

# DigiManuf

**AI-Powered Digital Twin Ecosystem for Smart Manufacturing**

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## **Team Members**

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# Challenges in Distributed Manufacturing

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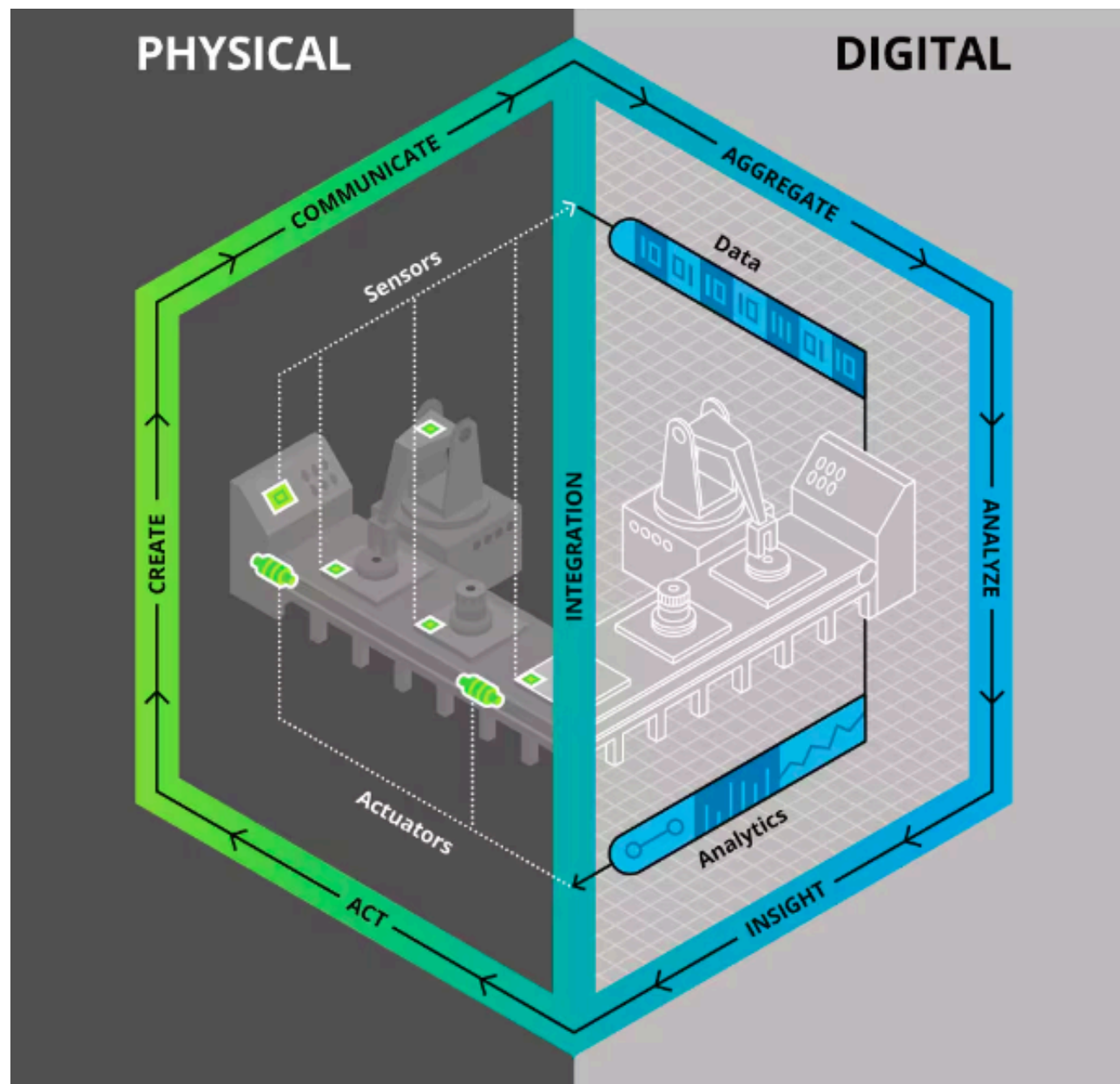


- Unexpected downtime and production losses
- Inefficient monitoring of geographically dispersed units
- Suboptimal workload distribution
- Lack of agility in responding to disruptions
- Ineffective quality control and safety management
- Limited data-driven decision-making capabilities
- Difficulty in predicting and mitigating equipment failures
- Inefficient energy usage and sustainability concerns

# Introduction to DigiManuf

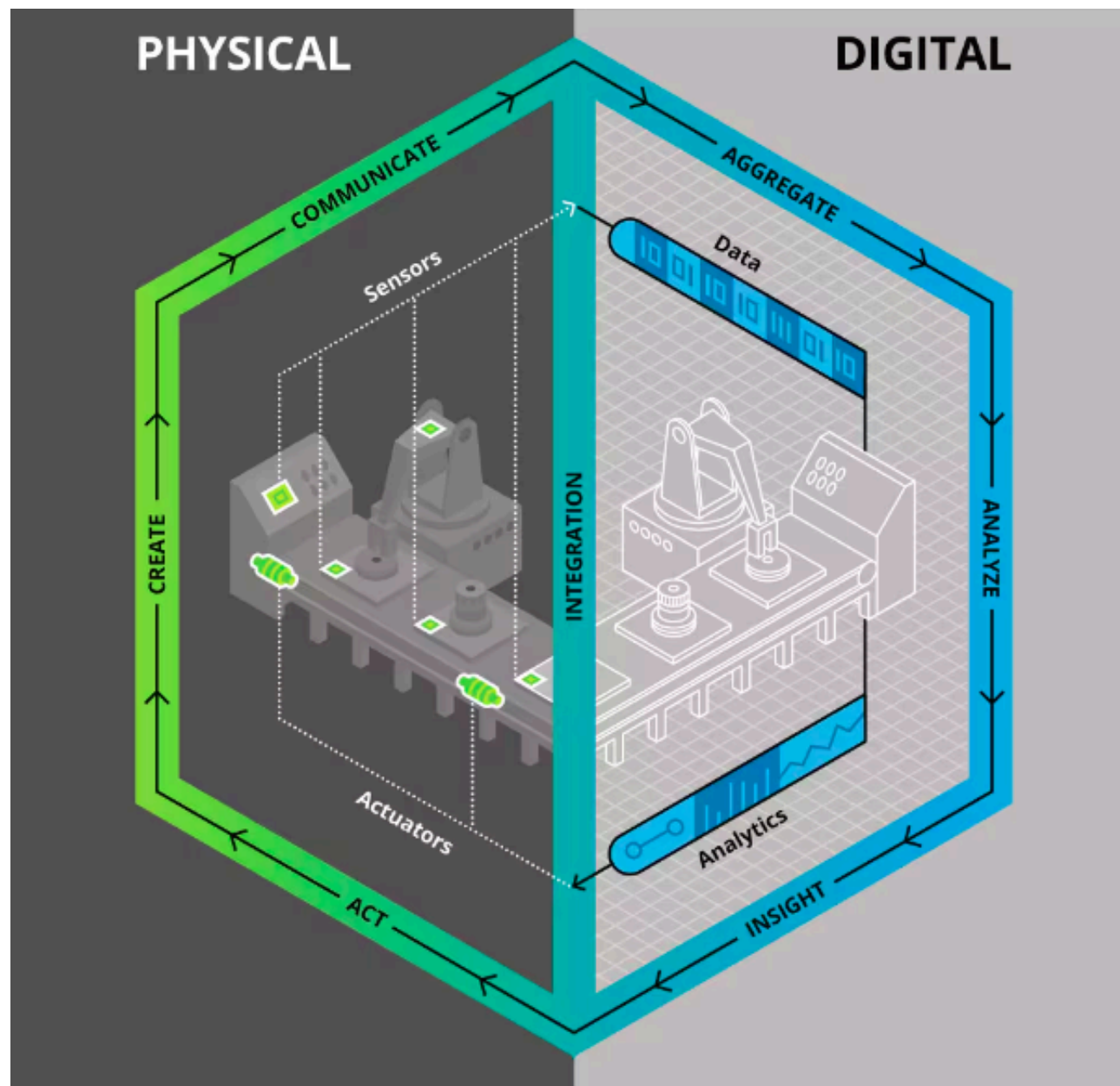
DigiManuf is a comprehensive AI-powered digital twin ecosystem that revolutionizes distributed manufacturing by:

- Creating virtual replicas of entire manufacturing operations
- Enabling real-time monitoring and control
- Leveraging AI for predictive maintenance and optimization
- Enhancing decision-making through data-driven insights
- Improving agility and responsiveness to market demands





# Powered by Cutting-Edge Technology



- Digital Twin: Creating accurate virtual representations
- Artificial Intelligence: Driving predictive analytics and anomaly detection
- Internet of Things (IoT): Connecting and monitoring real-world assets
- Cloud Computing: Enabling scalable and accessible solutions
- Big Data Analytics: Processing vast amounts of manufacturing data
- Graph Database (Neo4j): For workload and supply chain optimization

# Key Components

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## Advanced Digital Twin Technology

Real-time synchronization with physical assets

Interactive 3D visualizations

## AI-Powered Anomaly Detection

Continuous monitoring of machine performance

Real-time alerts for potential issues

## Predictive Maintenance

AI-driven analysis of historical and real-time data

Optimal maintenance scheduling

## Interactive Control and Simulation

Adjust parameters through digital interface

Simulate changes before implementation

## Intelligent Order Management

AI algorithms for optimal workload distribution

Dynamic reallocation based on machine availability

## Adaptive Manufacturing

Real-time reallocation of tasks during disruptions

Ensure business continuity

## AI-Powered Supply Chain Optimization

Comprehensive analysis of entire supply chain

Strategies to improve resilience

## Computer Vision-Enhanced Safety and Quality Control

Real-time monitoring via camera feeds

Automated hazard and quality issue detection

## How It Works?

- **Data Collection:** IoT sensors gather real-time data
- **Data Processing:** Cloud-based systems process incoming data
- **Digital Twin Update:** Virtual replica updated in real-time
- **AI Analysis:** Machine learning models analyze data and patterns
- **Insights Generation:** The system produces actionable insights
- **Control Implementation:** Changes applied to physical assets
- **Continuous Learning:** AI models update based on new data

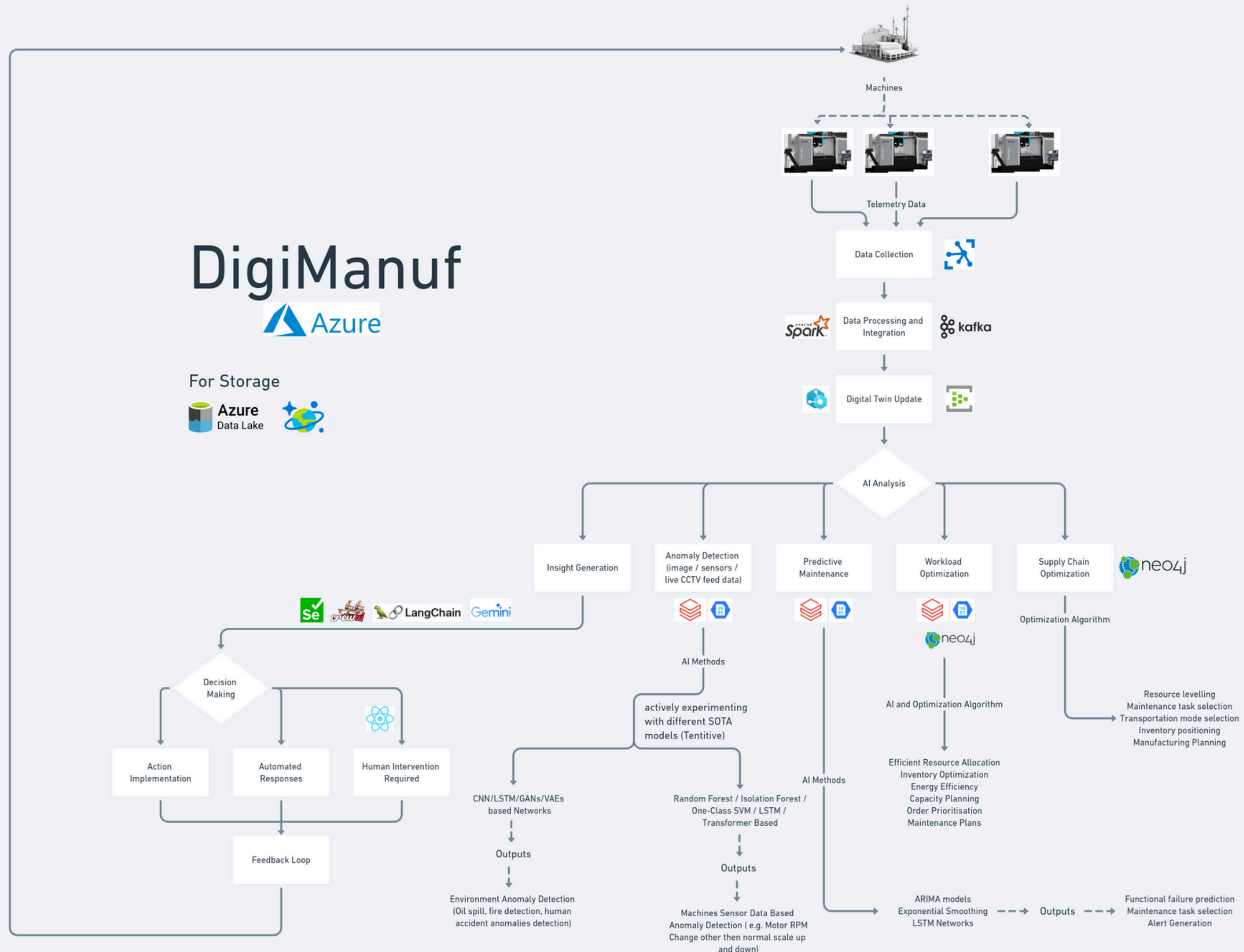
## Challenges faced

- Limited Azure Credits
- Limited open-source code related to resource optimization
- Near to no manufacturing instrument sensor data available for the AI model training

# DigiManuf



For Storage



## Benefits and Impact

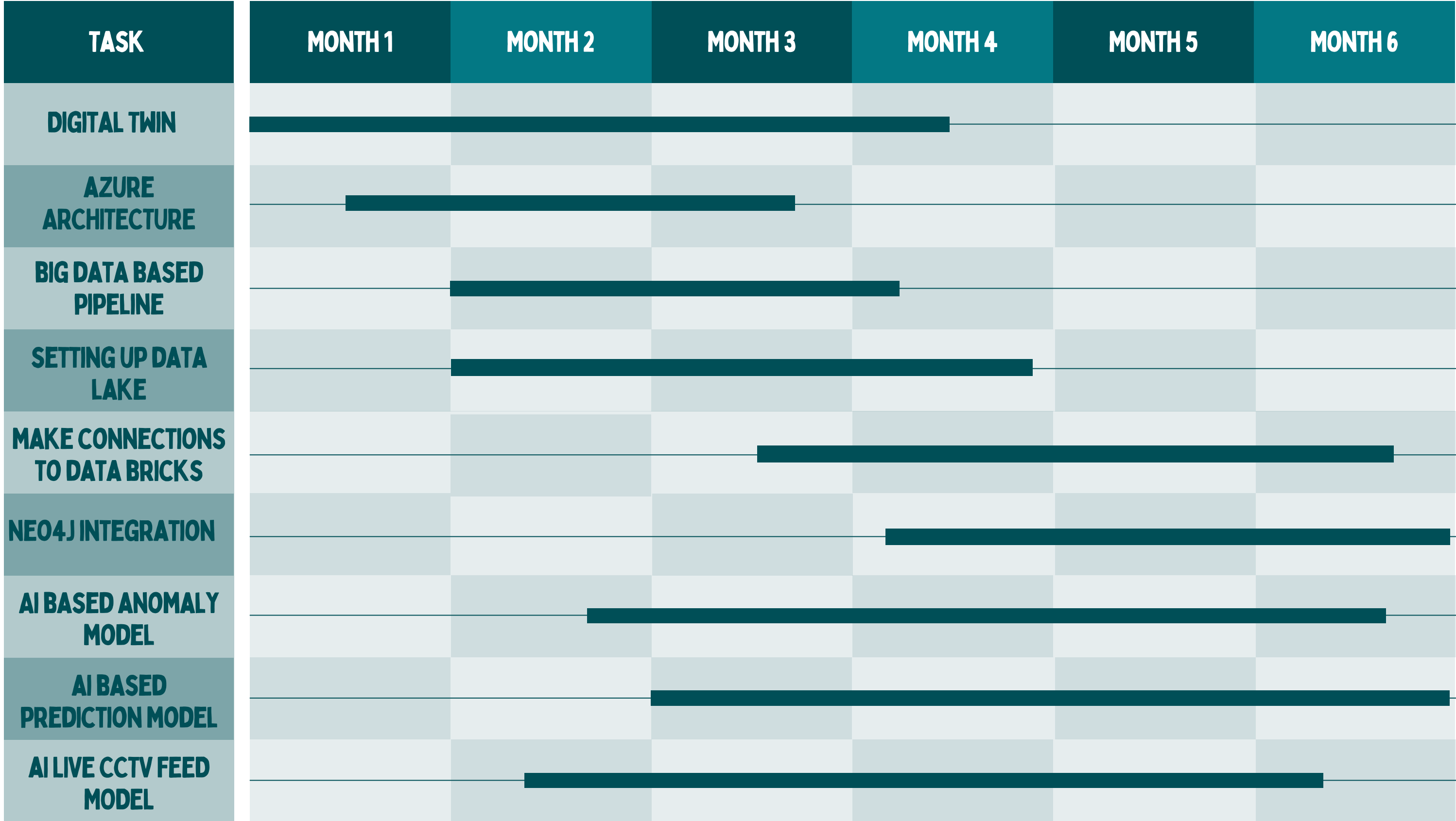
- Reduction in unplanned downtime
- Improvement in overall equipment effectiveness (OEE)
- Increase in productivity
- Lower maintenance costs
- Reduction in energy consumption
- Reduction in defect rates
- Faster time-to-market for new products
- Improvement in supply chain resilience

## What Sets It Apart

- Comprehensive Integrations
- Advanced AI Implementation: Predictive and prescriptive analytics
- Real-time Adaptability: Dynamic resource allocation
- Scalability: Easily accommodate diverse manufacturing setups
- Sustainability Focus: Built-in metrics and optimization
- User-Centric Design: Intuitive interface for complex data



# Path to Implementation (GANTT CHART)



# The Future with DigiManuf

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- Expansion to more industries (e.g., automotive, aerospace)
- Integration with emerging technologies (e.g., 5G, edge computing)
- Advanced simulation capabilities for product development
- Enhanced sustainability features and circular economy integration
- AI-driven autonomous manufacturing operations



**Thank You**

