



**Workers and Automation:**  
***How Mobile Technology Can Optimize***  
***The Human Element in Manufacturing Operations***

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**Summary:** They are manufacturing's three Cs: *Capacity*, the absence of down-time; *Consistency*, the requirement that all production machinery operates within specific parameters; *Compliance*, the need to meet or exceed regulatory and internal process, safety, and product standards. These are the three essential elements of modern manufacturing operations. And, although modern manufacturing is often assumed to take place in the absence of manual labor and the human element, almost every manufacturing company ultimately relies on its workers contributing their knowledge, observational skills and prompt action to ensure maximum production up-time and product quality without sacrificing safety or compliance with safety, regulatory, and internal standards.

In the last decade, the number of staff at most manufacturing and processing facilities has shrunk due to a greater focus on automation and the retirement of seasoned workers while the operations workload has remained constant or even grown. This situation has left plant operations management with a smaller, less experienced front-line workforce with a paperwork and reporting workload that can seem overwhelming. This stretched workforce doesn't always have the intimate knowledge of the processes they monitor to allow them to take consistently effective and timely corrective action when presented with unusual conditions during their data collection and observation rounds.

Manufacturing companies need to take full advantage of their human capital to keeping things running smoothly and profitably. Providing front-line workers with training and reference materials representing the accumulated best practices of the organization is one way to impart the knowledge needed to take the best actions in the field. Front-line plant floor workers by definition do not typically sit behind a desk. Yet, to be effective, they need the ability to react appropriately as they perform their rounds in the field, without relying on supervisors and desk-bound reference documents to assist in their decision-making process.

Mobile technology – smart phones and hand-held computers – holds enormous potential for providing workers with decision support at their fingertips and a simplified error-free method for collecting and submitting observational data to decision makers and back-end systems. Mobile technology can help fulfill the promise of integrating the human and non-human elements of monitoring and controlling a manufacturing operation.

With this in mind, a growing number of companies now are employing innovative mobile technology to achieve uniform best practices by field workers, faster, error-free data collection during rounds, and electronic reporting and analysis in a fraction of the time that traditional methods permit. The expanded capability for gathering, analyzing and reporting data, in turn, is creating new opportunities for performance improvement for these companies. Field intelligence about key operational performance indicators is finally becoming actionable, and this has important implications for many kinds of businesses.

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**F**or years, a large American snack food manufacturer required its workers at its more than 35 sites in the USA and Canada to fill out paper forms whenever they thought the product was not meeting standards. These plant floor workers would manage the product hold and disposition workflow process using triplicate paper forms. Over the course of a year, this one process generated thousands of pages of forms. In addition, the data was too unwieldy and time-consuming to collate the information from multiple sites on a regular basis. The completed forms – with valuable data about plant and national trends on product quality – were filed away in each plant year after year.

“Data on paper forms couldn’t be converted into usable information to drive performance improvement,” said the company’s head of quality and operations support. “You have to have good measurements to drive improvements. To have good measurements, you need an efficient system for getting and analyzing them. Paper-based systems don’t accomplish that.”

The situation at this food manufacturer is just one example of what occurs regularly in the world of large national and multi-national companies. Big, far-flung corporations have a seemingly insatiable need for information about their operations, but more often than not the information cannot be gathered, collated and analyzed across the enterprise using traditional paper and spreadsheet methods without costly labor expense and delay. Even worse, after the stale information is analyzed, it can become the basis for business decisions that may no longer be valid or prudent. As a result, large companies are operating with serious “blind spots,” unaware of opportunities for process improvement that are within their grasp.

Manufacturing companies need data way beyond what they can get from their control system and its field sensors. They need live workers to check the production facilities frequently and to correct issues immediately before they escalate. Live workers also gather data from stranded assets and make subjective observations. And front-line workers need information, as well.

The changing field workforce means that inexperienced or less experienced workers may be inserted into the process, resulting in inaction or mistakes when they encounter unfamiliar issues or situations in the field. They desperately need decision-support tools to help them be as effective and productive as possible.

Bear in mind that “mobile workers” are not only the stereotypical “road warriors” who you see lined up in the airports. They also are workers at fixed locations, such as processing plants and factories, who generally do not work at a desk or who don’t have regular and easy access to a desktop computer.

The vital roles played by mobile workers making the rounds of their plant raise several challenges: 1) managing the work flows of the data gatherers; 2) ensuring accountability and compliance with regulatory, product safety and quality standards; 3) reporting, analyzing and issuing alerts to interested parties in a timely fashion after observational data has been collected to ensure that deterioration in field conditions does not cause product quality to suffer; 4) providing front-line workers with the decision-support tools they need – whenever and wherever they need them.

After data have been collected, reported and analyzed, there often is a need to communicate findings and directions – text, diagrams, photos -- back to front-line workers and managers to ensure consistent quality and efficiency. For example, where machines can be set or adjusted to perform within specific parameters or ranges, front-line operators need guidance on best practices. These front-line decision makers simply can't lug around out-of-date bulky manuals or always be accompanied by experienced managers. Front-line workers need to be self sufficient, much like their "road warrior" associates.

The ever-growing number of people who do not work behind a desk compounds the number of silos of business information and the difficulty in compiling the information into an actionable enterprise dashboard. All these issues create an urgent need for decision-support and productivity enhancement tools specifically for mobile workers.

As global business competition intensifies, corporations are beginning to feel a sense of urgency to abandon and replace paper-based, manual data collection "systems" with automated, electronic systems. Likewise, the empowerment of front-line workers also demands that they be equipped with adequate decision-support technology in order to maximize their productivity and effectiveness.

### **The Paper Plague**

Data collection by workers away from their desks is one of the last bastions of paper-based manual systems in the corporate world. Despite great advances in information technology, telephony, and computing power, paper forms and manual systems remain the mainstay of subjective and non-instrumented data collection. Until recently, technology that enables the easy, automated collection of operational data, as well as *timely* analysis and reporting has not been affordable or easily accessible.

(True, for a long time overnight delivery companies, utilities, and mass-market retailers have used electronic systems to collect information from the field, but these are hard-wired, rigid systems dedicated to one purpose or the needs of one company.)

Paper forms and manual systems are plagued with problems. Revising and distributing forms can be a challenge, as is making sure the reporting employee has the current form. A request for a report might go out to 25 or more workers, but there's no quick and easy way to track who has responded. Information can be reported inconsistently and might even be illegible to the recipient. If there's an urgent need to collect information on a new issue, there is no quick and easy way to notify the data gatherers and track compliance.

The biggest problem, however, is that in order for the collected information to be useful, it must be converted manually into digital data, often in the form of a spreadsheet or keyed into a plant control system. And, even then, the process is prone to errors and time-consuming. Predictably, the data conversion often never occurs, or by the time it is done, the information is no longer useful. Even when the process is semi-automated, typically the information is only available by means of batch computing, and the information is often no longer timely and actionable. Multiple electronic spreadsheets can become as cumbersome and unwieldy as paper forms.

Then, there is the problem of communicating timely, accurate data back to the front-line decision makers and providing them with the decision support tools they need. Some companies attempt to address this need by using their most experienced front-line managers as “Resources” who help less experienced associates navigate through unfamiliar situations. That solution is inadequate because these workers need 24/7 access to updated critical information and the knowledge base related to operational issues and best practices.

### **The Mobile Electronic Information Age**

The rapid advance of wireless, mobile technology is setting the stage for solutions that provide the decision support tools that front-line workers need and elimination of paper-based manual systems for data collection and reporting. Three trends are contributing to these solutions. These trends are:

- The advent of powerful, relatively inexpensive handheld computers and smart phones capable of broadband connection to the Internet;
- Movement toward standard operating systems for these mobile devices, such as Microsoft’s Windows Mobile, Symbian and Palm OS, which opens the door to application development by thousands of programmers worldwide, and
- Web-based applications – sometimes referred to as Web 2.0 or “cloud computing” -- which make easily usable dynamic forms accessible to as many workers as necessary 24/7.

The growing acceptance and use of smart phones and handheld computers with broadband capability opens the door to a wide array of rich, dynamic content. These handhelds can support software applications and can be made to do many different tasks. Instead of static paper or electronic forms, for example, a handheld computer can present the user with a dynamic form that can be filled in and electronically sent back to the home office upon completion. These devices can even incorporate photos, videos and other elements into the data collection.

More importantly, the handheld computer can provide workers with access to reference material and contextual instructions while in the field doing their work so that even inexperienced workers can take corrective action promptly. Collected data from dozens or even hundreds of reporting workers can be directed immediately to an Internet-connected database for easy tabulation and analysis – and it all occurs in real time.

### **Technology Innovation to the Rescue**

One of the first companies to target paper-based, manual systems for data collection and exploit the new technological possibilities is an entrepreneurial software company, Dallas-based **Form Automation Solutions (FAS)**, [www.auditmatic.com](http://www.auditmatic.com). FAS has aligned itself with the Windows Mobile operating system, which is the most widely available OS on handheld computers for use in manufacturing environments and is supported by all the major cellular data providers.

FAS founders Stephen and Kevin Woram studied the problem of paper-based, manual systems for field data collection and decision support and concluded that the key to transforming the market is the elimination of any need for custom application development. Non-technical business managers, the

Woram brothers thought, must be able to create mobile forms, publish and monitor one time and recurring data collection rounds and routes, and generate meaningful reports without having a programming background or relying on technical specialists.

They also felt that the solution had to be available both as a licensed software product under the complete control of the buyer, and as a web-based subscription service maintained and supported by FAS. FAS introduced its first product, **AuditMatic™**, in 2006. Already, major companies such as **Frito-Lay, Abbott Laboratories, Kroger, Columbia Sportswear, Mountain Hardware, Buffalo Trace (liquor distiller), the prestigious Stanford Linear Accelerator**, and others are using AuditMatic to improve their operations.

The robust AuditMatic software combines in one package virtually all facets of gathering, analyzing, and reporting field data. In addition, it provides mobile workers with access to the decision-support reference material they need to employ best practices when they are confronted with problem conditions in the field. With AuditMatic:

- A manager can organize users into multiple groups, assign roles, and control access to forms and collected content;
- A manager can create, revise, and publish forms as needed, with testing and version tracking;
- Reference photos, text, and diagrams that enable front line decision makers to take prompt and effective corrective action on the spot can be published ;
- A manager can assign one-time and recurring data collection rounds, notify users, and have AuditMatic manage deadline reminders;
- Field workers can collect and submit data directly to a database program;
- Field workers can collect information incrementally as fits their routine and workflow, rather than all in one uninterrupted span of time; a Table of Contents feature enables the worker to navigate easily to specific topics or sections of the form;
- The collected data can include photos and video, as well as numbers, check-offs, and text, and
- A manager can view the collected and sorted data in chart and graph forms or can output collected data in standard formats for integration into historians, controls systems and other back-end systems.

And, most importantly, the data can be analyzed in real time, rather than waiting weeks for it. As a result, companies that use the AuditMatic software achieve:

- Greater productivity
- Lower labor costs
- Less down time
- Tighter budget control, and
- Higher return on investment in capital equipment

With software such as AuditMatic now on the market, the transformation from paper-based, manual data collection systems likely will accelerate because new applications now enable non-technical business unit managers to create publish and manage these forms. This eliminates the need for

expensive and time-consuming custom application development. And with web-based, hosted systems, the responsibility for technical support shifts to the outside vendor.

### **Implications for Business and Beyond**

The replacement of paper-based manual data collection systems will do much more than improve worker efficiency. This transformation could have a profound impact on how companies operate and expand, because they now will have access to more timely actionable data as never before. Instead of sitting around in file drawers or waiting for batch processing and getting stale, the collected data can be easily tabulated, reported and analyzed in real time. Company managers and executives will acquire immediate business intelligence and information on key performance indicators to a degree never before possible. And they will have accurate, reliable measurements of long-term trends.

When Frito-Lay, the national snack food manufacturer, shifted from paper-based, manual data collection to dynamic electronic forms, they were able to roll it out to its more than 35 manufacturing sites with only minimal training. The company immediately began to see a significant annualized cost saving. Now, with the help of hand-held computers, the company is using the automation solution to improve mobile worker productivity in the areas of food safety inspections, quality, and efficiency.

“You go from managing paper to managing the improvement you want,” said Tom Roche, North American director of Operations Support and Quality at Frito-Lay North America. “We are looking to replace all our manual, paper-based data collection and reporting with automated systems. We expect to recoup our investment within two years.”

Company managers say they are learning to work with a “data stream” that they never had before, and it is forcing managers to think differently about the data they collect. They must consider much more carefully how the collected data might be used, because unlike the old days, this time it will be actionable.

“The automation of data collection and reporting by front-line mobile workers gives us a new window on our operations,” said Roche. “We will be able to use information in a much more intelligent way.”

Solutions such as AuditMatic usher in a new era of enterprise management. Almost overnight, we are advancing from a business environment replete with blind spots, stale data, and information-starved front-line decision makers to one of near-total visibility, timely, informed decisions by front-line workers, actionable data, and genuine business intelligence.

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