Job Opportunity. Wanted: Multi-Skilled Technicians to Join a Six-Person Production Team Operating Highly Automated Equipment. Immediately

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Abstract

The combination of global competition and automation has had a major impact on how contemporary businesses serve their customers. Product development, operations, and sales have all been reshaped by the desire to provide high value products and services to the changing needs of customers. A corporation's ability to compete is intimately tied to its ability to continually develop its workforce. The number of traditional manufacturing jobs in the future will **decline**; the competency demands will **increase**. This paper outlines how one company developed six strategies to ensure that the skills of its workforce kept pace with the innovations of its production technology.

JOB OPPORTUNITY

Wanted: Multi-skilled Technicians to join a six-person production team operating highly automated equipment. Immediately.

The above *Want Ad* might never make its way into the Sunday paper. If it did appear, there might not be many candidates. The speed at which technology is being used in production settings is outstripping the ability of skilled technicians to be ready to effectively service or operate each successive generation of machine. The picture is complicated even more as production floors become more team oriented. As organizations re-engineer their work processes and flatten their organizational structures, few jobs remain that require single skilled, independent workers.

Manufacturing is not the only setting for these workforce transitions. Consumer, commercial, and mortgage banking--in fact, the total financial services industry--is changing with each new advance of information technology. Telecommunication, transportation, distribution and health care oriented organizations are moving just as rapidly. There are no exceptions.

At this point, most leading corporations prefer to grow their talent from inside the corporation, even if talent is available in the open market. This paper discusses how one corporation faced the challenge of internal development.

BACKGROUND. Picture a respected corporation, manufacturing and distributing its products worldwide from a central location in the United States. Business is brisk--so brisk that in just six years the company has extended its core product lines to provide greater customer choice, increased its sales tenfold, and expanded its production capacity through three levels of automation. The quality of the manufacturing process was matched by customer service and distribution technology. In addition, the company was committed to same day shipping for all orders entered before 2:00 p.m. with never a back order.

The three levels of production technology started with a basic level [Level I] of automation for the first, then the second, then the third production line. Next came a progression to an intermediate level [Level II] of automation for production lines four and five, followed quickly by a retrofitting of lines one, two and three with the same technology. This brought all five production lines to the same level of automation. Finally, the next group of production lines moved to an even higher level of integration and automation [Level III].

BALANCING FORCES. The engines of growth continued to turn, but--as is usually true--limiting forces began to appear. Competitive products nibbled at market share; innovative distribution channels [in this case, mail order] disrupted normal customer buying habits; price wars began to surface. In short, the marketplace began to heat up and threatened to slow down the rate of growth. The challenge on the production floor was to continue to use lines one through five to provide the volume of quality products needed to meet customer demand; continue to utilize Level II technology to its fullest; and, simultaneously, prepare for the new products which would be manufactured with Level III technology. And added to this challenge was that of getting people ready to operate the lines at the increased levels of automation.

The *"Limits to Growth"* archetype was emerging, but the company had identified many of the *balancing forces* and was working to reduce their impact. One of the most critical *balancing forces* was people, and their ability to get ready for the next phases of growth.

PEOPLE. Who were the people and what skills did they need? At automation Levels I and II, a fairly traditional division of labor existed. "Operators" ran the machines and were responsible for **output.** "Technicians" maintained the machines and were responsible for **machine availability**. These technicians handled all predictive, preventative, and emergency maintenance, as well as the installation of new technology as it was introduced on the first five lines. These teams of technicians evolved over time and developed into a sophisticated support group to the operators. They were well trained in mechanical, electrical, electronic, pneumatic, hydraulic, and robotic systems. They served as expert trainers for each other and for the operators--and for the engineers, who easily lost sight of the day-to-day, week-to-week challenges of maintaining highly automated production machines.

Two outcomes developed as the technicians enhanced their skills. On the positive side, the talent pool expanded as quickly as the technology advanced from Level I to Level II. The technicians were ahead of the curve--they knew the technology before it was installed, and could use it effectively.

On the negative side, operators became addicted to the help they received. *"Call the technician."* became too easy the acceptable response to trouble. It substituted for enhancing the operators' skills: the *"Shifting the Burden"* archetype began to play out. Emergency calls increased, the volume of work orders mounted, time delays increased, technician availability decreased. Over time, a unique and talented pool was developed, but was eventually over used.

Enter technology Level III. The next generation of technology was introduced for production lines built after line five. The level was significantly higher than Level II technology and was capable of running with fewer workers and with higher levels of machine availability. Level III represented the beginning of the company's transition from mass production to lean production. The traditional jobs of "Operator" and "Technician" disappeared. They merged into a new breed of team members who were required to have both sets of talents. *Where would these people come from?*

Level I and II technology called for operators and technicians to work together, but they were essentially **individual performers**, using **limited sets of skills** to address **relatively simple production problems**. Level III technology, on the other hand, called for fewer people working together as a **team,** using **multiple skills** to **solve complex production problems.** *Where would these people come from?*

To add to the challenge, the expectation is that within the coming decade, Level II technology will disappear and all production will be done, "at least", at Level III. The transition from Level I, through Level II, to Level III looks like this:

	Level I Technology:	**Level III Technology:**
Skills:	*Single*	*Multiple*
Problems:	*Simple*	*Complex*
Relationships	*Individual*	*Team*

Where would these people come from?

The obvious pool of talent was the technicians. They had already grown from Level I to Level II. As Level III became a reality, first at the pilot stage and then at the production stage, these technicians began to be transfer out of their present Level II positions into the emerging roles on the new lines. This movement of talent was not a completely new phenomenon for the technicians. They were traditionally a recognized group of skilled and experienced employees who worked well with others. Over the years they had moved, but usually only one at a time, into higher level positions in engineering, quality assurance, technical services, etc.

The move to Level III production assignments, however, was different. Larger numbers of people moved and at the same time. Meanwhile, the single flow of people to engineering, quality assurance and technical services continued. The combined result was that talent was leaving the technician group **faster** than it could be restored. Even if talent was hired from outside the company [the company preferred internal promotion], there was at least a twelve month delay to bring even the most talented people up to speed in serving the Level II technology on the first five production lines.

THE COMMONS. The "Tragedy of the Commons" archetype had occurred. A common resource which had serviced its internal users extremely well, and had successfully replenished itself as talent moved out to other parts of the company, was now being depleted faster than it could renew itself. Some of the consequences of this depletion were:

The remaining skilled technicians were spread thin--now serving all five Level II lines.

Experienced technicians needed to devote extra time to new technicians in an effort to bring them up to speed more quickly.

Response time for normal emergencies slowed significantly.

Normal predictive and preventative actions took longer.

Machine availability dropped.

Mean time between breakdown decreased, rather than increased.

The transfer of experienced "operators" to "technicians" reduced the number of skilled workers on the Level II production lines, causing a need to train new operators.

The flow of people through the organization created an internal "Beer Game":

New hire-->Production Lines-->Technicians-->Production Lines
Level II **Level III**

ARCHETYPES. As this organization expanded its markets and its production capacity to serve those markets (?), three familiar stories emerged:

The Limits of Growth. The company's success had created the need for increased capacity--and increased technology, which had to be supported by increased talent. The engines of growth in the market place could possibly be slowed or balanced by the demands for new talent on the production floor.

Shifting the Burden. Level II operators had become used to calling on technicians for even the smallest of problems. While this increased the problem solving skills of the technician, it caused delays in machine availability. And, at the same time, it limited the troubleshooting and problems solving skills of the operators.

Tragedy of the Commons. A talent *"commons"* had grown up over time in the technicians' group. This *"commons"* had continually recreated itself, until the demands of Level III technology were introduced. Then the pool was drained too fast, impacting the ability of the technicians to service their primary customers, the first five production lines.

How did the organization work its way through this potentially destructive situation? It initiated **six strategies** that allowed it to service the needs of both Level II and Level III production lines.

Strategy 1. Break the *"Shifting the Burden"* pattern which used the technicians to respond to every machine emergency. The technicians and operators identified frequent breakdown situations which required a relatively fundamental level of skill to rectify. Technicians then trained operators to do these tasks. Simultaneously, the technicians brought line operators into their department to serve as "Associates". After a six month period, these "Associates" then returned to their operator positions with more extensive technical skills. The impact of this strategy was predictable:

Less dependency on technical team for routine problem solving

Increased machine availability as problems were solved by operators

without a call to the technicians

Eliminated, relatively quickly, the many delays in other parts of the plant caused by moving technicians to emerging sites

Technicians became more available to address more unique and difficult problems

A new pool of talent was developed among the operators, who then became more developed employees ready to move to the more challenging positions opening up with the higher level of technology in Level III

Strategy 2. Speed up the learning cycle by formalizing task specific and machine specific training, together with a structured approach to rotating machine assignments for routine and engineering

situations. This system was anchored in a thorough task analysis system linked with an Expert On-the-Job training technique, using both *Job Aids* and *Performance Skill Checks*. The technician did the analysis, wrote the *Job Aids* and *Skill Checks,* and taught each other how to do the right things right--the first time. The goal was to **leverage the learning** of those who knew the most, so that those who knew the least could grow as quickly as possible.

Strategy 3. Continue to use the technician department as an incubator for the development of company talent. To work through the *"commons"* tragedy, the company had to create a **shared vision** of how it wanted to use its common and most powerful asset: the competency of its employees. Part of this vision included the creation of a three tiered approach to competency development [Fundamental, Experienced, Expert], linked to a clear path into-through-and-out-of the department. The path set performance standards for technical, operational, and management excellence.

Strategy 4. Increase the opportunity for **double-loop learning**, both for the technicians and the operators, using Level II technology. Operational *"know-how"* learning came from structured on the job training, the use of machine simulators in laboratory settings, and formal machine specific training. Conceptual *"know-why"* learning came through classroom based learning built around the socio-technical systems which were required on the job. These programs covered the field from Print Reading to Conflict Resolution to Pneumatic/Hydraulics, to negotiation, to advanced ladder logic for programmable controllers. The most demanding of these competencies to develop was troubleshooting. It is relatively easy to learn how to "tighten", "turn", "set" and "remove". Fixing a problem is easy compared to finding the problem to fix.

Strategy 5. *Compensation.* The compensation system was fine tuned to prevent any leakage that could occur due to pay imbalance. The pay system was structured to encourage a predictable move through the technical department rather than unplanned and unhealthy jumping to other departments, or out of the company.

Strategy 6. *Teamwork.* It might have been nice if the company's only agenda was developing people. The reality was that these development strategies were part of an overall thrust to build competitive advantage through quality customer service. Internally, service meant that technicians looked at the production lines as **customers**, and the production lines looked at the technicians as **partners.** Easy to say; tough to do. Even tougher to integrate this customer/partner relationship into daily behaviors. But very possible.

In addition to appropriate training, the company is experimenting with different methods of assigning new responsibilities. Both operators and technicians are learning how to manage themselves with the help of information provided by the automated system itself. **Information** and **multiple feedback loops** are *shaping new management strategies.*

CONCLUSION.

The company has learned that, just like "safety" and "quality", competency development is part of everyone's job. Practices which limit the growth of talent will eventually limit the growth of the business. Organizations shape their own structures, then those structures shape the behaviors within them. Development practices had built a talented workforcce for Level I and II technologies, but not enough talent was ready to handle the dramatic demands of Level III technology--at the speed with which it entered the production flow.

The six strategies are in place, and, for a beginning initiative, working with reasonable success. The transition to Level III technology continues, but in a more predictable fashion than when first begun. As it stabilizes, the preparation required to master the technology is better understood. Level II technology is still producing and, for the immediate future, will continue to produce the company's core products. It is now clearly evident that both "operators" and "technicians" need to progress along a three dimensional path for success--both in their present jobs, and in the jobs that are emerging as the future. They are moving from independent performers with single skills applied to well defined problems to interdependent team performers, with multiple skills, applied to complex problems.