הנדסת מערכות
למחזור חיים שלם
הכנס השנתי 2022 • INCOSE-IL
יום ד' 14/09/2022
מלון דניאל, הרצליה

הדגמת גישות יישומיות בהנדסת מערכת בתעשיות ההייטק - שלמה וולפמן

Smart Manufacturing Best Practices

יואב בועזי, Plataine

PLATAINE®
people-smart automation

Smart Manufacturing Best Practices: Supporting Ramp-up in Challenging Production Environments

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July 2022

Agenda

- Addressing the Current Industry Challenges
- The Digital Factory Vision
- The Critical Steps for a Fully Connected, Intelligent, Digital Factory
- Challenges & Best Practices
- Pushing the envelope; taking it to the next level

Market Proven Solutions in the Most Challenging Production Environments

Select Customers

AIRBUS GROUP · BOEING · QARBON AEROSPACE · BLUE ORIGIN · IAI · tpi · FESHER

MRA ST Engineering · CTRM DRB-HICOM · Triumph Group, Inc. · KAMAN · STARK · AAT COMPOSITES · ALESTIS AEROSPACE

Select Partners

SAP · SIEMENS PLM SOFTWARE SIEMENS · CTC An Airbus Company · The University Of Sheffield. AMRC ADVANCED MANUFACTURING RESEARCH CENTRE · McKinsey &Company · Marubeni · NATIONAL COMPOSITES CENTRE

Awards and Recognition as Market Leader

Information Security Management System ISO 27001 Certified

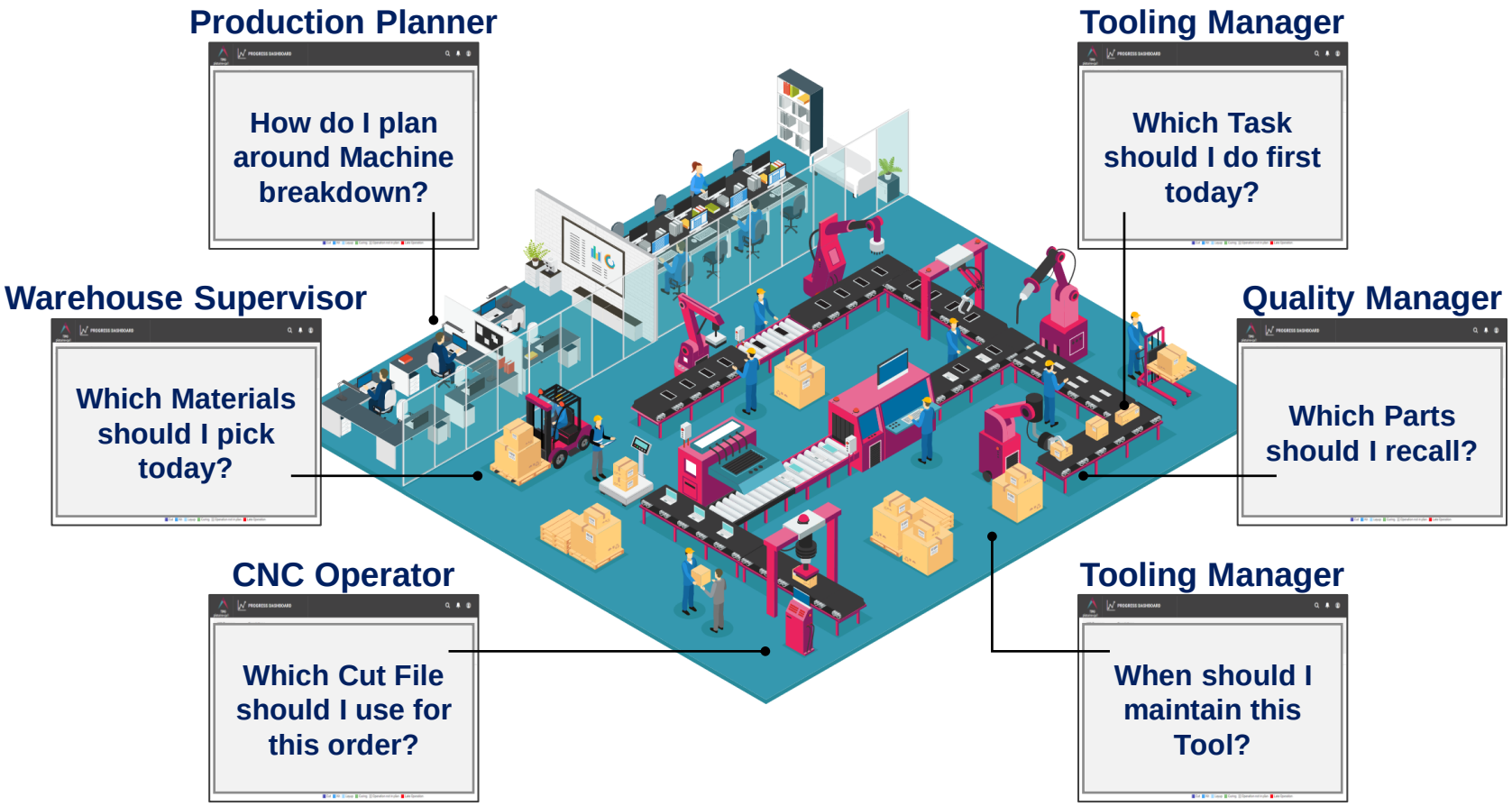
FROST & SULLIVAN 2021 BEST PRACTICES AWARD

JEC GROUP WINNER OF 2014 INNOVATION AWARD

Composites UK Trade Association
Industry Award Winner 2016 - Innovation in Manufacture

A Day in the Life of a Factory

Shop-level staff make **dozens of decisions** daily with
limited data, poor visibility, and with poorly connected systems



The result:

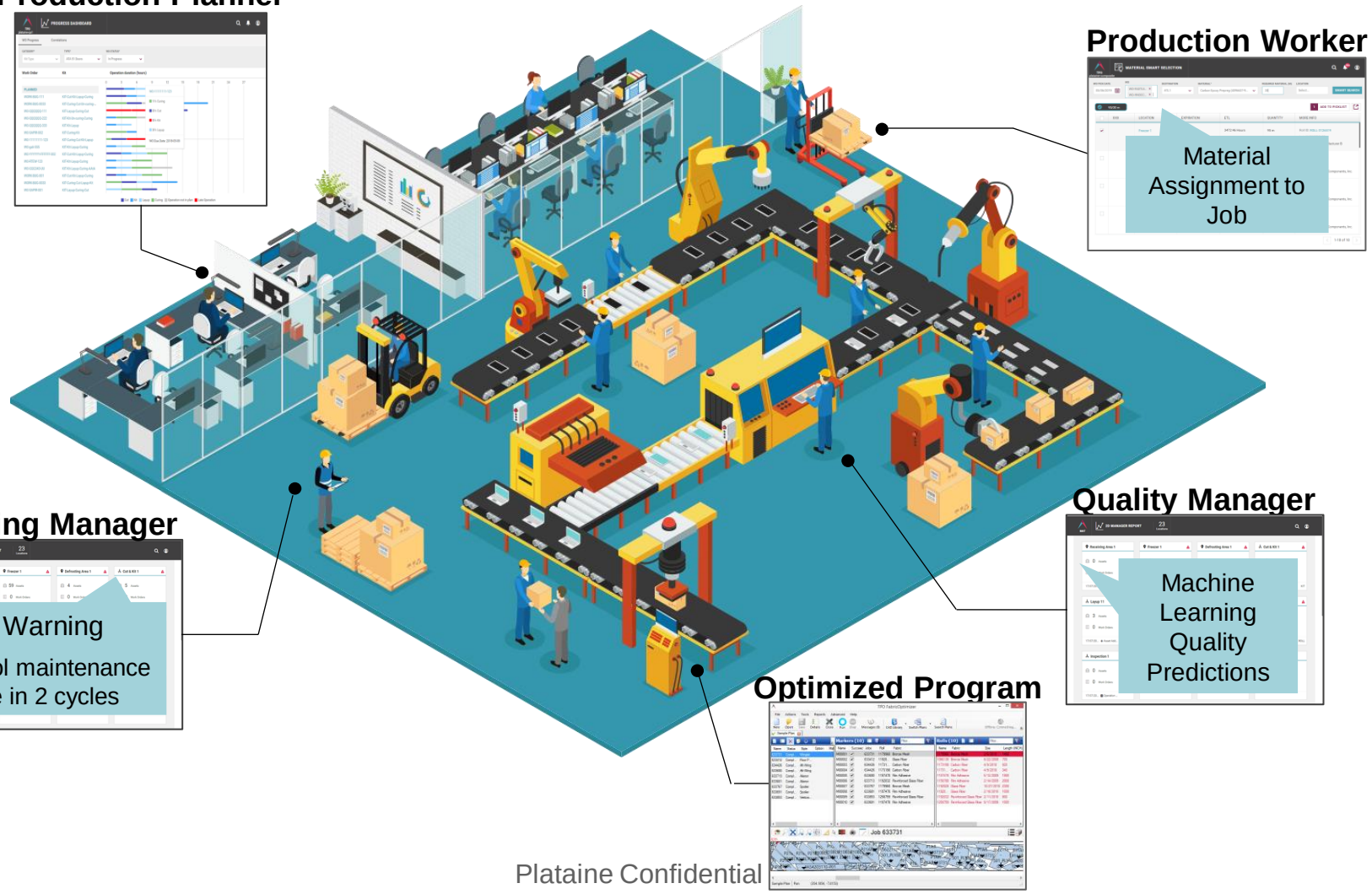
Low Productivity

Increased Waste

Reduced Quality

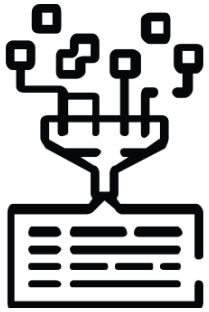
The Opportunity:
A Fully Connected, Intelligent, Digital Factory

Enterprise Level, Persona-Based Digital Assistants



The Critical Steps for a Fully Connected, Intelligent, Digital Factory

COLLECT

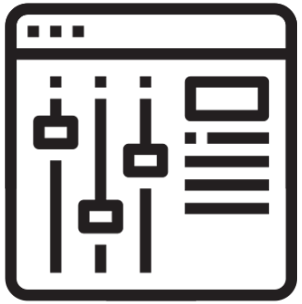


Collecting data from sensors in real-time

ANALYZE

AI providing predictions & recommendations

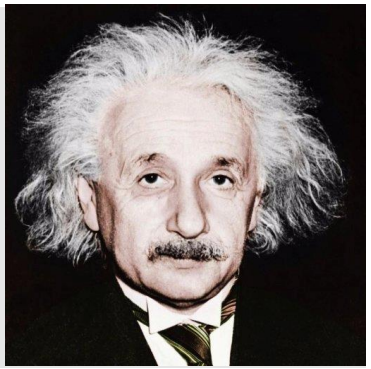
OPTIMIZE & AUTOMATE



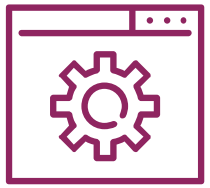
Driving efficiency, while reducing costs & waste

Solving a problem first requires clear Problem Statement & Definition

> ***If I were given one hour to save the planet, I would spend 59 minutes defining the problem and one minute resolving it.”***
>
> - Albert Einstein

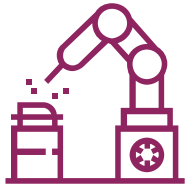


Step 1: Data Collection: getting as much [relevant] data, in digital format, in real time



Enterprise systems:

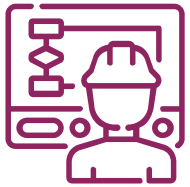
PLM, ERP, MES…



“Things” on the production floor:

Sensors, machines

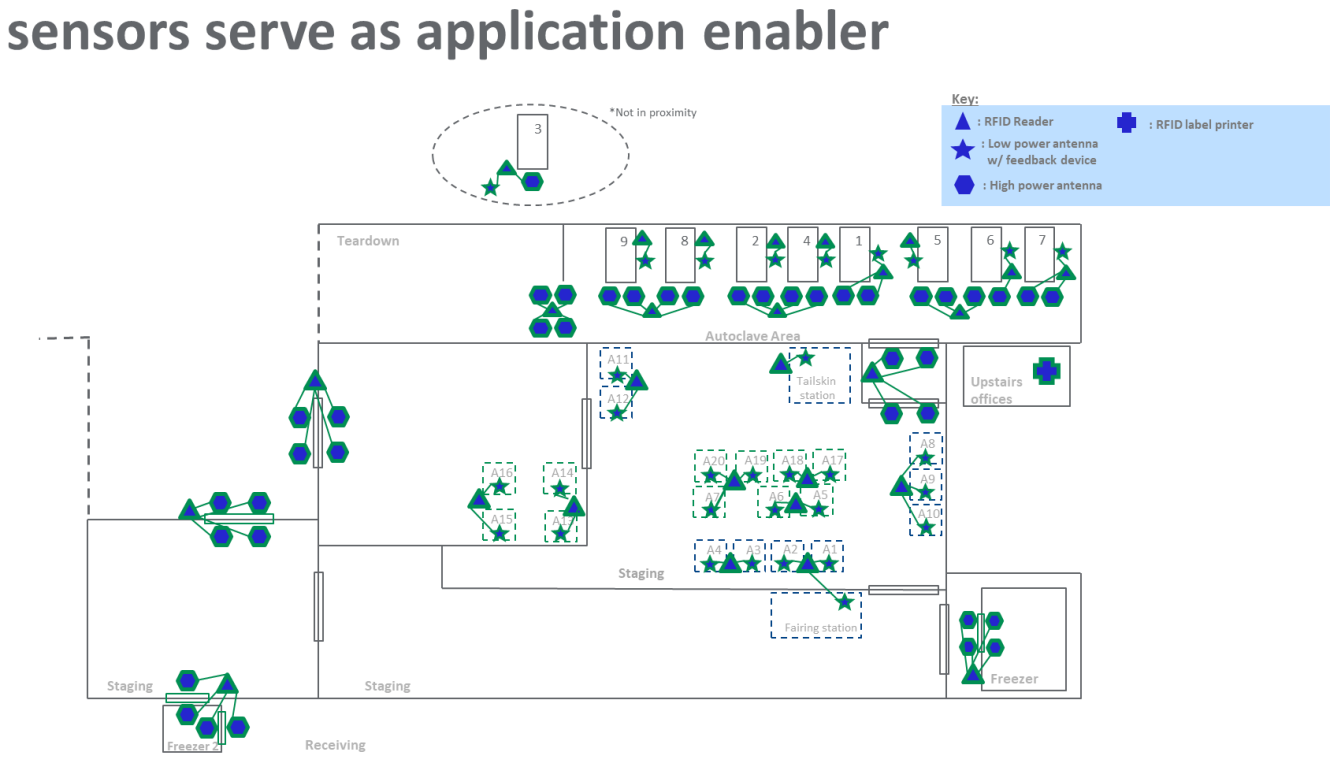
The ‘Un-connectables” – older machines, parts, materials, tools…



Human (operator) input:

Applications, wearables

Example: sensor network deployed specifically to address concrete business problem(s)



Step 2: Put the Data in Context (Context Awareness)

Why is context important?

Data alone is typically meaningless without context

The richer the context, the more we can do

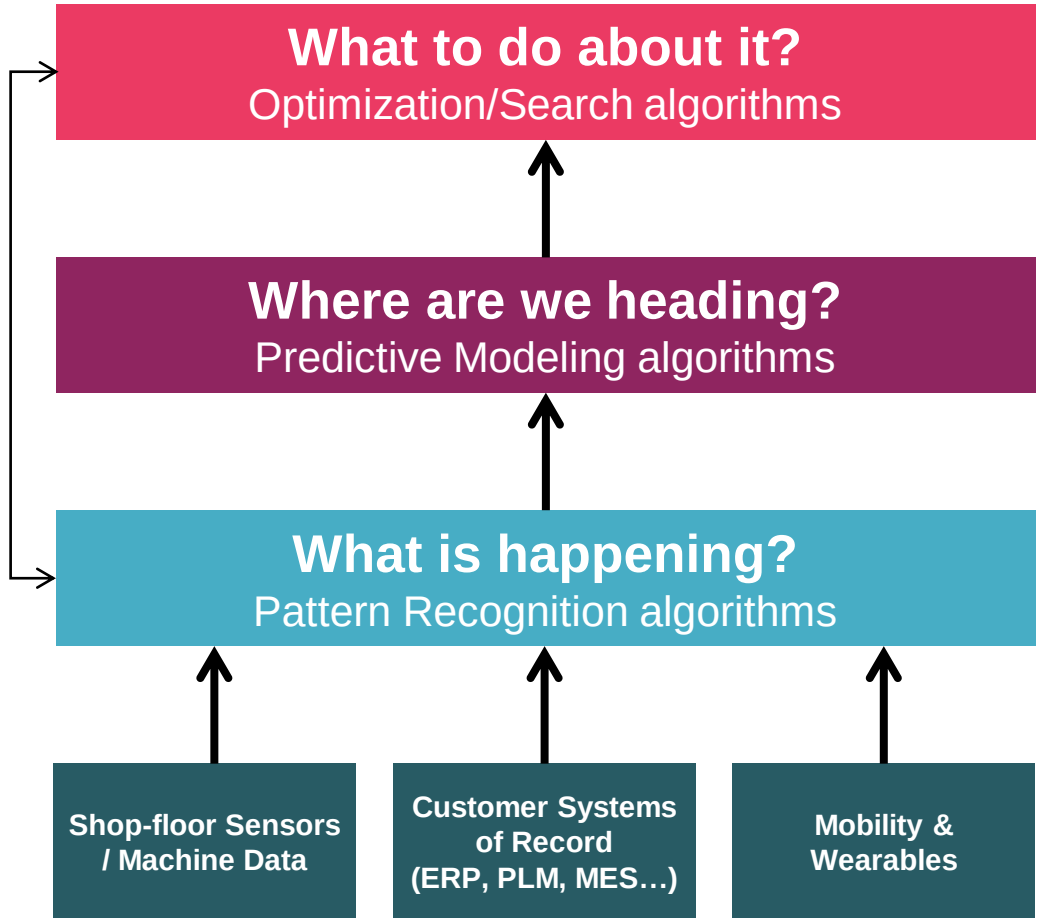
Questions:

How do we create context?

How do we go from Context to Actions?

Step 3: Solving Business Problems

Addressing the Full Workflow Creates Superior Value: Diagnosis, Prognosis and Treatment



Solving the 3 critical questions in all operational cycles:

1. What is Happening Now?
2. What is going to Happen?
3. What to do about it?

Proactive AI:

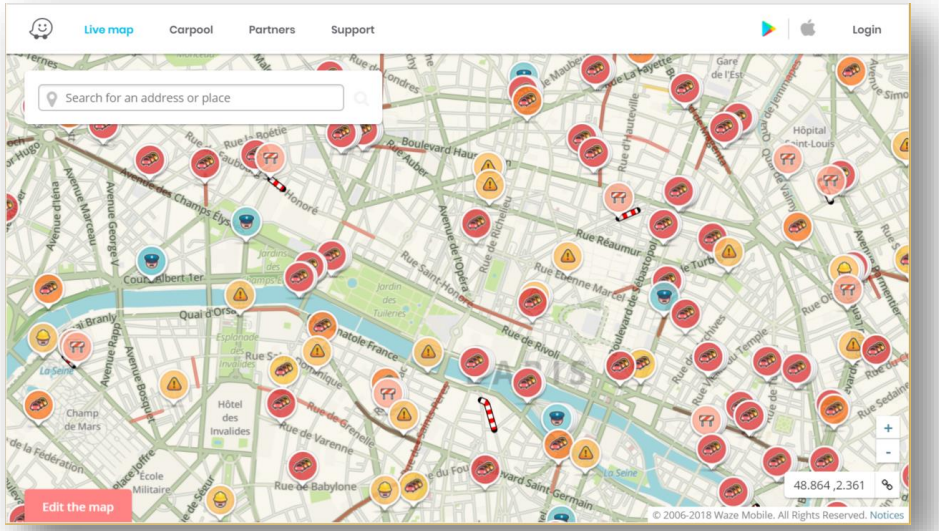
- Proactive, Data Driven
- Actionable Alerts & Optimized Recommendations

Based on an integrated set of AI/ML algorithms

- Extensive set of Digital Twins & Digital Threads
- Geared for AI in manufacturing

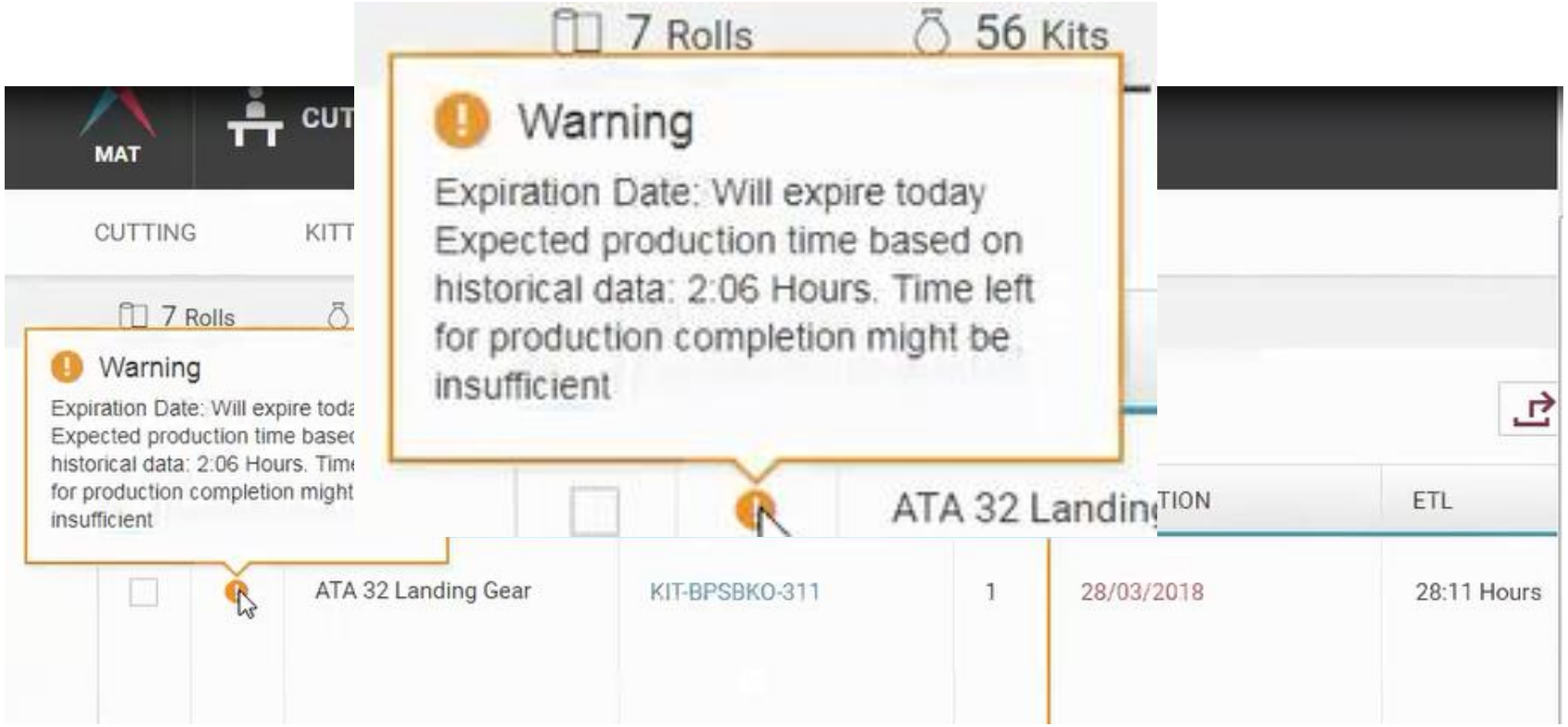
An Intelligent Digital Assistant is NOT a Dashboard

Dashboards display data,
but do not solve problems



An intelligent digital assistant provides
real-time recommendations & alerts

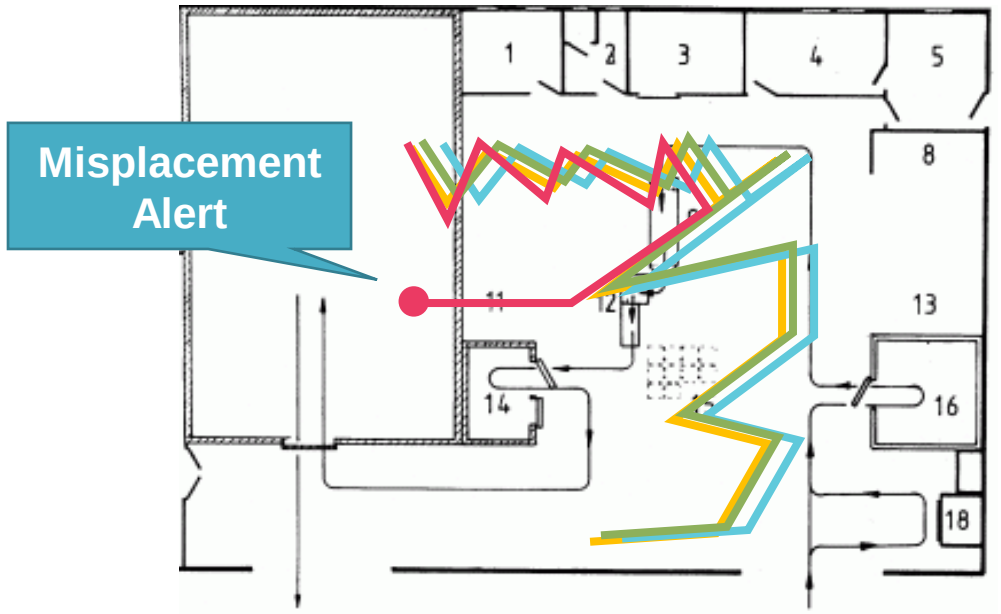
Context Aware Alerts for Production Delays or Quality Problems



Alert on Asset Misplacement

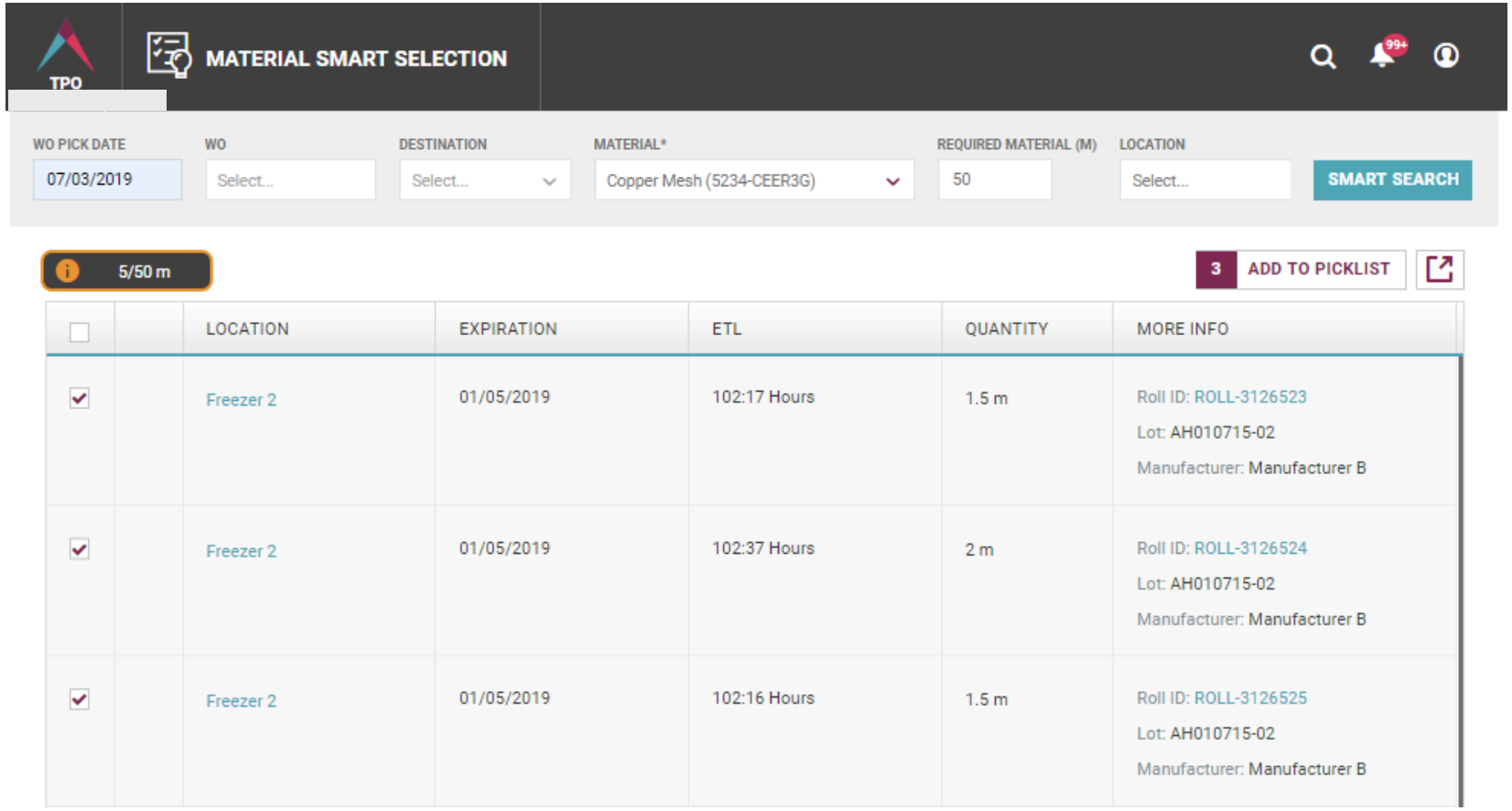
- The Challenge: tools and assets are being misplaced, causing production delays and rework

- The solution: create a typical production trail by for each asset type,
  by “learning” its historical movement.
- Alert relevant users upon deviation from the expected production trail

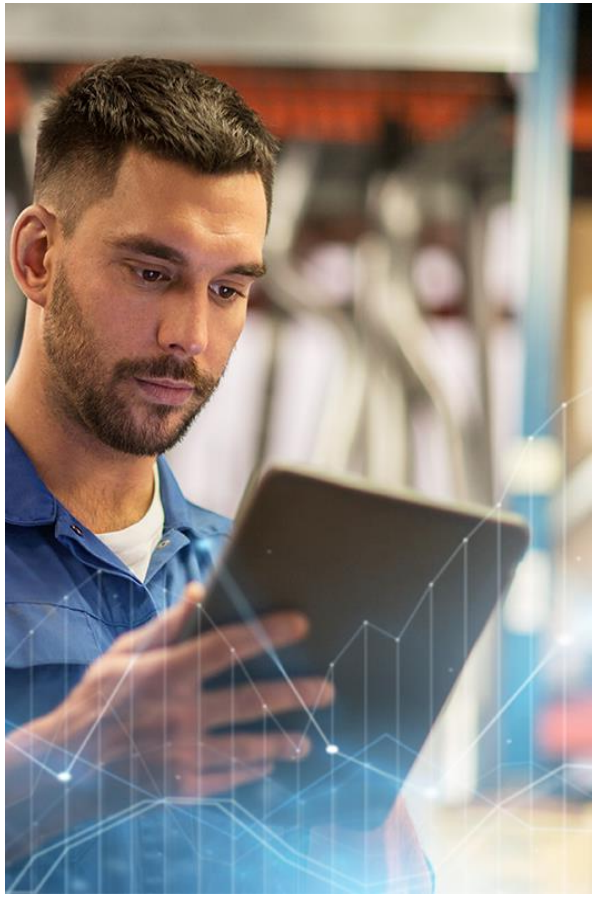


Going from Alerts to Recommendations:

Optimized Material Selection based on current status and predicted production flow



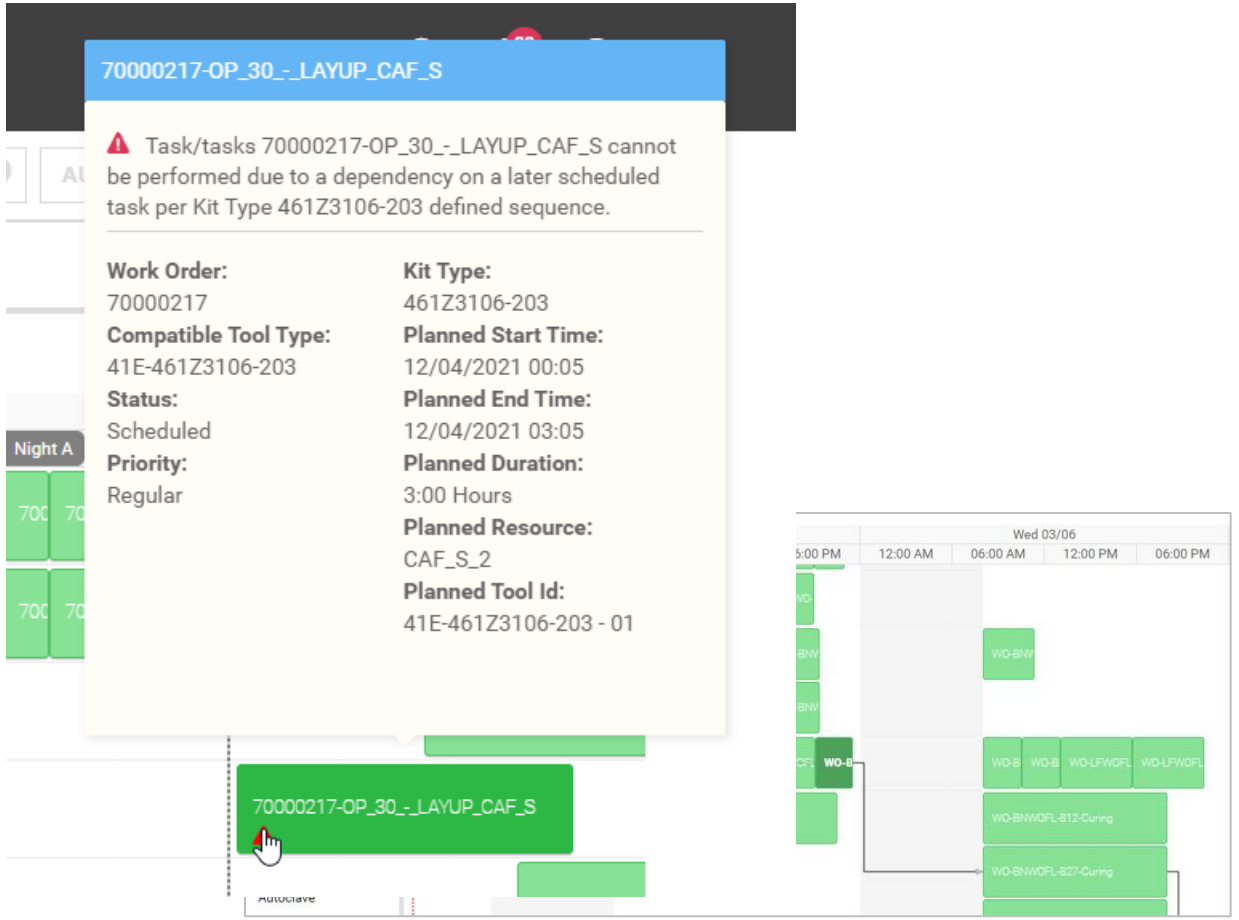
Trusting your Digital Assistant (Human adoption of AI)



- You can’t demand trust, you must earn it
- Typically, people start trusting AI, when it:
  - consistently makes decisions that are as good, or better
  - makes their life easier
  - does not make ‘glaring mistakes’
- It takes time to train the man-machine team

AI-Based Scheduling in Dynamic Environments

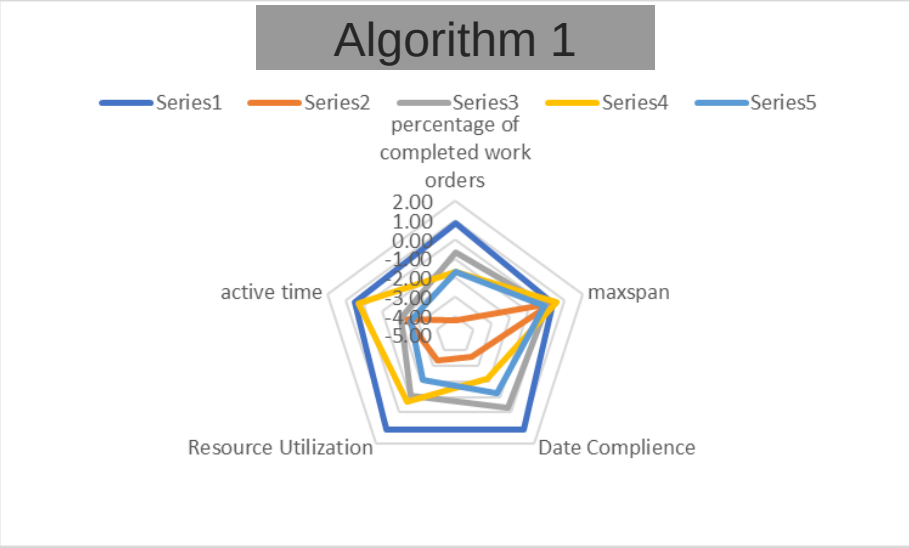
- **Holistic Approach, considers all aspects of production**: work orders, materials, tools, machines, HR…
- **Business Oriented:**
  - Dynamic, Real-Time
  - Driven by business Rules & KPIs (+tradeoffs)
  - Emphasis on practical execution
- **Learns from the Users, Teaches Itself**



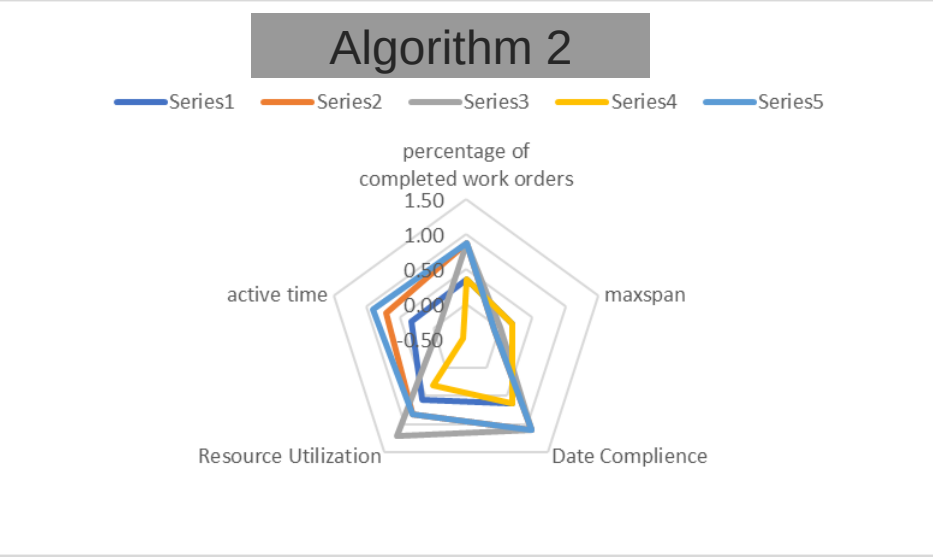
A Learning System: Practimum-Optimum™ Scheduling Learns from the Users, Teaches Itself

- **The algorithm automatically teaches itself deep structures in the schedule's universe**
  - trade-offs between competing goals, clusters of similar schedules, demand patterns…
- **Historic schedules are not mandatory, but very useful when available**
  - Over time, as the algorithm is being used and real-life data is gathered, it and improves its performance.
- **Strong emphasis on Executability**: What is Mathematically Optimal is not always Practically Optimal

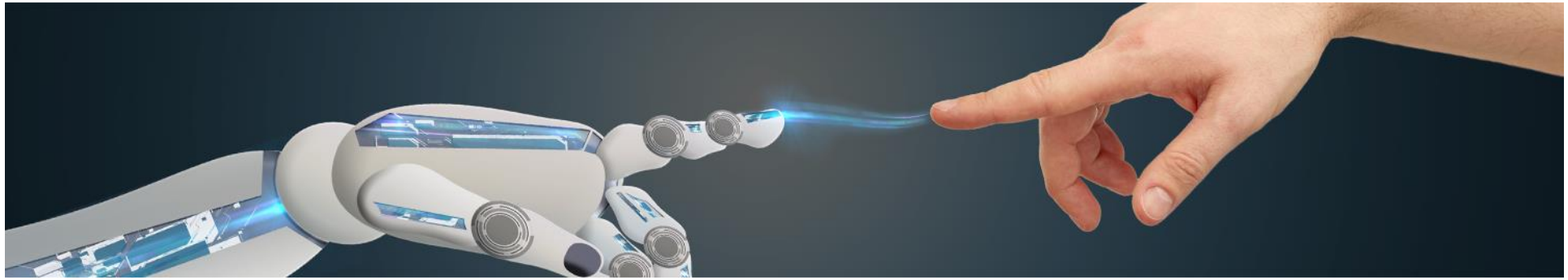
Algorithm 1, with 5 different tactics



Algorithm 2. with 5 different tactics



The Man-Machine Team



As computer intelligence level increases:

- Dependence on user's skills, knowledge and experience decreases
- The user spends less time on mundane tasks, spends more time on value-add tasks
- The user-computer **team** produces better decisions than anyone of them individually
- **Overall productivity goes up, error rates go down**

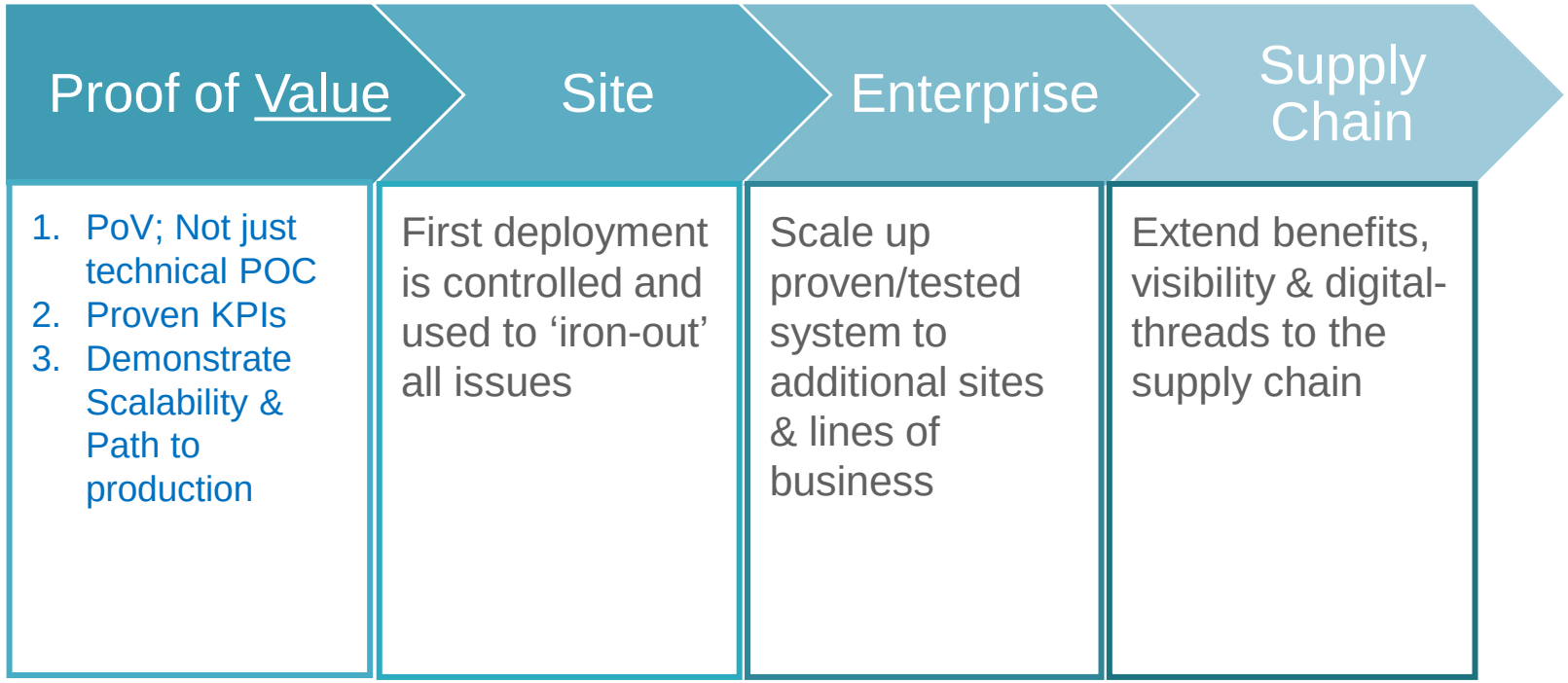
AI-Based Digital Assistants on Google Glass: Disruptive Empowerment of Production Floor Staff

- "Hands-free" user interaction with AI on the production floor
  - Natural Language Dialog/Interaction (NLP)
- Real-Time, Audio and Visual presentation of alerts and optimized recommendations to production floor staff

→ Improved productivity, better quality, full digital traceability

Demo Video

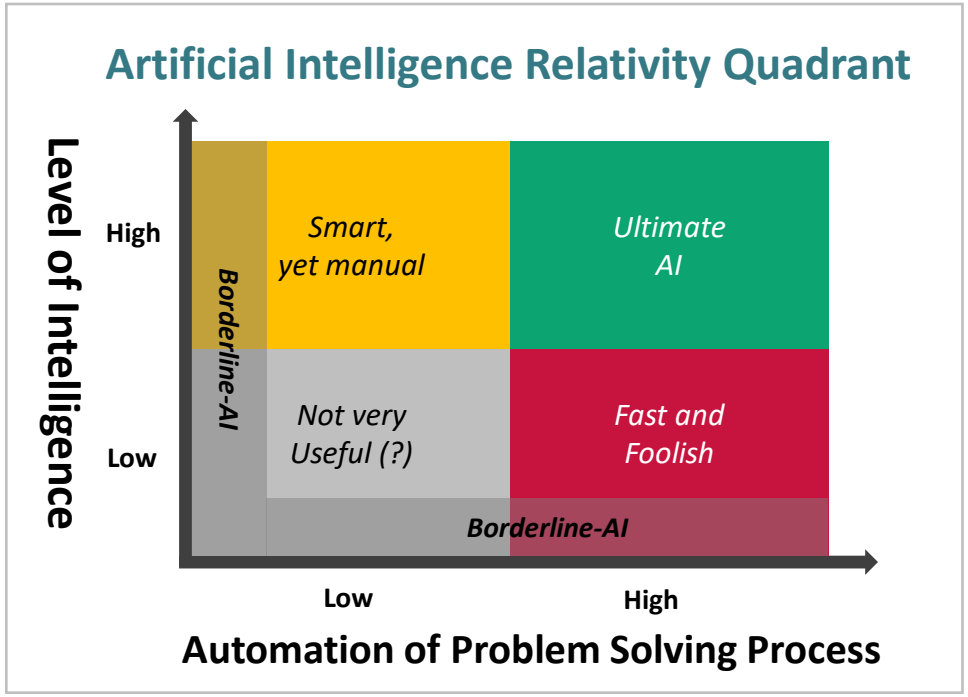
Taking the technology to production: (i) Addressing a specific pain, (ii) Quick deployments, and (iii) demonstrating strong ROI



Pushing the envelope: [Artificial] Intelligence is Relative

Two main dimensions establish a quadrant for positioning and comparing (AI) software products:

- **Level of Intelligence (Output Quality)**: high quality solutions to problem solving and decision-making challenges
- **Level of Automation**: reducing human involvement in the problem solving process



Summary

- AI and Industry 4.0 address significant business pains
- Digitalization and factory visibility is now critical than ever
- Greater Value is achieved by increased automation and higher level of intelligence
  - Not only predicting problems, also solving them
- Quantifying the benefits is within reach and demonstrates significant outcomes
- Push the Envelope with Greater Intelligence and Greater Automation

PLATAINE®
people-smart automation

Thank You

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