ARC WHITE PAPER

By ARC Advisory Group

JANUARY, 2010

Yokogawa VigilantPlant Services™ Provide a Sustainable Approach to Continuous Plant Improvement

ARC
Advisory Group

THOUGHT LEADERS FOR MANUFACTURING, ENERGY, & SUPPLY CHAIN

VigilantPlant Services Combined with Yokogawa Project Address the Entire Plant Lifecycle

Yokogawa's Portfolio of Operational Services is Growing Considerably

Executive Overview

Process automation end users are under more pressure than ever to do more with less. The current economic climate means that many automation capital projects are on hold. With capital budgets tighter than ever, users instead focus on operational budgets (where cost cutting is also a key concern), or on automation investments with a very rapid return on investment. Users no longer look to justify automation spend with a 12- or 18-month return on investment. Instead, the window has shrunk to six months or less. Many of today's non-project related services could provide this rapid return on investment.

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Automation suppliers are aware of the need to provide a wider array of operational services that enable end users to get the most out of their automation assets. However, the effectiveness of the services they can provide will directly reflect their own strategic approach to automation, internal business processes, industry-specific expertise, and ability to do business with clients anywhere around the world.

Yokogawa is one process automation supplier that has a good understanding of what it takes to develop a good operational services business. Today, the company has reorganized its operational and consulting services business under the name, VigilantPlant Services. This revolves around the philosophy of packaging services and solutions to support manufacturers in their continuous improvement activities throughout the plant lifecycle.

VigilantPlant Services™ consider the current state and scope of each end user's continuous improvement program. VigilantPlant's overarching message is to see clearly, know in advance what problems and issues need to be addressed, and act with agility to make fast and intelligent decisions. VigilantPlant Services follows this same model with three basic services-related domains: Opportunity Identification, Solution Implementation, and Lifecycle Effectiveness. Quick returns can be achieved using VigilantPlant Services. Yokogawa can execute almost all the services outlined in this report within a period of several months. Yokogawa also ensures that these services will be sustainable for the life of the plant with regular Lifecycle Effectiveness reviews.

User Requirements Fuel Growth in Operational Services

The global automation marketplace faces some tough times. Capital projects are being postponed, companies are experiencing huge layoffs, and growth levels in developing economies, such as China and Latin America, are slowing down to the lowest levels in years. These, and several other

> During these times of economic crisis, no segment of the automation market is growing faster than services. Automation suppliers and end users must align to take advantage of the growth and cost reduction opportunities, respectively, offered by the expanding range of services.

factors, will impact growth in the automation services business over the next several years. ARC identified the services business as the fastest growth segment of the DCS market almost ten years ago. The initial shift to a services-intensive automation marketplace came about because of the wave of downsizing that occurred in the process industries throughout the 1990s, combined with the increasing support and ongoing costs associated with automation systems and the automation infrastructure. This was due largely to the influx of commercial-off-the-shelf operating systems, hardware, and software components into this space.

Of course, conventional **project services**, including the popular main automation contractor (MAC) services subset, account for a big part of this growth in the overall services business. The highest growth in the services business, however, is in **operational services**. These include a vast array of services, from those dedicated to increasing plant performance, to remote control system monitoring, alarm management philosophy development, and others. The operations phase of the lifecycle deals with all activities required to run the combined assets of the plant on an ongoing basis. As the largest lifecycle phase, operations has the most significant impact on lifecycle cost. As the trend toward outsourcing grows, users will increasingly look to automation suppliers to provide many of the daily operational services they used to handle in house.

Operational Services can Produce a Rapid Return on Investment

There are several reasons for the increased growth in operational services. The current economic climate means that many automation capital projects are on hold. With capital budgets tighter than ever, users instead focus on

operational budgets (where cost cutting is also a key concern), or on automation projects with a very rapid return on investment. Users no longer look to justify automation spend with a 12- or 18-month return on investment. Instead, the window has shrunk to six months or less. Many of today's non-project related services could provide this rapid return on investment.
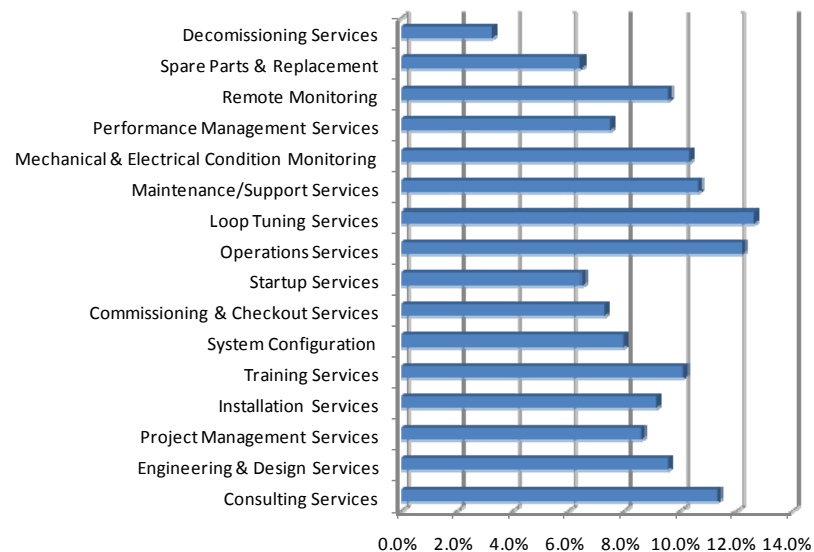
Relative Growth Rates of Supplier-Provided Automation Services Clearly Show the Most Growth Is Concentrated in After Sales Operational Services and Consulting

Addressing the Labor Crisis through Outsourcing Services

From the retiring wave of baby boomers in North America, to the shortfall of qualified engineers in Asia and other parts of the world, the labor shortage is the primary factor behind growth in demand for services. In a recent interview, a major refining company stated it had lost 2,500 years of experience last year when 100 operators retired at one site, each with an average of 25 years of experience. As further evidence, a major chemical company analyzed its plant demographics and found one of its largest plants would lose 75 percent of its operating staff to retirement by the end of this decade. This is also true for many discrete manufacturers.

At the same time, the engineering and construction firms that used to have deep expertise in automation now instead concentrate on their core business of managing projects and licensing technologies. This leaves the automation suppliers to pick up the slack and provide an increasing array

of services across the plant lifecycle, from control system design, installation, and startup, to the operational phase of the plant.

The Need for a Lifetime Partner

ARC has long advocated that automation users should form collaborative partnerships with automation suppliers. The true collaborative partnership goes beyond initial cost concerns and focuses on increasing plant performance and driving bottom line economic benefits from automation. This usually means forming a team consisting of representatives from both the supplier and end user company and holding periodic performance reviews. It also involves a fairly sophisticated approach on the part of the end user to determine the true lifecycle cost of the system and other performance benchmarks.

Collaborative partnerships are often born of necessity. Many end user companies today are a conglomerate of many companies acquired over the past several years, all with their own installed base of control systems, and all with their own views on process automation. In an effort to eliminate this large and diverse installed base, many companies have embarked on efforts to standardize on automation suppliers in their organizations. This usually means a phased or total migration of legacy systems from one supplier to those of another. Standardization efforts like this require a lot of commitment and follow-through and can meet harsh resistance from engineers, operators, maintenance personnel, and others in the organization.

In many cases, end users choose to standardize on suppliers for certain operating or business units within the company. For example, a company with diverse business units may find one supplier meets their needs for large continuous process operations, while another supplier fits better for batch or specialty material manufacturing.

If an end user is to standardize on an automation supplier and form a true collaborative partnership with them, ARC believes this should be done in the context of a long-term, lifetime relationship with that supplier. The supplier partner should share a common vision with the end user company or owner operator. A true lifetime solutions partner should be able not only to identify new improvement possibilities in plant operations, but also must have the resources to execute the project and provide the proper re-

sources. This includes the ability to identify and resolve issues, employ best practice methodologies, and sustain the effectiveness of the end user's installed solutions over the entire plant lifecycle.

Yokogawa has always strived to create collaborative partnerships. Today, the company is more dedicated than ever to ensuring that it will retain its existing end users and form lasting relationships with new end users. ARC feels that developing collaborative partnerships with end users is necessary for the long-term survival of any automation supplier. As end users increasingly understand that, through collaborative partnerships, they can take advantage of the increased solutions capabilities of automation suppliers (including advanced control, optimization, and enterprise production management software and services); these partnerships will spread across a wider range of industries.

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Globalization Presents More Service Challenges

Globalization presents an increasing challenge for end user companies. Many suppliers feel increased pressure to provide increasing levels of service and support around the world. Services have fast become a primary differentiator for suppliers, and more end users now demand that suppliers provide them with an increasing scope of services in increasingly diverse locations around the world. Being able to follow end users into any market in the world is becoming essential for suppliers. For end users, this means conducting stringent reviews of their global suppliers' capabilities, and end users must also consider the impact of placing too much load on preferred suppliers, since doing so can potentially stretch a given supplier's capabilities to the limit.

Increasing Complexity Makes it Harder for Users to Implement and Sustain Improvements

Even in an environment of reduced staffing and the shortage of qualified personnel, the business of process manufacturing is becoming increasingly complex. Health, safety, and environment used to be the primary concerns. Today a host of additional issues must also be addressed. At the same time, plants are becoming more automated. Operators themselves are more bur-

dened as well, with the average process operator responsible for 300 to 400 control loops.

Continuous improvement issues also come into play. While end users often find it difficult to identify new improvement opportunities, the same labor issues and time constraints make it equally difficult for them to resolve issues that have already been identified. If they do have the time to implement improvements and address issues in the plant, then sustainability comes into play. Does the end user have the resources to sustain the improvements already made, much less continuously identify and implement new improvements? A lifetime solutions partner with the appropriate resources can make all of these things happen in a sustainable environment of continuous improvement.

Yokogawa Builds on Experience Gained in the Japanese Market

Yokogawa has a wealth of experience providing users with operational services, identifying areas of improvement, and sustaining these improvements. Japanese process automation end users have already had to deal with many of the issues that now affect end users in other parts of the world. The Japanese process manufacturing industry, for example, went

Visibility of information:
Stable and accurate real-time information exchange throughout the plant

SEE CLEARLY

KNOW IN ADVANCE

Predictability of process:
Predictive intelligence anticipates changes and helps you plan your actions in advance

ACT WITH AGILITY

Agility of business:
Value chain-driven responsive operation via adaptive production management and fast intelligent decisions

Yokogawa VigilantPlant Services Line Up Well with the Overall VigilantPlant Philosophy

through its own mass retirement of experienced workers back in 2007. As a result, Yokogawa has done a lot of outsourced services for its end users in Japan. The company also completed a large number of modernization projects and performed many control room consolidation projects.

Japanese manufacturers have to deal with much higher shipping costs because of the lack of natural resources in Japan, most

of which must be imported. Japan also has extremely tight environmental and safety regulations. Yokogawa is able to drive this experience and the operational experience it has gained from its installed base around the

world, along with its correspondingly experienced staff of service people and consultants, to train new service people around the world.

VigilantPlant Services Builds on Yokogawa's Strategic Vision

Yokogawa's primary challenge has always been to market itself effectively and rid itself of its "quiet company" image. Often, the company has many years of success in various aspects of the process automation business that are little known outside of its native Japan. The company's operational services business is no exception. Here, Yokogawa has a 20-year history of providing operational services to most of the major owner operators in the refining, chemical, oil and other industries. It has been steadily expanding this capability outside of the Japanese market for several years.

After its VigilantPlant campaign, Yokogawa had developed a strategy to communicate its capability in operational services to the global marketplace. The VigilantPlant campaign, which is both a marketing strategy and an internal corporate reorganizational strategy, gives the company a single face around the globe and leverages its capabilities on a global level. Today, the company has reorganized its operational and consulting services business under the name, VigilantPlant Services. This revolves around the philosophy of packaging services and solutions to support manufacturers in their continuous improvement activities throughout the plant lifecycle.

The VigilantPlant Path to OpX

VigilantPlant Services consider the current state and scope of each end user's continuous improvement program. VigilantPlant's overarching message is to see clearly, know in advance what problems and issues need to be addressed, and act with agility to make fast and intelligent decisions. VigilantPlant Services follow this same model with three basic services-related domains: Opportunity Identification, Solution Implementation, and

Lifecycle Effectiveness. Opportunity Identification Services identify new improvement possibilities and prepare for solution implementation. Solution Implementation Services implement identified improvement solutions. Lifecycle Effectiveness Services sustain the effectiveness of installed solutions. VigilantPlant also focuses on the four basic areas of Safety Excellence, Production Excellence, Asset Excellence and Lifecycle Excellence.

Major target markets for VigilantPlant Services include Yokogawa's core verticals of oil and gas and chemicals. The power industry is also a major focus. Yokogawa has a large presence in the Japanese and Asian power markets and is undergoing a major strategic initiative to expand this capability worldwide. Initial applications for VigilantPlant Services in process plants include alarm rationalization, automation of procedural operations, HMI performance improvement, operator performance improvement, improvement of basic process control, and control room consolidation.

Opportunity Identification Services™: Understanding Plant Potential

Most end users do not have good visibility into the overall effectiveness of their automation systems. In the past, a company's strategic advantage was measured by its size. Today, strategic advantage is measured by effectiveness, agility, and overall performance.

Representative Business Objectives		Yokogawa Solutions		Improving Effectiveness
HSE Protection	Safety Excellence HSE Protection	Safety Instrumented System ProSafe-RS		Alarm
				Controllability
		Alarm Management System Operator Assistance System CAMS Operator Training System OmegaLand		Alarm
				HMI
				Operator
		Process Control System CENTUM VP		Alarm
				HMI
				Controllability
Cost Min Profit Max Operation	Direct Operating Expense	Production Excellence Production Optimization	MES, PIMS Real-time Production Organizer	Production Accuracy
			APC, AOA Exapilot	Operational Efficiency
			Process Control System CENTUM VP	Controllability
			Field Instrument, Online Analyzer	Measurement Accuracy
	Indirect Operating Expense	Asset Excellence Asset Utilization	Asset Management System PRM	Reliability
			Condition Diagnostics InsightSuiteAE	Availability
		Lifecycle Excellence Plant Uptime Maximization	Cleaning, Repair, Replace	Reliability
			PC Technical Refresh, Software Update	Availability
			Spare Parts Management, Training	Serviceability
			Database Backup	Integrity
			PC Security, Network Security	Security

Yokogawa's Opportunity Identification Services can Identify Areas for Significant Operational Improvement

Thus, it's critically important to be able to accurately determine the overall level of plant performance. In manufacturing, the need for knowledge is the common thread that runs through these characteristics. Deep knowledge can be obtained from the operational data and information that comes out of the process automation system. The relationships and patterns that exist in this data and information are critical to understanding and continuously improving effectiveness, agility, and overall performance. The true collaborative process automation system can enable users to discern this knowledge and use it to improve performance.

Yokogawa's Opportunity Identification Services target new possibilities for operational effectiveness and improvement and help the end user prepare for the improvement project by providing a deeper understanding of plant performance in several key areas. Currently available Opportunity Identification Services include Profit Finder -a web-based feasibility study service, Comparative Effectiveness Analysis, Master Planning, an Improvement Leader Development Program, and Yokogawa's own Management Seminars.

This is where the expertise of Yokogawa's consultants becomes crucial. In many cases, Yokogawa must lead the team and point out what problems may exist, even if it sometime means playing the "bad guy" by pointing out previously unrecognized issues to the end user. The Yokogawa consultant needs to be a good facilitator, point out probable root causes, and recommend countermeasures.

Yokogawa's Profit Finder Service Generates Reports that Help Users Determine the Effectiveness of their Installed Automation Solutions

Consulting Services Dispatched at the Commissioning Phase

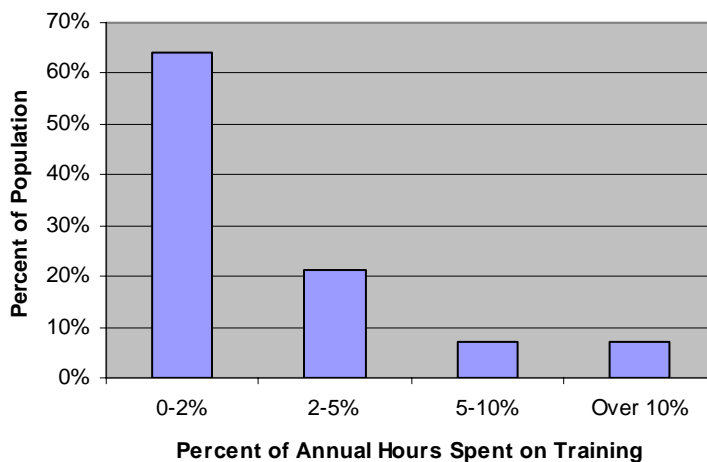Over the past few years, Yokogawa reorganized its approach to higher-level services by dispatching consultants in the commissioning phase of an automation project, rather than well into the operational phase of the plant. By dispatching consultants in the commissioning phase, Yokogawa con-

sultants can more easily identify opportunities for improvement in the plant. The consultant then forms a long-term relationship with the end user at the plant level and becomes like a "family doctor" that is available on call when needed.

Comparative Effectiveness Analysis

The Comparative Effectiveness Analysis service is a benchmarking service that looks at the end user's installed automation platforms (DCSs, safety instrumented systems, plant asset management systems, and so on) and compares the effectiveness of the previously installed systems of end user, or those currently installed at the end user's own company. Benchmarking data is also available from competitors through Yokogawa's considerable KPI database. KPIs include alarm, HMI, Control, Operator and RASIS performance (Reliability, Availability, Serviceability, Integrity, Security). Specific control system effectiveness metrics and KPIs include percent of time spent in automatic, percent of time without deviation, number of repeating or longstanding alarms, number of manual interventions per operator, and number of control loops per operator.

Based on these measurements, Yokogawa submits a half-year report that helps end users identify their primary challenges. As part of the service, Yokogawa loans online data acquisition and index calculation software to the end user and provides index and normalization algorithms. These are enhanced regularly based on discussions at Yokogawa's end user consortium and information from Yokogawa's KPI database. Yokogawa can then offer solutions based on the challenges identified during the opportunity identification phase.

ARC Survey Showing Training Hours Spent per Year as a Percentage of Total Hours

The Importance of Training Services

Increased investment in training is essential to derive the real value from implementing advanced technologies, such as optimization, plant asset management, and real-time performance management. In developing regions, such as China, where users typically specify the latest

technologies, workers must be trained and educated to an even greater degree. ARC has observed that suppliers that have made greater-than-average investments in training and education have had greater success in projects and have generated more future business.

Management Seminars

Yokogawa's Management Seminars provides management-level end users with a view into future operations trends and helps them identify their next challenges. Yokogawa serves as a facilitator in the seminars and helps develop a future action plan. These seminars are two-way data exchanges where the end users explain their direction and Yokogawa explains how they can address their challenges and deliver solutions.

Master Planning Services

Master Planning Services are a natural next step after the Management Seminar. After identifying the primary end user challenges, a plan must be developed to address how these challenges will be met. In Master Planning Services, Master plan creation includes budget planning and ROI targets. Yokogawa specifically wishes to target Master Planning Services at control system migration, plant modernization, and control room consolidation projects.

Course	Description	Lengths
Alarm Rationalization/ Fundamental Nuisance Alarm Reduction	Develops improvement leaders who can identify the root causes of existing nuisance alarms and take proper countermeasures to reduce them, facilitating a discussion by cross-functional team.	1 day
Alarm Rationalization/ EEMUA #191-based Alarm System Design	Develops improvement leaders who can establish the consistent policy for alarm system design based on HAZOP and EEMUA #191 guideline.	2 days
Alarm Rationalization/ Operational State-based Alarm Management	Develop improvement leaders who can design alarm thresholds and alarm suppression based on the different operational states.	
Best Practice Pilot	Develop improvement leaders who can standardize and automate non-automated procedural operations based on the best practice.	2 days
Regulatory Control Stabilization (PID Tuning)	Develops improvement leaders who can analyze the current regulatory control performance and achieve more stabilized control by PID parameter tuning.	2 days

List of Yokogawa Improvement Leader Development Program Courses

Improvement Leader Development Programs

The Improvement Leader Development Program is essentially a virtual on-the-job training environment based on a dynamic process simulator that enables end users to develop an improvement leader and measure the impact of their proposed improvements. This is a natural next step after the Effectiveness Analysis and Master Planning Service. To implement an improvement, no matter how big or small the investment, users require a project leader who understands the practical methodology for improvement.

Improvement Leader Development Program training sessions provide a deep dive into the material around which the improvement program is structured. For example, Yokogawa offers a one-day program for Fundamental Nuisance Alarm Reduction Training. Here, the leader is taught how to analyze alarm and event logs acquired from virtual plant to identify possible causes and countermeasures to be taken using Yokogawa's Exaplog software. Yokogawa also offers a 1.5-day program on EEMUA#191-HAZOP based Alarm System Design training. In this instance, the improvement leader learns how execute a HAZOP study and EEMUA#191 study, implement the result into the CAMS alarm management system, and confirm whether necessary alarms were displayed when a typical plant upset occurs. Other Improvement Leader Development programs include Operational State-Based Alarm Management, Automation of Procedural Operations, and Regulatory Control Stabilization.

Solution Implementation Services™: Turning Knowledge into Action

The Solution Implementation Services are the next logical step in the chain after Opportunity Identification Services. With Solution Implementation, Yokogawa works with the end user to implement the solutions identified in the Opportunity Identification process, while working with internal experts developed under the Improvement Leader Development programs. Yokogawa's Vigilant Plant Services engineer acts as facilitator of an end user's cross- functional team that identifies the root causes of problem and its countermeasures. VigilantPlant Services engineers also act as solutions providers, identifying the appropriate countermeasures from the full scope of Yokogawa services. Yokogawa's portfolio of Solution Implementation

Services is organized around Safety Excellence, Production Excellence, Asset Excellence, and Lifecycle Excellence.

Alarm Management-Related Services

One of the fundamental groups of services available under the Solution Implementation umbrella is Alarm Rationalization services. These sustain the end user's alarm system performance over the entire plant lifecycle. Yokogawa currently has three entry levels available for end users considering alarm rationalization programs: Fundamental Nuisance Alarm Reduction, EEMUA #191-based Alarm System Design, and Operational State-based Alarm Management. All Yokogawa alarm rationalization related services are performed using a six sigma define, measure, analyze, and improve process with an eye towards continuous improvement.

Yokogawa's Alarm Rationalization service identifies root causes of nuisance alarms and its countermeasures. Some nuisance alarms are caused by maintenance, some by poor control, and so on. To identify the root cause of these alarms, the end user needs to establish a cross-functional team of maintenance people, control engineers, and other stakeholders. In many cases, the end user may want a third party to lead this team, and Yokogawa can fill that role.

DMAIC Yokogawa's alarm rationalization service is based on standardized Six Sigma DMAIC methodology. This provides clear and effective steps to achieve a defined target while ensuring consistent and high levels of service quality.

Yokogawa's DMAIC Approach to Alarm Rationalization

Best Practice Pilots for Procedural Automation

Yokogawa has also done best practice pilot projects, where it implements industry best practices to certain functional areas of the process automation infrastructure. One area where Yokogawa has considerable work implementing best practices is in capturing, standardizing, and automating procedural operations.

In 2000, Yokogawa introduced Exapilot – an automated procedural control solution now installed in over 1,000 plants around the world. With Exapilot, by describing the expertise of non-steady-state operations by experienced operators as a graphical flow diagram of the sequence of actions, the operations can be fully- or semi-automated. In addition to Exapilot, the Exaplog event analysis package helps to refine the controllability of a plant and identify parts of the plant operation that could be improved. Combining Yokogawa's consulting skills with products such as Exapilot allows users to integrate operator actions and the control system into a single unified environment for best practice plant operation. Some operators have a lot of knowledge, but are not familiar with computers or Exapilot, so someone has to put this knowledge into Exapilot. Yokogawa knowledge engineers specialize in capturing this knowledge from experienced workers and driving it into the system.

Yokogawa's DMAIC Approach to Best Practice Pilot Services

Control Room Design and Consolidation

Yokogawa also offers services for control room design and consolidation. Many firms can design good-looking control rooms, but only a handful can design them around true workflow and worker roles. Yokogawa control room designers understand business workflows in process plants and can build control rooms accordingly to maximize workflow effectiveness. They can also figure in factors such as control system migration project concerns and overall system functionality. Many control system migration projects today also result in some form of control room consolidation. Yokogawa also has the knowledge to complete control room consolidation projects effectively and to meet the objectives of the often-related hot cutover control system migration projects.

Lifecycle Effectiveness Services™: Providing Sustained Performance

Solutions can be implemented, but if not continuously maintained and re-evaluated, they lose their effectiveness. This is particularly true for more complex solutions like advanced control and optimization, alarm management, and loop tuning. In advanced process control (APC) applications, for example, maintaining controller performance is often more difficult than the initial setup, but is the key to sustaining long-term benefits. The performance of an APC application deteriorates over time due to equipment degradation as well as deliberate or unintentional changes in the operations of the process.

Feedstock, products, and ambient conditions are dynamic in process plants. Many advanced applications generally adapt poorly to these changing conditions and must be adjusted to maintain maximum benefits. Without proper maintenance, these advanced applications will fail to provide any benefits and fall into disuse after only a couple of years. To maintain the benefits, companies must have a sound plan and established workflows and best practices to ensure that tools, people, and processes are in place to respond accordingly.

Quick returns can be achieved using VigilantPlant Services. Almost all the services outlined in this report can be executed within a period of several months. Fundamental nuisance alarm reduction, for example, can take as

little as two months for the end user to see a return. A Best Practice Pilot to eliminate manual interventions can again see results in as little as four months. These improvements will not be sustainable over time, however, without regular maintenance and review. Lifecycle Effectiveness Services fulfill the maintenance or continuous phase of the Yokogawa-implemented solution, providing sustained effectiveness as well as a means to identify further opportunities for improvement.

Managing for Service Quality

For an end user, outsourcing services to an automation supplier has both many benefits and many potential drawbacks. Automation end users without adequate internal resources often find it cost-effective to partner with an automation supplier like Yokogawa. Over the past several years, automation suppliers as a whole have greatly increased their knowledge base of the automation and controls marketplace. The automation suppliers have stepped in to fill the services requirements for the end users. Many key people with expertise in automation that are retiring from the end user companies now find second careers as consultants and engineers at supplier companies. Still, there are many pitfalls to avoid when dealing with automation suppliers for outsourced services. Quality of services, for example, is a key concern. The supplier must have consistent processes in pace to ensure overall level of competence and quality is maintained.
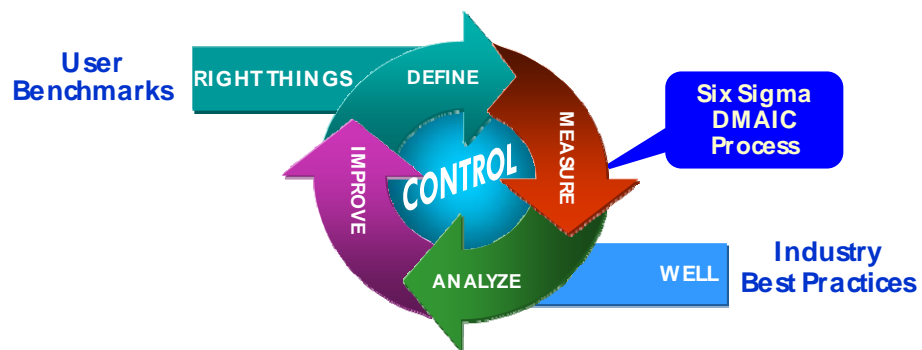
The Six Sigma DMAIC Process Means Doing the Right Things Well in an Environment of Continuous Improvement

Yokogawa has implemented a quality management culture around Vigi-lantPlant Services. This includes standardization of services procedures according to DMAIC processes. Certified managers manage the quality of the services business, and certified engineers deliver the services. Certified

quality managers check the validity of the services delivery procedure. These procedures are the same for Yokogawa on a corporate wide basis across all regions. Third-party service companies do not always have these procedures in place.

Yokogawa's staff of certified VigilantPlant Services trainers certify solution engineers through training programs based on Yokogawa's dynamic simulation environment. VigilantPlant Services engineers must have a wide range of required capabilities, from industry-specific engineering backgrounds to control and measurement engineering expertise, knowledge of the overall manufacturing business, comprehensive product knowledge, communication skills, and real world operational experience. Yokogawa recently held certification program sessions in Southeast Asia, the Middle East, Europe, Australia, Latin America and Japan. The company now has more than 50 certified VigilantPlant Services engineers, and that number is growing.

## Major Chemical Manufacturer Deploys VigilantPlant Services to Deal with Grade Changes

Yokogawa has already successfully deployed VigilantPlant Services-based solutions at many plants. One particular chemical manufacturer of high density polyethylene and polypropylene plant worked to automate their grade change operations with Yokogawa VigilantPlant Services engineers in combination with the Exapilot application to automate procedural operations. The goal was to reduce operating time, engineering time, and to preserve operational expertise that was slowly but surely leaving the plant in the form of retirements. The grade change operation is executed about once a day in this particular plant, which handles large grade/small volume production.

> Grade change is a complex operation that requires more than twice the operational procedures as a steady state operation.

Grade change is a complex operation that requires more than twice the operational procedures as a steady state operation. As the process was changed spontaneously, it was difficult for the DCS to monitor it at fixed points, so continuous monitoring was required, primarily through the use of trend graphs. As the timing of

manipulation and judgment all differed according to the skill of operators, this caused great variation in operation time and fluctuation of the volume of transient products at grade-change. These operating states had not been automated in the DCS and were executed manually. It was simply too difficult to automate these procedures with a DCS, since the frequent changes in product and operations would mean too much in the way of engineering time. Yokogawa assigned a VigilantPlant Services engineer to the project.

Through a Comparative Effectiveness Analysis, the manufacturer was able to benchmark the effectiveness of grade change operations, and clearly identify the needs for its standardization and automation. The manufacturer assigned a project leader, who attended the Improvement Leader Development Program so that he can understand the strategy and methodology of coming improvement project and functionalities of Exapilot software using dynamic simulation environment. At the beginning of the project, the VigilantPlant Services engineer selected the target operations with established cross-functional team including a leader, instrumentation engineer, and experienced operators. For optimal operation, existing Standard Operating Procedures manuals, historical data of past grade-change operations and operational expertise of experienced operators were collected. The VigilantPlant Services engineer then helped the leader standardized the operational procedures and knowledge of process supervision in consideration of Exapilot functions.
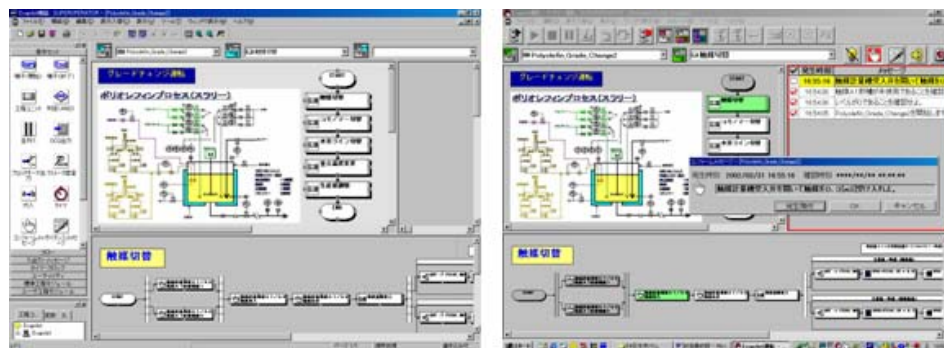
Exapilot Builder and Operation Windows

The VigilantPlant Services engineer worked with the team to develop a strategy to deploy the Exapilot application, which was installed on operator consoles, communicating with the DCS via an OPC connection. Using Exapilot to describe procedural operations and process supervision by experienced operators as a graphical flow diagram of the sequence of actions, the operations were able to be effectively automated.

After installation and startup, the complexity of DCS operations was significantly reduced. Manual interventions were reduced essentially to zero during grade changes, freeing the user for more value added tasks. Through the automation of operations and the optimization of operational procedures, it was possible to reduce the operation time of grade-change by as much as 10 percent compared with the previous operational strategy. The quantity of transient products at grade-change became more uniform, and it was possible to reduce off spec product by about 20 percent.

As the operation procedure was expressed in flowchart for anyone to understand easily, and it was clear what had to be monitored or operated. Common operational expertise became transparent not only to operators, but to everyone in the plant with a stake in operational expertise. Since everyone is using a common application, it also makes it easier to suggest and implement improvements.

In accordance with Yokogawa's DMAIC approach to VigilantPlant Services, the VigilantPlant Services engineer regularly reviews VigilantPlant Services engineer regularly reviews the effectiveness of the Exapilot application and proposes additional services if a degradation in performance is detected. The total profit generated by the implementation of the solution is currently $3 million over a 10 year period.

Yokogawa Strengths and Challenges

In ARC's view, Yokogawa has all the ingredients to make a successful operational services business and take advantage of the significant growth opportunities that such a business can offer. The company has experience both with its domestic Japanese end users and with major end users around the world. The company has a consistent set of tools that it can use to determine where improvements need to be made and to execute on an improvement plan. In its core industry segments, Yokogawa has much expertise that it can draw from to speak in the language of the end user and more readily identify problems and issues in a cost effective manner.

Of course, developing a sophisticated operational services business comes with a significant set of challenges. Yokogawa is developing this business as it strives to increase its presence in the overall process automation business around the world, particularly in regions such as North America, Latin

America, and the Middle East. This will naturally mean dedicating more resources to providing these services and maintaining them throughout the lifecycle of the plant. This can be very challenging, especially given the current economic climate. Nevertheless, Yokogawa continues to add personnel to its VigilantPlant Services business and certify these professionals using consistent processes on a global basis.

Many of the tools that Yokogawa uses to implement these solutions must also develop more of a global presence. The installed based for applications such as Exapilot is primarily in Japan and these applications are not well known to Yokogawa's global clients. The company will have to make investments in developing and marketing these toolsets if it wants to continue to capture the interest of global clients.

Lastly, in an environment of restricted capital spending and projects being put on hold or postponed, Yokogawa will have to make some very convincing arguments to end users that an investment in VigilantPlant Services can indeed present a quick return on investment and reduce the likelihood of unplanned downtime and plant incidents. The company is already building a database of success stories that can articulate this argument. One US copolymer resin plant used Yokogawa VigilantPlant Services to reduce its alarm load. The plant was experiencing 19,241 alarms per day. Through VigilantPlant Services, the end user was able to achieve a 93 percent reduction in unnecessary alarms after a two month project.

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Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/Research/IndustryTerms/

CAGR Compound Annual Growth Rate	**IOp** Interoperability
CAMS Consolidated Alarm Management System	**IT** Information Technology
	KPI Key Performance Indicator
CAS Collaborative Automation System	**MIS** Management Information System
CMM Collaborative Manufacturing Management	**OpX** Operational Excellence
	OEE Operational Equipment Effectiveness
CPG Consumer Packaged Goods	
CPM Collaborative Production Management	**OLE** Object Linking & Embedding
	OPC OLE for Process Control
CRM Customer Relationship Management	**PAM** Plant Asset Management
	PAS Process Automation System
DCS Distributed Control System	**PLC** Programmable Logic Controller
DMAIC Define, Measure, Analyze, Improve, Control	**PLM** Product Lifecycle Management
	RFID Radio Frequency Identification
EAM Enterprise Asset Management	**ROA** Return on Assets
EEMUA Engineering Equipment and Materials Users' Association	**RPM** Real-time Performance Management
ERP Enterprise Resource Planning	**SCM** Supply Chain Management
HAZOP Hazard and Operability Study	**WMS** Warehouse Management System
HMI Human Machine Interface	