How to Build & Execute a Digital Transformation Strategy

Honeywell Connected Plant

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October 2018
If only Digitalization was so simple ....

**SHOPPING LIST**

Corporate Digitalization

- 1 x Cloud
- 1 x Data Lake
- 1 x ETL tool
- 1 x Machine Learning Tool
- 1 x BI Tool / Dashboard
- 1 x Universal Data Connector
- 1 x Mobility Tool
- 1 x Cyber Security Tool

**Recipe**

**Dish:**

- Put all ingredients together
- Mix Thoroughly
- Enjoy Benefits !!

**Serves:**
What is the reality of IT / OT?

**IT**
- Most Manufacturing companies are either engaged in or planning for Digitalization
- The Digitalization phenomenon is primarily driven by IT (CDO role)
- Some levels of successful Data Integration and Cloud usage already exist on the IT side
- Cyber Security and Data Governance are major challenges to the pace of progress

**OT**
- Early adopters have been active in this space for 1-2 years
- Many pilot projects (proof of concepts) active or complete
- Significant learnings from early OT projects
  - Process Data is highly correlated, general purpose big data tools and data scientists not effective
  - Streaming process data in the cloud requires different tools to be effective
  - No single Analytic or ML tool solves all problems – requires a suite of tools approach

Rapid pace of technology change – need to be AGILE
What are the elements of an OT Digitalization strategy?

- Understand your existing Digital Footprint
- Assess your Digital Maturity and Priorities
- Develop Journey plan for OT Digitalization
- Design Data Architecture (Storage / MetaData / ETL)
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- Select Data Lake and Platform
OT - Digital Footprint

- **Asset & Time Series Data**: MES / DCS / PLC / SCADA Data Streams
- **Production Planning & Event Data**: Production Planning, Routing, Recipes & Execution Results/Events, Inventory Levels & Movements, Labor/Operations Schedules, Shipping & Logistics
- **Product Quality & Lab Test Data**: Product Quality/Sampling Test Results data Batch Quality / Batch Tracking
- **Maintenance Manuals, Requests, Logs**: Maintenance Guides, Maintenance WO Data, Maintenance Logs Operator Rounds management Data

If you manufacture you are already a digital business
### Digital Maturity Model

<table>
<thead>
<tr>
<th>Manual</th>
<th>Isolated</th>
<th>Connected</th>
<th>Distributed</th>
<th>Unified</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overview</strong></td>
<td>All data - everyone operates in silos</td>
<td>Data exists within silos for optimizing the performance of each silo.</td>
<td>Data is shared between silos when requested to solve problems within silos.</td>
<td>Data is freely shared across silos and used to solve problems reactively</td>
</tr>
<tr>
<td><strong>Factory</strong></td>
<td>Build what they want when they want, no flow to capacity. No data collected and used for factory process optimization.</td>
<td>Very few Cell/Line Flow in the factory. Flow optimized within the select Cell/Line/Process area. No visibility to data/information across the factory. Not enough data to optimize flow and improve factory productivity.</td>
<td>Data available for Machine to Process areas but stored in silos within individual systems/tools. Data from Edge devices is used to take proactive actions or trigger alerts. Aggregation data/information in the factory is complex and is done when required to solve a specific problem. Quality is improved.</td>
<td>Data from major enterprise systems and critical process functions is available and used widely. Aggregation of data/information is available near real time for Big data analytics. Data and analytics is used to drive preventative actions and optimizing factory flow &amp; Quality.</td>
</tr>
<tr>
<td><strong>Customer</strong></td>
<td>Customer pushes requirements to HON; No knowledge on when orders will be received or what SOD HON has; Order confirmation of PO receipt but no visibility on order status until delivery.</td>
<td>Known and consistent customer demand with some knowledge of buying habits. Perhaps some statistical forecasting of historical buying; annual forecasting and budgeting; discussions; call in email for order status.</td>
<td>Some connection with customer inventory or automatic forecasting feed; potentially some EDI ordering; ability to log into portal to see order status but not real time updates on status within factory (only shows as pending or shipped).</td>
<td>Analytics on inventory or demand that prompt automatic ordering from HON side; portal can provide real time status and availability changes (details such as production in process, ready for shipment, shipment and carrier) are available.</td>
</tr>
<tr>
<td><strong>Supplier</strong></td>
<td>Supplier delivers as they see fit, flow or little signals to planning or the factory, quality is discovered by the factory. Factory experiences down times due to missed manual order signals to suppliers.</td>
<td>High volume, low variability products have consistent flow of raw material as well as consistent demand to consumption rate. High variability lines depend on manual order signals to supply base resulting in occasional material shortages.</td>
<td>Factory planning function aligned to sourcing at product level driving demand forecast with suppliers. Raw material common across product lines can result in stock-out / over-ordering as cross-Value Stream connectivity is not available. Raw material quality validation available upon arrival.</td>
<td>Material planning at plant level by SKU with connectivity to all Value Streams, planning, Big data analytics for heuristics based predictive order patterns resulting in consistent real-time supply chain material planning. Material quality validation completed and communicated prior to shipment from supplier.</td>
</tr>
<tr>
<td><strong>Engg</strong></td>
<td>No automated data available, collected and collated manually if needed. Engineering and Quality must request data coming from the system in a reporting system like Business Objects, Data used when required difficult to collect off the system, not readily available to design or quality. 3D models are widely used during the design phase.</td>
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<td>Engineering and Quality access data available for evaluation in a server through a controlled access, utilized as needed by design or quality but not ingrained in the systems.</td>
<td>Engineering and Quality access factory data though a distributed possibly web based system, access is easy and available real time. A Digital Twin of the factory exists to model supply chain for first pass success.</td>
</tr>
<tr>
<td><strong>Maint</strong></td>
<td>Maintenance is when the equipment goes down or fails. Few equipment are connected and descriptive data on downtime and maintenance history exists. All Critical equipment in the plant are connected. Data is helping to accelerate diagnosis and resolution during maintenance.</td>
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<td>Through advanced analytic tools, optimum preventive maintenance schedules are prompted and intuitive guidance to solve the issue during maintenance. Maintenance is proactively driven by using data from Edge sensors and IoT information systems.</td>
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<td><strong>Planning</strong></td>
<td>Planning in constant state of adjustment based on late signals from supplier, factory defects etc. Normalizing / leveling demand to balance noise and linearity challenges at the site level. Data gathered from within the factory as input.</td>
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Digital Maturity Model

Alternatives

• Develop your own corporate DMM
• Hire a consultant
• Search online and use openly available work product
  • Multiple Industry 4.0 models published & available online
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HCP Digitalization Journey

IDENTIFY PROBLEMS / OPPORTUNITIES
• Lower than planned OEE & Yield
• Excess Inventory
• Excess waste material / High CPQ
• Quality / Capacity constraints
• Process & Equipment Reliability
• Challenges in supply chain connectivity & planning

IDENTIFY WHICH ARE IMPACTED BY DIGITIZATION
• Data not currently available for real-time decisions
• Ties up engineers gathering data vs analyzing data
• Data resides in multiple data sources
• Past evidence of lost opportunities
• Present and future challenges with compliance

DEFINE & PRIORITIZE USE CASES
• Problem to be addressed
• Assigned Owner
• Data / Data Sources Required
• Models / Heuristics available
• Analytic & ETL Requirements
• Expected Benefits

DESIGN DATA ARCHITECTURE & APPLICATIONS
• Data Lake / Repository
• New Data Sources
  • Digital rounds management / Shift Logging
  • Equipment continuous EHM data
  • IIoT / Mobile devices
• Analytics Tools
  • BI / Modeling / Classification
  • Demand Forecasting
• Search for packaged solutions / implementation partners

IMPLEMENT PILOT PROGRAMS (Proof of Concept)
• Rapid modeling / implementation of key use cases
• Install Data Lake and connect first data sources
• Implement first BI Dashboards / Self-Serve analytics

FULL SCALE IMPLEMENTATION PROGRAM
• Expand Data Sources connected to data lake
• Implement analytics at scale
• Deliver use cases
• Measure & Report results
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MetaData is Critical

- Data lakes contain massive and ever-growing amounts of data
- Without a well designed map (MetaData) Data rapidly becomes impossible to find and analyze
- Design the data lake AFTER the data and analytics requirements are fully understood
- Establish the right types of ETL tools to move existing and new data streams into the data lake

Compress Data before storage in the cloud

- Avoid storing raw data if it is not needed for analytics
  - Vibration data – do FFT at the device or EDGE
  - Calculation / Transformation / Aggregation at the EDGE
Deployment Depends on Data Governance & Regulatory Requirements

Analytics Data Target Architectures

**On-Prem Plant Hosted** (Single Site)
- Historian (Time Series Data)
- Data Lake (Structured & Unstructured “Relational Data”)

**Corporate or Private Cloud Hosted** (Single or Multi-Site)
- Cloud Historian (Time Series Data)
- Data Lake (Structured & Unstructured “Relational Data”)

**Public Cloud-Single Tenant Hosted** (Single or Multi-Site)
- Cloud Historian (Time Series Data)
- Data Lake (Structured & Unstructured “Relational Data”)

**Public Cloud-Multi Tenant Hosted** (Single or Multi-Site)
- Cloud Historian (Time Series Data)
- Data Lake (Structured & Unstructured “Relational Data”)
## Deployment Options

<table>
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<tr>
<th>Deployment Option</th>
<th>Considerations</th>
<th>Benefits</th>
<th>Constraints</th>
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<td>Plant Hosted</td>
<td>Data Governance Driven</td>
<td>Ensures Data doesn’t leave the Plant</td>
<td>Each Plant bears burden of Platform Administration &amp; Maintenance</td>
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<tr>
<td>Corporate or Private Cloud</td>
<td>Data Governance Driven</td>
<td>Ensures Data doesn’t leave the Corporation. Enables Global/Centralized Analytics &amp; Monitoring</td>
<td>Each Corporation bears burden of Platform Administration &amp; Maintenance</td>
</tr>
<tr>
<td>Hosted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Cloud</td>
<td>Total Cost of Ownership Driven</td>
<td>Data not Co-Located with other Tenants. Administration &amp; Maintenance outsourced</td>
<td>Higher Subscription Costs (vs Multi-Tenant)</td>
</tr>
<tr>
<td>Single-Tenant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Cloud</td>
<td>Total Cost of Ownership Driven</td>
<td>Administration &amp; Maintenance outsourced</td>
<td>Data Isolation designed at the Database &amp; through Role-Based Security Controls</td>
</tr>
<tr>
<td>Multi-Tenant</td>
<td></td>
<td></td>
<td></td>
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Cyber Security — Common Approach

- Disparate systems
- Lost productivity across the total ecosystem
Common ... but Amplifies Cyber Risk

54% of industrials experienced a cyber attack in last 12–18 mos.
Honeywell Industrial Cyber Secure

OEM Cloud

Enterprise Secure Cloud

3rd Party Cloud

Honeywell
- ISC Shield
- Secure Data Exchange

Secure Cyber Granular Data Pipe

Blowers  Compressors  Motors  Pumps  Process  People
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Read the Analysts’ reviews

• Gartner magic quadrant for Data Science Platforms

• Gartner Critical Capabilities for Business Intelligence and Analytics Platforms
  - Agile Centralized BI Provisioning
  - Decentralized Analytics
  - Governed Data Discovery
  - OEM Embedded BI
  - Extranet Deployment
  - ETL Capability

Whatever you choose this year will be superseded next
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Cloud Historian

• Scalable Enterprise Wide Data Store Supporting API Solution

  • **Enterprise Historian**
    - High performance for interactive scenarios
    - Connecting data from all sites in the enterprise
    - Enabling centralizing site and enterprise
    - Data cleansing & enrichment
    - Enabling central subject-matter experts

  • **Data Lake**
    - Combining Process Data with other data sources in a standard data lake
    - Enabling big data analysis
    - Connecting 3rd party visualization and analysis
    - Enabling central data scientist in the organization

  • **Context Model**
    - Consistent Asset Model to describe plant & facilities
    - Mapping between data sources
Asset Performance – Deployment & Workflow

Runtime Analytics

- Calculations (Actual & Predicted)
  - Pre-Processing / Cleansing
  - User Defined Calculations
  - UniSim® - Estimate / Predicted

- Even Detection (Compare Actual to Predicted)
  - Fault Models

- Fault Prioritization (Fault Severity * Asset Criticality)
  - Data Driven

Visualization

- Event Management
  - Notifications

- Business Dashboards
  - Process Graphics & Trends
Conclusions

- The journey to OT Digital Transformation is not simple and there is no single right answer to the tools and technology.
- The potential benefits at the end of the journey ARE worth the effort.
- Understand the problems you are going to solve with the technology.
- Learn from the successes and failures of others.
- Industry standard tools and connectivity should be designed in – do not allow a black-box approach.
- Industrial-strength cyber security mandatory to enable use of cloud / remote operations without compromising data integrity.
- Move fast – be agile and unafraid to fail a few times along the way.
- Find an OT partner (Honeywell HCP) to guide you to success.

Good Luck on your Digital Journey.