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New Automation Technology BECKHOFF
Manufacturers spend millions of dollars every year replacing failing automation components, yet often find their processes work no better than they previously did. So how do you justify the value of that investment? Over the coming pages, we’ll explore—from start to finish—how to break the cycle of failure and achieve better value from your automation investments.

To get a handle on this, we talked to experts about how to determine the value in new automation spending, and also how engineers and plant managers can determine which areas to focus on first.

The technological advances in automation technology often go unused when new devices are installed to replace failing components. In some respects, it’s like buying a smartphone and using it only to make phone calls. If you never take photos, send a text message, deposit checks or surf the Internet, then you’re not even coming close to taking full advantage of its capabilities.

That’s the situation many companies find themselves in despite spending significant amounts of money on automation products every year to keep their systems functioning. Most manufacturers use only 30-40 percent of a modern automation system’s capabilities, the result being that plants today—even those running on new technologies—are operating no better than they were with their old devices.

For nearly a decade, since the economic implosion in 2008, companies have been using replacement parts as a stopgap to keep production going and delay major investments. But that strategy could be nearing its end of life, along with increasingly obsolete automation systems. Massive downsizing in the U.S. manufacturing workforce over the past two decades, whether through layoffs, offshoring or retirements, compounds the problem.

“Overall headcount reductions have decimated plant workforces, which means there are fewer engineers, production supervisors, maintenance and technical support personnel to stay ahead of technology advances,” says Steve Malyszko, president and CEO of system integrator Malisko Engineering, a member of the Control System Integrators Association (CSIA).

So if your current technology is causing too many problems, nearing the end of the road or limiting your ability to achieve business objectives, how can you maximize returns when you do invest in new automation?

Ready, fire, aim doesn’t work in war any more than it does with automation projects. System integrators and automation suppliers point to the rules of engagement for achieving greater value from automation investments. The task of finding out what to spend, and where to spend it, invariably starts with a set of questions.

**HOW IS YOUR PROCESS WORKING?**

It’s essential to establish a baseline by analyzing your current operations and how they function. This allows you to focus your investments on achieving greater returns from company assets.

“Until you can understand what’s going on inside your production process, you can’t know what direction to take in making new automation investments,” says Charlie Norz, I/O product manager for Wago. “That’s why data gathering and analysis have become so important.”

Analyzing the flow in the process also helps. Will Aja, vice president of customer operations for CSIA member Panacea Technologies, recommends talking to operators to understand how the flow works and how the
Part I: How to Determine Automation Value and Focus

system was designed.

“You also need to look at the system’s components and whether you’re taking advantage of the technology already in place,” Aja adds. “Many upgrades just take the brains of the previous system and put them in new plastic. You end up transferring a lot of dead code. It doesn’t really improve how the process works.”

WHERE IS YOUR PLANT AT RISK?

As the needs of your business change, it’s essential to identify where current systems won’t be able to meet new requirements. What are the greatest risks to achieving your production and cost goals? Consider a three- to five-year investment-planning horizon when analyzing your existing infrastructure.

Manufacturing infrastructures are now so old, everybody’s looking for direction, according to John Riess, global marketing lead for Integrated Architecture at Rockwell Automation. “The ability to respond to business challenges is constricted by legacy equipment that isn’t flexible or productive enough, suffers too much downtime, takes too long for changeovers, uses too much energy, or has component availability and gray market quality issues,” he says. “You need to invest to overcome these inefficiencies and reduce the risks to your business.”

Risk mitigation also involves evaluating the cost to your business if a critical system were to fail in the future. “The easiest risk to identify is when something is no longer working or components are no longer available,” says Stefan Werner, marketing manager for factory automation at Siemens. “Then you can set priorities based on how important that system is to overall production.”

Better diagnostics are key to any optimization effort because they can tell you where your process needs to be more efficient. “There’s a huge difference between migrating and modernizing,” adds Keith Moreland, manager of product marketing for the TIA Portal at Siemens. “When you migrate to a new version of a component, you don’t necessarily achieve any production improvements. Modernizing, on the other hand, can help you increase data collection and achieve greater productivity at lower cost. You have to look at the ROI. If you stick with legacy systems by...
just replacing parts, at some point you will be forced into an emergency migration or modernization. It’s easier and less risky to plan for modernization so that you can take it in steps.”

WHAT ARE YOU TRYING TO FIX?
It makes sense to target the dysfunctional systems that are hard to work with, most often responsible for unplanned shutdowns, adding to production costs, or barriers to achieving potential new business opportunities. The first step is to find the root cause of a problem.

Aja points to a client who wanted to rip out their old control system because they didn’t like it and it didn’t work. “We spent eight weeks evaluating it and found out the problem was the way the process was designed,” he says. “Many of the problems were related to mechanical systems and piping that weren’t right for the process they were using. By changing those instead of replacing the control system, it saved a lot of money and time in what was originally going to be a multimillion-dollar project.”

WHERE CAN YOU IMPROVE EFFICIENCY?
The more efficiently your operations run, and the lower the cost, the greater the return from your production infrastructure. It’s why companies have begun to more closely monitor their systems, looking for ways to make them more reliable and productive. It’s also why networking, wireless technology and cybersecurity have become so important.

Manufacturing is just starting its evolution into the digital world, says Rich Carpenter, chief technology strategist at GE Digital. “The first step is to get devices connected to the Internet of Things so you can have visibility into the plant and gain insights you can use to achieve stable operations,” he says. “That’s essential so you can move on to the next phase: optimization. Often, it’s necessary to do that in parallel with existing systems because you still need to keep producing.”

The insights you gain will be invaluable in helping you improve the efficiency of your operations, Carpenter says. “While no one will ever be able to achieve 100 percent efficiency in their manufacturing infrastructures, world-class efficiency is considered to be 85 percent. Most companies are in the 60 percent range, so there’s lots of room for improvement,” he adds. “The goal should be to get 100 percent of your manufacturing infrastructure working at 70 percent efficiency rather than 10 percent working at 100 percent efficiency.”

ARE YOU MEASURING FOR VALUE?
It doesn’t always take connecting to the Internet of Things (IoT) to link production process data to business value.

“At the most basic level, even a DCS system installed in the 1970s can provide data on how much material is consumed by your process in an hour,” says Peter G. Martin, vice president of business value consulting at Schneider Electric. “From there, it’s easy to calculate the cost of that material. Once you add in labor, energy and other related costs, you’ve got a baseline against which to measure process performance before and after, which allows you to calculate the return on an automation investment.”

If your business needs a more sophisticated approach, start by measuring variances in your process, says David McCarthy, president and CEO of CSIA member TriCore. “Measuring even small variances can uncover a huge amount of value, particularly in high-volume industries like food and beverage,” he says. “You can only control a process as finely as you can measure it. To optimize a process, your infrastructure has to work in three layers—control, visualization, and business and engineering intelligence.”

TriCore recently tracked variances on 56 production lines across 16 milk plants. The information was used to tighten process controls, enabling a slight reduction in the amount of material needed to make each jug. The result was $4 million in savings and a four-month payback.

“It’s a technique that allows you to dig deep into the data and track variances over a period of time—even small ones you might not notice on a
daily basis,” McCarthy explains. “Using it to measure all kinds of activities can achieve a big impact for both preventive maintenance and optimization.”

**ARE YOU ALLYING WITH FINANCE?**
Build a solid business case for automation investments by focusing on projects that will help your company maximize productivity and reduce costs. Rank your wish list by potential ROI, then make those that deliver the most value your basis for budget requests.

“When on a value hunt, ask finance what costs the company the most money or restricts higher revenues and net profits,” says Randy Otto, vice president of business development for ECS Solutions, a CSIA member. “Too often, engineers attempt to justify the replacement of aging automation technology with one argument: If the system fails, the plant shuts down. While this argument is correct, it’s not aligned with the company’s financial goals.”

Prioritizing is easy when identifying projects with their financial numbers instead. The projects with the highest dollar return in the shortest time can be considered first. If the justification is written in alignment with the finance group, the project has a greater chance of being approved.

“Every year, an amazing amount of preliminary work is expended to identify, research, price and budget improvement projects. When a project gets cut, all that work is lost,” Otto notes. “So you have to focus on those projects most likely to be implemented; that deliver the greatest value to the company.”
A necessary second step is to identify specifically what can be done for the justification dollars available. “This requires insight into the process, how it currently works, what technology is available, what it costs and what improvements can be expected,” Otto says.

ARE YOU SEEING THE TREES OR THE FOREST?

Finding value often requires a reevaluation of your current processes to discover a more efficient means to the end.

Mark Sobkow, vice president for manufacturing solutions at CSIA member RedViking, says there’s “real value in asking ‘dumb’ questions like, ‘Why do you do it that way?’” That was the starting point at a jet engine manufacturer, where RedViking was able to combine 30 different operations spread across 15 stations into three automated assembly stations.

“Looking at the big picture allows you to reenvision the process, which can potentially save your company millions of dollars,” says Rod Emery, RedViking’s vice president of operations. “It also makes it easier to evaluate the merits of a project in terms of whether the proposed changes will deliver value to your business.”

Emery adds, “Some companies appropriate their budgets based strictly on new product launches and have little concern with scrapping things like AGVs every year, buying new when their products change. But others make sure their automation solutions are for the long haul. They look for long-term value and consider the whole cost of a system, including maintenance, repair, downtime, training and injuries. When you do that, you stop looking at just replacing machines and start seeing it from a bigger perspective.”

CAN YOU CONTROL THE TIMING?

There’s nothing worse for stable business operations—or an engineer’s reputation—than being forced into a major investment when there’s a sudden breakdown in existing systems.

“Production facilities need to strategically invest to maintain their automation infrastructure,” says Sean Sims, vice president of lifecycle services at Emerson Process Management. “Process infrastructure has a 20-40 year lifespan, so sooner or later you’ll need to modernize. Companies that operate with a run-to-failure strategy end up spending even more because failing to maintain systems shortens the lifespan of their capital investment. It also subjects them to unplanned downtime. It’s essential to control the timing and the cost of modernization, so we try to help customers make the right investments at the right time.”

The goal should be to extract the maximum value from your current systems, Sims adds. “That’s why we’re starting to see companies put a lot of effort and resources into measuring process productivity,” he says. “The more knowledge you can extract from your process, the better you’ll be able to improve its performance and extend its life. Using sensors and wireless communications to step up monitoring, for example, can improve process visibility so they don’t get caught flat-footed by unanticipated equipment failures or degraded performance.”

Sims points to an Emerson collaboration tool that helps operators, supervisors and maintenance improve operational effectiveness. “The most risk-laden time of the day is when shifts change. The electronic logbook in our DeltaV distributed control system lets everyone know what happened within the process during the previous shift and provides a context for future activity by the next operators,” he says. “By making small, well-timed infrastructure investments you can transition your automation infrastructure to the next technology stage with less risk and at your own pace.”
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SECURITY BUILT-IN
Learn how to get away from simply replacing your old system with another one just like it, and instead achieve the value of optimization that new technologies afford.

There’s nothing more permanent than a temporary fix. Companies spend many thousands of dollars every year just to stay in the same place. They might first spend too much time and money mending a legacy system piece by piece, just trying to keep the system operational.

But even when the decision is made to bring in a replacement, too often the goal is to simply create a newer version of the old—ignoring all the capabilities that have been rolled out to industry in the 25 or more years since the legacy equipment was first purchased. As a result, manufacturers spend money for an upgrade that doesn’t get the job done any better than the old system, and the CFO isn’t impressed with the idea of doling out money for an operation that doesn’t show any special return on the investment.

Too many manufacturers are not using the full capabilities of their technologies, says Tony Jacobsen, business development manager for Canadian system integrator Autopro Automation Consultants, a member of the Control System Integrators Association (CSIA). “They want to keep using legacy technology, even though new equipment would have been half the cost and easier to support,” he says. “What they don’t realize is that they’ll spend more money by delaying than it would have cost them to modernize.”

Breaking that pattern might take a generational change and a new way to structure incentives, according to Chris Noble, senior district sales manager for Aventics Pneumatics. “Companies can get locked into an annual or semi-annual maintenance schedule, which tends to consume most of the budget,” he says. “To change that, you have to realize that just replacing components is not going to get you a better system.”

Setting aside a certain portion of the budget every year for optimization projects allows you to get started. “While it’s important to keep things up and running,” Noble says, “it’s just as important to incentivize a mindset for innovation and optimization. Installing systems that give you better diagnostics on your operations can be invaluable. Better information can spark a forward-looking attitude and a whole range of useful new ideas from employees.”

FIND THE OPTIMAL SOLUTION
Deciding on a path forward for modernization typically involves a range of options. And, of course, the optimal solution often comes with the biggest returns. In many cases, the money spent on developing a system that’s truly optimized will come back in spades.

CSIA member RedViking was asked by a helicopter OEM to come up with a better solution for its laser radar measurement and robotic trim cell, which uses a portable laser measurement stand that gets wheeled to the aircraft and placed inside the frame to measure the hatch or door opening. The resulting point cloud data is then transferred to the robotic trim cell, creating a cutting path for the door.

“They were spending a lot of time hand grinding parts to make them fit, which meant huge amounts of labor, handwork, and trial and error,” says Mark Sobkow, vice president for manufacturing solutions at RedViking. “They had considered two choices: continue to measure by hand and automate the trimming process, or automate the measurement and continue to trim by hand.”

In fact, neither of these options achieved the best results. “Because they were willing to consider something other than a straight replacement,” Sobkow explains, “we were able to design and build a system that allowed them...
GET EVERYONE INVOLVED

It's important that everyone understand just what the modernization will look like, notes Robert Darling, group migration specialist at Siemens. "While maintenance may have identified the problem, modernizing requires a bigger conversation that must involve more people across multiple functions and levels to agree on the needs and financial factors, as well as the operational benefits," he says.

Get your partners—whether vendors or integrators—involved early in the planning process. Rather than dictating to them a duplicate of your previous automation system, you’ll achieve much bigger ROI if you let them help you see how new automation technologies can better address your manufacturing needs.

"If we just receive a specification sheet from a customer, we’ll never be able to optimize the process," says Roger Freeman, vice president of project services development for Emerson Process Management. "But if we understand their objectives, we can help them apply our technology in a way that enables greater savings."

As an example, Freeman points to a project in which Emerson deployed electronic marshaling and wireless technologies. By installing smart junction boxes that greatly reduce cabling, only one control cabinet was needed compared with the traditional approach requiring 20-30. "This solution also saved $14 million in E&I [engineering and inspection] costs, which is more than they spent on the automation," he says.

Early engagement in the design of an offshore separator manifold resulted in a more compact design, occupying less space and weighing considerably less. "We saved 15 square meters of space and 18 tons of weight, which is a
big deal on an offshore platform,” Freeman says.

It’s critical to understand a company’s culture and strategic objectives before the start of a project, says Frank deJong, vice president of global projects at Emerson. “The processes used by some companies are so complex or restricted by the laws of physics they can only be improved at the margins, while other companies are looking for a transformation,” he says. “Project teams need to know what’s achievable, and our experts can help them document it and show what other customers have achieved with similar projects.”

LEVERAGE NEW TECHNOLOGY
Every day, automation suppliers introduce products with new capabilities that offer opportunities to solve long-standing problems. Taking advantage of these technology advances can make it easier to achieve your vision for the future.

“Aging technology forces companies to look at their automation, which is the perfect time to evaluate advances in technology and how they can help pay for a project,” explains Randy Otto, vice president of business development for ECS Solutions, a CSIA member. “In nearly ever instance, companies are able to realize a greater annual return than the cost of the entire automation project.”

Southwest Baking Co., in Tolleson, Ariz., took the opportunity provided by a failing computer loaded with proprietary batch management software to replace it with new Rockwell Automation software and an HMI system for the controller. “We didn’t change any hardware except the computer,” Otto says. “It was just software that took advantage of the technology they already had in the controller.”

With the new system, equipment performance improved more than 30 percent, downtime per event dropped from 4 hours to 3 minutes, and material variances were reduced from 5 percent to less than 0.05 percent. Material savings will be $500,000 annually, and project payback was achieved in a matter of months.

“Without capitalizing on technology improvements, replacement just becomes a one-time cost with zero return,” Otto says. “It’s one of the reasons companies often cut replacement projects from the budget and do whatever possible to purchase based on low price.”

The growing use of consumer technologies that make it easier to collect, store and visualize data has increased capabilities in automation products as well. “Which means companies can achieve their goals with lower engineering and capital costs,” says Charlie Norz, I/O product manager for Wago. “The question is always which technologies will best improve performance and reliability, because that’s how you’ll achieve the greatest return on investment.”

CAPITALIZE ON OPPORTUNITIES
Downturns in specific industries—such as how low prices are affecting oil and gas—can also create opportunities to change the status quo.

As sinking oil prices lead to major declines in infrastructure spending, Auto-pro’s Jacobsen sees priorities changing. “The industry is circling the wagons, waiting to find out where prices are going,” he says. “Automation projects, once approved in the field, now have to go up to the executive level. You have to have a compelling reason for why a company should spend finite capital on automation.”

Downtime—which can cost a facility $500,000 a day—gets the attention these days, Jacobsen says. “Shrinking margins mean managers want their equipment to run 24/7 for five years without shutting down for maintenance. When obsolete equipment is no longer being supported, optimization becomes the key method to increase reliability.”

Cutting waste is another big opportunity to gain ROI. Its value in improving product quality and reducing material usage has long been recognized, but there are other areas where companies waste money that could be better spent on increasing efficiency.

“One of our large customers has multiple plants around the world, and
thought they had a tightly run ship,” says John Riess, global marketing lead for Integrated Architecture at Rockwell Automation. “In evaluating their installed equipment base, we found they were wasting a lot of money buying spares for equipment they were no longer using, on the order of nearly $500,000 every year. In spite of that spend, they weren’t certain they were properly covered. We’re now helping them modernize the process by centralizing spares at a single hub.”

LOOK BEYOND THE BUZZ
Although the Internet of Things (IoT) and other trends might seem like just a lot of industry buzz, there are cases to be made that present plenty of automation ROI opportunities.

“If you dig deeper, it’s not about the futuristic cool factor. It boils down to increasing efficiency and lowering costs,” says Eddie Lee, director of global industry marketing at Moxa. “It’s about dollars and cents because the executives who make the funding decisions ultimately have to answer to Wall Street and investors. The automation industry is pushing the concept of IoT because it can provide companies with a sound financial model of their operations.”

Your business case needs to be couched in terms of increased revenue and productivity, “because that’s the language executives understand,” Lee contends. “To do this, you have to be able to measure the benefits of process improvements with numbers, like reduced downtime, OEE and lower costs, because you’re being graded on the KPIs.”

The power of data to reveal what’s happening in industrial processes is just beginning to be understood, he says, pointing to its usefulness at a wastewater treatment plant. “They’re literally able to collect water quality data that tracks visitors to a hospital to identify their impact on bacteria counts in the water. Now they can fine-tune their treatment process as needed to stay within water quality regulations.”

ARE YOUR EYES ON THE PRIZE?
Engineers might be attracted to the latest shiny object, but staying focused on business objectives leads to better decision-making.

“Clients often say they want to use a specific hardware vendor,” says Steve Malyszko, president and CEO of CSIA member Malisko Engineering. “We try to be vendor-agnostic from the start and focus on what they want to do and why they want to do it. The hardware then just falls into place. One client had heard about a new processor with an amazing scan time. We pointed out that the valve in question took a second to open, so why would they need a processor with a response time in microseconds?”

Will Aja, vice president of customer operations for CSIA member Panaacea Technologies, agrees. “The conversation at bid meetings can get bogged down in hardware, software versions, I/O counts and vendor selections,” he says. “This will guarantee that the delivered solution matches a spec sheet, but it speaks nothing to functionality. A higher level of conversation on automation philosophy, expansion plans and desired capability should be had first. Once standards are defined and the function of the system is clearly detailed, the other items fall into place.”
Part III: How to Get Executive Buy-In for Automation
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Sometimes executives view automation as a black hole where money goes in, but no benefits ever come out. In this chapter on increasing the return on automation investments, we explore how to justify the investment to win over their support.

The U.S. economy continues to grow despite challenges within certain industry segments and from beyond our borders, and yet it might be harder than ever to win a place in the capital budget for projects involving automation technology. That’s because executives who decide on expenditures are asking tougher questions and demanding proof that significant business returns will be delivered with every investment.

“We’re at an inflection point now,” says Frank deJong, vice president of global projects at Emerson Process Management. “The marketplace is asking for a step change in execution because they no longer have the margins to cover up cost and time overruns. There’s also been a step change in technology, people’s comfort with it, and new tools to make process improvements happen.”

Though executives can be very skeptical of the value of automation, they also know they need it to achieve their business goals. Engineers who can speak the language of business value are in a strong position to help guide their companies to a more profitable future.

System integrators and automation suppliers, which have years of experience working with the managers who make funding decisions, can be valuable sources of information and tools for engineers seeking the best way to make a case for an investment in automation.

THINK LIKE AN ACCOUNTANT

“Automation applied correctly can add more value to the bottom line than any other business investment, but it requires talent that understands both the human rules of accounting and the physical laws that govern engineering,” says Peter G. Martin, vice president of business value consulting for Schneider Electric. “Unfortunately, many automation investments are made mostly to reduce the nuisance factor from existing systems, so a lot of automation is going in that’s not driving value. Its true financial impact on the business is also not widely understood.”

Martin thinks most people understand what the basic costs are for components and engineering, but few know what the benefits are. “Companies are focused on lowering project costs, which reduces automation to a commodity,” he says. “When you relegate automation to a benefit-less role, it’s no wonder that executives ask, ‘Why not just do a replacement?’”

Although accounting is the department that ultimately determines value at a company, a major challenge is that cost accounting systems can only measure the cost of a project. Since accounting looks at the plant as a whole, rather than on a unit basis, they also never know which unit is actually responsible for any benefits.

“To change that playing field, you have to evaluate the cost of an automation investment based on its economic value to the business,” Martin explains.
“Then you have to do real-time accounting at the work-cell level, which lets you measure operator activity. By modeling accounting in the control system, using the same accounting rules like GAAP (generally accepted accounting principles), you can establish a baseline and store a history, which allows you to watch performance before and after each investment.”

It can take a change in mindset for engineers to embrace this idea, according to Martin, but many have begun the shift. “Engineers often go through their entire careers without being measured on their activities beyond whether they’ve completed a project on time and on budget,” he says. “They need to be on planning teams and at the executive level, talking about business value rather than [just] project schedules.”

Dashboards that relate production data to financial data can be powerful tools for both operators and managers. “Historically we’ve put things like cycle time on dashboards, but putting real-time financial and production information at their fingertips allows them to make better decisions,” says Randy Otto, vice president of business development for ECS Solutions, a member of the Control System Integrators Association (CSIA).

WHAT’S YOUR STORY?
As they say in the advertising business, what’s your elevator pitch? It’s the quick, compelling story of the value you can deliver, how you’ll do it and why it’s essential to the future of the business.

You have to capture the attention of executives who are often more comfortable living in the world of numbers than on the factory floor, then spell out your business case using charts, graphs and any other visuals needed to demonstrate your proposition.

To do that, you need to speak the language of business, which is focused on productivity improvement, higher revenues, lower cost structures, risk avoidance and opportunities for growth. That’s why projects designed to reduce downtime can often be as important in generating business value as those whose goal is process optimization.

By understanding what’s driving the business and the management team’s vision for the future, you’ll be able to frame your arguments for investment in terms of its benefits to the business.

“You have to spell out what the business will gain from this project,” says David McCarthy, president and CEO of CSIA member TriCore. “Executives want to know how spending this money will let them make more money, improve product quality, lower costs, make workers safer or reduce risks.”

Where it makes sense, bring your project partners to the table to help build your case and provide any technical support or schedule justification to increase executive confidence in the team and in a successful project outcome. Automation suppliers and system integrators can be particularly useful sources of information in showing how other companies have succeeded with similar optimization projects.

The job of making a case for investment is a two-way street, and executives have their own set of responsibilities in this dialogue, explains Rich Carpenter, chief technology strategist at GE Digital. “Business executives need to understand how manufacturing technology and business itself is changing and see themselves as part of a digital industry. While large companies and those that make high-value products and consumer packaged goods have begun the shift, those in the mid-tier level need to wake up,” he says.

Even the smallest plants are connecting their enterprises and building digital links to their transportation partners to ensure product quality, Carpenter says. “With so much global competition, the imperative is to gain share. Companies need to be able to pivot their plants as market demand changes. Those that ignore the need to invest in their production systems and gain actionable business intelligence won’t be around in the future.”

MAKE A VIRTUAL CASE
If you promise to improve process efficiency, you have to deliver results. Taking advantage of virtualization tools to pretest and demonstrate the functional effectiveness of new system designs can be a game changer in proving
your case—and in gaining executive buy-in.

Emerson, for example, has built four engineering data centers around the world for its DeltaV control platform to evaluate system designs in a virtual environment. The centers allow customers to see how their virtual systems will work before the actual equipment is installed.

“While some customers initially express reluctance about virtual testing, there’s a growing comfort level with virtualization and the centers are now supporting more than 700 projects,” says Roger Freeman, vice president of Emerson’s Project Management Office. “This is another way a small investment in technology can be applied in a transformational way to achieve a big impact.”

It’s crucial to make sure new control designs will function as promised, says Will Aja, vice president of customer operations for CSIA member Panacea Technologies. “We do a lot of testing internally with a virtual test bed to simulate the operation of controllers on a system, so we can prove the changes we’re recommending will be worthwhile,” he says. “This helps us do a better job and ties in with the whole virtualization trend. It’s a tool for better decision-making that can also reduce engineering and startup time and costs.”

Computer simulations can also help dramatize the contrast between existing systems and how the process would work with an optimized design. “Simulations immediately show the engineering and management teams the impact on such things as labor, floor space and production rates,” explains Mark Sobkow, vice president of manufacturing solutions for CSIA member RedViking. “The key is that every piece of equipment, every piece of automation, has to earn its place and its price. By doing these metrics, whether it’s through simulations or helping customers think outside the traditional methods, you can focus on important things like the process. There’s no point in automating something that’s a bad process to begin with. You’ll just make a bad process faster.”
CREATE MANAGEABLE BITES
Phasing in automation upgrades over multiyear projects is both easier on the budget and less risky if there are transition problems.

“Modernization is a journey,” says John Riess, global marketing lead for integrated architecture at Rockwell Automation. “When you’re dealing with a significant installed base of 25- or 30-year-old technology with limited memory, you can’t do it all at once. Our job is to help customers get there without doing a complete rip and replace.”

One of the benefits of incorporating open, industry-standard technologies is that it allows industrial and commercial devices to coexist on the plant floor, Riess adds. “This means they function in a way similar to how products work within the Apple ecosystem, so they can sense each other in the same way a computer does when you connect it to a printer. This simplifies communications and integration, and reduces engineering and startup time.”

It can take many years to transition to a new control system, notes Tony Jacobsen, business development manager for CSIA member Autopro Automation Consultants. “We’ve found that if you start by first tackling the most complicated or risky piece of an upgrade, you’re able to find the answers you’ll need to make the entire project successful. By frontloading the project, it becomes easier to do the less expensive and less complicated pieces in the following years,” he says. “Executives tend to focus on the big-ticket items in a project, like equipment or piping. Typically, automation costs make up a small share of a total project budget, even though automation may be the brains of the operation. Make the case that by adding a smart expenditure on automation to the budget, it will ultimately improve the success of the entire project.”

PREPARE FOR A NEW GENERATION
Modern technology can be a powerful recruiting tool for manufacturers, which often find it difficult to attract young people with the higher-level skills needed to operate a successful business today.

The most innovative companies are often those where change is happening quickly and management has made a commitment to optimization. “Certain companies don’t necessarily have more money, but they’re more open to change. The automotive industry is a great example for always being on the leading edge of automation. Improving processes in their plants always was a major driver for change,” says Stefan Werner, marketing manager for factory automation at Siemens. “Even in process industries, engineers are being forced to deal with changes in equipment like boilers as vendors are now obsoleting and recertifying their systems about every five years.”

In many cases, the new generation is making a push for change. “Young people have had computers in their hands for their entire lives,” says Keith Moreland, product marketing manager for the TIA Portal at Siemens. “This new generation is questioning the status quo and pushing for improvements now that money for investment is starting to flow again, even if slowly. Our job is to aid them in making their arguments. The chance to optimize industrial processes using new technologies can be very attractive to this group. They’re the ones companies will need to rely on as the current generation of engineers retires over the next few years.”

Adds Rockwell’s Riess, “Generational change is bringing attitude changes. Young people are not interested in learning the old industrial stuff. They want things to work the same way their smartphones and tablets do. Managers have to ask themselves whether they’re going to be able to support legacy equipment when their current workforce retires.”
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It’s no secret that too many industrial modernization projects end up taking longer and costing companies more to complete than was originally anticipated. The bigger the project, the greater the risk of failure seems to be.

“Today, in the process industries, 65 percent of projects worth more than $1 billion and 35 percent of projects under $500 million fail, where failure is defined as at least 25 percent over budget and/or late by 50 percent,” reported Jim Nyquist, president of Emerson Process Management’s Systems and Solutions business, at last year’s Emerson Global Users Exchange in Denver. “Budgets have increased, but expenditures have increased more, especially on larger projects.”

According to Nyquist, the reasons for these failures range from the large size and complexity of many of today’s projects to their remote locations where the availability of roads, power and people are real obstacles. A perhaps more significant contributing factor is changes that occur during a project.

The result is more custom projects where uncertainty and complexity lead to cost and schedule overruns. “Automation has not been the major cause, but it can make a big difference, and it’s on the critical path during startup,” Nyquist said.

Changing that dismal record by making project completion more predictable and reliable, he says, will require new processes and methodologies to reduce project cost and complexity and better accommodate the changes that are inevitable.

Though the record in discrete manufacturing might not be as dramatic by virtue of smaller budgets, there’s no doubt that many projects get derailed for similar reasons. Projects often fail because promises are made to executives before a detailed project scope is defined, resulting in unrealistic budgets and schedules.

EYES ON THE GOAL

When project teams run off the tracks by overspending, this invariably means trying to cut costs in the last half of the work, when the automation component is on its critical path. By cutting corners then, you can end up building a racecar with only half an engine, which means you’re never going to reach the finish line.

“Instead of preserving the integrity of a system designed to achieve their productivity goals, project managers often try to get the automation done as quickly and at the lowest cost possible,” explains Randy Otto, vice president of business development for ECS Solutions, a member of the Control System Integrators Association (CSIA). “When you’re trying to create software that will help improve business agility and productivity, cutting corners here can sacrifice optimization goals and the ability to make future changes more easily. The ultimate losers in this scenario are the company and its engineering team, which will miss out on opportunities to reduce costs and improve performance in the future.”

STAY REALITY-BASED

Starting with a realistic budget and schedule, or reducing the scope of a project to fit the parameters you have to work within, can keep a project from spinning out of control.

“The numbers are often pulled out of the air and schedules are more optimistic than are achievable,” explains Steve Malyszko, president and CEO of
CSIA member company Malisko Engineering. “We call it the ‘pregnant lady syndrome’ because it’s like insisting that three newly pregnant women together deliver a baby in three months.”

It’s important to realistically determine how much time must be allocated for the different parts of a modernization effort and do the project in phases if necessary. To minimize production downtime, for example, it’s a good idea to get things like cable installation out of the way before a project starts.

DON’T WAIT TO INTEGRATE MES
Companies that insist on adding a manufacturing execution system (MES) after the equipment has been installed miss out on big opportunities to avoid bottlenecks and identify problems beginning at startup.

Mark Sobkow, vice president of manufacturing solutions at CSIA member company RedViking, relates the experience of one automaker that used to field large launch teams armed with clipboards and stop watches to start up new production lines. Launch delays invariably ensued as team members tried to locate problems manually. Connecting to the MES after installation always became a retrofit project that caused disruptions to production.

“Post-recession, and with a much-streamlined launch team, the company insisted that the MES be fully qualified before the equipment was shipped,” he says. “The MES becomes part of the launch because it’s all integrated and validated with the equipment purchase. Your launch is much smoother and your quality is better because you have the right information from the beginning.”

This approach, adds Rod Emery, vice president of operations for RedViking, “means the MES is on site providing maximum value when it’s most needed. It’s a constraint and throughput analysis tool. Costs are minimized for both the launch and the MES integration because it’s being delivered as part of the base system and not as a bolt-on after the fact.”

Testing every physical device before startup is another important best practice, adds Lisa Sobkow, executive director of MES for RedViking. “When one of our customers is in their pre-production build events and they’ve got some downtime, they’ll have us physically go out and manually test every potential down event—every pushbutton, every light screen, every safety gate, so that we can pre-qualify as much of the system as possible,” she explains. “That way, they don’t work through those issues during production.”

DESIGN MODEL FOR CONTROL SOFTWARE
A software framework that uses object-oriented programming, standardized control libraries and an architecture that can accommodate change and expansion in the future is the key to optimizing control system functionality and future plant flexibility, according to Will Aja, vice president of customer operations for CSIA member company Panacea Technologies.

“Object-oriented programming makes it easier, especially for new engineers and users, to program and decipher the structural framework of the control system’s design,” he says. “A standard library for programming simplifies training and use because it’s easier to trace the code. It’s also useful for future system expansions because it provides a good, flexible design structure. A client-server architecture is also essential. Security is much easier and you can use it to log into the system from any screen. In many ways, thin clients are similar to how things functioned with mainframe computer systems.”

Tag-based rather than address-based programming systems provide greater functionality, according to Steve Barriger, regional services solution consultant for Rockwell Automation. “Where possible, you should try to leave the I/O wiring alone, but it’s still essential in any modernization program to verify that all the I/O is properly wired,” he says. “It’s also important for data collection that you determine whether you have discrete or analog I/O and whether any indirect addressing is going on.”

TRAINER IN A BOX
Training that allows a plant’s staff to become familiar with the capabilities of a new control system is an essential aspect of any modernization project.

To help customers get quickly on the path to harnessing their system’s
potential, ABB has designed a suite of packaged services that include the required software and licenses, along with an expert in the field to install and set up the system at the customer’s site.

“One of the most important aspects of these services is the built-in coaching sessions, which provide an opportunity for a customer’s engineering staff to take ownership of the advanced solutions,” explains Steve Burt, business development manager for DCS lifecycle services at ABB. “These relatively inexpensive and short (one week) service engagements produce valuable improvements immediately.”

**CHECK YOUR CONNECTIONS**

In any control system modernization, it’s essential to determine everything in the system is connected before you start work. “You have to pay attention to the details in the planning stage, and what systems your controls are tied to, or you’ll have to address them after the fact,” says Robert Darling, group migration specialist for Siemens. “Control engineers may not be familiar with peripheral systems and, in the rush to get it done, crucial connections like logistics can be overlooked.”

**STANDARDIZE PLANT HMI**

You can make life easier for operators—and your processes safer—by standardizing human-machine interface (HMI) systems plant-wide. “Operators often have to operate multiple types of equipment across the plant,” Darling says, “so it’s important to have a common standard for HMIs, such as screen design and how alarms work. You also need to structure the PLC code so it can automatically generate HMI screens out of the program. There should be a clear structure and layout, including type sizes and colors, so an operator can go to any machine and operate it. It’s also essential to add diagnostics into HMI displays.”

Understanding the principals of high-performance HMI, such as using color against a plain background to bring attention to the things that need attention, is essential. “The downside of model graphic schemes, however, is that they can be too monochromatic and boring,” cautions Ryan Smith, general manager of system integrator Calcon Systems. “HMI design requires a certain level of artistry to do well, which includes understanding the actual process...
and how the operator needs to react to it. Showing the process on the screen is crucial for troubleshooting. Being able to see things in real time gives the operator confidence in the information.

**IT’S NOT THE TECHNOLOGY, BUT THE KNOWLEDGE**

Though a lot of great technologies exist, problems arise when the person responsible for applying it does not have the required knowledge and skillset.

“A number of integrators and plant personnel haven’t caught up with technology yet, even though universal standards exist to provide guidance. They might assume they’re smart enough to just figure it out, but that can be a disaster waiting to happen,” Malyszko says. “There’s also a huge education gap at the client level between IT and OT (operational technology) practices and the ramifications of how following office practices can be damaging to plant-floor operations.”

He recommends using the best practices set forth in the Converged Plantwide Ethernet (CPWE) design and implementation guide to create robust networking systems for manufacturing automation applications. The manual provides guidance on key aspects of network design, such as segmentation, hierarchy, security and scalability.

**WHAT EXTRAS DO YOU NEED?**

Define your objectives before you start your control upgrade, because just installing a modern control system is often not enough.

“Migration is not justified if you don’t gain more value. You need to understand what improvements will come automatically from a modern control platform, and what other capabilities you may need to add,” says Stefan Werner, marketing manager for factory automation at Siemens. “You have to put in place a complete system, including hardware, software, communications and field devices, and determine what extra benefits you want from modernization, such as security, diagnostics, faster changeovers, uptime or lower time to repair.”

**MANAGING YOUR ASSETS**

Harnessing the power of technology within control systems to achieve operational excellence can maximize operational asset performance while lowering maintenance costs. A well-executed asset optimization strategy can reduce unnecessary maintenance and downtime, track causes of failures, identify repeat offenders, provide root cause data and fault diagnosis, and recommend actions. It can help detect failure conditions in advance, eliminate manual actions, handoffs and paperwork, and reduce latent time between problem identification and resolution.

“Simple strategies like counting motor starts and hours of operation can provide the needed boost to transition from periodic maintenance to condition-based maintenance,” explains Umesh Chitnis, operations manager for ABB Consult IT. “Asset monitoring of IT devices (servers, workstations, switches, power supplies) and field devices (transmitters, valves, actuators) can provide round-the-clock insight into asset conditions. This enables asset maintenance to be achieved in a predictive rather than a reactive way. Integration with maintenance management systems can help close the gap between operations and maintenance crews.”

**DEALING WITH THE HUMAN FACTOR**

The physical aspects of applying technology are usually pretty straightforward, but managing the human variable is often the most challenging hurdle involved in an automation project.

“A lack of understanding of the process that needs to be followed, particularly at mid-market companies that do upgrades infrequently, sends many projects off the rails,” says David McCarthy, president and CEO of CSIA member company TriCore. “You need to find a partner—the adult in the room—who is able to understand what it will take and who can control the behaviors at an organization.”