instructional plan, materials and techniques, etc. Mike has simplified vendor documentation and reduced it to a few basic steps. His philosophy is that no one will fail. The dropout rate is less than 5%. Workers who complete the training program are eligible to bid on new jobs. Those workers who are successful are mastering the detailed training for their new jobs in half the usual time. The training also can help a worker bid into an existing job if there were a reduction in force at the plant. He is assumed qualified for the job even if he hasn't done the job before.

Manufacturing Floor Performance Support Systems

Mike Grant and Rick Contel
Systems Consulting Group

Mike reviewed some of the trends towards increased workers' skills and knowledge and summarized by saying that the common underlying dimension of these trends is the need for workers to learn continuously throughout their working lives. His company's approach to facilitating learning was based on experience with two projects in the 1970s. One involved the New York Transit Authority which faced an emergency training need after an unusually large number of city busses broke down at once. Another involved the Air Force's I-CAM project. The Systems Consulting Group generalized from the methodology used in this project to develop the Instructional Support System (ISS). ISS is used to educate, qualify, communicate with and inform workers about knowledge intensive work.

Each ISS is custom-made to the needs of users and their backgrounds, as well as to the work environment they face. The system is designed so that it can be updated or accessed 24 hours a day. SCG personnel develop an ISS by interviewing expert users, observing them in action and studying their machines. The information they gather is then archived within a hard disk and made accessible to new users. The system is designed to be updated as new knowledge and experience accumulates. A coordinator serves as a clearinghouse for new information that is to be entered into the system. The coordinator doesn't physically update the system, a programmer does that. The coordinator, however, is someone who has a vested interest in the user's success.

Rick described the objective of ISS as optimizing the capability of the operator to manage technology. The focus is on learning because the system is never complete, but is updated continuously from experience. ISS permits individual workers to learn by interactive video, but groups of workers also can learn within and across shifts because the system facilitates the sharing of information. ISS also can be used for on-line diagnostics and problem-solving. In designing a customized system, it is not necessary to capture all possible data, only the data that is specifically relevant to the objectives the worker is suppose to achieve. The system has four levels of capability. Level I allows the user to enter new information in the form of text or graphics. Level II provides pre-existing information on an as-needed basis. Level III provides maintenance and diagnostics information which also is pre-existing. Level IV is the beginning of a true expert system in which gray areas about system functioning can be explored. ISS is not a neural network which is capable of learning on line in real-time. By contrast, ISS makes users responsible for learning, but facilitates their learning by helping them develop and update the information they need.

Integrated Manufacturing and Human Resources

Jim Dean and Scott Snell
Penn State University

Jim and Scott conducted a study of the impact of integrated manufacturing on human resource practices at the technical support and operator levels. In their study, integrated manufacturing refers to Advanced Manufacturing

Technology (AMT), e.g., CAD, CAM, CAE; total quality (TQ), e.g., statistical process control, Taguchi methods; and just-in-time (JIT), e.g., set-up, lead-time and inventory reduction. AMT, TQ and JIT are labelled "integrated manufacturing" in their study because all three encourage the integration of the stages, functions and goals of manufacturing. Human resource practices refers to selection criteria, e.g., physical, technical and problem-solving ability; type of training, e.g., technical or problem-solving; performance appraisal criteria, e.g., capabilities, activities, or outcomes; reward systems, e.g., market determined, or group or individual based. Jim and Scott collected data on integrated manufacturing and HR practices from 124 companies in the spring of 1989. Questionnaires were sent to senior managers, and functional managers in operations, quality and production control. Questionnaires also were sent to two rank and file operators, as well as to the human resource manager.

Jim and Scott proposed four patterns of possible effects of integrated manufacturing on HR practices. In pattern 1 (deskilling), management pays less attention to HR practices in all functions. In pattern 2 (skill upgrade), management pays more attention to HR practices in all functions. In pattern 3 (isolated effects), management pays attention to HR practices only in the function that relates directly to the type of integrated manufacturing introduced, e.g., operations for AMT, quality for TQ, production control for JIT. In pattern 4 (reintegration), management pays more attention to operations, but less to technical support functions because they have been reintegrated into operations.

The results for AMT and TQ most consistently resemble pattern 3 (isolated effects), at least for selection, training and appraisal. AMT, however, impacts rewards in all three functions (pattern 2). TQ strongly impacts selection, training, and appraisal in the quality function, but has no impact on rewards in any function. JIT has no impact on any HR practice in any of the three functions.

One forum participant suggested that the pattern may depend on the stage of implementation. For example, pattern 1 (deskilling) might occur first, then followed by pattern 3 (isolated effects), then pattern 4 (reintegration) and pattern 2 (skill upgrade). Another participant suggested that pattern 4 might occur first, then followed by pattern 2. The sequence of patterns cannot be determined from this data because it was not collected at different points in time, i.e., longitudinal. However, these suggestions are very useful for testing in future data collection.

A general discussion ensued which focused on some additional data that suggested that TQ and JIT increased job classifications. This was thought by some participants to be a temporary phenomenon that will disappear as the implementation matures. While the data suggested that AMT and TQ were increasing the amount of technical and problem-solving training that workers were receiving, the participants commented that the secondary schools were not preparing workers adequately in basic reading, writing and arithmetic.