Investing in smart manufacturing is crucial for maintaining a competitive edge in many industries. Such practices allow organizations to uncover deeper insights into production efficiency, equipment reliability, and asset performance and health over time. Pursuing a complete digital transformation is key to getting there.
The path toward a complete digital transformation likely seems daunting and overwhelming. However, breaking the process down to simplified steps can make the process more approachable. 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.

Some typical concerns organizations may face when considering a move toward digitally transforming include:

- Worry that reject rates are too high and production efficiency will suffer.
- Anxiety about maintenance costs; interest in a predictive maintenance strategy, but overwhelmed with how to achieve beneficial results.
- Seeing an explosion in the amount and types of data available, as well as in the number of devices that are feeding data to the organization, but without an effective or sustainable way to get it into the hands of those who can use it at the right time.

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 when it needs it.

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:

- 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? The “why” 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 the “how” question. No matter the role in the organization — whether as a leader, an engineer, scientist or technology personnel — individuals are always driven by needing to know “how,” typically before the vision and road map are defined. Remember: The “how” comes during the project delivery and execution phase and should not be discussed during the vision and strategy phase.
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 into the process.

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.

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

- 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 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.

Figure 2: Digital transformation road map.
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.

Some such initiatives might include:

- **Identify incident data** as early as possible and effectively communicate this data so that operators can analyze the issue 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, in real time, production and asset performance** to enable factory personnel to identify issues in real time. In this way, issues can be addressed before overall equipment effectiveness is impacted. With better visibility into machine health and processes, organizations can rest 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.

**Biography**

**Damian Bahr** is a project manager and technology consultant at 1898 & Co., part of Burns & McDonnell, with nearly 20 years of experience. Damian’s current focus is on developing scaleable, real-time transformative digital solutions that enable clients to realize the full potential of the industrial Internet of Things to drive innovation in various industries. His experience includes work in engineering best practices of integrated control systems; engineering tool design for project execution; electrical instrumentation and control system design; and project management.

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