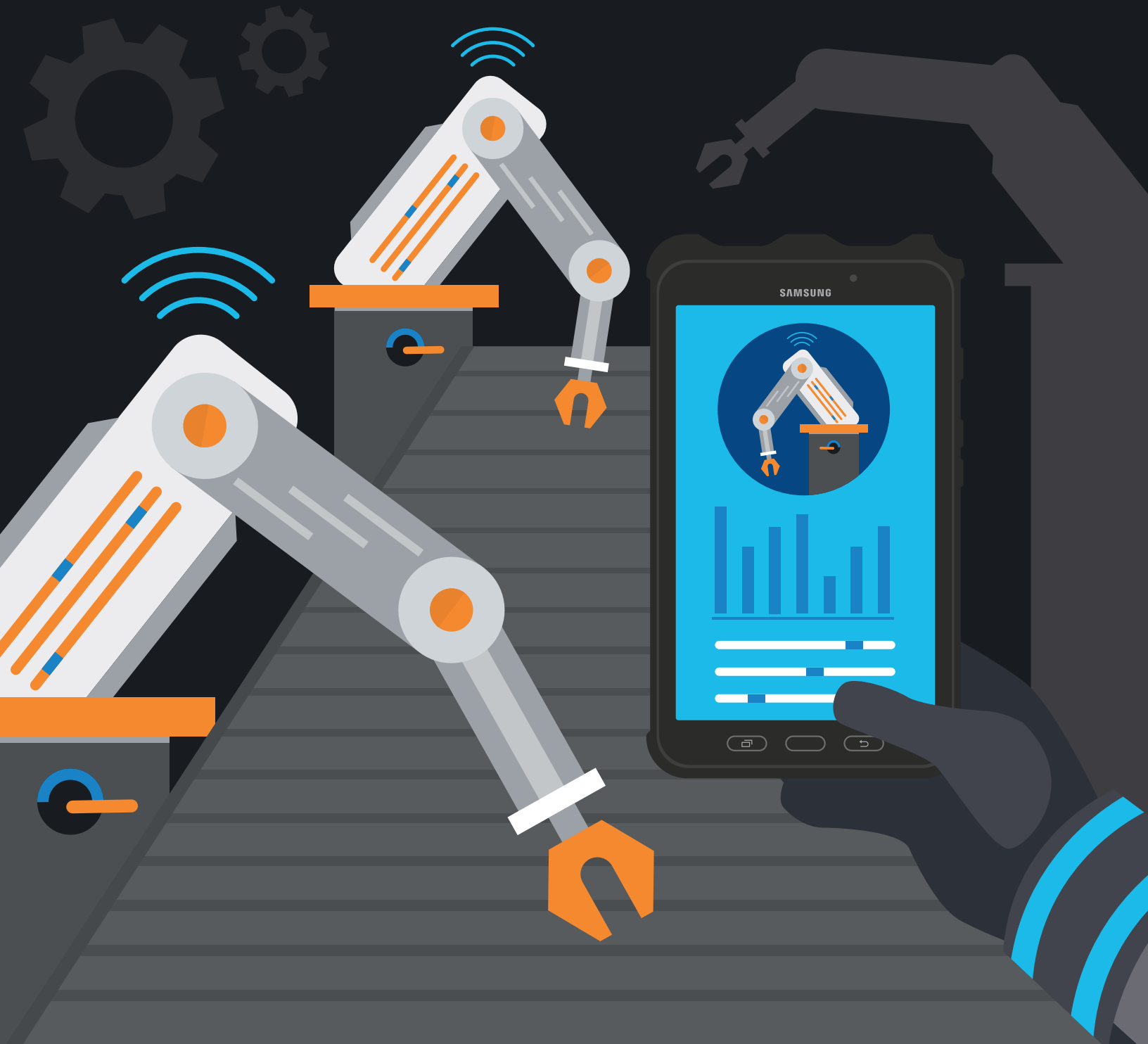


White Paper:

Manufacturing Modernization: How to Get There



Introduction

Most companies today are adopting smart factory principles, whether they are engaged in discrete or process manufacturing. A 2017 report by CapGemini¹ found that early adopters have already realized production gains of 20 percent in their smart factories. The report predicts much-improved on-time delivery, productivity and labor rates from smart factories by 2022. “We estimate that smart factories can nearly double operating profit and margin for an average automotive OEM manufacturer,” the report states. Manufacturers are embracing the trend, CapGemini reports, with 76 percent either having a smart factory initiative in place or in the process of formulating one.

Regardless of where a company is on their smart factory journey, mobile technology is the key enabler of modernization. Smartphones and tablets are the conduits that connect staff to the applications that run the business and distribute intelligence and insights on the production floor. Cloud-based apps and analysis put the “smart” in smart factories, and mobile devices consolidate that intelligence in one platform that any employee can use with minimal training.

This guide will help any manufacturer who is adopting smart factory principles understand how to accelerate their modernization with smartphones and tablets. It explains the different ways that mobility supports intelligent manufacturing and offers step-by-step instructions on how to choose the right devices and incorporate them in inventory management, predictive maintenance, task management and more.

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—CapGemini



Part 1: The Current Landscape

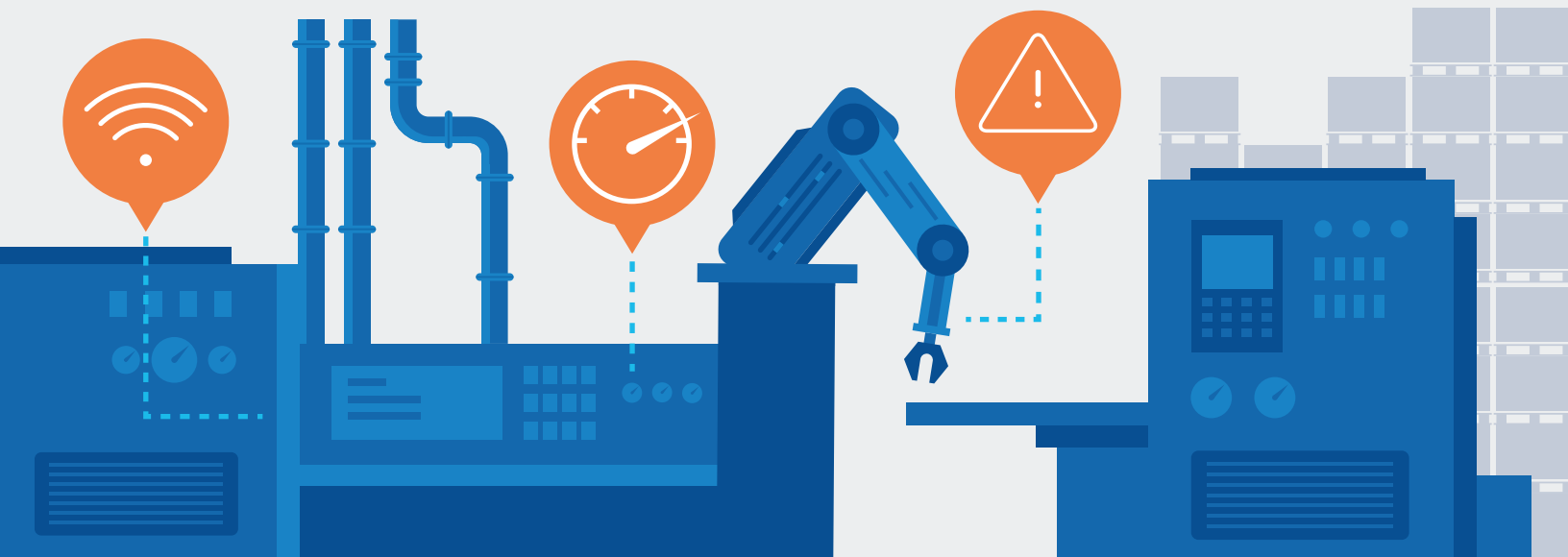
The smart factory running on an automated physical-digital-physical loop is the gold standard to which manufacturers aspire, but it is fully achievable only by the most digitally mature organizations. To fully leverage the best of Industry 4.0 for Product Lifecycle Management (PLM), companies must be outfitted with modern Industrial Internet of Things (IIoT)-embedded machines, use cloud computing to process large volumes of data and develop proprietary machine learning algorithms that can keep production running without disruptive downtimes. What's more, the smart factory requires a complete digital transformation nurtured by a C-Suite that embraces this bold new vision.

While many manufacturers are embracing digital transformation, most are not yet running fully automated smart factories; instead, they are in an earlier stage of their journey. A 2018 Forrester survey reported that just 58 percent of decision makers at manufacturing companies said their companies had launched a digital transformation initiative, and a mere 19 percent have completed the journey.²

Industry 4.0 and the Smart Factory

Industry 4.0 is the digital transformation of manufacturing that includes enhanced connectivity and convergence within the business, its partner ecosphere and the supply chain. The smart factory is a production facility that pursues optimization through the use of digitization and connectivity.

Smart factories typically embrace future-forward technologies such as machine learning and artificial intelligence (AI) to achieve a connected, self-auditing and self-correcting cyber-physical loop that is several steps beyond traditional automation. Data from the Industrial Internet of Things (IIoT) sensors and other physical inputs feed cloud-based analytics that help drive continuous improvement in the physical world.



Companies looking for easy and early wins would be well advised to first make the switch to mobile devices for their task management needs.



Today, manufacturing personnel might still punch in and out using paper cards. They often use paper work orders to decide which production jobs to tackle on any given day. Many workers are taking paper notes on quality issues or other problems that will need to be digitized at a later time.

The machines themselves might be slated for regular maintenance on a predetermined schedule, which leads to unnecessary disruptions in production and possible premature maintenance. Spare parts might be ordered in advance, even if not needed right away, tying up working capital. If machines fail, supervisors might need to manually sign off on purchase orders to facilitate repairs. Systems like these have worked for many years, but they are inefficient and have tremendous potential to go wrong — in costly ways.

The traditional means of doing business may be ingrained in the business at the C-Suite level. The Forrester report suggests that manufacturing companies are stuck in the age of the product and company executives are more concerned about cost reduction than improving customer service. Such a focus can be damaging to the long-term health of manufacturing companies, but the smart factory can help reorient the focus on the customer.

What will this take? Big data analytics demand high-speed computing power with low latency — something the legacy mainframe computers running many manufacturing companies simply cannot deliver. Some mainframe machines from the 1980s are not built to shoulder the responsibility of smart factories.

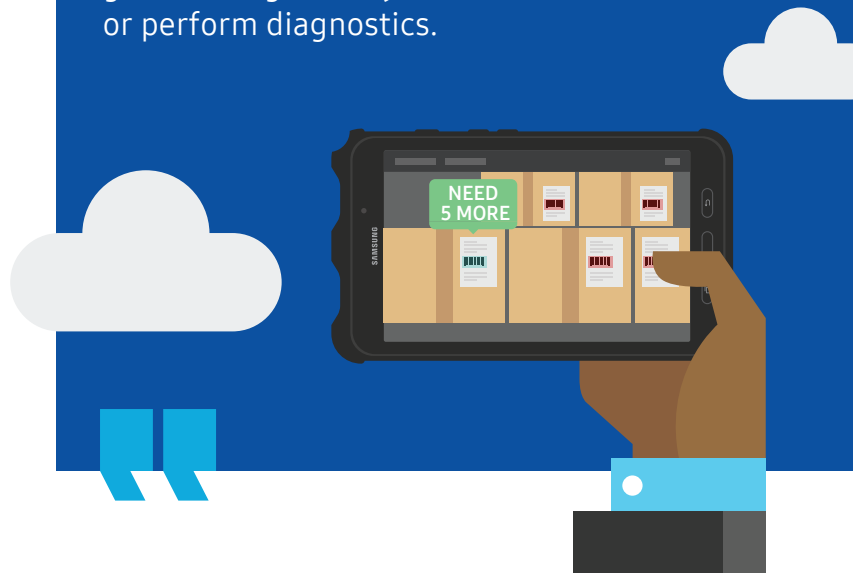
Stopgap solutions can help bridge legacy systems and big data in the short term. For example, Android-based systems on tablets and smartphones can communicate with mainframes as if they were just another green screen appliance. Older machines on the shop floor can be retrofitted with sensors to read IIoT data, but lack of uniformity in data types retrieved from different sensors might pose another hurdle. The biggest challenge with a network of add-on solutions is that they're often not all operating on a uniform platform. This means data still cannot be shared easily, which prevents the smart factory from reaching its potential.

Companies looking for easy and early wins would be well advised to first make the switch to mobile devices for their task management needs. No matter where companies are along the smart factory journey, mobile devices like the Samsung Tab Active2 and the Samsung Galaxy Note9 are the front line for the gathering, processing and analyzing of information. Both devices use the Samsung S Pen, which enables digital checklists and note-taking and liberates users from paper and clipboards. In companies where the move toward smart factories is a little further along, mobile devices can move them a step closer, serving as powerful edge computing machines that decrease latency by processing data closer to the source.

Mobile devices give employees control and access to data. Through smartphones and tablets, production personnel can access analyses and recommendations from the cloud and get the insights they need to course-correct or perform diagnostics. Through technology like Samsung DeX, which enables a complete desktop experience from a mobile device when docked, plant managers can easily switch between desktop mode at a workstation and mobile mode and enjoy the benefits of advanced mobility.

Mobile devices make employees more productive, increase manufacturing uptime and simplify task and asset management. They provide the essential conduit through which employees can access — and act on — data and keep the smart factory in high gear. Going mobile helps in practically every aspect of PLM, no matter where factories are on the path to mobile maturity.

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Part 2: Mobility Makes Factories Smarter

To maintain a competitive edge, manufacturers need to concentrate on the customer. This is an especially important pivot for manufacturing companies, because compressed product development cycles leave very little tolerance for products that don't make the mark. One of the many advantages of the smart factory is that it makes manufacturing adaptable and agile enough to accommodate a thorough transformation.

Manufacturing companies get there by digitizing systems throughout the value chain, so that every key segment of the production process is driven by data. Data-driven processes yield greater transparencies, which in turn enable plant managers to root out inefficiencies more quickly. Working with data necessitates efficiencies in each of the three stages: collection, analysis and delivery of actionable results. Mobile devices help with every stage and across the manufacturing production process.

Here are some key areas in the PLM cycle where manufacturing companies can lean on mobile to make factories smarter and operations more customer-centric.

Inventory Management

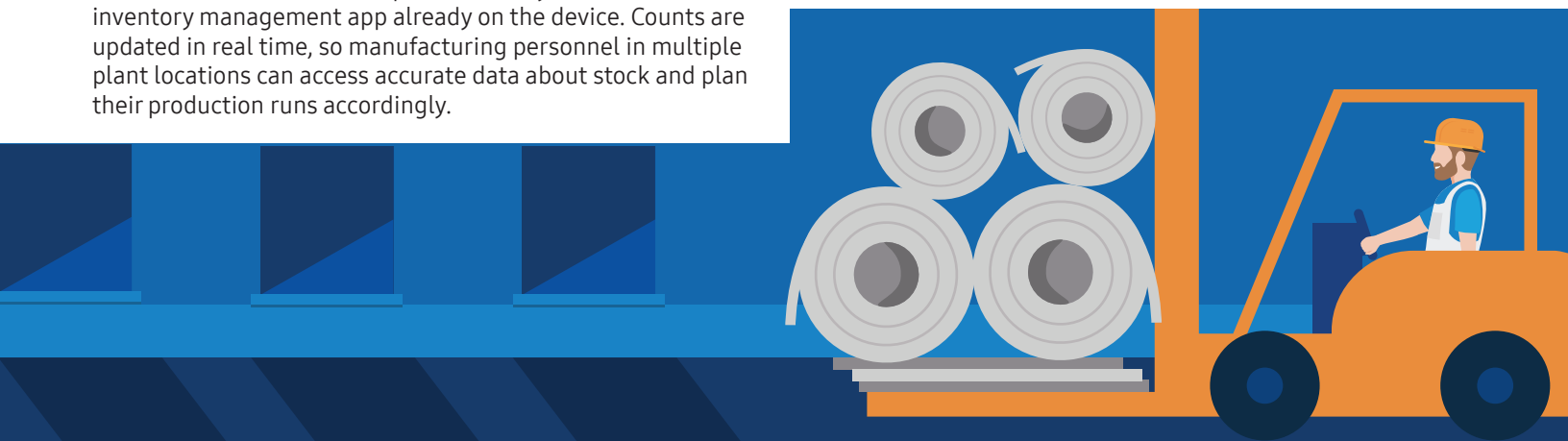
Barcode scanning is commonplace in production facilities, but for many manufacturers it still requires a separate piece of hardware. To successfully record transactions, the scanner traditionally has to be connected to a desktop computer or other device to access the inventory management software. The biggest inefficiencies are latency and the unnecessary cost of the single-purpose device. Since it takes time to synchronize current inventory data with the software, employees might not always get an accurate window of inventory in real time.

Moving the barcode and QR code scanning process to a smartphone or tablet confers a number of benefits:

1. Inventory updates in real time: The mobile device scans the raw material or finished product and synchronizes with an inventory management app already on the device. Counts are updated in real time, so manufacturing personnel in multiple plant locations can access accurate data about stock and plan their production runs accordingly.

2. GPS time-stamping: It's often not enough just to know inventory levels at a production facility — employees must also know where parts and materials that they have ordered or shipped are located at any given time. Manufacturers can use a combination of GPS-enabled smart sensors and mobile devices to track locations throughout the production facility and the supply chain. This allows workers to track supplies and goods from anywhere, provide accurate reporting to partners at any time and plan production runs with greater accuracy.

3. Beyond inventory management: It's often necessary to do more than just count inventory — employees might want to record problems or other information related to the product. A stylus device like Samsung's S Pen allows workers to write on the tablet as they would on paper and capture crucial information. Using the S Pen on the Galaxy Note9, for example, managers can also sign off on receipts, email them or generate PDFs for use by relevant stakeholders.



4. Visual record-keeping: Photographic records can help manufacturers in numerous ways, such as documenting the conditions of materials as they arrive at the facility or looping in an expert at another site to help diagnose a production line problem. A camera-enabled mobile device makes it easy for workers to attach visual documentation of any material claims along with the inventory log — a capability basic barcode scanners cannot provide without additional peripherals. Samsung smart devices can be customized prior to deployment through Knox Configure, which allows IT administrators to configure an off-the-shelf device like a phone into a purpose-built one, like an advanced barcode scanner that performs specific functions such as capturing data. Knox Configure can also customize for specific security controls, such as turning off Bluetooth and Wi-Fi to control data sharing. This would enable a manufacturer to capture and collect images securely and share them only where and when they're needed.

Production Optimization and Preventive Maintenance

Every time an asset on the production floor breaks down or goes unused, production efficiency is compromised. Unplanned downtime takes a heavy toll on manufacturers — as much as \$50 billion annually.³ To cut downtime and optimize asset ROI, companies must improve machine maintenance scheduling.

On the one hand, they can choose to extract the most life from a machine (run-to-failure) so as to save on unwarranted interruptions in production. This frees up working capital that might otherwise be tied up in spare parts and decreases the number of times production has to be suspended to attend to machine maintenance. However, the approach carries a risk of catastrophic failure that could lead to days of stalled production and a scramble to find replacement parts.

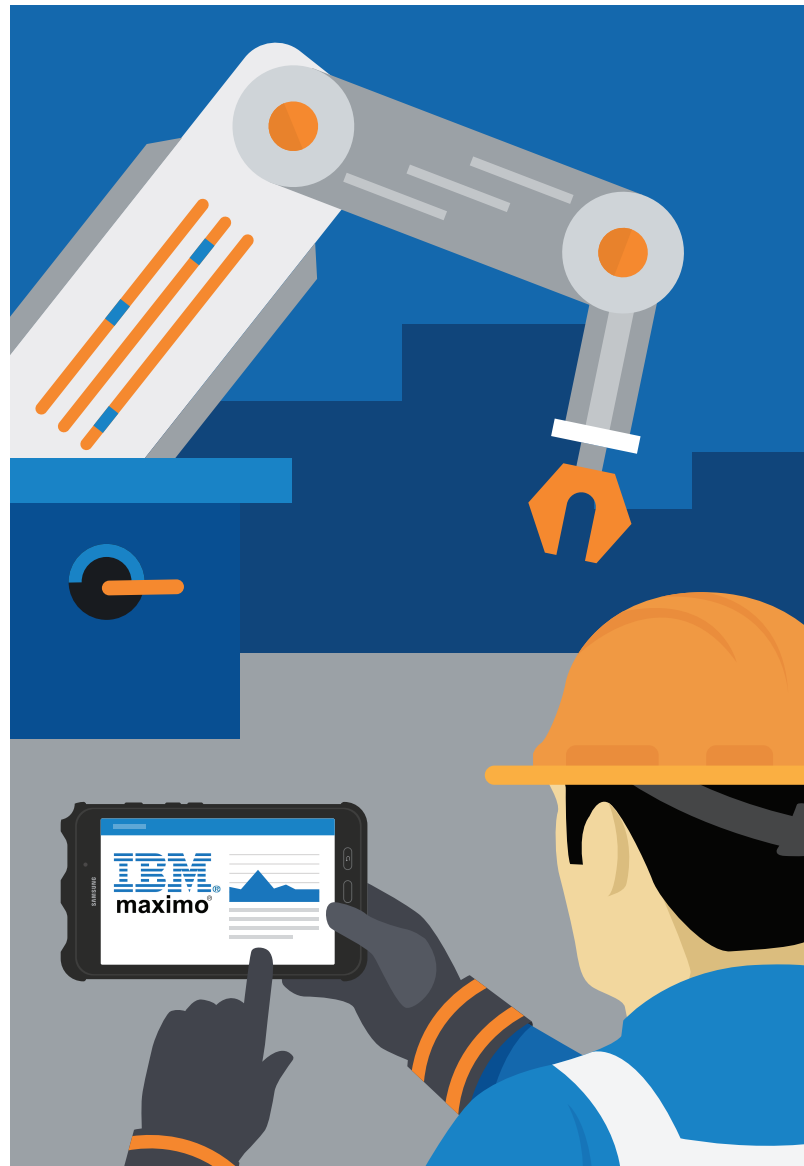
To prevent such extreme measures, factories can rely on preventive maintenance, studying historical data and leaning on knowledge from floor workers to predict when a part might fail — and to plan for contingencies by ordering and replacing spares on a fixed schedule.⁴

However, while a preventive approach avoids the dramatic swings of run-to-failure, it is still inefficient for two reasons: It does not squeeze out the maximum usable life from machines, and maintenance chores can disrupt production more than necessary.

The smart factory, aided by the mobile device, addresses these potential inefficiencies. Data gathered from IIoT devices now triggers alerts when a predetermined threshold for a certain parameter is exceeded. A motor overheating, for example, can send a text alert to a worker's smartwatch or phone. Predictive

maintenance (PDM) runs on machine learning algorithms built on baseline models of part failures, and the algorithm's forecasts grow increasingly accurate over time as new information about failures is inputted into existing models.

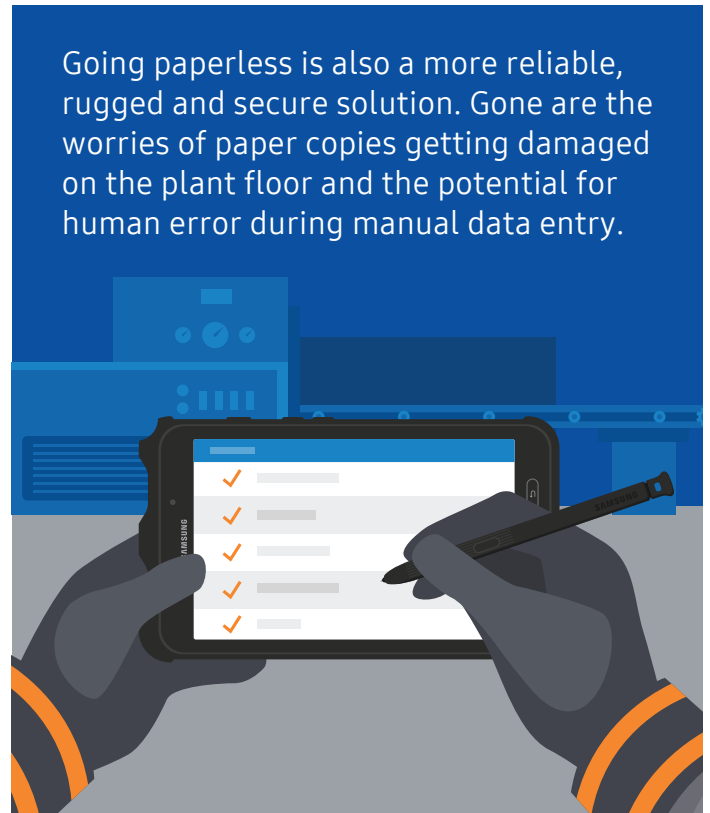
Mobile devices serve important functions in PDM: as the conduit to receive alerts about potential failures through a smartphone or wearable; as a powerful edge processor; and as a data layer that helps workers diagnose problems, review past history of repairs, fill out work orders, submit to managers for review and record a data log of potential failure (including photographs and video). A tablet or phone can also aid in machine repair using augmented reality to layer machine diagrams over pictures of failed parts, enabling faster diagnosis on the production floor. Downtime decreases, ROI increases and changeovers take less time.



Employee Productivity

A Frost & Sullivan study shows that using mobile devices can increase employee productivity by an impressive 34 percent per day.⁵ Mobility delivers these advantages in two ways: enabling companies to go paperless and cutting down on the movement required to complete tasks. Production workers can punch in and out using a mobile tablet, request time off and perform other administrative functions more conveniently. Plant managers can sign off on work orders using a device pen and access task lists. Paperless task management is one of the cornerstones of smart factories, because it eliminates clutter and repeat data entry. Going paperless is also a more reliable, rugged and secure solution. Gone are the worries of paper copies getting damaged on the plant floor and the potential for human error during manual data entry.

Mobile devices help employees attend to work on the go — a key factor in improving productivity. Managers need not travel to a desktop in the main office just to file a maintenance report; they can dock a smartphone to a hot desk and access a complete desktop experience, file reports and answer emails. Essentially, mobile devices come to where the work is, instead of the other way around with stationary devices. Such a solution increases speed and decreases data latency, both of which are key performance indicators in the smart factory.



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Quality Control

Customer-centric production in smart factories often focuses on specialty products with shorter lead times that leave very little tolerance for defects. Quality control is a critical aspect of all production processes but is especially so in Industry 4.0. A versatile mobile device can enable manufacturing personnel to layer augmented reality (AR) images of the ideal against a test sample from the production lot to conduct a visual quality check. When mobile tablets are dedicated to individual machines, they can house videos and processes that employees can access and train on, further increasing the chances of a high-quality final product.

A versatile mobile device can enable manufacturing personnel to layer augmented reality (AR) images of the ideal against a test sample from the production lot to conduct a visual quality check.



Part 3: Mobility Strengthens Hybrid Computing Environments

In manufacturing companies that are further along the path to a smart factory, mobile devices present a radical opportunity as edge computers that make powerful processing portable and local. Since data powers Industry 4.0, manufacturing companies need robust computing resources to analyze it all and deliver meaningful insights. Adding servers onsite might not always be the most agile solution. The alternative: cloud computing for much of the data, which occurs on a remote server and allows results to be accessed by employees anywhere through robust and secure connectivity. The problem with relying on cloud computing alone is that it increases latency in data processing — the data has to be routed to the cloud and the results delivered back. Every microsecond matters when a machine is about to fail.

Hybrid computing — a mix of cloud and on-premise data processing centers — solves this problem elegantly. Machine learning algorithms that need a high level of computing power reside on the cloud; meanwhile, mobile devices increasingly take up the on-premise aspect of the

hybrid computing equation. Today's powerful smartphones, which have 4GB to 8GB of RAM and up to 1TB of storage support, can function as capable edge computing processors. A tablet reading the pulse of IIoT data from a machine can have the company manufacturing execution system (MES) and all relevant machine learning algorithms pre-installed and periodically updated.

Such devices deliver predictive maintenance alerts through their edge computing abilities by crunching all the numbers close to the source. Experts forecast that the demand for edge computing is only going to increase. According to IDC, edge computing will comprise over 40 percent of cloud deployments by 2022, and a quarter of all edge processing units will be executing AI algorithms.⁶

With their capacity to deliver multiple improvements to production environments, mobile devices are essential allies in every company's digital transformation, regardless of the company's current level of digital maturity.

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Part 4: Getting There

Once a company chooses to increase mobility, what does that process look like and where does one begin? The first step to launching a digital transformation is ensuring a buy-in from all stakeholders involved, including the C-Suite and employees who will need to be trained to work with new technology and a potential reshuffling of responsibilities.

A blueprint must outline SMART goals (specific, measurable, achievable, relevant and time-based) against which to measure progress. Key performance indicators (KPIs) must be outlined, and companies need to establish realistic timelines against which to achieve progress. Companies also need to anticipate speed bumps and unforeseen circumstances along the way. Strategic partnerships can enable better optimization of mobile deployments while making the transition more seamless.

Once the foundation for the transition to mobile is in place, it's time to make a thorough walkthrough of the production process — keeping data, technology, process and security under the spotlight.



Even if embedded machines on the shop floor are generating copious amounts of data, not all of it needs to be analyzed to yield relevant insights. Companies must understand which data sets to gather and how to process them most efficiently. They should also evaluate processes

to find out which procedures are easy wins, which ones might need more extensive technological backup, and what the expected ROI will be from each switch to digitization. It is important to remember that since processes are interconnected, dividends won't necessarily be siloed but instead be spread up and down the production process, which means efficiencies stack up incrementally.




A Blueprint for the Switch to Mobile


Making the switch to mobile will require that companies adhere to a basic checklist:


-  **1. Ensure Corporate Buy-in**
Above all, a switch to mobile requires a mindset shift both in the C-Suite and from employees across the organization. Since the process is technology-driven, ensure CIOs and IT system administrators are on the same page, with the complete backing of corporate.
-  **2. Conduct an Inventory of Existing Devices**
A blueprint must include an inventory of existing staff and devices (mobile or otherwise) — and must assign devices accordingly. Which employees incorporate mobile devices in their workflows during the first phase, and why? What are the long-term efficiencies you hope to achieve?
Companies need to choose devices based on the following considerations:


 - Ruggedness
 - Processing power
 - Device features
 - Battery life
 - Security

Depending on the long-term goals of manufacturing modernization, companies may also choose to retrofit individual machines with tablet devices that monitor equipment health.

 **3. Inventory of Existing Applications**
Most companies are already working with a combination of software applications and often have a proprietary MES layered over them all. An application inventory determines which applications can be moved over to mobile-only processing first. Android mobile apps, for example, are already seamlessly enabled in Samsung devices, while web-based applications can be accessed through browsers in the mobile devices. Applications that are Windows-native will require a virtual desktop infrastructure (VDI) until mobile equivalents become readily available, or they can be ported into the mobile environment.

 **4. Capacity Considerations**
As the transition to mobile gets underway, IT administrators will have to gauge ongoing system and training capacity, as both mobile and desktop devices will be utilized during a transition.


 **5. Implement an EMM Protocol**
Once companies have run down the checklist of parameters that must be considered before making the transition to digital, it's wise to implement a company-wide enterprise mobility management (EMM) suite. EMM is IT's toolkit for conveniently handling a fleet of smartphones and tablets. With Samsung Knox Platform for Enterprise, IT has a powerful set of tools to enroll devices; create custom device profiles; and manage devices, operating systems and apps remotely.

 **6. Organize the Device Rollout**
The manufacturing company's switch to mobile devices can be executed in a three-step process, depending on its technological maturity and long-term blueprint.

Stage 1: The first stage transfers routine desktop functions like data entry to mobile devices. For example, requesting vacation time, punching into and out of work and signing work and purchase orders can move over to mobile devices. It's a good idea to move one function over at a time and test all processes to ensure a seamless transition.

Stage 2: In stage two, functionalities can target the specific advantages unique to the mobile device. For example, manufacturing companies can take advantage of video and camera capabilities to facilitate record logs that incorporate these visual proofs if needed. Manufacturing personnel can also use geolocation and barcode scanners provided by mobile devices for more efficient inventory management.

Stage 3 and beyond: More advanced stages could leverage mobile devices as edge processors to increase the level of automation on the plant floor. Mobile devices can analyze IIoT data against machine learning algorithms and enable predictive maintenance.

 **7. Define and Measure Metrics**
Establish KPIs, measure them on an ongoing basis and course-correct as needed. Measurements must account for a few hiccups during the transition. Do you see an increase in CRM abilities because sales reps now have a window into production schedules? Does inventory management synchronize with production schedules? What does manufacturing uptime look like? Where are the bottlenecks, if any? Remember that a switch to mobile will not automatically eliminate inefficiencies; instead, it modernizes manufacturing to an extent where the process becomes transparent and the inefficiencies are easier to spot and address. Over time, companies can expect mobile devices to become the conduit through which most analytical insights are delivered.

Conclusion: Building Toward the Future

Today and in the smart factories of tomorrow, mobile devices grease the wheels of manufacturing by delivering efficiencies across the board: improving employee productivity, decreasing downtime, tightening the digital supply network, and improving inventory and asset management. Mobile devices create a robust platform for companies to leverage the many advantages of future-forward technologies such as AI, robotics, IIoT and machine learning. They are essential for companies looking to adopt the principles of Industry 4.0 and gain a new competitive edge in the landscape. Factories can begin the path to mobility no matter their stage of digital maturity. They can implement the blueprint to mobility one step at a time, and realize greater efficiencies the further along they are in the journey to becoming a completely smart factory.

About Samsung

Samsung develops custom mobility solutions for manufacturing companies looking to modernize their methods and embrace the principles of smart factories. As a leader in enterprise mobility and information technology — and the operator of some of the world's most advanced factories — Samsung draws on its experience and expertise to deliver comprehensive, turnkey solutions. Using Samsung services, manufacturing companies can conduct a systematic survey of their current manufacturing capabilities, craft a blueprint for a complete digital transformation and rely on Samsung to deliver the mobile capabilities that bring these plans to fruition.

Footnotes

1. <https://www.capgemini.com/resources/smart-factories-how-can-manufacturers-realize-the-potential-of-digital-industrial/>
2. <https://www.forrester.com/report/Center+Your+Manufacturing+Digital+Transformation+On+The+Customer/-/E-RES141895#>
3. <https://partners.wsj.com/emerson/unlocking-performance/how-manufacturers-can-achieve-top-quartile-performance/>
4. <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/process-and-operations/us-cons-predictive-maintenance.pdf>
5. <https://insights.samsung.com/2016/08/03/employees-say-smartphones-boost-productivity-by-34-percent-frost-sullivan-research/>
6. <https://www.forbes.com/sites/louiscolombus/2018/11/04/idc-top-10-predictions-for-worldwide-it-2019/#13d7dab57b96>

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