

Industrial Training Coming to a Computer Near You!

A new initiative is underway at the UT Center for Industrial Services (CIS)! IPS Online is an endeavor between CIS and the other agencies that make up the Institute for Public Service (IPS) to develop and deliver training and assistance online.

Examples of courses CIS will offer online include environmental, safety, lean manufacturing, and ISO. Courses already developed include PPE Hazard Assessment, Metric Conversions, Solid and Hazardous Waste Regulations, and Lockout/Tagout. Courses under development include an Introduction to Lean Manufacturing, Tier II Reporting, Hazard Communication, and Means of Egress. Courses being developed by other IPS agencies include Effective Meetings, Role of the 21st Century Manager, Family Medical and Leave Act, and Workplace Discrimination.

In June CIS conducted a beta test on a Form R course. Participants indicated that the course was helpful and that they liked the flexibility of the online format, including being able to review the material at a later time and being able to work on the course in time segments that fit their schedules. Additional beta tests on different courses will be conducted through the end of the year. If you would like to participate in one, send an e-mail to mmoon1@utk.edu.

We anticipate that the IPS Online web site and online registration system will be operational in the first quarter of next year. If you would like to be notified when the system is complete or if there is a class you would like to see offered online, send an e-mail to mmoon1@utk.edu.



FOCUS ON MANUFACTURING

Helping Tennessee companies achieve a sustainable competitive advantage

Issue 3 - 2001

TMEP Eases Bennett's Growing Pains

Steve Bennett had his back against the wall - literally. As president of Bennett's Incorporated, a contract manufacturer of metal products in Dyersburg, Tenn., he had seen his business grow in sales, services and square footage. But now he needed to grow in something else: space utilization.

Founded in 1968 as a tool and die shop, Bennett's added a stamping operation in the early 1990s. A sister company, Impressive Manufacturing, LLC, was started in 1997, with Gary Davis as president, to provide basic metal fabrication services. Then, they added an industrial maintenance division and industrial supply services. As services were added, the facilities were expanded. But as happens with many businesses, new equipment was added to the production lines wherever an opening existed - not to enhance proper material flow.

"We had room on our property for one last expansion. So we knew we had to make the most of it," said Steve.

"We were too cramped. We were moving stuff to get to the parts we actually needed. But we had to expand and add equipment to make money," Gary said. "The other problem was that we did not



With an improved plant layout, productivity, safety, quality and morale have improved.

have the resources on staff to solve our layout problems. That's when the Chamber of Commerce put us in touch with TMEP Field Consultant Al Cash."

Al and TMEP Manufacturing Consultant Richard Haynie worked with Larry Lynch, a private consultant, to determine the best machine and office layout, even the site for the loading dock in the 18,000 square foot addition. The answers: move a utility pole, set the building and then place existing equipment and storage racks. The layout allows for segregated parts storage (important for their ISO registration), proper die storage, and easier press changeovers.

Steve and Gary worked with the Tennessee Department of Economic and Community Development to obtain a loan through the Community Development Block Grant (CDBG). "We had to wait a little longer than for a

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By Jim Womack
President, Lean
Enterprise Institute

(Provided courtesy
of the National
Association of
Manufacturers & the
Lean Institute)

To learn how we can
help you implement
value stream
mapping and other
lean manufacturing
tools, call us at
1-888-763-7439 or
visit us at
www.tmep.utk.edu

The Product Family Matrix: Homework Before Value Stream Mapping

Lean thinkers always start with the product or service. After all, the customer's only interest in your company is your product. Your customer doesn't care about some weighted average of all your products or some fraction of your core competencies or assets.

You will need to draw a value stream map for every product so you can get at the waste in your value streams, and in our next installment we'll talk about how to do this. But first, you need to identify your products.

In some companies this is dead simple, especially if you produce only a few items on a daily basis. However, many of you have hundreds or thousands of products, and it is obviously not going to be possible to draw a value stream map for each one.

So we need a way to simplify reality by grouping many products into a few product families. We've found that the best tool for doing this is the Product Family Matrix.

To create a product family matrix, simply list your products down the left column and the process steps working backwards from the customer along the top. In most cases, it won't be necessary that all the steps be listed. Usually the ones closer to the 'downstream' customer are enough for you to differentiate product families. (See our frequently asked questions at the end of this article). Then place a mark in each of the squares where the step applies to the product. Next, look for common process steps that apply to several products. These products can then be grouped into families.

What we mean by "downstream" is steps closer to the customer, and "upstream" means steps closer to raw materials.

The process steps need not be absolutely identical, because later on we may create flow in such a way that several products can pass through each step with some slight detours (for instance, in a cell) if required.

You might be surprised by what you find when you do this analysis. For example, some

products that you thought were totally different from each other may, in fact, travel through a similar set of process steps. If this is the case, then they can be grouped into product families, even if they are not related from a marketing viewpoint. The key is to think in terms of shared processes.

Frequently Asked Questions:

Why do we use downstream steps in the value stream to define product families?

In most commodity parts manufacturing companies, the product is truly differentiated to the customer's requirements in the downstream assembly steps. Often upstream processes and equipment serve multiple product families. Examples of this are stamping machines, plasma cutters, and robots. Where upstream processes serve multiple product families it would be difficult to define a product family based on these steps, as these steps may, in fact, serve most of the products.

I work in a custom parts company. How do I apply these techniques?

In a custom parts organization everything is produced to customer order. We want to set up a continuous flow from the point of order release straight through to shipping. In these cases, the product family matrix may also include more upstream steps, as these steps are closer to the point of order release.

Commonly in custom parts producers, the key processes that drive the pace of the operation are a little further upstream than in a commodity parts producer. In a custom parts organization the key is to understand which of the orders can be grouped by the processes they follow. The product family matrix can still be used in this case; however, there may be more upstream steps listed on it.

Defining your product families by observing the common processes that they travel

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Bennett's, from page 1



Steve Bennett (left) and Gary Davis proudly display their ISO 9002 certificate.

conventional bank loan, but the better interest rates made it worth the wait," Steve said.

More Than Impressive Manufacturing — Impressive Results

Steve reports that during the first year following the TMEP expansion assistance, sales have increased approximately \$1 million, and he expects sales to increase \$1.5 million more during the second and succeeding years. The company made a \$600,000 capital investment in the additional plant and equipment and added 25 new full time employees.

On his TMEP customer satisfaction survey, Steve stated, "The plan developed by TMEP was an essential ingredient to our success. The expansion was needed to support the growth of our business."

Facility Profile:

Bennett's Incorporated
Steve Bennett, President

Impressive Manufacturing, L.L.C.
Gary Davis, President

2255 Industrial Drive
Dyersburg, TN

P: 901-285-8351 F: 901-285-7119

- 60 employees
- 2 shifts per day/ 5 days per week
- 40,000 s.f. facility
- Stamping operation is registered to ISO 9002

Launch a New Product Using NASA Technology

Advanced sensors, inspection systems, composite materials and alloys, unique motors and specialized software are just a few of the many technologies that are essential to NASA's space and earth science missions. In many cases these innovative technologies can become the basis for new products and processes that business and industry can use to better compete in the global marketplace. Technologies developed by NASA are evaluated to determine whether they may have commercial potential. Those that are judged to have such potential are made available for licensing or for cooperative research and development.

NASA makes leading-edge technologies available through the Southeast Regional Technology Transfer Center (SERTTC). The University of Tennessee Center for Industrial Services (CIS) is the Tennessee affiliate of the SERTTC. It is our mission to match NASA innovations with companies that can put them to work building their businesses and strengthening the nation's economy.

Examples of NASA technologies made available recently include:

- Accurate Location of Lightning Strikes
- Hybrid Butterfly Valve
- Hand-Held Hydrogen Fire Imager
- Improved Ultraviolet and Infrared Hydrogen Flame Detector

In addition to assisting companies with the licensing of NASA technologies, CIS also assists companies with applications for the NASA Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. CIS also can help locate specialized R&D facilities that are available to business and industry for development work.

For more information contact Lynn Heer at 615-532-6698 or lheer@utk.edu.

Focus On Manufacturing is published quarterly by the Tennessee Manufacturing Extension Program (TMEP), Tennessee's industrial extension service. The TMEP is a joint program of The University of Tennessee Center for Industrial Services and the Tennessee Department of Economic and Community Development.

Re-tool Your Workers, *Continued from page 5*

are necessary and how they present opportunities for change in the way things are done.

Let workers know that concurrent with your commitment to technology upgrades is an equal commitment to employee development. Assure them that you will provide them with adequate and timely training support.

If you are in a union environment, look at work rule options not work rule changes. In this context, management and union do not bargain over specific work rule changes but rather discuss work rule options available for coping with the impact of the technology on the human infrastructure.

Finally, set up a structure to harvest process improvement ideas during the debugging and trial run stages. The methods can be as simple as setting up flip charts for people to log problems, solutions, and ideas, or you can gravitate toward a more formal arrangement such as a Kaizen team.

Whatever you do, be sure to capture suggestions and provide constructive feedback in a timely and meaningful manner. Leave out the feedback mechanism and you will have a drought of ideas.

Keep in mind that HPT is not a cookie-cutter approach. You must adjust the scope of each element and tailor the interventions to fit circumstances. For example, some situations may require more emphasis on feedback and inputs than on selection. Other situations may benefit by concentrating effort on instituting structured on-the-job training.

Implementing any new manufacturing process or a technology upgrade requires some degree of training. But HPT goes

Product Family Matrix,

through is an essential step. However, please don't let prolonged discussion hamper the efforts to conduct value stream mapping and thereby identifying and removing the waste. Drawing a product family matrix in itself offers no value to your customers. So keep it

beyond training, and examines the systems and factors that impact upon human performance. In fact, HPT will look for ways other than training to produce the intended results.

Training is an effective tool, but it is also an expensive one. Do not make training the first (or only) bullet you fire.

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What if you are not sure what tools your workers need?

TMEP adult training specialists want to hear your vision for success, then we will help you explore the skill areas your employees need to get you there. Together, we will devise a training plan that will move your organization closer to your vision.

If applicable, TMEP can help your organization use the Tennessee Job Skills program to pay for some of the training. For information on this workforce incentive grant program, visit: www.state.tn.us/eecd/tjjobskills.htm

Or, contact TMEP at
1-888-763-7439

simple, and set a time limit on the discussion. Don't get bogged down trying to produce the perfect product matrix. Once you have it to a "good enough" state then get out there on the floor and move to your next step, which is value stream mapping.

RE-TOOL YOUR WORKERS

You upgraded your technology, but what about your people?

One methodology born in the late 1900s and an early candidate for the "dominant" technology of the 21st century is human performance technology (HPT). It is a science that is emerging from the need to more successfully integrate human performance with advancements in manufacturing science and technology.

Here is what I have seen on more than one occasion: the engineers launch a new technology project. But engineers are often measured only on their ability to meet milestones and deadlines. In the vernacular, it is known as "throwing the technology over the wall" and getting on with the next project.

The operations and production sides of a company often do not want to know what is going on until it smacks them in the face. Then when problems arise, the people-versus-machine finger pointing begins. Too often, we forget all about the people side of the technology equation. But if the people part is done completely and correctly, the results are impressive, and you can achieve measurable benefits.

One company, a durable goods manufacturer, was able to get the second shift to reach production quotas and produce the requisite quality within two weeks. Another company reported no downtime due to "operator error" during a new plant startup. Other companies have found the training time (the time it takes an individual to reach contributing level) shrank anywhere between 30 and 60 percent.

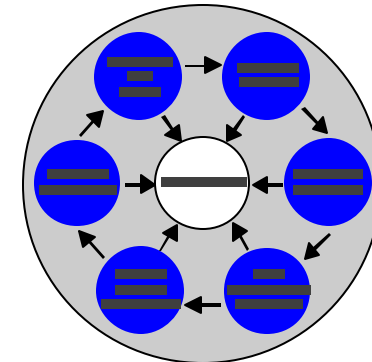
One of the main benefits in each of these examples is that companies can greatly reduce nagging questions about the capabilities of their workers. These manufacturers achieved great results by using a systematic approach to engineering human performance. This enabled them to focus their attention where it needed to be: on improving technology to meet the demands of their customers.

Defining human performance technology

Simply put, HPT is a systematic approach to improving human performance. It is a scientific method to determine what you want — instead of what you are getting — from the performance of people. It transcends traditional human resource development and training functions. Instead, HPT encompasses a number of disciplines including organizational development, instructional systems, quality systems, process analysis, problem solving, human-machine interfacing, and information technology.

Typically, HPT is used to help resolve an existing conundrum. But the principles, practices, and techniques of HPT can also be used as a type of preventive medicine, especially when introducing new technology to a workforce. The "performance wheel" below illustrates the components of an HPT approach.

As we examine each spoke of the wheel, we will look at that element in context of a new technology introduction. Progress on these items should be initiated as soon as (and sometimes before) you place the equipment order.



Selection methods

Selection involves the processes or procedures associated with hiring new people, making

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For more information on HPT, call Bill Stetar at (615) 244-2022 or send e-mail to bstetar@utk.edu

Re-tool Your Workers, *Continued from page 3*

promotions, or accommodating internal transfers. If you select people with the wrong skill sets and competencies, you will be fighting an uphill battle. Long before you begin bolting down the hardware, you can make significant inroads to ensuring that the new technology will be a success.

Here are some actions to take:

- Make a list of the core skills that the new technology or process requires.
- Make these skill statements performance-oriented (state what a person must be able to do), not knowledge-oriented (what a person must know).
- Perform a make-versus-buy decision. That is, figure out if you are going to train incumbent workers or recruit people who already have the needed skills.
- Develop instruments that enable you to verify an individual's competence in critical skills. Use devices that say "show me how to do this" instead of questions that say "tell me how you would do this."

The strength of the selection component, however, will be dependent on whether you have compiled a list of tasks associated with the new technology or process. If you do not know what people will be doing, you will not be able to accurately specify what skills you want people to bring with them and what equipment-specific skills you will teach once they have the job.

Job duties and tasks

Job analysis usually looks at the performance requirements of a specific job classification. With new technology, you really won't know what the specific jobs and job responsibilities will be until the process has been debugged. But don't postpone activity in this area. Instead, focus on process analysis. That is, examine what it is that people must be able to do to operate, maintain, and ensure quality in this new

technology.

By examining what the process will require, you can begin to organize a list of tasks that have to be done (and learned) by someone at some point in time. Core to any job or process analysis is a consistent and defensible definition of the term "task." Among other things, a task must be:

- A discrete unit of work that has a distinct beginning and end.
- An observable and measurable behavior performed by a person.
- An activity that can be broken into a step-by-step procedure.
- An activity that can be completed in seconds, minutes or hours, but rarely, if ever, needs days or weeks to complete.
- something for which an employer will pay.

Job-process analysis requires a three-tiered hierarchical mapping:

- Level 1 (or the grandparent) is the process being examined.
- Level 2 (the parent) consists of "duty areas," which represent collections of closely related tasks within a specific area of competency associated with the target technology.
- Level 3 (the child) consists of the tasks themselves, the discrete units of work that comprise the area of competency.

To use an analogy, the automobile would be Level 1. The various sub-systems, such as suspension system, exhaust system and brake system, would comprise Level 2. Tasks in Level 3 would include actions such as "adjust toe-in," "inspect exhaust system," and "replace disc pads" and are linked to their respective Level 2 parent.

You can derive tasks in a number of ways. One way, of course, is to compare existing technology to the new technology. If the process technology is completely different, then work with the equipment vendors to

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Re-tool Your Workers, *Continued from page 4*

determine what tasks are associated with the various components and subsystems that make up the new technology.

The analysis will go more smoothly if you focus on what someone has to be able to do, rather than trying to compartmentalize the tasks along traditional job definitions.

Task performance standards

One of the most powerful steps a company can take is to establish measurable, observable criteria whereby a competent individual can determine if a specific, critical task has been done correctly and completely. If individuals have no formal, structured means to evaluate their own performance, supervisors will have no structured, formal means to evaluate an individual performance and provide useful feedback.

Measurable task standards can encompass all or some of the following elements:

- Quantity/output: What is the minimum acceptable output per task within a specified period of time?
- Quality of work: What are zero defects? What determines that a specific task has been performed to minimum acceptable quality standards?
- Timeliness: What is the minimum acceptable task delay tolerance, i.e., how much time can elapse before task performance starts?
- Performance precision: Is it a "go" or a "no go?" How accurate was the task?

These established standards—a definition of what constitutes correct task performance—become the foundation of any training to be designed, developed, and delivered.

Training

Training can only address skill deficiencies, that is, the "can't do" versus "won't do" behaviors. Nonetheless, training can have a dramatic impact by increasing productivity, decreasing unplanned downtime, reducing the

learning curve, and reducing trial-and-error learning.

The thrust here is to approach "training" as part of a system for continuous improvement. Training practices do not have to be centralized; they just need to be systematized. A systematic approach to job training will ensure that the right skills get to the right people at the right time.

A structured on-the-job training system will mean less time spent in the classroom and more time spent on the equipment getting hands-on experience and individual tutoring. It will mean less time spent on costly trial-and-error learning and more time spent on relevant practice.

Tools and references

A deficiency that companies must often overcome is the lack of standard operating procedures (SOPs), job aids, and other visual tools that can be used to minimize or mitigate process variations introduced by people.

For example, operators can use items such as "if-and-then" charts or flowcharts to do first tier troubleshooting, rather than waiting on a mechanic. Expanded views of the equipment, with components and parts labeled, will allow the operator to communicate more clearly, with proper terminology, when attempting to describe a problem with the equipment. The use of such job aids can dramatically reduce training time and structured on-the-job training development costs.

Feedback and inputs

The processes, systems, and methods by which information is conveyed to job incumbents individually and as a group are integral to the total technology plan. Give the workforce early and frequent information. Give all ranks of employees plenty of advance information regarding the impending technological changes. Help them understand project objectives in clear and simple terms. Educate them as to why these technological upgrades

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