Digital Transformation Drives Efficiency in Manufacturing Enterprises

Smart manufacturing investments can maintain a competitive edge in many industries. Such practices can yield deeper insights into production efficiency, equipment reliability and asset performance and health.

The path toward a complete digital transformation may seem daunting and overwhelming. However, breaking the process down to simplified steps can make the process more manageable. Defining a vision, assessing the organization's current state and developing user stories will go a long way in effectively diminishing concerns — enabling an organization to embrace and successfully adopt a comprehensive strategy and road map.

Typical concerns organizations may face when considering a digital transformation include:

- Excessive reject rates and concerns that production efficiency will suffer.

- Anxiety about maintenance costs. Though there may be interest in a predictive maintenance strategy, steps to achieve beneficial results may seem overwhelming.

- An explosion of data being fed into the organization without an effective means to direct it in a timely way to those who would benefit the most.

Solving for these issues requires that organizations understand their business, their market and their current systems to truly gain the efficiencies available through a digital transformation and smart manufacturing practices.

Find Meaningful Data

Many organizations assume that if they have data they can perform effective analysis. But to be valuable, data needs to be carefully managed from creation to consumption. This requires a thorough understanding of the data life cycle and how data quality is maintained. It also requires careful planning to see that an organization's data is useful — not only to solve existing problems, but to address new issues as they arise.

Data should be viewed as an asset, just like the machines in a plant and products they produce. In fact, asset data can, in some cases, become more valuable than the asset itself. Consistent and reliable data helps businesses make decisions that impact both the top and bottom line. Yet, few companies

have consistent access to data that is valuable at the point of decision-making. Understanding the data life cycle and implementing effective data governance is essential for accessing the high-quality data an organization needs at the right time.

Interpret the Data

Meaningful digital transformation takes more than simply collecting data. While data is critical for business operations, it pays even more dividends when gathered in real-time and interpreted accurately to drive informed decisions. Taking a comprehensive look at use cases throughout the value chain — coupled with data governance and an architectural framework — is imperative for an organization to realize the full potential that a digital transformation offers. The underpinning actionable data creates a scalable Internet of Things platform, enabling stakeholders to quickly define, develop, deploy and iterate through the process, going seamlessly from strategy to solution and implementation to feedback.

Define the Vision and Strategy, Objectives and Targets

A necessary step in the transformation, and the key to success, is to develop a vision addressing some key questions:

- Who in the organization needs to have input into the process? Who are the key stakeholders to help frame the vision? The broader the group, the more diverse the thinking.

- What are the problem statements? What are the current issues that the organization has and what concerns may arise in the future? What are the business drivers? What are the areas that need to be focused on? What is the current business reality and what does the future state look like? No problem is too big or idea too small.

- Why does the organization need to transform? Why change now? Answering these will help flesh out the impacts and the benefits to the organization.

- When should the organization begin the process? This is where ideas, problems and future state goals are prioritized according to importance and duration.

- How will all of this be implemented? It is very tempting to ask how. No matter the role in the organization — whether as a leader, an engineer, scientist or technologist — individuals are always driven to understand how something will be achieved, typically before the vision and road map are defined. However, it is important to remember that answering the how questions should be deferred to the project delivery and execution phase. Leave these questions aside during discussions of vision and strategy.

Figure 1: Vision and strategy framework.

The combination of both strategic and executional criteria will empower the organization to develop an effective vision, strategy, structure and process to gain the resources needed to successfully execute a digital transformation. Figure 1 lays out the components and stages that an organization might incorporate in the process of defining the vision and road map to success.

At first glance, the framework looks intimidating. The intention is to lay out all the components, resources and processes that are involved with developing a clear vision and strategy. The inner ring is the foundation that will empower the organization through the digital transformation. This includes developing clear communication from leadership teams; understanding and acknowledging goals that propel the organization forward; incorporating cross-functional teams from different areas of the organization; maintaining focus on the financial impact to the business; and, finally, utilizing process and people change management to build continued success.

Delivering a clear message to everyone impacted by the transformation is the linchpin to success. The outer ring of Figure 1 represents the various business units or value chain drivers within the organization. These are the stakeholders. The middle rings illustrate the process that will evolve from defining the vision, assessing the organization's current state, developing the strategy to achieve the vision, and executing the strategy.

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Using these key approaches during the assessment and strategy phase, organizations can lay the foundation for digital transformation to drive sustainable smart manufacturing:

- Generate a comprehensive inventory of use cases spanning the entire value chain of the organization from procurement to quality control and compliance, production, and customer care.

- Organize the list of use cases into categories of applications that solve similar business pain points or address the same workflow process, such as asset health and reliability, asset performance and efficiency, procedures and documentation, and employee safety.

- Consider simple valuation methodologies to quickly estimate the potential business impact for each application. Collaborate across different areas of the organization to quantify each application's value using an approach that encompasses cost, revenue, reliability, safety and stakeholder engagement.

- Prioritize each application using several criteria, including feasibility, value, alignment with corporate strategy and stakeholder engagement. The weight of the categories will most likely change as the organization's digital transformation process matures.

Build a Road Map

If an organization does not already have an IoT framework laid out, a team will need to develop a system architecture for connected devices and software applications that considers all currently used components within the organization. Focus must be on current business needs, how these tools are currently leveraged, and gaps across the various business units.

An effective plan will incorporate these needs while allowing for future growth and the possibility of the unknown. Software solutions and technology strategies are ever-evolving. Defining a strategy that embraces this reality — instead of trying to contain and slow it down — is vital and imperative to the successful evolution of a digital transformation strategy.

Once an organization has the necessary approach and framework set, personnel must be mindful about the key building blocks required to progress through the stages of the digital transformation process. Stages can be defined as Connect, Contextualize, Visualize, Analyze and Act. Figure 2 lays out in detail these stages and benefits they provide to the organization.

Read the Map

Too often, organizations rush to get to the Analyze and Act stages of the process. This is understandable — these are the points at which the organization believes it will realize the most benefit from the digital transformation process.

However, the Connect and Contextualize stages are arguably the most critical — and most overlooked — stages, enabling
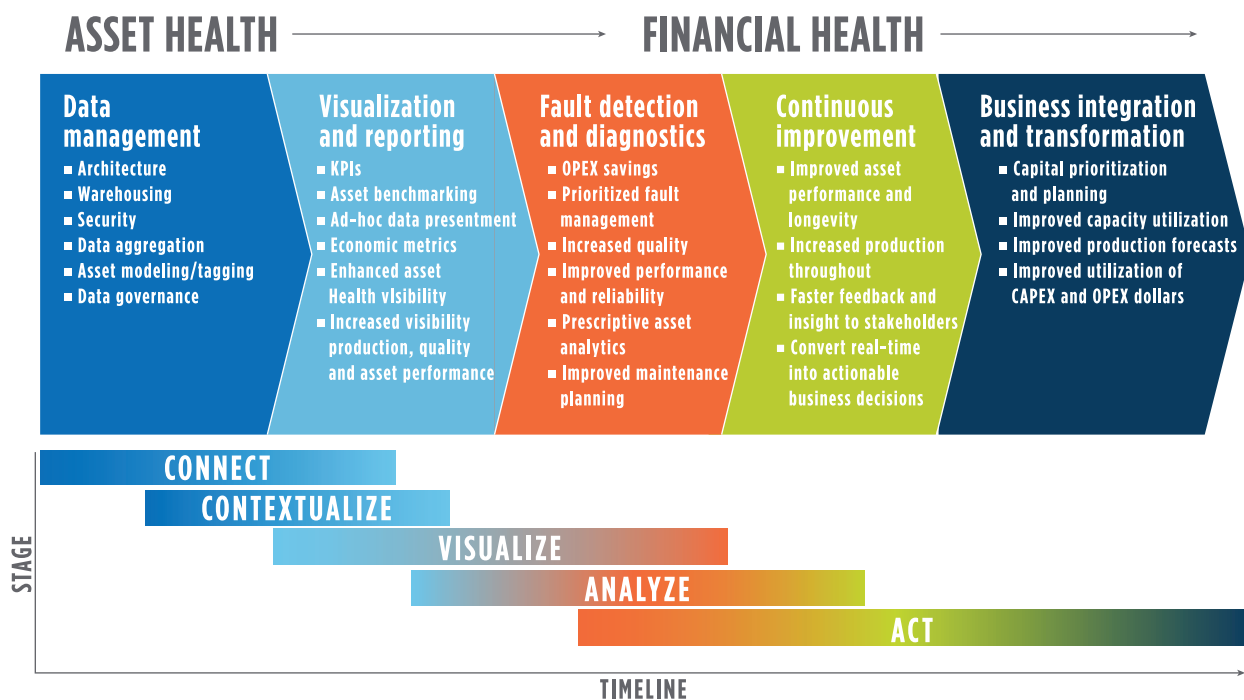

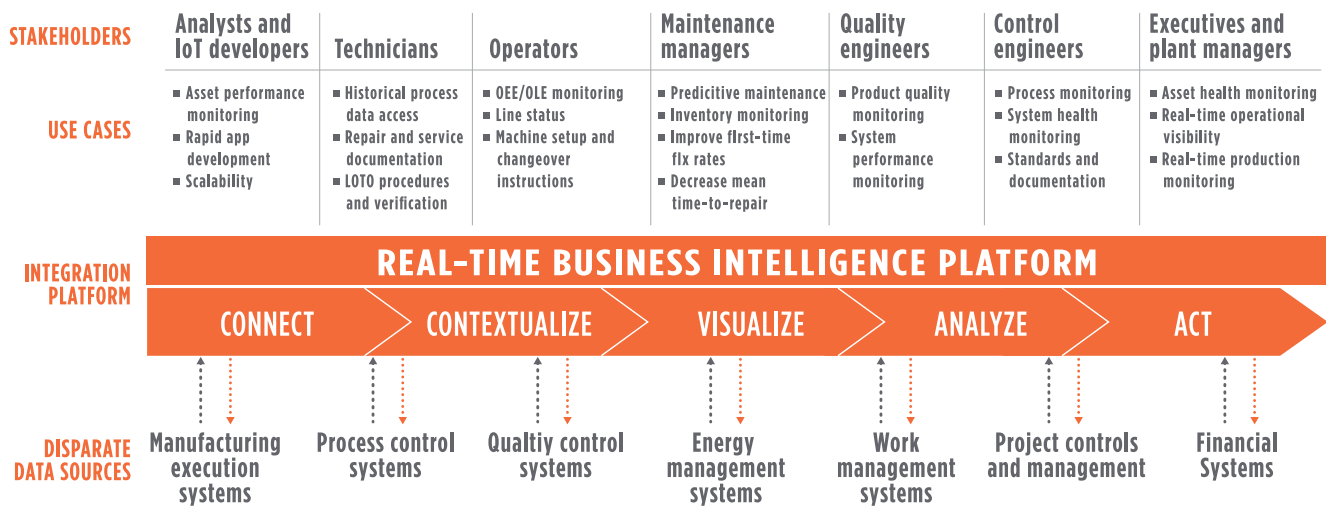*Figure 2: Digital transformation road map.*

Figure 3: Concept of the smart manufacturing enterprise.

STAKEHOLDERS	Analysts and IoT developers	Technicians	Operators	Maintenance managers	Quality engineers	Control engineers	Executives and plant managers
USE CASES	▪ Asset performance monitoring ▪ Rapid app development ▪ Scalability	▪ Historical process data access ▪ Repair and service documentation ▪ LOTO procedures and verification	▪ OEE/OLE monitoring ▪ Line status ▪ Machine setup and changeover instructions	▪ Predicitive maintenance ▪ Inventory monitoring ▪ Improve fIrst-time fIx rates ▪ Decrease mean time-to-repair	▪ Product quality monitoring ▪ System performance monitoring	▪ Process monitoring ▪ System health monitoring ▪ Standards and documentation	▪ Asset health monitoring ▪ Real-time operational visibility ▪ Real-time production monitoring

INTEGRATION PLATFORM

REAL-TIME BUSINESS INTELLIGENCE PLATFORM

CONNECT → CONTEXTUALIZE → VISUALIZE → ANALYZE → ACT

DISPARATE DATA SOURCES	Manufacturing execution systems	Process control systems	Qualtiy control systems	Energy management systems	Work management systems	Project controls and management	Financial Systems

the financial gains that can be achieved when the process is completed. It is within these stages that the platform's framework is leveraged to achieve scalability and expansion. This is the point where data governance and asset modeling enable the organization to move forward in quick iterative sprints.

Agile organizations recognize that they need to start small, gain real value and create the foundational building blocks upon which to expand. These early projects should be valuable and measurable with tangible business results, not just technical proofs of concept. Figure 3 shows a high-level look at a smart manufacturing enterprise where data from various systems are brought together to achieve a real-time business intelligence platform. This model gives stakeholders access to the information they need when they need it and, based on the use cases for their respective roles, enables them to make sound actionable decisions against that data.

Such initiatives might include:

- Identify incident data as early as possible and effectively communicate this data so that operators can analyze issues and correct them with as little disruption to production as possible.

- Develop the ability to troubleshoot and repair a machine that is unexpectedly offline, underperforming, out of tolerance or otherwise anomalous. Engineers and plant technicians need to speak a machine's language. For industrial equipment, that language is real-time, accurate, accessible and contextual data. Having this ability improves first-time fix rates, decreases mean time to repair, increases production efficiency and enables predictive maintenance.

- Monitor production and asset performance in real time to enable factory personnel to quickly identify issues.

In this way, issues can be addressed before overall equipment effectiveness is impacted. With better visibility into machine health and processes, organizations can be assured that operators are making speedier, better-informed decisions on the plant floor. Real-time visibility eliminates the wait for up-to-date metrics, helping organizations achieve more complete awareness and insight into machine health and operational performance.

Realize the Benefits

The realization of a digital transformation to achieve a smart manufacturing stance does not come without challenges. New functionality, skill sets and technology stacks often leave organizations feeling overwhelmed with the daunting task ahead. Many times, these organizations are strapped for resources and looking for better ways to leverage their existing software and technology.

But by breaking the digital transformation process down to simplified steps, organizations can develop a road map for getting there. Through an understanding of current systems, the market and the industry involved, a system can be developed that is designed to respond to shifts in production, thereby gaining agility and efficiency in business.

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