How Mobility on the Shop Floor Transforms Manufacturing Operations

A properly crafted and implemented mobile strategy can provide access to critical shop-floor data on-the-go; eliminate waste; improve issue resolution and responsiveness; and enhance collaboration among stakeholders near and far.

Executive Summary

Manufacturing organizations are well aware that they need to become more agile and adaptive in order to remain profitable and competitive in the global economy. Many are already adopting technologies that can help them better manage processes and respond faster to market needs without compromising the safety and security of human and plant assets.

Among these technologies, mobile computing has emerged as one way manufacturers can streamline processes across various organizational functions, and realize significant operational improvements and productivity enhancements along the entire value chain.

This white paper describes how manufacturers can use mobile technologies to enable considerably greater flexibility in transferring data from the shop floor, to engineering, and to the frontlines of the organization. Using this next-generation approach, manufacturers can deliver greater capabilities to various stakeholders (managers, supervisors, operators, engineers and marketing personnel) and provide critical decision support when and where it is required.

The Manufacturing Imperative

In today’s dynamic business world, manufacturers in every industry are under huge pressure from various stakeholders across the value chain to build organizations that are agile and flexible enough to meet the high demands of a global market. To achieve this objective, manufacturing companies must find ways to operate in more efficient, more cost-effective ways.

To accelerate time to market, control costs and provide capabilities that enhance products and services and improve the customer experience, manufacturers are applying methodologies such as Lean, Six Sigma, total productive maintenance (TPM) and quality management (e.g., ISO9001) for example, to streamline processes. They are also leveraging a variety of technologies to measure performance data, guide continuous process improvement, sustain competitive advantage and increase value for all stakeholders.

Technologies applied in manufacturing are continuously evolving – promising to optimize resources, transform processes, facilitate innovation, and enhance the way companies drive business growth by improving the customer experi-
Key to this evolution is the SMAC Stack,™ which includes social, mobile, analytics and cloud technologies.

- **Social networking** offers a platform for an organization's workforce and leadership to exchange ideas, troubleshoot problems and interact with employees to make enterprise-wide improvements. Social tools can be used for shop-floor activities such as production-line quality control, design access and problem-solving. These tools can also help foster collaboration and knowledge sharing; improve research and development (R&D) practices; enhance product training and product marketing, and obtain customer feedback.

- **Mobile technologies** can accelerate the delivery of business information, and manufacturers now consider it a critical tool for integrating people, processes and data across different business silos. Also, recent advances in mobile technology are liberating information from the confines of the desktop and making it possible to deliver it to the organization's frontline. This allows marketing and sales teams to make more informed decisions in real time and perform critical transactions – all while on move.

- **Big data analytics** can uncover hidden patterns and derive unknown correlations from large volumes of existing complex data, as well as provide a means for visualizing findings in a meaningful form. Manufacturers can integrate data from marketing, customer responses, R&D and operations to expose product and quality gaps; optimize operations; manage factory scheduling; refine maintenance planning; improve workforce scheduling and deployment; track components, and perform predictive analytics.

- **Cloud computing** allows manufacturers to process, store, retrieve and analyze large volume of data in real time – across platforms and beyond shop-floor and top-floor boundaries. All with the promise of reducing overhead, lowering prices and accelerating installation – with easier scalability and better collaboration. While many sections of manufacturing plants can easily shift to cloud-based systems, companies are cautious due to security, performance and reliability concerns.

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**Reviewing the Manufacturing Enterprise**

In manufacturing, product-development activities and production systems are highly distributed across plants and geographies. Each manufacturing function uses a diverse set of non-integrated point solutions from multiple vendors to keep track of overall production responsibilities and manage manufacturing operations from centralized locations.

These non-integrated point solutions not only make it difficult for manufacturers to maintain data consistency and integrity; they also make it costly to update foundational technologies for achieving critical management goals, such as uniformly measuring key performance indicators and deploying best manufacturing practices in a responsive, efficient and uniform manner.

Also, most functions of the manufacturing enterprise (the shop floor in particular) rely on paper documents and templates to capture transaction and status data from the field, and to prepare task lists. The information captured from paper documents is then manually entered into central databases and stored in various data formats in different systems. This process can lead to various issues, including error-prone data entry, poor work quality, delayed response, a lack of real-time visibility and overall dissatisfaction with the results.

Furthermore, as manufacturers grow in size and complexity, their ability to leverage data to improve organizational performance, address market needs and enhance employee delivery capabilities rapidly diminishes.

These factors inhibit the agility and flexibility needed to develop new products, manage orders, plan and schedule production, manage the workforce and enhance customer services.

**Mobile Technologies: Trends in Manufacturing**

The rapidly changing mobile landscape can offer manufacturers the capabilities needed to gather accurate information, make processing speed a competitive advantage, and capitalize on the intelligence and knowledge gained from every interaction across the value chain (see Figure 1).
Key indications of mobility’s staying power include:

- Rapid advancements in device computing cycles – better processing power, improved user interfaces, smaller form factors, lower prices and expanded services – are expected to reduce user frustrations.¹
- According to a recent study by International Data Corporation (IDC), the world mobile workforce population is expected to reach 1.3 billion by 2015, representing 37.2% of the total global workforce.²
- According to another IDC report, smartphone shipments are expected to reach 957 million units this year, up 33% from last year.³
- Upwards of 80% of the Fortune 100 companies will either use or test the iPad for viability to handle particular business functions.⁴

These trends suggest that smartphones and tablets will soon play key roles across all manufacturing business functions. Engineers, supervisors, quality managers, executives and other stakeholders will be using mobile devices not only to view business data and make key decisions, but also to see graphical representations of real-time work center performance ... manage warehouses ... scan barcodes ... print labels ... analyze and approve user steps in work processes ... perform quality inspections ... and improve customer services, for example. On the go.

Mobile technology can free up the workforce from their desks – enabling them to integrate major improvements into the workspace by redefining the way they access information, collaborate on key internal and external transactions, and embrace more productive and efficient ways of working.

By combining their existing technologies with mobile devices, manufacturers can build simple and intuitive solutions that enable users to communicate and collaborate anywhere, anytime. Figure 2 illustrates the key benefits manufacturers can achieve with mobility.

### Assessing Mobility Solutions for Manufacturing

Since the beginning of this decade, mobile solutions have been used by many corporations. However, adoption of mobile solutions in manufacturing has lagged behind because of stringent requirements for industrial-strength devices (e.g., heat, shock, water and dirt resistant) and the sub-par return on investment (ROI) delivered by previous generations of hand-held solutions.

Recent advances in mobile technologies provide the essential capabilities manufacturers need to make critical decisions, using real-time and historical data available in existing heterogeneous systems when and where it is required – in product R&D, on the shop floor, in the field, in...
the conference room, and in sales and support. A leading utility company in Europe is successfully employing mobile solutions for work management and inventory management by integrating IBM Maximo, an enterprise asset management solution, with a mobile antenna framework. The mobile solutions enable users to report time and work via the app, measure performance metrics and analyze data.

Additionally, the high-resolution, built-in camera features of the current generation of mobile devices can be used to read barcode/QR codes. This can facilitate faster and more precise decision making at the point of need, as well as enable better collaboration among teams.

Developing and implementing an effective mobile strategy in manufacturing requires a compre-
A comprehensive study of an organization’s business processes, and assessment of the manufacturer’s strengths and pain points. Such a study will help determine the opportunities available across functions, define a clear mobility adoption road map, identify solution areas that can demonstrate significant ROI rapidly, and act as a tool for implementing further large-scale changes.

Also, implementing a mobile strategy in manufacturing should take into consideration various parameters (see Figure 3) that will help bridge the technology gaps in non-integrated systems and ensure more agility and efficiency in manufacturing.

Figure 4 illustrates scenarios where mobility can be applied to deliver value for various stakeholders in the manufacturing enterprise. The following identifies existing system barriers, and highlights mobile-based enablers that have the potential to bring manufacturing-wide improvements in process, collaboration, productivity, performance, profitability and revenue.

- **Product lifecycle management**: Manufacturers have come a long way from storing engineering and product data in multiple systems that complicated the data access process. Leading manufacturers have invested in product lifecycle management (PLM) tools to centralize data storage and improve the way they innovate, design, develop and manage the product creation process – enabling these businesses to enhance products, processes and profitability.

However, PLM tools often confine engineers to their offices to review, update and approve designs, even though they are expected to have access to engineering product data 24x7 – when and where it is needed – to analyze and make engineering changes, update design documents, collaborate with teams, and approve and sign off on design.

Mobile solutions can facilitate the expansion of the existing PLM infrastructure – giving engineers access to design data when and wherever needed – to support faster, sounder decision making and contribute more to continuous product development, program management and innovation.

Mobile solutions can also help shop floor personnel gain access to product data, manufacturing plans and processes, as well as quality information, for example, to view up-to-date information required to assemble or disassemble equipment for maintenance and repair.

- **Control plant and equipment**: Depending on their size and process complexity, manufacturers invest heavily in state-of-the-art process control systems (PLCs, DCS, SCADA, etc.) and human-machine interface (HMI) technology. These investments provide plant personnel with the ability to visualize, monitor and control

Where Mobility Plays Across the Manufacturing Enterprise

![Smart Manufacturing Diagram](image)
In particular, smartphones and tablets are finding their place in work management, workforce management, inventory management, and online and offline data entry.

plant assets, analyze production data and notify plant personnel in the event of a problem. This translates into less downtime, improved production and the ability to manage increasingly complex operations.

The need to monitor the process and possibly control the operations of the industrial systems from virtually anywhere is becoming hyper-critical. Manufacturers are demanding that control-system product vendors develop interfaces that can extend and expand the functionalities of existing SCADA and PLC systems to include mobile devices.

The interfaces of mobile devices with high processing power can be used to access plant data through high-speed wireless networks – arming engineers and management with heightened visibility and full control of their automation systems, and enabling remote coordination of engineering maintenance activities.

Also, with the advances in cellular networks and the growth of the Internet, wireless devices are increasingly finding their way onto the manufacturing shop floor. Wireless devices offer the capability to export machine data for machine/plant HMI, process monitoring and real-time collection of process data. Smartphones or tablets can act as a natural platform to connect to the wireless devices from anywhere, visualize process data and control equipment in real time.

Additionally, smartphones and tablets fitted with data-acquisition devices can offer a more flexible standardized option to replace fixed functionality devices. Mobile solutions built with intuitive buttons, knobs and controls that mimic standard portable devices (for example, voltage or current meter) can easily replace the typical handheld portable devices with fixed functionality and enhance engineers’ interaction with plant equipment.

- **Maintenance management:** In manufacturing, production assets require periodic inspection and routine maintenance to ensure their availability and reliability. Most manufacturers still use paper documents to identify specifications of these assets and obtain details of required maintenance activities. This can result in longer downtime, higher maintenance costs, inaccurate information and deviations from regulatory compliance.

So it is important for manufacturers to provide relevant information and communication capabilities to technicians when and where they need it. When on the go, technicians should be able to receive alerts and notifications about plant process events and assigned tasks; identify plant information and asset locations; verify tools and spare parts availability; access knowledge bases; capture data, and report work status to the central system in a timely manner – wherever they may be. This will enable them to have all the information needed to perform maintenance more efficiently and effectively.

Rugged mobile devices that use standard operating procedures (SOPs) for independent tasks have emerged in warehouses, distribution centers and in areas of field operations. Nonetheless, these devices are costly, difficult to configure and complex to maintain. Also, the need for a designated technology stack has restricted large-scale adoption.

On the other hand, conventional smartphones and tablets are in a unique position to replace costly rugged devices and deliver all the information technicians need to do their jobs better. Mobile solutions developed for these devices can give maintenance technicians access to critical information in the field. The built-in features of standard mobile devices, such as high-resolution cameras, GPS, wireless and Bluetooth, allow technicians to execute key tasks – thereby lowering service costs, improving knowledge, reducing paperwork, cutting equipment downtime and enhancing overall service efficiency.

In particular, smartphones and tablets are finding their place in work management, workforce management, inventory management, and online and offline data entry.

- **Quality management:** Improving decision-making processes, managing time-to-market complexities, delivering more value and ensuring consumer satisfaction are primary concerns for manufacturers. Developing quality standards and continually improving response times are therefore critical to staying competitive.

Through these standards, manufacturers can streamline quality processes to reduce variability and delays ... improve collaboration across
the enterprise ... combine quality, planning, budgeting and forecasting processes ... and provide timely, quality data for critical decision making. These efforts create a feedback loop that aligns day-to-day operations with key business goals to achieve best-in-class performance.

Mobile solutions can be used to help embed quality processes across the entire manufacturing value chain – from quality inspection of incoming parts to verification of label printing and order dispatch. Mobile-based quality management can help in effectively implementing quality assurance programs and accurately executing the quality inspection process. It can also facilitate in-process optimization, collaboration, business planning and decision making.

- **Inventory management for production:** Manufacturers use a diverse range of processes and inventory management systems to gain visibility into their day-to-day business needs, reduce inventory cost, optimize working capital and provide a unified customer experience through the whole order-management process.

  In particular, key operational activities in warehouse management include the receiving and issuing of raw material for production, and spare parts management for maintenance. Large warehouses and distributed material storage shelves across the warehouse require operators to move around to locate parts using paper documents. This makes it necessary for manufacturers to manage complex material identification systems to locate, identify and verify that the right material is issued to service the order or perform maintenance on time.

  Mobile solutions can leverage built-in camera features to scan QR codes/barcodes and access material specifications from back-end systems while on the move. This level of mobility can help improve material tracking and handling, reduce manual tasks and costs, and help ensure that the right level of inventory is available at all times to manage production and maintenance.

  Mobile solutions can be used to provide accurate data and insights to improve visibility and gauge future demands. They can also ensure that the right material is available to the team to manage production and improve customer services.

- **Field services management:** Product companies typically have a strong services model for delivering continuous, on-time maintenance to customers, and bringing in additional revenue through upsell activities. To ensure optimal customer services across their product range, companies usually employ a large number of field technicians with varied skills and competencies to perform preventive maintenance.

  However, some manufacturers struggle to offer an integrated infrastructure that provides field technicians with clear, simple procedures for performing maintenance, accessing information on spare parts, checking the availability of parts, confirming warranty and contract information, and connecting with remote back-office personnel for support and scheduling. These capabilities can incur high service-delivery costs and extend asset downtime – ultimately resulting in customer dissatisfaction. Also, some manufacturers face challenges in retaining the knowledge and experience of their field workforce, which can further increase service costs.

  Mobile solutions should be designed to send real-time alerts and notifications to field technicians. This can significantly improve responsiveness and issue resolution, and enable deeper collaboration among technicians and engineers. Mobile solutions can also provide transaction capabilities to field technicians – allowing them to accurately locate customers via GPS, use RFID/QR code scanning to identify the asset type and specifications, and feed job information and report job status to back-office personnel for consolidation.

  This type of integrated service enables providers to gather more insights, and respond faster and with more accuracy to problems typically facing customers – from frequency of maintenance, to the efficiency of the workforce, to parts inventory requirements. Service providers can also establish tools to help improve customer service and enhance their competitiveness in the market while lowering operating costs.

- **Manufacturing intelligence:** It is becoming more and more evident that having access to production status, assets performance, plant utilization, downtime factors and various other key performance indicators (KPIs) using real-time and historical data can enable executives, sales teams and production managers to act swiftly – in tune with market demand and with greater agility.

  Mobile solutions can bring these capabilities to all stakeholders by integrating data from a diverse
Mobile Strategy Focus Areas

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<thead>
<tr>
<th>Business Transformation</th>
<th>User Experience</th>
<th>Technology</th>
<th>Governance</th>
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<tbody>
<tr>
<td>• Focus on the opportunity to deploy mobile solutions across manufacturing functions, such as quality, inventory, production, etc.</td>
<td>• Determine how to create a mobile experience aligned to user needs.</td>
<td>• Integrate strategy for linking mobile solutions with non-integrated shop-floor systems.</td>
<td>• How to plan, refine and prioritize mobile initiatives over time.</td>
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<td>• Identify how these solutions will reshape the way current operations are performed.</td>
<td>• Enable improvement to productivity while eliminating waste in the existing system.</td>
<td>• How to manage access to real time information on assets and services anywhere/anytime.</td>
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<td>• Define the technical architecture and application blueprint required to support mobile user needs today and in the future.</td>
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<td>• Leverage the power of new mobile technologies, including NFC, camera, GPS, augmented reality.</td>
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Source: Cognizant
Figure 5

A set of applications deployed by operations across the extended manufacturing enterprise. This enables frontline teams to make key strategic decisions, manage customer relationships better and drive significant value across the business portfolio.

Looking Ahead

We suggest that manufacturers take a phased approach to mobility as they seek to transform shop-floor operations, improve product/service delivery, better manage core assets and the workforce, and share insights from the diverse array of systems across the enterprise. We believe that mobile solutions can extend the value of existing infrastructure investments, enhance existing processes, make the most of an organization’s workforce, and equip manufacturers with the tools they need to leverage social networking, big data analytics and cloud computing technologies. We strongly contend that “the time is now” for manufacturers to embrace mobile solutions as one of the key elements of their overall business strategy.

Defining a mobile strategy that is aligned with user needs, the business strategy and current mobile best practices should specify clear ownership, and the participation of a cross-discipline team. This is a crucial first step to achieving operational excellence. Such a strategy should focus on business transformation, the user experience, systems and governance, and consider the needs of people, processes and technologies (see Figure 5).

From there, developing a mobile strategy requires a deep understanding of the specific challenges, drivers and opportunities your organization faces. We have developed a five-step approach to help manufacturers create a robust mobility strategy (see Figure 6).

Most manufacturers have the technological insights and capabilities to prepare a mobile strategy. However, their resources often reside in silos, which can result in a lack of focus. Methodological rigor is required to transform mobile opportunities into positive business outcomes. Engaging a strategic mobile partner with a proven track record in mobility can help create an accurate picture of current systems and a strategy for delivering mobile solutions that are properly orchestrated to transform the manufacturing enterprise.
A Five-Step for Developing a Mobile Strategy

1. **Assess**: Manufacturers require different approaches based on the maturity of current systems and processes. Assessing the maturity of these systems and processes should consider the focus areas – business transformation, user experiences, technologies and governance – to help address existing challenges and build a future-proof mobile strategy.

2. **Gather**: Engage with cross-discipline stakeholders to determine the business needs and identify gaps where building mobile capabilities will prove strategic and drive mindshare among users.

3. **Evaluate and Prioritize**: Evaluate each of the mobile initiatives with a balanced cost vs. benefit analysis – taking into account mobile technologies, security needs, user experiences, project priorities, system integration needs and ROI estimates.

4. **Define and Develop**: Engage with key stakeholders across business units to evaluate the business objectives and define a mobile deployment strategy by clearly articulating the vision and goals; capability requirements; a solution roadmap; risk and dependencies; investment; and a process for reviewing benefits and reporting.

5. **Sustain and Optimize**: Establish a team of cross-disciplined stakeholders and empower them with clear mobile governance processes. The team should review, monitor, evaluate and deploy mobile initiatives to ensure smooth user adoption.

Source: Cognizant
Figure 6

Footnotes

References
• IQMS. “Mobility in the Manufacturing Workspace: 8 must have mobile application qualities to increase operational efficiency.” Available at http://panorama-consulting.com/wp-content/uploads/2010/02/Mobility_in_the_Manufacturing_Workplace.pdf.
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