SIX WAYS PROCESS DIGITAL TWINS CAN OPTIMIZE MANUFACTURING

Honeywell

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MANAGEMENT SUMMARY

Process digital twins are the not-so-secret sauce in manufacturing, with capabilities that are fueling game-changing improvements for companies across all industries. Digital twins give operators an end-to-end view of how a process is functioning, enabling them to monitor performance and make real-time adjustments to increase efficiency, reduce costs and improve quality. But not all process digital twins are created equal. How can you be sure the solution you're considering will deliver the ROI you're looking for?

In this whitepaper we'll examine the process manufacturing environment today, discuss some of the opportunities and challenges operators face and highlight six ways you can use a next-gen process digital twin to improve efficiencies and margins while reducing operational risk.

WELCOME TO THE NEW
MANUFACTURING PARADIGM

It's survival of the fittest and leanest today in process manufacturing. Even before the pandemic created unprecedented supply-chain disruptions, process manufacturers faced a host of challenges ranging from increasing competition created by globalization and advances in technology; constant changes in supply chain and market dynamics; pressures from consumers and regulators to meet sustainability goals; difficulties attracting and maintaining a skilled workforce; and more.

EMERGING TECHNOLOGIES

In the early 2010s, the use of digital twins in process manufacturing began to gain momentum. Advances in data analytics and simulation technology made it possible to create more accurate and comprehensive digital models, which in turn created new opportunities for manufacturers to:

- Continuously optimize unit operations against changing supply/demand/regulations
- Turn data into KPIs and predict key properties for in-depth process monitoring
- Understand the impact of changes in a virtual environment
- Make more informed decisions
- Break down silos with a consistent view of plant capabilities/constraints
- Maximize productivity
- Perform root cause analysis
- Correct potential problems before they occur
- Maximize ROI
- Minimize downtime
- Achieve continuous improvement
- Democratize specialized tools

EMERGING CHALLENGES

At the same time as the emerging technologies of digital twins were ushering in new opportunities for process manufacturers, they were also creating challenges that had to be dealt with or mitigated:

- Inaccurate or incomplete data can lead to flawed predictions and decisions
- No standard way of cleansing, assessing, communicating and contextualizing data
- Incompatibility with legacy systems
- Complexity that makes calibration/tuning difficult, especially when there is no standard on tuning or supplementing with auto-correction models
- Offline feed and product analysis may be infrequent, asynchronous and of poor quality
- Processes and use cases that demand steady or non-steady handling
- Results interpretation is not always straightforward
- No consistent way of grading data quality and model performance
- Cost-prohibitive investment in hardware, software and skilled personnel

Fortunately, there are next-gen solutions purpose-built to address each of the above challenges, while optimizing virtually any manufacturing process imaginable.

SIX WAYS TO OPTIMIZE WITH NEXT-GEN PROCESS DIGITAL TWINS

The technologies that gave birth to the first generation of process digital twins has continued to evolve, enabling a host of powerful new capabilities. Here are six ways next-gen solutions, such as the new Honeywell Process Digital Twin, can optimize manufacturing across a wide range of industries.

TURN DATA INTO KPIs FOR IN-DEPTH PERFORMANCE MONITORING

Plant digital twins can provide real-time performance monitoring. The Honeywell Process Digital Twin achieves that by:

- Transforming real-time data into key performance indicators (KPIs) such as catalyst activities, compressor efficiency and heat transfer oefficients.

- Providing a soft sensing solution for key properties that cannot be measured on a real-time basis.

- Detecting early performance deterioration enabling preventive maintenance.

- Identifying constraints and running what-if analysis for informed decision-making, fast troubleshooting, root cause analysis and more.

- Utilizing both dynamic and steady-state simulations with real-time data.

BREAKING DOWN SILOS AND ENABLING END-TO-END OPTIMIZATION

Different teams operating in isolation with little communication or collaboration is a recipe for inefficiency, duplicated efforts and reduced productivity. Process digital twins streamline operations by:

- Giving access to the same data and insights to everyone at all skill levels.

- Providing real-time visibility into processes, enabling teams to address issues before they disrupt production.

- Promoting collaboration by providing a shared platform for modeling and simulating solutions.

- Improving communication by providing a shared understanding of processes and assets.

- Supplying APC gain and LP vector updates.

CONTEXTUALIZED, TUNED AND READY-TO-USE SOFTWARE

Complexity is no longer a speed bump to be overcome. Today's process digital twins:

- Quickly respond to supply and operational changes.

- Convey input data quality and model performance metrics, as well as highlight anomalies.

- Optimize performance with AI/ML-based auto-correction and tuning capabilities.

DATA CLEANSING, RECONCILIATION, STEADY-STATE DETECTION AND GROSS ERROR DETECTION

- Identify and correct or remove inaccurate data, errors and outliers.
- Resolve discrepancies in datasets.
- Detect steady-state operation when needed.
- Ensure high-curated quality used in simulations.

WORKFLOW IMPROVEMENTS AND FLEXIBLE MODE OF DEPLOYMENT

The game-changing capabilities of process digital twins are no longer restricted to simulation or modeling experts. User-friendly Honeywell Process Digital Twin makes it easy for cross-functional teams to:

- Access digital twin data and simulations from their browser,

- Use templatized reporting and customizable graphics.

- Improve workflows by monitoring performance, predicting the impact of changing production schedules, optimizing material usage and more.

- Implement a flexible cloud-based platform that accelerates adoption.

BYOML AND BYODT CAPABILITIES

Finally, manufacturers can bring their own machine learning or digital twin models and deploy them on the fly for specific applications. Honeywell Process Digital Twin is designed for:

- Leveraging first principle simulation models in tandem with ML algorithms.

- Starting with UniSim Design models, and also agnostic, open and interoperable.

- Reducing order models for use cases where speed of execution is important.

CHANGING THE GAME
FOR MANUFACTURERS
IN REAL TIME

Now let's take a closer look at some of the benefits you could see in your operation. To illustrate what's possible with a next-gen platform, we'll consider the Honeywell Process Digital Twin — a new comprehensive software offering designed to create, maintain and drive value out of online process models. By providing real-time insights into process constraints, optimal operating points and capabilities, the platform enables in-depth monitoring, troubleshooting and evaluation. It also allows users to try out scenarios in a virtual environment and have a consistent and up-to-date view of plant capabilities across different functions.
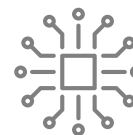
LEVERAGES A WORLD CLASS PROCESS SIMULATION ENGINE

UniSim Design is currently integrating with multiple 3rd party databases and applications to significantly improve it's functionality

PRE-PACKED WITH POWERFUL DATA PREPROCESSING CAPABILITIES

Ensure quality data for the Process Digital Twin

AI/ML AND REDUCED ORDER MODELS

AI/ML for auto correction of the Process Digital Twin to current operating conditions Automated generation of reduced order models for faster execution

BUILT WITH HONEYWELL 'S OWN INDUSTRIAL HERITAGE

Used by UOP for designing it's process units. Integrates with PWO/APC and LP's to enable E2E Optimization

PRE-BUILT WITH OT SPECIFIC DATA CONNECTORS

Out-of-the-box conectors for multiple OT applications

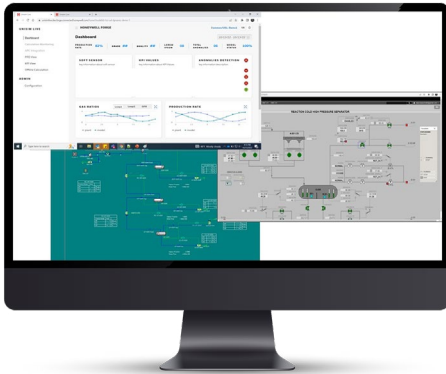### VENDOR AGNOSTIC & MULTI-CLOUD

Source agnostic, open and interoperable

THINK OF IT AS AN ENGINE FOR DRIVING VALUE

Here are a few of the ways you can optimize processes, workflows, decision-making and other critical aspects of manufacturing with the capabilities of the Honeywell Process Digital Twin.

5

PRODUCT

+2 MM\$/yr
BY AVOIDING CONSERVATIVE OPERATIONS

+25%
INCREASED WORKER PRODUCTIVITY
Directional estimates

Directional Benefits estimated based on a 6500 BPD Platforming and based Naphtha complete

+1 MM\$/yr
BY INTEGRATING APC, LP AND PDT'S
Directional estimates

CAPABILITIES

Real-time Performance Management

KPIs, soft sensors, anomalies, model and calculation management

Steady State & Dynamic Process Digital Twin

Turned to Current Plant Conditions

Data Pre & Post processing Routines

To ensure quality data for and accuracy of the Process Digital Twin

Scenario Analysis (What-ifs)

Understand the impact of changes in a secure virtual environment

Updates to LP and APC/PWO models (GA Release)

Ensure a consistent model across functions

Browser Based Access and customizable graphics

Role based access for multiple personnel with varying skills and expertise

BYODT, BYOML*, Calc & Model Management

Leverage USD models, existing PFD style graphics and external Python algorithms *GA Release

BENEFITS

1

Improved Operational Efficiency

- Planning and Scheduling can set targets based on current plant capabilities
- Plant operations can consistently achieve targets
- Close the loop with LP and APC to ensure a consistemt model of the plant across functions (planned)

2

Improved Margins

- Improved yields
- Operate closer to actual contraints
- Reduce Utility usage

3

Reduced Operational Risk

- Insight into process and key equipment constraints
- Faster root cause analysis and scenario analysis for better operational and planning decisions

WHAT'S POSSIBLE

The best way to show how a comprehensive next-gen solution like the Honeywell Process Digital Twin can address common production challenges is with a couple of use cases. In reality, the potential for optimization is equal to the number of processes that exist in manufacturing — and growing every day.

PERSONA	PARADIGM	KEY ISSUES	SOLUTION
PROCESS ENGINEER	"Crude supply constraints in Europe have forced my crude unit to operate at turndown! I saw this coming, and have designed my unit for Turndown at Design Feed Case A, B, C. But the current feed in the market is Case	Not have a tuned/calibrated PDT to run feed change scenarios and investigate operating options.	Use H-PDT to create online model that is in sync with plant operation; PDT generates updated yield vector
PLANNER	D. What process constraints am I going to lead into? What impact will this have to my production if I introduce this new feed right now! How do I optimize operating conditions?"	Not have a planning model that is in sync with the plant and therefore not having updated yield vectors for the new feed	Use Scenario Analysis to run what-if analysis for impact of new feed, new constraints, yield vector, and optimal operating conditions
OPERATOR	"My reactor outlet GC is often plugged, so I don't have enough time to take any corrective action to maintain product spec"	Not have a reliable measurement for reactor outlet composition, not able to take corrective action to maintain product specs	Use soft sensing capability to predict composition or other key properties in real time

CONCLUSION

In an era of intense competition across all industries, shrinking margins, regulatory pressures, supply chain disruptions and countless other challenges, manufacturers need to extract maximum value from each process — and do it scalably and repeatably. This is possible today thanks to the remarkable advances in process digital twins.

We focused on six ways the new Honeywell Process Digital Twin enables end-to-end optimization, from breaking down silos that inhibit collaboration and efficiency to making it easy for operators with varying technical capabilities to model use cases. We also explored how the platform enables manufacturers to systematically connect simulation to live data, process it, and continuously drive value out of rigorous first principle model and plant data. Finally, we looked at some of the potential benefits for manufacturers in a wide range of use cases.

Clearly, this is an exciting new era in process manufacturing — an era that's rich with opportunities for manufacturers who are ready to capitalize on the game-changing capabilities of next-gen process digital twins.

For more information
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**THE
FUTURE
IS
WHAT
WE
MAKE IT**

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