



Production Assurance AI

Can You Predict Future Profitability?

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In the current global economic climate and still suffering from instability in global conditions caused by the pandemic, unexpected sanctions, shipping logjams, and increased labor costs, combined with limited available labor, manufacturing organizations confront a host of business challenges. Manufacturers that don't quickly adapt their strategic business plans to changing conditions will likely lose market share or fail completely.

That's one reason why leading manufacturers continue rolling out smart manufacturing strategies as part of an Industry 4.0 program. Other reasons fall on the production side. Manufacturers are choosing to automate specific processes and, using data analytics, identify

bottlenecks and inefficiencies in their operations and then make improvements that lead to increased efficiency, productivity, and competitiveness.

Analytic tools aid manufacturers in analyzing vast amounts of data, which helps them not only make informed decisions about their operations, supply chain, and product development but also better understand customer needs and preferences to improve the customer experience and increase customer satisfaction. By collecting and analyzing production costs, manufacturers can take an order and turn it into profit by making real-time improvements. The big question is: Can they predict their profitability when taking an order five years from now.

What Is Production Assurance AI?

Though the fog of pandemic and supply chain issues appears to be clearing, instability continues due to current global economic conditions pressuring the bottom line. In a market that's competing for skilled workers and balancing unexpected outside disrupters, production efficiency is not the main goal for the digitization of manufacturing — it's resiliency.

While manufacturers confront many different challenges, the need for manufacturing organizations to pivot and adapt to changes on demand has never been greater. However, the most significant challenge involves the ability to plan and ensure profitability in the future. Addressing this challenge depends on a company's ability to create an informed business plan to guide the corporation.

Imagine applying technology that creates a better business plan by using generative artificial intelligence (AI) and inferencing. There are several new generative AI technologies on the market. Enterprise data applied to new algorithm models in a Production Assurance AI solution would result in a strategic business plan — an entirely data-based means to ensure future profitability.

A Production Assurance AI solution gathers data from disparate information sources across the enterprise, analyzes that data, and produces a business plan that not only predicts future production capacity and profitability but also tracks progress according to the plan over time (see Figure 1).

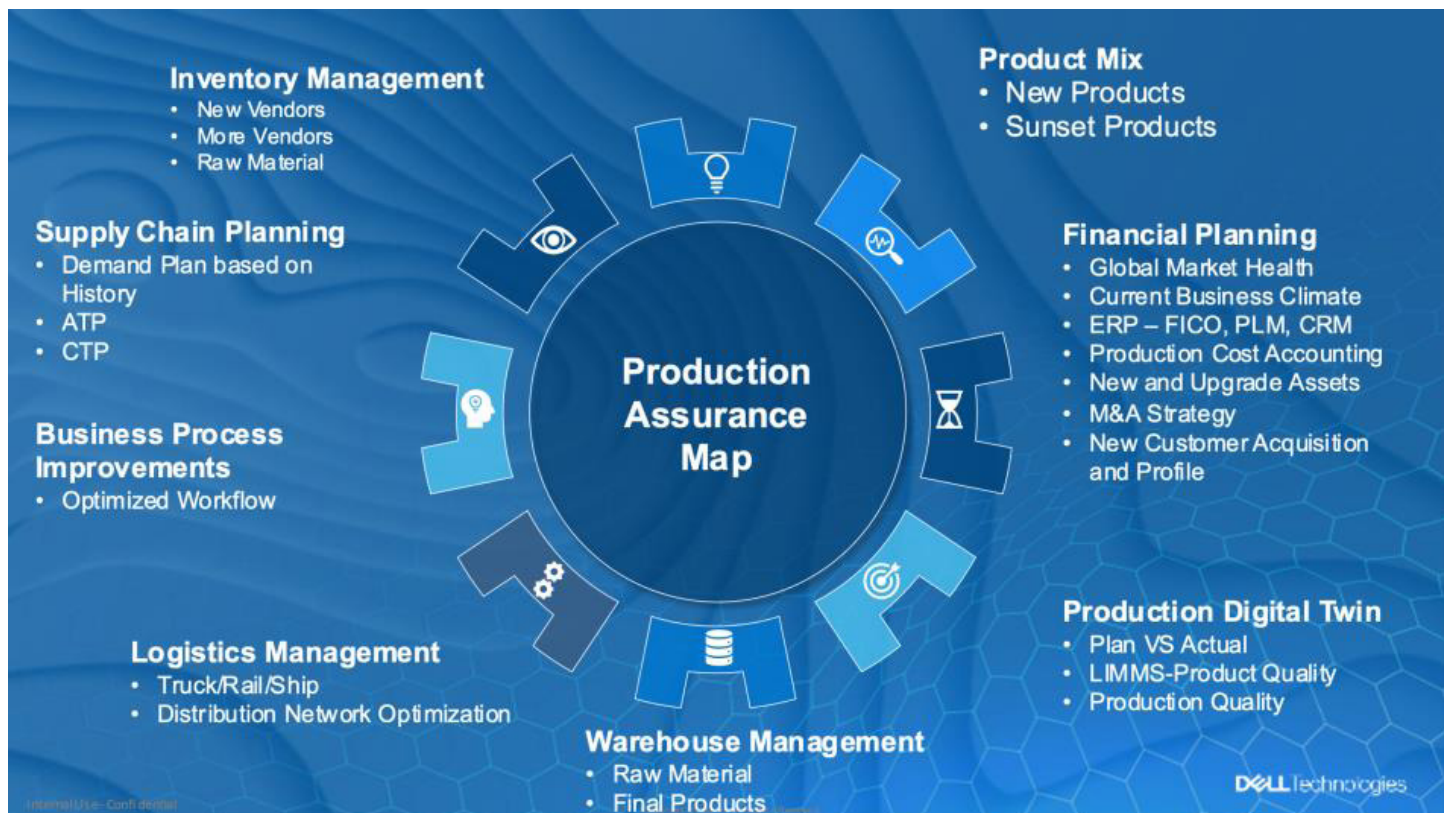


Figure 1

The ability of this type of Production Assurance AI solution to process and analyze large amounts of data and generate business plans and dashboards makes it a valuable tool for businesses seeking to understand their chances of long-term profitability.

This solution is trained on business and production data to generate reports, summaries, and forecasts based on the information it has analyzed. It can also develop strategic plans by analyzing trends and patterns in the data and generating recommendations based on the insights it has gained.

In addition, Production Assurance AI can be fine-tuned for specific tasks, such as market analysis, customer segmentation, and demand forecasting. This can help businesses make data-driven decisions and develop more effective business plans.

For future profitability, Production Assurance AI provides production risk mitigation and intervention processes, key performance indicators (KPIs), and tools that work at the speed of each company's business. Based on what is known about a business today, a Production Assurance AI solution can estimate the production risk and profitability related to taking and delivering a future order. To reduce risks, Production Assurance AI applies specific methodologies to predict if a business will require new equipment, upgraded production lines, or major repairs over and above normal turnaround and scheduled maintenance procedures. In other areas of the enterprise, Production Assurance AI can help determine whether the plant needs to be expanded or if an acquisition may be required.

The solution includes estimating future labor costs and determining whether personnel are properly trained. The Production Assurance AI solution examines the business's distribution strategy, evaluates its channel partner structure, and examines its service network to determine if and when expansion will be required to service new customers. Production Assurance AI also examines and recommends any necessary logistics and supply chain changes, such as shifting from trucks to rail.

Addressing all these considerations requires defining a baseline of knowledge of the business. Whether it's looking at next week, next month, next quarter, or five years from now, a Production Assurance AI solution creates a business plan and provides KPIs that provide insights into future profitability.

Not to Be Confused With ISO 20815:2008

It should be noted that Production Assurance AI for business planning explored in this paper is distinct from the production assurance described in ISO 20815:2008, which is written for the petroleum, petrochemical, and natural gas industries. Though the Production Assurance AI solution for business planning discussed in this paper has many similarities to ISO 20815:2018, it is not limited to petroleum, petrochemical, and natural gas industries but rather can be applied to the entire manufacturing market.

Production Assurance AI is an important aspect of modern manufacturing and is critical to the success of a business. It requires the development and implementation of robust processes, the use of appropriate technology and equipment, and the training and development of employees to ensure that they have the skills and knowledge necessary to produce products that meet the highest standards of quality.

In simple terms, Production Assurance AI is a solution that ensures a manufacturing process creates products that meet established quality standards, are consistent and reliable, and can be delivered to customers on time. It encompasses a range of activities and practices to minimize defects and deviations, improve customer satisfaction, reduce waste, and increase profitability.

Creating Business Plans Today

Business leaders rely on many financial value metrics and calculations to help guide and manage a company, such as net present value, internal rate of return, return on investment, and payback (Figure 1), among many others.

One way to calculate net operating profit and determine economic value added (EVA) is by using the formula in Figure 2. The calculation takes inputs such as average sales price, raw material costs, and variable and fixed costs. However, this simple calculation is not enough to allow a VP of Production, a Mergers and Acquisitions (M&A) strategist, a CFO, or a VP of Innovation and Supply Chain to analyze a company’s ability to take an order a year from now and deliver that order profitably.



Figure 2

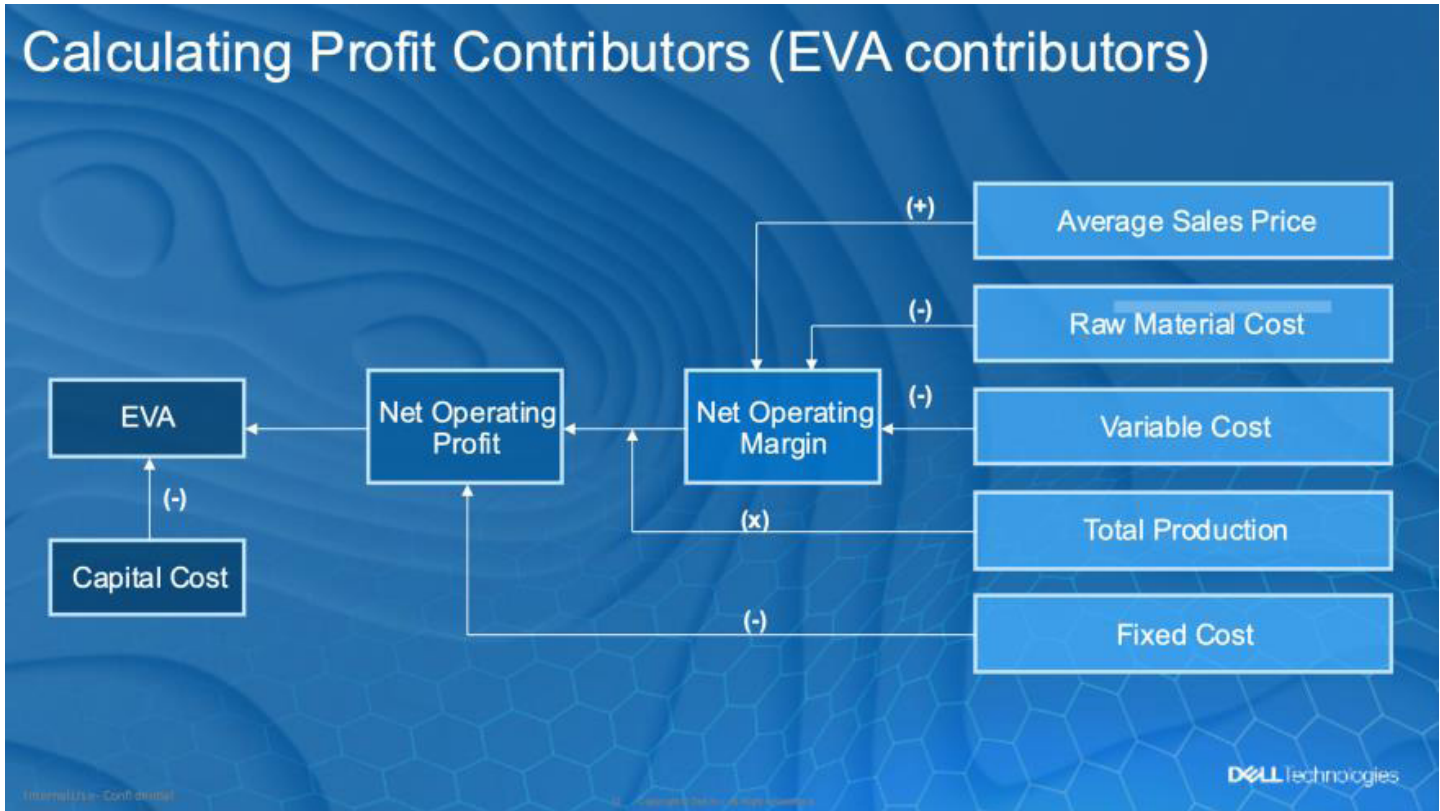


Figure 3

Business Plans Using Collective Intelligence

Today, the biggest challenge of creating a business plan is that it involves accumulating data from all parts of the business as inputs. The production cost accounting team tracks data on raw material price, current production rates, production costs, total product produced, safe person-hours worked, and fixed and variable costs. The plant production department logs data such as plant production rate, asset availability, planned maintenance shutdowns, product quality, and plant production costs.

Additional inputs to the business planning process from the production and operations teams include data on intra-factory logistics, the raw material supply chain, plant production rates, overall equipment effectiveness, machine health monitoring, and warehousing capacity. Maintenance analytics to display KPIs such as the severity level of each work order, average duration of open work orders, planned maintenance versus actual plant production, and the number of planned and unplanned shutdowns for equipment maintenance, repairs, and retrofits are other business plan inputs.

After gathering all this data from information sources across the enterprise, corporate analysts, business unit leaders, and strategists work together to analyze the data and come up with a somewhat disconnected business plan utilizing spreadsheets.

This method relies on collective intelligence, or the ability of a group to collectively solve problems, make decisions, and achieve goals more effectively than its members could individually. This is based on the idea that the combined knowledge, skills, and perspectives of a group can result in a greater level of understanding and insight than any single individual in the group could achieve on their own. By leveraging the diverse perspectives and abilities of the group, collective intelligence can lead to improved decision-making and problem-solving.

Because collective intelligence appears in consensus decision-making, it frequently involves aspects of mass peer review and crowdsourcing and often relies on consensus building, social capital, and formalisms that may include voting and other means of quantifying the collective group activity.

The resulting business plan is then brought before the executive team and board of directors for approval. Since this typically involves the use of large spreadsheets, each iteration of and update to the plan is not only time-consuming and cumbersome but is also prone to errors due to corporate politics and human subjectivity.

~33%

of enterprises have adopted leading operational practices to support AI.¹

28%

of enterprises have adopted processes associated with strong AI outcomes.¹

25%+

of enterprises have reached full-scale deployment of five or more AI applications.¹

1. Deloitte Insights, Becoming an AI-fueled organization, 2021.

Creating the Business Plans of Tomorrow with Production Assurance AI

Imagine applying technology that creates a better business plan by using new types of artificial intelligence algorithms and new inferencing engines.

This type of AI model is coming as a follow-on to chatbot AIs. Enterprise data models are typically trained in two stages. The first stage involves pretraining the model on large amounts of historical data. This pretraining stage helps the model develop a strong understanding of the various data relationships and generates a coherent and semantically meaningful dataset.

The second stage involves fine-tuning the pretrained model for a specific task, such as answering questions related to M&A, distribution networks, or production quantities. During this stage, the model is trained on a smaller, task-specific dataset. The pretrained weights from the first stage serve as an initialization, allowing the model to leverage its prior knowledge of the business data and adapt to the new task.

In this way, Production Assurance AI models can be trained more quickly and effectively for specific tasks compared to training a large model from scratch. The pretraining stage allows the model to learn a more general representation, while the fine-tuning stage allows it to learn task-specific information.

The Production Assurance AI solution would have the ability to:

- Centralize and analyze data to help corporations plan the best path forward
- Eliminate siloed calculations with the addition of data interdependencies
- Reduce reliance on massive spreadsheets and subjective, labor-intensive manual analysis
- Enable better communication among departments
- Produce an iterative multiyear business plan using a model designed to maximize shareholder value
- Track progress according to the plan using KPIs
- Periodically review KPIs and update the business plan accordingly

Data Is Key to Training a Production Assurance AI Solution

A prerequisite for training any AI system is data collection and preparation from disparate systems across an enterprise. Today we have the technology and computing power to integrate different types of data: structured, unstructured, and streaming. All these data types will serve as inputs into a Production Assurance AI solution.

Whether leading, coincident, or lagging figures, economic indicators based on broad market conditions form a good basis for any Production Assurance AI solution. This data includes trends in gross domestic product (GDP), unemployment, inflation, consumer price indices, and even certain commodity prices that inform global economic trends.

Whether a company treats mergers and acquisitions as a strategy or as an important enabler of strategy and long-term value, it's important for the Production Assurance AI solution to include past M&A data. Developing a clear M&A blueprint that will accelerate progress toward strategic business goals requires the analysis be informed by a deep understanding of industry value chains and underlying economics. Only when armed with this information can the Production Assurance AI solution best determine which sectors and capabilities offer maximum potential.

Data Input Types from Across the Enterprise

Enterprise Resource Planning (ERP)

Enterprise resource planning (ERP) software is a great source of data for a Production Assurance AI solution. Since ERP software helps organizations automate and manage core business processes by coordinating data flows between disparate business processes, it provides a centralized source of data that spans operations across the enterprise. ERP can link a company's financials, supply chain, operations, commerce, reporting, manufacturing, and human resources activities on a single platform and may include the following data:

- Financial accounting and controlling (FICO), including initial margin (IM)
- Human capital management (HCM)
- Customer relationship management (CRM)
- Material management (MM)
- Plant maintenance (PM)
- Production planning (PP)
- Quality management (QM)
- Sales distribution (SD)

ERP technology excels at bringing processes together. Once connected, processes, systems, and data provide great sources of business intelligence, with the acceleration and adaptability needed for operation optimization. With ERP data, a Production Assurance AI solution can access and analyze data to provide insights that enhance decision-making and reveal ways to improve future operational performance.

Supply Chain Applications Data

The data generated by supply chain applications is critical for the development of Production Assurance AI. Available-to-Promise (ATP) and Capable-to-Promise (CTP) supply chain solutions, as well as profitability analysis of customer orders, are important metrics that should be integrated into the Production Assurance AI model. Additionally, finite capacity scheduling (FCS) and planning data must be incorporated into supply chain solutions to ensure efficient use of resources and to meet production demands. Incorporating these supply chain

datasets into a Production Assurance AI solution is an important part of the overall business plan for future production and costs.

Production Analytics Data

Production data is collected and analyzed and then used to improve production processes. For example, it can be used to identify areas where workers are spending too much time on a task, to find ways to optimize the production line, or to track worker performance and identify areas for improvement.

By having a more detailed understanding of the production process, manufacturers can identify areas for improvement and make data-driven decisions to optimize their operations. Using Production Assurance AI integrated with this data will generate a more detailed business plan for the production process.

Operational Equipment Effectiveness Data

Operational equipment effectiveness (OEE) is a metric used to measure the performance and productivity of a manufacturing process or production line. OEE takes into account factors such as availability, performance, and quality to determine how effectively a machine is being used. Availability involves the amount of time the equipment is available to be used. Performance refers to the speed at which the equipment is running compared to its designed capacity. Quality concerns the amount of product manufactured that meets the specified standards. OEE values integrated into the Production Assurance AI solution will be one factor in predicting future production for the business plan and KPIs.

Asset Optimization Data

Asset optimization is the process of maximizing the value and performance of physical assets, such as machinery, equipment, and facilities. The goal of asset optimization is to improve the utilization and efficiency of these assets, reduce downtime, and extend their life spans.

Asset optimization typically involves the implementation of best practices for asset management, such as preventive maintenance, predictive maintenance, and condition-based monitoring. This may also involve the use of technology, such as sensors and Internet of Things (IoT) devices, to gather data about the performance of assets and to identify areas for improvement.

With asset optimization data incorporated into a Production Assurance AI solution, a business plan will include steps for the manufacturer to take to maximize the value and performance of physical assets, improve efficiency, reduce downtime, and extend asset life spans.

Energy Optimization Data

Energy optimization is the process of reducing energy consumption and improving energy efficiency in a manufacturing plant or organization. The goal of energy optimization is to minimize the amount of energy consumed while maintaining or improving the performance of the production system.

With energy optimization data included in the Production Assurance AI solution, a business plan will include an energy consumption reduction strategy that will help the organization not only reduce its energy costs and carbon footprint but also improve its sustainability and resilience while minimizing power outages and other disruptions to the business.

Computer Vision Production Quality Data

Computer vision technology uses cameras and image processing algorithms to analyze images of products and identify defects or deviations from established quality standards. This information is used to make real-time decisions about whether a product meets quality standards and to identify specific defects or deviations that need to be addressed.

With computer vision quality data in the Production Assurance AI solution, a business plan can include a strategy designed to improve not only product quality but also the accuracy and consistency of quality assessments over time.

Manufacturing Execution System Data

A manufacturing execution system (MES) is a software system that provides management of the manufacturing processes in a factory. The goal of an MES is to improve the efficiency, productivity, and quality of the manufacturing process by providing a centralized and integrated system for tracking and controlling the production of goods.

An MES typically integrates with other systems in the factory, such as production control systems, quality control systems, and enterprise resource planning (ERP) systems. This allows for real-time data exchange between systems, enabling manufacturers to make informed decisions about the production process in real time.

With MES data integrated into the Production Assurance AI model, the business plan will provide insights gained from production scheduling, machine monitoring, quality control, inventory management, and shop floor data, helping manufacturers identify bottlenecks and recommend adjustments that will improve the efficiency and productivity of the process.

Computer Maintenance Management System With Prediction Data

A computer information maintenance management system (CIMMS) is software designed to manage and track maintenance activities in the production facility.

Adding predictive maintenance to a CIMMS to plan and perform maintenance on equipment before it fails reduces the risk of unplanned downtime resulting in loss of production and costly repairs. By incorporating maintenance data and control system historian data, the Production Assurance AI model can analyze data and identify patterns and effects on the production demand plan from the supply chain application, which in turn will predict future production plans.

With CIMMS data included in the Production Assurance model, the business plan can include a hit list of projects for equipment maintenance teams across the enterprise and use KPIs to facilitate the management and tracking of maintenance activities.

Laboratory Information Management System (LIMS) Data

A LIMS with product quality capabilities can be used to manage and track the quality of raw materials, in-process products, and finished goods. The system gathers and stores data about the quality of products, including information about the manufacturing process, test results, and quality control metrics.

With LIMS data fed into the Production Assurance AI model, the business plan would include steps to not only manage product quality over time but also to improve the accuracy and consistency of quality assessments. The plan would look at how to increase first-pass quality numbers by identifying and addressing quality issues in real time.

Warehouse Management and Logistics Data

Raw material inventory management as part of a warehouse management system is the process of managing the storage and control of raw materials used in the production of goods and services. The goal of raw material inventory management is to ensure that the right amount of raw materials are available when needed, without over- or understocking. Production Assurance AI can predict inventory levels of raw materials and generate reports and other information to support decision-making. It also involves monitoring and controlling inventory costs, as well as coordinating with suppliers and other stakeholders to ensure timely delivery of raw materials.

Final products warehouse logistics is the process of managing and controlling the storage, organization, and distribution of final products. To manage final products in a warehouse effectively, warehouses often use a warehouse management system (WMS) or other software tools to automate and streamline the process. Adding inventory levels, storage locations, and other reports into the Production Assurance AI solution would optimize strategies for managing and controlling the storage, organization, and distribution of final products in a warehouse, all with the goal of improving efficiency, effectiveness, and safety.

Logistics management is the planning, execution, and controlling of the movement of goods, services, and information from origin to the point of consumption. The goal is to ensure that goods are delivered to the right place at the right time in the right quantity and at the right cost.

Logistics management involves a wide range of activities, including transportation, storage, and distribution of goods, as well as the coordination of these activities with suppliers, customers, and other stakeholders. It also involves the management of information related to the movement of goods, such as order tracking and delivery status updates.

With logistics management data in the Production Assurance AI model, the business plan will include steps required to better plan, execute, and control the movement of goods, services, and information from the point of origin to the point of consumption, with the goal of ensuring timely and cost-effective delivery to customers.

Work Streams

Using work streams to integrate data and create the model for Production Assurance AI consists of collecting datasets across the enterprise. This requires collaboration and joint development between the business, information technology, and operations teams. Work streams would include:

Enterprise Strategy

- Enterprise analytics strategy, cloud analytics, and corporate KPIs
- On-premises, hybrid, and multi-cloud architecture
- Edge development strategy
- User productivity strategy (mobile, KM)

Optimization Strategy

- Integrated planning and scheduling with analytics and KPIs
- On-premises, hybrid, and multi-cloud architecture
- Multi-plant optimization, business optimization
- Process optimization across disciplines or departments

Automation and Reliability

- Production line OEE
- Maintenance assessments (asset planning, criticality ranking)
- Control system and sensor platform consolidation

IT Manageability and Consolidation

- Consolidation of production use cases and IoT architecture
- Consolidation of edge infrastructure and network topologies
- Integration strategies — interfaces, OT middleware
- Manageability strategies — rollout of updates, patches, and inventories

Process Improvement

- Business process and workflow reengineering
- Edge analytics — connected worker
- Computer vision — product, production quality, and safety



Figure 4

Enabling Personas

After building an agile, connected, and iterative Production Assurance AI solution architecture that will help a manufacturer increase productivity, boost ROI, and stay resilient, it's important to make sure it also provides data in context per persona to help the various users of the solution perform their roles more efficiently and effectively.

For example, a company's M&A strategists need to know if an expansion, purchase, or merger would help meet the company's growth goals. Imagine leveraging the power

of a trained AI inference engine to harness the power of collective intelligence to guide such decisions based on the correlation of current data and future projected costs and sales. A Production Assurance AI solution could determine whether an acquisition or plant expansion might be required.

With this technology, production analysts could determine whether major repairs or retrofits are needed in addition to normal turnarounds and scheduled maintenance on production lines. They will know if they need additional production capacity based on predicted business projections.

They might determine that the company will need to purchase another company. This level of analysis would also consider implications on labor capacity and the right skill sets.

A CFO could use the tool to determine what and how much capital a company needs to outlay for double-digit growth and what the future capital spend on assets is. A CFO can also work with other teams to help find creative solutions, such as deciding which go-to-market strategy is best or how to change a channel and partner structure for more market reach and better profitability.

A VP of Innovation and Supply Chain could use the solution to answer key strategic questions. To determine if logistics processes need to change, the tool could evaluate the impact of shipping by rail instead of trucks. It could also assess network expansion requirements to service new customers and determine what an optimized network of distribution centers would look like.

Production Assurance AI Business Plan and KPIs

The Production Assurance AI solution will use a forecasting method that is similar to a rolling forecast, which is regularly updated based on the most recent actual data. In contrast to a traditional forecast, which is created once and remains fixed, with updating at regular intervals — quarterly, monthly, or even weekly — the Product Assurance AI business plan provides a more up-to-date and accurate view of future performance.

For example, if a company has a forecast for the next 12 months but actual results differ from the forecast/prediction in the first two months, the rolling forecast could be updated to reflect the new information. The updated forecast/prediction could then be used as the basis for the next set of predictions, and so on.

The Production Assurance AI model uses a rolling forecast/prediction to provide a continually updated business plan that allows a company to adapt to changing circumstances and make more informed decisions about future operations.

By providing a more realistic view of future performance, a rolling forecast can help companies stay on track and achieve their goals. Using all the previously mentioned inputs, the Production Assurance AI model can estimate key business metrics and KPIs, including:

Feedstock Cost

- Predicted primary feedstock consumption

Variable Costs

- Raw material consumption
- Energy consumption
- Byproduct yields
- Labor
- Shipping
- Scrap

Fixed Costs

- Staff (productivity) — training, number, location
- Inventory information — raw and final levels required
- Maintenance strategy — scheduled, reactive, prescriptive, preventive
- Asset costs — replacement, upgrade, new

Total Production

- Utilization rates
- Cycle time
- Product changes
- Capacities
- Yield
- Average sales price
- Product mix fluctuation
- Primary product yield

M&A Strategy

- Buy new for growth
- Organic growth

Conclusion

It's more important than ever for manufacturers to be able to predict future profitability in their business plans. While Production Assurance AI is a complex solution that requires centralizing data from across the enterprise, new technology in AI can simplify this task. Data gathered from sources across the enterprise applied to a new AI technology (Production Assurance AI) can be brought together to help corporations plan their future paths.

As it becomes increasingly important for business to curate data at the right velocity, new Production Assurance AI technology can provide answers to what-if scenarios while tailoring dashboards for various personas, such as business analysts and executive management, who can use the tool for risk mitigation and intervention, as well as to track Production Assurance AI KPIs to see how they align with the business plan.

This Production Assurance AI solution approach will generate a business plan that provides:

Greater accuracy: By analyzing large amounts of data and identifying patterns and trends that humans may miss, an AI-generated plan is likely to be more accurate and informed than a plan created by humans alone.

Speed: Developing a business plan can be a time-consuming task. AI can help speed up the process, as the algorithm can quickly analyze data and generate an iterative business plan.

Cost-efficiency: Hiring a team of consultants or gathering all relevant stakeholders to create a business plan can be expensive. A Production Assurance AI solution is a cost-effective alternative, as it can analyze data and create a plan without the need for additional human resources.

Flexibility: Business plans often need to be updated as circumstances change. Using a Production Assurance AI solution to generate a plan can make it easier to adapt the plan, as the model can analyze new data and adjust the plan as needed.

Innovative insights: A Production Assurance AI solution can uncover insights and opportunities that humans may not have considered. By using machine learning algorithms, Production Assurance AI can discover patterns and correlations in data that can lead to new and innovative ideas for business growth and sustainability.

This is the right time to bring together new technologies that provide insight to answer the question of future profitability.

Contact Dell Technologies to help your business plan for future profitability and success.

