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TwinThread: Digital Twins & AI - The Journey to Autonomous Operations & Continuous Innovation

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AVEVA



Digital Twins & AI

The Journey to Autonomous Operations
& Continuous Innovation



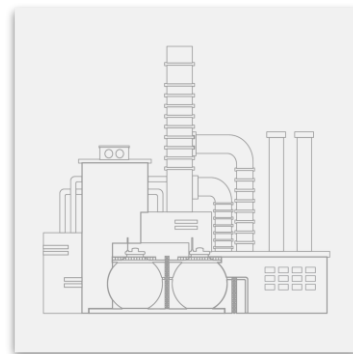
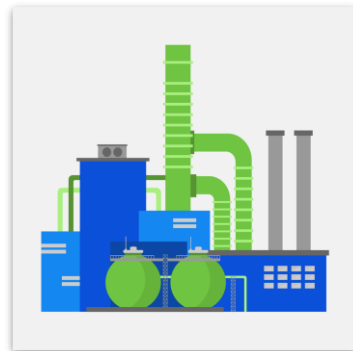
The COMPLETE AI-Powered Digital Twin Platform

What is a Digital Twin?

A digital twin is a virtual, real-time representation of a physical asset, system, or process.

The twin can reflect a single asset, a collection of field-based assets, a process within a manufacturing environment, or an entire multisite industrial operation.

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AI-Powered Digital Twin Platform Requirements

Rapid Time to Value

Implement a solution quickly and efficiently prove value as fast as possible



Operationalization

Identify improvement areas and act on insights and recommendations



Stability & Longevity

Maintain the solution without added resource costs or additional work

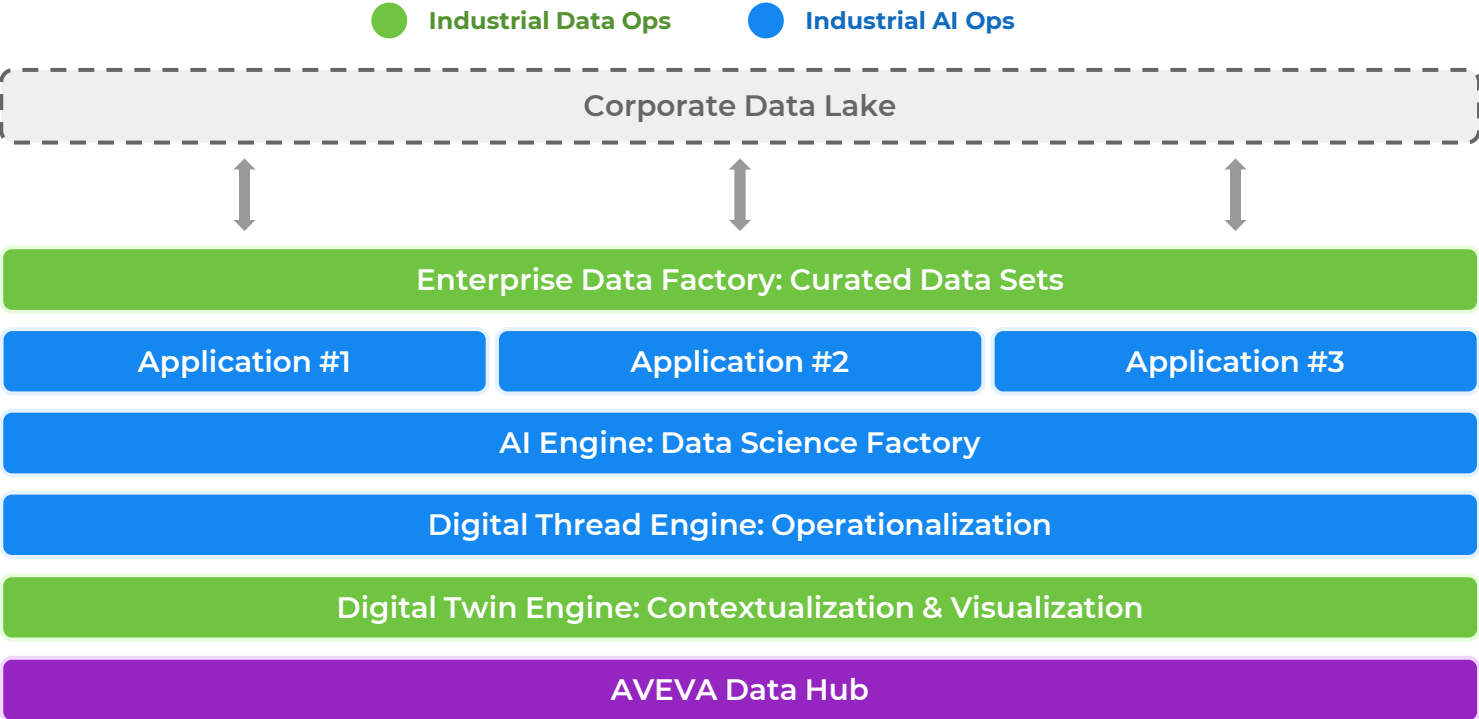


Scalability

Scale the solution on all equipment, lines, and facilities - across the enterprise



TwinThread Digital Twin Platform Stack



IIoT Digital Twin Options



Off-the-shelf software tools, platforms, and packaged applications



Building your own solution from scratch



Building components from scratch in combination with tools or platform components from various suppliers



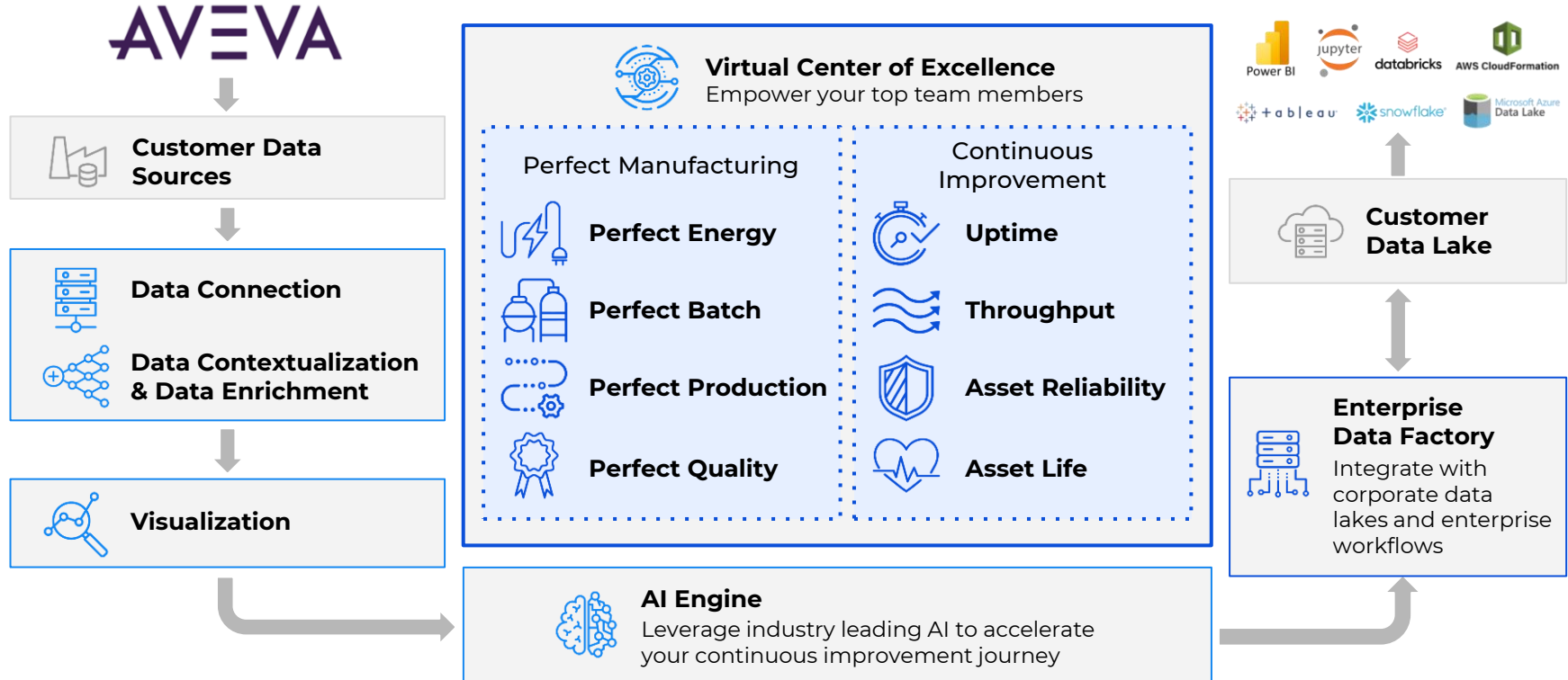
Stitched together components from a range of suppliers

The Economic Case for AI in Operations

Energy Intensity	➔	5% - 10%
Material Losses	➔	1% - 3%
Production / Capacity Increases	➔	2% - 5%
Yield Improvements	➔	1% - 3%
Reliability Improvement	➔	5% - 15%
Quality Improvement	➔	25% - 50%

Impact @ Scale : 5-8% Gross Margin Improvement - 12x Return On Cash (3yr)

TwinThread's AI-Enabled Applications

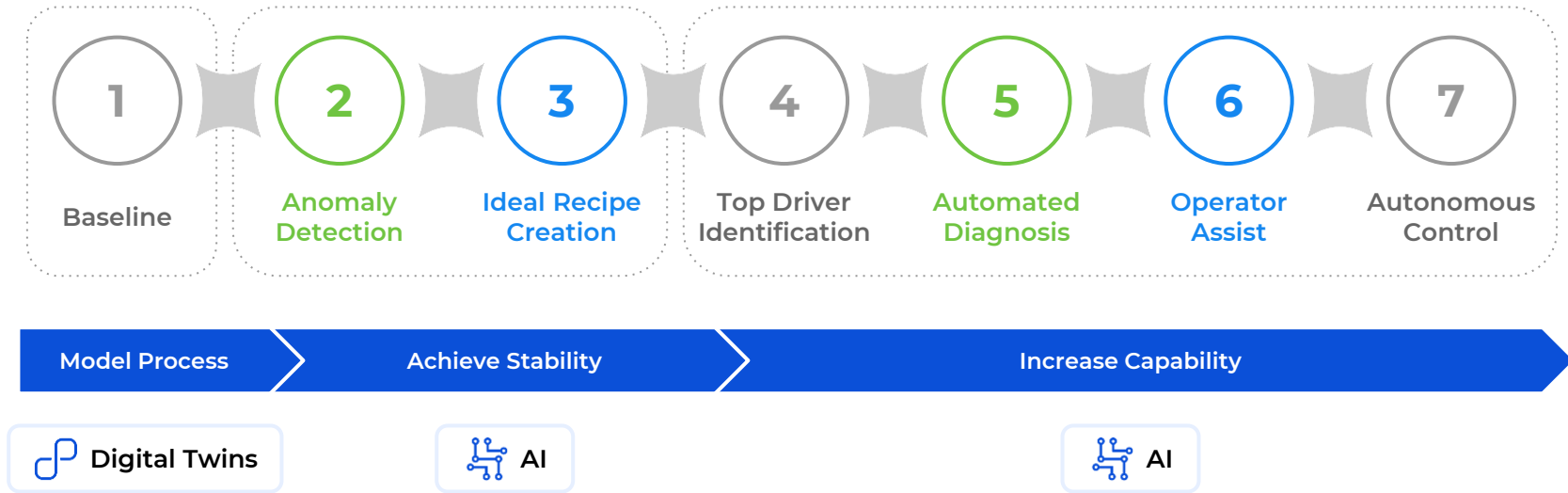




AI and the Journey to Autonomous Operations

How Digital Twins + AI Transform Your Supply Chain

Levels of Autonomous Operations

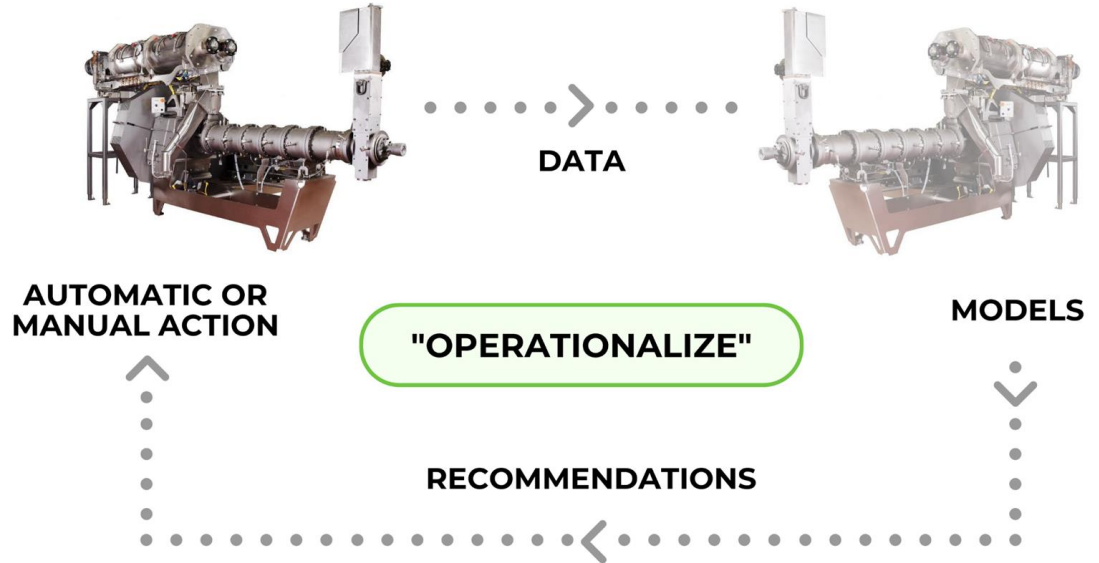


Composite Models in Action

7

Autonomous Control

Autonomous control of key quality parameters in food manufacturing



AUTOMATIC OR
MANUAL ACTION

"OPERATIONALIZE"

MODELS

RECOMMENDATIONS

Data is Your Competitive Advantage



**“If you own the data, you own the model
produced from that data”**

It is Best to “Buy” First, Then “Build”

The screenshot displays a workflow builder interface for a 'Train' operation. The workflow consists of several steps: 'Collect States', 'Sample Normal Intervals', 'Merge State Statistics', 'Optimize Property Features', 'Train Multilayer Neural Network', 'Train Multilayer Random Forest', and 'Select Predict Property Model'. A blue box highlights the 'Train User Defined Predict Property Model' step, which is the focus of the 'Build Here' callout. The right-hand panel shows the configuration for this step, including a name, description, and a Python task code for training a Random Forest Regressor.

```
python task code
1 from sklearn.base import BaseEstimator from sklearn.ensemble
2 import RandomForestRegressor
3
4 class ColumnSelectorRandomForestRegressor(BaseEstimator):
5
6     def __init__(self, keep_columns=[]):
7         self.model = RandomForestRegressor()
8         self.scoring = "accuracy"
9         self.keep_columns = keep_columns
10
11     def transform_data(self, X):
12         if len(self.keep_columns) > 0:
13             keep_columns = self.keep_columns
```

Build Here

How Do I Know Which Use Cases to Apply AI?

Characteristics of Ideal Use Cases:

1

Has historical data available:
3 months to 1+ year

2

Metric and outcome are well defined

3

There is high variation in the metric

4

Meaningful economic benefit in outcome

5

Same or similar objective across many / all sites or production lines

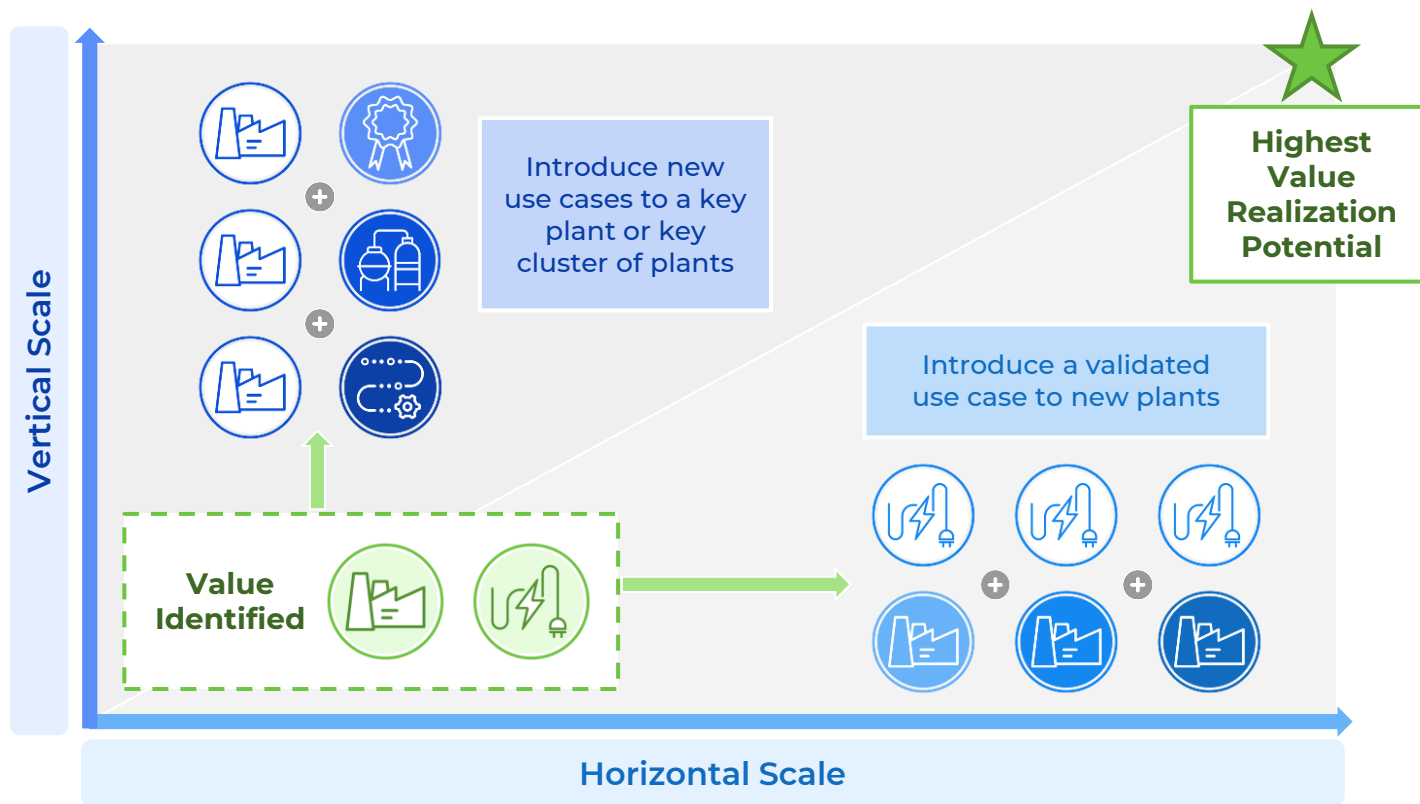
Reduce Unplanned Downtime by 15%

Unplanned Downtime is 19% +/- 10% month to month

Consider cost of change management

There is opportunity to scale

Maximize Value Realization



Overcoming Barriers to Scaling AI Use Cases

Problem

Solution

Inconsistent [tag] naming line to line



Digital Twins

Different lines have different equipment



Automated "AI Ops"

Configuration burden at scale



Digital Twin Classes

Storage and Compute burden at scale



Automated "Data Ops"

Lack of skilled / experienced resources



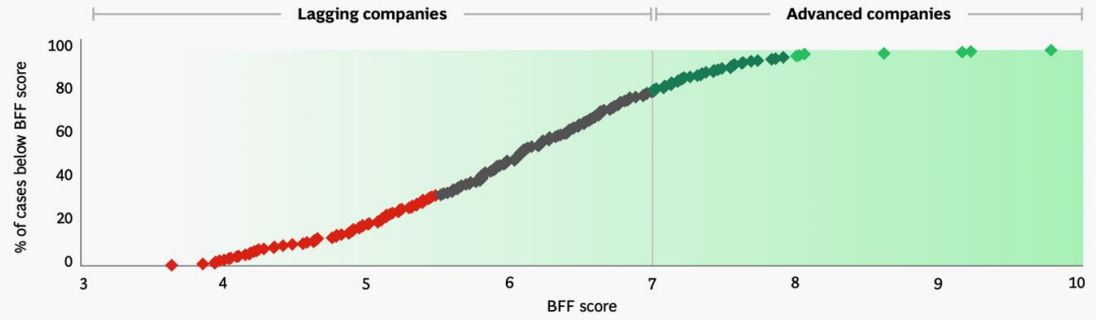
Virtual Center of Excellence



The Virtual Center of Excellence (VCoE) and a Modern Continuous Innovation Process

**Just 3% of
manufacturers
are fully
future-built**

Most manufacturers have significant work ahead; only 16% are scaling their efforts to build for the future, and just 3% are fully future-built



Company Type	Stagnating	Emerging	Scaling	Future-built
Manufacturing companies: ¹	32%	49%	16%	3%
All companies:	30%	45%	19%	6%

Source: BCG Build for the Future Survey 2022; n = 724.
Note: Advanced = future-built + scaling; lagging = stagnating + emerging.
¹Manufacturing-oriented sectors: machine and automation, consumer products, oil and gas, medtech, transport and logistics, biopharma, auto and mobility, hardware and semiconductors, materials and process industries.

<https://www.bcg.com/publications/2023/designing-factories-built-for-the-future>



The foundational dimensions for factory of the future success directly align with the six key attributes that enable a future-built company



People

- 1 Align **leadership around a corporate purpose**, particularly sustainable manufacturing.
- 2 Develop a clear **people advantage** by attracting, upskilling, and retaining top talent and building the capabilities to drive innovation, operational excellence, and exceptional customer satisfaction.
- 3 Institute an operating model to enable **agility and resilience**, making supply chains more responsive and durable to efficiently deliver products.
- 4 Establish an **innovation-driven culture** by empowering employees to explore emerging technologies, leverage analytics, and apply advanced solutions to improve operations.
- 5 **Embed AI** in the organization to increase transparency, analyze performance, forecast more accurately, and optimize production.

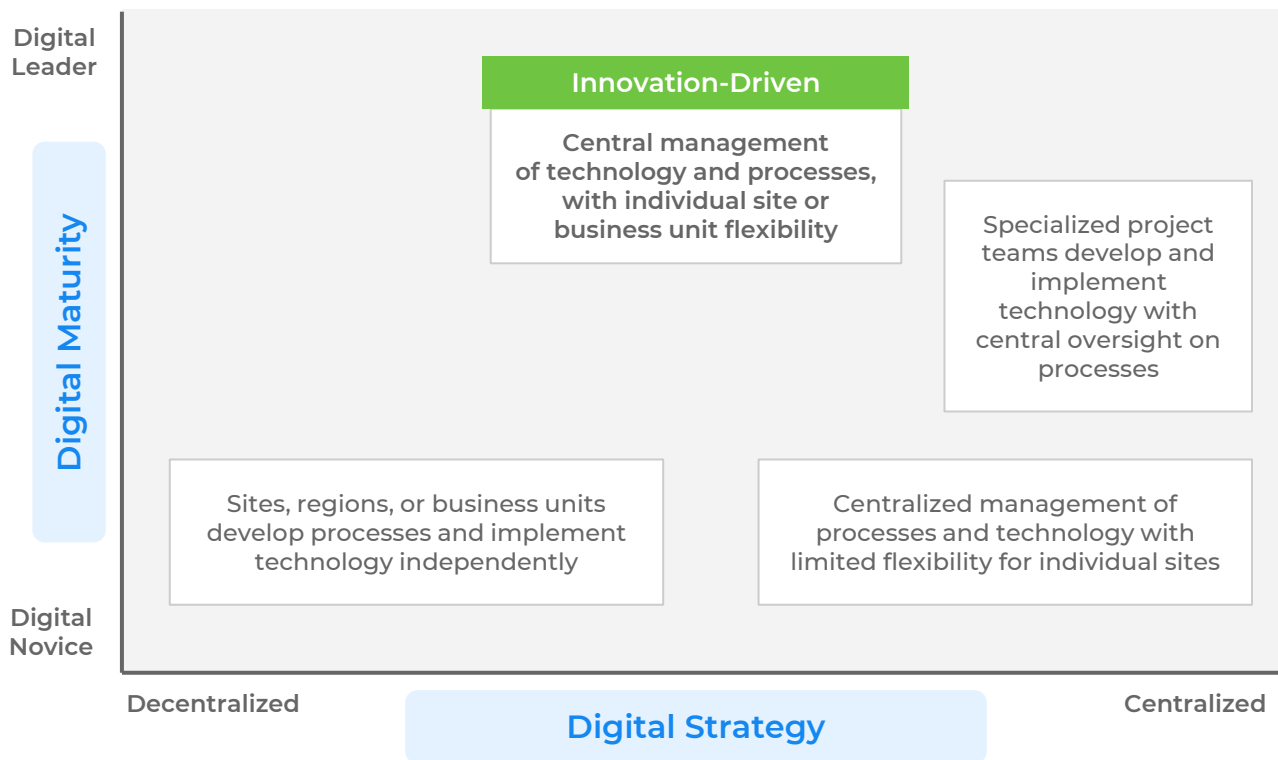


Technology

- 6 Migrate to **modernized tech platforms**, including scalable infrastructure to leverage the power of manufacturing data and capitalize on advanced technologies such as AI.

Source: BCG Build for the Future Survey 2022; n = 724.

Digital Manufacturing Transformation



Virtual Center of Excellence

The **Virtual Center of Excellence** brings multiple teams together with a shared mission and shared operational context

The **Virtual Center of Excellence** is the command center for coordinating a modern, scalable Continuous Innovation Process



DATA SCIENCE



OPERATIONS



SMEs



ENGINEERING

VIRTUAL CENTER OF EXCELLENCE

Scales knowledge sharing and collaboration of your highly skilled workforce

COMPARE
RANK
BENCHMARK

LEARN
DIAGNOSE
STABILIZE

PREDICT
RECOMMEND
PREVENT

Modern Continuous Innovation & Improvement

Continuous Improvement will always be an important concept for industrial operators. How this concept is approached; however, is positively evolving in the age of AI.

Digital Twins accelerate the speed at which improvements are identified, prioritized and implemented by leveraging AI powered data insight generation capabilities and the enablement of advanced collaboration through TwinThread's Virtual Center of Excellence.

Insights and use cases identified at a single plant, along with the resultant optimized business processes, are shared across plants, positively impacting all applicable operations..



The VCoE is responsible for comparative analytics which aid in the identification of opportunities and best practices, driving increased scale and value across the organization.



Key Takeaways

1

Digital Twin, powered by AI, is the foundation

2

Rapid time to value, operationalization, sustainability and scalability are key

3

Requires a complete platform stack

4

Protect your data and your competitive advantage

5

Promote a continuous innovation mindset

6

Build from a foundation of fit-for-purpose AI enabled applications

7

Connect successful Innovation projects with a separate Scaling process

Please
remember to...

Navigate to this session in
the mobile app to complete
the survey.



Questions?



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