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## Assessing costs and benefits of ISO implementation for small firms

By Verlyn K. Anders, CIRAS

	Small	Medium	Large
Customer Satisfaction	1	1	1
Productivity	4	4	5
Defect Rate	2	2	2
On-Time Delivery	4	4	4
Sales	6	6	6
Market Share	7	6	6
Cost of Quality	2	2	2
Export Growth	8	8	8
Employee Retention	9	9	9

Table: Rank of performance change since ISO 9000, with change attributed to ISO 9000 registration.

This article explores the costs and benefits of implementing ISO standards for small companies based on the ISO 9000 Survey '99—An Analytical Tool to Assess the Costs, Benefits, and Savings of ISO 9000 Registration. The survey, conducted by Quality Systems Update and Plexus Corporation and published by McGraw Hill Inc., 1999, takes into account 33,000 U.S. and Canadian certified companies that generated a response rate of over 11 percent. Manufacturers accounted for the highest percentage of respondents.

The data reported in the survey came from large companies with sales greater than \$200 million, small firms with sales of less than \$25 million, and mid-sized companies with sales between \$25 and \$200 million. This data further takes into account length of time since registration, which includes a span of more than five years, between two to five years, or less than two years. Similar data is also reported by the following industry sectors:

- agricultural, and forestry and mining
- services, and trade and construction
- food, textiles, and wood products
- petrochemicals and plastics
- manufacturing, metals, and machine electronics and instruments

### COSTS

#### Internal Costs

- Average: \$72,502
- Cost trend: Over a period of eight years, the average internal cost for registration has decreased by 63 percent.

#### External Costs

- Average: \$42,209
- Trend: Over a six-year period, external costs have decreased by 41 percent to \$29,595 for small companies.

### BENEFITS

The survey looks at how companies have improved performance from certification to ISO 9000. One-third of the respondents noted that customer satisfaction was the most important benefit they received. In this area, companies registered for less than two years showed as much improvement as companies registered for a longer period of time.

Improvement in defect rate and cost of quality were also mentioned as significant benefits, with one of the areas of least improvement, as reported by the survey, being in export growth. As with other aspects of ISO 9000 adoption, the benefits varied among industry sectors.

#### Performance Change

- The greatest performance change for all firms was in the area of customer satisfaction.
- Other top changes included defect rate, cost of quality, and on-time delivery.
- More than 50 percent of all respondents reported increased outside sales.
- The least reported gains were in market share and export growth.
- Companies registered for more than five years reported more significant gains than recently registered companies.

#### Return on Investment

- Savings-to-cost ratio: \$1.50 overall
- Smaller companies: \$1.30
- Average return on investment: 51 percent

A copy of the report may be purchased from McGraw-Hill by calling 800-773-4607. For more information on ISO costs and benefits, you may contact Verlyn Anders at 515-294-1316 or [vanders@iastate.edu](mailto:vanders@iastate.edu).

### CIRAS Mission Statement

*The mission of CIRAS is to enhance the performance of Iowa industry, and associated entities, through education and technology-based services.*

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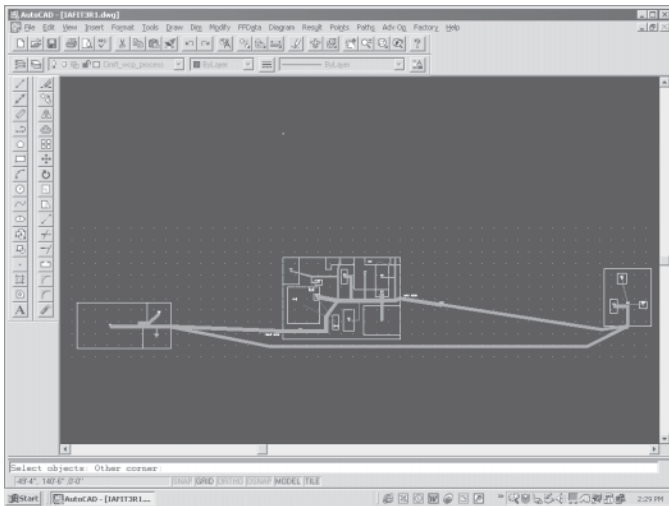
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# Computer simulation: A decision tool for manufacturers

By Sunanda Vittal, Engineering Communications, and Marketing and John Van Engelenhoven, CIRAS



*Iowa Fittings existing plant layout, showing material flow intensities. The software used for the simulation is FactoryFLOW™ and AutoCAD™.*

**T**o build or not to build is a question many small- and mid-sized manufacturers often ask themselves as they consider consolidating operations to improve productivity and cut costs.

Terry Pierce, owner of Iowa Fittings in Oakland, Iowa, faced this dilemma as he debated constructing a new building that could pull together his operations under one roof. Iowa Fittings, which manufactures industrial welded steel fittings and horse-drawn agricultural equipment, currently operates out of three separate buildings.

Fortunately for Pierce, the answer surfaced in a convenient venture that utilized advanced technology through the Center for Industrial Research and Service (CIRAS) and financial assistance from Iowa Western Community College (IWCC). CIRAS provided Pierce a glimpse into the future with the help of a computer modeling software program that simulated the material handling cost and layout of the proposed building. Likewise, Pierce also gained a wealth of information and data on existing facilities from a computer simulation program applied to current manufacturing practices.

The critical decision to construct a new building hinged on a comparison of these two simulated environments.

*But first, what is simulation and what are its benefits?*

Simulation is a controlled, non-disruptive form of experimentation on a system that analyzes and generates information based on performance changes to help predict likely outcomes. “Almost any type of system involving complex factors can undergo simulation,” said CIRAS Engineering Specialist John Van Engelenhoven. “Many of the simulation packages available today provide visually realistic and convincing output that can simulate team interest and participation.”

CIRAS offers a variety of simulation services that target two major areas: planning (plant layout) and process design and improvement. Software products used include AutoCAD, FactoryPLAN, FactoryFLOW, Process Model, and ProModel. CIRAS worked with Iowa Fittings to create drawings of the existing layout and proposed facilities along with collecting data on product quantities, product routing systems, machine placement, and the material movement process between work centers.

The data was then fed into the FactoryFlow software, which simulated environments of cause-and-effect relationships of systems and then predicted their behavior under potential circumstances. The program examined materials handling costs for both existing and proposed plant layouts, and the savings were assessed accordingly.

“On the whole, simulation is easy to use and understand and can promote ‘total system’ solutions, which are typically cost-effective solutions to the ‘what if’ questions in manufacturing,” said Van Engelenhoven.

## *IMEP assistance*

The Iowa Manufacturing Extension Partnership (IMEP) assisted with obtaining funding from the local community college, IWCC. The Iowa MEP is part of a network of 76 not-for-profit centers in all 50 states that provides monetary and technical support to small and mid-sized manufacturers. Linked to the Department of Commerce’s National Institute of Standards and Technology (NIST), this federally funded program is supported by regional partners at research and business institutes across the state. They include CIRAS, the Small Business Development Center (SBDC), and the Institute for Physical Research and Technology (IPRT) at Iowa State University; University of Northern Iowa; Iowa Extension Services; Iowa Association of Business and Industry; Graphic Arts Institute; Casting Institute; and several community colleges.

IMEP Agent Don Reiner and CIRAS Industrial Specialist Clay Crandall initiated contact with Iowa Fittings through a routine courtesy visit to the company. The visit turned out to be timely since the company was in the process of exploring ways to increase profit margins and expand market-targeting capabilities.

Reiner and Crandall charted a course of action that included two key elements. They compiled a market survey that helped Pierce successfully identify prospective buyers and high-yield markets. For this project, Reiner obtained marketing assistance from UNI and funding through the SBDC/IMEP Field Partnership Program.

Next, Reiner contacted Van Engelenhoven to assist the company in a plant simulation and develop operation-based strategies to help improve productivity. “The plant

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# EDE expands scope into short course arena

By Rebecca Kellogg, Engineering Distance Education



**A** two-day seminar, titled “Durability Considerations in Design” and offered in July 2001 by Dr. Jess Comer from Iowa State University’s Department of Mechanical Engineering (ME), attracted twenty engineers from across the state from companies such as John Deere, Maytag, Fisher Controls, and Rosenboom Machine and Tool.

The seminar, sponsored by Engineering Distance Education (EDE) and CIRAS and held at the ISU Industry Outreach Center, gave participants a comprehensive overview of durability and design, a field that integrates materials and manufacturing selection, life-prediction methods, failure analysis, preventive measures, statistics, and reliability. Positive feedback from the engineers in attendance has encouraged EDE to consider follow-up courses focusing on specialized topics. Additional information about this seminar can be found at <http://www.ede.iastate.edu/durability/index.html>.

The durability and design short course may be offered again in the future depending on audience need. EDE also plans to work with the instructor to archive a digital version of the instructional content, which will be available via streaming video over the Internet in a just-in-time format.

In collaboration with College of Engineering faculty, EDE is working to meet the continuing education needs of Iowa industry. For more information on future short courses, visit the EDE Web site at [www.ede.iastate.edu](http://www.ede.iastate.edu). We would also like your feedback on your technical or engineering education needs. E-mail your suggestions to [ede@iastate.edu](mailto:ede@iastate.edu) or complete our on-line survey available on our Web site. We are also happy to visit with you by phone at 1-800-854-1675.



On-campus students in a high-tech EDE classroom

*ISU College of Engineering expands off-campus course selection*

EDE is pleased to offer an expanded selection of credit courses in several disciplinary areas at the bachelor’s and master’s degree level. These courses can be taken as part of a program of study to complete a degree or as stand-alone courses to refresh technical skills. Fall 2001 courses to be delivered to off-campus students:

- Systems Engineering & Analysis, AerE/EE/IE 565
- Digital Feedback Control Systems, AerE/EE/Math/ME 576
- Finite Element Fundamentals with Applications, AerE 590C
- Prestressed Concrete Structures, CE 535
- Advanced Computer Networking Data Communications, CprE 530
- Information System Security, CprE 531
- Introduction to Parallel Algorithms & Programming, CprE 426/526
- Real-Time Systems, CprE 458/558
- Advanced Computer Architecture, CprE 585
- Introduction to Microcontrollers, CprE 211
- Introduction to Electromagnetic Fields, EE 312
- Continuous Signals and Systems, EE 321
- Microwave Engineering, EE 414/514
- Communication Systems I, EE 421
- Steady State Analysis, EE 553
- Human Factors in Product Design, IE 576X
- Material & Manufacturing Considerations in Design, ME 520
- Magnetism & Magnetic Materials, MSE 519

This is a partial list of the courses currently scheduled for Spring 2002:

- AE 437/537 Crop Harvesting Dynamics
- MSE 539 Electronic Properties of Materials
- EE 554 Power Systems Dynamics
- EE 303 Energy Systems and Power Electronics
- EE 324 Discrete Signals and Systems
- Math 307 Theory of Matrices
- EE 422 Communication Systems II
- CprE 305 Computer Organization and Design
- CprE 532 Information Warfare
- CprE/Math 533 Cryptography
- CprE 545 Fault Tolerant Systems
- IE 566 Applied Systems Engineering

For a complete list of Spring 2002 courses, please visit the EDE Web site at [www.ede.iastate.edu](http://www.ede.iastate.edu).

*Additional information about each course is available on the EDE Web site, [www.ede.iastate.edu](http://www.ede.iastate.edu). Registration instructions and an application form for fall courses are available at [www.ede.iastate.edu/register2.html](http://www.ede.iastate.edu/register2.html).*

# IPOC co-hosts two successful events in July

By Kathy Bryan




*Dwight Johnson and Cheryl Eftink discuss government bid practices with Verlyn Anders, Carolyn Tonn, Charlie Tonn, and Paul Romero, president, Polyshield.*

An IPOC/CIRAS cooperative effort resulted in two highly informative programs for area businesses and individual entrepreneurs. The Federal Procurement Workshop, held July 11, 2001, at the Des Moines Botanical Center, provided participants with a storehouse of knowledge on small business operations and electronic posting systems. The morning program, which highlighted the different services offered by the Small Business Administration (SBA), included presentations by Cheryl Eftink, Des Moines district director of the SBA, and Dwight A. Johnson, SBA Procurement Center representative from Omaha, Nebraska. The training segment concluded with an informative session on the mentor/protégé programs and BusinessLINC by IPOC Program Manager Bruce Coney.

Lois R. Phillips, business specialist at the Office of Business & Support Services from the Kansas City U.S. General Services Administration, was the keynote speaker for the afternoon session. Her presentation focused on issues such as how to access the federal electronic posting system (EPS), the federal supply schedule, tips on the bidding process, locating contracting officers, and information on products and services covered by the federal supply schedule contracts. Phillips also provided one-on-one counseling for businesses.

The workshop elicited many favorable comments, from the exceedingly “informative” nature of Phillips’ presentation to how well organized the seminars were. “All the speakers were great,” said one participant. Another commented on how crucial it was for businesses to periodically attend the IPOC/CIRAS events as a way to keep “abreast of changes.”

At the July 12, 2001, Business, Breakfast, and More mini-expo held at the Des Moines Holiday Inn Downtown, over 100 participants enjoyed breakfast, networking, and meeting individually with purchasing representatives from 15 companies and federal and state agencies. Additionally, small business representatives met with purchasing agents and learned about how to become one of their suppliers. Purchasing agents, in turn, welcomed bidding opportunities and made available registration information to prospective buyers.

The breakfast sponsors were Channell Construction, Principal Financial Group, and the Minority & Women Business Conference & Expo. The next Business, Breakfast, and More will be held on November 1, 2001, at the Holiday Inn Downtown, 1050 6<sup>th</sup> Avenue, Des Moines. For more information and to make your reservations, call Kathy Bryan at 800/458-4465 or e-mail her at kbryan@ciras.iastate.edu. 

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## Computer simulation

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simulation was so successful in identifying areas of improvement that the owners are now interested in projects that help them improve productivity such as Lean Manufacturing,” said Reiner.

### *The Iowa Fittings solution*

The simulation process was an eye-opener. It helped Pierce arrive at some cost-saving measures that included a decision not to build but instead re-visit existing conditions in ways that could better serve his needs. To accomplish this goal, Pierce worked with CIRAS on planning and implementing a change in equipment layout.

The “tumbler” room used for cleaning machinery, for

example, was relocated to a more strategic position, saving labor cost and adding to worker convenience. “What’s more, the material handling process began to lend itself to a better flow bringing in a savings of \$45,000,” said Pierce.

There is nothing more vexing for manufacturers than to undertake a major project and then realize it didn’t accomplish the goal it was designed to achieve. Now, the means to a well-researched decision is just a phone call away in state-of-the-art technology available through CIRAS and its partner resources. 

*For more information on how to use computer simulation in your business, contact John Van Engelenhoven at 641-791-0765 or e-mail at jve@iastate.edu.*

Paul Gormley, project manager for CIRAS in Cedar Rapids, is on a temporary leave of absence. Engineering project concerns are being forwarded to Jeff Mohr, staff engineer for central CIRAS. Gormley's E-Business duties are now in the hands of Rudy Pruszko, senior project manager located in Piosta.

## Feely heads CIRAS Advisory Council



CIRAS would like to welcome John Feely as chair of the CIRAS Advisory Council. Feely is president of Schaeff, Inc., a leading designer, manufacturer, and marketer of stand-up electric counter-balanced lift trucks. With

international headquarters in Sioux City, Iowa, Schaeff sells its products through 75 dealerships in North America, including one in Asia. In addition to products manufactured in the Sioux City plant, Schaeff has exclusive rights in North and South America to import and market three-wheel electric sit-down lift trucks manufactured by an Italian company.

As an active CIRAS Advisory Council member, Feely is pleased with the many benefits of the job. "My network of business associates and academic professionals has expanded greatly, and the opportunity to meet new people and volunteer has been exciting," he said. The CIRAS Advisory Council serves to guide and counsel CIRAS while providing continuing liaison between CIRAS clients and resources. Currently, Feely is directing collaborative efforts with another Italian company in the design and marketing of setrucks, a novel manufacturing concept in product picking and pallet consolidation.

## In Memoriam

CIRAS Advisory Council member Darrel W. Edeker, 65, of Marshalltown, died June 29, 2001. Edeker joined the council in December 2000.



Edeker graduated with a degree in industrial engineering from Iowa State University in 1960, after which he began his career in manufacturing engineering. He worked for 17 years for Loudon Machinery. His family later moved to Cedar Falls where he was employed by Viking Pump and White Farm Equipment of Charles City for a decade. Edeker then moved to Columbus, Nebraska, to work for Appleton Electronics. Most recently, he served as a plant

manager for Marshalltown Trowel.

Survivors include his wife, Carol, of Marshalltown, seven sons, one daughter, his father, one brother, and six grandchildren.

## Terrones retires



Sarah M. Terrones will be retiring September 28, 2001, after 15 years of service at ISU. During her career she has worked for the Engineering Extension Radon Project, the continuing education accounting department, and the business and industry department, formerly a parent of CIRAS.

Sarah's duties at CIRAS have included making travel arrangements for staff, planning meetings, marketing, and providing support for the CIRAS Advisory Council.

Her plans for the future include travel, volunteering, home projects, and enjoying her grandchildren. We all wish Sarah the happiest and best of retirement life!

## New CIRAS staff member



CIRAS welcomes Andrew Bice, a new member to the central staff in Ames. Bice is an electrical engineer with the product design and testing group. His responsibilities will include product development and management.

Prior to joining CIRAS, Bice worked as an operations manager for Advanced Analytical Technologies in Ames. He graduated with a B.S. degree in electrical engineering from Iowa State University. He is currently pursuing a dual master's degree in business administration from the University of Iowa and systems engineering from Iowa State.

Andrew and his wife, Glenda, live in Ames. His other interests include skydiving, landscaping, and golf.

Bice may be contacted by phone at 515-292-8524 or e-mail at [abice@iastate.edu](mailto:abice@iastate.edu).

# IEC can provide a windfall of energy savings to industry

By Tim Sullivan, CIRAS

There are times in industry when the constant pressure to meet efficiency goals, exceed productivity quotas, and maintain quality standards is overwhelming. Maintaining cost or even reducing it becomes critical. At times like these, when you are saddled with more responsibility and less time, wouldn't it be nice to find an industry-proven tool for cutting production costs? If last winter's energy crisis were to re-occur this year, learning how to reduce energy costs now will pay you handsomely in the future!

The Iowa Energy Center (IEC) invests its resources to create a stable energy future for the state of Iowa. Iowa industries are the state's largest energy consumers, using approximately 38% of total state consumption. The IEC provides industries with tools to help them implement significant energy-efficiency measures. This article focuses on four tools that have been tried and proven to deliver savings:

- Compressed air challenge
- Motor challenge
- Steam challenge
- Total assessment audit (TAA)

## Compressed Air Challenge

Compressed air is vital to the operation of nearly every industrial plant. Many industries use compressed air systems as power sources for tools and equipment in pressurizing, atomizing, agitating, and mixing applications. Compressed air is not typically viewed as a cost of production, but it is anything but "free." Existing compressed air systems in the United States consume an estimated 90 billion kWh/year, which accounts for \$1.5 billion per year of U.S. energy consumption.

### What is the problem?

Many of today's compressed air systems have been "pieced together" over the years in an attempt to meet the growing needs of production and facility expansion. The result is often an unbalanced system with various components negatively interacting to create artificial demands and poor air quality. Optimization of compressed air systems can provide energy-efficiency improvements of 20%–50%.

The IEC, in conjunction with the U.S. Department of Energy's Office of Industrial Technology (OIT), offers a fundamentals and an advanced workshop for the management of compressed air systems. During these sessions, participants learn how to

- calculate the energy cost of compressed air in their facility
- improve compressed air system efficiency and reliability
- match the system supply to actual production requirements for pressure and flow
- find and fix leaks and establish a leak prevention program
- better control compressed air to improve productivity and profitability

Downloadable software called "AirMaster+" is offered free of charge. Also, individuals can work through the IEC to become certified compressed air system managers. For detailed information, point your web browser to the IEC Web site: [www.energy.iastate.edu](http://www.energy.iastate.edu), or [www.oit.doe.gov/bestpractices/compressed\\_air/](http://www.oit.doe.gov/bestpractices/compressed_air/).

## Motor Challenge

Motor-driven equipment accounts for 64% of the electricity consumed in the U.S. industrial sector. The motor systems used by nine of the most energy-intensive industries including metal casting, agriculture, steel, aluminum, etc., consume approximately 290 billion kWh per year. This represents dramatic potential for both energy and cost savings to implement energy-efficient equipment or procedures.

Individualized training is available by request, and a software product called "MotorMaster+" can be downloaded free. Visit the IEC Web site or the OIT site at <http://www.oit.doe.gov/bestpractices/motors/>. Case studies, tip sheets, and technical publications are also available through this site. A recent independent evaluation determined that OIT's Motor Challenge Program has been "highly cost effective," helping industrial facility operators to significantly reduce energy consumption.

## Steam Challenge

Over 45% of all the fuel burned by U.S. manufacturers is consumed to produce steam. Steam is used to heat raw materials and treat semi-finished products. It is also a power source for equipment, building heat, and electricity generation. But producing steam comes at a price. It costs approximately \$18 billion (1997) annually to feed the boilers generating the steam.

Manufacturing facilities can reclaim their costs by installing more efficient steam equipment and processes. A typical industrial facility can realize steam savings of 20% by improving its steam system. If steam system improvements were adopted industry-wide, the benefits would be \$4 billion in fuel cost reduction and 32 million metric tons in emission reduction.

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IEC can provide

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The IEC can provide awareness seminars, fact sheets, several software programs, and an assessment tool that helps you determine if you could benefit from a formal steam audit. Opportunities for savings can be found in several areas:

- Steam generation through cogeneration applications, boiler controls, and water treatment
- Steam distribution through checking steam leaks, installing insulation, and proper steam trap maintenance
- Steam end use through heat exchanger maintenance
- Steam recovery through condensate return

For more information check out the IEC Web site or [www.oit.doe.gov/bestpractices/steam/](http://www.oit.doe.gov/bestpractices/steam/).

*Total Assessment Audit (TAA)*

As the principal sponsor of the TAA project, the IEC has established and is committed to the goal of improving the economic viability, competitiveness, and profitability of Iowa's industrial base through

- reduced dependence on energy
- reduced waste stream creation during manufacturing processes
- enhanced productivity

The TAA project team, through a grant to the IMEP (Iowa Manufacturing Extension Partnership), assembles expertise in the fields of industrial productivity, energy efficiency, and waste reduction. This group performs a holistic assessment of the company's facilities. Before leaving the site and producing a detailed written report, an open discussion of findings with the management team helps to clarify the opportunities. After examining the report, company managers decide on which ideas to pursue. The project manager then brings in the specific resources required to best serve the identified needs.

For detailed information about a TAA, click on the "Energy Efficiency" link on the IEC Web site or contact your local IMEP agent.

For information about any of the services offered at the IEC, contact Bill Haman at 515/294-4710, or email [whaman@energy.iastate.edu](mailto:whaman@energy.iastate.edu).