
Accenture Digital:
Helping clients use digital to change the way the world lives and works
High performance. Delivered.
Strategy | Digital | Technology | Operations
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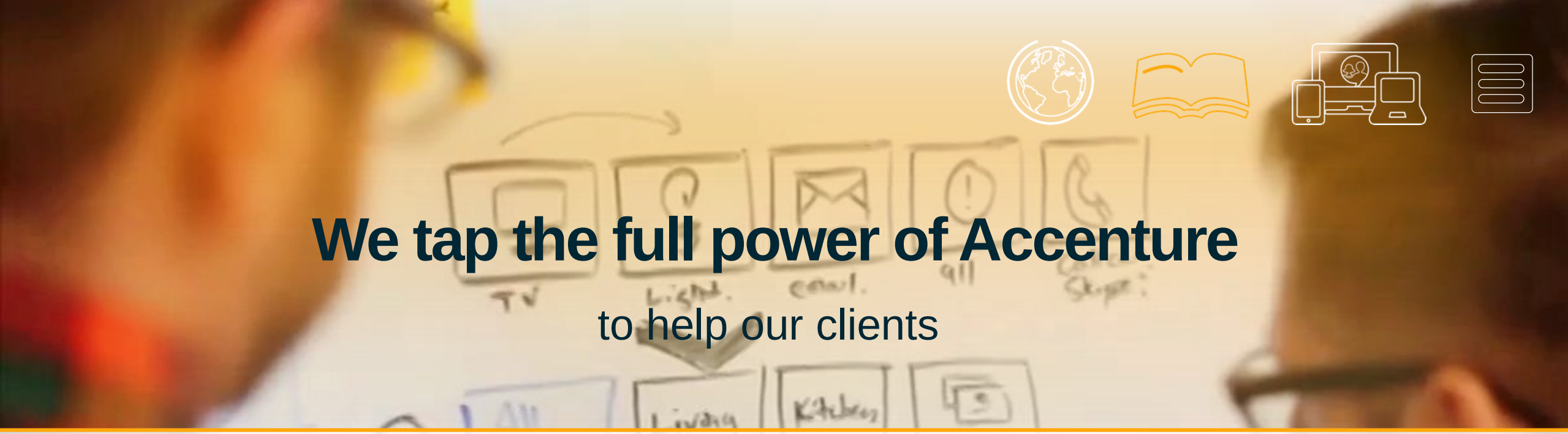


We tap the full power of Accenture

to help our clients

accenture digital

accenture technology

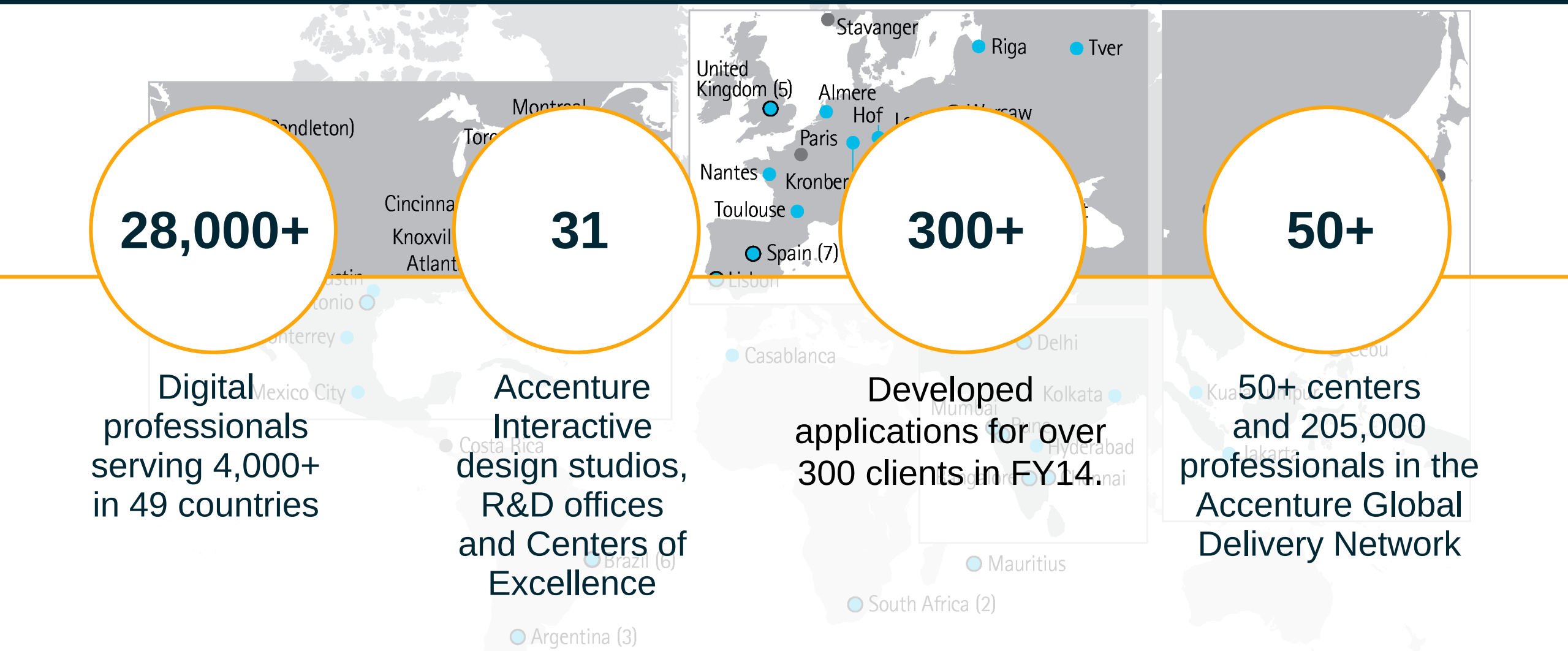
accenture strategy

accenture operations

We tap the power of our global delivery network for unmatched global reach

Locations not exhaustive; (#) indicates centers in more than one city

Accenture Digital



28,000+

Digital professionals serving 4,000+ in 49 countries

31

Accenture Interactive design studios, R&D offices and Centers of Excellence

300+

Developed applications for over 300 clients in FY14.

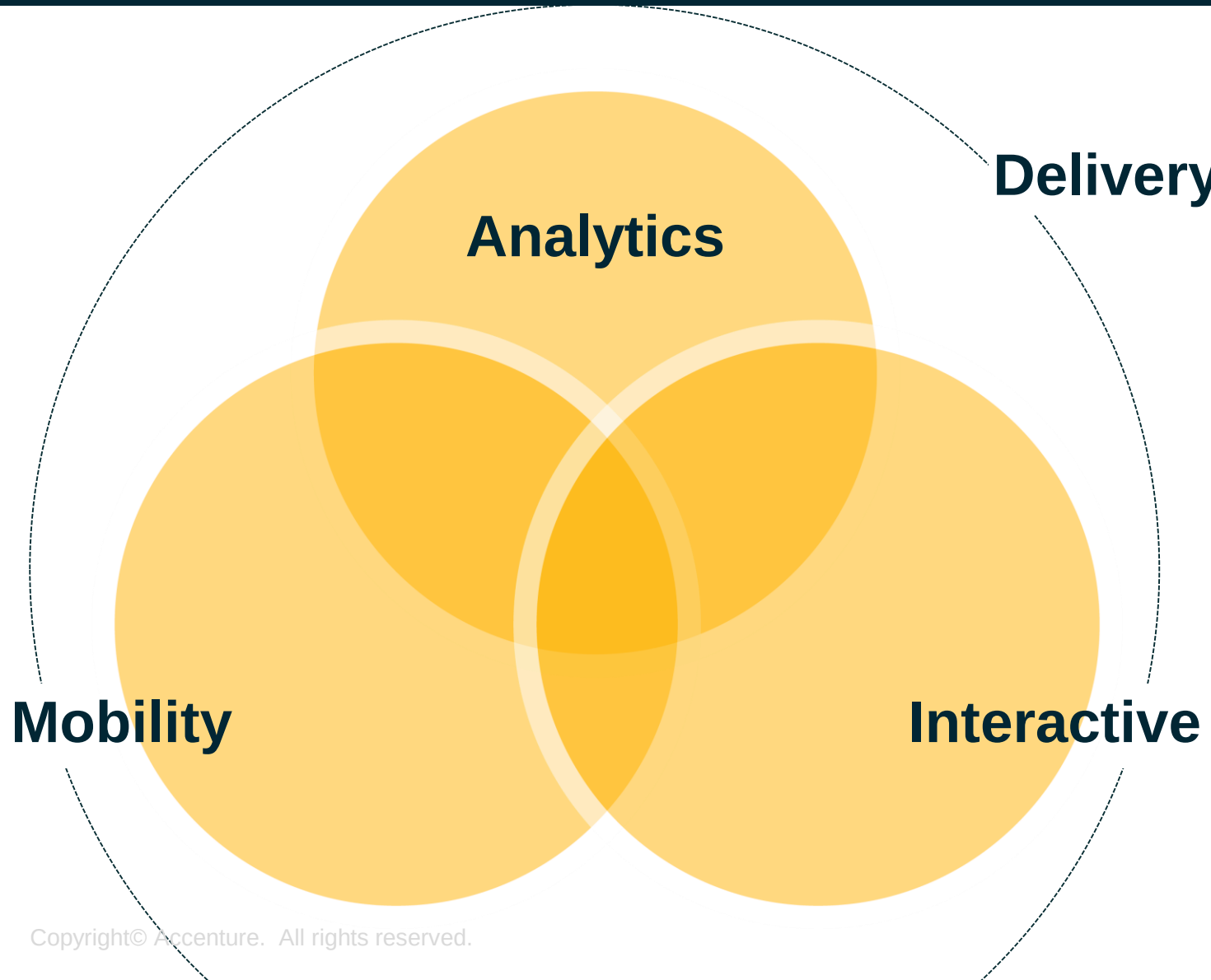
50+

50+ centers and 205,000 professionals in the Accenture Global Delivery Network

The heart of your business

We work
at the heart of your business

@speed @scale



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Accenture Analytics

IoT
Technische Universität Dresden
7.11.2016

accenture digital

High performance. Delivered.

Strategy | Consulting | Digital | Technology | Operations

Objectives

Technology Trends in IoT - Architectures

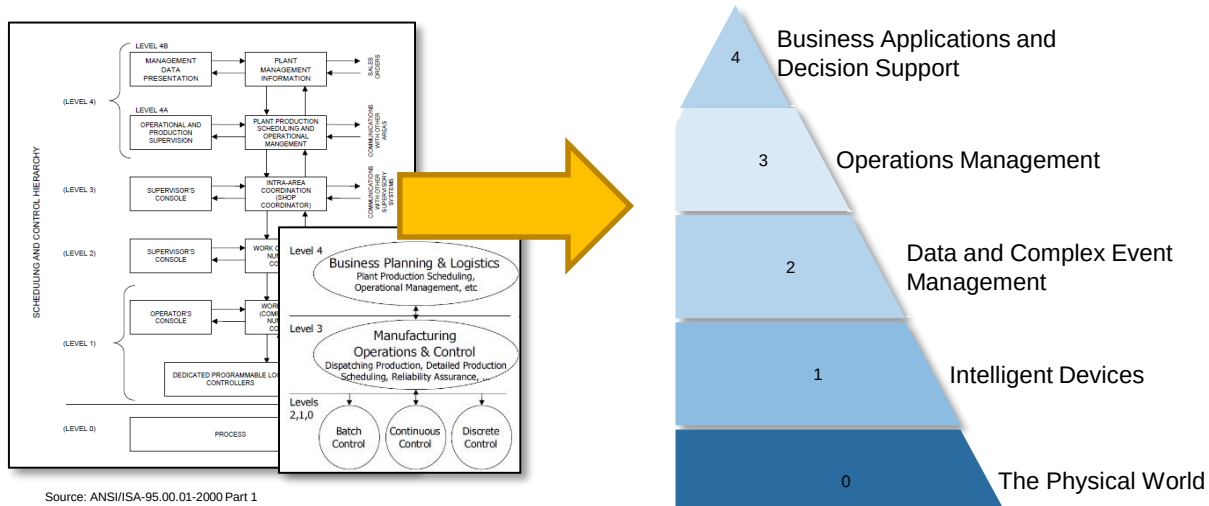
What is the IoT?

Industrie 4.0 Example

What is the IoT?

What is Connected Analytics in the IIoT & Industrie 4.0

Based on **ANSI/ISA-95** layered model, an important reference for Enterprise Control System Integration on Industrial Environments.



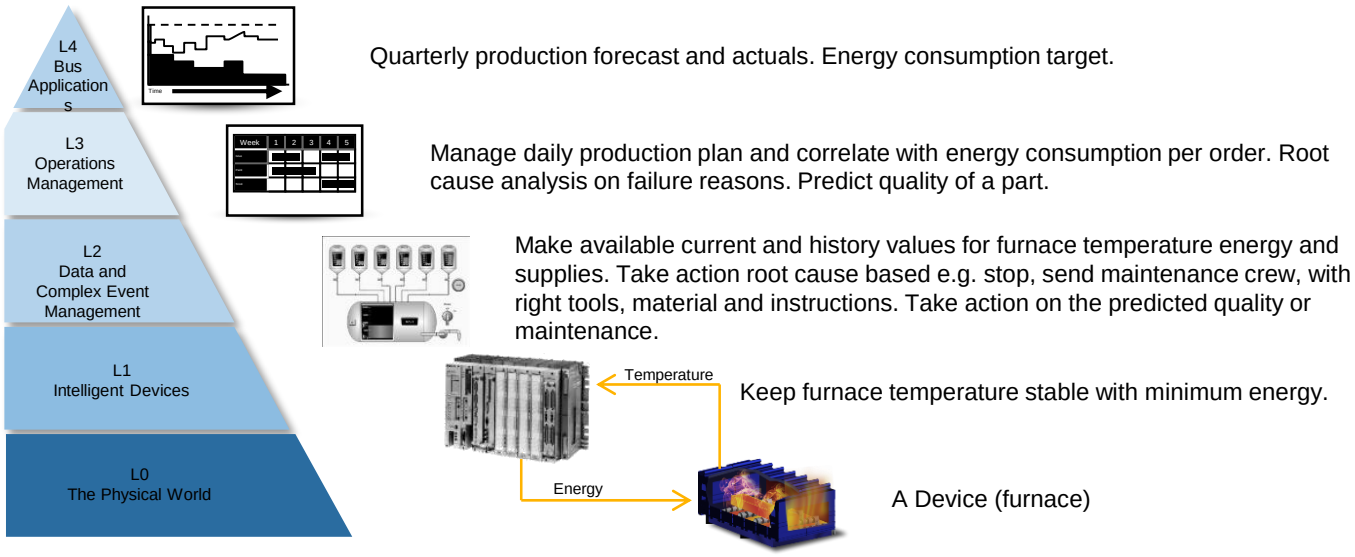
Source: ANSI/ISA-95.00.01-2000 Part 1

Industrial Automation Reference

Proposed IIoT Reference

What is Connected Analytics in the IIoTS & Industrie 4.0

Example on an Industrial Environment



Quarterly production forecast and actuals. Energy consumption target.

Manage daily production plan and correlate with energy consumption per order. Root cause analysis on failure reasons. Predict quality of a part.

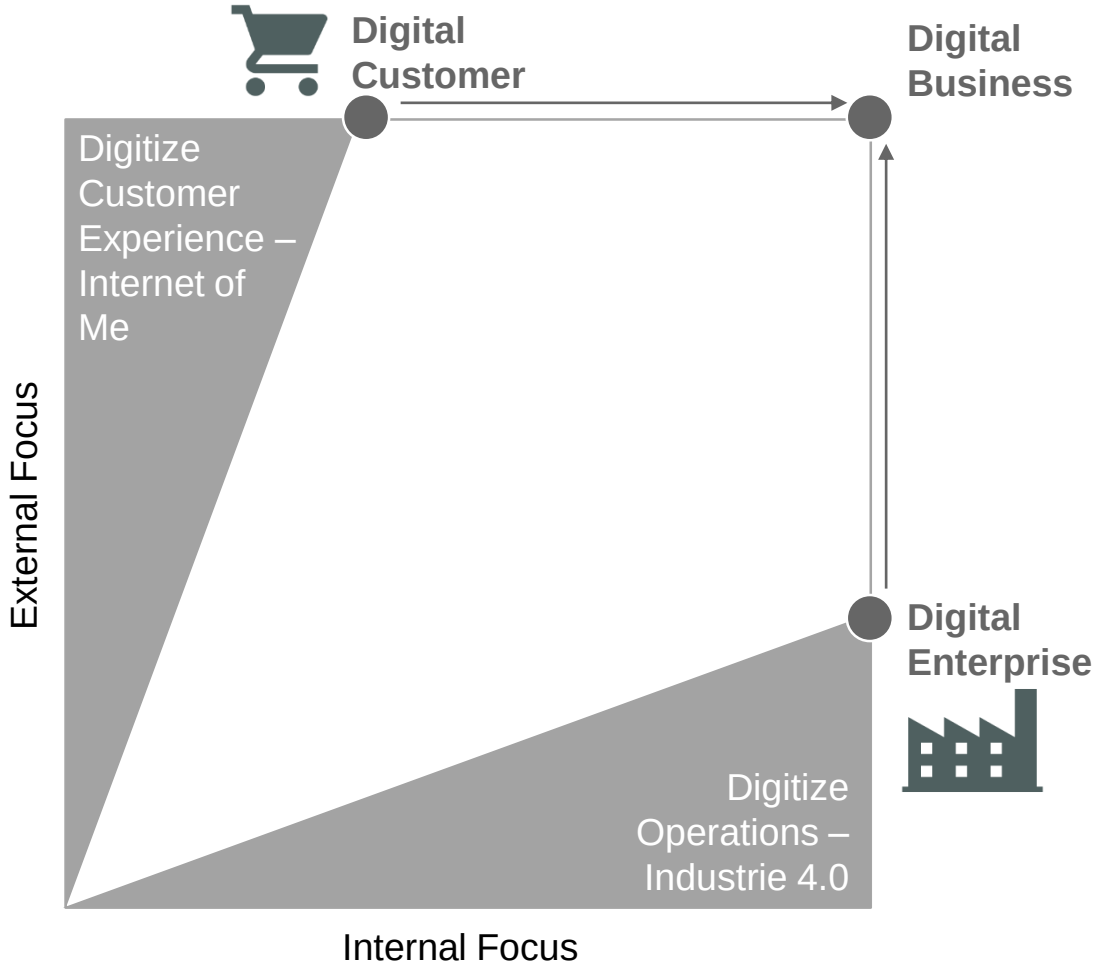
Make available current and history values for furnace temperature energy and supplies. Take action root cause based e.g. stop, send maintenance crew, with right tools, material and instructions. Take action on the predicted quality or maintenance.

Keep furnace temperature stable with minimum energy.

A Device (furnace)

IoT helps companies on their path to digital business by digitizing customer experience and operations

Digital Strategy Framework



3 Value Pockets

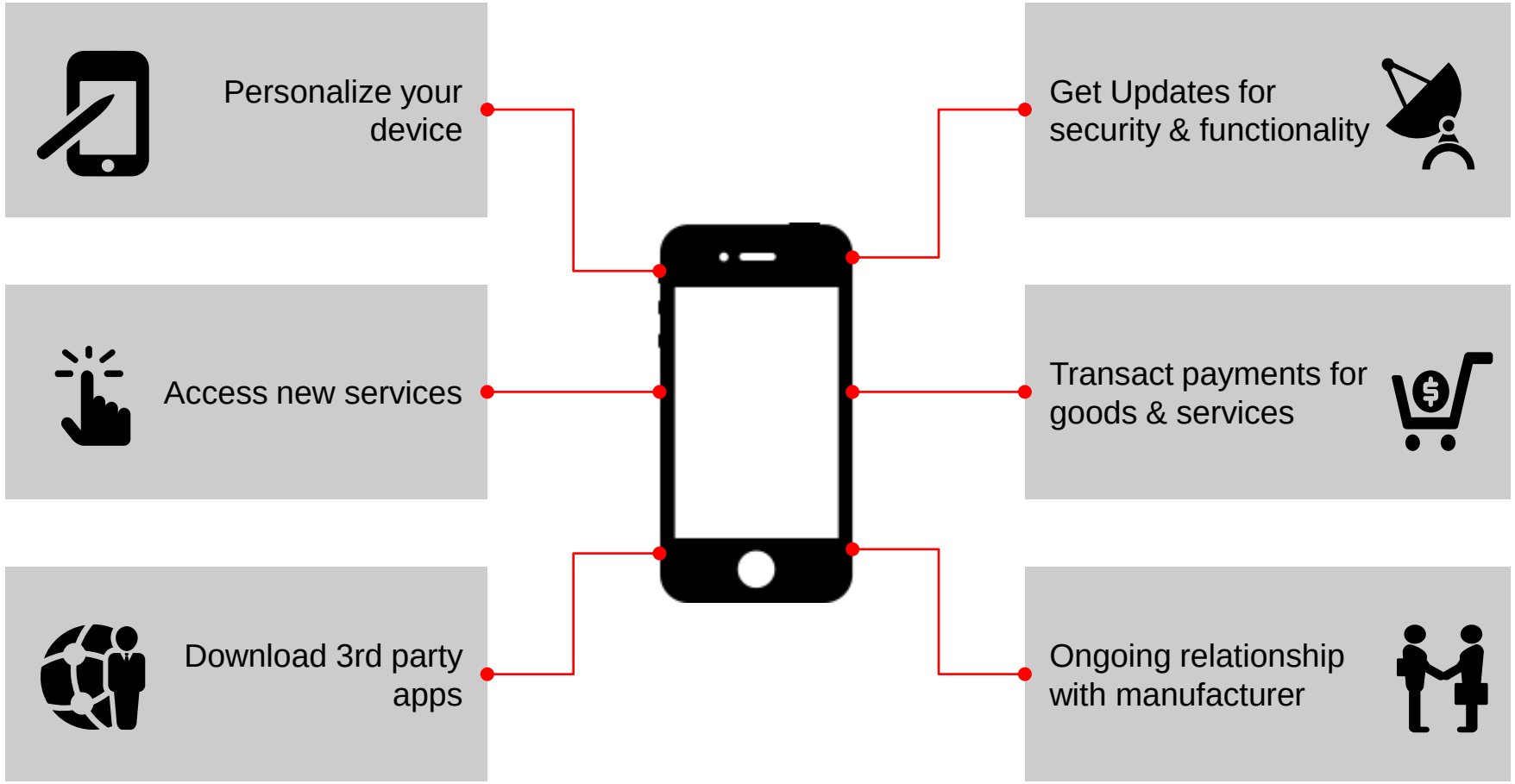
Digital Customer: Apply digital technology to address customers in a more sophisticated way and thereby to improve market reach

Digital Enterprise: Apply digital technology to the existing value chain (e.g. R&D) as well as support functions (e.g. HR) to increase productivity

Digital Business: Completely digitize your current business model or develop new business models generating profits based on digital technology

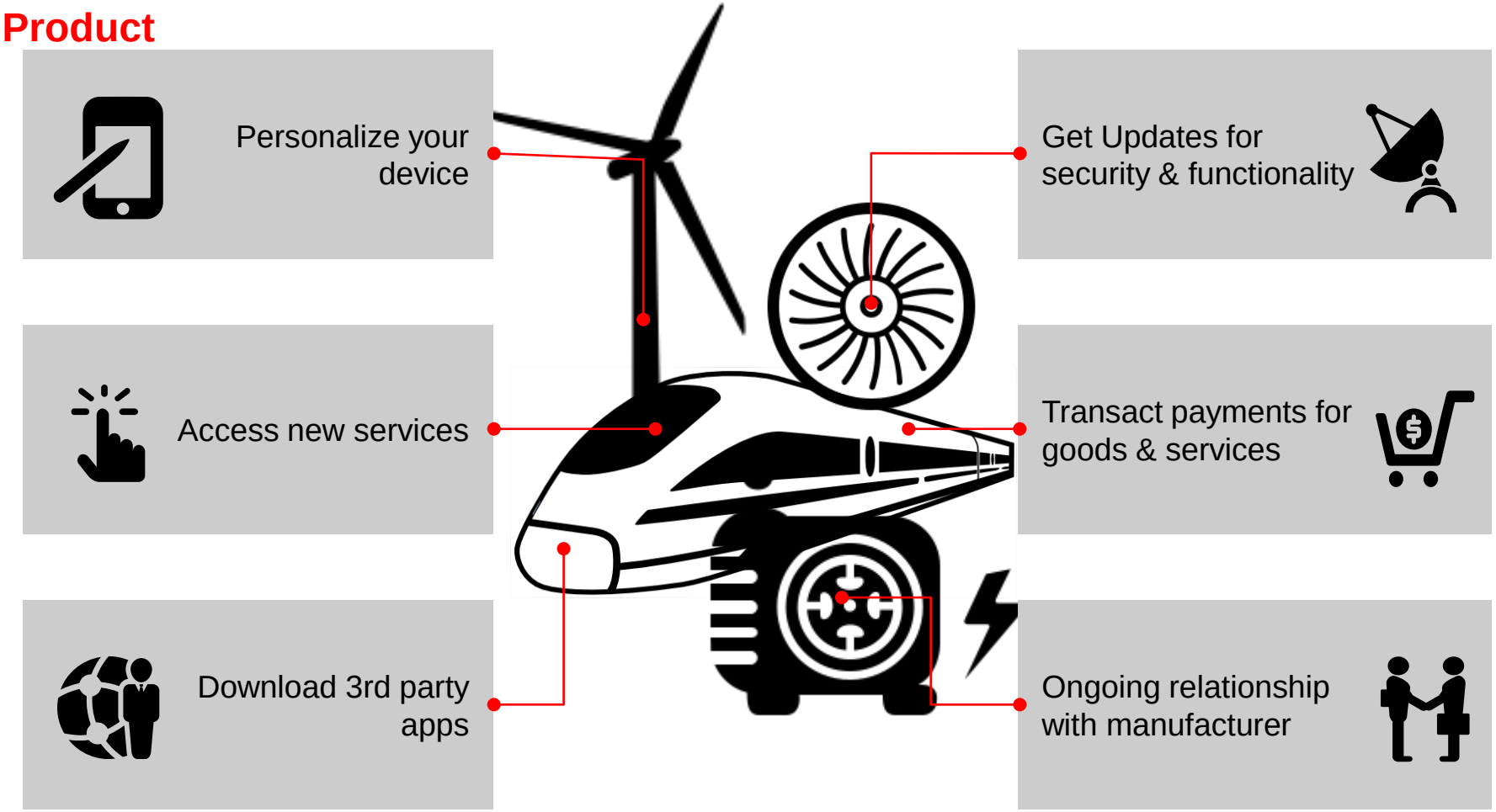
Mobile experiences have led the way …

Connected Product

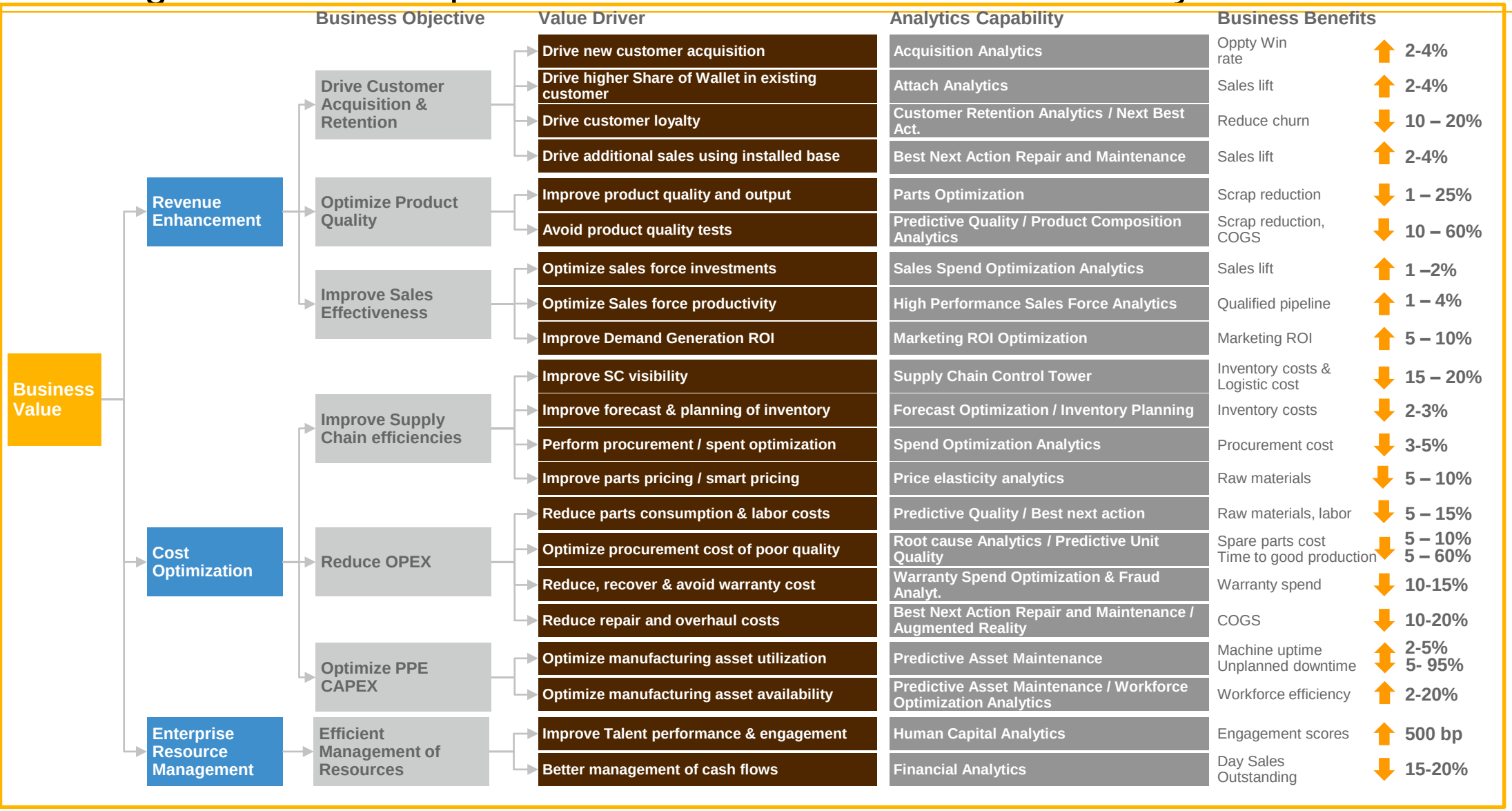


… but are just as relevant in other sectors

Connected Product



Driving value across specific business levers for PRD industry



Advanced Analytics may also drive additional revenue streams from new business modes as well as alliances, depending on the engagement context.

To exploit IoTS business transformation opportunities six core capabilities have to developed

IoTS Capabilities

Business Model

Monetize

Connectivity and intelligence built into industrial products to capture usage-based revenue, and create new service revenue from captured data.

Operating Model

Diagnose & Treat/Service

Sensor based monitoring of worker, environment, and industrial asset improves worker safety and extends asset lifecycle.

Access & Secure

Sensors & wearables enhance physical safety & identity management, while our IIoT Security Offering enhances the cyber security of industrial assets.

Technology Model

Enable & Manage

Outfit existing equipment with sensors enables global visibility. Equip workers with wearable devices improves data access and collaboration in the field.

Find & Track

Use of real-time location data to track and coordinate interactions with workers and industrial equipment and tools.

Automate, Predict

Industrial analytics predict equipment and asset failure, and generates automated maintenance work orders.

What is the IoT?

Definition IoT – Internet of Things

Connecting

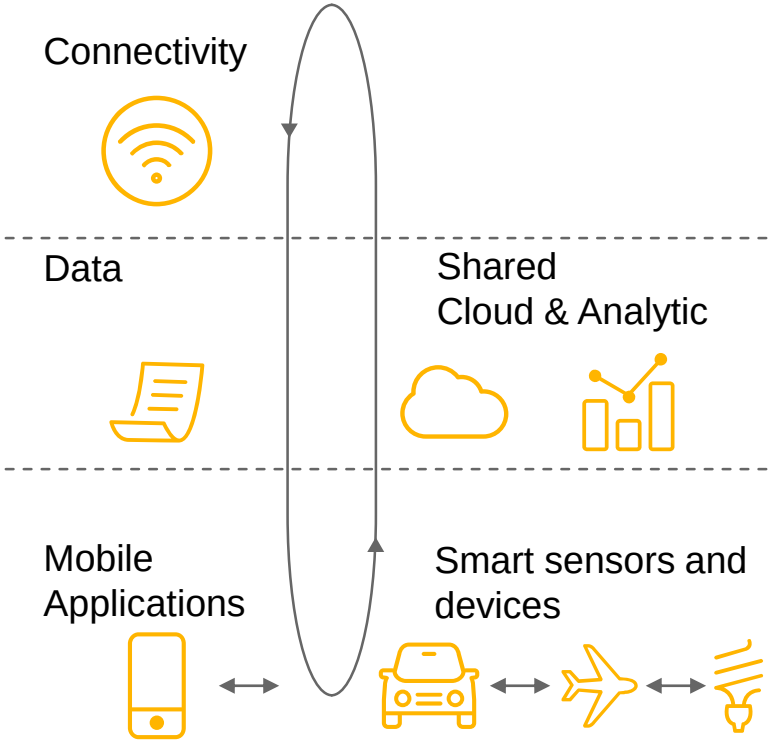
- Remote and local Controlling
- Indra Networks: Wireless, wire…

Computing

- Predicative & Cognitive Analytics
- Newest Technology
- Cloud based

Communicating

- M2M
- Ergonomic Human Machine Interfaces / Communication



New Business
New Digital Products and Services create new revenue

Operational Efficiency
Automation, flexible production, optimized and predictive maintenance

Example Daimler

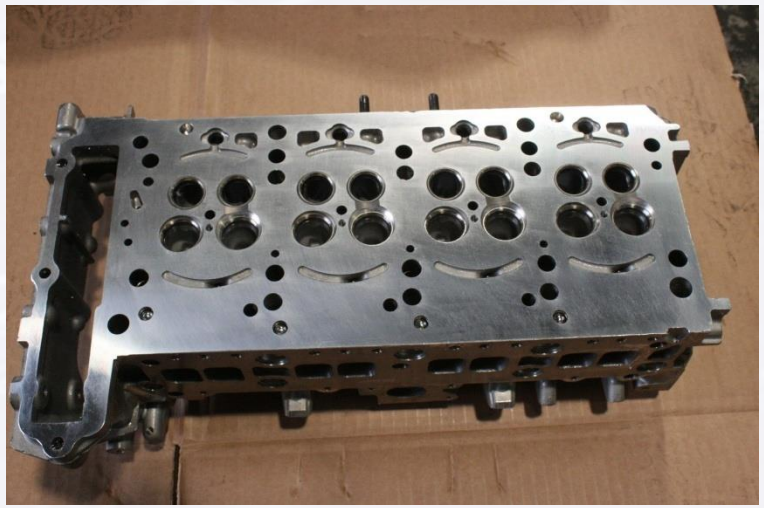
PTU – Predictive Analytics for Daimler Power Train

Objectives and Challenges in Detail

- High internal reject rate in cylinder head production (foundry)
- Unknown causes of these complex quality issues
- Significant reduction of rejects
- Reduction of run-up phase
- Complex quality issues
- Consideration of 632 processes and quality parameters
- Limited, circuitous, and time-consuming analysis options with Excel
- Outlook: Predict probability that component is rejected in order to minimize redundant work

What is a cylinder-head?

- The cylinder-head is a part of the motor in cars
- Must be very robust and perfectly fitting to prevent leaking of oil and water



Reducing failure by automated multivariate root cause analysis

Initial situation

- On average 3000 cylinder-heads a produced per day
- 500 variables are tracked at the quality managment process
- The later a quality problem is detected in the process, the higher are the costs

Predictve technologies

- Process optimization based on new findings about the failure pattern (root cause)
- Causes of erros are detected daily and can be solved the same day
- Responible operators get clear information about causes of errors
- Complex root cause are reported as simple multivariate if-then rules

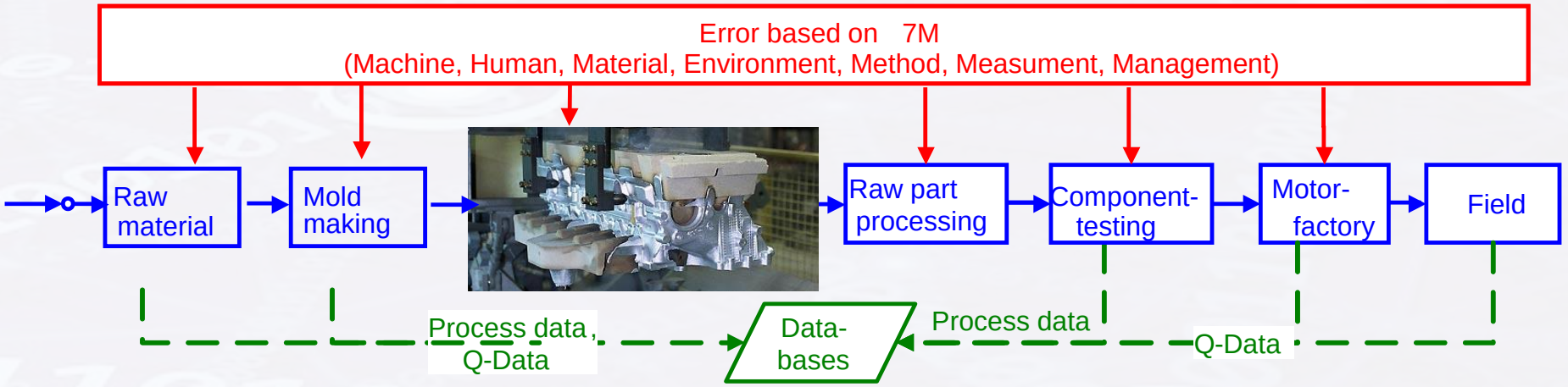
Results:

- ✓ 100% reduction of worktime for creating regular reporting 2*(3h/Day)
- ✓ 40% reduction for ad hoc analysis
- ✓ reduction of scrap rate from 9% to 1,5%
- ✓ Optimized maintenace for production equipment, reduced stand times of the factory
- ✓ 50% reduction of scrap rate during ramp up process of the factory
  25% increase of productivty of the cylinder-head production line
- ✓ reduction of the time to deploy a compliant and controled process by 3 years
  (based on 7-year-plan)
- ✓ ROI after 8 week

Assumptions of the project

- Data are only partly structured
- A not correct produced cylinder-head wastes time and money
- The faster reasons for production failures can be detected and solved, the faster and cheaper the production runs
- The earlier in the production process defective cylinder-heads can be located, the cheaper the following costs are
  - Example: If the measure of the sand mold does not fit, destroy the mold, cheaper 1 Euro, loss the complete cylinder-head means 500 Euro
- The responsible operators are neither statistical experts nor IT experts, they need easy to understand information about complex multivariate failure reasons
- The structured ongoing root cause analysis is optimizing the production process
  - Example: Even new facts about production rules were found, such as new optimized temperature curves during casting
- Measurement, quality, process and maintenance data in different databases
- Data can have various errors from processing
  - Example: Wrong optical tracked DMC, duplicates from post processing, sensor defects, etc
- Various data are collected, so it is highly manual work to run analysis

Conventional quality control loop



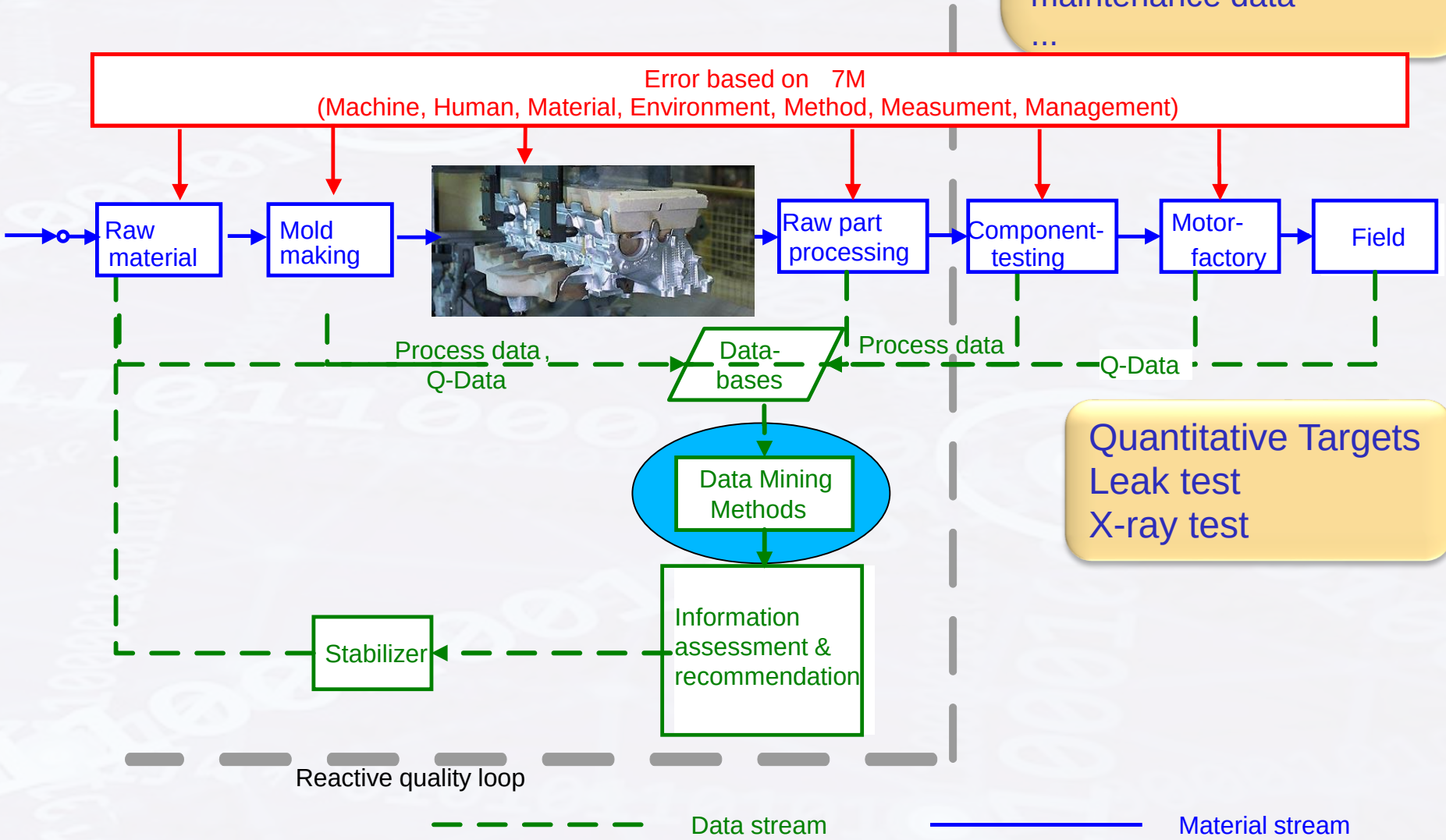
Search for causal realtions (cause ← → reaction) between measured command variable and input parameters that could be changed

data stream

material stream

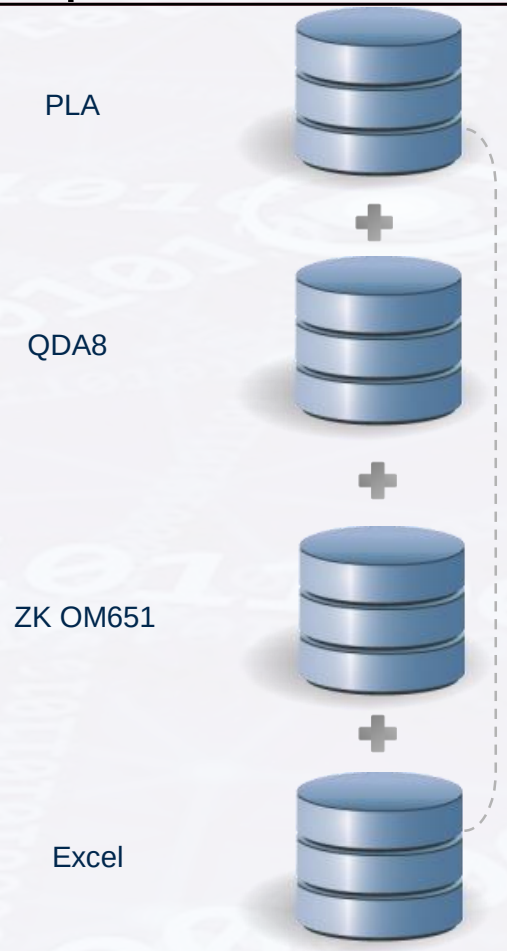
Reactive quality control loop

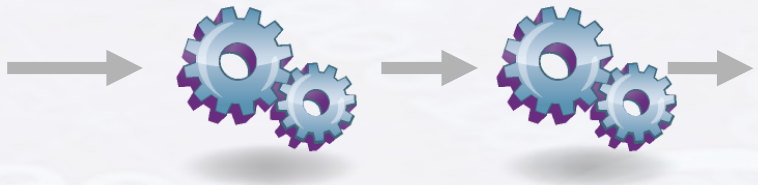
Input parameters
Material parameters
Temperatures
Proportions
Machine and mold maintenance data
...



Quantitative Targets
Leak test
X-ray test

Cylinder-head production





Automated ETL

Data must be checked being plausible

Data cleansing based on mistakes in tracking process, e.g. reading errors

Cylinder-heads could be N-times in production because of post-processing, that needs special strategies

Automated data analysis

Failure types must be detected and quantified

For the relevant failure types an automated root cause analysis detects the reasons

Automated reporting

The most relevant failure types and the failure reasons are reported to the responsible operators

"What failure types and reasons do we have and how often do they appear?"

Based on that information next best steps can be planed and maintenance can be prioritized

Key Values:

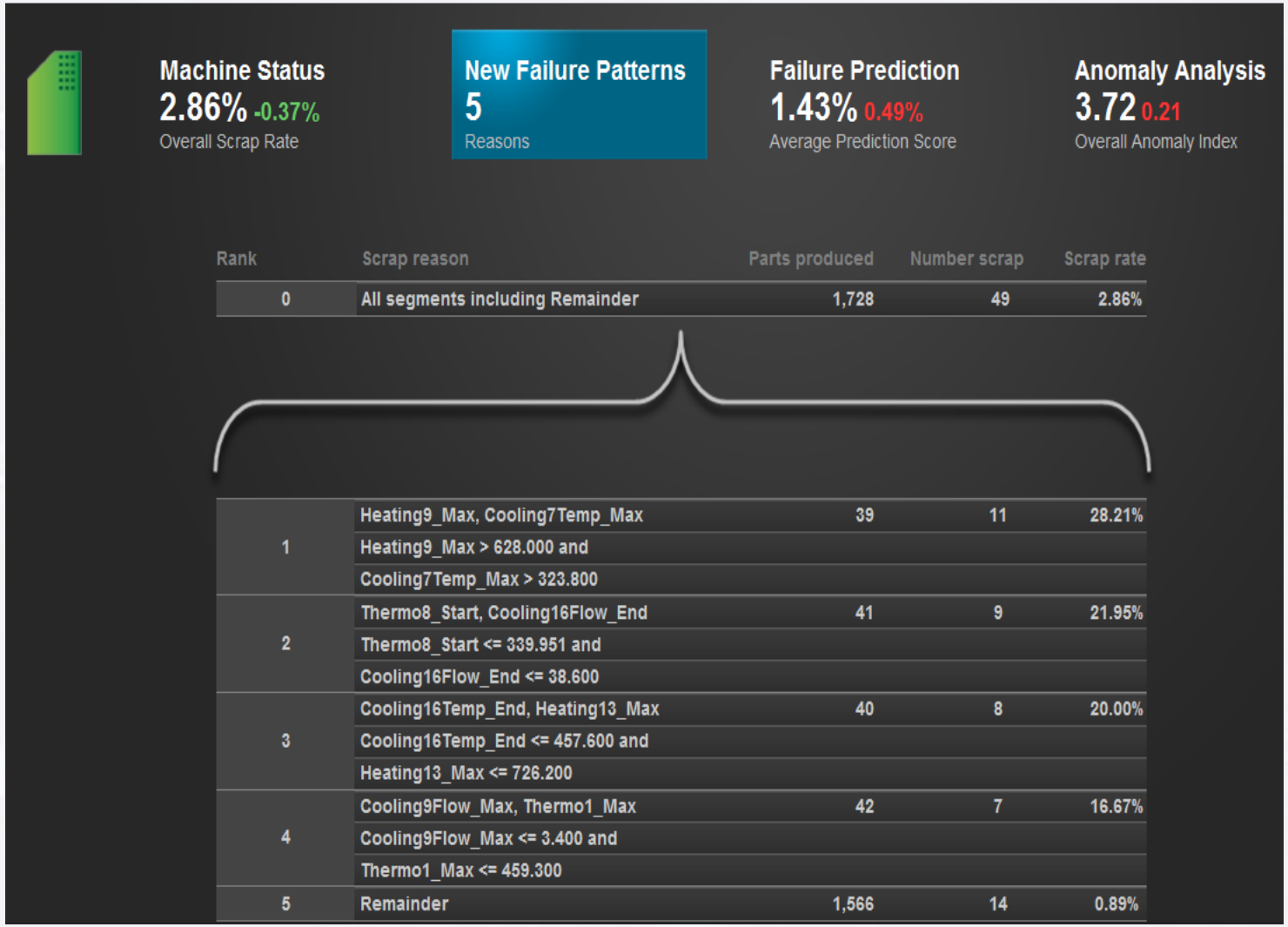
Reduced time to find the right key reasons for failures

Optimized process getting deep multivariate insights of failure patterns

Detecting the right failure reason combination (Root cause analysis)

Failure Diagnostics:

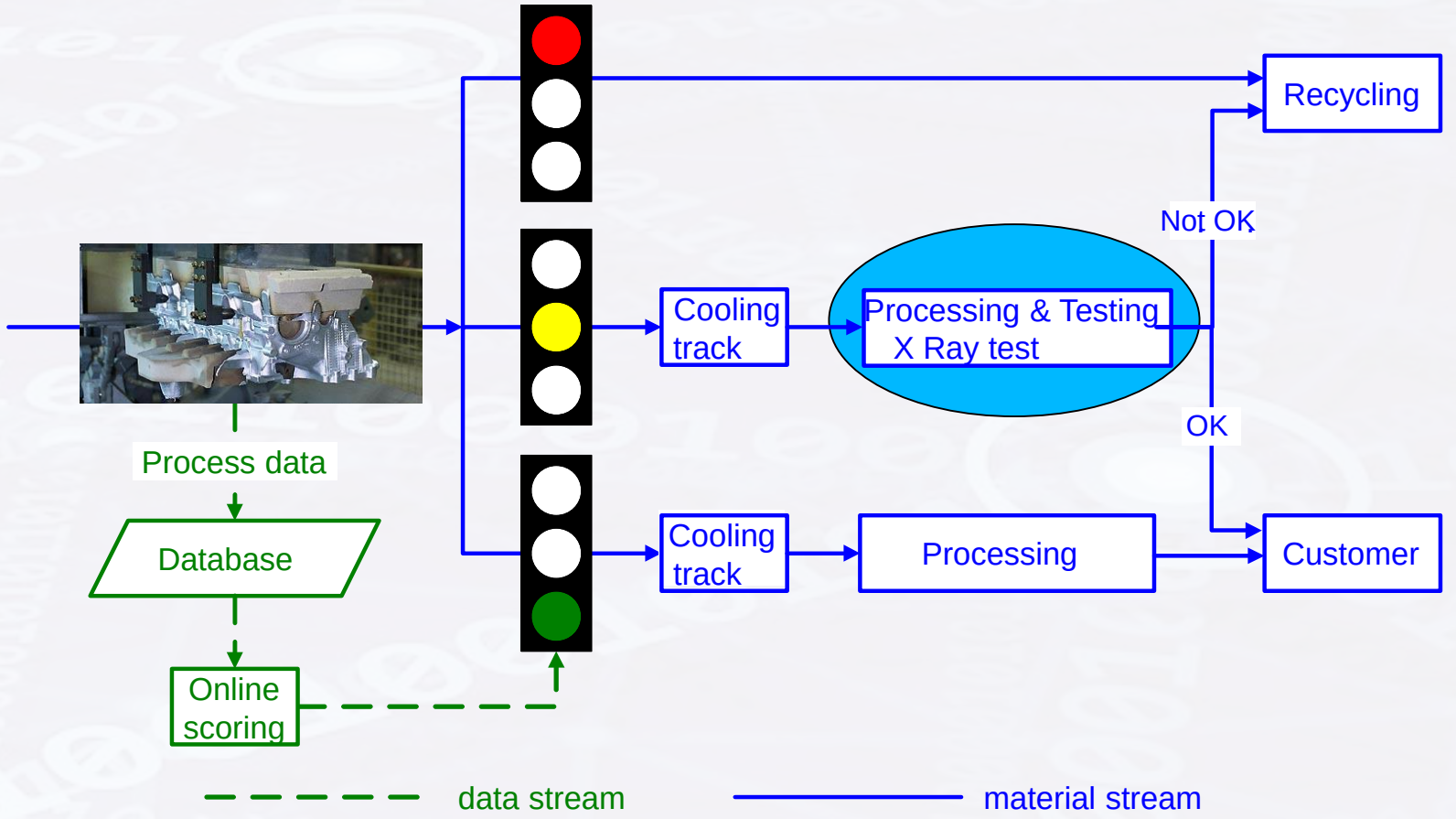
New failure patterns:



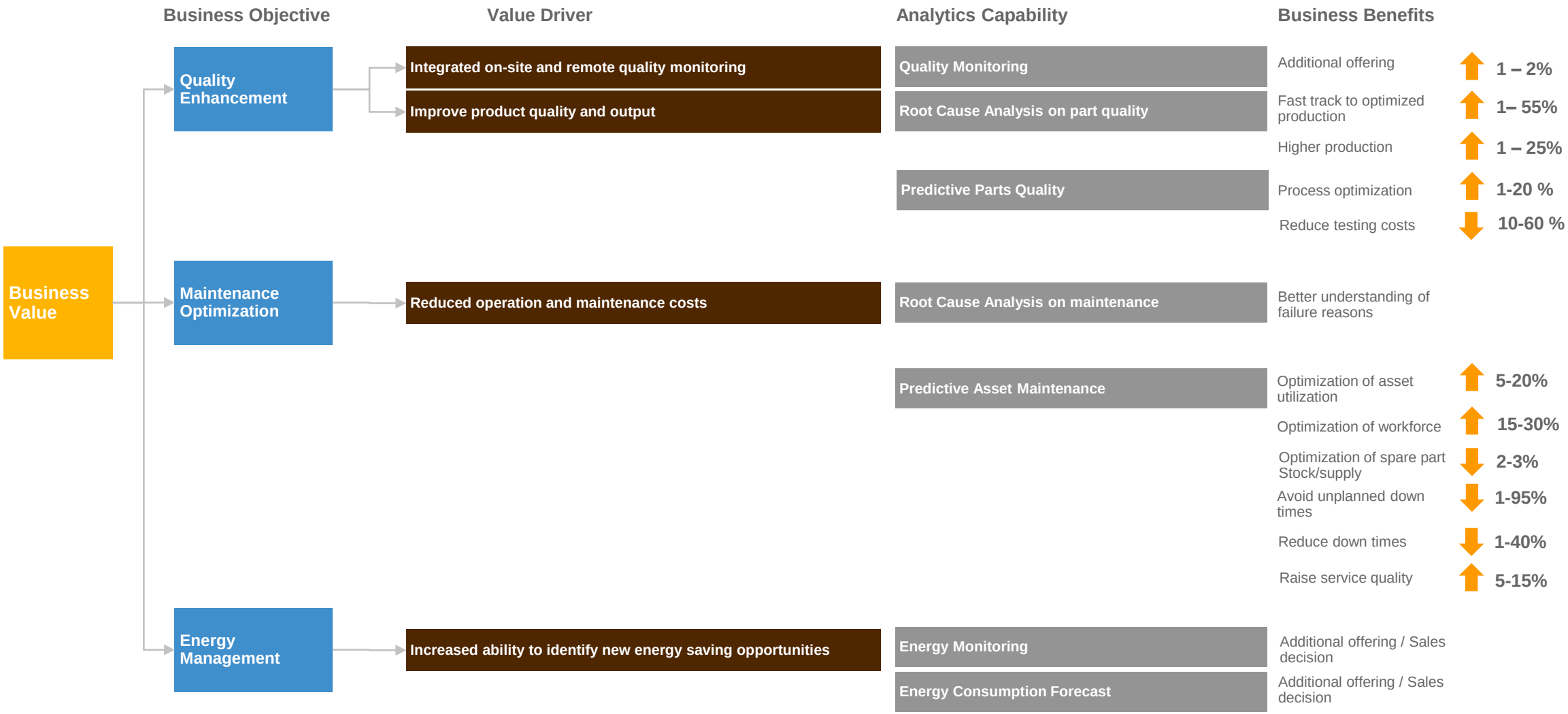
Rank	Scrap reason	Parts produced	Number scrap	Scrap rate
0	All segments including Remainder	1,728	49	2.86%
1	Heating9_Max, Cooling7Temp_Max Heating9_Max > 628.000 and Cooling7Temp_Max > 323.800	39	11	28.21%
2	Thermo8_Start, Cooling16Flow_End Thermo8_Start <= 339.951 and Cooling16Flow_End <= 38.600	41	9	21.95%
3	Cooling16Temp_End, Heating13_Max Cooling16Temp_End <= 457.600 and Heating13_Max <= 726.200	40	8	20.00%
4	Cooling9Flow_Max, Thermo1_Max Cooling9Flow_Max <= 3.400 and Thermo1_Max <= 459.300	42	7	16.67%
5	Remainder	1,566	14	0.89%

The next step:
Proactive dynamic testing – M2M – predictive quality

If the process is stable, then cost reduction by integrating predictive analytics in the production process can be done



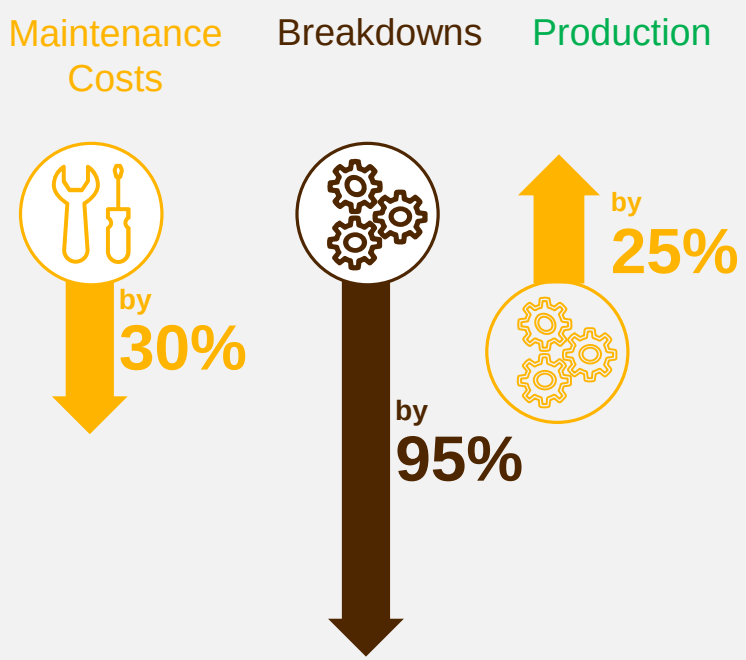
Analytical Value Tree on Machine 4.0

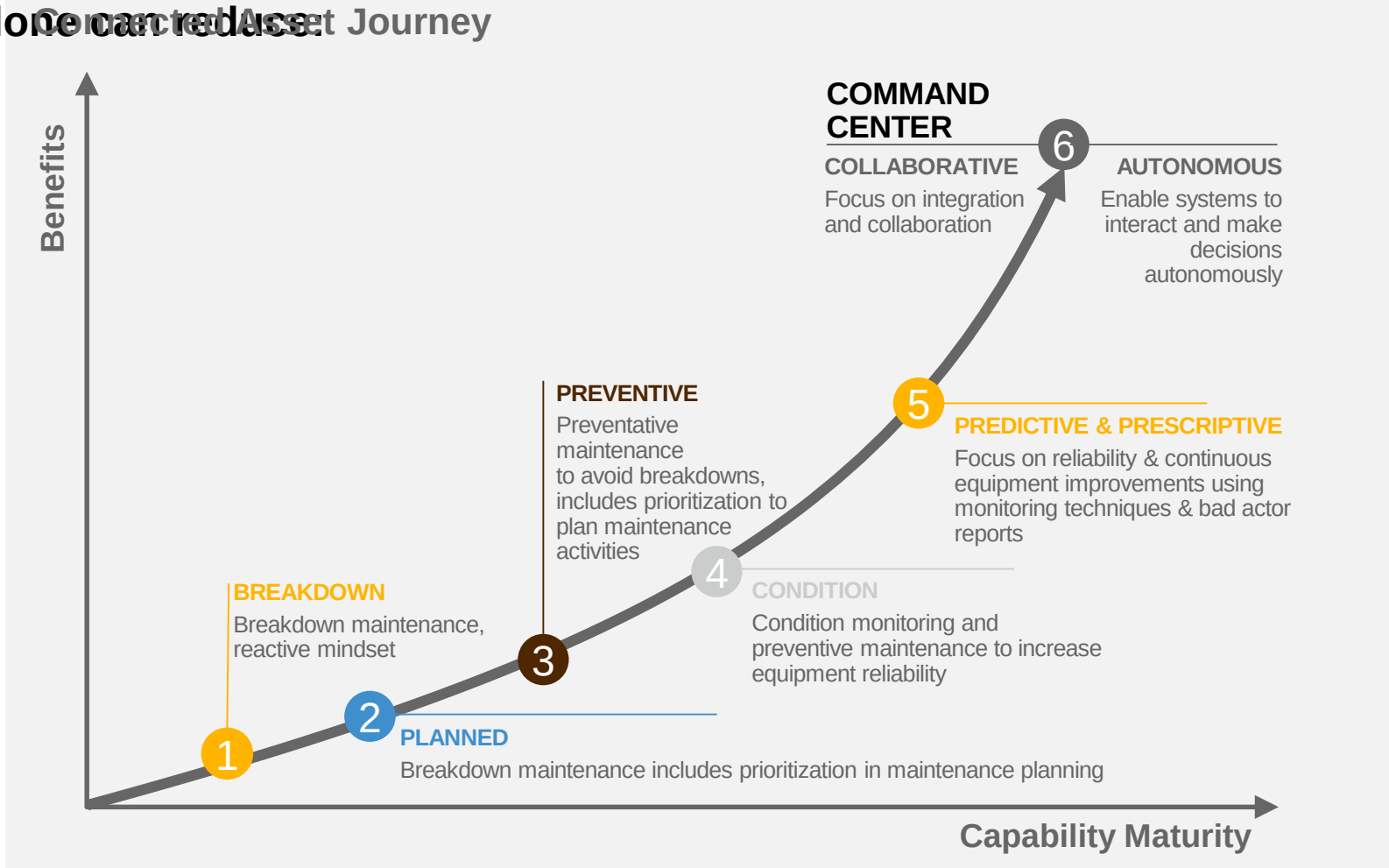


Connected & Predictive Asset Maintenance (CAM) – an Evolution of Asset Management and Process Quality

CAM services focus on the evolution of optimum asset and operational performance

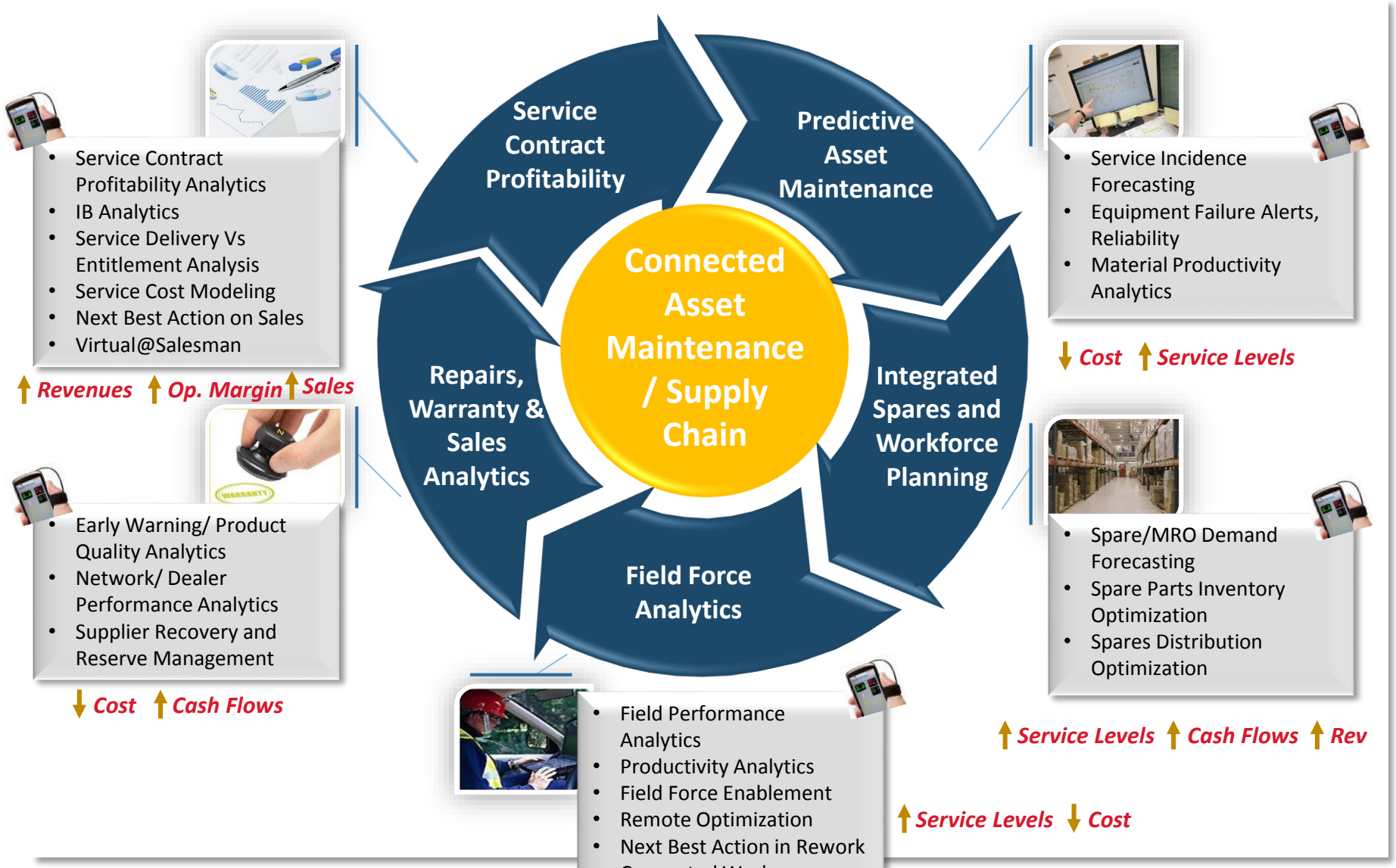
one can reduce:





IoT Trends

IoT Solutions are started small and have to be ready to grow



Most Companies are still in defend and learn to differentiate

… in a time of liquid customer expectations and liquid opportunities

Industrial IoT adds incremental value in the near term but becomes transformative over the long-term

Beyond Product Transformation

Immediate to near term

Longer term

Operational Efficiency

- Asset utilization
- Operational cost reduction
- Improvement worker productivity, safety and working conditions

New Product & Services

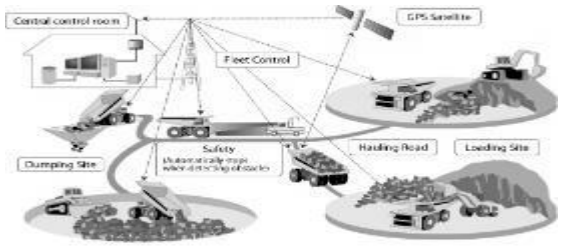
- New business models
- Pay per use
- Software based services
- Product / Service hybrids
- Data monetization

Outcome-based Economy

- Pay per outcome
- New connected ecosystems
- Platform-enabled marketplace
- Industry blur

Autonomous Pull Economy

- Continuous demand-sensing
- End to end automation
- Resource optimization & waste reduction

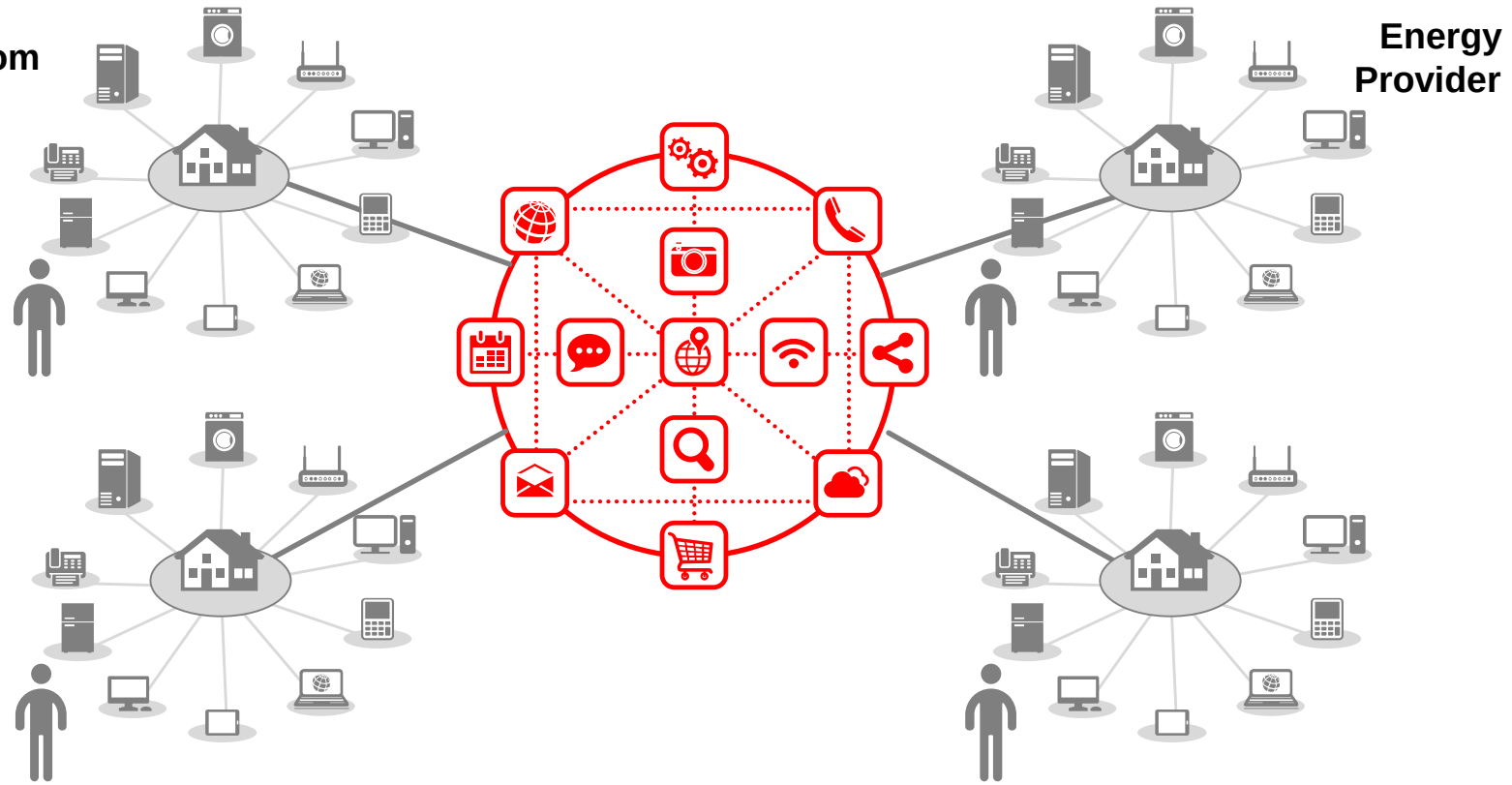


From Product to Service Outcome Pull

Connected world enables new ecosystems across industries faster than ever before

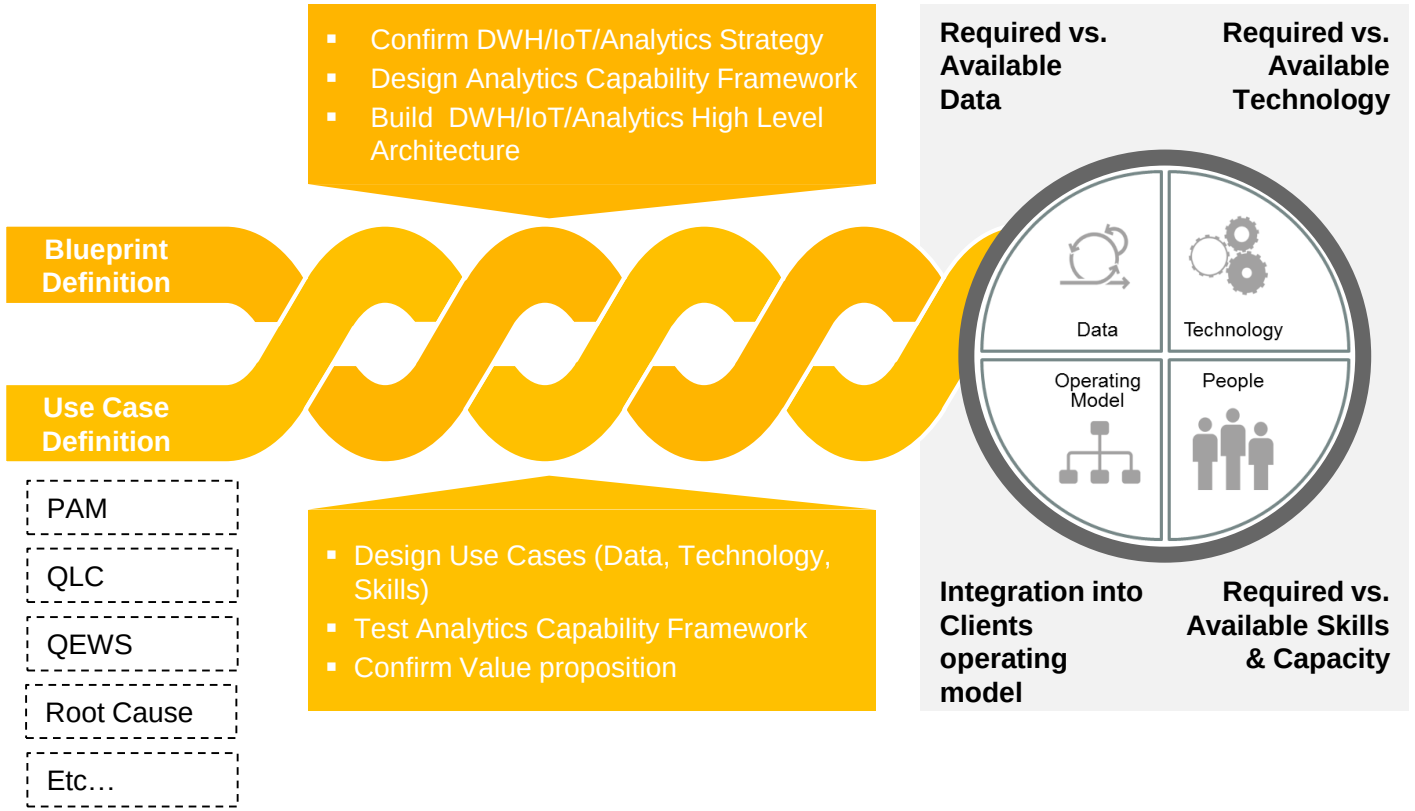
Interconnected Platform of Platform

- Cloud
- Liquid projects
- New technologies
- Security
- Privacy
- Open Source
- Governance
- Operating Models
- Data Monetization
- Analytics



Governance and IT concepts are close connected in the IoT development

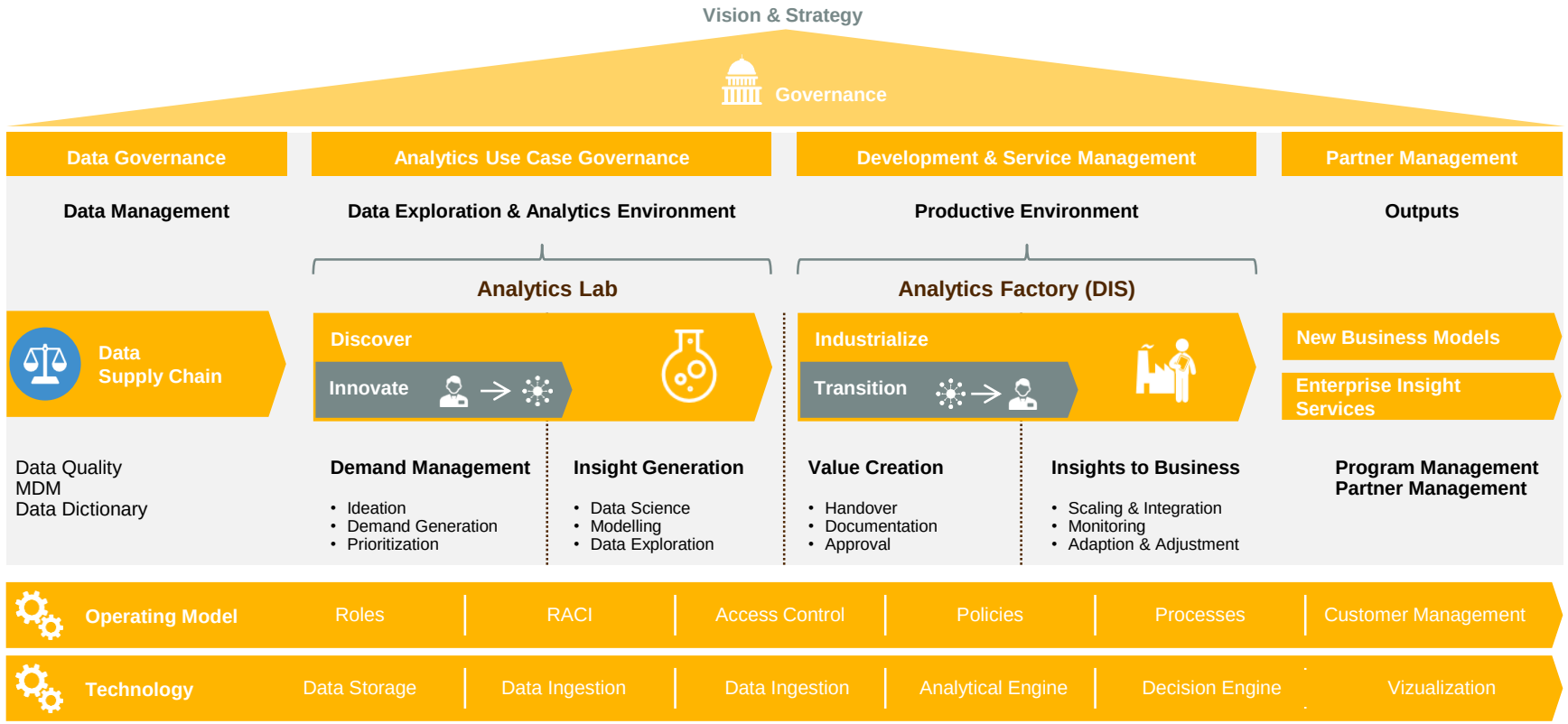
Trend to application engineering



Reference Model

Companies need to address aspects around data management, technology, operating model and governance

Data value chain from data ingestion to business value



Thank you!

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