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Looking at lean in a new way accommodates unique workers

By Tim Sullivan, CIRAS

What do you do when many of the standards of lean cannot be applied to an organization that otherwise needs to streamline its operations? For Paul Gormley and his colleagues at Iowa State University Extension, Center for Industrial Research and Service (CIRAS), it meant taking a new look at lean.

The Contracts Division of Goodwill Industries in southeastern Iowa works annually with 200 individuals. The division provides area business partners with a variety of manual services, including assembly, collating, and inspection. The individuals who work on these projects have disabilities, a lack of marketable job skills, or other barriers to traditional employment. Goodwill provides them with paid training and job experience to build the skills needed to attain permanent employment.

“Usually when we help a company implement lean manufacturing principles, we build a process that assumes standard worker capabilities,” says Gormley, an account manager with CIRAS. “We focus on the process and not as much on the unique individuals working on the line. But with Goodwill, we had to work around the variability of Goodwill’s clients’ abilities. It was an interesting and rewarding challenge for us.”

Animal deterrent manufacturer RepellIt in Cedar Rapids, Iowa, asked Goodwill to take a major role in the assembly and production of its Deer Fortress deer repellent. “While we work regularly with manufacturers, this was the first time we were asked to make a product from start to finish,” says Jessica Schamberger, business development manager for Goodwill’s Contracts Division. “We were excited to take on the challenge and became one of just a few Goodwill’s across the country that have done it.”

Promising early sales results led RepellIt to expand production of Deer Fortress. In order to ramp up Goodwill’s production capabilities and meet RepellIt’s needs, Schamberger realized she



Goodwill’s contracts supervisor, Nancy Feldmann, shown above manually cutting filters used in the deer repellent product assembly.

would need to get some outside assistance. For that, she turned to CIRAS.

Gormley knew Goodwill’s manufacturing line would need to be dramatically revamped in order to meet RepellIt’s quantity projections. A standard lean manufacturing process would have to be adjusted to compensate for the needs of Goodwill’s disabled workers.

Typically, lean practices focus on process and not individual people, and they assume standard worker productivity throughout. At Goodwill, Gormley and his colleague, CIRAS industrial specialist Mike Willett, concluded that they would have to combine lean best practices with real-world accommodations for workers with disabilities.

“State regulations require that one worker’s earnings cannot be affected by variances in

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Center for Industrial Research and Service
2272 Howe Hall, Suite 2620
Iowa State University
Ames, Iowa 50011-2272

CIRAS Web site: www.ciras.iastate.edu

515-294-3420 / Fax 515-294-4925

CIRAS Mission Statement

Improve the quality of life in Iowa by enhancing the performance of industry through research, education, and technology-based services.

CIRAS

Ames

Ronald Cox, PhD—CIRAS Director
515-294-9592 • rcox@iastate.edu

Jim Black, CLM, CSSBB, Jonah
Lean Manufacturing; Kaizen Implementation; Strategic Planning
515-290-4070 • jimblack@iastate.edu

JoAnn Miller
CIRAS Business Manager
515-294-4449 • jvmiller@iastate.edu

Jeff Mohr, PE, Jonah
Lean Manufacturing; Noise Control; Training Within Industry
515-294-8534 • jeffmohr@iastate.edu

Jessica Riedl
BioPreferred Program
515-294-5416 • jesriedl@iastate.edu

Mark Reinig
College of Engineering
Economic Development
515-294-7883 • mreinig@iastate.edu

John Roberts, PE
Finite Element Analysis (FEA); Product Testing
515-294-0932 • jarobert@iastate.edu

John Van Engelenhoven
Cranes/Monorails; Plant Layout Simulation; Product Testing
515-294-4475 • jve@iastate.edu

Ankeny

Verlyn Anders, CPIM, CQA, Jonah
BQ-9000; Compliance Audits; Failure Mode Effects Analysis (FMEA);
Feasibility Studies; Financial Management; Financial and Risk Simulation
Analysis; ISO 9001:2000; Strategic Planning
515-231-4497 • vanders@iastate.edu

David M. Bogaczyk
Bid Preparation Assistance; CCR and ORCA; Electronic Commerce;
Market Research; Post Award Assistance; RFID
515-422-6313 • bogaczyk@iastate.edu

Kathleen D. Bryan
Bid Preparation Assistance; CCR and ORCA; Electronic Commerce;
Market Research; Post Award Assistance
800-458-4465 • kathyb@iastate.edu

Sharmon Norris
Bid Preparation Assistance; Post Award Assistance; RFID
515-290-2724 • sharmon@iastate.edu

Joseph Papp, PE, CPIM
South Central Iowa Account Manager
515-231-1452 • jpapp@iastate.edu

Boone

Derek L. Thompson
North Central Iowa Account Manager
515-419-2163 • thompson@iastate.edu

Davenport

Steven Vanderlinden
Bid Preparation Assistance; Financial Management;
Post Award Assistance; RFID
563-370-2801 • stevev@iastate.edu

Dubuque

Rudy Pruszko
Baldrige Quality Award; Biodiesel; Feasibility Studies
563-557-8271, ext. 251 • rpruszko@iastate.edu

Grundy Center

Ruth Wilcox
Northeast Iowa Account Manager
515-290-1134 • rwilcox@iastate.edu

Lewis

Jill Euken
Biorefining
712-769-2600 • jeuken@iastate.edu

Marion

Paul A. Gormley
Southeast Iowa Account Manager
319-721-5357 • gormley@iastate.edu

Pella

Steven Devlin
BioPreferred Program
641-613-3297 • sdevlin@iastate.edu

Sioux City

Robert R. Coacher
Western Iowa Account Manager
515-419-2162 • coacher@iastate.edu

Merle Pochop

BQ-9000; Compliance Audits; Baldrige Quality Award; Customer Satisfaction;
Failure Mode Effects Analysis (FMEA); ISO 9001:2000;
Root Cause Analysis
712-274-0048 • pochop@iastate.edu

Urbandale

Timothy T. Sullivan, Jonah's Jonah
Operations/Production Management; Theory of Constraints;
Supply Chain/Distribution Management
515-727-0656 • sullytt@iastate.edu

Waterloo

Michael Willett
Operations/Production Management; Plant Layout Simulation;
Theory of Constraints
319-433-1286 • mwillett@iastate.edu

Engineering Distance Education

www.ede.iastate.edu

Paul Jewell
515-294-1827 • pjewell@iastate.edu

The Center for Industrial Research and Service (CIRAS) provides education, research, and technical assistance to Iowa industry through partnerships with Iowa's universities and community colleges, government agencies, and professional associations. Assistance is supported in part by the DoC/NIST Manufacturing Extension Partnership, the DoD Procurement Technical Assistance Program, and the DoC/EDA University Center Program.

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Biodiesel a hot topic: The workshops continue

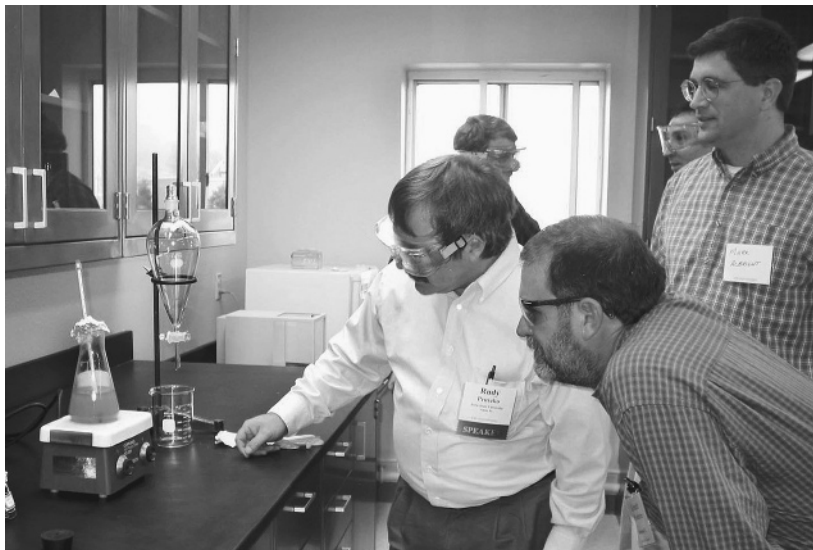
By Rudy Pruszko, CIRAS

Even now as ethanol plants continue to develop and additional corn is planted to meet their needs, biodiesel continues to expand as new plants are being constructed. The drop nationwide in soybean planting has not dissuaded many from pursuing their biodiesel dream. As of September 2007, according to the National Biodiesel Board Web site, 84 plants are under construction and 4 are expanding. When completed, the total production capacity of these plants will be 1.37 billion gallons per year. Added to the capacity of 165 existing plants producing 1.85 billion gallons, Iowa leads the nation in biodiesel production. It should be noted that not all plants are running at capacity, and therefore sales of biodiesel might not equal the available capacity of the plants.

Even though soybean oil prices were high during the first half of this year, many biodiesel plants are still producing and the demand is growing. Alternative feedstocks are being used to make biodiesel, with lower-priced animal fats and oils being the main substitute for soybean oil until adjustments to the market take effect to compensate for the higher feedstock prices. The continued biodiesel demand and support for biodiesel plants are also factors in the growing interest in Iowa State's biodiesel workshops. The annual workshop has been sold out for the past four years; the 2007 event drew 138 attendees from 7 countries and 33 states in the U.S., as well as 6 participants from Iowa.

First offered five years ago, workshop content is continually updated as new material becomes available and the industry changes. The event is a collaborative effort between Iowa State; CIRAS; the University of Idaho; Renewable Products Development Laboratories, Inc.; and the National Center for Agriculture Utilization Research. The workshop is offered three times a year with two workshops in Ames during the summer and fall. The workshop is five days long; participants receive two books on biodiesel and a binder with the presentations and handouts. Nightly networking sessions are attended by participants and their instructors, thus enhancing the learning process.

The workshop offers information on all facets of biodiesel such as marketing, production, analysis, business, chemistry, feedstock, and technology issues. Each day of the workshop consists of roughly six hours of classroom lecture and discussion followed by two hours of hands-on laboratory exercises in the following areas: making biodiesel, which includes a tour of a biodiesel plant and mechanical extraction equipment; how to recover from common biodiesel processing mistakes; testing feedstock for free fatty acid, soap, and catalyst; testing an unknown feedstock and pre-treating it so it can be



Rudy Pruszko showing workshop participants how to make biodiesel.

made into biodiesel; and designing a biodiesel plant using alternative feedstock.

This workshop has drawn participants from every facet of the biodiesel industry. Engineering companies and technology providers have sent their employees to be trained. People who simply want to learn more about biodiesel as well as those who want to enter the business also attend. The workshop provides information on biodiesel ranging from basic to complex. Participants leave the workshop with a solid overall understanding of the product, how to use it, and what's needed to enter the field.

The Iowa State workshop is more comprehensive than other workshops on this topic. It addresses all aspects of biodiesel: what it is, how it is made, why it works, what you should know if you are going to use it, and what feedstocks can be used. In addition, it's taught by five instructors, all experts in the field of biodiesel and all from various disciplines. This provides participants a range of perspectives and experiences.

Information on the biodiesel workshops can be found on the CIRAS Web site under the biodiesel area, www.ciras.iastate.edu/bioindustry/biodiesel.asp, and clicking on the "See in-depth information and related links" link.

If you have any questions about the workshop or biodiesel, please contact Rudy Pruszko at 563-557-8271, ext 251; rpruszko@iastate.edu. ■

EDA assistance extends to companies and research projects

By Mark Reinig, College of Engineering, and John Roberts and John Van Engelenhoven, CIRAS

In fiscal year 2007, 24 Iowa businesses received technical assistance in product design, product testing, productivity, and quality management from the Iowa Economic Development Administration (EDA) University Center operated by CIRAS. Many EDA projects are ongoing, but work completed thus far has generated positive feedback. In surveys, the average client satisfaction level was 9.2 on a 10-point scale. Below are examples of recent EDA projects and their potential to reduce costs, increase sales, and create new opportunities for Iowa manufacturers.

The Original Saw Company, located in Britt, manufactures wood- and metal-cutting radial arm saws, horizontal panel saws, and saw accessories. In an effort to reduce machining requirements, Original Saw considered changing a large casting of one of its radial arm saws. With CIRAS' assistance, the company can implement changes in the casting and machining processes to reduce the cost of producing the part.

Pella Supply, Pella, makes custom metal fabrications and weldments. CIRAS helped the company compute job shop rates based on current expenses and labor rates. The company commented the work done by CIRAS "opened our eyes to help us become more profitable"; they expect an increase in sales of \$62,500.

Welch Products, Carlisle, manufactures playground rubber tiles and the equipment to make them. CIRAS assisted Welch in measuring the loads applied to a new machine they have in development. Welch Products expects sales from previous years to double and commented, "We learned a lot in a short period of time."

A Rapid Manufacturing and Prototyping workshop sponsored by CIRAS and Iowa State's Department of Industrial and Manufacturing Systems Engineering provided a valuable insight on advances in product design and engineering. According to one participant, Tim Schank, American Athletic, the event provided "a good overview of technology with enough detail to really understand the processes of rapid prototyping and laser scanning."

In addition to providing technical assistance to Iowa businesses, CIRAS has partnered with the Iowa State University Department of Economics to conduct economic studies on regional industries. Economic developers will use the information to improve their regional economy.

The studies have five objectives:

- Provide an overview of the regional economy and the forces affecting it
- Assess regional industrial structure, examining strengths and weaknesses
- Identify regional key industries with an eye toward assisting industrial development, recruitment, and retention
- Promote the use of research-based criteria for justifying public economic development spending
- Link local organizational structures and needs with Iowa State University research, extension, and continuing education professionals

Three studies have been completed. The latest report titled *Targeting Industrial Growth in Southwest Iowa* involved 10 counties: Adams, Cass, Fremont, Harrison, Mills,

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EDA University Center funded

The Iowa Economic Development Administration University Center has been awarded funding for another three years by the Department of Commerce, Economic Development Administration. The program will continue to support technical assistance for companies and regional industry research. A new initiative will be undertaken over the next three years.

Biobased Product Supply Chains

A list of Iowa's biobased product manufacturers will be developed that includes information on size, location, and NAICS codes.

- A summary report identifying suppliers of biobased materials, Iowa biobased product manufacturers, and entities that purchase products from them will be developed. A simplified model will also be developed that describes a biobased product supply chain.
- A list of Iowa biobased product suppliers and a summary of their needs will be developed.
- Technical assistance reports will be provided to Iowa biobased product companies participating in this project.
- A Web page describing the biobased product supply chain initiative will be created.

EDA assistance

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Montgomery, Page, Pottawattamie, Shelby, and Taylor. The other two studies have already produced written reports titled *Targeting Industrial Growth Opportunities in Southeast Iowa* and *Targeting Industrial Growth in South Iowa*.

Copies were provided to everyone who participated in the meetings. All of the reports can be viewed on the CIRAS Web site under Economic Development at www.ciras.iastate.edu/library.asp?spec=Publications.

Intangible effects from all of the studies include

- Enhancing a unified regional effort to improve economic conditions
- Generating additional awareness of the deteriorating industrial conditions
- Promoting actions to address these industrial conditions
- Providing quantifiable research data to show the needs and opportunities of the region

A total of 19 economic developers have been assisted by the southern Iowa study, and preliminary results indicate an increase in economic activity within the region. As of June, the Iowa EDA University Center has measured over \$5 million in local and state investment coinciding with over \$87.5 million in private capital investment. These investments have led to 96 jobs created or retained, with future employee growth expected.

The Iowa EDA University Center was established at CIRAS in 1981 to provide technical assistance to Iowa industry and assist with the transfer of university technology. The center also provides guidance, information, and design assistance in developing new products.

For more information, contact Mark Reinig at 515-294-7883; mreinig@iastate.edu, John Roberts at 515-294-0932; jarobert@iastate.edu, or John Van Engelenhoven at 515-294-4475; jve@iastate.edu. ■

Looking at lean

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another worker's productivity," said Schamberger. "As a result, most of our work in this assembly process was being done in cells, so that our clients could work at their own pace."

Finding flexibility

Gormley and Willett used the input of the supervisors from Goodwill to develop a current-state computer simulation model. By analyzing the present process and discussing options for the workforce, Willett helped supervisors pinpoint the constraint on the system.

He then helped them develop a computer simulation-based future state that would both streamline the process and provide opportunities for the Goodwill clients to excel. In the end, it was determined that four labor-intensive processes in the system needed to be automated and condensed into two steps. In addition, another process was split into two parts, one of which was handled in a cell separate from the line's flow.

"Taking some of the assembly functions off the line to pre-produce some of the components in independent cells helped lower-producing Goodwill clients to continue to work at their own levels without impacting the productivity of the line," says Gormley. "Goodwill really needed flexibility in the process to allow all their clients to be able to participate in this exciting project."

In addition to the productivity assistance, CIRAS connected Goodwill with an Iowa manufacturer that could provide pre-cut bent wire, a critical component in the assembly process. Securing the pre-cut wire pieces was actually cheaper and kept the production pace moving.

Gormley and Willett also suggested automating the steps, but it was RepellIt and one of their many resources that developed the final production tools. "I came back two weeks later and they had brought in a retired Rockwell-Collins engineer to design and build a terrific repellent-dispensing machine," says Gormley. "The Goodwill people took our advice and ran with it."

As Schamberger reports, "We got so much out of the support we got from CIRAS and with their help were really able to take our assembly process to a whole new level."

With the changes in the process and the development of the repellent-dispensing device, Goodwill met RepellIt's inventory needs. Each retail box of six RepellIt units was produced, packaged, and fulfilled from the Goodwill facility at a rate of 12,000 units per day for four months.

More than 130 Goodwill clients worked on some part of the project, "and gained tremendously valuable training in the process," says Schamberger. "Learning and implementing lean is just the kind of work experience that will help them in other jobs that we hope they move on to from here."

"Hats off to RepellIt for bringing this opportunity to Goodwill, and to CIRAS for helping us meet the challenge," Schamberger says. "This project and our clients' familiarity with lean led to great interest in our services from other potential partners. In turn, we hope to provide even more workers with the kind of experience this project gave us."

For more information, please contact Paul Gormley at 319-377-9839; Gormley@iastate.edu or Mike Willett at 319-433-1286; mwillett@iastate.edu. ■

CIRAS and IPRT help Iowa manufacturer reach its goals

In February 2006, Dennis Froehlich, general manager of Tire Environmental, Muscatine, Iowa, called Paul Gormley, CIRAS southeast Iowa account manager, for assistance in finding markets for its products. At the time, Tire Environmental was looking to explore additional markets for its recycled shredded tire products. While the company had already gained ground in the septic field aggregate and landscape mulch arena, it was interested in moving into markets where it could add more value and reap higher margins. After Gormley's initial visit, it was clear that the company had a good concept of tasks it wanted to do but lacked some of the key resources to get them done quickly.

Finding an easy fix

The company's first and most easily addressable problem was a significant amount of downtime caused by inadequate conveyor belts on a critical piece of machinery. Wire fragments exposed in the shredding process were penetrating the belts and requiring frequent fixing and replacement. Gormley connected Tire Environmental with a mutual client, Apache Hose and Belting of Cedar Rapids. After a short visit on the phone, a conveyor belt specialist was able to recommend a solution to the problems. The result of replacing just two belts was 50 percent less downtime, which allowed the company to focus on its more long-term goals of producing a new product for the marketplace—a first for Tire Environmental.

Tough sorting problem

Tire Environmental had its eye on a slice of the landscape mulch industry. However, to produce products usable as landscape mulch, e.g., playground mulch, the pieces of shredded tire with exposed wire needed to be eliminated and virtually all remaining steel removed. While Tire Environmental had been using magnetic separation to screen out a good portion of the shredded tire bits that contained exposed wire strands, the company was still forced to employ a time-consuming and costly visual inspection process to detect the final entrapped steel bits in the mulch. Without a considerable leap in capabilities, the company would not be able to scale up high or fast enough to make a profitable venture from mulch.

That is when Gormley asked Dave Utrata, manager of the Institute for Physical Research and Technology's NDE group, to review the company's process. As some of the pragmatic aspects of such inspection were beyond the specialty of the group, IPRT invited an Iowa firm, Industrial Motion Technologies, who represented Eriez Magnetics, a firm that specializes in magnetic separation, to get involved. The team reviewed the metal detection process at Tire Environmental and immediately made practical suggestions for improvement. Also, the company performed trial metal separations using suggested new equipment.

Meanwhile, Dave and IPRT's NDE group verified the use of x-ray inspection to reliably detect wires trapped

in batches of shredded tires. While this testing was not anticipated to be practical in the field, it helped the team validate proposed alternate sorting methods. As a result of the collaboration, Tire Environmental has significantly improved sorting capabilities with verified quality. "Since we finished the NDE project, the quality of our product has changed so much for the better," says Froehlich. "No one else in the industry seemed to have the answers for me; I am just so glad that Dave and his team were able to help us with this tough problem."

Making it pretty

The end products that Froehlich and his team had envisioned were not black rubber. "This was meant to replace products like wood chips on playgrounds and in landscaped spaces," Froehlich says. "The black material had all the positive characteristics it needed to be sold, except it didn't look like the products it was supposed to replace." This problem was shared with Gormley, and within a few days Froehlich and his team were speaking

About NDE and IPRT Company Assistance

Nondestructive evaluation, or NDE, is a collection of powerful methods such as ultrasound and x-rays that can be used to detect defects and measure physical or mechanical characteristics of a material or component. NDE is ideally suited to the demands of today's manufacturing processes, where it can help improve quality and productivity.

Iowa manufacturers have a leg up on using NDE, thanks to experts from the Institute for Physical Research and Technology (IPRT) Company Assistance. With a staff dedicated to working with Iowa companies, IPRT's NDE group provides short-term assistance and education on NDE technology and applications. As part of Iowa State University's outreach efforts, IPRT's NDE group works closely with CIRAS to provide access to world-class expertise and equipment and help Iowa manufacturers and entrepreneurs address technical problems and R&D needs. The NDE group is also part of IPRT's Center for Nondestructive Evaluation, a world-renowned scientific research group that develops noninvasive methods and instruments for assessing the integrity of structures and materials.

IPRT is a network of scientific research centers at Iowa State University and has been assisting companies from all corners of Iowa since 1987. Each year IPRT helps about 150 companies—from one-person start-ups to Fortune 500 corporations—solve scientific and engineering problems.



IPRT's nondestructive evaluation experts helped Tire Environmental of Muscatine, Iowa, create a better process for removing wire strands from shredded tires, making a product suitable for mulch and other applications.

with two more clients of CIRAS, Becker-Underwood and Marion Mixers. Gormley says, "I knew of two Iowa companies that work in the colored wood mulch industry that could help Tire Environmental make their ideas real. So I set up some phone calls, and they took it from there. Sometimes it's just about putting the right people together."

Every cloud has a silver lining?

On June 1, 2007, Tire Environmental sustained a direct blow from a tornado that wreaked substantial havoc on Muscatine and its business community. The roof of the company's production facility was badly damaged, and its offices were almost completely destroyed. But, after the storm, which luckily did not seriously injure anyone in the building, Tire Environmental fought back. While replacing the roof and streamlining its process, the company perfected the new sorting system and implemented the new coloring technology. Even with the setback, during what should have been its ramp up to a

busy spring season, Tire Environmental was able to sell 200 tons of safe black ground cover and 50 tons of the colored material in 2007.

"We have had nothing but good comments from our dealers and customers; sales are increasing as more and more people are exposed to our mulch," says Froehlich. "The (coming) spring season looks good. Without the help we received from CIRAS and IPRT NDE, we would still be working to solve our problems, sales would not be there, and we would be looking at a less-than-desirable future in the mulch business."

CIRAS' Gormley sums it up by saying, "We can do a lot of things at CIRAS, but what makes us capable of making significant impact with some companies is our ability to call on great partners like IPRT Company Assistance and people like Dave Utrata. Without his expertise and genuine interest to help, we would not have been able to help this client like we did."



David Bogaczyk is the new program manager for the CIRAS Procurement Assistance Program. David's professional experience includes over thirteen years in the government procurement arena as an attorney, director of contracts, consultant, and senior executive. He brings a wide range of expertise in providing strategy and counseling to businesses for increasing their government sales and managing their existing government contracts. In his new role, David will be directing a team of three procurement specialists whose mission it is to counsel any Iowa business or organization regarding their government contracting needs. Such counseling services include core items such as registration and regulation assistance and advanced marketing techniques. David also specializes in identifying previously unrealized market opportunities at all governmental levels (federal, state, and local) and creating strategic plans to increase a business' government contract capture rate. If you have a question regarding any area of doing business with the government, please contact David at 515-422-6313; bogaczyk@iastate.edu.

Iowa manufacturers benefit from collaboration

Lean manufacturing combined with safety training works!

Progressive partnerships

The Center for Industrial Research and Service (CIRAS), Iowa's community colleges, and the new Safety Training Instruction and Research Center (STIR) at Iowa State University are partnering for the second year to provide additional safety, health, and environmental training resources for manufacturers across Iowa. Collaborations to provide services for a wide variety of safety, health, and environmental training and support, including the 10- and 30-hour OSHA courses on occupational safety training for general industry, have been very successful.

Fielding industry problems with 'safety solutions'

CIRAS account managers have utilized the safety expertise at STIR to field company questions regarding employee safety and health; conduct plant audits; recommend engineering controls; develop written safety, health, and environmental programs; and provide employee safety and health training. Throughout the state of Iowa, STIR has provided new, transferred, and existing employee training for Iowa manufacturers.

Teamwork across Iowa pays off

This collaborative effort to improve employee safety and health is beginning to pay off. A few recent examples of the positive impacts follow:

- **Continuous improvement**—CIRAS account manager Derek Thompson and James Wright of STIR met with the plant operations manager of an Iowa boat manufacturing facility with approximately 80 employees to discuss company safety and health improvement opportunities. A proposal was developed to help with occupational safety, health, and environmental issues by providing safety resources and employee training material. Hazard analysis and risk assessments followed, including a plant inspection. A strategy was designed to provide employee training and produce a written safety program including an employee safety handbook containing employee right-to-know and hazard communication, welding safety, job safety analysis, material safety data sheet information, OSHA recordkeeping, safety signage, and employee personal protective equipment initiatives. As a result of working collaboratively, the company enjoys a formal safety program with policies and procedures that did not previously exist. Thompson and Wright have conducted manufacturing lean and safety audits for several other companies.
- **Meeting manufacturers at the point of their need**—CIRAS account manager Joe Papp and James Wright partnered on lean manufacturing assessments and

safety audits for a central Iowa engine company. As a result, "Monthly Safety Meetings" were established, a "Safety Health and Environmental Written Program" was drafted and implemented, and a safety incentive program is being developed.

- **Performance improvement**—CIRAS account managers Joe Papp and Bob Coacher joined forces with James Wright of STIR to visit the three locations of an Iowa energy company to give support on lean manufacturing and safety, health, and environmental issues. An updated Safety, Health, and Environmental Program was drafted for the company and employee training materials were provided, along with recommendations for continuous improvement.
- **Beneficial Partnerships**—North Iowa Area Community College's (NIACC) Extension department and STIR partnered to provide high-impact training for a biofuel company in north central Iowa. Their combined efforts provided a written Safety and Health Program review, edit, and update; facility safety audit and occupational safety hazard assessment; safety solutions support; a train-the-trainer video; and employee process safety management training. NIACC and STIR are currently working with several companies in north central Iowa to produce similar results.

During the month of May, Des Moines Area Community College and STIR collaborated on 60 hours of occupational safety and health training. STIR is currently working with community colleges across the state to develop 10-hour OSHA-approved courses for general industry and construction as well as professional development workshops for the biofuel and renewable energy industry.

STIR's mission

In January 2006, the Safety Training Instruction and Research Center was established in the Department of Agriculture and Biosystems Engineering (ABE) at Iowa State University. STIR is a resource for safety, health, and environmental training, outreach, and education. Its mission is to provide safety training and instructional resource information to educate employers and their employees about the values, best practices, and benefits of an injury-free workplace and lifestyle.

The center is staffed with five faculty members—Steve Freeman, David Inyang, Nir Keren, Charles Schwab, and James Wright—whose experience and training focus on safety. They are certified safety professionals who teach occupational safety in the ABE department and have experience with standards for workplace hazard recognition and hazard abatement, as well as experience

in training workers and managers in academic and nonacademic situations. The center conducts numerous safety workshops and provides 10- and 30-hour OSHA training programs for general industry and construction. Safety publications and products are distributed during training sessions, which are conducted on campus, at the work site, and online at www.stir.iastate.edu.

Safety director's comments

Here's the message that STIR director Jim Wright promotes to companies throughout Iowa: "World-class safety performance in manufacturing begins with individual responsibility for environmental safety and health. Our key values are: (1) accidents are preventable—every injury can be prevented; (2) safety is everyone's responsibility; (3) safety and health are equal to quality, production, and cost; and (4) investment in injury and loss prevention training doesn't cost, it pays with dividends!

Safety in the workplace is the responsibility of all personnel. Employees must be encouraged to identify and follow safe methods, practices, and policies. Management must be receptive to valid suggestions for safety improvement. They must be prompt in implementing them and persistent and active in the pursuit of greater levels of safety in the workplace. Here are a few guidelines we can follow to help take the lead in making our safety programs work:

- **Know** what to do in the event of an emergency.
- **Follow** established rules, procedures, and safety signs.
- **Wear** required personal protective equipment.
- **Handle** hazardous materials according to instructions.
- **Operate** equipment correctly.
- **Avoid** taking safety risks.
- **Remove**, repair, or report safety hazards right away.
- **Report** accidents promptly.
- **Contribute** to work area safety through good housekeeping.
- **Implement** safety training into ongoing work practices.

Zero injuries in the workplace can be a reality. Nearly all occupational injuries and illnesses can be prevented, and most operating exposures can be safeguarded. Preventing safety incidents and injuries contributes to employee well-being and business success.

Safety staff

The STIR staff consists of a diverse group of highly talented trainers with various levels of expertise in occupational safety, health, and environmental stewardship. They represent a talented blend of facilitators who are some of the leading experts in their field, as well as having a wealth of practical hands-on experience.



James Wright, PhD, CSP, Director and Program Manager—James is the STIR director of safety, health, and environmental programs. His experience includes private sector manufacturing at a Fortune 500 company. He is a board-certified safety professional.

Phone: 515-294-3692

E-mail: jowright@iastate.edu



Steve Freeman, PhD, CSP, Education Consultant—Steve is an associate professor in the Department of Agricultural and Biosystems Engineering and a board-certified safety professional at Iowa State University.

Phone: 515-294-9541

E-mail: sfreeman@iastate.edu



Nir Keren, PhD, Education Consultant—Nir is an assistant professor in the Department of Agricultural and Biosystems Engineering and a process safety expert. He has extensive background in process safety and managing people and projects.

Phone: 515-294-2580

E-mail: nir@iastate.edu



Charles Schwab, PhD, Education Consultant, Extension Safety Specialist—Chuck is a professor in the Department of Agricultural and Biosystems Engineering and an Iowa State University extension specialist specializing in farm safety.

Phone: 515-294-4131

E-mail: cvschwab@iastate.edu



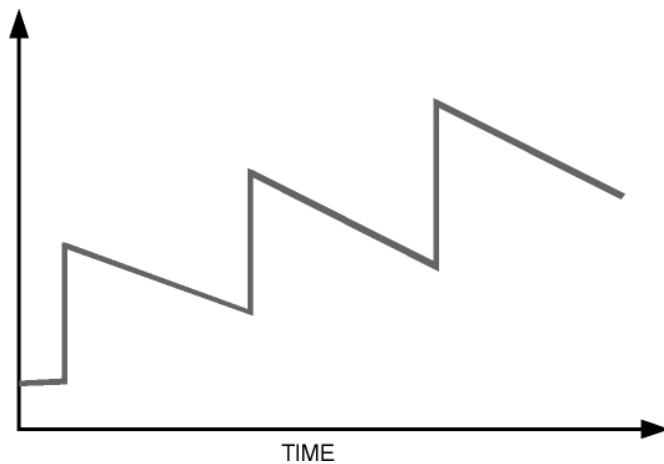
David Inyang, PhD, Education Consultant—David is an adjunct faculty member in the Department of Agricultural and Biosystems Engineering and the Iowa State director of environmental health and safety. He is also a registered environmental manager and certified infrastructure protection specialist.

Phone: 515-294-7676

E-mail: adinyan@iastate.edu

A missing link in continuous improvement

By Jeff Mohr, CIRAS



Do your improvement efforts look like this familiar saw-toothed graph?

How would the people in your organization answer these questions?

- Do you have trouble sustaining continuous improvement efforts?
- Have your continuous improvement efforts focused on tools before culture or even tools before system?
- Has your “Standardized Work” or “SOP” documentation failed the conversion from words on a page to behavior on the shop floor?
- Do your continuous improvement efforts consist mostly of kaizen events but lack the true kaizen spirit of everyday, everybody, everywhere?

And how would your supervisors answer these?

- Have you ever been given an effective, systematic way to deal with worker problems?
- Does your company have an effective and systematic method for quickly training employees to do a job correctly, safely, and conscientiously?
- Have you ever been given an effective and systematic method for improving individual jobs?

If you identify with any of these situations, you're not alone!

Supervisors and team leaders are in a pivotal position to both implement and sustain change. However, they're often promoted from the shop floor in recognition of their knowledge about product, processes, and materials. Many do not have the skills to deal with the aforementioned questions. The Training Within Industry (TWI) Program provides a countermeasure to help supervisors solve the problems that arise when implementing a strategy of continuous improvement.

TWI, World War II, and the Toyota way

The TWI Program was developed in the United States during WWII to help companies drastically increase productivity to meet the rising demands of the war even though a large percentage of their traditional workforce had left to support the war effort in other ways. The

program was discontinued in the United States after the war. However, it reached Japan where it played a vital role in the effort to quickly rebuild that country's industrial base.

TWI was adopted by Toyota in the early 1950s. TWI Job Instruction is still used today, almost unchanged, in Toyota plants worldwide. TWI Job Relations was used in one form or another by Toyota until 2000. TWI Job Methods was credited by the Japanese as the foundation for kaizen.

Authors like Jeffrey Liker, David Meier, Art Smalley, and Jim Huntzinger have emphasized the role of TWI in the development of the Toyota production system and as a cornerstone of the foundation of its elusive culture. The Toyota claim is that the company builds people first, then cars. In other words, one of a supervisor's primary responsibilities is to develop the workers they supervise. TWI is a key tool Toyota gives its supervisors for “building their people.”

According to Smalley, former Toyota Motor Corporation employee and author of *Creating Level Pull*, “if companies would spend half the time developing these essential skills (TWI) in the supervisor ranks that they spend on conducting value stream mapping or kaizen workshops, I am convinced that they would not only achieve more impressive results, but the results would stick better as well.”

The five needs of supervisors

TWI is based on a model that says every person has five needs that must be met in order to function effectively as a supervisor or team leader. These needs are divided into two categories, knowledge and skills.

Knowledge category

There are two types of knowledge unique to each company and industry that supervisors must master in order to do their jobs:

1. **Knowledge of Work**, which is unique and differs from work assignment to work assignment. In each work area, specialized knowledge is needed to effectively carry out the work that is done there, such as knowledge of the materials, machines, tools, and processes.
2. **Knowledge of Responsibilities**, which relates to the necessary responsibilities and authority a supervisor holds. This knowledge consists of company policies, practices, agreements, regulations, safety rules, production plans, sales plans, interdepartmental relationships, etc.

Skills category

Skills are those abilities we acquire through repetition and practice. There are three skills required for supervisors to perform within their role, regardless of the industry.

1. **Skill in Leading** allows supervisors to have good relationships among co-workers. Since the result of any supervisor's work depends on the output of others, gaining cooperation is crucial. With a foundation of good relationships, morale is assured so that team members do what needs to be done, at the time it needs to be done, and in the way it needs to be done because they want to do it. Simply put, poor relations yield poor results and good relations yield good results.
2. **Skill in Instructing** is an essential skill that helps to train people so that they can *quickly* begin to work on their own. Proper job instruction helps reduce the number of defects, rejects, and rework. It also reduces the number of accidents and the amount of equipment and tool damage. In other words, it ensures the presence of a well-trained workforce.
3. **Skill in Improving Methods** enables supervisors to more effectively utilize the people, machines, and materials that are available to achieve greater production of quality products at the lowest cost. As conditions change and problems are found, this skill ensures that improvements are made to the standard work as an immediate response in the workplace.

These five needs are not new. Because they are basic to the important and complex role of supervisors, it is only common sense that all supervisors would be provided with both the knowledge and the skills needed to do their jobs effectively. But common sense is not always common practice. Many companies recognize the need to provide knowledge training for supervisors but have not demonstrated an equal emphasis on skills training. TWI bridges that gap.

What is TWI?

TWI consists of three standardized programs that teach the essential skills needed by all people responsible for the work of others, regardless of industry: *Skill in Leading*, *Skill in Instruction*, and *Skill in Improving Methods*.

Each of the TWI Programs is similarly structured. There are five two-hour sessions with 8–10 trainees, all of whom are supervisors or team leaders. In the first session of each course, the trainer presents real-world problems that are relative to everyone and the less effective ways in which these problems are usually handled. Then, the TWI 4-Step Method, one for each of the three programs, is demonstrated to show how supervisors can handle such problems more effectively to gain better results. The first session or two are spent learning the method. The remaining course time deals with actual and current problems suggested by each supervisor for analysis and solution using the TWI 4-Step Method. This “learning by doing” concept is key to the continuing success of the TWI Program.

TWI Programs

First, what is a supervisor? In the TWI Program, the definition of a supervisor is “*anyone who is in charge of people or anyone who directs the work of others.*”

Throughout TWI, an emphasis is placed on staying focused on the objective.

Job Relations Training (JR) teaches supervisors how to build positive employee relations, increase cooperation and motivation, and effectively resolve conflicts.

JR has two key parts. The first is how to prevent problems. The second, how to handle a problem, begins with the supervisor determining the overall objective and finishes the process by asking, “Did you accomplish your objective?”

Job Instruction Training (JI) teaches supervisors how to quickly train employees to do a job correctly, safely, and conscientiously, resulting in less scrap and rework, fewer accidents, and less tool and equipment damage.

In JI, the focus is teaching a job, hence the key concept, “If the worker hasn’t learned, the instructor hasn’t taught!”

Job Methods Training (JM) teaches supervisors how to produce greater quantities of quality products in less time by making the best use of the manpower, machines, and materials now available.

The 4-Step Method for JM is not only a systematic way to improve the job, but includes selling new methods to operators and bosses and to key personnel in areas like safety and quality.

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Mohr has recently completed the TWI Institute’s trainer certifications for JR, JI, and JM. The TWI Institute is the center for education, trainer certification, and connections for the TWI community of practitioners, trainers, and historians. It has created a large and rapidly expanding network of certified trainers based in the United States, delivering the TWI Program here and around the globe. The TWI Institute is dedicated to maintaining the integrity and the quality of the materials and delivery of the TWI Programs.

For more information on TWI, consult the following resources:

CIRAS Web site—www.ciras.iastate.edu/productivity/twi.asp

The TWI Institute—www.twi-institute.org

The Art of Lean (Art Smalley’s Web site)—artoflean.com/documents/docs.htm

TWI Service—www.trainingwithinindustry.net/

The TWI Workbook by Patrick Graupp and Robert Wrona, 2006

The Toyota Way Fieldbook by Jeffrey Liker and David Meier, 2005

Toyota Talent: Developing Your People the Toyota Way by Jeffrey Liker and David Meier, 2007

Gemba Kaizen by Masaaki Imai, 1997

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A missing link

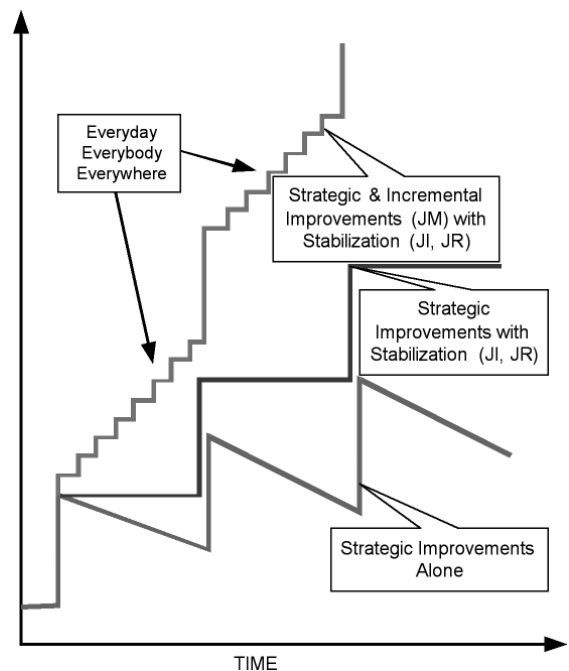
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Summary

Returning to the questions at the beginning of the article, will TWI lead the people in your organization to more favorable responses?

TWI is a systematic and effective method to teach a job, prevent or deal with worker problems, and improve individual job methods. It also helps to bring the focus back on developing people and creating a culture of continuous improvement that best utilizes the available continuous improvement tools. JI provides a way to convert standards documentation from words on a page into behavior on the shop floor and helps to foster the stability needed as a foundation for improvements. It also closes the loop for sustainment by providing an effective method for turning improvements into standard work behavior. JM teaches supervisors a systematic method for making day-to-day improvements on the shop floor and helps move a company toward true kaizen, or continuous improvement, everyday, everybody, everywhere.

CIRAS is currently offering TWI as a service to Iowa companies. If you would like to know more about this service, contact Jeff Mohr, 515-294-8534 (office), 515-450-7639 (mobile), or jeffmohr@iastate.edu.



What line are you on?

CIRAS News is published quarterly by the Center for Industrial Research and Service and edited by the CIRAS publications team. Design and production is by Engineering Communications and Marketing, Iowa State University. Please send questions, comments, or address changes to ciras.news@iastate.edu.

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