

Establishing Change Management to Reduce the Total Cost of Ownership of Your HMI/SCADA System



Establishing Change Management

Hardly anyone likes change. Yet most of us must embrace it on a near-daily basis. Nowhere is change more frequent and constant than in a manufacturing plant. Managing such a dynamic environment efficiently and effectively requires special skills and tools which, when properly applied to HMI/SCADA systems, can help manage operational, regulatory, and quality issues; heighten production efficiency by reducing errors and downtime; and monitor and control automation projects.

While some might say this is a monumental task that is easier said than done, today's high-technology world enables the application of software systems to help realize these goals. These change management solutions—as they have come to be called—provide analysis and reporting tools, methods for optimizing engineering practices through system life cycles and means for managing automation projects. They may be implemented with relative ease, are cost justifiable and reap a variety of quantifiable benefits.

The key to their successful application is understanding not only the change management system but the total cost of ownership and life cycle costs of your HMI/SCADA system as well. This white paper provides a starting point in understanding these concepts, applying them to your plant situation and moving toward establishing change management in your operation.

Life cycle and total cost of ownership (TCO) concepts

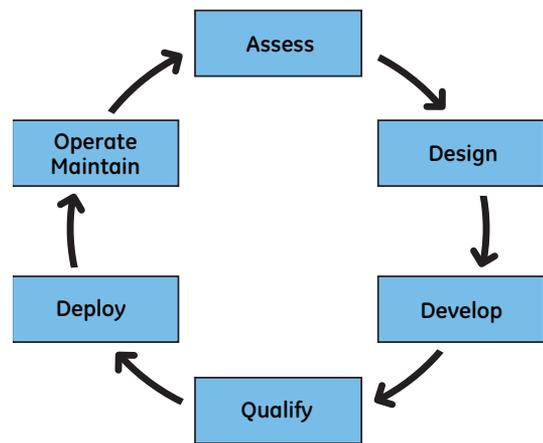
Nearly everyone looks for ways to lower the overall costs of an HMI/SCADA system. When a system is installed in a plant, it has a life cycle with benefits and costs. Change management concepts afford the opportunity not only to save costs upfront but also to reduce ongoing costs throughout the life cycle of the system. To understand how this is done, it is necessary to determine the total cost of an HMI/SCADA system, and then determine how to reduce that TCO.

The HMI/SCADA life cycle: five phases

First, it is necessary to identify and describe the various phases of a typical HMI/SCADA life cycle:

- *Assess and Define*: In this phase, outline what the system is and specify what it is going to do.
- *Design*: Beyond the design work, this phase involves examining standards, considering different architectures, identifying system requirements and looking at the opportunities for integrated solutions.
- *Develop/Build*: The applications are put together. In this phase, create screens, determine the tag database and ascertain what needs to be alarmed—and what does not. In addition, consider what elements can be re-used, what possibilities for collaboration exist and what productivity tools are available; all these factors can help reduce TCO.

- *Qualify/Deployment*: The system that has been built is put into the plant for testing and modification, if necessary. At this point, it is imperative to capture changes, train personnel and determine the flow of information.
- *Operate and Maintain*: The system you've installed will likely need to run for the next 5 to 10 years. Establish resources to support the software and the application, and determine methods for managing any changes. Remember, it is more difficult to justify the replacement of a system that is already up and running, especially when many of its benefits often are intangible. Strive to create a system that will give you what you need for as long as possible.



What is the total cost of ownership?

Understanding TCO involves examining project costs and life cycle costs. Change management techniques can help manage—and lower—both.

Define the life cycle, and then separate project costs from life cycle costs, as there is a difference. When implementing the HMI/SCADA initially, you must consider—beyond normal development time—all the components: the computers, the network and peripherals. In addition, you need to include development costs; for example, a specific number of engineers will work on the project for a specified amount of time.

When you consider life cycle costs, it is important to remember not only those up-front costs incurred when the system is deployed, but also the expense of keeping the system up and running. Making changes costs money, and there will always be changes. Maybe you are changing the application because of a change in the manufacturing process; or there is even a bug in the software or in the original application; or perhaps you added PLCs or new machinery. All these factors force management to

review the existing configuration and possibly—in fact, likely—go back and change or modify the system.

Maintenance costs, actions performed on a system regularly after it has been deployed, are also part of overall system costs. There are large costs associated with what comes after the up-front purchase, which are part of the life cycle costs as well. You should consider all costs from project start-up to project shutdown.

Typical project costs and life cycle costs

Here is a summary of some elements to consider when separating project costs from life cycle costs, and calculating TCO. Typical project costs may include:

- Software, including licenses, databases and drivers.
- Hardware, including PCs, display and communication cards.
- Outside applications that interact with the system.
- Networking infrastructure.
- Project definition costs such as site assessments, requirement listing, design specifications and consulting services.
- Training, from how to use the software and hardware initially to ongoing training due to personnel changes and modifications.
- Application engineering and development costs, including consulting services, screen creation and database tags.
- Customization and integrator costs.
- Deployment and commissioning costs, including installing the software and testing and tuning the application.

Life cycle costs come into play only after these tasks are complete. They may include costs for:

- Application modifications caused by changing requirements, new equipment installation or the need to fix unexpected problems encountered with the deployed application. Remember, HMI/SCADA software may require operating system updates, security patches and changes in software standards, which all come at a cost.
- Vendor support, including emergency phone support, updates and patches.
- Internal support, if your organization offers it. In-house help desks and support services from corporate IT are generally budgeted items.
- Hardware maintenance such as those associated with client/server components and interface cards.
- Downtime due to failures of any kind: Costs of a system or a production line going down are often intangible and difficult to quantify. They vary greatly with the product being manufactured and the nature of the system but they are always there.
- Expansion costs such as those for a new line, a re-design or process optimization.

What is change management?

With total costs acknowledged and understood, let's turn now to how they can be managed and lowered through change management technology. First of all, what is change management?

A computer fails, a hard drive crashes, and no one knows which version of an application was running on the system. Suddenly, downtime takes on a new dimension. How can a plant reduce such incidents or keep a system from going down in the first place? If a disaster does occur, how does an operation recover?

Without a mechanism in place that is part of the entire maintenance phase, re-engineering could become all too commonplace, which is never cost effective. That reason alone makes change management critical to your HMI/SCADA system. GE Intelligent Platforms can point to a number of customers who lost hours, even days of work, because they were running a system with no current backup. (Read the accompanying sidebar on the following page to learn how one company improved its operation through change management.)

In a nutshell, change management helps reduce TCO. It is about controlling changes that are made to an application; it is about documenting and tracking everything that is done to a system—and who is doing it. By definition, a change management system manages data assets in an industrial environment. These include all the important elements in which a company has invested significant time and money, and may include PLC programs, HMI/SCADA application files, CNC data and programs, and CAD and robotic programs.

A change management system's primary capabilities

Most change management solutions are client/server based and typically offer four primary capabilities: version control; security (access control); audit trails and reports; and automated scheduling, notification, and reporting. The components are intended to provide an integrated way of optimizing engineering practices, managing the life cycle of an automation project and meeting validation or quality system requirements such as those specified by 21 CFR Part 11 regulations or NERC.

Let's look in more detail at the four key pieces of a change management system:

- *Version control.* This feature ensures that only one person at a time can make changes and that versions are archived as changes are made. For example, if an engineer is making a modification to an existing HMI screen, a change management system will keep track of the current version of that screen from the server. Thus, files are maintained centrally.

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Change management helps semiconductor facility boost safety and cut downtime

An environment of constant change in a volatile, dynamic chip market prompted NEC Electronics, a West Coast semiconductor fabrication facility, to embrace the benefits of change management capabilities. It increased safety and reduced downtime and waste due to its installation and application of Proficy* Change Management, GE Intelligent Platforms' solution for managing data assets in an industrial environment. The company also uses GE's CIMPLICITY* 7.0 to manage its very large HMI system.

The company uses more than 100 PLCs and numerous computer programs. Changes are made constantly as engineers modify programs offline and then return them to the server for use. Revision problems resulted as the staff sought to ensure the correct and current programs were on the server. In addition, NEC is in the process of installing some 300 new proprietary tools, frequently upgrading and improving its operation. And product waste was an issue for the fab plant, with significant dollars lost any time a line went down; it can take an hour or two to diagnose a problem, in some cases leading to wafer destruction.

With the installation of change management capabilities, there are fewer failures and recovery from failure is quicker, as the technology brings consistency to maintaining the hundreds of programs used in the operation. "Once it saves you a couple of times, it becomes invaluable," said Joe Gruber, director of process controls for the Barry-Wehmiller Design Group, who works with NEC at the facility.

NEC notes it has had many programmers at the plant over the past 20 years. "We are finding errors in programs that occurred some four years ago," said a company representative. "With change management, we know who made that change, and we can go back through all of the changes that person made and see if any errors migrated through the system."

Said to be one of the safest semiconductor plants in the world, the NEC facility has numerous redundant systems, using multiple sensors in a single gas tank and fail-safe wiring design. Change management is helping to make it even safer as the new system works with all types of equipment—from process devices to HVAC components.

The engineer works on the screen, saves the changes and then checks the file back into the system. The "check-in" process creates a new version and marks it as the current one.

Among the benefits of version control is the ability to revert back to a previous one, if needed. If someone changes something inadvertently and an alteration disrupts the application, a record is available of what happened and of the previous version. It gives management the ability to track all changes and generate reports of what happened. Only one "latest version" exists.

- *Security (access control)*. The ability to monitor and control who has access to what reduces the number of errors that occur due to unauthorized access. If something unexpected happens, management can easily determine who made a change and whether or not they had authorization. Your permissions hierarchy should be set up in a role-based fashion. For example, only the maintenance staff may modify process system screens; only engineering may create a new HMI screen; and technicians may view but not change process screen parameters. Role-based hierarchies are more efficient, eliminating the need to establish permissions for every employee.
- *Audit trails and reports*. This function tracks what is happening with programs and devices in the plant. It may be compared to a logbook or activity record, providing an accurate method for tracking changes, automatically logging who did what, when, where, and why, and time- and date-stamping the entry. More than a version record, such detailed tracking is important—and, in fact, required—in many food and drug and pharmaceutical applications. The U.S. Food and Drug Administration (FDA) can require certain industries to produce such records on demand should an incident occur or other reason for monitoring food or drug activities arise. Once important only in certain industries, such audit trails are increasingly becoming necessary in more areas of manufacturing and in infrastructure industries such as water, oil and gas, power, and metals and mining.

Many audit trail systems have configurable settings, allowing management to select what information will be logged. Audit information is also maintained in a server-based arrangement. An integrated report generator allows data to be sorted and filtered, and compiles reports according to need. Audit trail databases may be maintained in a variety of formats, including Microsoft® Access, SQL or Oracle.

- Automated scheduling, notification and reporting. A change management system is applicable to just about

any document in the plant, from HMI/SCADA operations to PLC equipment. Because of the broad-based nature of plant activities, it is advisable to check the integrity of what is happening on a regularly scheduled basis. For instance, is process line #1, which is now running in your plant, actually using the most up-to-date application information available on the server? Is the process using the correct information?

Whether it is once a day or once a week, functionality that automatically reviews server files and compares them to what is running should be part of every change management system. And management may be notified of any discrepancies through regular automatic reporting. Notification to the appropriate people can be done through email and comparison reports distributed and incorporated into audit trails. It is beneficial to have a remediation process to define the workflow required to deal with these exceptions to determine root cause and prevent these conditions in the future.

Such schedule-related functions yield a number of benefits, most notably the elimination of repetitive tasks and reduced downtime. Unexpected, unwanted or undetected changes can lead to safety issues, product quality errors and liability concerns. In one case, a temporary change in a PLC resulted in a bypassed safety switch during a maintenance procedure, whereby a technician forgot to return the switch to its original position when the work was completed. Change management scheduling functions can help prevent such dangerous oversights, as the human element can always fail.

How does change management reduce TCO?

Effective change management generates various savings:

- It reduces development costs by tracking changes, preventing overwriting of work in a multi-user environment and integrating activities into the HMI/SCADA environment.
- It reduces deployment costs by capturing changes during critical commissioning activities, ensuring that all changes are recorded and backed up, and documenting actions to support maintenance.
- It reduces maintenance by increasing safety and security, performing audit trails, managing version control, providing notification of changes, documenting and reporting activities, and easing disaster recovery, should one occur.

Consider also the impact of these factors:

- Collaboration is important, especially in environments where multiple engineers and technicians perform many and varied tasks, and each one needs to know what the others are doing. They need to know what has already been done or what has been tried, and who did it so that no time and effort are wasted repeating or re-inventing. Functions that can be

re-used in multiple applications need to be easy to access, and everyone needs to know what is available and where to find it. Change management organizes and simplifies such tasks.

- Information flow must be free and clear. Oftentimes, those who develop a system are not the ones who maintain it. In fact, many times, developers are outside integrators who are no longer present once the project is done. Maintenance staffs may need to take over the installation without a lot of input or answers to questions addressed by change management such as “Why was it done this way?” or “Why was this changed?”

The flow of information must extend through all phases of plant projects and activities, from define and design to development, deployment, and operation and maintenance. If project documentation, design documentation, testing procedures, and more all reside in one central place, they are accessible to everyone. Maintenance personnel faced with troubleshooting a problem will have the latest version of all information and documentation and the entire change history of an application, including what modifications were done and who did them. Change management systems make it simpler to determine what is happening and easier to apply a remedy.

Here are some examples. During the design phase, a significant amount of work is done using documentation. Therefore, why not manage the documents and make sure the design is indeed the latest one? A system employing version control ensures this control. During development, documents are checked in and out frequently. Change management ensures work is being done on the current plan and that only one person at a time is making changes—saving time and avoiding duplication or even destruction (through over-writing) of effort.

Change management offers significant savings opportunities, especially during deployment and commissioning phases. With multiple staff members working on a system installation, it is mandatory to have careful control of modifications. Invaluable change management capabilities ensure that all details are recorded and are available for future recall. Often changes are made in a plant and no one backs them up, or they are made but not noted in the finished deployment documentation. Change management provides savings from both a lost work and future maintenance perspective.

In the operations/maintenance phase, change management capabilities help keep a system up and running efficiently and effectively. With all the latest information and backups in place and accessible in a central location, quick recoveries are virtually guaranteed. Subsequent maintenance workers

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arrive knowing what changes were made previously, simply by reviewing the change history and audit records. All change management activities come together and readily show the benefits of this technology.

Conclusion

There are more to costs than just those incurred through project development and ongoing maintenance. Change management technology offers an automated way to help your organization assess, monitor, manage, control—and lower—project costs as well as ongoing maintenance costs.

Can change management technology help your company reduce the TCO of your HMI/SCADA and control systems, and manage and maintain projects and systems more effectively? Ask yourself the following questions:

- Has your operation been unable to restore programs quickly when a PC or device fails?
- Have you lost engineering time because work was accidentally lost and no backup existed?
- Has equipment damage occurred in your plant because an incorrect program was loaded into a device?
- Is your operation monitored by a federal agency that requires compliance documentation?
- Do you use devices from various manufacturers and lose time because you must use many different interfaces?

If you face any of these issues, consider the benefits of a change management system. Change management tools should not be viewed as prototypes, as they are neither new nor untested. Although embryonic in manufacturing, they are commonly available and frequently used in the mainstream IT environment.

“We would never undertake a large software project without a change management system in place,” says one IT manager. And yet it happens in manufacturing, although more and more companies are beginning to recognize the payback benefits and are embracing change management capabilities.

No aspect of the project life cycle is untouched by change management; these capabilities play critical roles in managing all elements of the project life cycle—throughout that life cycle. Whether it is during assessment and design, development and deployment, or operation, maintenance, and servicing, the benefits of harnessing such technological advances such as version control and audit trails are immeasurable.

Economic justification of new technology is often challenging, especially when benefits can be intangible or difficult to quantify. Change management is difficult to define in terms of “dollars per widget saved.” Nonetheless, increasing complexity of manufacturing operations, coupled with an expanding regulatory environment, is raising awareness and pointing toward the need for these centralized monitoring and control systems.

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