Mobility in Manufacturing Industry

This paper seeks to describe the emerging trends, challenges, approach and application of mobile and wireless technologies and the adoption of such technologies in Manufacturing Industry.

This white paper focuses on how mobility can improve the efficiency of business processes across the field sales, field services and supply chain.
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About the Domain

The Manufacturing ISU focuses on high-end consulting and on delivering IT-based solutions to a wide spectrum of continuous process and discrete manufacturing industries globally. The thrust is on developing solutions and services that help companies improve their operations in today's 'e-Manufacturing' paradigm, leveraging the power of the technology to drive improved efficiencies across the value stream of the enterprise.
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Introduction

Today's manufacturers face a number of business challenges from the globalization of the marketplace, reduced new product introduction cycles and more demanding customers for customized products. In order to maintain profitability in this environment, manufacturers must manage costs without affecting quality, customer service or machine availability. Manufacturers are being pressured by customers, suppliers and competitors to do more, do it better and do it with less. The firms that succeed know that innovations in manufacturing capability and reach must be matched with improvements in business processes.

Extending business processes outside the boundaries of the organization through wireless technologies provide the capability to connect executives with the business while out of office. With wireless technology and smart devices, the people are freed from being latched to their desks and carry out transactions using their mobile devices enhancing both visibility (decision support) and execution (implementation). Technological advancements in Mobile & Wireless arena provide an opportunity for manufacturing companies to broaden the enterprise support systems and enhance resource planning for service activities in the field, eliminating paperwork, streamlining service processes and increasing customer satisfaction.

In today's world, most of the new developed products do have integration with the mobile devices to facilitate remote monitoring and operating the product. Product can independently communicate to a remote device about their performance, send reports of critical information and also diagnosis for troubleshoots.

Mobile technologies used in manufacturing cover the full range of devices. These include laptop and tablet computers, handheld mobile computers, personal digital assistant (PDAs), mobile handsets, smart phones, sensors (for parameters such as pressure or temperature) and other rugged electronic devices that are enabled with wide-area wireless networks such as Enhanced Data rates for GSM Evolution (EDGE) and High-Speed Downlink Packet Access (HSDPA), as well as Wi-Fi or Bluetooth.

In this paper, discussion will be focused on understanding mobility, technology challenges and areas where mobile/wireless solutions can be developed and deployed.

1.0 Mobility Overview

Basic understanding of mobility can be studied with market research, trends, benefits and challenges faced by the industry.

1.1 Market Research

Manufacturing tends to lag in technology adoption and wireless is no exception. While other vertical markets have experienced earlier growth spurts, ARC Advisory Group's recent market study “Wireless Technology in Process Manufacturing Worldwide Outlook,” forecasts a compound annual growth rate of a very robust 30 percent. Manufacturing is quickly adopting wireless technologies that have been developed for the IT, telecom, consumer, or military markets.

A recent IDC study of 933 U.S. and Canadian companies showed that 53% of process manufacturers and 39% of discrete manufacturing companies have already implemented some wireless and mobile technologies such as ruggedized devices, laptop computers, BlackBerry devices, Pocket PC™ and Palm OS™ smart phones and industry-specific tools.

Productive pressure drives mobile adoption. Many executives and sales road warriors are already carrying BlackBerry devices to stay in touch and stay informed. BlackBerry devices have been considered tactical tools, limited to phone, e-mail and calendar tasks and justified by turning employee downtime into productive time. Even companies that have adopted BlackBerry solutions for their entire executive and sales team are only enjoying a fraction of the benefits of wireless.
1.2 Trends
Forrester’s analysis reveals several trends:

- Most firms have prioritized mobile technology expansion. Mobility is front and center for CIOs and IT leaders across the globe. This indicates that mobility is a top priority both within the firm and in taking the products or services to customers.
- Interest in mobilizing enterprise applications is growing. Organizations across the globe will be spending on mobilizing enterprise applications. There is clearly significant interest in mobilizing applications and business processes within the organization.
- New types of mobile devices are entering the enterprise. While Research In Motion (RIM) continues to dominate the enterprise mobile device market, with 70% of enterprises supporting BlackBerry devices, Apple’s iPhone and Google’s Android platform.
- E-mail and calendar applications dominate the mobile application landscape. Most of the organizations have mobilized their e-mail, mobilized personal calendars and contacts.
- Companies deploy mobile applications to drive employee productivity and responsiveness. Organizations deploy mobile applications to increase worker productivity, and to increase employee responsiveness. Overall improved customer satisfaction is an important driver of mobilizing applications.

1.3 Benefits and Challenges
Mobility provides an extraordinary value. Its reach is universal — unlike a point solution, it extends benefits to each and every area of your operations, allowing you to take ‘lean’ to a new level throughout the business.

As manufacturing enterprises implement their mobile technology strategies, clear benefits emerge to counter the challenges that exist. More than one in four manufacturing enterprises surveyed (44%) report that key mobile applications lead to increased employee productivity. More than one in five enterprises (23%) experienced increased inventory and/or order fulfillment accuracy with key mobility applications such as materials management and warehouse management. And 29 percent of manufacturers using field service applications report an increase in customer satisfaction.

Measurable benefits provide compelling incentives to offset some of the challenges when implementing Enterprise Mobility solutions. Respondents of the study cited security risks (38%)
and cost (hardware -- 35%, software -- 29%) as some of the most important issues. Watching the bottom line is, as expected, a heightened concern in today’s market. Yet proving ROI is no longer the primary requirement for investment indicating that confidence in the value of mobility investments has solidified. Awareness of security concerns and risk is also a natural development as Enterprise Mobility moves beyond the proving ground of “new” technology into wide-spread use.

Q: “What are your organization’s key benefits and challenges with regard to the usage of mobile and wireless technologies?”

Figure: Benefits and challenges of mobile and wireless technologies
(Source: Motorola Enterprise Mobility Barometer - State of Mobility in Manufacturing)

Following is just a small sample of the many applications and benefits that can be achieved through the deployment of a mobility solution:

- A real-time view of your inventory
- Highly cost-effective material tracking
- The anywhere anytime ability to monitor supervisory control and data acquisition (SCADA), Manufacturing Execution Systems (MES) and other key machine metrics in real time
- The ability to give maintenance workers real-time access to all the information needed to maximize productivity as well as asset uptime
- The ability to achieve Six Sigma quality levels
- The ability to check inventory, place orders and check order status in real time
- The ability to give field service workers real-time access to the information required to maximize the value of customer visits.
- Instant and constant access to a real-time business intelligence dashboard
- The ability to wirelessly enable video cameras and allow your security officers to view real-time video surveillance
2.0 Approach and Technology Aspects

The “one size fits all” model is dead in mobile computing. It is important for an organization to have a strategic vision on how they wish to implement mobile technology with their existing technology landscape. A clear strategy needs to be worked out on how mobile technology would integrate different processes of the business and connect with partners across the value chain. With the advent of mobile advertisement and viral marketing, it is important to have a mobile strategy to reach out to customers facilitating to build brand and provide better services to customer.

Once the strategy is in place, next step is to develop business cases considering people, process and technology – to introduce mobility. To start with time sensitive and place specific process are good candidates for mobility. Develop user profile segmentation to understand the mobility requirement of each segment of users based upon their travel, usage and so on.

A strong robust technical architecture is very important to sustain the mobile solutions. There are plenty of parameters such as security and performance that need to be considered while developing mobile architecture for an enterprise. In the later part of this document each parameters are discussed in detail.

Finally, feeding the right information to the right device is the key for the users of mobile solutions. Based on the business requirement, in few scenarios it is important to have real time synchronization with the back end system and in few other scenarios an offline system suffices the business requirement. Based upon employee coverage/usage organization needs to identify the right device as depicted in the following figure:

![Figure: Approach for mobility implementation](image)

![Figure: Device capability vis-à-vis employee population coverage](image)
Getting Started
Experts agree that you should pick the “low-hanging fruit” inside your company. Focus on applications that automate paperbound processes and improve customer service, enhance the productivity of expensive workers, reduce data-entry errors and cut process costs. Field service and sales are excellent initial candidates.

Start by providing mobile workers with basic, job-specific information such as inventory or customer history, accessed through simple icons on a dashboard display. Then add basic transaction capability to automate tasks such as logging a service call. Keep in mind that users would not be nimble-thumbed teenagers, so the data-entry process needs to be simple.

The hardware’s form factor, portability and battery life are just as important as the software it runs. Will they be using devices inside their vehicles, or outdoors in rain and snow? Do they need a device outside of the plant at all? Do they need an expensive ruggedized unit or a laptop? Finally, companies should determine whether their network coverage needs to support wide area wireless applications for field sales and service in addition to local area wireless coverage for the plant floor and distribution center.

Technology aspects
Before developing any mobile solution the following aspects need to be considered very seriously and finalized with development team and the respective stakeholders. By leveraging the computing power and form factor of the device, the application can include the following characteristics:

- Front End Requirement - A sophisticated user interface
- Light Weight Solutions
- Local data storage
- Synchronization with enterprise data stores
- Business logic in the client application
- Integration with Web infrastructure such as application servers
- Mobile database and synchronization
- Offline access to Internet content and applications (offline Web)

Front-end Requirements (User Interface)
- Modification of some applications for different form factors. Depends on the mobile/handheld devices, the user interface needs to be designed; i.e. the browser used for Online Web application will be different from the browser on PDA
- At times the requirements may lead to redevelop a scaled down size of the online application (portability perspective)
- Functionality and Performance testing of business applications of standard and customized (online & offline) application that are run from different Operating Systems and devices.
- IT companies should have developer's toolkits to rapidly build wireless device screens from portability and maintainability aspects

Light Weight Solutions
- The light weight database needs to be designed or used specifically for mobile devices with very limited resources.
- Business logic to be built in the mobile client application should be simple enough to make it work in both online as well as offline mode.
- Mobilize current desktop applications (only tune apps, no rewrites required)
- Different technologies may lead to maintainability issues; one source for online and other source for offline applications e.g. for online application Java has been used for development, whereas for offline .Net might have been used to development.
- Industry standard interfaces that allow rich application development using industry standard tools.
Online/Offline Solutions (Connected/Disconnected Mode)
- Rich runtime environment for Online-Offline Solutions
- Easy to integrate with Enterprise application servers
- Identify required connectivity and application architecture options
- Thin client Terminal Services, real time, or offline Web services, transaction processing, on-device database

Data Synchronization
- Robust data store
- High performance for larger data transfer
- Synchronize the data with enterprise systems & applications
- Scalable and efficient synchronization
- Security & Authentication for Mobile/wireless solutions
- Security features designed into the system
- Security Review and the verification that the security provisions and mechanisms work
- Common Access Security Mechanism (IPSec virtual private network (VPN) over Dial, Wireless, Digital Subscriber Line (DSL), Cable and so on)

High Reliability
- Secured High Speed Wireless Data.
- End-to-end security on Mobile devices and on applications

Maintainability Issues (Component rollout)
- Web-based administration tools for component distribution/upgrades, application changes
- Application Web-enabling tools

Integration with Back Office Application
- Designed for rapid integration into legacy application environments (integration with back office applications)

Convergent Solution: Cross Technology Collaborative solutions (GPS/RFID) to send and receive the data using GPS

Interoperability and roaming testing across the service provider’s network based on the respective geography and the growth of wireless broadband internet access.

Figure: Present state vis-à-vis Future state
3.0 Application of Mobility

Major applications of mobility are listed below:

- Mobilizing Field Service Management
- Mobilizing Field Sales
- Mobilizing Supply Chain Management
- Mobilizing Asset Management
- Mobilizing Shop Floor Management
- Mobilizing Business Intelligence

Manufacturing enterprises present unique challenges for the implementation of mobility as they operate in characteristically diverse an environment which includes carpet-to-concrete spaces, warehouses for incoming materials and outgoing products, clean or industrial production areas. Today’s technology solutions are designed to enable mobility across these environments in manufacturing producing benefits from the shop floor, through warehouse and transportation and in the hands of field employees.

In the field environment, standard business productivity applications such as wireless e-mail/contacts and calendar applications are widely used, as expected. Sales force automation (46%) and field service applications (24%) are identified for their importance in increasing field worker productivity and making real improvements in customer satisfaction.

We will be focusing on areas of Sales & Service Management with emerging field of Supply Chain.

Q: “What are the KEY applications driving your mobile device investment in a manufacturing enterprise?”

(Question and graph data from Motorola Enterprise Mobility Barometer - State of Mobility in Manufacturing)
3.1 Mobilizing Field Service Management

The field workforce is your primary interface with customers. With mobile voice and data in-hand, these workers have the tools they need to act as efficiently as possible in the dynamic environment of life in the field, enabling the delivery of a superior level of service excellence for each and every customer. Field personnel can collect an electronic signature as proof of delivery, transmit the signed invoice to the business billing system and print out a copy for the customer, right on the spot — no need to complete paper forms which must then be entered into the computer upon return to the office. The improved efficiency allows field personnel to make more stops — and generate more revenue or perform more service calls — per day. And the same device that streamlines the sales process also enables the rapid and accurate collection of compliance data to meet batch traceability requirements — and can transmit accurate invoices in real time to shave days of the order to cash cycle.

For industries that sell and service equipment with long product life cycles, the number of field service technicians can be in hundreds or even thousands. These technicians are the front line in the post-sale process. How well they perform their jobs can greatly influence both customer retention and new business opportunities.

Problems
- Loss of productivity
- Inaccurate information
- Reduced customer service
- Increased Costs
- Reduced employee morale

Capabilities needed
The critical issue is to get important information to the field service technician without the need to call in or visit the office. The following information pertaining to the customer and service request should be available on the technician’s mobile device:

- WP tracking
- Inventory and Material movement
- Plant Operations, Human Machine Interface
- Wireless email/Contacts & Calendar
- Asset Management & Maintenance
- Quality, Control & Quality Assurance
- Task List/Schedule
- Facilities Management
- Voice/Telephony/Factory Talk
- Record/Document Management
- Wireless SCADA Telemetry

- Shipping & Receiving
- Inventory Management
- Warehouse/Stock Management
- Transport/Regulatory/Stock Maintenance
- Facilities & Asset Management
- Wireless email/Contacts & Calendar
- Picking & Put-away
- Record/Document Management
- Voice/Telephony/Factory Talk
- Cross-Cutting
- Wireless email/Contacts & Calendar
- Sales Force Applications
- Field Service Applications
- Inventory Management
- Voice/Telephony/Factory Talk
- Asset Tracking
- Dispatch/Schedule
- Print of Sale Applications
- Fleet Management/Maintenance
- Facilities Management

Figure: Detail applications of mobility
(Source: Motorola Enterprise Mobility Barometer - State of Mobility in Manufacturing)
Even more time could be saved by adding mobile transaction capabilities that exchange information with the enterprise, such as:
- Call completion reporting
- Payment recognition and receipts
- Appointment booking
- Printing
- Service call escalation
- Complaints Entry
- Service ordering
- Barcode and Radio Frequency Identification (RFID) scanning
- Billing/Invoicing
- Integrated Global Positioning System (GPS) and routing

**Benefits**
- Increased customer service
- Increased competitiveness
- Increased revenue
- Lower service costs
- Improved Intelligence
- Better worker morale

### 3.2 Mobilizing Field Sales

During the last decade an explosion of sales force automation (SFA) and customer relationship management (CRM) systems were introduced to the market. Despite these enormous investments, however, user adoption is still challenging and limited. Extending SFA and CRM functionality to accessible, easy-to-use wireless devices puts these high value systems into the hands of mobile workers where and when they need them most, dramatically increasing user adoption rates and end user buy-in.

**Problems**
- Decreased selling efficiency
- Outdated pipeline intelligence
- Reduced worker morale

**Capabilities needed**
The critical need is to get important information from the SFA system to the sales representative:
- Contact management
- Personal and team calendar access
- Team notification for action items
- Personal to-do lists and alerts
- Situational fluency sheets
- New lead alerts
- Inventory availability
- Customer order history
- Order and delivery status
Pricing and break points
Offers, discounts and promotions
Competitive updates
Product bulletins
Access to knowledgebase

Consider extending your mobile field sales capabilities further still and incorporate simple transactions so sales representatives can complete reports as they go. This would include:

- Sales process tracking
- Call status reporting
- Pipeline metrics
- Quote and invoice creation
- GPS integration
- Product catalog access

**Benefits**

- Reduced selling costs
- Higher quota attainment
- Improved Intelligence
- Better worker morale

### 3.3 Mobilizing Supply Chain Management

Supply Chain Management (SCM) is a broad topic that encompasses many strategic issues such as number, location and size of warehouses, distribution centers and facilities, partnerships with suppliers, distributors, and customers, product design impact, and technology infrastructure. It also encompasses tactical processes such as demand planning, forecasting, sourcing, production, third party logistics, scheduling, inventory and transportation.

Most applications of wireless technologies today involve the use of RFID devices for material handling in distribution warehouses, moving inventory, cycle counting, shipping and receiving, and direct store delivery programs. Retail and consumer products companies with vast supplier and distribution networks have led the charge. Mainstream manufacturing is still in the early stage of adoption. Typical requirements for wireless in supply chain logistics management are:

- Mobile dispatch
- Mobile order tracking
- Package tracking
- Converged voice, data, GPS, route and vehicle information
- Integration to various data collection devices, e.g. barcode, RFID, electronic signatures
- Instant messaging
- On-the-spot mobile printers
- Exception alerts
- Virtual real-time vehicle tracking
- Fuel tax reporting
- Yard management
- Cross docking

**Benefits**

Improved material tracking and handling
Conclusion
Manufacturers have come out of the latest economic cycle with increased awareness not only of the importance of inventory control, but also the importance of improving customer service and visibility into their operations. Wireless can be a key enabling technology for businesses seeking to improve information quality, reduce costs, increase revenues and improve customer service and responsiveness. A wireless solution extends the value of your existing investments in enterprise and e-business applications. It also empowers your mobile employees both in and out of the building by delivering critical information to the point of performance and enabling them to record as they work.

Mobility is not about mobilizing existing processes. It is about rethinking them and finding new ways to harness the growing mobile workforce. Gradual change and ongoing process refinements is preferable to delaying your wireless initiatives until you can roll-out a sweeping change.

Mobility solutions lend themselves well to the following principle:

- Think Big – wireless can and will alter virtually all businesses practices
- Start Small – choose one functional area and then expand
- Move Fast – control initial project scope to deliver rapid results
- Make Money – eliminate waste and generate accounting verifiable Return on Investment (ROI)

Now is the time to make wireless mobility solutions part of your short, medium and long-term IT infrastructure plans. By investing in wireless solutions today, you can position your company to take full advantage of the “next big thing” tomorrow.

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