



# The Resilient Plant: The Truth about Building Capabilities for Workforce Enablement

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## 1. Introduction

According to a recent ARC Advisory Group study, *Why We Need a Better Approach to Procedural Automation*, it was reported operator error is the leading cause of significant plant incidents. In process industries, these incidents account for the highest dollar loss per incident resulting in 42% of unscheduled plant shutdowns. Recently, a major oil company paid:

- \$15M in fines to the U.S. Environmental Protection Agency (EPA) as part of a consent decree
- \$51M in fines to the U.S. Occupational Safety and Health Administration (OSHA) related to one facility
- \$20B in escrow to the U.S. government to cover potential costs of an oil spill

Is this an exception? Hardly. A recent J & H Marsh & McLennan report documents the **average cost per major incident related to operator error exceeds \$80M**. The Chemical Safety Topical Committee, sponsored by the U.S. Department of Energy (DOE), findings reveal there is one chemical incident per day, on average, in the U.S. These incidents have an estimated cost of over **\$2 million per incident to comply with the Occurrence Reporting and Processing System (ORPS)** which is required by the DOE's Office of Health, Safety and Security (HSS). This ORPS cost does not take into account other direct or indirect costs such as repairing equipment/facilities, employee injuries, revising procedures, increased training, work slowdowns, stoppages during accident investigations, corrective action implementations and others.

*There has to be a better way ... and there is.* This white paper looks at the issues facing process industries today and presents a strategy framework that can yield step-change process improvements to your operational excellence objectives and can help you achieve true Workforce Enablement.

## 2. Why is Achieving World-Class Workforce Enablement so Difficult?

The problem is compounded by aging workforces and the need to assimilate new workers faster. The problem is further exacerbated by an ongoing deluge of new regulations creating an operating environment which did not exist the year before. **Traditional training alone can no longer overcome this aging workforce/regulatory compliance crossfire.** All organizations train their people and most spend significant money doing so. 90% of the respondents to the July 2010 McKinsey Quarterly survey said building capabilities was a Top 10 priority for their organizations. In addition, the study stated only 25% of the companies surveyed said their training programs were effective at improving performance measurably and only 8% percent track a program's return on investment (ROI). Do these situations sound familiar?

Here are what major companies have stated during interviews with Invensys:

*"Our traditional training was moved out of the actual job context and moved to less and less real situations."*

*"Our experts were removed from working with novices. For most roles in manufacturing environments there are very few situations where the experts in our organization can spend time coaching and mentoring others."*

*"There is very little post-training support; most of it is limited to manuals."*



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Many organizations have no idea whether or not they are getting real business value from their training investments. Companies typically measure training impact by conducting surveys of attendees or counting how many employees complete courses rather than assessing whether or not those employees learned anything that improved business performance. *We therefore have to ask:*

Has anything really changed much in training over the past 20-30 years? Cell phones are now a necessity, the Internet is vital to daily business and increasingly technology advances that drive real-time decision making are becoming critical factors in operating manufacturing and industrial facilities. Considering how dramatically and rapidly the technology landscape has evolved in only the past decade, it is worth time questioning the status quo:

- When industry experts estimate it takes 10,000 hours to develop an employee's expertise, what can you do differently to reduce the learning curve?
- When 30% of plant managers switch sites and/or companies annually, how can you best sustain a safety culture?

The McKinsey Quarterly report also noted it is imperative senior executives not only understand these training issue trends but think strategically about how to adapt management and organizational structures to meet these new demands. The report emphasizes that training programs generate greater value for organizations when the curricula reflect key business performance metrics (e.g., testing real-world outcomes is crucial).

## 3. Workforce Enablement Defined

Workforce Enablement encompasses many areas of plant operations, both inside and outside the control room (board operators, field operators, maintenance, EHS personnel, etc.). It is recognized as one of the foremost contributors to bottom-line performance improvements for industrial operations and is credited with safely delivering the highest possible availability, reliability and throughput to create a "resilient" plant environment. Workforce Enablement results from a combination of skills, tools and system design which include the following important elements:

- Competency-based learning
- Accessibility of information and procedures on demand
- Work processes/workflow decision support systems
- Human factor issues (situational awareness/responsiveness)
- Effective communications and collaboration
- Control room/system design and environment
- User interface design for relevance
- Abnormal situation management (including alarm system effectiveness)
- Automation and control system integrity and reliability
- Asset performance management (mechanical integrity and reliability)
- System data integrity (accuracy, reliability and security)

Many companies may not need or be able to resource process improvement initiatives across all of these elements. Instead what they require is prioritization which necessitates a Workforce Enablement strategy.

## 4. A Strategy to Improve Workforce Enablement

Let's first make sure we understand the goal.

**The goal:** Operation executives want to run plants safely and profitably and know in order to achieve these objectives they must empower employees to make better decisions faster. That's it.

The Workforce Enablement strategy framework should address the company's management of:



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- Content, control and decision support systems (knowledge, documentation, intellectual property)
- Learning (classroom and experiential)
- Business processes and workflow (required to support the organization's performance needs and continuous improvement)

These three key elements of Workforce Enablement success can be accelerated and sustained by innovative technologies to achieve the behavioral and culture change required for a high-reliability organization to make **better decisions faster**. Manufacturing competitiveness today requires a culture where people's behavior becomes more proactive, they take pride of ownership and actively contribute to continuous improvement. In today's multi-billion dollar business, simply having a high-performance team of empowered field and control operators running mission-critical processes, making better decisions faster while complying with procedural best practices is no longer a potential advantage ... it is a mandatory requirement to stay in business from year to year. Success is revealed by consistently delivering execution of best practices at the point of incident as the norm, not as an exception.

## 5. Getting it Right by Design

An effective Workforce Enablement program should be customized to a company's specific situation. The program assessment must at all times consider the impact changes will have on people, processes and assets. **"Getting it right" requires identifying and prioritizing where Workforce Enablement capabilities can best improve operational performance.** Where there is no situational awareness, there is complacency. Factors to be considered include:

- **Organization** – field workforce, control room and/or decision support
- **Disciplines** – operations, health/safety/environmental, maintenance/reliability
- **Locations** – process areas, control rooms, offsite areas
- **Workforce Enablement tools** – simulation, work process management, mobility, workflow, communications, etc.
- **Scope** – determining how the project fits into a risk management plan
- **Validation** – leveraging industry references and experts who have "been there – done that"
- **Justification** – quantifying the ROI payback period for management
- **Auditing** – assessing/tracking the benefits based on situational data

## 6. Workforce Enablement as a Response to Operational Challenges

Operations management faces many challenges in today's global economy as a result of intense competition, tight budgets and limited resources. In addition, the increasing complexity of plant processes coupled with greater risk in terms of environmental, health and safety considerations strain operations as they run closer and closer to safe operating limits. Workforce Enablement can help address many of the symptoms caused by these concerns including:

- Inexperienced employees who lack situational awareness to take proper actions
- Increased complexity of processes and procedural compliance
- Inconsistent execution of best practices across shifts, units and sites
- Inability to rapidly access proper documentation and procedures
- Immature safety culture that is not an integral part of day-to-day operations

These issues affect plant employees and supervisors at all levels. So, what can leaders do differently to combat the "crossfire" of high workforce turnover and increasing regulatory compliance and to better retain learned knowledge for future workers? According to ARC Advisory Group, 42% of all corporate knowledge is actually held by employees in personal memory (tacit knowledge). This recent report states the downward trend in staffing and the increased demand for accurate real-time information will translate into the deployment of additional operations systems and higher, more sophisticated levels of automation and decision support.

How does a company effectively transfer knowledge possessed by older workers and properly train new workers? ARC Advisory Group suggests the smaller, less-experienced workforce that will exist in the future must be empowered with new technologies and workflows that can **transfer knowledge on demand**. Due to the critical nature of operator response and the multitude of interactions with key operations personnel, **a new generation of training, operations and workflow management tools are required to capture and transfer knowledge while empowering personnel with real-time process and procedural support.**

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## 7. Workforce Enablement Technologies Drive Behaviors that can Positively Impact Culture

The value of any good technology is determined by its ability to accelerate and sustain process improvements that make operations more safe, reliable and efficient. When the right Workforce Enablement technologies are in place, they support and enforce situational awareness and proactive behaviors which help deliver a superior safety culture.

Many employees are in the field or in control rooms. Management teams are responsible for running mission-critical processes across multi-billion dollar businesses with the most important goals in mind—operate them safely and profitably. Empowering these employees with tools and “know-how” are vitally important to enable them to make better decisions faster while simultaneously following the company’s procedural best practices. Let’s look at technology solutions aimed at addressing gaps in operational excellence, as identified in the U.S. Chemical Safety and Hazard Investigation Board (CSB) 2007 findings from their review of the BP Texas City explosion which highlighted the need for managing and executing better procedures in operations. The CSB report emphasized their findings were not unique to one company, the site investigated or specific accident reviewed but are instead prevalent within the process industries.

FACT – Great safety cultures are observed where everyone is always looking out for each other to prevent accidents and employees take pride of ownership of the company assets by actively contributing to continuous improvement.

### CHALLENGE AREA #1: Content, Control and Decision Support Systems

According to the CSB report, Workforce Enablement challenge areas related to control and decision support systems are:

- Poor or no maintenance of safety systems
- Startup proceeded even though there were reported instrument malfunctions
- High level alarm failed to activate
- Control board display was inadequate for optimal response
- Shift handover communication was poor or non-existent

#### A New Approach: The Control Management “Toolkit”

The dissemination of process knowledge is an important objective in a comprehensive training program. Interaction between board operators, field operators, maintenance technicians, and other plant personnel is critical to success. There are several types of tools which enhance knowledge of operations management and line workers. These include simulation to provide training in various environments, alarm and event-notification software to alert workers of processes that go offline, workflow software applications for procedure enforcement/tracking and wireless applications which provide a mobile infrastructure for remote data collection, event tracking, procedure execution according to best practices and process validation.

A capable solution should eliminate the distractions operators traditionally face such as alarm storms, manual control of process loops and tuning/optimization of those same loops. With the distractions eliminated, operators can then focus on true effectiveness by enhancing their skills and knowledge.

Event notification and alarm management, in addition, are important elements in the implementation of a successful Workforce Enablement strategy. ARC Advisory Group has identified alarm management as an important process automation system function contributing to an environment of flawless intervention. By linking telecommunications to industrial automation software systems, alarm management applications enable real-time data and immediate notification of process issues in the facility. Operators can monitor the entire network 24/7 and deliver validated information to the right person at the right time. A variety of software applications are available which enable operators to hear the details of an alarm through loudspeakers, intercom systems, radios and telephones. The technology allows operators to select alarms and access the proper diagnostic, identify root cause and/or access the correct Standard Operating Procedures (SOPs). These applications also enable alerts via alphanumeric text messages and/or emails sent to the correct employee cell phones, handheld computers and other mobile devices so that plant and facility issues are resolved quickly and accurately.

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## CHALLENGE AREA #2: Learning (Classroom and Experiential)

According to the aforesaid CSB report, Workforce Enablement challenge areas regarding training and experiential learning are:

- Inadequate operator training
- Lack of training for abnormal situation management (emergencies)
- Lack of structured formal training that was auditable and reinforced

### A New Approach: Experiential-Based Learning

With the availability of low-cost and powerful computing, it is time to revisit simulation as now it is a cost effective means to assimilate new workers rapidly. Industry leaders recognize training simulators are a vital component to a site's preparation and learning programs, placing workers in virtual high-risk conditions and testing their responsiveness within a risk free environment. Operator training simulators (OTS) provide plant field and boardroom operators, maintenance and HSE personnel efficient knowledge transfer and skill development in a matter of months rather than years. With OTS, employees are able to improve overall skills and performance by experiencing plant "issues" and "problems" in a virtual reality digital environment. This approach improves operator responses which can reduce the number of abnormal situation occurrences or unplanned shutdowns and lowers the risk of loss of life, assets, production and/or environmental releases. In both "green field" projects and startups after shutdowns at existing facilities, these systems help ensure faster start-up times, quicker recovery from process upsets with less equipment stresses, and the ability to correct procedure errors prior to online production.

Operator training simulation software is an essential ingredient to a successful Workforce Enablement strategy. Many solutions on the market today provide a rigorous dynamic simulation and control system emulation for process engineers, plant engineers, operators and managers to improve plant design, check out controls, train operators and boost plant performance. These solutions feature comprehensive, dynamic process simulation programs which enable users to meet and overcome the dynamic challenges of designing and operating a modern process plant safely and profitably. They expedite comprehensive engineering workflow including design, operational analysis and dynamic simulation. In addition, operator training and plant performance improvements reduce capital investment costs, increase process yields and enhance management decisions while leveraging existing technology investments.

### 3D – The Next Generation in OTS

Some applications take simulation one step further by providing simulation training in a 3D environment. These applications are particularly useful when training field operators working in hazardous or mission-critical locations. This type of advanced simulation also enables training and operations practices to be enforced, standardized and proliferated, from employee to employee, and maintains consistency by shift, by plant, or by site. Comprehensive 3D simulation solutions link control room operators to field and maintenance operators by means of a high-fidelity process simulation and virtual walk-through plant environment. As a result, plant crew training improves safety by enabling operators to perform tasks in a simulated environment, react quickly and correctly, facilitate reactions in high-stress conditions and instill standards for team training and communications.



## CHALLENGE AREA #3: Business Processes and Workflow

According to the CSB report, Workforce Enablement challenge areas regarding procedural management and execution of best practices are:

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- Out-of-date, ineffective or unenforced operational procedures which lead to ad-hoc operations
- Incomplete or disregarded safety and work permit procedures
- Insufficient absent abnormal situation management procedures for emergency or upset operations
- Nonexistent or passed over Management of Change (MOC) procedures
- Irrelevant, outdated and unused written (hard copy) procedures

## **A New Approach: Mobility as a Key Enabler**

Advancements in mobile and wireless technology solutions provide an effective on-the-job tool for operations management to facilitate mobile learning. A mobile workforce is better equipped to address issues at the location of a problem and determine the best course of action to resolve the problem, leveraging remote data. Configurable software and ruggedized mobile hardware solutions enable a smooth workflow, accurate data collection and general task management for plant operations, maintenance management, production tracking and compliance applications. Wireless applications are a vital component of a complete plant and operations management solution which connects all wired and stranded assets, enabling even broader visibility into operational performance than ever before.

Mobile technology combined with intelligent workflow technology now provides field workers and desk workers with intelligent on-demand dynamic procedures, pushed to the right people based on best practices. These procedures are not “dumb text” documents but instead smart procedures with decision tree logic to ensure proper steps are followed and auditable. No more dumb documents sitting on the shelf ... instead better, faster decisions. A capable solution should eliminate the distractions operators traditionally face such as alarm storms, manual control of process loops and tuning/optimization of those same loops. With the distractions eliminated, it is possible to focus on true effectiveness by enhancing operator skills and knowledge.

## **8. Chevron: The New Path Forward**

Chevron was recently named by Managing Automation as a “Progressive Manufacturing Top 100 Award Winner” in the category of Operational Excellence Mastery. What are some of Chevron’s keys to success in Operational Excellence? Let’s start with understanding **Chevron Corporation’s Top Ten Tenets of Operation:**

1. Always operate within design or environmental limits
2. Always operate in a safe and controlled condition
3. Always ensure safety devices are in place and functioning
4. Always follow safe work practices and procedures
5. Always meet or exceed customers’ requirements
6. Always maintain integrity of dedicated systems
7. Always comply with all applicable rules and regulations
8. Always address abnormal conditions
9. Always follow written procedures for high risk or unusual situations
10. Always involve the right people in decisions that affect procedures and equipment

Their recent award also recognizes the company for being a leader in mobile learning—handheld computers with intelligent work process management software for executing procedures according to best practices. Chevron identified more than half of most process manufacturing plant assets are non-instrumented and require numerous manual inspections. Previously, data was often collected on clipboards and entered into databases or spreadsheets manually, which was not timely enough to identify and act upon process data when issues arose. With the implementation of the Workforce Enablement mobile technology, Chevron achieved significant savings by standardizing refinery process steps using mobile workflow software and rugged PDAs to deliver decision support to field workers. The company implemented a solution which increased refinery operating reliability, reduced maintenance costs and improved safety and environmental compliance.

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As cited at Microsoft's Global Energy Forum 2011, the Chevron program delivered "higher equipment availability and faster reaction to plant concerns (typical \$1M hard dollar annual savings per site from reduction in unplanned downtime and maintenance cost savings)". The company has also found the solution helps capture process knowledge before workers retire and speeds new worker assimilation through mobile learning—both desirable outcomes of an effective Workforce Enablement solution.

## 9. Summary

Plants and factories today face numerous challenges resulting from the loss of highly knowledgeable workers to retirement, workforce reductions and the increasingly complex nature of manufacturing and industrial processes and technologies. With such resource deficits expected to continue during the immediate future, companies must continually review and revise their strategies to operate more efficiently and profitably. Importantly, the tools they use must be focused on specific needs and goals.

Many of your employees in the field, control rooms and management are responsible for running mission-critical processes across your enterprise with the most important goals in mind—safe and profitable operations. A focus on enabling these daily decisions through Workforce Enablement technologies is one of the most cost-effective means of achieving greater levels of effectiveness. With quantifiable performance improvements for the majority of industrial operations, Workforce Enablement not only improves safety in control rooms, process areas and factory floors, but is acknowledged as one of the most important means of maximizing availability, reliability and throughput.

Fortunately, there are new, constantly-evolving technologies designed to address the issues of a changing workforce and increasingly sophisticated automation systems. These solutions empower plant operators with real-time information, highly capable decision support and workflow tools and ultra-realistic training simulation scenarios designed to test new operations procedures and solutions without impacting safety or expense lines. Ultimately, companies can manage business continuity and profitability by leveraging a variety of technology solutions specifically addressing the realities of today's streamlined – yet highly technical – industrial environment.

At the heart of a resilient plant is your workforce; they provide the creativity and agility to respond to normal and abnormal situations. Closing gaps in Workforce Enablement requires we look at roles, tools, resources, incentives, knowledge and skills. An assessment is the first step to target the right objectives and answer basic questions to help set new Workforce Enablement priorities.

- What performance results are expected of the team or individual related to short- and long-term business goals and strategies?
- What competencies are required to meet the target performance results?
- What gaps exist between required practices and current performance of the team?
- How are current work environment factors and programs either encouraging the workforce to perform as needed or discouraging them from doing so?
- What current programs are working and what new programs or content should be made available?

From the initial assessment, a recommended solution can be derived and tied to the business KPI targets. To learn how Invensys can help you create the "Resilient Plant" by enhancing your Workforce Enablement strategy and plan execution, contact us at 888.869.0059 or [contact@Invensys.com](mailto:contact@Invensys.com).



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