Automation Objectives
Lower Cost and Improve Time-to-Market

Eli Lilly and Co., uses process automation to help reduce product unit cost by 27%

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KEY WORDS

- **Process control & instrumentation**
- **Analyzers**
- **Capital spending**
- **Information systems**
- **Life-cycle analysis**

At Eli Lilly and Co. (Indianapolis, Ind.), a leader in the development and manufacture of pharmaceutical products, process automation has played a key role for over 20 years. So in 1994 when Lilly's management challenged the manufacturing units to cut unit operating costs by 25% over the next three years, process automation was an acknowledged key element in meeting the challenge. Today, Lilly's cost to produce a unit of product is 27% less, on average, than it was in 1994.

During the past 20 years, Lilly's process automation team has demonstrated that the following factors are critical for process automation to help achieve business objectives:

- Automation investment life-cycle analysis;
- Empowered teams of talented employees;
- Partnering with automation suppliers;
- On-line process analysis;
- Procedural process control; and
- Information integration and data warehousing.

Life-cycle analysis

Lilly utilizes the Rockwell Automation/Allen-Bradley Automation Investment Life Cycle model to analyze the costs and benefits of automation (see graphic).

This model segments life cycle of an automation investment into six stages: Justify, apply, install,operate, maintain, and improve.

"We analyze recurring costs in each life-cycle stage, pursue ways to lower those costs and shorten automation development times, and continuously optimize the process to maximize value," says Dave Adler, Lilly engineering consultant.

Twenty-years ago Lilly's automation team began collecting project automation data for each stage of the life cycle. Analysis of the data reveals that 40% of the cost but only 20% of the benefits come from the original automation project (see graph). The remaining cost and most of the benefits occur from improvements after the initial installation. Lilly uses this information to compare projects and identify cost-effective automation investments. For example, when a project does well in the area of instrument design, software development, or reductions in project variability, Lilly's automation team determines how to replicate the improvement and deploy it as a company wide best practice.

"Conducting regular life-cycle analysis helps us focus automation team talents, resources, and methods to reduce automation project variability and ultimately life-cycle cost," shares Traci Willman, manufacturing process automation department head.

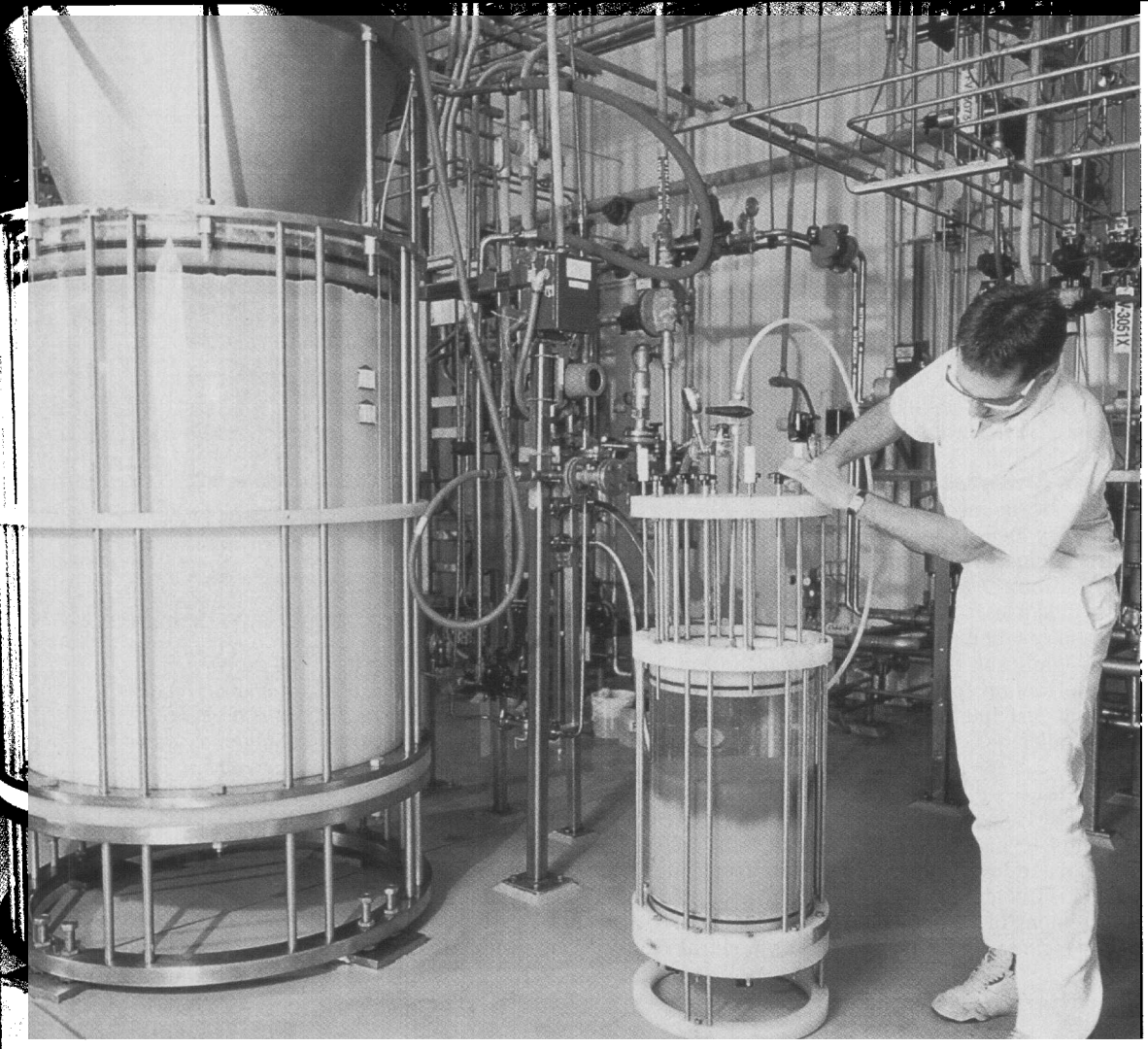
Automation life-cycle analysis is not limited to production facilities. Relying on consistent worldwide metrics, Lilly analyzes lab and development area projects, in much the same way as production facilities, to find worthwhile and sharable best practices. Specification development, project methodologies, definition of project staffing and skill requirements, validation methods, development of maintenance systems, and defining long-term support requirements are examples of best practices Lilly's automation teams can universally apply.

When conducting life-cycle analysis, Lilly's automation team considers business benefits such as capacity, yield, safety, quality, reduced people count, time-to-market, and product cycle times aggregated into a cost-per-I/O-point metric (see bar chart). When all six parts of the life-cycle model are included, this metric provides a valid comparison for both DCS (distributed control system) and PLC (programmable logic controller) automation systems. The cost-per-I/O-point includes data about field instruments, design and installation activities, process control code development, application engineering, process control system hardware, and software maintenance.

"Life cycle is not simply reducing cost, it's also about achieving more value. We continuously ask ourselves how we can use automation to build company value," emphasizes Mr. Adler.

Lilly's on-going analysis of life-cycle data provides information necessary to make informed automation project decisions that can reduce long-term cost. Development, improvement, and maintenance of application software are significant parts of total automation cost. Lilly's analysis reveals that investments to develop standardized database and software tools specific to process automation needs are justified when development cost is spread across several projects.

"When you understand the entire life cycle, consider how long the systems will be around, and how often improvements to the application will be



Pharmacutical facilities require highly automated processes to achieve quality, yield, and cost goals.

Lilly benefits from effectively applying life-cycle models, such as promoted by Rockwell Automation.

made, you realize the payback is many times larger than the investment in development tools," states Mrs. Willman. "Without a life-cycle view, you either can't justify the investment, or you never see its value," adds Mr. Adler.

Talented people

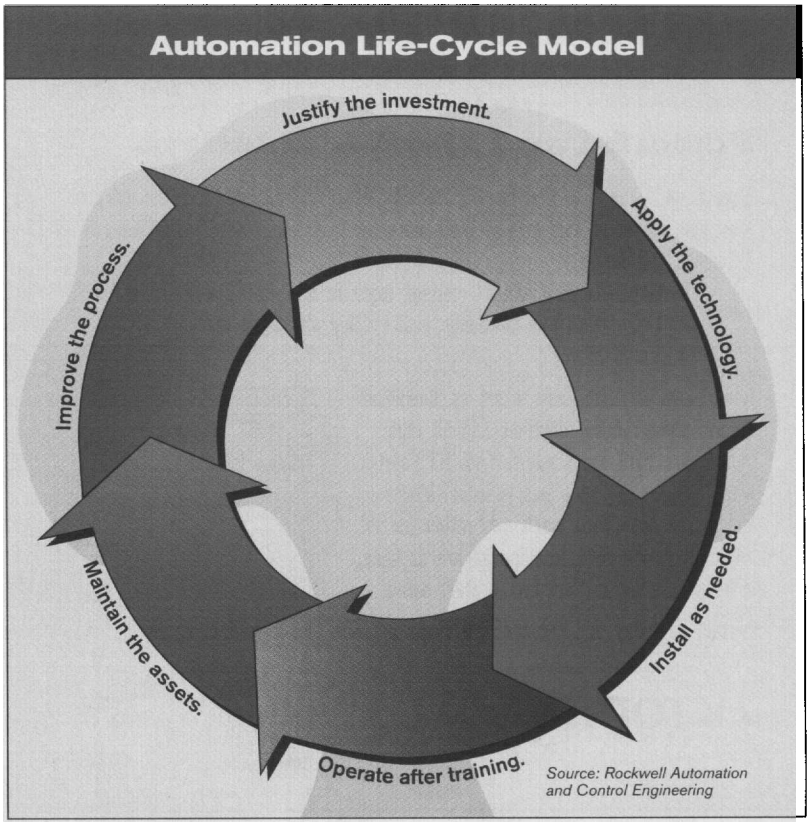
Lilly's analysis of life-cycle information supports academic proofs of the necessity to staff projects with talented people.

Implementing nearly identical projects, using the same DCS in the same application, produced different results in different locations. Post project analysis revealed one team had established clearer, more measurable goals and possessed a better mix of skills–in areas of unit operations, process control, instrumentation, software development, database technology, DCS and PLC system management, networking, interpersonal relations and communications, and project management–leading to a more successful project.

Partnering

Lilly's management recognizes automation engineering as a core technical discipline and strives to provide the support to attract, develop, and retain experienced automation professionals.

When the entire skill set is unavailable in-house, Lilly augments the automation team with established partners, such as Rockwell Automation (Mayfield Heights, O.), Rockwell Software



Process automation helps warehouse information needed for new drug approval

(West Allis, Wis.), Fisher-Rosemount Systems (Austin, Tex.), Foxboro (Foxboro, Mass.), Simulation Sciences (Brea, Calif.), Coleman Instrument (Cincinnati, O.), Fluor Daniel (Greensboro, S.C.), and Jacobs Engineering (Cincinnati, O.).

"Combining project standardization and replication, with partner relationships built on long-term trust has been key in allowing Lilly to increase the scope of automation by three-to-four times during the past 20 years," says Dave Adler.

On-line/in-line process analysis

Eli Lilly and Co. defines on-line/in-line process analysis as traditional laboratory measurements–such as pH, high-pressure liquid chromatography, gas chromatography, near-infra-red, and optical density–each adapted to field use.

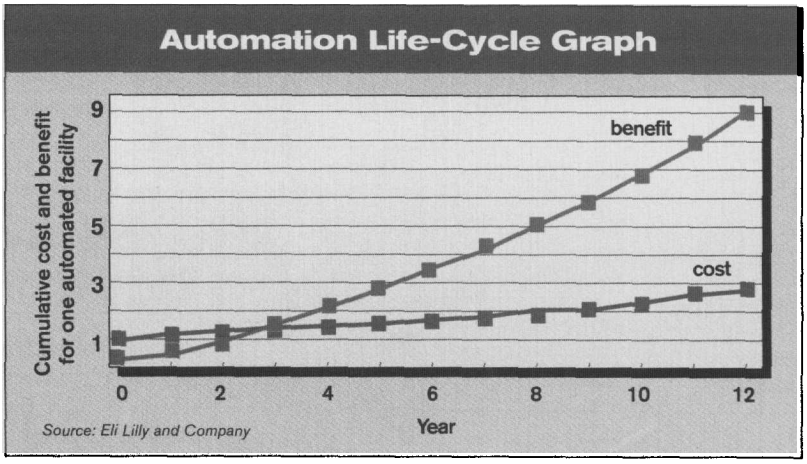
"While the commitment and cost of developing and operating such tools is significant, the benefits of providing timely information to reduce product variability and unit cost has made it worthwhile," comments Mr. Adler.

Procedural Control

Using standardized methods, reusable process control objects, and common terms, Lilly has developed an integrated procedural control framework of automated recipes, chaining of unit operations, and the management of equipment and control modules. Commencing with development of project specifications and extending to development and testing of unit operations, procedural control helps Lilly automation teams achieve agreement on common requirements, further assisting in worldwide deployment of automation best practices.

"With the price of new pharmaceutical facilities approaching $200 million, producing more product within existing facilities provides us a competitive advantage," says Mrs. Willman.

Developing process control applications using the procedural control framework also brings



The benefits of automation require commitment to continuously seek improvement opportunities.

On-line/in-line process analyzers improve profits

Using automation life-cycle analysis to evolve "best practices" is helping Lilly drive down the cost per I/O point.

benefit to post-project efforts to reduce process variability. "Procedural control provides the structure for deployment of improvements developed in one facility into the next product run at a different location," adds John Brasker, development process automation department head.

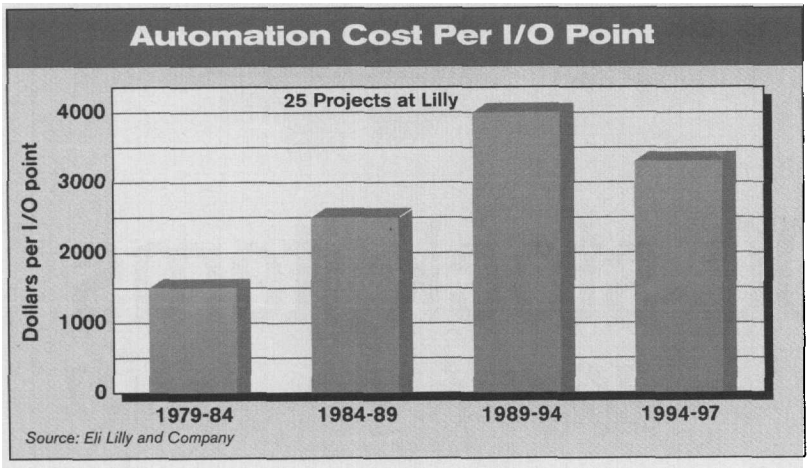
Data warehousing

Data related to process, logistics, inventory, analytical, and cost is integrated into an electronic "data warehouse" where graphical interfaces and statistical packages support timely business decisions. Ensuring decisions are based on accurate data, Lilly's information technology group and process automation team established data validation procedures defining initial and periodic revalidation requirements.

"Providing process and management information throughout Lilly has defined a value-chain mentality. We can collapse the chain, reduce cost, and minimize the time from raw material receipt to product shipment," states Mr. Brasker.

Instrumentation and in-line process analyzers provide an abundance of data for analysis. Converting the data into meaningful product development information assist in obtaining approval for a new drug. Development information then becomes hallmark in scaling-up to produce the new drug. "With millions of pieces of data, making sure you have complete and accurate information is a difficult but important task," explains Mrs. Willman.

With all six of the key factors firmly in place, Lilly has proven that automation systems are a critical element in achieving business objectives, like reducing product unit cost by 27%. □



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