Is Your Organization Ready to Embrace a Digital Twin?

Before industrial organizations invest in technologies for creating data-driven product design strategies, they need to reassess their operational maturity and technology readiness to compete in a world where the virtual and physical seamlessly fuse.
EXECUTIVE SUMMARY

The Internet of Things (IoT) presents many advantages to organizations seeking competitive differentiation. Two unique advantages pivot around the availability of new types of sensing devices (e.g., wireless sensors) that can be added to most types of industrial gear, and the ability to collect near-real-time data from equipment for analysis and prognosis (known as edge analytics).

By deploying these new-age technologies, industrial organizations can transform previously stand-alone systems into integrated networks that leverage greater computer capabilities and data analytics to increase efficiencies and productivity. By embracing these technologies, organizations can reduce operational costs, a key consideration in the margin-challenged industrial space. Any reduction in operational costs directly impacts the organization’s bottom line.

It is estimated that there will be about 20 billion internet-connected things by 2020. Based on the expected massive increase in installed devices – and the torrents of data that these devices will generate – numerous breakthrough advances are expected to sprout up across the industrial sector.

Two IoT-enhanced technologies, augmented reality and artificial intelligence (AI), are rapidly being adopted into the business core of many organizations. This paper examines another breakthrough technology area – the concept of the digital twin, in which a digital replica of physical assets, processes and systems is created. The digital twin concept enables organizations to better understand, predict and optimize the performance of its installed assets. We present a detailed three-point framework that industrial organizations can use to pursue the digital twin concept:

• **Organizational readiness:** An assessment methodology of an organization’s process and technological maturity.

• **Building blocks of digital twin:** Analysis of the fundamental building blocks of digital twin and their associated challenges.

• **Implementation practices:** The best implementation practices for adopting the digital twin.
The digital twin concept enables organizations to better understand, predict and optimize the performance of its installed assets.
A digital twin is a virtual representation of a physical asset that is virtually indistinguishable from its physical counterpart. It includes design and engineering details that describe its geometry, materials, components, and behavior or performance.

**BUT FIRST ... A DIGITAL TWIN PRIMER**

The emergence of high-performance, low-cost computing capabilities is motivating industrial organizations worldwide to rapidly adopt digital technologies. They see digital as a way to reduce waste and improve their bottom lines.

The IoT and wireless sensors make it possible to “sensorize” select pieces of industrial equipment. Doing so enables industrial manufacturers to collect and integrate real-time operational data from the equipment and integrate this with “run the business” enterprise digital information. Such integrations have paved the way for the digital twin.

A digital twin is a virtual representation of a physical asset that is virtually indistinguishable from its physical counterpart. It includes design and engineering details that describe its geometry, materials, components, and behavior or performance. A digital twin can be associated with its physical product unit identifier such as an asset ID, equipment number, etc.

Moreover, a digital twin integrates all of the organization’s digital information on a specific asset or piece of equipment with operating data streaming from the product while in use. At a conceptual

**Look Before You Leap: A Simple Digital Twin Q&A**

1. **Readiness survey: Is your organization ready?**
   - Process maturity, technology maturity.

2. **Building blocks for digital twin adoption: Are these boxes ticked?**
   - Clarity of concept, 3-D models, managing design data, optimal detailing.

3. **Are you aware of the best practices for implementing the concept?**
   - Value chain participation, standard practices, gathering data from many sources, long access life.
level, all the equipment within a factory floor can be aggregated into a digital twin or a digital factory. When combined with analytics, the concept of the digital twin delivers insights that can unlock hidden value for the organization. It can provide engineers with information on potential operational failures of IoT-connected products, for instance, and thus help prevent unplanned downtime, improve product performance, etc.

The concept can be applied to assets across various layers of organizational hierarchy. A digital twin can be built for a machine component, and it can be extended to a larger context to include complex, interconnected systems such as an entire manufacturing plant.

A digital twin helps manufacturers avoid costly product quality issues by generating “what-if” scenarios using stochastic simulations, thus reducing time-to-market and improving throughput. Using the digital twin, years of equipment usage can be simulated in a fraction of the time. The advantages of embracing the concept of the digital twin are multifold; however, organizations must first resolve a few questions before jumping headlong into the fusing of the physical and digital worlds (see Figure 1).

**ASSESSING PROCESS & TECHNOLOGY MATURITY**

Organizations vary in terms of how they operate across processes and technology stacks. We classify organizations into five groups, based on how they define processes and use technology (see Figure 2).

**Metrics to Measure Organizational Maturity**

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>Unstructured</th>
<th>Repetitive</th>
<th>Defined</th>
<th>Dynamic</th>
<th>Optimal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process</strong></td>
<td>• Limited product feedback</td>
<td>• Minimal information sharing</td>
<td>• Managed services</td>
<td>• Smart decision-making</td>
<td>• Integration into corporate processes</td>
</tr>
<tr>
<td></td>
<td>• Isolated M2M applications</td>
<td>• Fragmented information</td>
<td>• Integrated analytical data model</td>
<td>• Harvest of knowledge and insights</td>
<td>• Application of machine learning to create predictive models</td>
</tr>
<tr>
<td></td>
<td>• No intelligence or connectivity</td>
<td>• Static reports of operational activity</td>
<td>• Localized intelligence</td>
<td>• Real-time analytical data processing</td>
<td>• Cognitive analytics</td>
</tr>
<tr>
<td></td>
<td>• Descriptive analytics</td>
<td>• Diagnostic analytics</td>
<td>• Predictive/prescriptive analytics</td>
<td>• Converged technology</td>
<td>• Value-oriented</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>• Siloed sensors</td>
<td>• Connected devices</td>
<td>• Software tunable assets</td>
<td>• Self-optimization</td>
<td>• Strategy iterates rapidly in response to competitive opportunities and threats</td>
</tr>
<tr>
<td></td>
<td>• Data unavailability</td>
<td>• Data localized</td>
<td>• Secured remote management</td>
<td>• Interaction with ecosystem</td>
<td>• Ad hoc people management</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td>• Decision-making is ad hoc</td>
<td>• Managed</td>
<td>• Process-driven</td>
<td>• Policy-driven</td>
<td>• Continuous focus on improving individual competence and workforce motivation</td>
</tr>
<tr>
<td></td>
<td>• Minimal or no strategic planning taking place</td>
<td>• Near-term focused and limited in scope to key initiatives</td>
<td>• Longer-term focused; created in response to specific events or immediate conditions</td>
<td>• Long-term focused; taking advantage of enterprise synergies and coordinated efforts</td>
<td>• Quantitative goals for people management in place</td>
</tr>
<tr>
<td><strong>People</strong></td>
<td>• Ad hoc people management</td>
<td>• Policies developed for capability improvement</td>
<td>• Standardized people management across organization</td>
<td>• Quantitative goals for people management in place</td>
<td>• Continuous focus on improving individual competence and workforce motivation</td>
</tr>
</tbody>
</table>
## Surveying Asset Attributes

### PROCESS

<table>
<thead>
<tr>
<th>Product Data Management</th>
<th>Is the product-related data managed in your organization?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Are the CAD documents managed manually or electronically?</td>
</tr>
<tr>
<td></td>
<td>Are the design documents maintained locally (at source) or globally?</td>
</tr>
<tr>
<td></td>
<td>Does your organization maintain a central design repository which can encourage design reuse?</td>
</tr>
<tr>
<td>Lifecycle</td>
<td>Does your organization have defined processes for engineering and manufacturing activities that are documented, standardized and integrated?</td>
</tr>
<tr>
<td></td>
<td>Are your organization's standard processes audited and approved when there is a change?</td>
</tr>
</tbody>
</table>

### TECHNOLOGY

| Sensors                 | How do you rate your organization's current installation of sensors on your plant floor? |
|                        | What process does your organization follow to measure the criticality of the equipment? |
|                        | What is the level of installation of sensors across the equipment; how much of it is based on their criticality? |
| Connectivity           | What are the enabling information systems, applications, tools and infrastructure in place to ensure end-to-end data collection and sharing? |
|                        | Does your organization use the latest modes of communication such as wireless, Bluetooth, mobile, etc. for operations activities? |
|                        | Are the systems of record (PLM, ERP, MES, etc.) integrated with other business information and engineering systems? |

### GOVERNANCE

| Decision-Making         | Does your organization utilize data trends and patterns to make proactive, real-time decisions to improve operations? |
|                        | Does your organization follow a fixed schedule to address maintenance issues? |
|                        | What is your organization's strategy for effectively analyzing all of this data and ensuring that meaningful and relevant data and decisions are made? |
| Strategic Planning      | Is your organization's strategic planning short-term or long-term focused? |
|                        | Does your organization take into account its strengths when it conducts planning? |
|                        | Does your organization consider competition and enterprise synergies when determining plans? |

### PEOPLE

| People Management       | Does your organization have development programs in place to upgrade employee/people skills? |
|                        | Does your organization implement policies and procedures for capability development? |
|                        | How does your organization measure? |
Readiness Assessment Survey

A digital twin relies on the availability of complete information for fault analysis or prognosis to deliver precise predictive foresights. Nonavailability of information from any of the data sources—such as field measurements, quality inspection reports, customer feedback, etc.—detracts from digital twin accuracy.

A well-defined data process ensures that data is generated and stored at the source. When coupled with the technology, the stored data can be shared across organizational boundaries. An assessment survey is devised with the key parameters of process, technology, governance, and people to understand the maturity and readiness of the organization (see Figure 3, page 6).

Figure 3 is representative, not the complete survey. The survey needs to be comprehensive and detailed. Survey inputs can be used for the assessment methodology highlighted in Figure 4 to rate organizational maturity.

A Maturity Assessment Approach

The real benefits of the digital twin concept become evident only when various departmental data is integrated and quality data can be sourced from business planning systems (ERP, PLM, SCM) and manufacturing operations management systems (MES, LIMS, CMMS). An organization at level 3 or below is still struggling with these data integration and data sourcing challenges. They also suffer from a lack of documentation and nonstandardized processes because data isn’t regularly shared but rather is localized.

Hence these organizations can’t consolidate the information necessary to create a picture of all possible operational failures and will be unable to determine the best strategies to tackle critical situations or to leverage data for competitive advantage. Organizations at this tier that still attempt to create a digital twin will fall short; the project will not be economically viable or match the level of value creation expected. This doesn’t necessarily mean that these organizations shouldn’t pursue a digital twin. It means that they need to reassess their process maturity and try to make the necessary changes to attain the maturity needed to successfully create a fully functioning digital twin.

For organizations at levels 4 and 5, it is comparatively easier to adopt the digital twin concept. But this doesn’t mean that every organization at these levels can easily embrace the concept. There are many questions that must be answered before making that choice.
Illustrating the above ideas, Figure 5 depicts the value of digital twins for organizations facing pump status issues at different maturity levels: unstructured (level 1), defined (level 3) and optimal (level 5). The dimensions of monitoring, analysis, planning and execution are provided in this example, with gauges shown for commonly used parameters such as discharge pressure, flow rate and current. “Unstructured” organizations, which do not receive readings in real time but rather as averages or delayed monitor data, are limited to basic analysis, without prediction capabilities. Thus, planning and execution are moot.

At the “defined” level of maturity, organizations receive pump data in real time and can conduct failure analysis to determine the cause. But these organizations lack enterprise-wide integration and are

Value Derived from Digital Twin by Organizations at Different Maturity Levels: Pump Cavitation Problem
limited access to historical data or fleet learning, so available execution options might not be ideal. “Optimal”-level organizations have the means to monitor the pump status in real time, conduct failure prediction and send alerts, plan for troubleshooting and suggest best possible options to address the failure.

**DIGITAL TWIN BUILDING BLOCKS**

Before embracing any new technology, it is good practice to understand the concept clearly and to grasp its potential advantages and disadvantages. The fundamental building blocks that make the digital twin concept a reality include:

- Concept definition.
- Design data management.
- Optimal detailing.
- A 3-D model of the asset.

This section examines a few perceived challenges, such as:

- Is the concept of digital twin correctly understood?
- Does the requisite technology work with existing assets, products and processes?
- How will design data be handled?
- How much detailing does this concept require?

**Clarity of Concept**

The concept of a digital twin, as first defined by Dr. Michael Grieves in 2003, consists of three main parts:

- Physical products in real space.
- Virtual products in virtual space.
- The connected data that tie the physical and virtual products together.

Industry and academia view the concept a bit differently, but both views tend to overlook the process aspects of the digital twin. Some define the digital twin concept as a digital representation of a specific asset in the field that provides live information from installed sensors based on current and past configuration states such as serialized parts, software versions, options and variants. While other information technology and service-based companies define it as an integrated virtual model of a physical asset that mirrors all the manufacturing defects and continuously updates on the live condition of the asset currently in use.

A fair definition of the digital twin concept should view it as an evolving digital profile of the physical asset that captures its past and current behavior to provide clues about its future behavior. The digital twin concept is built on large amounts of cumulative and real-time operational data measurements across an array of dimensions. These measurements can help create an ever-evolving digital profile of the asset that may provide vital inputs on system or business performance leading to actions in the physical world.
Managing Design Data Among Supply Chain Partners

To realize the true value of digital twin requires a comprehensive approach to collect, manage and manipulate the product’s digital data. Close integration among partners and suppliers is essential to ensure that the digital twin accurately maintains digital and physical configurations. So as the physical product evolves, managing the design data for creating a digital twin among partners and suppliers becomes an ever-growing challenge.

Choosing an Optimal Level for Detailing the Digital Twin

One of the major challenges with implementing the digital twin concept is gauging the optimal level of detail that is needed. If it’s very basic and simple, then it might not yield the expected value that the digital twin concept promises. If a broader approach is taken, however, then there is the danger of getting lost in the complexity of details.

It is imperative to choose an approach that is neither too simplistic nor too complex. One such approach is to start with a basic, simple model of a digital twin and keep on adding the necessary inputs and analytics as the situation evolves (see Figure 6).

One of the critical challenges with such a phased approach is accurately predicting the evolution of digital twin models. The inherent danger is that if the models built are not flexible or are incorrectly built, they might become obsolete.

For example, if a digital twin of a dump truck tire is considered, then the simplistic model would be used to monitor parameters like tire pressure and temperature. If a more complex model is needed, then the parameters that can be monitored include tire shape, tire material strength, durability of

Detailing the Digital Twin
the tire, etc. As the complexity of the parameters increase, the number of inputs needed to perfectly estimate the value also increases. Consider the parameter of tire durability: the inputs might include the tire material make, model, grade, tire pressure, terrain in which the vehicle operates, climatic conditions, number of hours of operation, time of the day which it operates, etc.

**3-D Models & Drawing for Implementing a Digital Twin**

3-D models are among the essential components of visualizing and implementing the digital twin concept. In the “2016 Worldwide CAD Trends Survey by Business Advantage”³ two-thirds of the 610 users surveyed still rate 2-D drafting as highly important. The study states that 39% of design work produces only 2-D drawings, 27% of them produce only 3-D models and 34% of them produce both 2-D drawings and 3-D models.

A few major suppliers notwithstanding, most small and medium size suppliers still rely on 2-D drawings. One of the primary roadblocks is that the existing equipment might not have developed 3-D models. And with possible changes made over time – during maintenance and turnarounds – creating 3-D drawings of existing equipment would be a challenge. To overcome this, and for a successful implementation of the digital twin concept, organizations need to force their suppliers to adopt a digital approach and completely transform their design operations to full 3-D models.

**BEST PRACTICES FOR IMPLEMENTING A DIGITAL TWIN**

As detailed in the earlier sections, it is not sufficient to know just that the organization is mature and the technology is ready for implementing the digital twin concept. If the model built is not flexible enough, is incorrectly built or serves only a single purpose, then the model will become obsolete over time and thus severely undermine the investment in building it.

To avoid such mistakes and build a truly dynamic digital twin that can deliver the promised value, we highlight a few of the best practices defined by Gartner (see Figure 7).

**Digital Twin Best Practices**

- Involve the entire product value chain
- Establish well-documented practices
- Include data from many sources
- Ensure long access life cycles

Charts/graphics created by Cognizant based on Gartner research.
Figure 7
Supply Chain Input for Digital Twin

Empowered with information and high on expectations, today’s global consumer expects their demands to be met within the shortest possible time and also with a good order of transparency about their package status during the fulfillment and delivery process. To satisfy their demands, businesses need to accelerate both their decision-making and their quality delivery of products and services. Real-time tracking of order status is possible from value-chain partners only when there is cross-functional collaboration and visibility across the supply chain.

A digital twin investment with inputs from the value chain will bring in real-time digital awareness. This awareness will enable value-chain partners and stakeholders to better govern and manage products, or assets such as industrial machinery, across the supply chain in more structured and holistic ways.
A Hydraulic Pump as a Digital Twin

Creating a geometric 3-D model for a hydraulic pump has numerous limitations. Any design change made into the existing model of the pump, with an eye on its future use, will need to be standardized. This is because any changes made would impact the components that go into making the pump, the assemblies that need to be coupled to this pump, the devices that are used to measure the pump operating parameters, etc.

Any change needs to be standardized and also must be easily communicated across the organization, so the change can be understood with minimal effort. An established standardized approach for modeling the pump would incorporate best practices to minimize the amount of rework and must include an ability to improve the model’s flexibility.

Standard & Healthy Practices for Creating & Modifying the Models

Forming standardized design practices helps organizations to connect and communicate design ideas across the globe. This practice makes it easier for multiple users of the digital twin to build or alter the models. Such practice also enables downstream users to quickly construct or modify the digital twin with minimal need to destroy and recreate portions of the model.

Data Collected from Multiple Sources

Often organizations fail to imagine the different types of problems a product or asset encounters throughout its lifecycle, from design and product introduction all the way through aftermarket service. It also is difficult to predict the type of simulation models, data types and data analytics might be necessary to replicate these problems.

While a digital model can replicate how various components fit together, organizations need to gather the data from many sources — sometimes both internal and external — to perform simulations or carry out the necessary analytics to gain business value from a digital twin.
QUICK TAKE

Gearbox as a Digital Twin

We worked with a U.S.-based manufacturer on detecting gearbox failure in its installed industrial equipment. Major gearbox components include bearings, shaft, gears, grinding bed and structure. Past studies indicate bearing failure as one of the leading causes of gearbox failure. Data needs to be sourced from various parameters in different operating conditions to build simulation models for detecting bearing failure using techniques such as vibration analysis, acoustic emissions, oil debris analysis and temperature-based analysis.

These simulation models need to account for failures caused due to poor lubrication, contamination, incorrect bearings, etc. Also, more models are needed to understand external factors affecting bearing failures such as housing deformation, operating speed, extreme loads, etc.

Ensure Long Access Lifecycles

Digital twins implemented using proprietary design software have a considerable risk of locking their owners to a single vendor. This risk becomes significant for assets with long lifecycles such as industrial machinery, buildings, etc., as the lifecycles of the digital twins of these assets are greater than the proprietary design software’s lifecycles.

The newly released proprietary design software or hardware might be incompatible with the older versions. Digital twin models currently built on this proprietary design software format run the risk of becoming unreadable in the later part of their service life. The dependency of the digital twin owner on the design software vendor increases further with the impact on the digital twin of growing historical data.

To overcome such risks, digital twin owners and IT architects need to insist that proper terms are set and agreed upon with proprietary design software vendors to ensure data compatibility is maintained, backward and forward, for relevant categories of software.
**ADOPTION PITFALLS**

Organizations must be aware of the common pitfalls when embracing the digital twin concept. Figure 8 details some of the common adoption pitfalls and their possible mitigation plans.

### Overcoming Pitfalls in Digital Twin Implementations

<table>
<thead>
<tr>
<th>PITFALL</th>
<th>MITIGATION PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Platform for different applications:</strong> Industrial assets having a</td>
<td>The digital twin for an asset is unique. Though the assets may have common functionality, they differ in configuration and operating conditions.</td>
</tr>
<tr>
<td>common functionality — e.g., centrifugal pumps — are very differently</td>
<td>Hence, it would a big mistake to believe that similar digital twins can be created for assets with similar applications.</td>
</tr>
<tr>
<td>configured from one another. Configuration of a pump used in an O&amp;G</td>
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<tr>
<td>refinery vary from the one used in a paint manufacturing plant in terms</td>
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<tr>
<td>of fire and safety regulations, substances to be handled, etc. In fact,</td>
<td></td>
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<tr>
<td>configuration of a change-over-pump in the same plant differs from the</td>
<td></td>
</tr>
<tr>
<td>pump-in-operation in terms of operating conditions, run time, etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Big Bang approach:</strong> In the long run, organizations can envision building a digital twin for an entire factory floor. But to</td>
<td>A better approach would be to identify the criticality of assets and also their data dependency needs for building a digital twin. Based on these two factors, the assets can be combined into groups. Organizations can then follow a phased approach for building digital twins for these groups of assets to reach the end goal of a digital factory.</td>
</tr>
<tr>
<td>reach that end goal, organizations cannot look for a Big Bang approach</td>
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<tr>
<td>and start investing in building the digital factory at one go. This</td>
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</tr>
<tr>
<td>approach would be detrimental to the organization.</td>
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<tr>
<td><strong>Sourcing quality data:</strong> Many organizations collect operational data</td>
<td>Organizations need to ensure that standardized practices are followed to minimize data entry errors by using standardized data collection templates, collecting more field samples, etc. Organizations can employ data de-duplication techniques to ensure duplication errors are minimized or eliminated entirely.</td>
</tr>
<tr>
<td>via field logbooks and then update the local information management</td>
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<tr>
<td>systems — which in turn become the input sources for enterprise</td>
<td></td>
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<tr>
<td>management systems — quality of data thus sourced gets affected by</td>
<td></td>
</tr>
<tr>
<td>factors like data entry error, data duplication from multiple local</td>
<td></td>
</tr>
<tr>
<td>systems, etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Lack of common device communication standards:</strong> As part the</td>
<td>IoT devices are one of the core enablers of the digital twin concept. Organizations can look to employ service providers that can develop or follow the standard software framework which allows for the communication of different IoT devices and also ensures their mutual interaction.</td>
</tr>
<tr>
<td>digitalization initiative, organizations have been investing in IoT</td>
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<tr>
<td>devices to gather process data from across the enterprise. Most of</td>
<td></td>
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<tr>
<td>these devices suffer from not being configured to speak in a single</td>
<td></td>
</tr>
<tr>
<td>language, as currently there is no universally accepted communications</td>
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</tr>
<tr>
<td>standard. Hence, these devices have challenges in understanding and</td>
<td></td>
</tr>
<tr>
<td>communicating with each other.</td>
<td></td>
</tr>
<tr>
<td><strong>User education:</strong> An organization would benefit from a newly</td>
<td>Organizations should seek to remedy this issue with quality documentation, intensive training and software socialization efforts to smooth the adoption process.</td>
</tr>
<tr>
<td>installed solution when its employees utilize most of its functionalities. Factors like user skepticism, user resistance, etc. would impact the adoption rate of the installed solution.</td>
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</tbody>
</table>
MEASURING SUCCESS

The digital twin concept is unlike other technologies; a twin can be built for an individual asset, an organization or an entire enterprise. Depending on the level of the twin implemented, the corresponding impacting measures (utilization, cost reduction, user satisfaction, etc.) need to be analyzed and measured for both pre- and post-implementation stages to generate a business case.

Typical KPIs at the Equipment, Organization & Enterprise Levels

![Figure 9]

IDC predicts\(^5\) that by 2020, 30% of global 2000 companies will use data from digital twins of IoT connected products and assets to improve product innovation success rates and organizational productivity, achieving gains of up to 25%. Gartner predicts\(^6\) that by 2021, half of large industrial companies will use digital twins, resulting in those organizations gaining a 10% improvement in effectiveness (see Figure 10).

Envisioning Digital Twin Benefits

![Figure 10]
Knowing the multifarious nature of the digital twin concept, it is difficult to define a percentage for measuring the success of digital twins. As stated above, the configuration of digital twins is determined by the type of input data, number of data sources and the defined metrics. The configuration determines the value an organization can extract from the digital twin. Therefore, a twin with a higher configuration can yield better predictions than can a twin with a lower configuration.

Organization needs to agree and decide on the relative percentage of improvements that can be achieved based on the level of twin implemented. Comparisons cannot be made between differently configured twins. The reality is organizations can have a relative measure of the success of digital twin implementation based on their defined configuration.

**MOVING FORWARD**

Digital technologies are evolving rapidly. As a result, organizations need to more quickly embrace them to achieve early mover advantage. To a large extent, this move favors organizations that are early adopters.

However, technologies that create significant business impact – such as those that compose a digital twin – must be understood completely by all organizations, particularly industrial companies, before they dive in. Otherwise, organizations will implement something that they are unable to technically support or will end up with an inaccurate model that offers limited economic value.

Through this paper we have discussed a three-point framework that industrial organizations can use to advance their investigation of the digital twin concept. As an initial step, organizations can assess their maturity along the four dimensions of process, technology, governance and people, and then arrive at a rating based on the maturity scale.

Organizations at level 3 and below need to focus on the operational, technological and governance aspects and the investments that can help them to move to the higher levels of maturity. A next step would be to analyze the fundamental building blocks of digital twin and understand the major challenges associated with each of the building blocks. Once the challenges have been identified, organizations should invest in plans that can help them to overcome those challenges. As a final step, organizations need to understand and follow best practices for implementing digital twin to take full advantage of the opportunities the concept offers.
FOOTNOTES


REFERENCES


Is Your Organization Ready to Embrace a Digital Twin?

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Cognizant’s Connected Products provides turnkey product design and development solutions for the digital era — from insights to design, development to qualification, and product management to pilot production. We engage with organizations to extend their capability across the entire product lifecycle. Our mission is to help organizations globally deliver business results through increased enterprise capabilities. Connected Products solutions include IoT strategy and advisory, as well as connected factories, places, products and vehicles. Read more about Cognizant Connected Products at www.cognizant.com/cognizant-digital-business/connected-products.

ABOUT COGNIZANT
Cognizant (Nasdaq-100: CTSH) is one of the world’s leading professional services companies, transforming clients’ business, operating and technology models for the digital era. Our unique industry-based, consultative approach helps clients envision, build and run more innovative and efficient businesses. Headquartered in the U.S., Cognizant is ranked 195 on the Fortune 500 and is consistently listed among the most admired companies in the world. Learn how Cognizant helps clients lead with digital at www.cognizant.com or follow us @Cognizant.

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