# UTILIZATION OF HANDHELD COMPUTING TO SIMPLIFY COMPLIANCE

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## Abstract

Monitoring job site performance and building a continually improving organization is an ongoing challenge for operators of process and power generation facilities. Stakeholders need to accurately capture records of quality and safety compliance, job progress, and operational experiences (OPEX).

This paper explores the use of technology-enabled processes as a means for simplifying compliance to quality, safety, administrative, maintenance and operations activities. The discussion will explore a number of emerging technologies and their application to simplifying task execution and process compliance. This paper will further discuss methodologies to further refine processes through trending improvements in compliance and continually optimizing and simplifying through the use of technology.

## 1.0 Introduction

Providing objective evidence of procedural compliance and ongoing improvement of job-site performance is of critical importance to owners, operators, contractors and regulators. With the high costs and long-reaching impacts of non-compliance, organizations need the ability to rapidly identify trends in non-compliance to initiate corrective actions and implement systematic procedural improvements.

*What are the real costs of non-compliance?*

Typically increased costs and schedule are the key indicators most projects are concerned with. While the cost and schedule impacts are immediately visible and tangible, there are many other significant risks propagated by non-compliance issues, including [1]:

- Risk to License to Operate (This is equally true for Contractors and Operators)
- Penalties assessed by Regulators
- Mandated Inspection Frequency Increases
- Potential removal from bid lists
- Injury or death
- Decreased workplace morale

*What are ideal processes?*

An ideal process communicates clear instructions in a timely fashion to a properly trained, qualified and equipped work force. These processes allow rapid communication of concerns and objective evidence of compliance to the owners and regulators. Additionally the processes assist with proper checks and balances to ensure suspected non-compliances are immediately identified and resolved [1].

Information communicated from the work face needs to be translated into trendable performance metrics, based on critical success factors, to determine key areas of non-compliance and opportunities for improvement. Systemic changes need to be tracked, trended and internally benchmarked over time to monitor improvement in processes and compliance ongoing.

*How can new technologies help build a continually improving organization?*

Human performance deficiencies stemming from systemic process breakdowns are a major source of non-compliance, which need to be identified quickly and corrected. With increased pressures on stakeholders to ensure procedural compliance, the growing acceptance of new technology in the nuclear industry provides organizations the ability to effectively monitor job site performance, trend compliance using key performance metrics, and rapidly identify opportunities for improvement.

*What is the role of handheld technology?*

Handheld technology helps simplify the communication of information to and from the field; the information captured on the handhelds is immediately processed into informative reports and made available to key stakeholder, rather than being captured on paper forms which may go unprocessed.

By leveraging handheld technology to directly capture inputs from the field and utilizing online reporting to generate immediate documented outputs, trended positive behaviors can be reinforced and negative behaviors corrected reducing rework and improving process compliance. Identified process improvement opportunities reveal are driven through the organization using the same technology, creating a learning organization.

*This paper will focus on three key questions:*

1) How can handheld technology be used to accurately capture records of quality and safety compliance, job progress, lessons learned and OPEX?

2) How can handheld technology inputs be used to drive output performance metrics, reveal trends in compliance and identify improvement opportunities?

3) How can handheld technology be used to drive continual improvements and preventive actions through the organization ongoing?

## 2.0 Handheld Technology and Procedural Compliance

With the resurgence of the nuclear industry, technological innovation will be necessary to assist operators in achieving cost-effective compliance. The identified growth in the complexity of procedures at the workface calls for processes that reduce the impact of human performance-related non-compliance incidents and improve communication and information flow.

Handheld technologies at the workface show a significant opportunity to meet both objectives. Implementing new technologies at the workface to streamline and simplify existing processes, without further straining project budgets, will become a fundamental necessity for all nuclear projects.

It is important that any new technology introduced meet these key requirements:

- Reduces process complexity
- Has a short learning curve for field workers
- Is a cost effective solution

There is evidence that procedural compliance is more likely when staff view procedures as being useful and describing the "quickest and most efficient way of doing the job" [2]. Any new technologies introduced that are difficult to learn will be viewed as more complex and inefficient than current methods and will be met with resistance [1].

### 2.1 Impact of Handheld Technology on Effective Communication

*Areas Benefiting From the Utilization Handheld Technology*

Handheld technologies can aid in supplementing management processes. Inserting simple applications to improve current processes directly into the existing workflow can achieve a net benefit of significantly improved communication. These applications can assist field workers remain compliant through a number of mechanisms such as:

- Ensuring key information is in hand
- Utilizing forms with detailed instructions embedded
- Gating forms to enforce required actions
- Allowing worker to take credit for completed work
- Date and time stamping operations
- Automating detection of and highlighting suspected non compliance
- Elimination of transcription errors
- Easing document revision control concerns
- Facilitating remote review of results
- Speeding results archiving

## 2.2 Non-Compliance Indicators Addressed With Handheld Technology

Breakdowns in human performance are typically a result of systemic process issues. The use of handheld technology helps address a number of non-compliance factors impacted by human performance:

1) **Maintenance failure, e.g. equipment (controls, resources) does not function or is not available due to missing or inappropriate management:**

   Handheld technology can identify these issues earlier in the process during detailed walk downs of work conducted utilizing forms equipped with required reference material and easily populated responses to anticipated variables. Walk down personnel take ownership of the process by accepting all of the attributes they have verified. Unverified or unacknowledged attributes prompt immediate follow-up.

   Management is alerted to problems with resources or controls during the planning phase when it is possible to reassess the work as opposed to during the execution. The status of walk down activities is easily formatted to provide progress reporting to determine actual state of readiness leading into the execution phase.

2) **Inadequate quality control, e.g. lack of resources or supplies:**

   Documentation is gathered electronically, through intelligent forms, bar code readers, RFID, digital cameras or other handheld technology by performer, peer reviewer or QCI at the work face.

   This information is screened for acceptability through automated processes or remote reviewers, significantly reducing the amount of time and effort spent on QC checks. This same information is used to provide true status reporting on accepted work.

3) **Management problem, e.g. the line of command is not well defined and control of the situation may be lost:**

   Senior management can communicate requirements simultaneously throughout the organization to supervision and trades at the workface receiving repeat backs and providing documented evidence of three way communication.

4) **Design failure, e.g. the interface is inadequate, and the cause is clearly a design failure:**

   Handheld technology can identify these issues earlier in the process through a detailed walk down of work conducted utilizing forms equipped with required reference material and easily populated responses to anticipated variables.

5) **Inadequate task allocation, e.g. the organisation of work is deficient due to the lack of clear rules or principle:**

   Inequities in task allocation are readily detected due to transparent real time reporting. With reporting slaved to accepted and documented task completions or by peer reviewed reporting senior management is looking right at the workface.

6) **Social pressure, e.g. the individual's understanding of the situation is guided or controlled by the group:**

   Utilizing smart forms with embedded procedural requirements and detailed explanations of expectations available in picture, sound or video, culminating in individuals signed acceptance or questioning of the assigned task allow individuals the freedom truly exercise a questioning attitude.

Handheld technology supports existing processes and embeds best practices directly at the work face. This enforces procedural compliance and provides information directly back to management for analysis and trending.

## 3.0 Translating Field Data to Trends in Compliance

*Moving Beyond the Field*

While handheld technology shows a significant opportunity to enforce procedural compliance and provide objective evidence of compliance, the value and impact of the available information gathered reaches beyond improved communication with the field. The information output allows organizations to simplify communication through the entire management chain, by translating results into key performance metrics and trending compliance through online reports published to key stakeholders. This provides organizations the opportunity to benchmark critical success factors over time, reveal systematic process issues and identify key opportunities for continual improvement.

## 3.1 Managing Information Output From the Field

*Managing the Information Interface*

To produce trendable metrics from the field, organizations must first implement a methodology for capturing and communication form the field consistently and uniformly. Adopted technologies must eliminate inconsistency in the information captured, reduce complexity in the process of actually capturing the information and transmitting it back to management, and reduce the variation in responses from various job sites. Further, the organization must ensure the quality of the results collected before translating responses to performance metrics and compliance trends. The utilization of handheld technology, with the proper checks and balances implemented, satisfies these requirements.

Using pre-populated responses on the handheld and well-designed in-hand electronic forms, management can create a uniform process for capturing information at the work face on critical success factors throughout the organization, and across all job sites. Handheld forms at the work face with proper reference material attached ensure management intent is not lost in communication to the field and the correct information is captured. Sign-off captured on handhelds ensures trades ownership of responses. Information is then translated back to management for quality of response review.

*Quality of Responses*

Capturing information directly from the field using handheld technology enforces procedures and reduces human error by providing supporting processes and infrastructure, but in itself does not ensure compliance; it is important for the process to incorporate a separate verification step to ensure the completeness and correctness of the data collected, beyond the field level sign-off. This provides an extra layer of verification between the field and the client and works to ensure the correctness of the output.

Review by Subject Matter Experts (SMEs) for the correctness of the output information captured on the handheld allows immediate feedback on found issues. Output reviewed online as data is received from the field allows immediate identification and correction of inconsistencies. This streamlines the process of filtering information, ensuring as-is conditions from the field are reported and verified. Reviews for completeness ensure forms are completed as expected. Findings are corrected upon review by management and the quality manager; this eliminates potential errors early and reduces rework costs.

## 3.2 Online Reporting: Performance Metrics and Compliance Trends

*Enhancing Project Management Using Performance Metrics*

For a performance measurement and benchmarking system to be effective, it should be crafted to fill multiple organizational needs, carry the imprimatur of the users, and be accepted at all levels of the organization [3].

The following groups of performance metrics are identified:

- *Project-level input/process measures.* Assess the resources provided to deliver an individual project and the management of the project against standard procedures.
- *Project-level output/outcome measures.* Assess the cost and schedule variables of an individual project and the degree to which the project achieves the stated objectives.
- *Program- and department-level input/process measures*. Assess the total resources provided for all projects within a program or department and the degree to which program- and department-wide goals for projects and their management are met.
- *Program- and department-level output/outcome measures.* Assess overall project performance and the effectiveness of completed projects in supporting program and department missions.

By defining appropriate measures in the planning phase of the project, the supporting technology processes can be configured to ensure critical information is effectively and consistently captured across the organization.

Objective measures tracked over time significantly enhance project management by providing key stakeholders with direct insight to job site activities. By instituting the proper planning up front to capture daily metrics on field activities, management ensure they are always aware of activities conducted and the costs associated. By implementing processes supported by technology, project management costs can be trended and controlled over time, improving satisfaction of all stakeholders.

*Trending Compliance and Benchmarking*

To effectively trend compliance and benchmark activities across the organization, the following nine activities should be established and conducted:

- Determine what to benchmark
- Define the measures
- Develop data collection methodology
- Collect data
- Identify deficiencies in the use of best practices and project management performance
- Identify reasons for deficiencies (root causes)
- Develop an action plan (select best practices to reduce deficiencies)
- Integrate best practices into the project delivery process
- Institutionalize benchmarking as part of a continuous improvement program

Measuring performance and benchmarking should be viewed as a routine, integral part of project management processes rather than a separate function. This requires that advocacy be built into the system. The most difficult step is establishing an organizational culture that is ready to assess, compare, and analyze performance and to adopt best practices used by others when they are identified. This requires an organizational commitment to continuous improvement, acceptance of new ideas, and open communication and cooperation at all levels of the organization [3].

To effectively trend compliance over time, the established measures must be consistently and uniformly tracked. The output results become more powerful over time, as a database of learning throughout the organization is built and areas of non-compliance are revealed. By consistently providing trends in compliance from the work face through visually insightful reports, management will be prompted to institute corrective actions.

## 4.0 Continual Improvements in Compliance

Emerging technologies can be leveraged to drive a cycle of continual organizational improvement. By reducing variance of response from field personnel, across multiple job sites, and providing objective compliance metrics to benchmark overt time, organizations can analyze their output information and drive improvements back through the cycle. This cycle of continual improvement is in its basic form the PDSA cycle, as made popular by Deming:

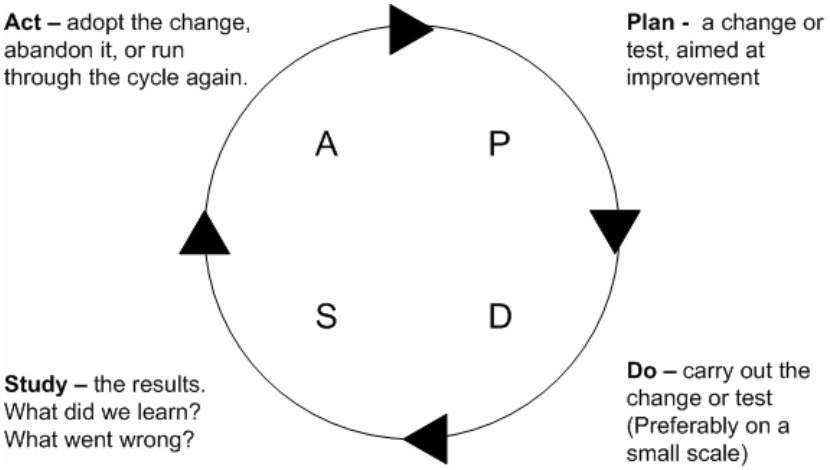


**Figure 1: PDSA Cycle [5]**

While the cycle is useful as a visual representation of a continual improvement process, it is important to note organizations must work harmoniously with new technologies to analyze information and plan improvements. Technology simplifies the process, but continual improvement cannot be a passive activity; management must take an active role in driving the effort and communicating change throughout the organization.

### 4.1 Utilization of Technology to Drive Systemic Process Improvements

*Elevating Human Performance*

The inherent benefits of technology to elevate human performance are strengthened through management commitment to continual process improvement. Opportunities for process improvement to support field personnel are revealed upon management review of the data trended over time. By providing a reporting interface to key stakeholders, management can take an extremely active role in review and take immediate action.

Analyzing the variance and trends in the output information quickly reveals gaps in training, personnel understanding of procedures and systematic process issues. This allows management to take actions and adjust processes and procedures resulting in tangible outcomes. Further training and coaching, improved communication to personnel and systemic improvements where consistent breakdowns are identified can significantly improve operations.

Areas of persistent non-compliance which may not be readily apparent are identified through objective analysis of personnel feedback and corrected; issues with personnel understanding of the correct way to complete a form, or a lack of understanding of the correct process. By providing a mechanism for personnel feedback to management, processes can be further refined.

*Communicating OPEX and Lessons Learned*

Utilizing technology to consistently capture information in the field across all job sites, organizations can gather operational experiences and develop best practices based on positive behaviors revealed through trend analysis. Negative behaviors can be used to reinforce behaviors in training and coaching. Communications maintained electronically provide objective evidence of training and feedback from personnel ensures understanding of the process

Management can further leverage technology to communicate improved processes and procedures directly back to work face. By updating electronic forms reflect feedback, providing more detailed information and revised procedures, management can take immediate actions to give personnel the correct information, training and coaching. Management detailed pre-job communication to ensure effective execution of procedures. Lessons learned and procedural enhancements are built directly into the forms; this builds a continually learning organization

## 4.2 Monitoring and Trending Ongoing Improvement

*Building a Learning Organization*

Process improvements driven back through electronic forms benchmarked over time versus previous results provide an objective evaluation of the effectiveness of improvements. Utilizing technology to benchmark performance metrics and compliance trends over time, lessons learned from identified successful practices are communicated through the organization.

This cultivates a learning environment:

- Systemic changes can be evaluated by observing output trends following process improvements
- Personnel coaching and training can be reviewed to determine if human performance errors are corrected, or if systems need to be further evaluated improved to support personnel
- Output reports can be further trended over time to determine if incidents of non-compliance are decreasing across all job sites
- Operational experiences and best practices from all job sites can be reviewed and communicated consistently

Improvement trends are monitored using online reports, as data is collected and results are benchmarked over time. The more data collected for review, the more valuable the process of reviewing and trending results becomes. The resultant cycle of trending behaviors, revealing improvement opportunities and monitoring outcomes drives a continual learning organization.

## 5.0 Conclusion

The utilization of emerging technologies can provide significant organizational benefits in trending compliance, benchmarking critical success factors over time and driving continual organizational improvement.

The result is a cyclic system, supported by technology:

- Project management evaluate requirements and develop plan to implement process and procedures to achieve project goals
- Simplified forms created using handheld technology to enforce procedural compliance and provide personnel with the right information
- Collected information from the field reviewed for completeness and correctness (checks and balances in the results)
- Output information translated into performance metrics and compliance statistics based on critical success factors
- Results trended to determine areas of non-compliance; management reviews reveal opportunities for systemic process improvement
- Communications from field personnel are reviewed to identify further improvement opportunities
- Process improvements, training and coaching driven through the organization; updated systems, forms and procedures based on output results
- New electronic forms driven back to field personnel using handheld technology; information, such as processes and procedures included on the handhelds are updated to reflect findings and trends
- Results from updated processes and procedures continually trended and benchmarked against previous results to evaluate improvements – this builds a continually improving and learning organization.

Owners, operators and contractors can leverage emerging technologies to significantly reduce non-compliance for the long-term, lowering costs and increasing satisfaction for all stakeholders.

## 6.0 References

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