

Operational Excellence through Digital in Manufacturing Industries



Executive Summary



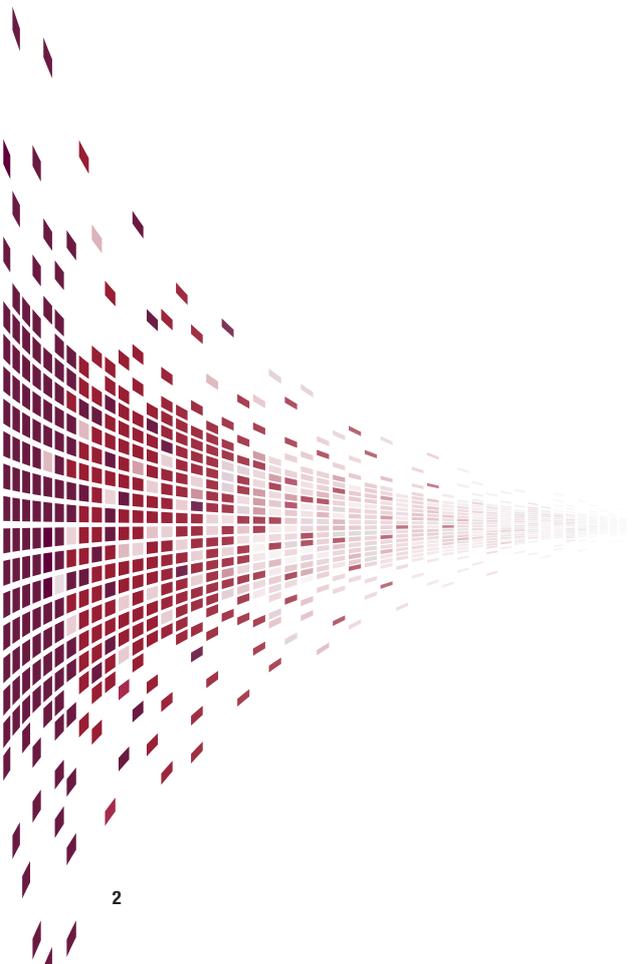
Manufacturing companies have historically had an on-off relation with technology. Most have aggressively adopted traditional technologies such as Enterprise Resource Planning (ERP). However, they have been slow in adopting recent digital technologies such as big data analytics, real-time order confirmation, Web-EDI among others. Moreover, most have adopted technologies to varying extent creating a connectivity gap in their operations. We believe digital technologies will help manufacturing companies in eliminating this gap. Our research and project experience indicate that by adopting digital tools, manufacturing companies can cut costs by as much as 30% by enabling savings on capital costs, labor field force among other key cost elements.

The first area where digital technologies can have significant impact is on manufacturing operations. Most manufacturers still rely on traditional and outdated models of planning. By migrating to advanced planning systems, and using digital technologies, they can gain greater visibility into their manufacturing operations. LG Display integrated seven different planning and execution systems to gain a unified process data view of its global plants.

Supply chain visibility is a key item on the agenda of Supply Chain Management (SCM) professionals. Over the years, SCM has seen deployment of multiple disparate digital tools, creating a siloed system that distorts end-to-end visibility. Digital tools can help bridge these connectivity gaps. Levi Strauss & Co. reduced manual tracking and tracing of inbound shipments by 98% by implementing a supply chain visibility platform supporting ASN (Advanced Shipping Notification).

Digital tools aid the service function in overcoming information paucity, enabling effective scheduling, providing multifunctional tools to field technicians and driving the overall productivity of service operations. Kinetico, a manufacturer of water treatment systems, cut its service resolution time into half, after deploying a cloud-based service management solution.

We believe digital technologies can help manufacturing organizations achieve excellence in manufacturing operations. However, this requires a structured approach involving, among other steps, a maturity assessment, prioritization of digital initiatives and setting up of a digital operating process model. Manufacturers should also consider lessons learnt from the earlier generation of technology deployments and stay away from taking a silo-based approach.



Manufacturing Companies Do Not Fully Leverage Digital Technologies

Manufacturing companies have traditionally been early adopters of selected technology such as ERP and Production Planning systems. For instance, a survey among 170 global manufacturers reported that 92% of them had implemented an ERP system¹. Manufacturers also have systems in place that are able to support the management and control of internal material flow. Most warehouses are managed automatically and machines are controlled by CNC¹ or DNC² software. However, the challenge is that most of these initiatives have been implemented in silos. Different processes have been made digital at different times

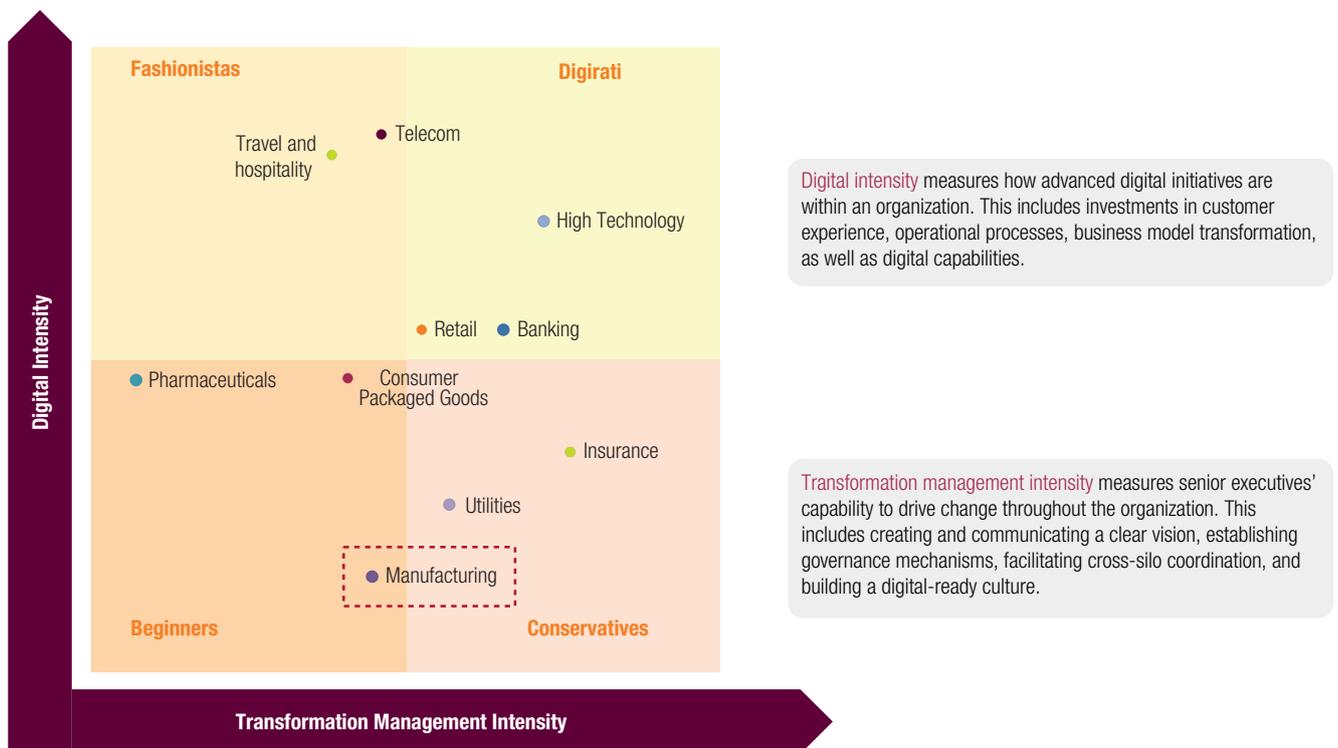
and to varying extent. Consequently, most manufacturing companies have not achieved a complete integration of information flow along the operations process.

Compared to older technologies such as ERP, manufacturing companies have been quite slow to adopt more recent digital technologies. Our research with the MIT Center for Digital Business showed that only 12% of manufacturing companies are truly leveraging the power of digital technologies – we call these companies Digiratis³. This compares unfavorably to other industries such as banking,

insurance and telecom where over 30% of companies are Digiratis. As an overall industry, manufacturing companies collectively fall in the “Beginners” category (see Figure 1).

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The manufacturing industry is a ‘Beginner’ in digital maturity.
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Figure 1: Digital Maturity by Industry, 2012



Source: Capgemini Consulting – MIT Center for Digital Business research, 2012

1 CNC = Computerized Numerical Control

2 DNC = Distributed Numerical Control

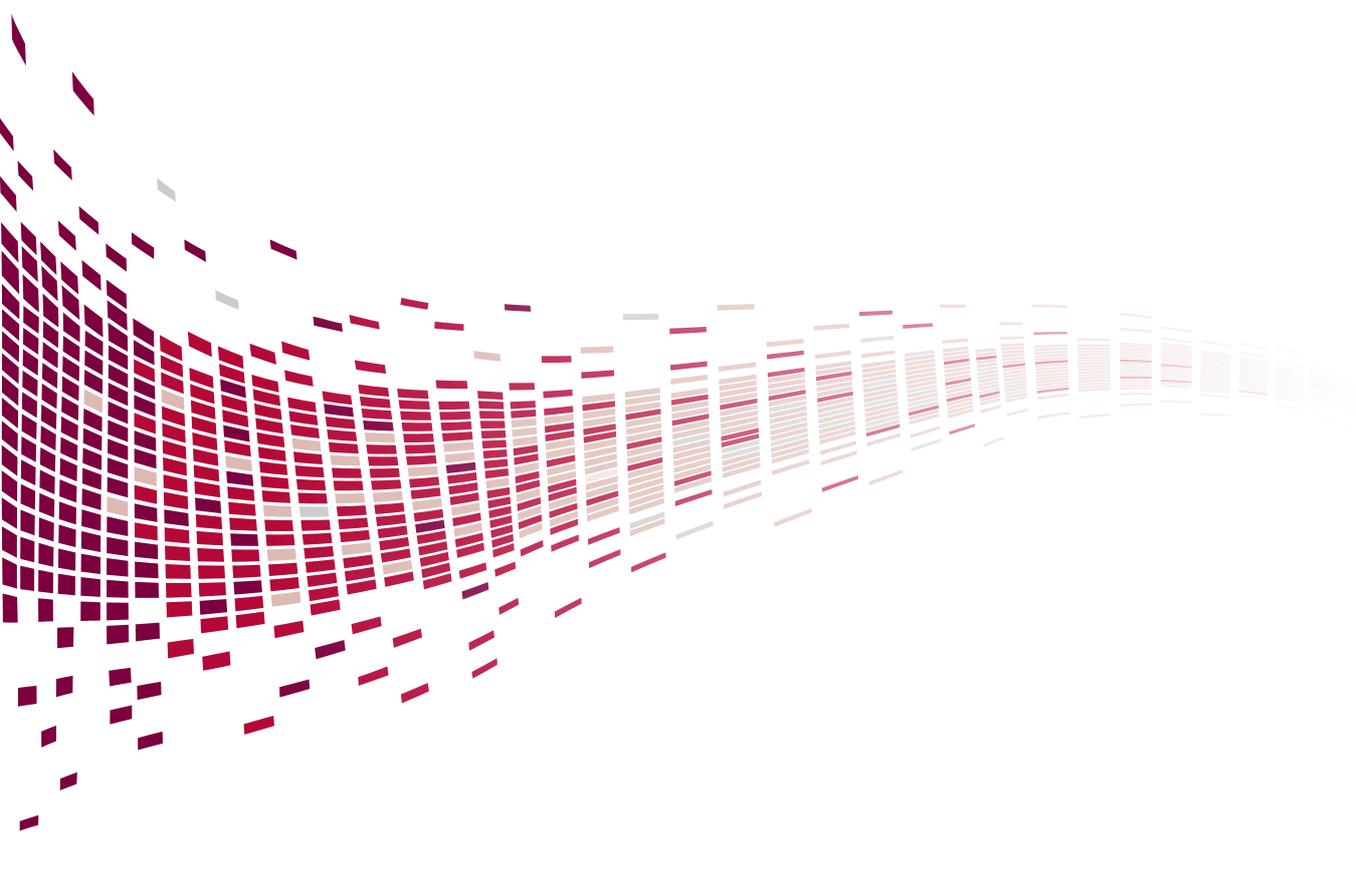
3 Digiratis are the category of companies that exhibit the highest amount of digital maturity, a combination of digital initiatives and management practices

Our research indicates that while manufacturing companies have invested in technologies, they have largely done this in silos. Only 38% of manufacturing industry executives indicated that digital initiatives in their company were coordinated across functions or regions. Such an approach results in connectivity gaps where information does not flow freely across departments and business units. This hinders achieving operational excellence. Manufacturing companies have now begun to recognize this gap. For instance, a global survey highlighted that 75% of manufacturers considered improving internal cross-departmental systems, and process collaboration and integration as their top strategic prioritiesⁱⁱ.

Most manufacturing companies today are still in the early stages of their digital transformation journey. They are not leveraging the significant benefits that digital technologies can bring in driving operational excellence.

In this paper, we take a look at how digitization will help manufacturing companies in the key three main process domains of manufacturing operations, supply chain and service maintenance. For each of these areas, we assess how manufacturers can minimize the connectivity gap. We conclude the paper with an actionable roadmap on how to achieve operational excellence using digital transformation.

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Digital Technologies Enable Operational Excellence in Manufacturing Operations



When it comes to key aspects of operations, most manufacturers still rely on outdated models of planning, systems that offer poor visibility and involve excessive human intervention leading to suboptimal results.

Lack of Integration between planning and execution impedes operations

Materials Requirements Planning (MRP) is a key part of operations management and inventory control in most manufacturing operations. MRP systems ensure that materials are available for production while maintaining the lowest possible material and product levels in store. They are also responsible for purchasing and manufacturing activities and for planning delivery schedules. However, manufacturers continue to rely on traditional methods of operations execution. It is estimated that more than 70% of manufacturers still use 'Infinite Planning' methods through MRP systems to schedule their production programⁱⁱⁱ. Such 'Infinite Planning' methods forecast potential future capacity without taking into consideration the actual capacity constraints of each individual work stream. Instead, they assume an infinite capacity, which results in machine overload and unrealistic delivery dates. This causes split of production orders, inventory carrying and change-over costs. As a result, frequent manual adjustments on shop floor control level need to be done to improve deviations in production. The unnecessary manual work impedes automation and overall productivity, and adds waste to the system.

Digital Tools Afford Greater Visibility

Digital integrated production planning and shop floor control improve visibility into production progress and material availability. These tools help in avoiding activities with limited value-add such as searching for material, counting and

troubleshooting, and manual data entry tasks. Consideration of current production capacity enables organizations to prevent outcomes such as unreasonable delivery dates. Finite planning and execution tools take existing capacity into account, unlike infinite planning that assumes unlimited capacity. In combination with real-time confirmation and current machine status information, resource overload situations can be avoided resulting in a feasible production order plan that would eliminate manual intervention. Reliable and real time order confirmation can be enabled by machines connected to the ERP and integrated with customer order management system. This will enable companies to give their customers realistic order confirmations leading to increased customer satisfaction.

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LG Display integrated 7 different systems and created a unified process data view resulting in better decision-making.
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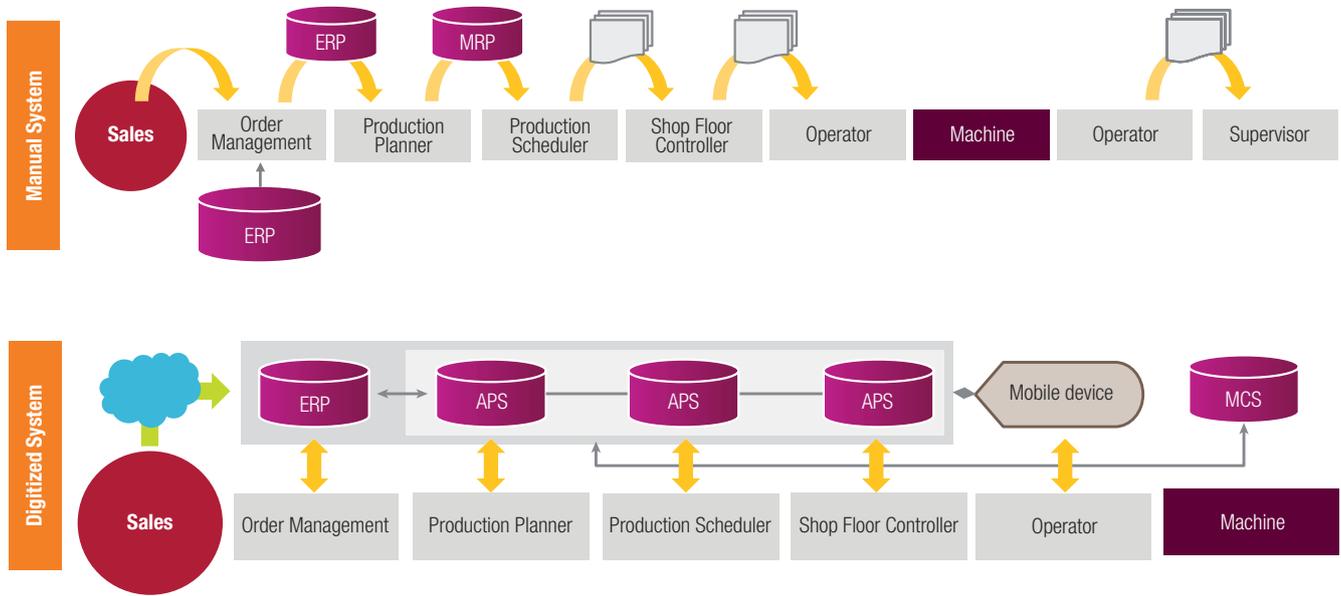
By integrating information flow during all steps of operations, the visibility required to properly manage these end-to-end processes can be achieved. Consider the case of LG Display. It is a leading global manufacturer of LCD panels. The company had been using disparate Manufacturing Execution Systems (MES) in each of its plants. They were facing challenges with data standardization, standards of production information and hardware profiles. They wanted to integrate all of the MES with their existing ERP in order to make their business systems real-time. They also wanted to consolidate decision-making systems by processing and displaying real-time information through ERP. The company integrated multiple areas of its IT systems

including Enterprise Resource Planning (ERP), Master Data Management (MDM), Element Management System (EMS), Manufacturing Execution System (MES), Supply Chain Management (SCM) and dataware house (MDW, EDW). Post the deployment, the company was able to have a unified process data view of 9 overseas offices of LG Display. Through data standardization and process re-establishment, systematic data connection and integration between European, Korean, and foreign offices was made possible, resulting in better decision-making^{iv}.

Digital Technologies Cut Down on Delays by Eliminating Human Intervention

Connecting an Advanced ERP system with a machine control system allows for direct transfer of production orders to the machine. Alternately, the production orders can be transferred to digital devices, which display them to the shop floor control team. This eliminates manual tasks and automatically directs information flow to the target destination. The connectivity between ERP and operations execution system also introduces more transparency and visibility into material availability (see Figure 2).

Figure 2: Integrated Digital Manufacturing Operations



Source: Capgemini Consulting Analysis

Flow of Digital Data Simplifies Supply Chain Management



Supply chain visibility is a key item on the agenda of Supply Chain Management (SCM) professionals. Similar to manufacturing operations, SCM has seen the implementation of multiple disparate digital tools, which creates a siloed system and distorts end-to-end visibility. Indeed, our global survey found that over 40% of supply chain executives believed that improving supply chain visibility could improve their organization's competitive advantage^v. There are three major connectivity gaps related to supply chain management processes. These include the

- point of sales connection and immediate customer order reactivity,
- lack of inventory visibility during inbound transit, production and outbound transfer and
- absence of integrated supply chain planning and execution.

These gaps can collectively lead to process and cost inefficiencies.

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40% of supply chain executives believe improving supply chain visibility can result in the organization gaining a competitive advantage.
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Digital Tools Bridge Connectivity Gaps

Multiple sales opportunities are lost due to the inability to confirm customer orders quickly and consistently. Academic research has shown that the magnitude

of lost sales increases with time delays^{vi}. Similarly, production downtime often occurs when there is no information regarding delays in the inbound supply chain. Lack of visibility into stock levels results in overproduction and inventory pile-up. Research studies indicate that over 90% of suppliers incur anywhere between 0-7% of their sales as additional costs due to forecast deviations^{vii}.

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Companies can achieve savings of over 20% in transport costs by using end-to-end planning systems and processes.
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Integrated digital tools perform information synchronization, inventory management, order fulfillment, delivery planning and coordination. These tools take the guesswork out of operations and reduce complexity during the planning process. The coordinated use of an Advanced Planning System, Point of Sale data and analytics solutions ensures reliability of sales projections and stability of the supply chain. Fully integrated planning systems that take into account actual capacity restrictions help avoid unnecessary production, troubleshooting and premium freights.

Integrated Business Planning Drives Transparency

Manufacturing companies can increase the overall level of transparency in their supply chains by using advanced planning tools and integrating company

functions during the planning process. This leads to greater stability in inputs across planning and operational processes. It also helps companies to be more effective at customer demand-driven production and delivery. We have observed that reliable planning can significantly drive down logistics costs for transportation. Order splits caused by 'surprises' in the supply chain typically lead to additional transportation and handling efforts. These can be avoided by using end-to-end planning systems and processes that provide full visibility into the supply chain. Companies that have implemented such systems have shown that savings up to 20% of transport costs can be achieved – by eliminating order split and emergency freight (often air freight). In the case of a Swiss manufacturing company, we found that additional transport required, caused by late deliveries due to order split, reduced by 13%. Reliable planning can also reduce the cost of warehousing as inventory levels can be optimized. Moreover, such integrated planning also ensures that stock levels are optimized based on forecasted demand that is derived from historical sales and inputs from sales teams^{viii}.

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Digital Technologies Enable Effective Management of Information Flow

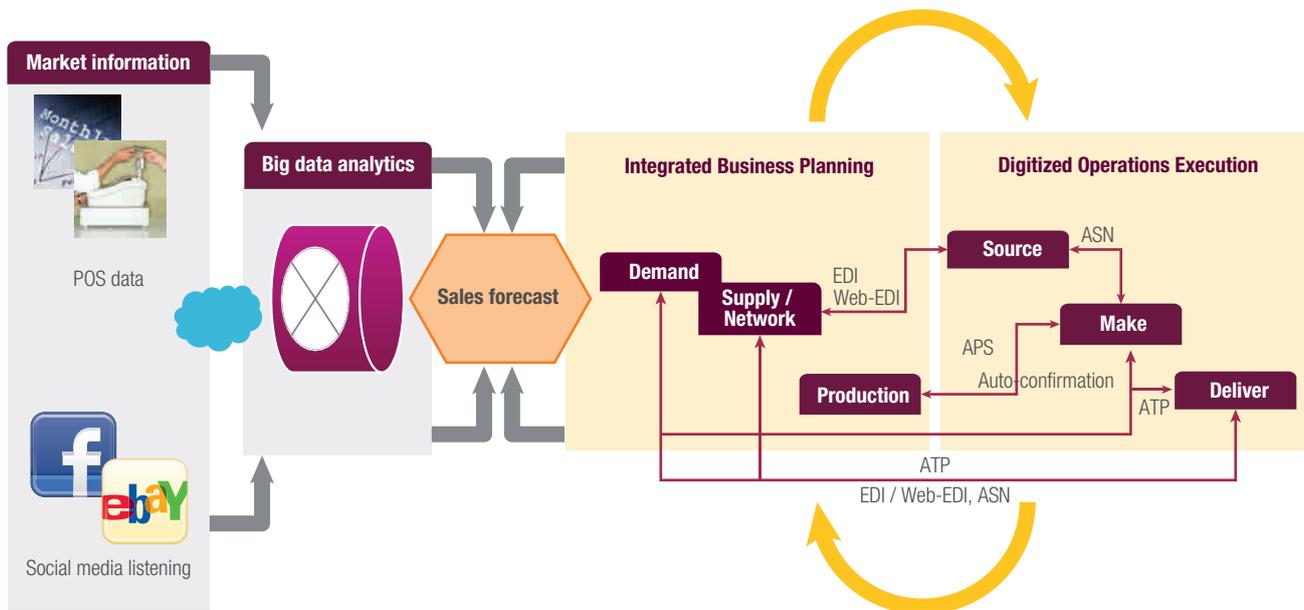
Digital technologies can also be used to manage the information flow from suppliers to the manufacturing facilities and further down the value chain to the customer. This can be achieved through technologies such as EDI⁴-enabled Advanced Shipping Notification (ASN)⁵. Similarly, companies can connect inventory management tools across transport modes using digital technologies such as positioning and navigation systems (see Figure 3).

Take the case of apparel company Levi Strauss & Co. The company sells its products through a variety of channels including retail chains, department stores and online sites. Managing inbound logistics for the company was

a complex task as it required interfacing with hundreds of trading partners through manufacturing and supply bases located across Asia, Middle East, Africa and Latin America. Levi Strauss & Co. deployed a best-of-breed supply chain visibility platform to handle their inbound logistics. A key requirement was the need for the platform to handle shipping notifications that came through EDI. Post the implementation, Levi Strauss & Co. experienced a positive impact on the safety stock, improved its lead times and staff efficiency. They were able to realize the benefits in less than 18 months as against an initial estimate of two years. The deployment also enabled the company to reduce manual tracking and tracing of inbound shipments by a significant 98% and calls/emails by 80% as the system provided self help to users^{ix}.

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Levi Strauss & Co. reduced manual tracking and tracing of inbound shipments by 98% by implementing a supply chain visibility platform supporting ASN.
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Figure 3: End-to-End Digitally Enabled Supply Chain Model



Source: Capgemini Consulting Analysis

4 EDI = Electronic Data Interchange

5 Advanced Shipping Notification is a notification of pending deliveries and is usually sent in an electronic format

Field Service Becomes More Effective using Digital Tools



The service and maintenance function has evolved from being a cost center to a significant value generator for manufacturers. A recent survey reported that 58% of organizations treated the service function as a profit center with clear profit and loss objectives in place. Similarly, 54% of organizations see service as a means to rise above competitive pressures from other manufacturing or service organizations^x. However, controlling activities in the service and maintenance function presents a challenge, particularly with increasing number of outsourced service partners. Due to this, the end-to-end control and visibility across the function decreases resulting in suboptimal after-sales performance. The service function is plagued by several key challenges, which can be overcome with effective use of digital technologies.

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Digital Tools Help Overcome Information Paucity

A common challenge across service functions is the lack of information at the right place and at the right time. For instance, missing information on installed base can result in wrong estimation of resource calculation for servicing and efficient call handling. Similarly, multiple instances of capturing information at call reception, field service and escalation to second- and third-level support result in suboptimal information transfer, which impacts the service process. In an integrated digital environment, relevant

information is available by integrating an ERP/CRM solution where this data is held centrally. Since all captured information is stored centrally, it minimizes the chances that information scarcity and quality will impact the overall service function.

Research suggests over 65% of incoming service requests require a field visit or a dispatch.



Diebold, a manufacturer of self-service transaction systems such as ATMs, had over 2,200 service technicians and received over 11,000 service calls per day in the US alone. The company faced multiple challenges with efficiently servicing its customer base, prioritization of jobs and visibility into field operations. The company rolled out a scheduling solution integrating its existing CRM, logistics, parts management, reporting and mobility components. Post the deployment, the company improved the number of calls per technician by 33% and also gained greater visibility and control of the service operation^{xi}.

Digital Tools Enable Effective Scheduling of Field Force

Managing field force and assigning schedules represent a significant challenge in a manual process. Digital tools eliminate the guesswork that is inherent in such manual operations. Take the case of a fleet operator that maintains and repairs a fleet of over 4,000 vehicles with 400 employees. A typical process involved eight sheets of large paper for scheduling these employees. After their move to a digital scheduling solution, the time a supervisor spent to prepare daily

schedules came down from half a day to 90 minutes. Supervisors can now use their smartphones to resolve scheduling issues on-the-go^{xii}.

Digital Technologies Provide Multifunctional Tools for Field Technicians

Digital tools help service technicians improve customer satisfaction levels. Research carried out with over 220 service and manufacturing organizations indicated that over 65% of incoming service requests require a field visit or a dispatch^{xiii}. For these field technicians, the ability to be remotely connected to central databases is critical for information retrieval. Centrally hosted tools allow service technicians to reduce problem resolution time and potentially increase their billable time by reducing unnecessary rework.

Take the case of McKinley Equipment, a company that makes warehouse and loading dock equipment. The company faced three primary challenges – converting paper archives to data streams, creating a more efficient workflow for its field service technicians and delivering an enhanced customer experience. In 2011, it adopted tablets and a cloud-based CRM and service solution for its field technicians. The company has seen a significant rise in first-call fix rates. With the new solution, technicians can now directly update the work ticket, show the customer the necessary parts on the tablet and get a signature on the tablet itself to approve the new parts order. This order can then be sent from the service solution. The company experienced a direct increase of 38% in its service business as a result of gaining a new account through these digital tools^{xiv}.

Digital Tools Drive Overall Productivity of Service Operations

Manual management of service organizations typically results in inefficient operations. Field technicians are challenged with inefficient knowledge management and suboptimal quality of information. They also face challenges in managing work orders and handling escalations through manual processes. Digital tools can significantly impact overall productivity of service operations by eliminating many of these manual challenges.

For instance, Kinetico, a manufacturer of water treatment systems faced many similar issues with using manual spreadsheets that were shared via email. As the company grew, the

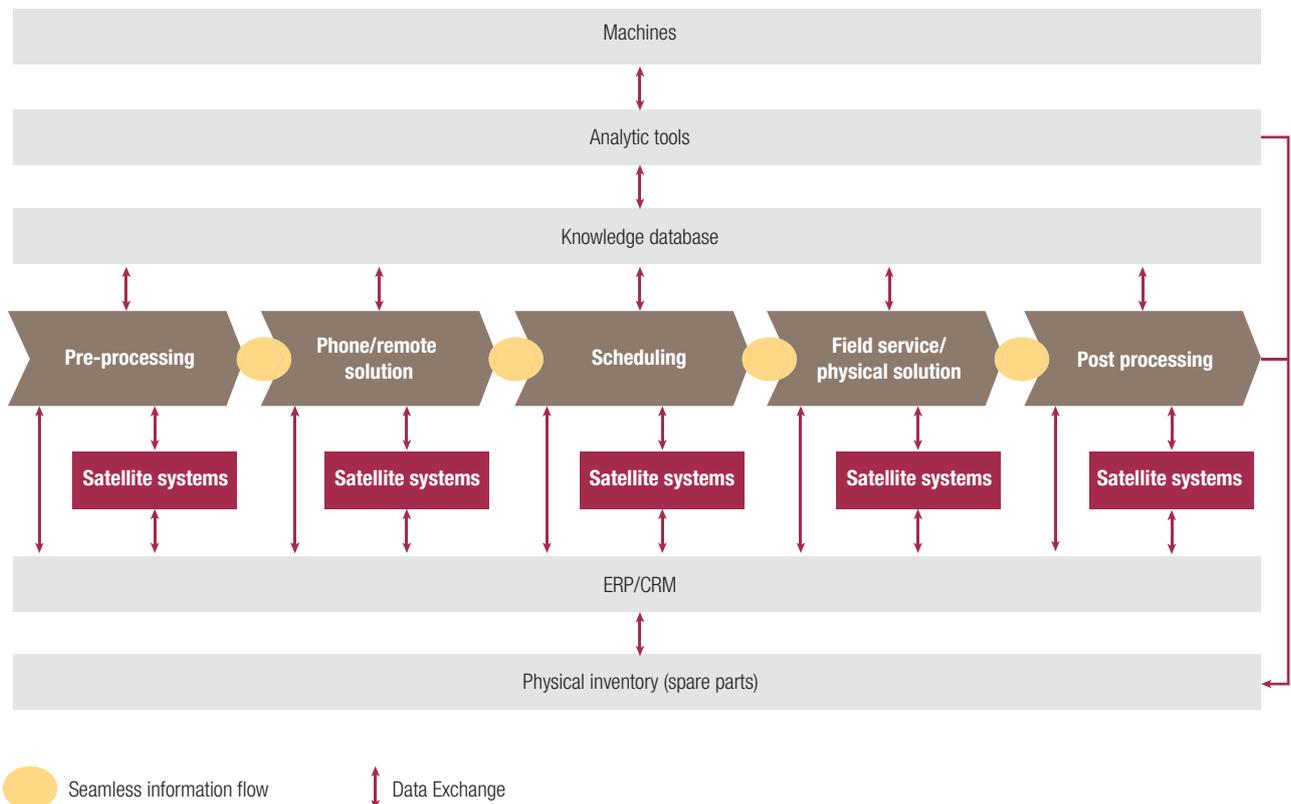
existing manual nature of the process caused them to miss deadlines with their customers. Moreover, the process gave the company little insight or metrics around its service performance. It implemented a cloud-based service management solution that had the ability to manage work orders, handle escalations, automate scheduling, and generate reporting and metric tracking to overcome these challenges. As a result, resolution time has been cut in half, technicians have high visibility into work orders and save significantly on time. Post the implementation, technicians are automatically notified of an open case in their area and can easily debrief with a work order^{xv}.

Digital technologies can help integrate several service and maintenance tasks such as planning activities, checking

availability of required spare parts and consumables, physical transportation and ensuring efficient remote services and scheduling of field technicians. Figure 4 illustrates the integration of data exchange and information flow in a digitalized service model.

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Kinetico cut its service resolution time into half, post the deployment of a cloud-based service management solution.
 ”

Figure 4: Digital Service Model



Source: Capgemini Consulting Analysis

Digital Tools Can Help Manufacturing Companies Cut Costs by 30%

Digital tools have a very strong impact across the three key areas of manufacturing operations, supply chain management and service. We believe manufacturing companies can realize significant cost savings while driving delivery reliability, quality and customer satisfaction by deploying digital initiatives. We summarize a selection of tools and their impact on key success factors in the below charts.

Key Cost and Productivity Benefits from Integrated Digital Manufacturing Processes

Area of Impact	Digital Tool/Initiative	Influence on Key Success Factors				
		Cost of Goods Sold	Capital Cost	Delivery Reliability	Quality of Service	Customer Satisfaction
Manufacturing Operations	Introduction of Finite Planning					
	Real-time Order Coordination					
<i>Potential Improvements, based on Capgemini Consulting Project Experience</i>		-20%	-30%	+25%	+30%	+30%

Key Cost and Productivity Benefits from Integrated Digital Supply Chain

Area of Impact	Digital Tool/Initiative	Influence on Key Cost Elements				
		Labor call handling	Labor field force	Labor Supporting Processes	Inventory Costs	Penalties for Missed SLAs
Service Operations	POS Data-Big Data Analytics					
	Integrated end-to-end Business Planning					
	Real-time Order Confirmation					
	Web-EDI					
	Planning-Execution Integration					
<i>Potential Cost Reduction, based on Capgemini Consulting Project Experience</i>		-5%	-30%	+5%	-20%	-8~-15%

Key Cost and Productivity Benefits from Integrated Digital Service Function

Area of Impact	Digital Tool/Initiative	Influence on Key Cost Elements				
		Labor call handling	Labor field force	Labor Supporting Processes	Inventory Costs	Penalties for Missed SLAs
Service Operations	Integrated ERP/CRM					
	Flexible Satellite Systems					
	Planning and Scheduling Software					
	Knowledge Database					
	Technological Integration machine-service					
	Big Data Analysis Tools					
	Advanced Hardware/Software for Field Service					
<i>Potential Cost Reduction, based on Capgemini Consulting Project Experience</i>		-40%	-30%	-25%	-10%	-15%



How Can Organizations Achieve Operational Excellence through Digital Transformation?



The starting point of the digital transformation journey varies from one organization to another, mainly due to different digital footprint and maturity levels. Across manufacturing, SCM, service and maintenance, there are a variety of digital initiatives that organizations can select. Organizations need to have a structured approach when implementing these digital initiatives (see Figure 5).

First, manufacturing companies should undertake a comprehensive maturity assessment of where they stand. This should be done across the two key dimensions of process maturity and digital maturity. A Digital

Maturity Assessment (DMA) reveals the current level of process digitization compared to the availability of digital process support options. Performance maturity assessments add information about the positioning of a company's process maturity and the opportunities for improvement. This stage helps companies identify the right starting point for developing an operational excellence strategy through process digitization. Without a clear understanding of the opportunity and the potential value for the company the transformation journey would lack a clear focus and thus would not progress in the right direction. A maturity assessment is the basis for further progress and enables

organizations to decide on a clear go/no-go based on where they stand.

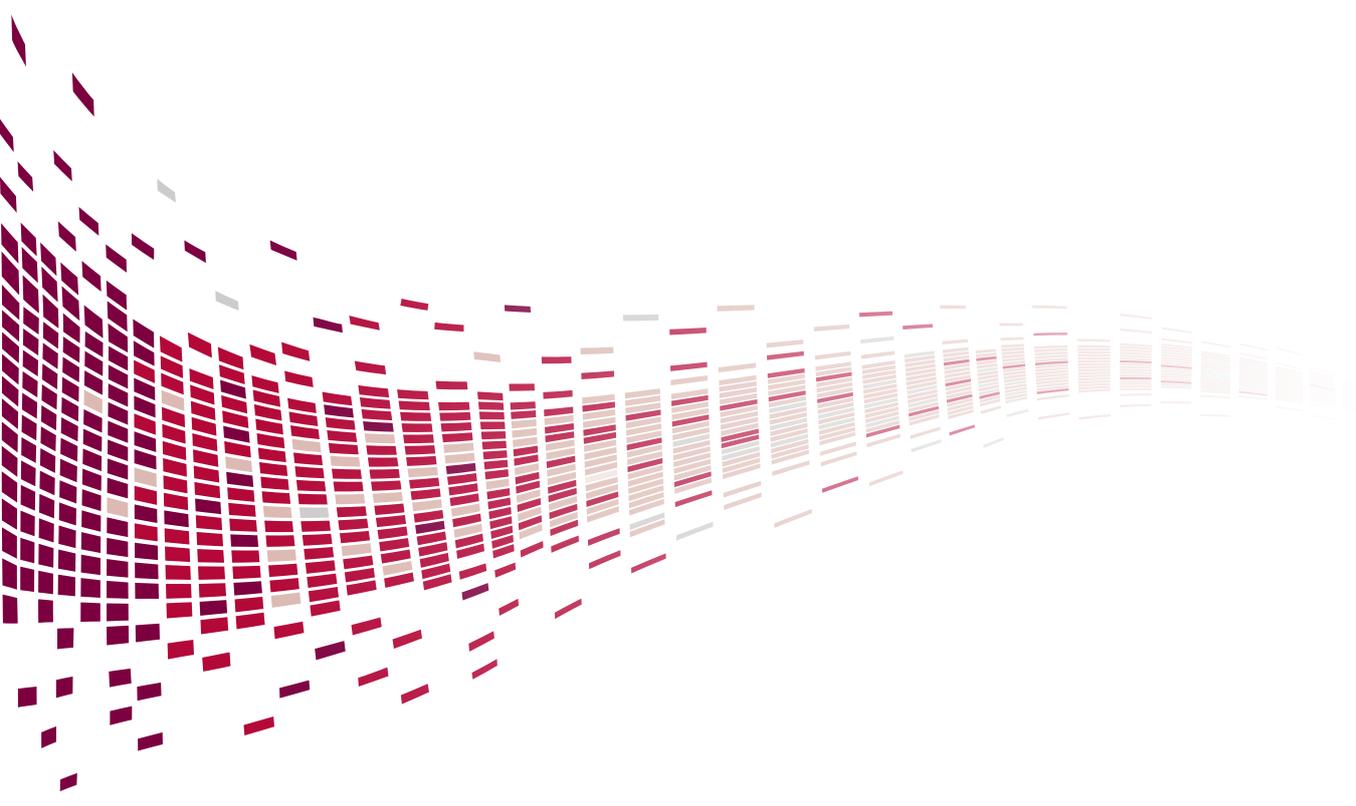
The second step is to develop a clear organizational vision and mission that answers what operational excellence in the future means to the organization and why it is good for the organization.

Manufacturing companies should bear in mind that it is more complex to enhance and adjust existing tools than to implement new processes and solutions. As such, it becomes important to prioritize areas of interest. Consequently, the next step is to prioritize integration of digital initiatives according to the expected operations benefits and level

Figure 5: Digital Transformation Roadmap for Manufacturing Companies



Source: Capgemini Consulting Analysis



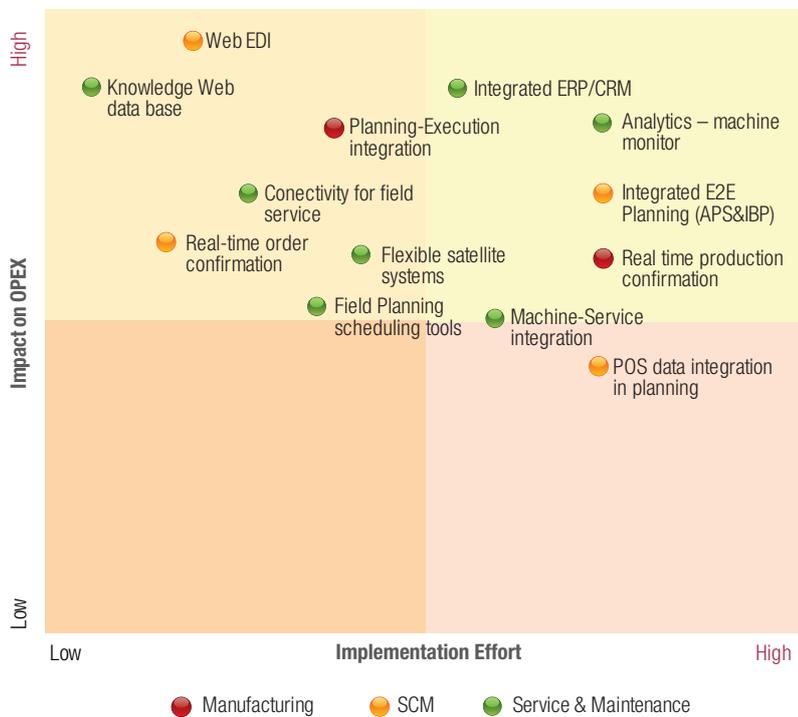
of implementation efforts. For instance, a company that is facing challenges in sending the right information to its field technicians should focus on creating a Web-based knowledge database before thinking of initiatives such as integrated ERP/CRM (see Figure 6).

After prioritizing initiatives, organizations should proceed to **create an efficient process architecture** that imbibes meaningful digital elements. This architecture should clearly lay out how a digitized value chain for the company would work and the steps involved in getting there.

The next step is to create a strong foundation for the transformation towards operational excellence by setting up the organizational environment, and **defining the digital operating process model** and the relevant IT infrastructure.

And finally, the **implementation** stage will involve significant process redesign and adjustments, training of employees across levels and deployment of software solutions that will enable the company to run with optimized digitized processes.

Figure 6: Digital Initiatives' Impact on Operational Excellence and Implementation Effort



In summary, digital transformation in manufacturing processes will drive operational excellence by enhancing information flow and eliminate waste across manufacturing, supply chain management and service operations. Manufacturing organizations should realize that digital technologies offer them a strong opportunity to efficiently connect processes and people, and use information effectively without connectivity gaps. They should also consider lessons learnt from the earlier generation of technology deployments and stay away from taking a silo-based approach towards digital technologies. Instead, the focus needs to be on leveraging digital technologies to make information flow fluid and drive operational excellence.

Source: Capgemini Consulting Analysis

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