Winning in Ops digital transformation with agile IoT
Brief overview and case studies
INTRODUCTION - We are Auk. Industries

- Founded by experts in ops management, data science, process specialist, hardware & software engineers to serve the global industrial market
- Aim to eliminate the complexity and cost associated with I4.0/IIoT adoption by developing a scalable, ‘plug-and-play’ and agile system with deep ops analytics capabilities
- 5-10x more cost effective and >5x shorter project cycle so clients can roll-out successful deployments bigger, better, faster.

- Food production (basic ingredient, meat produce, powder)
- Electronics Manufacturing (solder & flux product for iPhone 8)
- Precision Engineering (aerospace superalloy/steel, CNC mill, lathe, metal processing)
- Oil/Fuel Processing (blending, primary & secondary packaging)
- Polymer Molding (injection/blow mold, containers, packaging, components)
- Machine OEM (food processing equipment, packaging eqpmt)
- Utilities (Uninterrupted power system, gas network)
- Horizontal technology applicable across sectors

Auk’s end-to-end system is deployed across 9 countries globally
~5000 machines connected and on track to hit >6000 in year 2023
System is used in >120 manufacturing sites

9 countries
>5000 machines
6+ industry sectors
>120 sites

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WE ARE A **GLOBAL COMPANY** WITH AMBITIOUS EXPANSION PLAN

Focused on countries with high industrial output

[Map showing global locations and headquarters with details of existing and planned market presence and services offered.]

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**Turin, Italy**  
Europe Regional HQ  
- Collaboration with Industry 4.0 leaders  
- European MNCs  
- Mittelstand companies

**Mumbai, India**  
**Bangkok, Thailand**  
**Kuala Lumpur, Malaysia**

**Shenzhen, China**  
**Tokyo, Japan**  
**Singapore**  
Asia Regional HQ  
- Global Sales HQ  
- Global Engineering HQ  
- Regional support for APAC

**Jakarta, Indonesia**  
**Australia**  
**New Zealand**

**San Francisco, USA**  
Americas Regional HQ  
- Technical support  
- Partnership & sales

**Chicago, USA**  
**Toronto, Canada**

**Munich, Germany**

**Munich, Germany**

**São Paulo, Brazil**  
**Mumbai, India**
TRUSTED BY WORLD’S LEADING CONSULTANTS & COMPANIES
SHOWCASED IN MODEL FACTORIES GLOBALLY
**WIDE RANGE OF APPLICATIONS & IMPACT**

**CAPACITY / LEAD TIME**
- >90% gain in OEE and production output within weeks
- ROI of >60x achieved

**COST-SAVING (MAN-HOUR AND SHIFT REDUCTION)**
- >40% man-hour savings realised within months
- 2.5 shifts to 1.5 shifts

**QUALITY**
- >15% reduction in product defects
- ROI of >45x achieved

**CAPACITY / LEAD TIME + MAINTENANCE**
- >30% increased in equipment utilization
- Proactive usage+condition-based maintenance achieved

**COST-SAVING (ENERGY COST OPTIMIZATION)**
- >25% monthly energy cost savings realised
- Hundreds of thousands saved/month

**QUALITY + CAPACITY (CCP OPTIMIZATION)**
- >20% increase in line output due to CCP optimization
- ROI of >35x achieved
HUGE OPPORTUNITIES TO DIGITALIZE OPS UNCAPTURED DUE TO COMPLEXITY/COST

Problem Statement

Huge value remains uncaptured in industrial operations. One of the most critical KPI of an industrial ops is Overall Equipment Effectiveness (OEE) which measures the actual output vs. theoretical capacity. As a benchmark, 40% is low but not uncommon, 60% is typical, while 85% is world-class.

To put it in perspective, OEE gain can have huge impact:

- OEE 60% > 85%: 10 factories can now produce 14 factories equivalent
- OEE 40% > 85%: 10 factories can now produce 21 factories equivalent

Yet conventional solutions are often bulky, rigid, anti-agile.

Top barriers to digitalization:
- High complexity/over-engineered
- Highly specialized expertise required
- Heavy infrastructure change needed
- High cost of implementation
- Mix of equipment types/legacy/model
- Lack of agility/flexibility
- Lock-in inflexible and not future-proof

IoT Solution - Implementation process mapping
Source: PUMAS Automation & Robotics

Challenging hardware in field
Source: Client equipment

Complex architecture requiring high integration/maintenance efforts
Source: Kepware IoT Platform
WE ARE **FITBIT-FOR-MACHINE x LEAN OPS-ANALYTICS**

We have created a powerful suite of 'Lego blocks' which can be **assembled into basic solutions** for small applications, or **constructed into sophisticated systems** which can autonomously model and analyze large scale operations.

Our global customers receive **Auk Industrial IoT kits** which are **ready to self-deploy** onto existing industrial machines. Machine data & OEE analytics can begin streaming onto cloud and visualized on dashboards within 2 hours.

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<tr>
<th>DATA</th>
<th>INFORMATION</th>
<th>PERFORMANCE &amp; INTELLIGENCE</th>
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<tr>
<td>Steps</td>
<td>Cycle/Std-time</td>
<td>Reduce CapEx &amp; Save Cost</td>
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<tr>
<td>Output/Input Yield</td>
<td>Heart-rate</td>
<td>Increase Capacity &amp; Throughput</td>
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<td></td>
<td>Current/load Temperature</td>
<td>Improve Productivity &amp; Efficiency</td>
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<tr>
<td>Sleep pattern</td>
<td>Active/Idle Pressure</td>
<td>Enhance Quality &amp; Yield</td>
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<tr>
<td>Active/Idle Breakdown</td>
<td>Shutdown</td>
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PLUG-AND-PLAY ARCHITECTURE. **SUPER FAST ROI**

No complex system integration & additional IT-infra required

01 MACHINE/ EQUIPMENT

Wireless Mesh

02 NODE

Edge IoT Device is plug-and-play ready and can be connected to machines and equipment immediately.

03 GATEWAY

Machine data is transferred wirelessly and securely to the gateway.

04 SECURED CLOUD

Data stream ingestion, pre-processing, ETL and advanced analytics. Big data storage, warehouse and API servers.

05 CLIENT

SECURITY

Strong industry standard cyber-security protections deployed full end-to-end.

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ZERO BARRIER APPROACH TO DIGITAL TRANSFORMATION

For legacy and new equipment, serial and I/O hybrid approach

CONNECT VIA MACHINE INPUT/OUTPUT (I/O)
Connecting to the machine at the sensors or actuators layer. Inputs and outputs are basic building blocks regardless of machine complexity or size. Hence, I/O level signal are typically universal and applicable across machine, brand, model.

CONNECT VIA CONTROLLER (SERIAL/IP)
Using serial communication protocols, subject to availability of serial communications access given by OEM, suitability of built-in aggregation method, and mapping of data variable tags.

CLIENT SELF-DEPLOY OFF-THE-SHELF
Our highly productized opware enables clients to deploy through internal crew. The no-code setup go-live in 5 minutes, a game-changer in slower industrial world. We are world’s few I4.0 technologies to ship/pilot remotely even in post-covid new norm.
ABSOLUTE VISIBILITY WITH REAL-TIME DASHBOARD

Machine nodes with QR code scan activation.

Drag and drop interface to model system dynamics, zero-minimal training required.

System level analysis based on block diagram representation.
Production line, factory performance can be analysed as a system to gain greater visibility on overall performance.

Identify potential bottlenecks automatically, essentially focusing your attention to solve the most critical points.
IMPROVE PERFORMANCE FOR THE ENTIRE GROUP LEVEL
Retort machine group level OEE/utilization analysis

Group Level Utilization
- The individual utilization of each retort can be studied
- The overall retort group performance can also be analysed

Cycle, Changeover Time, batches
- Batch cycle time can be accurately defined and captured
- No. of batches can also be inferred easily
- Average idling or changeover time in between batches can also be determined
HIGH-RES, RELIABLE DATA KEY TO IMPROVE EFFICIENCY
SOLVE THE RIGHT PROBLEM, MOVE THE NEEDLE

Deep dive into the top 20% reasons that cause 80% of operational losses

Focus resources to solve issues that ‘moves the needle’!

Waiting for material contributed to >96 hrs of production loss! Occurred >80 times

Waiting for metal scanning & cleaning contributed to >100 hrs of production loss per month! Occurred >250 times

Changeover & product stuck caused >50 hrs of production loss per month! Occurred >300 times
For a snacks manufacturer, changeovers are frequent and duration inconsistent (30 mins - 130 mins). **Standardization of SOP** has improved productivity by >15% within 2 months, translating to **higher output, without additional machines/manpower/shift**.

For a metal fabrication plant, waiting for material contributed to >96-hrs of losses per month/line, or 4.3M pcs per year. **Improved load balancing with dedicated material transfer ‘runners’** reduced the total time from >96-hrs to 32-hrs.

Due to lack of visibility, bottleneck thermoforming stations of a meat processing plant were running at 40%. **Reduction of speed loss and staggering of breaks** improved the output by 75% within 4 months.
**IMPROVE CONSISTENCY WITH BETTER CONTROL**

*Improving consistency in performance has an upside potential of 17.9% OEE or 18,558 pcs additional output per machine per day*

**Data Observation**
- Throughout the week, OEE ranges from 36.1% to 82.6% and the average OEE is 64.7%.
- The best cycle time determined by our software is 0.83333, or 72 pcs per minute.

**Improvement Potential**
- There are fluctuations in the OEE and output on a daily basis, which represents an upside potential of 17.9% if consistency is maintained.
- This translates to additional 18,558 pcs that can be produced for 1 machine per day.

*17.9% improvement potential = 82.6% (max OEE achieved) - 64.7% (average OEE)*
SOFTWARE IS **POWER-PACKED OUT-OF-BOX** WITH ADVANCED ANALYTICS

No-Low setup required. **Ready to use out-of-box.** Go-Live in minutes.

High level glance at monthly plant performance in a single view

RCA can be done and documented systematically.

A highly refined OEE analysis can be done even with SKUs with different cycle times producing at the same machine.

Simplified operator console enables shop-floor information to be updated by operators immediately

Build baseline of normal operating conditions of equipment for optimization and anomaly detection.

Important production parameters can be compared and correlation can be studied to identify gaps for improvement on performance and QA

Group and manage access level of different personnel across the organization
HIGH GAIN/EFFORT IS FREQUENTLY ACHIEVED THROUGH IMPROVING MACHINE EFFECTIVENESS

OVERALL EQUIPMENT EFFECTIVENESS (OEE) Percent %

Loading losses Availability losses Performance losses Quality losses

Significant operational gain can be derived regardless of machine sophistication - from complex million-dollar automated equipment to simple thousand-dollar human operated packers.

OEE loss-bridge chart
Source: McKinsey & Company
CLIENT CASE STUDY 1: BEVERAGE BOTTLING PLANT (EQUIPMENT PRODUCTIVITY)

Productivity improvement: Throughput increased by >80%, huge CapEx avoidance

A leading beverage bottling plant piloted the Auk Industrial IoT system for a single line and subsequently roll out across the entire plant consisting 6 lines with various products. More than 80% gain in throughput is achieved, enabling saving of costly CapEx while meeting demand growth. Levers for rigorous reduction of speed losses and minor stoppages include improving packaging settings, machine alignment calibration, operator skill training, etc.

- Real-time data of plant/line/equipment performance and operation losses
- Single source of data for performance management across departments
- Material first-pass-yield monitoring from raw material to final process

No. of equipment: 40+  Mid complexity
IIoT deployment cost: $90,000  Hardware + SaaS
Operations benefits: $2,500,000  >90%  Gain in throughput
CLIENT CASE STUDY 2: CENTRAL KITCHEN (EQUIPMENT UTILIZATION)

Increase equipment utilization, labor productivity: >60% increase in production capacity without CAPEX

In a large central kitchen serving ready-to-eat meals, Auk IIoT system is deployed across 3x manufacturing facilities. Utilization of one of the bottleneck process equipment has increased substantially, resulting in overall improvement at the plant level. Specific levers include load balancing of processes/steps, optimized production scheduling, staggering of break times, reorganization of batch and team sizes to reduce waiting time.

- IoT compatible across very broad range of equipment such as combi-oven, blast-freezer, vege-slicer and etc
- Fact-based data and visualisation enabled constructive workforce rescheduling
- Top losses from minor stoppages and breakdown identified for bottleneck processes

Examples of equipment:
- Thermopacker
- Flattener
- Sausage filler
- Bowl cutter
- Smoke house
- Tumbler
- Blast Freezer
- Combi-oven

No. of equipment: 50+ Mixed complexity
IIoT deployment cost: $100,000 Hardware + SaaS
Operations benefits: >60% Gain in equipment utilization

Utilization of one of the bottleneck process equipment has increased substantially, resulting in overall improvement at the plant level. Specific levers include load balancing of processes/steps, optimized production scheduling, staggering of break times, reorganization of batch and team sizes to reduce waiting time.
CLIENT CASE STUDY 4: MEAT PROCESSING PLANT (MANPOWER EFFICIENCY)

Increase equipment utilization, labor productivity: workshift reduction from 2.5 to 1.5 shifts

In a joint venture between a global top meat processing company and a renowned airline logistics company, Auk IIoT system is deployed across 3x manufacturing facilities. Manpower efficiency was significantly improved, enabling reduction of workshifts from 2.5 to 1.5 shifts. Specific levers improved operator handling via identification of top stoppages/faults, optimized production scheduling to level-load production equipment for max capacity.

- IoT compatible across very broad range of equipment from manual bandsaws to state-of-the-art laser-guided portioner
- Fact-based data and visualisation enabled constructive workforce rescheduling
- Top losses from minor stoppages and breakdown identified for bottleneck processes

No. of equipment: 80+ Mixed complexity
IIoT deployment cost: $120,000 Hardware + SaaS
Operations benefits:
- >40% Saving in work-hour
- <90% OEE

Trade magazine interview: https://www.foodnavigator-asia.com/Article/2019/02/15/Hype-or-glory-Can-the-Internet-of-Things-transform-food-manufacturing-in-APAC

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<th>IIoT deployment cost: $120,000 Hardware + SaaS</th>
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<tbody>
<tr>
<td>Operations benefits:</td>
<td></td>
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<tr>
<td></td>
<td>&gt;40% Saving in work-hour</td>
</tr>
<tr>
<td></td>
<td>&lt;90% OEE</td>
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</tbody>
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Sausage filler
Tumbler
Smoke house

Thermo-packing machine
CLIENT CASE STUDY 8: FOOD MANUFACTURING (CCP OPTIMIZATION)

Increase overall production line speed/output: >20% increase in line-level OEE and output

In a large biscuit manufacturing facility producing for both local and overseas market, Auk IIoT system is deployed across 100x machines at 8 lines.

>20% gain in production line capacity unlocked, enabling the company to meet the demand without incurring additional manpower and CAPEX. Specific levers include optimization of critical CCP such as oven temperature and conveyor speed with real-time high resolution data.

- IoT compatible across very broad range of equipment from relay-controlled legacy upstream machines and new/sophisticated conveyor ovens
- Fact-based data and visualisation enabled constructive workforce rescheduling
- Bottleneck identified and real-time data analytics is used to optimize CCP to unlock production capacity

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<th>No. of equipment:</th>
<th>100+ Mixed complexity</th>
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<tr>
<td>IIoT deployment cost:</td>
<td>$200,000 Hardware + SaaS</td>
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<tr>
<td>Operations benefits:</td>
<td>&gt;20% Gain in line speed</td>
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- Fact-based data and visualisation enabled constructive workforce rescheduling
- Bottleneck identified and real-time data analytics is used to optimize CCP to unlock production capacity
CLIENT CASE STUDY 10: PET FOOD PRODUCTION (ASSET OPTIMIZATION)

Reduction in changeover/cleaning time can increase number of batches to 18 per machine/day

Data Observation
- Time range selected is 21st Dec, 24-hr period. OEE is 41%.
- The batch cycle time is ~74 mins.
- Changeover time ranges from 5 mins - 255 mins.
- Heating & cooling contributed 32 mins or 43% of total time.

Improvement Potential
- Based on batch cycle time of 74 min and changeover time of 5 min, the maximum achievable performance is 18 batches/day, vs 8/day currently.
- Any ways to shorten heating and cooling duration?

https://ops.auk.industries/asset/6016?from=2022-12-20T17:00:00.000Z&to=2022-12-21T17:00:00.000Z&res_x=5&res_period=minutes&entity_id=396
CLIENT CASE STUDY 11: FOOD PRODUCTION (CCP OPTIMIZATION)

Data Observation

- Monitoring correlation between connected signals for future improvement and root cause analysis
- Get visibility on each signal type and be able to faster identify when machine have issue
- Also can set notification when have issue for faster response
ENERGY DATA BECOMES ACTIONABLE WHEN SYNERGIZED WITH PRODUCTION DATA

Via the fusion of both energy and production data, specific energy per unit of goods produced can be derived and energy load curve baseline is discovered through multivariate regression analysis.

This establishes optimal performance at each throughput level, and breaks down energy inefficiency into (A) Performance Losses and (B) Load Losses for respective mitigation actions.
In a chemical plant in the ASEAN region, the energy consumption trend and composition across different areas/blocks and different Work Orders can now be determined in real-time. Utility equipment with the highest running cost is identified. This means that the total energy consumption for specific product/batch can be tracked and potential adjustments made, where the high energy consuming operations are scheduled at periods of low tariffs.

Auk’s robust long-range mesh-network architecture means that no additional investment in LAN/WIFI infrastructure is required.
In a beverage bottling plant in Malaysia, the specific energy cost for a particular product SKU can now be determined. Management has a much clearer sense of cost and margin for every product.

Production and engineering team performed a detailed study on energy cost analysis between different packaging materials and made the switch to carton box packaging due to its lower overall cost (despite having a higher raw material cost).
MAINTENANCE STRATEGY

L1: BREAKDOWN
Fix when broken

L2: TIME-BASED
Planned maintenance based on calendar

L3: USAGE-BASED
Planned maintenance based on usage-cycle

L4: CONDITION-BASED
Asset monitoring and maintenance based on condition threshold

L5: PREDICTIVE
Advanced analytics and data-sensing to predict machine reliability
WE ARE 3-5X MORE COST-EFFECTIVE (inclusive 12 months software & support)

**Hardware**
- **Pilot**
  - 25 machines
  - Typical company rev: <$10M
  - 1 x gateway
  - 25 x nodes
  - 1 x year
  - 25 nodes
  - 75 user accounts
  - [Basic] Lean I4.0 Onboarding Program
    - 1x Deployment Training
  - **USD** 28k upfront
  - **USD** 1.3k/month *12m (billed every 1 year)
  - **USD** 43k total for year 1

- **Mid factory**
  - 1 factory (50 machines)
  - Typical company rev: $10~50M
  - 1 x gateway
  - 50 x nodes
  - 1 x year
  - 50 nodes
  - 150 user accounts
  - [Intermediate] Lean I4.0 Onboarding Program
    - 1x Deployment Training
  - **USD** 44k upfront
  - **USD** 2.3k/month *12m (billed every 1 year)
  - **USD** 73k total for year 1

- **Large factory**
  - ~2 factories (200 machines)
  - Typical company rev: $100~500M
  - 2 x gateways
  - 200 x nodes
  - 1 x year
  - 200 nodes
  - 600 user accounts
  - [Advanced] Lean I4.0 Onboarding Program
    - 2x Deployment Training
  - **USD** 134k upfront
  - **USD** 8k/month *12m (billed every 1 year)
  - **USD** 233k total for year 1

- **Global Enterprise & MNCs**
  - >20 factories (2000 machines)
  - Typical company rev: >$1B
  - 20 x gateways
  - 2000 x nodes
  - 1 x year
  - 2000 nodes
  - 6000 user accounts
  - [Advanced] Lean I4.0 Onboarding Program
    - 2x Deployment Training
  - **USD** 970k upfront
  - **USD** 66k/month *12m (billed every 1 year)
  - **USD** 1.78M total for year 1

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Our mission is to build the most powerful digital engine for Industry 4.0, disrupt the big incumbents, and level the playing field by making the best-in-class arsenal accessible to every industrial operations, from the smallest Mittelstand to the world’s largest conglomerates.

"Why would a line worker in a developing country save so hard to buy an Apple Iphone?" “Because unlike cars & houses, it is probably the only great thing that even a billionaire like Elon Musk loves using, that he too has a chance to own.”