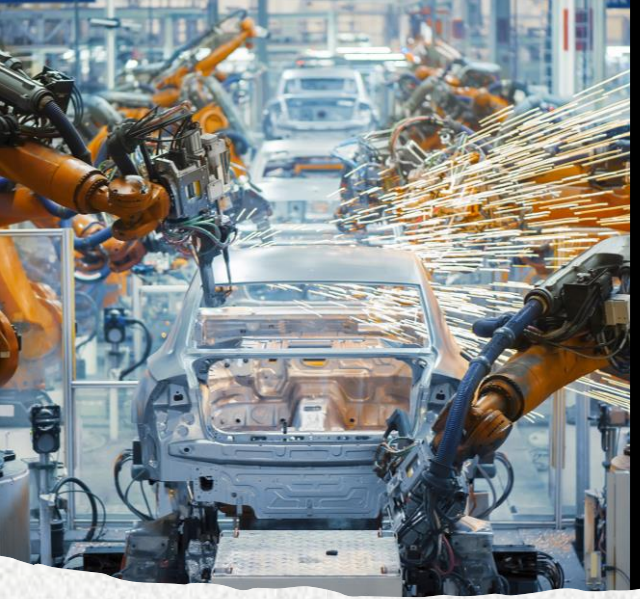

GLOBAL TRENDS IN AI

Srirangam – Managing Director
ALTAIR

10th October 2023

Safe Harbor Statement

This presentation and the accompanying oral commentary may contain "forward-looking" statements that are based on our beliefs and assumptions and on information available to us as of the date of this presentation. All statements other than statements of historical facts contained in this presentation, including statements regarding our future results of operations and financial position, customer lifetime value, strategy and plans, market size and opportunity, competitive position, industry environment, potential growth opportunities and our expectations for future operations, are forward-looking statements. The words "believe," "may," "might," "objective," "ongoing," "will," "estimate," "continue," "anticipate," "design," "intend," "expect," "could," "plan," "potential," "predict," "project," "seek," "should," "would" or the negative version of these words and similar expressions are intended to identify forward-looking statements. This presentation also contains non-GAAP financial measures. We have provided a reconciliation of such non-GAAP financial measures to the most directly comparable measures prepared in accordance with U.S. GAAP in the Appendix to this presentation.

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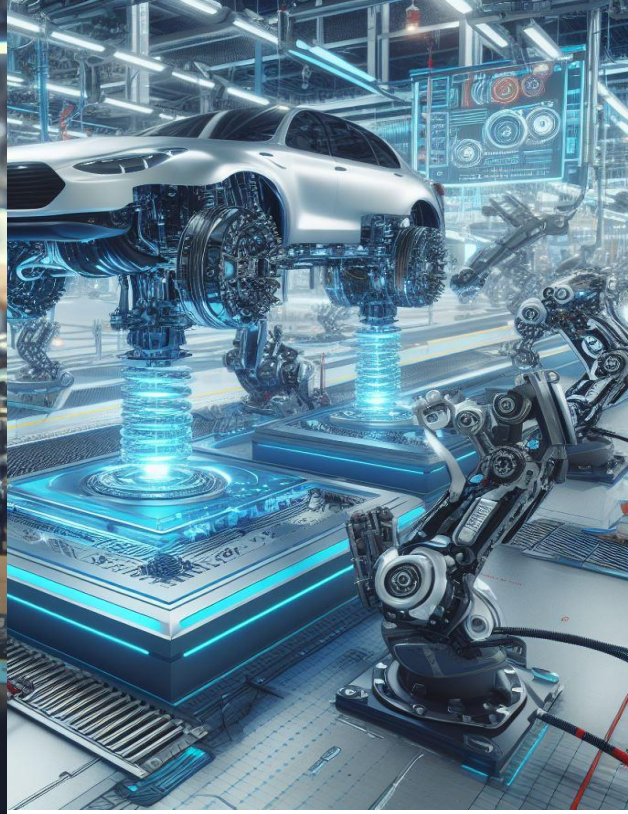
SME



Manufacturing

Rather than making a very generic talk to accommodate the Finance and manufacturing segments of the audience, I wanted to take a more focused approach

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3 Questions

WHY?

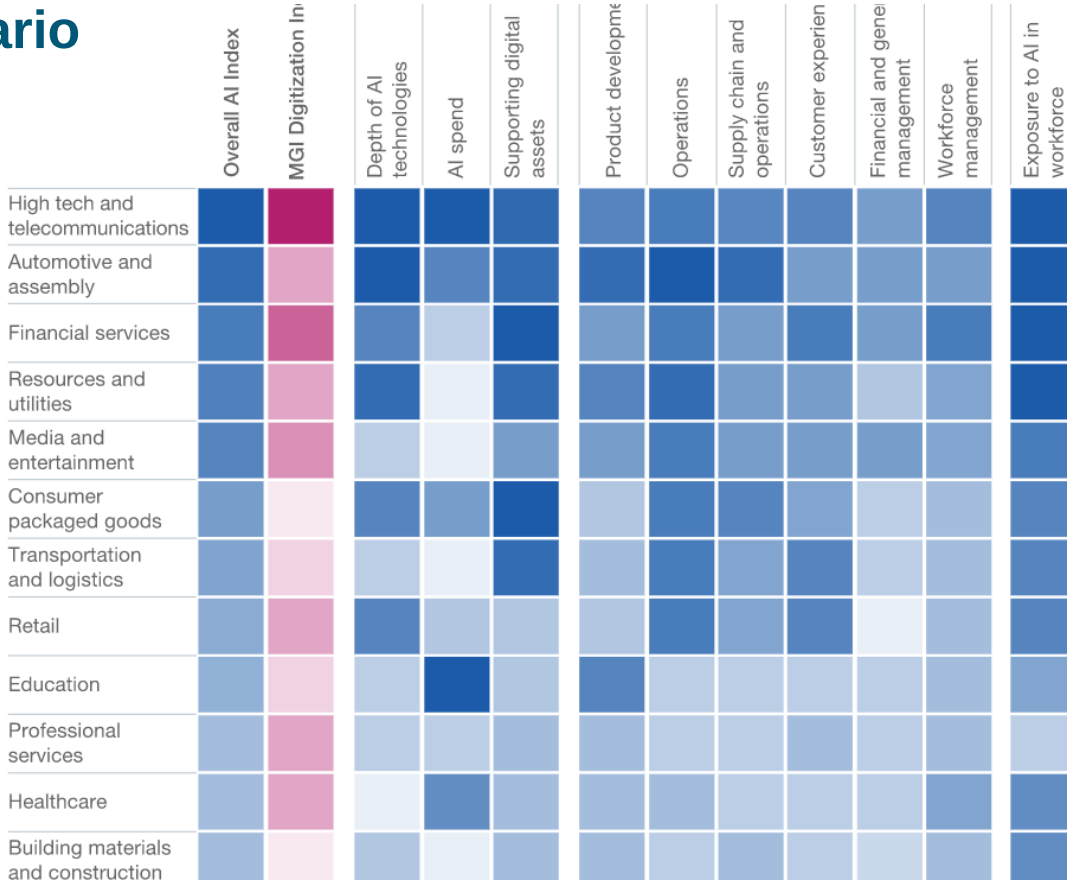
WHAT?

HOW?

Global Digitalization Scenario

Digital Transformation is happening at a faster pace

Courtesy McKinsey



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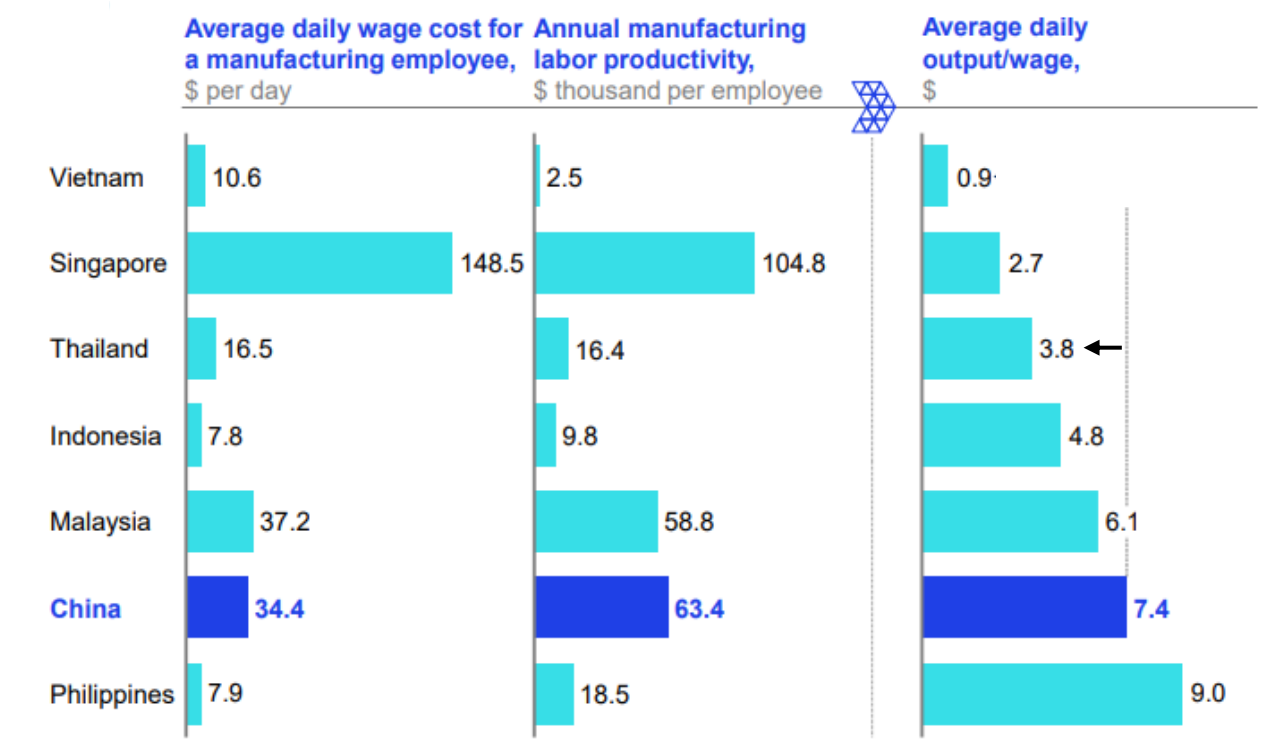
Why?

Current State of Manufacturing in ASEAN|Thailand

Labour costs are lower than China's but this competitive advantage is undermined by lower productivity



Note: ASEAN = the Association of Southeast Asian Nations. Brunei, Cambodia, Laos, and Myanmar are not included because of a lack of available data. Analysis assumes work Monday through Friday and 4 weeks off work per year for all countries (combination of leave allowances and public holidays).

Source: IHS

Why?

Current State of Manufacturing in Thailand

TFP – Total Factor Productivity

$$Y = A \times k^{\alpha} \times L^{\beta}$$

Y=Output, A=TFP, K=Capital, L=Labour

Lower TF productivity compared to China, SG…

Middle income trap

Key to improve productivity

Investment in Technology that assist humans

Technology

Robotics, Robotic Process Automation (RPA)
Data Analytics (DA), Video Analytics (VA),
Artificial Intelligence (AI), Machine Learning(ML),
IoT, sensorization, Realtime streaming, cloud…

United Nations Industrial Development Organization

Why?

National priorities – Industry4.0

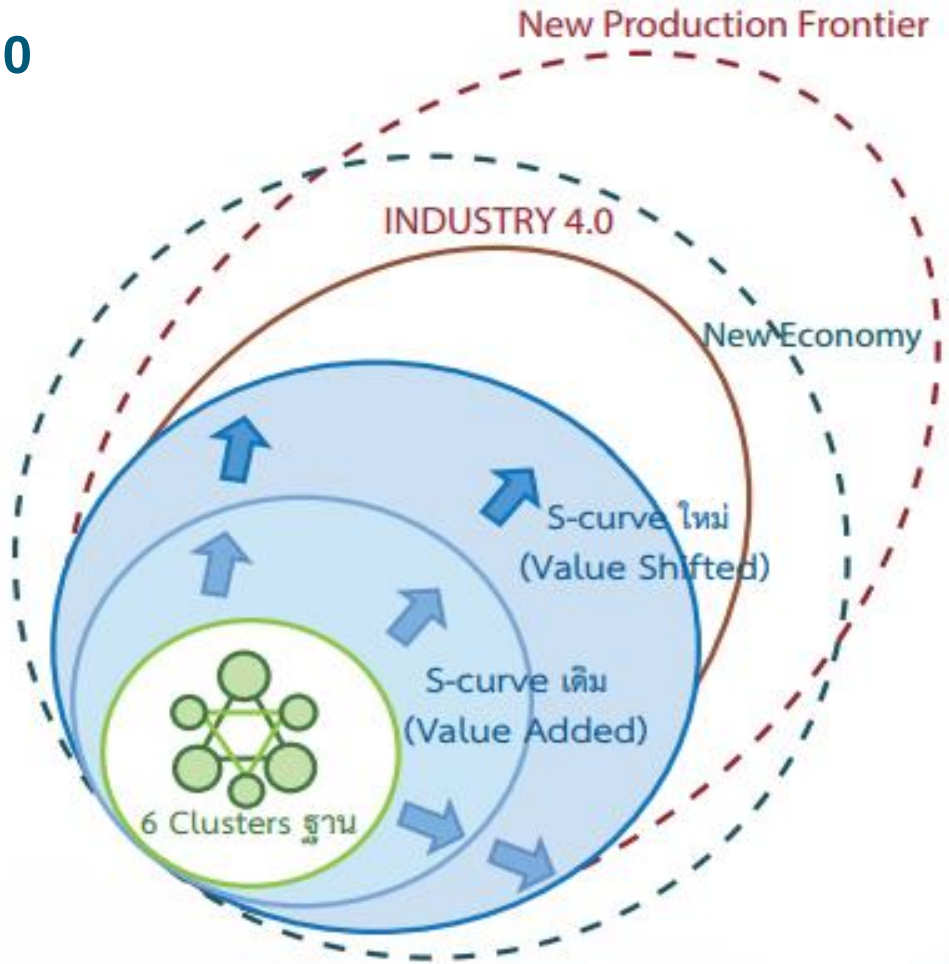
The Sunrise industries are the first and second S-Curve industries

Next-generation Automotive

Smart Electronics

Robotics

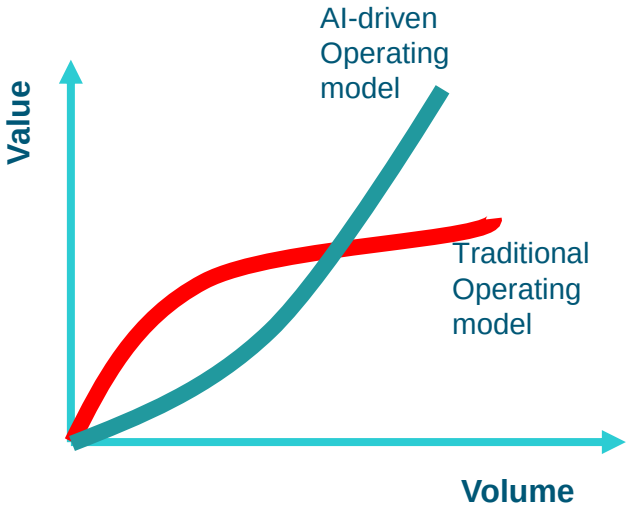
Digital Enterprise



Courtesy Ministry of Industries, Thailand

Why?

Digital enterprises outstrip traditional ones



Courtesy HBR

Traditional

diminishing returns beyond a point

AI-driven

rapid scaling

easily connected with other digitized businesses

Single Source of Truth - integrated data assets

powerful insights, incredible opportunity to automate

shun gut, make more accurate & sophisticated decisions

What benefits Data Analytics bring to the Manufacturing Industry?

Shopfloor improvements

Demand Forecasting

Product quality assurance

Operations Optimization

Health & Safety. Accident Avoidance

Predictive Maintenance

Inventory Optimization

Warranty Analytics

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What benefits Data Analytics bring to the Manufacturing Industry?

Demand Forecasting & Inventory Optimization

Accurately forecasting demand is crucial for manufacturers to best plan production: a) **reduce inventory costs**, b)**maximize profit**

Traditional Demand forecasting methods are semi-manual, inflexible, often inaccurate

ML models can aggregate historical data with new data from sources: a)enterprise resource planning systems, b) point-of-sale systems, c) social media marketing campaigns, coupled with raw material prices, d) supplier issues, e) changing consumer preferences

ML models are dynamically adaptable, forecast accurately and ultimately, reduce costs

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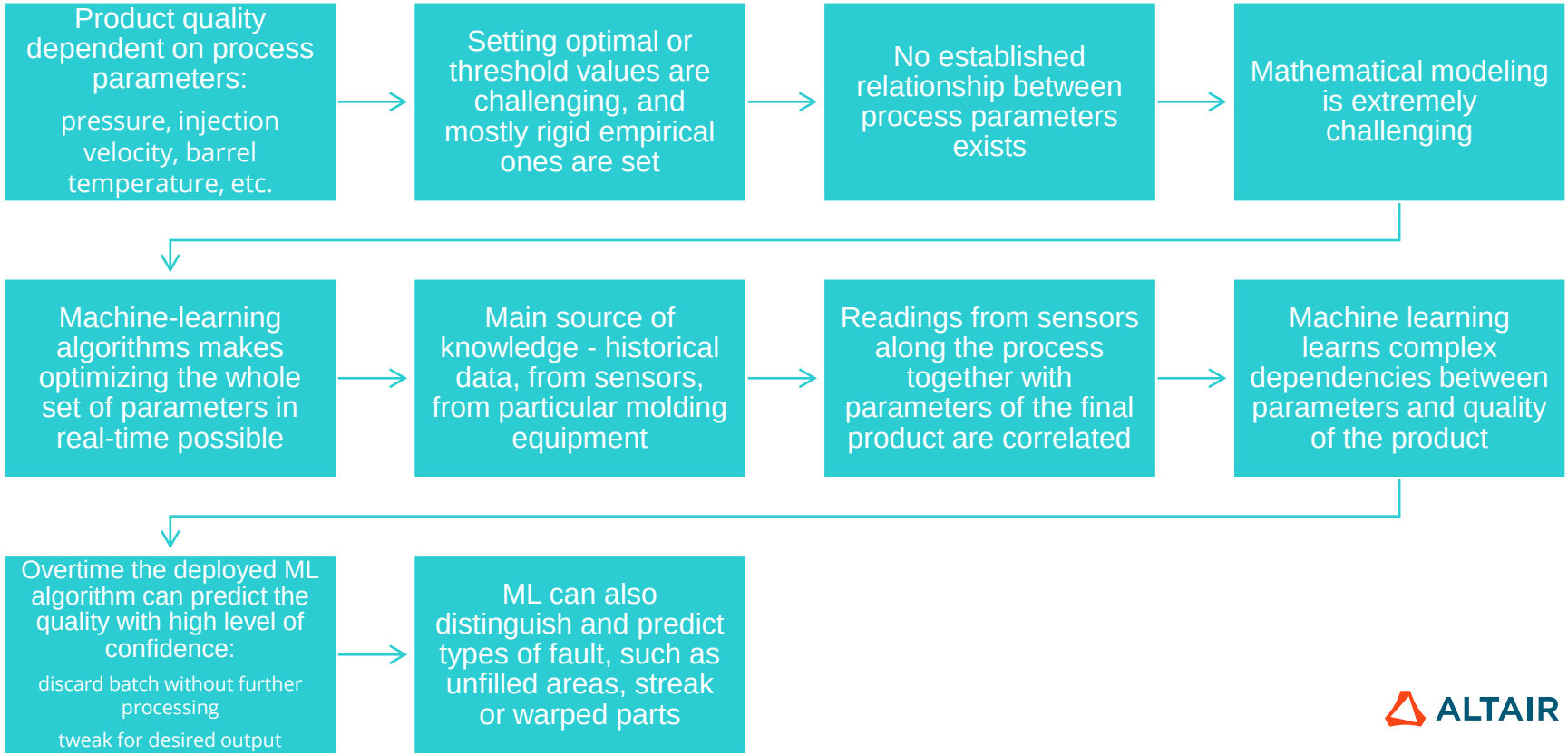
What benefits AI brings to the Plastics Industry?

Product Quality



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What?

What benefits can Data Analytics bring to the Manufacturing Industry?

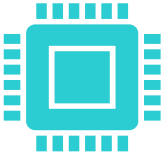
Operations Optimization

Methods

Increase throughput

uncover hidden efficiencies in the manufacturing process

- throughput quantity
- production defect rates
- machine downtime
- Hundreds of different value-creation opportunities baked into this



Power optimization

Largest input for any manufacturer is electricity

ML schedules energy-intensive activities when power is cheapest

AI can analyze millions of variables that impact the supply chain:

Supply chain optimization - crucial for inventory and cash flow

Increased supply chain efficiency - higher productivity, reduced volatility

global factors like fuel prices in real-time

tariff rates

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What benefits Data Analytics bring to the Manufacturing Industry?

Predictive Maintenance

With ML models

- Predict equipment failure
    - IoT sensors to provide extremely accurate predictions
- proactive replacement of parts
- scheduled repairs

Result:

- maximized efficiency
- minimal downtime
- drastically lower maintenance costs

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MANUFACTURING PROCESS ANALYTICS WORKFLOW

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Manufacturing Data Analytics Workflow

- Data Visualization
- **Model Deployment**
- Machine Learning
- Raw Data Processing
- Data Acquisition
- Value Identification

ERP
MES
Static

SCADA
PLC
Sensors
Streaming

Raw Sensor Data

Data for Inference / Training

CUSTOMER STORIES

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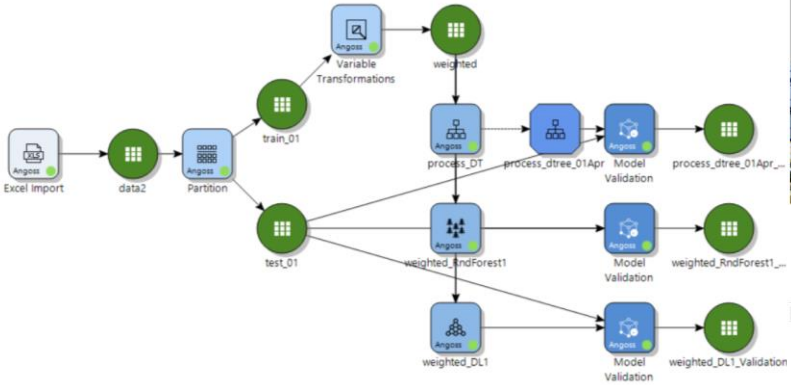
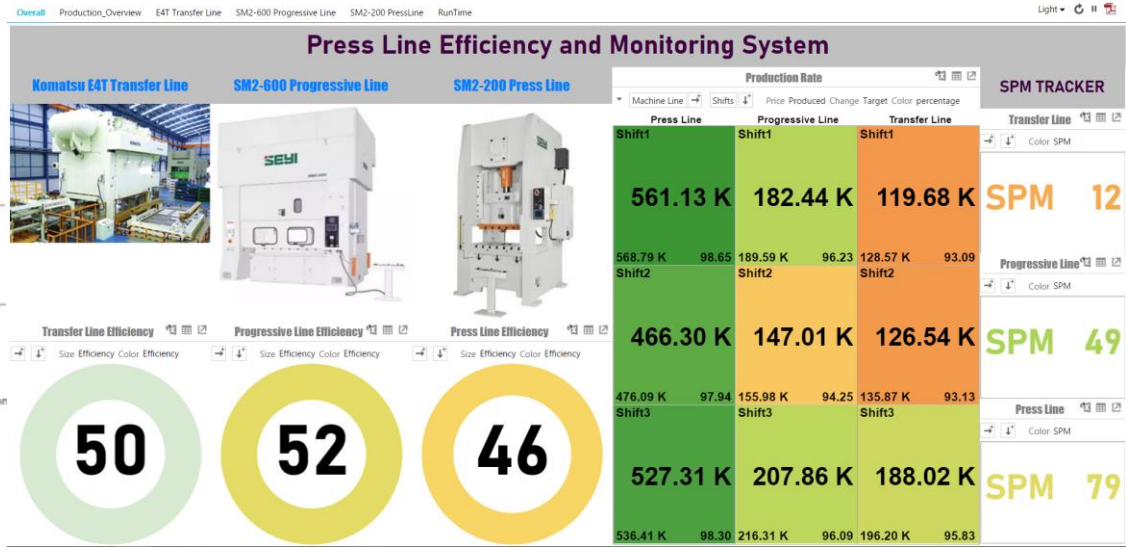
Press line efficiency monitoring





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Customer Story: Ford

Expert emulation with Knowledge Studio

Challenge

Stamping process selection requires highly experienced engineers, yet rework is unavoidable

Solution

Build & deploy Machine Learning models to automatically predict the optimal stamping processes

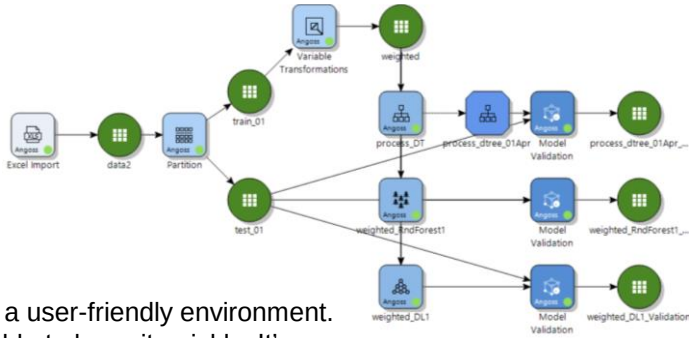
Result

Near 100% accuracy in automatic process selection

Reduce cost of materials, increase First-Time Through (FFT) rates

Use models to train young engineers

The existing manual process was modeled in Knowledge Studio



"Altair® Knowledge Studio® provides a user-friendly environment. I am not a data scientist, and I was able to learn it quickly. It's easy and anyone can use it. It is really cool!"

Albert Ochoa Frías
D&R and Stamping Process Engineer
Ford Motor Company

The models can now automatically predict the right stamping processes

Customer Story: Maxion

Knowledge Studio helps global industrial company improve quality and reduce unit costs

Challenge

Quality & efficiency improvements. Python coding limitations

Solution

Build & deploy Machine Learning models to automatically detect parameter dependencies and improve quality

Result

Improved quality

Reduced wastages & better material utilization

Improved efficiencies

Rolling out to other departments

MAXION WHEELS

“We are now rolling out this technology in all departments, including manufacturing planning… It enables us to develop hundreds of Machine Learning applications quickly and leverage our archives of historical production data.”

Carlos Eduardo Lopes
Advanced Engineering Global Director
Maxion Wheels

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Quality Analytics

Reduce unit costs, improve quality, accelerate deliveries

- Real-time quality checks
- Quality predictions
- Automated parameter corrections

Challenge

Remove HFI (Hold For Inspection) during production
Quality efficiency improvements
Loss of reputation due to returned lots

Solution

Get insight into the influential parameters and rank them

ML algorithms learn interdependencies between parameters

Golden (ideal set of) parameters, tolerance ranges

Real-time monitoring and alerts for outliers

Feedback loop for corrections

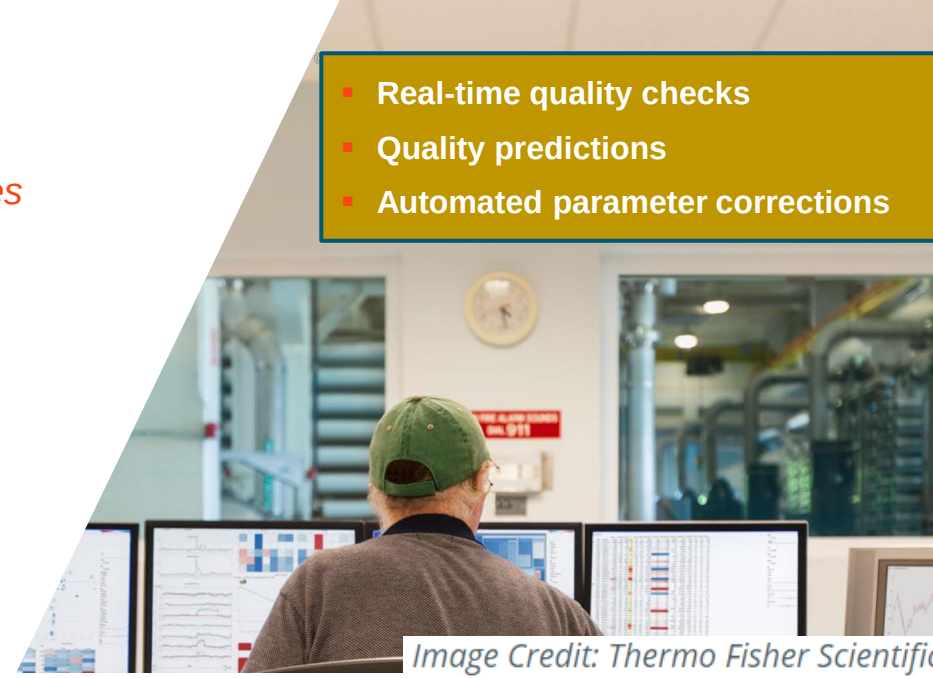
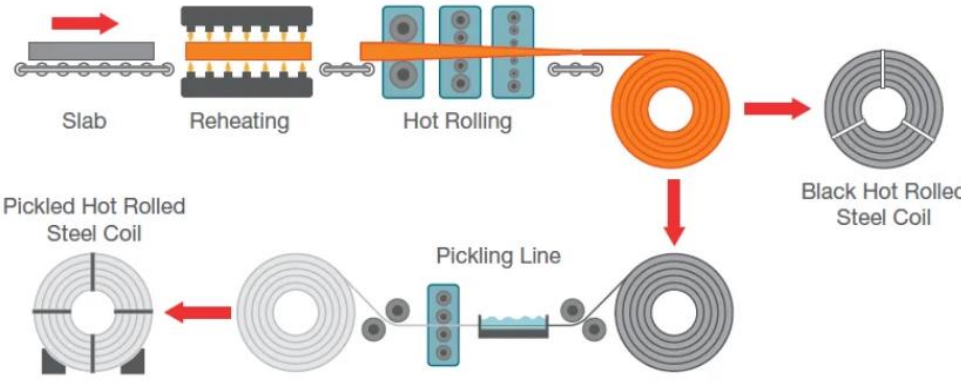


Image Credit: Thermo Fisher Scientific



Result

Improved quality

Reduced wastages & better material utilization

Improved efficiencies

Bid Analytics

Do not lose an order, do not make losses unknowingly

Challenge

Either lose orders or
Lose money

Solution

- Two ways
  - ML model to run through **historic data**
    - Stopped bidding at $, bid closed at $, competitive info
    - Classifications along various parameters
  - By calculating the **exact conversion cost**
    - Losses due to quality (scrap) & Trials
    - Cost of Power, Machines, Rework, Labor, overtime, Process, Storage, Inventory, volume, inspection methods, outsource vs in-house, shipment, etc.

- **Calculating material cost is easy**
- **Conversion cost depends on a few key factors**

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VERIZON WIRELESS

Understand Causes of Customer Churn

Challenge

- Pre-paid churn rates higher than post-paid
- Predict churn-likely customers before next bill
  - Target them with remediation or marketing
- 32 million prepaid transactions daily
  - 40 different channels
  - 100+ transaction types

Solution

- Capture all real-time data and aggregate
  - Complex pre-processing process
- In-depth feature engineering process:
  - 200 attributes collected; 80 generated
- Compared 7 models – GBT selected:
  - Accuracy
  - Model confidence

Impact

- Gained actionable insights from data
- Identified leading indicators of churn for:
  - Pre-paid customers
  - Post-paid customers
- Were able to proactively identify 30% of churn
- Able to challenge fundamental assumptions
  - What was causing the churn?
  - How addressable is the problem?

verizon

Problem type: Classification

Universal relevance: Customer retention is a top priority for most businesses as the cost of acquiring new customers is high and constant churn creates a drag on profitability. Understanding why customers churn with AI delivers a clearer path to reliable results.

LUFTHANSA INDUSTRY SOLUTIONS

Improve Profitability by Predicting Delays

Challenge

- Late flight arrivals severely impact operations:
  - Disrupts catering services
  - Delays flow of flight crews between aircrafts
  - Jeopardizes gate availability
  - Delays connecting flights for passengers
- Identifying delays early makes it easy to adjust
- Delays are hard to predict & slow to identify

Solution

- Quickly pinpointed the most predictive variables
- Built innovative yet simple widget for flight ops:
  - Input specific flight numbers
  - Immediately receive a predicted arrival time
- Automated flight scheduling
  - Includes the predicted arrival times

Impact

- Discovered prime factors that create delays:
  - Which runways are utilized
  - How many passengers have connections
- Model accuracy optimized at time of take-off
- Annual cost benefits in the 10s of millions

Lufthansa Industry Solutions

Problem type: Regression

Universal relevance: Every business experiences some kind of delays, which can cost you time, money and effort. Identifying delays before they happen gives you time to prepare.

THE WORLD'S LARGEST STEEL MANUFACTURING COMPANY

Reduce Re-work to Slash Costs

Challenge

- Steelmaking is complex and energy intensive
- Identifying defects early is critical
  - Spares energy expenditure of final steps
  - Product will be defective regardless
- Must find defects early & optimize production
  - Keep the cost of final output low
  - Stay competitive

Solution

- Leveraged a wealth of sensor data in aggregate
- Predictive models monitor casting & rolling processes
  - Detect anomalies early
  - Identify variables that cause defects
- Advanced time series feature extraction
  - Represent the shape of time series data
  - Enables detection of similar shape patterns

Impact

- Able to identify possible production problems
  - As early as possible
  - Explore them to understand them
- Custom dashboards help in a variety of ways:
  - Monitor results of defect detection process
  - Enables team to continuously improve model
- Less metal re-work

ArcelorMittal

Problem type: Anomaly detection

Universal relevance: Not every business has 're-work' as part of their operations, but re-work is just a specific kind of bad outcome. Predict bad outcomes before they happen, so you can stop them at the source.

MAJOR PETROCHEMICAL MANUFACTURER

Optimize Energy Costs

Challenge

- Ethylene plant relies on Crack Gas Compressors
- CGCs facing massive low efficiency issue
- Typical 500 KTA capacity ethylene plant:
  - CGC power accounts for 30 MWh of electricity
  - Equivalent to $20 million per year
- Traditional management approach is ineffective
  - 100+ interdependent operating parameters
  - Relies on observation & domain expertise

Solution

- Identified 40 variables that drive plant efficiency
- Deployed models that can adjust parameters
  - In real time
  - Based on sensor data
- Dashboard for plant operators
  - Monitor model performance and predictions

Impact

- 5% reduction in power consumption
  - Equivalent to 1MW
- Turn around maintenance schedule extended
  - 6-8 month impact
- Total savings of $1 million per year

Problem type: Prescriptive optimization

Universal relevance: Not every business has a single asset that consumes $20M/year in energy costs, but they can add up no matter the industry. AI offers a fantastic way to be more green and save more money.

PPT PROCESS POINT
Enabling Business Processes

PHARMACEUTICAL

Predict Market Share Threats

Challenge

- Facing threat of competitor drug
  - Marketed as better alternative to a client offering
  - Advantages from improper dosing of client drug
- Measuring adoption of competitive drugs is difficult
  - Particularly in existing client base
- Possess external data about the doctors' preferences
- Goal: target doctors likely to transition to competitor
  - Take proactive marketing action
  - Coordinated sales effort

Solution

- Leverage internal and external data sources for analysis
  - See each attribute's effect on new drug adoption
- Create likelihood assumption of the doctor's adoption
  - Gradient boosted tree algorithm selected
  - Internal client data to predict & validate assumptions
- Physician groups classified by "likelihood to adopt"
  - Low, medium, or high
- Further segmented medium and high segments:
  - High volume of patients
  - Those who are sub-optimally dosing their patients

Impact

- Action plan created to defend market share
  - Target specific groups of doctors
- Create lists for targeted sales effort
- Arm reps with critical information, including:
  - Further education on disease that drug treats
  - How to properly dose
- Channel optimization shows best way to reach audiences
- Improved organizational competency
  - Exploratory analytics approach to problem-solving
- Replicated model for other competitive markets

Problem type: Clustering & classification

Universal relevance: Any marketer knows the value of segmenting their audiences. Using predictive analytics you can segment based on 'likelihood' to take a specific action, which enables you to identify threats and opportunities in your market.

CLARKSTON CONSULTING

ELECTRONIC TRADING PLATFORM

Automate Real-Time Reporting for High-Frequency Transactions

Challenge

- Reporting requires ETL and complex data prep
  - Leveraging many data sources
- Data analysts build non-IT-supported solutions
  - Run on analyst-supported prod servers
  - Custom tools, including custom code
- Analysts burn capacity to support infrastructure
  - Creates technical debt
- Stability of reporting is high-risk
  - Analyst turnover will cause big problems

Solution

- Users of all skills to collaborate on a single platform:
  - Data professionals, analysts, & data scientists
  - Driving collaboration and standardization
  - Lowering TCO
- Approved process automated on Server
  - High frequency reporting for brokerage
  - Process monitoring and governance
  - Results exposed through Tableau

Impact

- Low barrier to create new reports and models
- Standardized process:
  - Streamlines employee onboarding
  - Reduces downtime with turnover
  - Reduces technical debt
- Centralized, governed, and portable repository
  - For code and processes
  - Includes searchable metadata
  - Data analysts manage easy maintenance
- Management: greater visibility into data and the work

Problem type: Automation & data integration

Universal relevance: Up to 80% of a data scientist's time can be spent on data preparation. Custom-built data pipeline solutions are hard to maintain and creates organizational bottlenecks. Automating ETL and data prep builds a foundation for success and more advanced analytics projects.

ACCOUNTING FIRM

Automate Daily Manual Tasks

Challenge

- Difficult to identify missing, repeated, or bad data
  - Inefficient, manual and time consuming
  - Huge percentage of monthly team efforts
    - 16 Hours Per Project
- Information fatigue leads to errors
  - Errors create more direct and indirect cost

Solution

- Extracted and compared data sets in a couple clicks
- Developed a series of predictive models
  - Find repeat variables
- Project driven by a small, junior team
- Model was easy to put directly into production
  - Process re-used across projects
  - Process shared among users
- Automated process scales to larger data sets

Impact

- Manual Time: 16-hour project to 45 automated seconds
- Reporting is both accurate and timely
- Increased team efficiency – more time for:
  - Focusing on more strategic work
  - Delivering more custom projects
- Easily repeat and reuse process for new projects
  - Organizational Efficiency
  - Happier Staff
  - Improved Quality & Reduced Errors

Problem type: Data integration & automation

Universal relevance: Every business is challenged to integrate data from disparate sources to enable business-critical analytics. These data integration tasks are time-consuming and labor-intensive. AI and automation streamline these tasks and shorten time-to-insight.

HOME FIXTURE & HARDWARE CPG

Optimize Supply Chain SKU Management

Challenge

- # of SKUs has grown exponentially
  - 1500+ SKUs
  - Too many variables for a human to manage
  - Extensive cost to hold/manage each SKU
- Downstream impact of SKU removal not always clear:
  - Volume doesn't tell the whole story
  - May be profitable items associated with a SKU
  - Profitability can be hard to gauge
  - Difficult to properly analyze these implications

Solution

- Text mining to group similar products
- Cluster the high and low sales revenue SKUs
- Cluster the high and low profit margin SKUs
- Auto correlation identifies low value SKUs
  - Replace them with high-value SKUs
- Model simulator shows impact of changes
  - SKU elimination
  - Using replacements for low value SKUs

Impact

- Holding cost per SKU $40,000 a year
- Total holding costs of $60 million
  - 1500 SKUs
- 5% SKU reduction delivers savings of $3,000,000
  - Avoid downstream complications

Problem type: Text analytics & clustering

Universal relevance: Most organizations can benefit from some level of portfolio optimization. Volume doesn't tell the full story and profitability implications can be difficult to gauge without predictive analytics.

LARGE CONSUMER GOODS PROVIDER

Create a Data-Driven Product Portfolio Strategy

Challenge

- Manages thousands of product SKUs
- Large volume makes it incredibly laborious to:
  - Analyze customer perception of products
  - Find factors that influence reviews & ratings
  - Isolate product review outliers

Solution

- Collect and aggregate data from many sources
  - Data repository for all company products
  - Includes competitor products
- Text analytics and topic recognition at scale
- Easy to find complaint-causing characteristics :
  - Quality
  - Packaging
  - Sensory characteristics
- Model fed to dashboard for lines of business

Impact

- Clearly identified high-performing products
  - Found undermarketed products
  - Optimized promotional strategies
- Faster fixes on packaging and quality issues
- Created a powerful competitive advantage:
  - Understand customers at scale
  - Agile adjustments to product strategy

Problem type: Text analytics & topic mining

Universal relevance: Even if your business doesn't manage thousands of SKUs, reading and understanding everything people are saying about your company or product is challenging at scale. Data science can help!

DOMINO'S PIZZA

Forecast Supply Chain at Massive Scale

Challenge

- Need to optimize supply chain forecasting
- Over 4k locations created scalability issues
  - Each location requires individual model
  - Resource and time intensive
- Shared data science resources are limited
  - Ecosystem of projects expanding rapidly
- Suffer from too many unique variables causing:
  - Food spoilage
  - Idle labor and overtime
  - Strained supplier relations

Solution

- Combined native operators & open source libraries
  - Leveraged RapidMiner's extensibility
- Able to leverage RapidMiner Server Scalability
  - Horizontally
  - Vertically
- Predictive models prescribe based on
  - Demand history
  - Previous and upcoming promotions
  - Holiday dates

Impact

- Prescribing accurate 8-week supply chain forecasts
- Optimize for:
  - Food waste
  - Labor pool usage
- Model runtime saw performance boost of 10x
  - Allows 4,000+ locations to receive forecasts

Problem type: Time series forecasting

Universal relevance: If your organization is building AI solution in code, like Python or R, then you likely suffer challenges managing deployments (runtimes, configurations, etc). Multimodal AI platforms can unify the development and deployment process across teams, while lowering costs and improving performance.

DIGITAL TRANSFORMATION AT SMES
NOT ABOUT IF; ABOUT WHEN - AND THAT IS NOW

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Digital Transformation - How to go about implementing?

Hire

Hire a team of Data scientists

Outsource

Outsource data science job

In-house Team

Assemble a small team

- Data scientists need business context
- Business stakeholders need to clearly understand results
  - Citizen data scientists

- Data driven culture
- Data literacy and analytical know-how
- CoE – Centre of Excellence set up

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How?

Digital Transformation - How to go about implementing?

Our Approach

connect & get buy-in from the CXO

GAP Analysis for overall vision and gauging coaching needs

CoE – Centre of Excellence

Improving the Data literacy
Presentation to all levels in the organization
Training and certification
Work-place Application project

Digitalization Roadmap

Encourage DBDT
Brainstorming sessions with various stakeholders & departments, contests

Identification of low-hanging fruits – less time/effort and high impact/yield

Steering, Management, Working committees
Shared project ownership & Joint understanding of what success looks like

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Digital Transformation imperative & challenges

Friction everywhere

Data residing in Different silos. Some handwritten

Deluge of various types of data. At the same time not sure if all needed data are captured

C-Suite still prefers going by gut feel. No trust in Tech. Resistance

Skill shortage. IT, business, shopfloor. Coders priorities

Funding challenges. Cloud/Hybrid strategies

How?

The Frictionless AI Platform

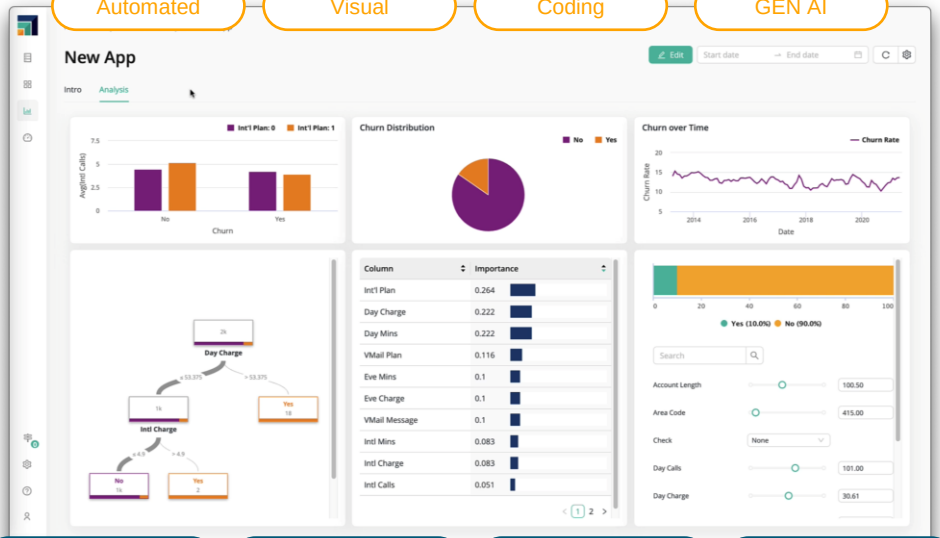

Domain Experts


Data Experts


IT


Leadership

Automated | Visual | Coding | GEN AI



Data Engineering | Model Building | Model Ops | Operationalize

Analytics App Development | Collaboration | Governance | Trust & Transparency

Enterprise Data Mesh

PDFs, Excel, Core Reports

IIoT

Synthetic Data

Enterprise Data Mesh

Monitoring and Reporting

Enterprise Applications

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START ANYWHERE, SCALE THE ENTERPRISE

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How?

Departments	Areas or Use Cases	Brief
Finance	GL Reconciliation	Monthly general ledger reconciliation could be automated to eliminate human errors and free up man-hours for better tasks.
	Fraud Detection	Vendor, employee, balance sheet, etc.
	Data Aggregation	Reading and aggregating data from various sources like pdf, excel, data bases.
	Risk Analysis	Analysis of risks like business capital, investments, loans, customer segmentation, etc.
	Velocity & Quality of decision	Improved velocity & quality of data generated and decision taken basis factual analysis by automating and eliminating human errors.
	Stock Market insight	Analysis of stock prices by more holistically modelling taking into consideration more variables.
Procurement	Invoice & PO automation	
	Fraud Detection	Detect the fraud as it happens and take corrective measure rather than finding out at a later time.
	Vendor Management	Differentiating tail spends, saving costs.
	Bid & Spend management	Spend & bid, cost benchmarking, invoice compliance, payment term analytics and supplier risk & performance.
	Inventory Management	Optimize costs, space and run production smoothly.
Product Planning	Profitability management	A simple delta drill chart could explain, by removing which parts from production line the profitability could have been boosted further.
Shop Floor	Lower Cost of production	Reducing or eliminating costly unscheduled downtimes using Predictive Analytics.
	Quality Improvements & scrap reduction	Fault pattern identification & elimination.
	Productivity Enhancements	Resource availability & productivity enhancements.
	Near Real-time feedback	Take corrective measures without delay, as you get notified of actual scenario near real-time.
Human Resources	Employee Experience	Measuring employee engagement, time to hire, retention rate, better planning & overall workforce management decision.
	Payroll Reconciliation	Automating the Payroll reconciliation process to avoid human errors and free up man-hours.
Marketing	Customer Behaviour	Survey insights, trends.
	Promotion	Promotion insights and optimization.
	Customer Experience	Combination of data and ML. Targeted messaging.
	Dealer Management	Drop laggards, cut costs on retaining dealers.
Warranty	Lower Warranty costs	Lower or eliminate warranty costs by doing root cause analysis, identifying design & manufacturing flaws, eliminating fraudulent claims and claim processes.
CEO's office	Management Dashboards	Overall health of the company at fingertips: production quantity, quality, inventory, risk, profitability, costs, etc.

ALTAIR SERVING THE INDUSTRY

ALTAIR

Altair-at-a-Glance

$572M
FY22 Revenue

74
In 27 Countries

3,000+
Engineers, Scientists, and Creative Thinkers

150+
Altair and Partner Software Products

13,000+
Customers Globally

ALTAIR

15,000+ Customers Worldwide

Automotive

Aerospace

Financial Services

Technology

Energy

Civil Engineering

Government & Defense

Heavy Rail

Industrial Goods

Life & Earth Sciences

Education

Material Suppliers

ALTAIR

Trusted by the World's Leading Financial Institutions

Embedded in leading trading analytics software

Broad Solution Portfolio & Powerful Business Model

Physics Simulation & Conceptual Design

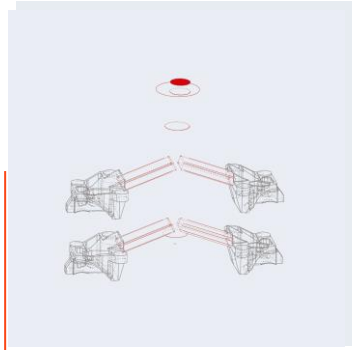
High-Performance Computing

Data Analytics & Artificial Intelligence

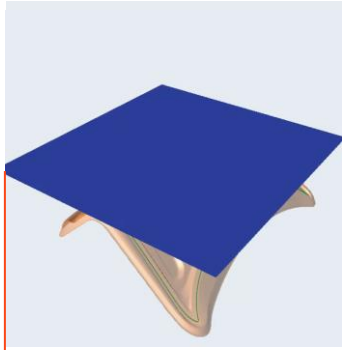
IoT

ALTAIR

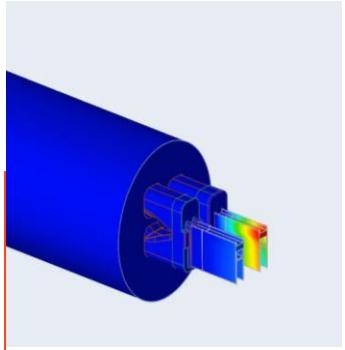
Manufacturing Simulation Within the Design Process



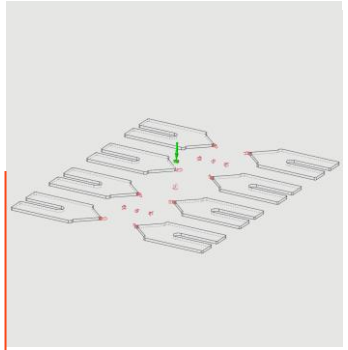
Casting



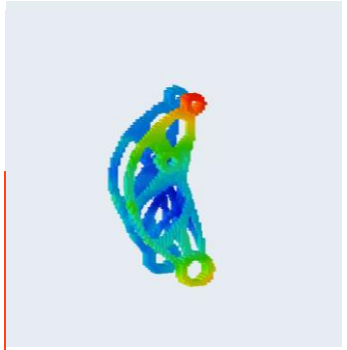
Metal Forming



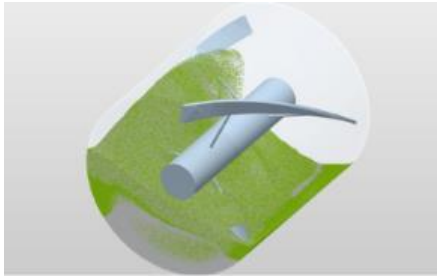
Extrusion (Metal and Polymer)



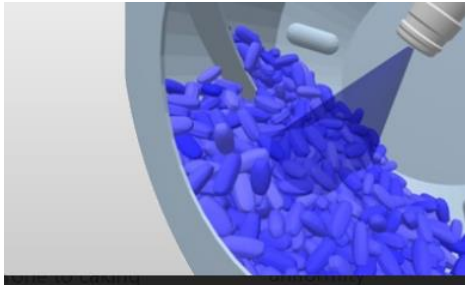
Molding



Additive



Dry Pigment mixing



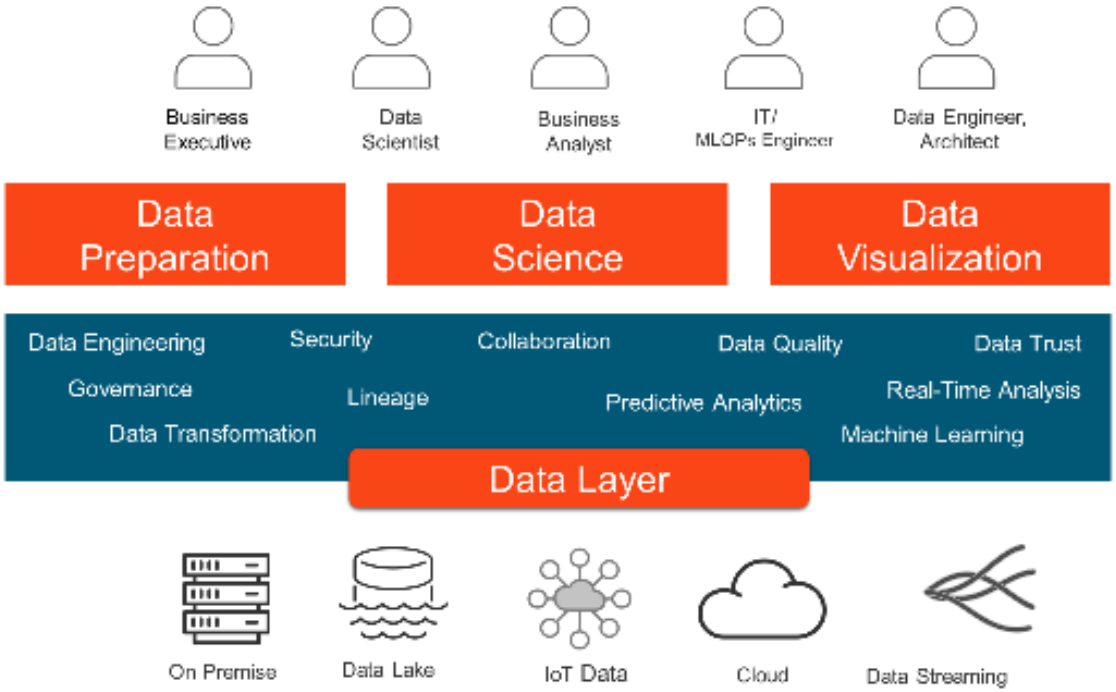
Solvent colouring

Altair’s intuitive simulation solutions for design & process engineers to create manufacturable high-performance products with high –quality at the least cost

Altair - Revolutionizing Manufacturing Process Analytics

End-to-End Platform

- Designed for many different skill sets
- Connect to and transform almost any data source
- Collaborative, governed analytics
- Augment existing analytic applications



Code-free data automation, machine learning & visualization

ALTAIR

THANK YOU

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#ONLYFORWARD

ALTAIR