Process automation is essential to operating any complex production process. The sophistication and power of process automation enables vastly improved productivity, quality and cost control.

Process owners know that nearly every system has the potential for even greater productivity and efficiency. Mainly through minor incremental improvements and subtle system tuning, but also through the occasional giant improvement leap, process automation provides the tools to move towards the ideal of maximized production.

As with all technology, the day a process control system is installed, it begins the gradual slide towards obsolescence. Most process owners realize that these systems could benefit from an ongoing lifecycle optimization approach, but few invest the needed strategic thought and action to make that happen. Approximately 20% of system owners take a strategic lifecycle approach to their control system. The rest do nothing or are strictly reactive, making changes only as needed to correct problems.

Presented with the potential for continually improved productivity and performance, why don’t more process owners take a lifecycle approach to proactively manage process automation? Some don’t want to invest in the next generation of technology until they’ve realized the greatest possible return on investment for their existing system. Others hesitate to alter a process that seems to be performing as required. Making changes, they believe, invites trouble. In some cases, this is understandable, since not all upgrade programs go as smoothly as the suppliers promised.

Many believe that all technology follows a predictable arc of performance. A new system is installed and various startup issues addressed. That’s followed by a long period of satisfactory operation with occasional repairs or updates. Towards the end of its life, performance degrades until it reaches the point where it becomes intolerable and replacement is required.

While most technology does follow this arc, this is not necessarily the typical or most desirable lifecycle for process automation. Managed properly, with the help of third-party experts, a process control system can provide continually higher levels of performance throughout its life. Rather than degrading over time, it can be maintained in a way that vastly extends its longevity and continually increases its performance.
This white paper explores the three keys to maximizing the process automation lifecycle:

- Extend the system life
- Lower the system cost
- Derive additional value from the system

**Extend the System Life**
To extend the system lifecycle, process operators must begin with a thorough understanding of the system at the component level. This requires an audit and planning process, typically conducted by the automation provider.

The audit identifies each asset and its main components to determine their age and condition. This data is compared to historical data regarding typical component failure experience in order to plot each component’s location in its expected lifecycle. The result of this analysis is a report profiling each piece of equipment in the system. The process owners are then consulted to identify their expectations or goals for the system.

- What are the desired levels of performance and reliability?
- What are the budget constraints?
- What market or competitive forces must be considered?
- Is there a desired life expectancy for the system?

"With that information, it’s possible to generate a plan or set of prioritized recommendations to optimize the system lifecycle," explains Kent Morrisey, Evolution Manager for ABB Process Automation Services. "The core of that plan and the major contributor to extended system life is a long-term maintenance program."

**Preventive Maintenance**
Equipment very often will exceed its expected life. Plant operators may be fortunate to have equipment operating two or three times beyond what was expected. But without a plan for regular repair, update or replacement, nearly every system component will eventually fail. If system owners haven’t been keeping the system’s asset_component failures can create a ripple effect of serious problems and a major maintenance issue that could result in extended downtime.

"Experienced maintenance staff may develop a good feel for the probable life of common mechanical components - motors, valves and actuators," explains Jim Crowl, Vice President, Parts, Repair, Training and Support Services, ABB Process Automation. "Assessing the health and longevity of process control system components may be more problematic. Because of the difficulty of predicting the life expectancy of a piece of equipment, a common solution is to just keep it running until it fails."

This may seem to be the best approach to getting the longest service from the component. In fact, with routine attention and maintenance, it may have continued to operate even longer and provided an even greater return on investment. This approach, however, creates production disruption and unexpected downtime.

"Breakdowns often occur at exactly the time when plant managers can least afford it," Crowl says. "The more logical approach is to proactively manage automation system health through regular attention and routine service, avoiding unexpected shutdowns."

The insights and tools needed to monitor and manage the lifecycle of an automation system are usually outside the areas of expertise of the process owners. They typically turn to a system provider or third-party system service organization. These resources have the tools needed to help maximize their automation system throughout its lifecycle.

**Lifecycle Planning**
"OEMs and outside service providers often promote cradle-to-grave support for production equipment," Crowl explains. "Their engagement begins with the day the equipment is installed and extends until it is deemed obsolete and taken out of service. For process automation, that model is often inappropriate because there isn’t a ‘grave’ as an endpoint. Instead, service providers can create a program supporting a constant evolution of the system."

In this "evolutionary" approach, they start with an audit, looking at each component in the automation system. That’s followed by an analysis that results in an individual assessment of each part, its current health and predicted life.

"The service provider then consults with the process owners regarding their system goals or expectations," explains John Murray, Global Business Development Manager - Evolution. "Some owners prefer to replace their system on a regular basis so they always have the latest systems. Others do everything they can to avoid system replacement, constantly updating and repairing what they have. Their preferences are an important input to the audit."

With the information about the installed equipment base and input from the process owners, the outside experts can generate a detailed plan for managing the system throughout its lifecycle. This is an action-based maintenance plan, a detailed schedule of recommended activities that could include:

- Suggested inspections and tests
- Environmental tests and checks
- Routine replacements of filters
- Scheduled part/component replacements

"With a comprehensive process automation maintenance program in place, the process owners have a well-defined path forward," says Murray. "Through regular upgrades and routine maintenance, their system can literally evolve over time and may never require a wholesale upgrade or replacement. The essential point is that they will have a cost-effective, low-risk approach to maintaining a reliable system that they can depend on to consistently support their production needs."

**Lower the System Cost**
It’s reasonable to expect that the process automation supplier will offer support in the form of maintenance, management services and software. They could provide the system owner with software to guide ongoing troubleshooting, maintenance and improvement of their products. This support may also be available as fee-based services from a third-party support organization.

"The process owner can rely on these resources to guide them as they develop an appropriate long-term maintenance plan and parts strategy," says Joerg Niemann, Group Leader - Control Life Cycle Management. "Of course, the future is uncertain, and inevitably, you have to plan for the uncertainty there is. Experience has shown that it’s possible to look ahead four to six years when considering a process control system lifecycle. Thinking in that timeframe ensures the greatest possible cost savings."

**Upgrades**
When planning for a major system upgrade or replacement, system owners typically rely on an all-at-once, project-based approach requiring an ad hoc team. Members are pulled from their normal duties to lay the groundwork, do the scope work, investigate various suppliers and technologies, and manage the implementation.

Companies that follow a long-term process automation management plan can avoid all of these project administration-related costs. Rather than a “siege” approach, they rely on a “campaign” based on a multi-year plan of incremental upgrades. This step-wise approach, with components or process areas upgraded individually as required during normal maintenance activities, provides a seamless, lower-cost path towards the newest technology or a higher-performing system without the risks associated with a system failing unexpectedly.

**Parts Management**
"Current system maintenance approaches include an effective spare parts management program, which creates significant cost reductions," says Crowl. "By identifying which components are most likely to fail and when, the process owner can precisely control the spare parts spend. These costs are predictable and easily budgeted, providing reduced parts expenditures."

A more-sophisticated parts program specifies component-level replacement that minimizes the cost of parts. For example, it would recommend replacing a board or a fan in a server. Less-sophisticated programs take the imprecise approach of recommending only major upgrades, like the replacement of the entire server. The result is the same; the prevention of unexpected breakdowns. The parts-level approach is markedly less costly.

"Scheduled parts replacement further reduces spare parts spend because, as process owners upgrade equipment over time, they can set aside replaced but still functional, components as spares for the older components in a system until such time that they are upgraded as well...," says Morrisey. "This ensures extracting the maximum value out of each part."

While not always thought of as "parts," software replacement, upgrades or patches are important to consider. These are also best managed via a formal parts management process. It’s critical to determine which upgrades and patches will improve performance or security, and which may cause incompatibilities or operational problems.

"Experience has shown that organizations adopting a lifecycle approach to the automation systems realize 10 to 30% reduction in the system maintenance costs," Niemann says.

**Derive Additional Value from the System**
In the 1980s, when distributed control systems first came into common use, users were content simply to have I/Os connected to the process and controllers. The system ran the process and delivered expected benefits in terms of repeatability and productivity.

"System designers soon implemented major enhancements," Murray says. "They added screens to provide feedback and control to process operators. Tools were created that enabled process engineers to configure both the system and control logic and to modify the process. These incremental steps helped process owners get more value from their systems through increased productivity and functionality."

In today’s world, plant managers have the opportunity to go much further and greatly increase the value delivered by their process automation by sharing the process-related data in new ways, going beyond the boundaries of the local process. Many other functions in the plant - Scheduling, Purchasing/Supply Chain, Human Resources and others - may benefit from customized, summary views of this data.

Routines can be developed to extract the appropriate data that provides at-a-glance summaries of Key Performance Indicators relevant to different employees or functions. The network capability of most systems allows access to this data throughout the facility. If connected to the Internet, the summary views can be accessed by authorized individuals wherever they happen to be.
“This information could be displayed on screens located at key areas throughout the facility or selectively delivered to individual users,” Murray explains. “It could appear as a narrow text display across the bottom of their screen or as an on-demand, pop-up display. The content and format of the information can be tailored to individual needs. Used this way, the system truly delivers information, not just data, and in doing so it delivers added value.”

While there’s great potential in sharing this data via the Internet, no connection between a process control system and the outside world should be implemented without first thoroughly analyzing and resolving all security concerns. Measures are available to ensure the information is readily available to authorized users while protecting it and the automation system from hackers, worms and viruses.

The other, and often more significant, way to derive additional value from an automation system is to ensure that it is truly optimizing the production process. Even the most stable process will deteriorate over time. This results in longer cycle or process times, wasted materials and energy, and production of sub-optimum products.

Process owners can turn to their equipment OEM for optimization services to correct these shortfalls. Their approach will typically include:

- Diagnosis of current system performance
- Identification of gaps between current and potential capability
- Implementation of improvement actions
- Creation of a long-term program to sustain maximized control system performance

Whether to solve a current process or problem or to attain higher system performance, optimization is key to deriving the greatest value from a process control system.

**Replace vs. Lifecycle Maximization**

A customer was preparing to completely replace his company’s control system. The managers had done all the calculations to determine the expected five-year costs of this approach.

Before beginning the process, they took advantage of ABB’s system evaluation using the evolution process. The ABB approach involved keeping the current system but upgrading it over time, providing a carefully planned schedule to evolve it to the new level of desired performance and reliability.

The resulting data demonstrated that the evolution approach would save 70% of the cost estimates for a complete replacement of the system, while delivering the same level of system performance.

**The Lifecycle Index**

ABB engineers in Europe developed the Lifecycle Index to help customers assess their needs regarding their process automation. It is a mathematical model that works something like the Body Mass Index, providing a numerical value based on various data that allows comparison to an optimum or target value.

Customers respond to detailed questions about their hardware and software and are asked to provide their KPIs and designate the desired planning horizon – how far into the future they want to plan.

Analysis on that input provides a rating of their current system reliability. A target or goal is also calculated, enabling a direct comparison of current state to desired state. Accompanying that comparison is a diagram that represents the required actions to close the gap between the two.

The Lifecycle Index provides a fact-based analysis that enables clients to understand where they are today and the actions required to get them to their goal.

**Conclusion**

It’s common to discuss process automation “lifecycle,” but the term is really a bit of a misnomer. The term implies a beginning, middle and end. In fact, by relying on third-party processes and services, process automation can continually evolve via regular upgrades and new components.

Doing so precludes the need to ever entirely replace a system. Through an ongoing evolution process that includes continuous evaluation, selective upgrades and business-driven enhancements, it’s possible to always own a system that continues to grow, perform and provide increasing value.

"When you take an evolutionary lifecycle approach, the process never ends," says Niemann. “As the operator’s needs grow, change and evolve over time, the supporting process automation keeps pace. If the operator’s goals or strategies change, the process automation can be modified to support that change. That ensures the longest possible system life, lowest system cost and maximum value from process automation."

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