The Beginner's Guide to AI in Manufacturing

How Artificial Intelligence Can
Optimize Production Performance

EBOOK

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TABLE OF CONTENTS

INTRODUCTION

Manufacturers today face a highly competitive environment with rising costs of materials and resources. The nominal price of steel, for example, has increased by 167% since the turn of the century while energy costs have climbed more than 2.5 times their prices in 2000[1].

In order to be more efficient while managing tight margins, manufacturers have begun exploring digital transformation solutions such as Artificial Intelligence (AI) and Machine Learning (ML). These technologies help factories unlock previously hidden opportunities while helping solve problems faster than ever before. Getting started with these initiatives, however, remains a challenge.

In this eBook, we will explore the concept of Prescriptive AI: a data-driven process that helps manufacturers discover new ways to reduce costs and increase productivity.

You'll learn the fundamentals of a digital transformation journey and the benefits of starting quickly to give you a competitive edge. Time is an asset you can't get back, so it's critical to start collecting valuable data today. We hope this eBook helps you gain a better understanding of how to get started.

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1 *TRACC Solutions: Rising Cost of Raw Materials*

In this eBook, we look at:

Top challenges manufacturers are facing with Industry 4.0

Creating operational visibility with smart manufacturing initiatives

How to deliver production efficiencies while reducing waste

Getting measurable results fast with AI-driven automation

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THE CHALLENGES WITH INDUSTRY 4.0

Manufacturers must combine data from multiple sources to obtain insights.

Structured Platform Data

⚙ Business Systems (ERP & PLM)

👥 Production Execution Systems (MES)

▯ Process Monitoring Technologies (HMI-SCADA)

▮▮ PLCs

Unstructured Data Sources

📄 Text Documents

🖼 Images

▶ Videos

💬 Speech

Manufacturers face growing pressure from a highly-competitive, globalized environment. Rising material costs and increased competition are threatening contribution margins while a rapidly digitizing world can quickly leave you obsolete.

As a result, manufacturers are turning to Industry 4.0 solutions to maximize efficiencies within the production cycle. The goal is to improve output, reduce waste, and increase overall productivity while making the organization more competitive and profitable in the long run.

IDC predicts that organizations worldwide will invest $5.9 trillion in Digital Transformation between 2018-2021[2], showing that technology plays a key role in enabling these objectives. ISA-95 standards were developed in the wake of growing industrial automation initiatives to provide guidelines for developing an automated interface between enterprise and control systems.

But turning data into actionable insights is anything but easy

Many manufacturers face challenges when combining data from multiple platforms with other unstructured forms of information including:

01   Poor interoperability that leads to data silos

02   Unplanned downtime that can result in significant production losses

03   Delayed operational & process visibility that limit accurate decision-making

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THE RISE OF THE INTELLIGENT FACTORY

Industrial AI technologies help manufacturers overcome many of these challenges by eliminating data silos, creating operational visibility and providing intelligent recommendations. Prescriptive AI, for example, can draw on historical and real-time data to identify the most efficient way to make a product and achieve peak performance.
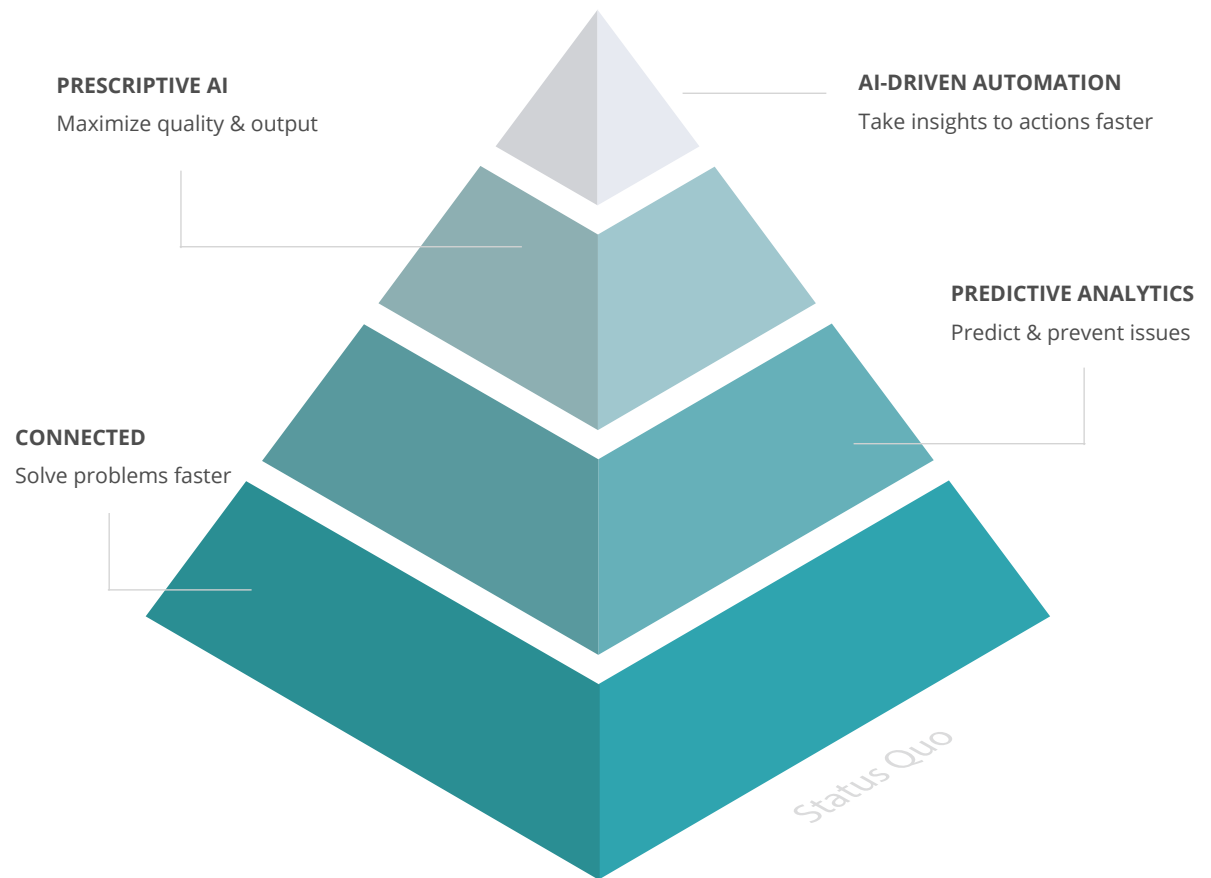
2/3

OF ANALYTICS-DRIVEN PROCESSES

Will not only uncover what happened and why, but prescribe what action should be taken by 2021.

Ventana Research

The Four Analytic Capabilities

PRESCRIPTIVE AI
Maximize quality & output

AI-DRIVEN AUTOMATION
Take insights to actions faster

PREDICTIVE ANALYTICS
Predict & prevent issues

CONNECTED
Solve problems faster

Status Quo

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Quick Guide
to Understanding
the Intelligent Factory

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CONNECTED FACTORIES Solve Problems Faster

Data is generated and stored by various sensors, machines and systems on the factory floor. But unless this data is aggregated in a centralized location, it can take a long time for operators or engineers to find the root cause of a problem since they must look in various places.

What You Need to Know

Centralized data can be easily aggregated and leveraged to solve problems faster. It also involves integrating machine data with MES, ERP and other sources to provide real-time visibility of production status and more.

INTEROPERABILITY

Data should be stored on an OPC server and accessible over OPC UA standards. This ensures you'll be able to integrate with different solutions or solution providers for increased flexibility.

DATA VISUALIZATION

Centralized data can then be displayed in various dashboards and shown on the factory floor. Metrics such as OEE, throughput, order status and more can be highlighted for all team members to track.

Benefits You Can Expect

- Ability to **investigate the root cause** of offline quality failures in hours rather than days

- **Alerts** when process parameters are out of thresholds to minimize extended downtime

- **Live monitoring** of factory conditions that can be displayed on the factory floor

PRO TIP

Historical data is something you can't get back. It's important to start collecting data from machines & key production points even if you're not ready to connect them. When you're ready, you'll be able to realize the results faster because of this historical data.

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PREDICTIVE ANALYTICS Predict & Prevent Issues

Once you start aggregating your data into a centralized location, you'll be able to use AI and Machine Learning to predict patterns and proactively solve issues. Predictive applications can identify potential problems, alert operators, and allow them to make adjustments necessary to minimize the impact.

What You Need to Know

A strong, scalable data infrastructure is critical to enabling predictive analytics. If a database can't handle the speed and volume of incoming data, it won't be able to function effectively.

HISTORICAL DATA

The amount of data available dictates how precise algorithms can be when predicting quality, offline results or other applications. A good rule of thumb is that you want 10 times the examples compared to the variables you're analyzing.

CLOUD-EDGE ARCHITECTURE

A hybrid of Cloud and on-prem Edge technology allows you to build and deploy models faster. It also provides a single data stream from factories to the Cloud while reducing latency and eliminating the impact of a short-term network outage.

Benefits You Can Expect

✓ **Minimize wasted materials** and other resources with scrap prediction

✓ **Limit unplanned downtime** by allowing operators to proactively solve potential problems

✓ **Predict offline results** to reduce the amount of non-conforming product

💡 PRO TIP

Train operators on what actions to take when they get predictive alerts. A quick reference guide can allow them to make decisions faster.

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PRESCRIPTIVE AI Maximize Quality & Output

Operators typically follow their own process, resulting in a high amount of variability in both product quality and production efficiency. Algorithms can quickly compare data from various segments of time to identify the conditions that led to the most profitable production runs and optimize OEE.

What You Need to Know

Prescriptive AI takes smart manufacturing one step further to analyze historical data and provide recommendations for improving quality, productivity and other metrics. They can identify your best production runs, isolate the reasons why, and then recommend settings to achieve those results consistently.

CONTROLLABLE VARIABLES

Many variables impact a production run and operators won't have control over all of them. It's important to understand which factors impact production, then identify which ones an operator has control over.

CONTINUAL IMPROVEMENTS

Algorithms continually evolve, leveraging new data and projections with each run to become smarter. The result is better recommendations to optimize productivity based on changing factors.

Benefits You Can Expect

- Allow engineers to make faster, more accurate decisions to **optimize production**

- **Increase profitability & OEE** while eliminating wasted resources

- **Increase customer satisfaction** by significantly reducing the likelihood of non-conforming product

☀ PRO TIP

It's best to start with a pilot project that works as a proof of concept and leads to further, incremental developments.

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AI-DRIVEN AUTOMATION Take Insights to Actions Faster

With Prescriptive AI, a process engineer receives recommendations to optimize production, reviews them and then informs the operator who physically changes the settings. AI-driven automation pushes recommendations directly to an operator on the floor.

What You Need to Know

AI SYSTEMS

AI systems can identify new ways to improve a product, create the settings necessary and push recommendations directly to operators for implementation. While AI-driven automation can send instructions to a machine to make changes automatically, we advise having an operator validate the new settings as a second layer of verification.

DATA-DRIVEN AUTOMATION

To reach true data-driven automation, a significant amount of data is required. There must be enough information for the system to understand the impact different variables and changes have on production. It will take time before the end-to-end manufacturing journey becomes fully automated.

Benefits You Can Expect

✓ The main benefit of AI-driven automation is **faster, more accurate decision making**

✓ **Production can adjust** based on numerous factors so a factory can operate at peak performance every single time

✓ For example, if the temperature and humidity within the factory increases, the algorithm can **recommend new settings** that maximizes quality output

☀ PRO TIP

AI and Machine Learning are meant to enhance the process by leveraging data to make more profitable decisions faster, not to replace the work of operators or engineers.

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The Value of
AI-Driven Automation

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THE VALUE OF AI-DRIVEN AUTOMATION

Industrial AI technologies give you quick access to insightful recommendations that the human eye may otherwise miss, making your factory more efficient and maximizing contribution margins. AI examines how you've been making a product, then identifies the best sections of each run and uses those insights to generate optimal settings.

You'll also benefit from a clearer understanding of key variables that inform your most efficient production conditions such as:

- Run Times
- Material Costs
- Equipment Speeds
- Energy Consumption
- Scrap & Other Waste
- Human Resources Required

PRO TIP

The AI and Machine Learning algorithms providing this type of knowledge are called 'recommendation engines'. Once you know these optimal conditions, the next step is to automate some—or potentially all—of the manufacturing process.

Don't collect data for the sake of collecting data.

And don't implement AI for the sake of implementing AI. Understand how and where to maximize impact by asking yourself the following questions:

04
03
02
01

01 WHAT CREATES IMPACT FOR YOUR BUSINESS?

02 WHAT CAN AI AND MACHINE LEARNING HELP OPTIMIZE?

03 WHAT DOES YOUR DATA ALLOW YOU TO DO?

04 WHAT SHOULD YOU DO?

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GETTING MEASURABLE RESULTS FAST

Recommendation engines make it easy for manufacturers to gain all the benefits of high-level prescriptive analytics technology without the need to employ new internal expertise, such as hiring data scientists. All the work is done through an algorithm so there is no need for labor-intensive human analysis.

Once the success of each run no longer relies on a few individuals, you can achieve greater consistency and find solutions that go beyond the scope of human analytics and experience.

9.58 DAYS (230 HOURS)

M	T	W	T	F
M	T	W	T	F

SUCCESS IN ACTION

A global manufacturer identified more than 230 hours of production time savings over six months – almost ten days of full-time production. The manufacturer was able to execute the next run 15% more efficiently after using Oden's Golden Run™ recommendations.

Here's how a recommendation engine works:

Analyzes history to identify best performing segments & the key settings that contributed to peak performance.

Generates recommended settings for controlable variables to replicate optimal runs more consistently.

Monitors live process to ensure key variables stay within recommended settings & generates real-time alerts as needed.

Deploys predictive alerts to provide early warnings of departure from ideal settings, allowing operators to proactively solve potential issues.

Continues to monitor the process to refine recommendations and achieve incremental production improvements.

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KEY TAKEAWAYS The Future Is Prescriptive & Automated

01 **Industry 4.0 solutions** can maximize efficiencies within the production cycle to improve output, reduce waste, and increase overall productivity to drive higher contribution margins.

02 **The smart manufacturing journey** can be broken down into four key stages: Connected Factories, Predictive Analytics, Prescriptive AI, AI-Driven Automation.

03 **Industrial AI technologies** give you quick access to insightful recommendations that the human eye may otherwise miss to optimize both performance and quality.

04 **Timing is critical.** Historical data is essential for accurate recommendations and you can't go back in time to collect data you don't have.

05 **Recommendation engines** allow manufacturers to take advantage of Prescriptive AI without the need to employ new internal expertise, such as data scientists.

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TURN DATA INTO INTELLIGENT ACTIONS FASTER WITH **GOLDEN RUN™**

Golden Run™ is a proprietary recommendation engine specifically designed to address manufacturers' need for efficiency and to identify the most profitable way to make a product. It enables manufacturers to solve problems faster than ever before and unlock cost-saving efficiencies from data that could have remained hidden.

Using Machine Learning algorithms, Golden Run identifies where changes and improvements can be made and generates new settings so manufacturers can continually realize cost-saving improvements.

Learn how Oden can help with your digital transformation initiatives

REQUEST A DEMO

MAKE MORE.
WASTE LESS.
INNOVATE FASTER.

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