

## Unlocking the digital opportunity in metals



**Industrial digital transformation  
that's grounded in the real world**  
A playbook for digitalization at scale

# Metals 2040



# The Digital Vortex is gaining speed - disruption to become new constant

### Age of Platforms:

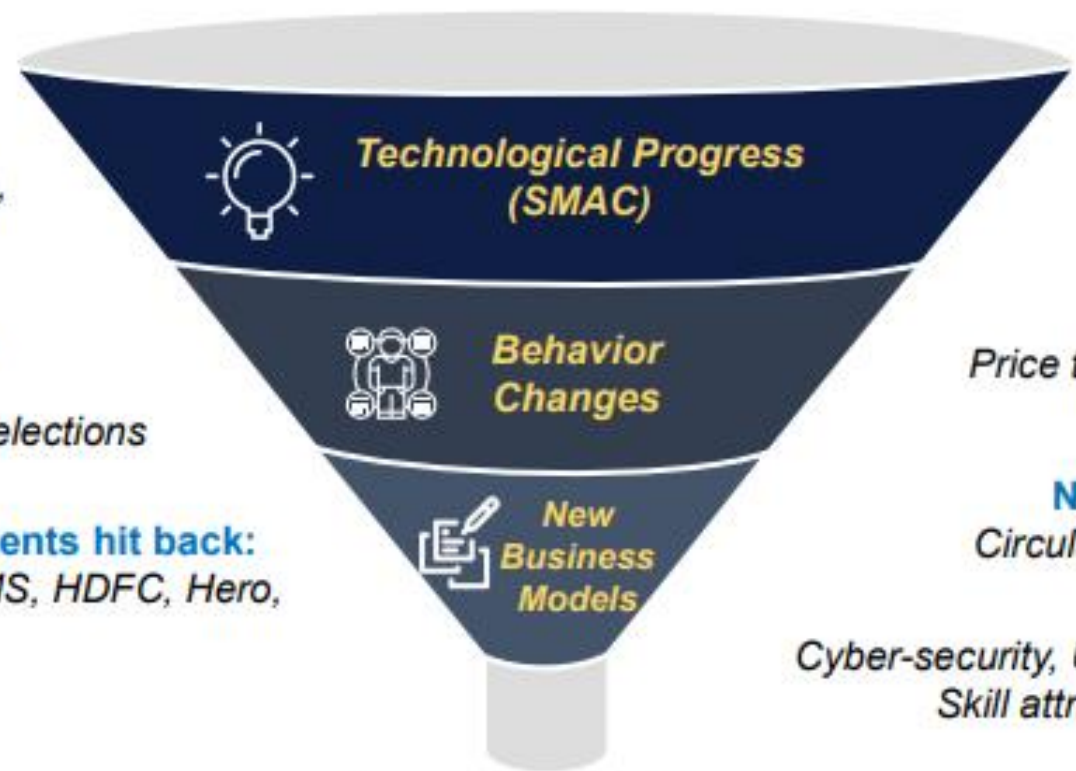
Android / iOS, FB / Whatapp, Uber / Airbnb, Netflix

### Black Swan events:

Brexit, Trump win, Demonetization, UP elections

### A few Incumbents hit back:

GE, CISCO, MS, HDFC, Hero, Apple, TSL?



### Sci-Fi tech democratized:

LiFi, Autonomous cars, AI digital assistants, Neuralink

### Hyper-competition:

Price transparency, Ubiquitous reach, WoM, Social Search

### Newer ways of doing things:

Circular economy, Crowd-economy

### And bigger Risks:

Cyber-security, Unemployment Armageddon, Skill attrition, Digital detox, Post-truth

**Winner takes it all!**

CURIOSITY

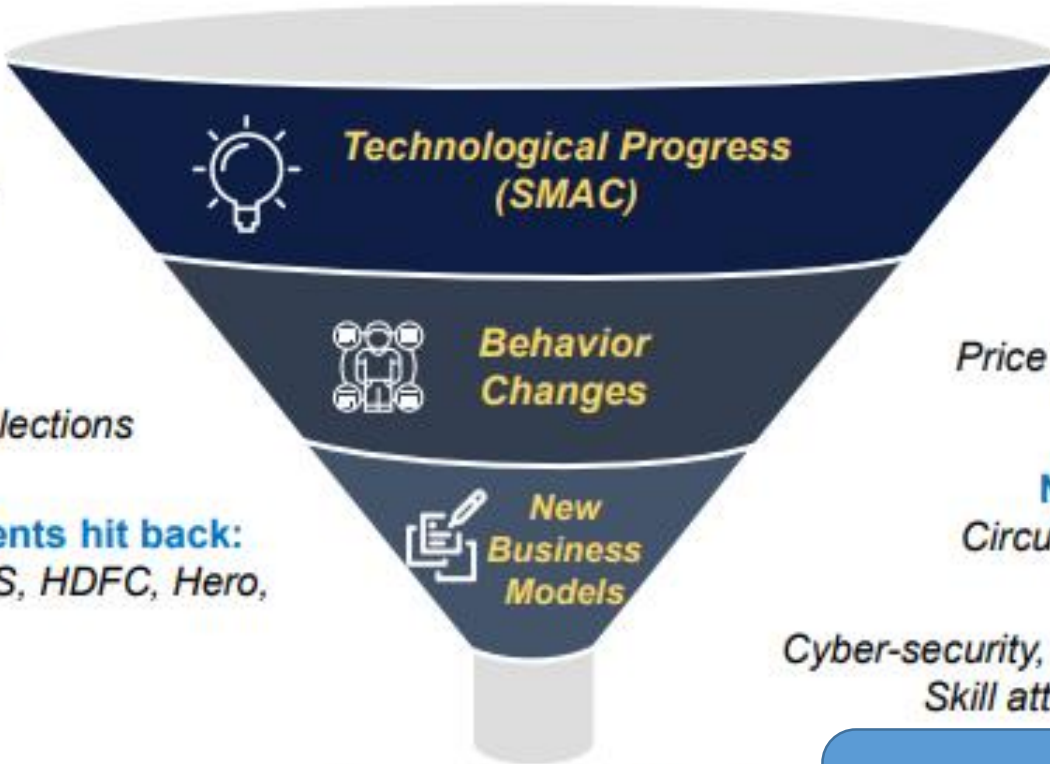
COLLABORATION

CURATION





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**Technological Progress (SMAC)**



**Behavior Changes**



**New Business Models**

**Winner takes it all!**

CURIOSITY

COLLABORATION

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Estudios, informes sobre implementación de TD disponibles en internet

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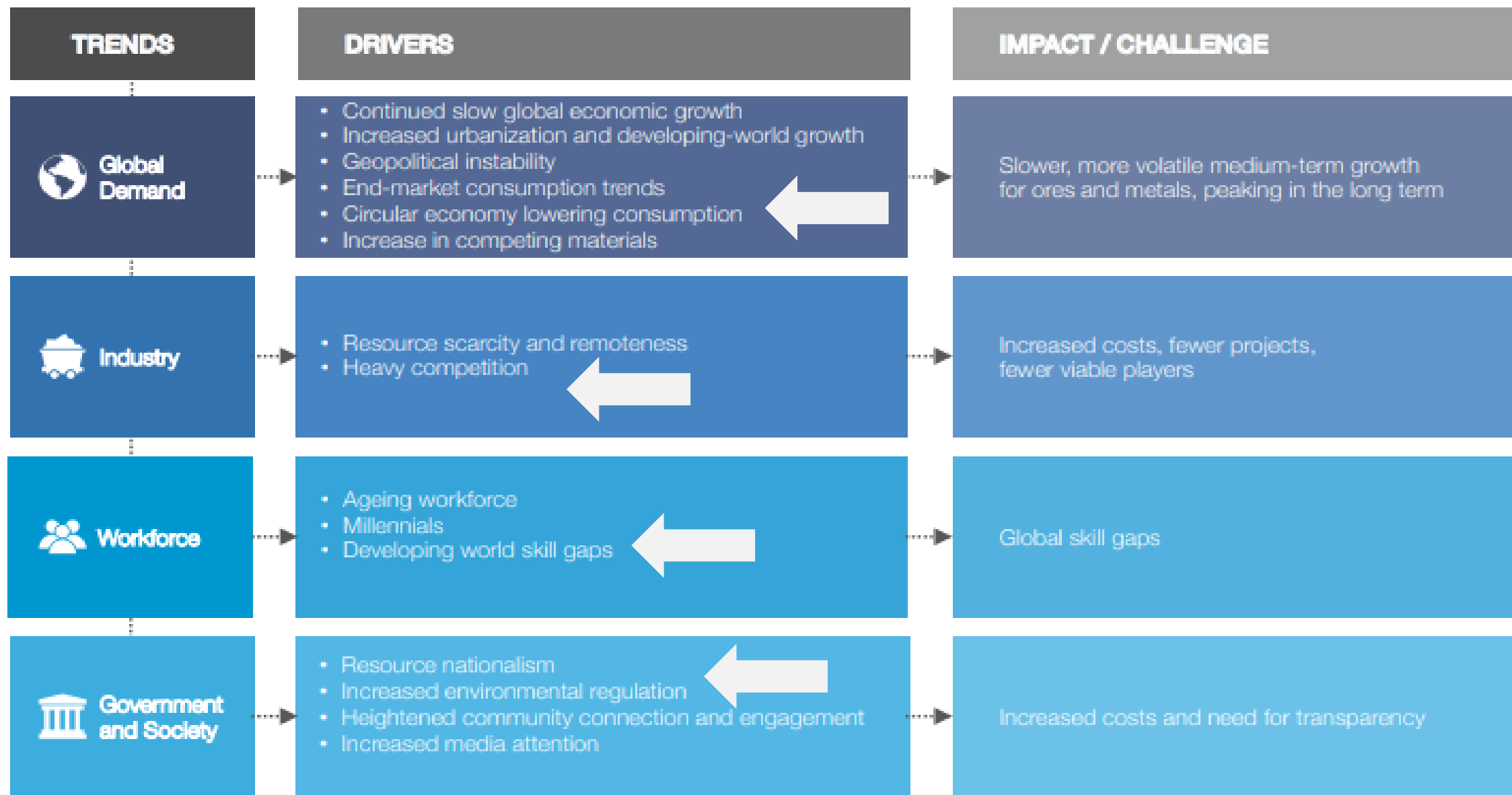
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Hiper Urbanización

Cambios comportamientos en ciudades

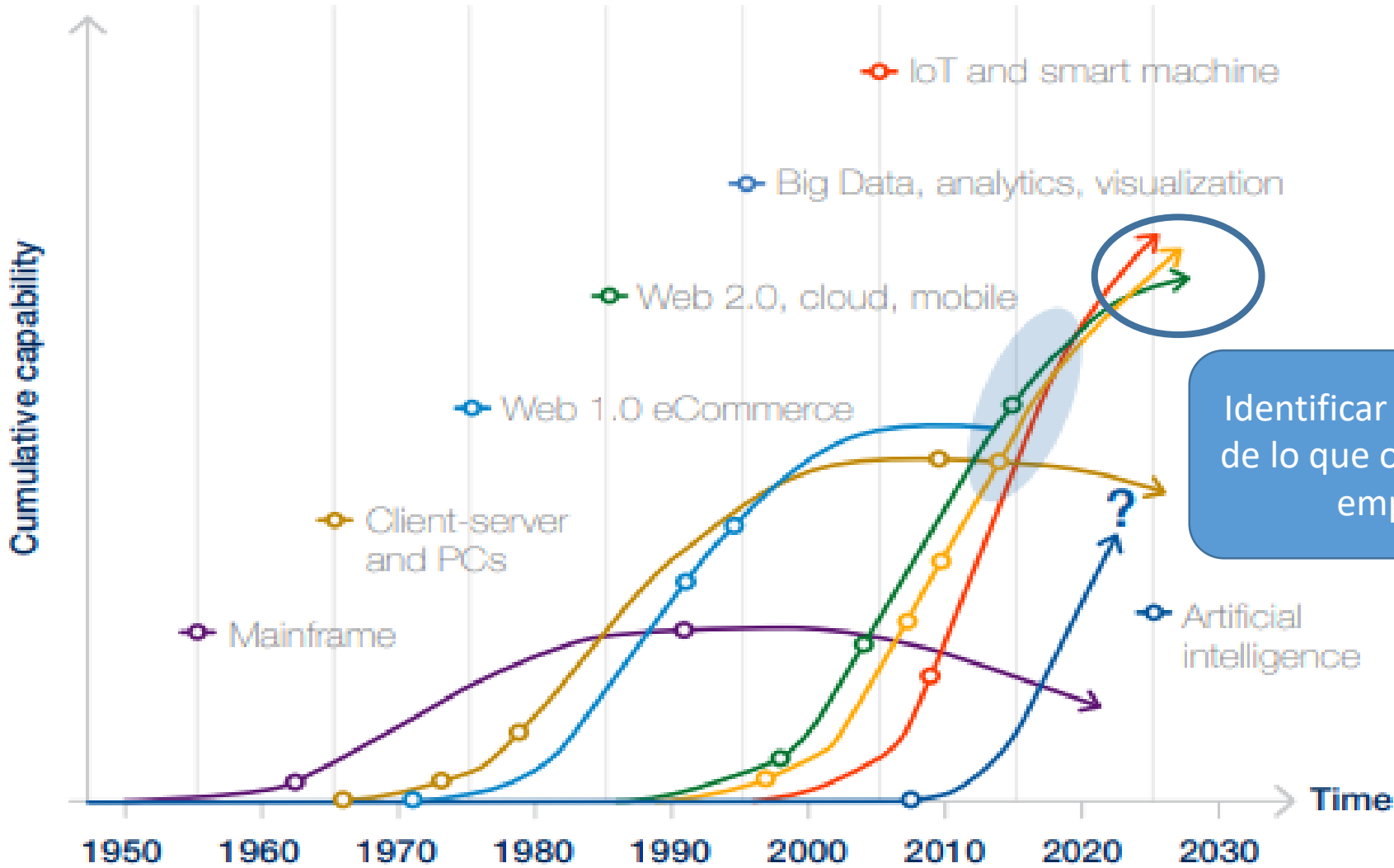
Incremento estándares EH&S





Source: World Economic Forum/Accenture analysis

# Increasing Capability of Digital Technologies



Identificar el escenario de lo que ocurrirá en la empresa

## Digital Themes and Initiatives in Mining and Metals

### Themes



**Automation, Robotics and Operational Hardware**



**Digitally Enabled Workforce**



**Integrated Enterprise, Platforms and Ecosystems**



**Next-Generation Analytics and Decision Support**

### Initiatives

Autonomous Operations and Robotics

3D Printing

Smart Sensors

Connected Worker

Remote Operations Centre

IT/OT Convergence

Asset Cybersecurity

Integrated Sourcing, Data Exchange, Commerce

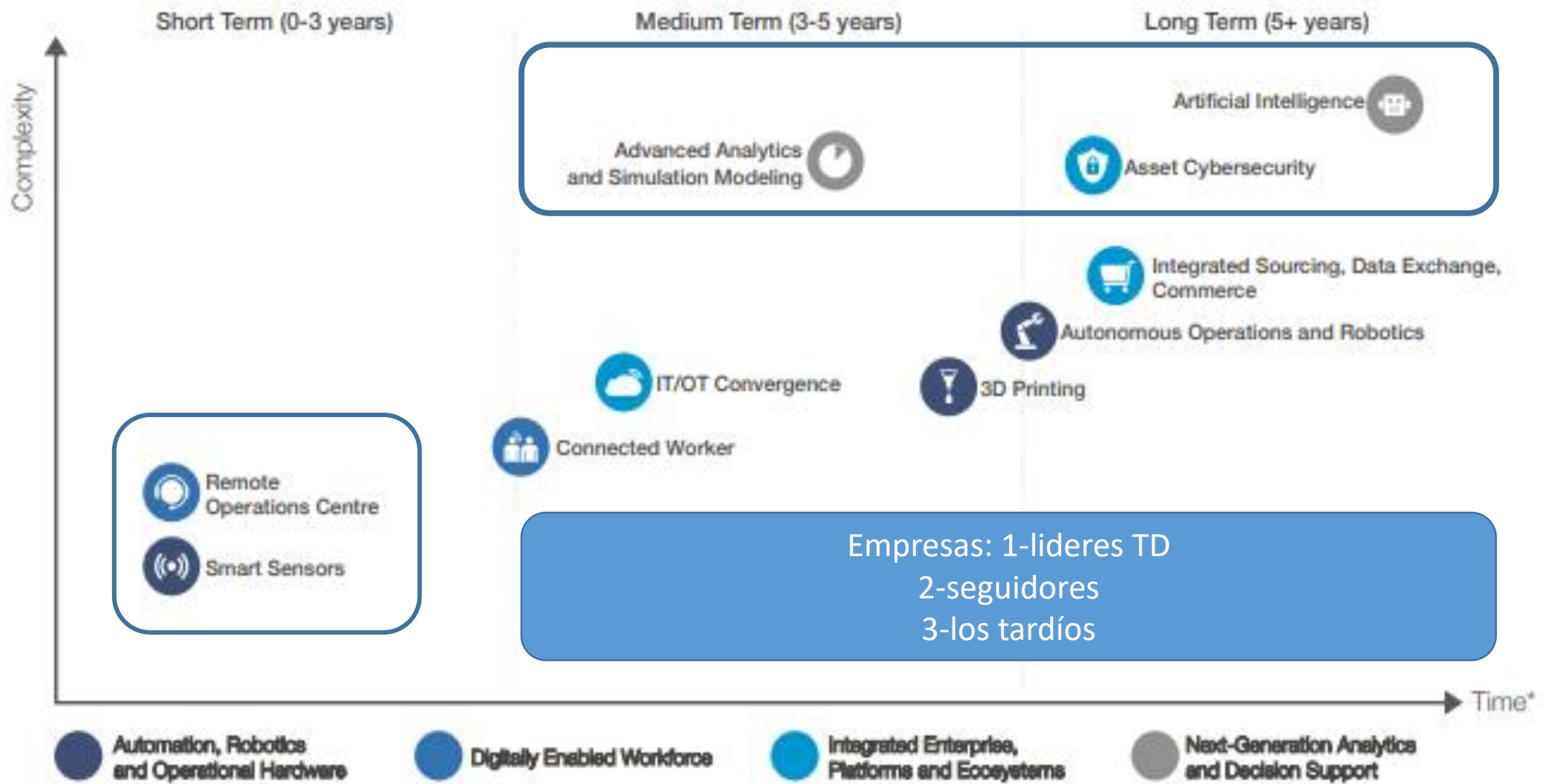
Advanced Analytics and Simulation Modelling

Artificial Intelligence

Construcción de habilidades, destrezas y conocimientos





El gran sueño vs el gran hermano

**Figure 8: Time and Complexity for Digital Initiatives to Reach Scale**



\*Time indicates technology maturity and industry-wide adoption

Figure 9: Digital Maturity Archetypes in the Mining and Metals Industry

	Business as Usual	Fast Followers	Digital First Movers
 <p><b>Automation, Robotics and Operational Hardware</b></p>	<ul style="list-style-type: none"> <li>Traditional disconnected sensors at site level</li> <li>Heavy human involvement combined with automated mechanization in select process steps</li> </ul>	<ul style="list-style-type: none"> <li>Smart sensors within departments</li> <li>Selected processes are automated, with experiments in areas such as autonomous robotics / drones</li> <li>3D printing under consideration</li> </ul>	<ul style="list-style-type: none"> <li>Integrated enterprise-level smart sensors</li> <li>Integrated automation across sections of value chain, while using robotics / drones in operations</li> <li>Experimenting with 3D printing for production / operations and evaluating potential downstream disruptions</li> </ul>
 <p><b>Digitally Enabled Workforce</b></p>	<ul style="list-style-type: none"> <li>Little or no use of connected devices to support day-to-day workforce jobs</li> <li>Low worker awareness and willingness to leverage mobile and other digital technologies</li> </ul>	<ul style="list-style-type: none"> <li>Using mobile technology in selected applications</li> <li>Using near or on-site connected operating centres</li> <li>Employees aware and trained at basic level on how to use digital technologies</li> </ul>	<ul style="list-style-type: none"> <li>Integrated mobile technology with remote operating centres, providing real-time information, both push and pull</li> <li>Digitally native workforce is well trained in and actively using technology. Empowered to trial new opportunities for digital</li> </ul>
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Reestructurar la industria:  
 1-consolidación ( hoy hay dispersión TD)  
 2-desintermediación  
 3-integración vertical  
 4-entrada de nueva competencia con nuevos modelos  
 5-nuevos modelos de negocio

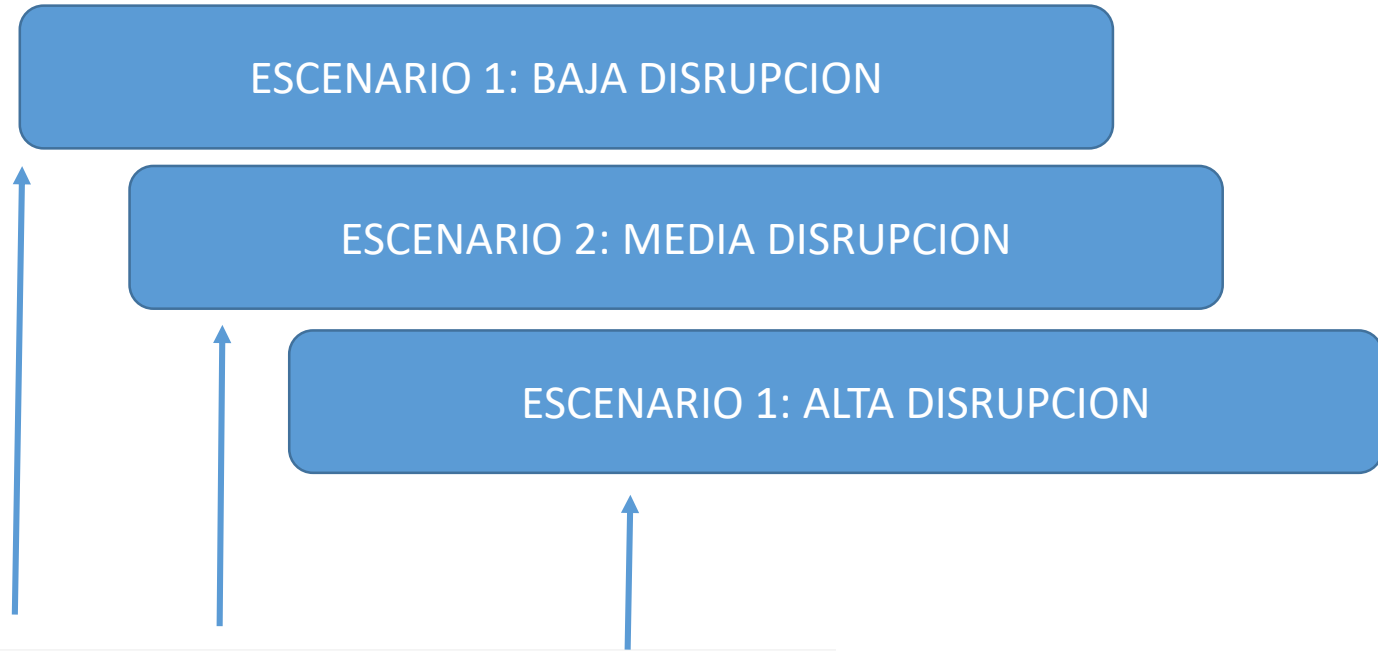






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The challenges of

# 2040



## Changes in supply

Scarcity and tightening of trade borders mean access to raw materials, energy, and water can pose a serious challenge for the metal producers of tomorrow

EVOLUCION DE MATERIAS PRIMAS-  
METODS DE PRODUCCION  
MATENIMIENTO PREDICTIVO  
MANUFACTURA ADITIVA  
ENERGIA RENOVABLES  
MATERIALES INTELIGENTES



## Competition for talent

An increasingly digitalised world means new skillsets are required from employees. Companies need to invest in development of smart factories and sustainable products and processes in order to attract talented employees.

DIGITALIZACION  
QUE ORIENTA LOS  
TRABAJO



## Emissions

With global pressure to lower CO2 emissions, all organizations must adapt to changing environmental standards - especially industries with large impacts on the environment.



## Changes in demand

Rapid urbanisation will be a defining trend in terms of consumption, affecting not only infrastructure but also trends in consumer habits and culture.

PLANTAS QUE OPERAN EN  
CIUDADES

CRECIMIENTO URBANO-PAIS  
TRANSPORTE AUTONOMO

DIGITALIZACION  
QUE ORIENTA LOS  
TRABAJO

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TRANSPORTE AUTONOMO

# How will the future metals plant succeed?

90%

## Scrap metal as primary source of production

Due to trends of protectionism, raw material scarcity in regions like Europe will require companies to adjust their operations to use resources available. Furthermore, scrap metal production methods produce significantly less carbon dioxide emissions when comparing to traditional manufacturing methods.

Within the plant...

10%

## Iron ore from mines

Not all steel companies will have transitioned from iron ore pellets. With scrap a primary source for raw materials, raw iron ore pellets processed with environmentally-friendly and sustainable methods will be a necessity to cover for inadequacies in scrap resources.

## Autonomous material transportation and production

Scrap metals and iron ore pellets will be transported utilising autonomous vehicles such as trucks, sea freight, and rail. The logistics operations will be managed semi-autonomously, as

## Within the plant...

### Digitalisation and data-integration

With rapid digitalisation in the metals industry, the organisation must be able to manage a vast amount of data collected throughout the entire production process and ecosystem surrounding the plant. Integrating collaborative data management into the metals production cycle is imperative in managing production cycles, shipments, resource management, and maintenance of equipment and machinery in order to develop a streamlined production process.



### Automation

Due to the exponential improvements in automation and the vast amounts of data collected, human interaction to these processes is mainly limited to maintenance, process development and attention to special, unpredicted situations.



### Sustainable energy sources

In principle, steelmaking will have similar processes in place in the year 2040 as it has today, with the utilisation of more efficient and powerful electric arc furnaces. A key difference in the process will be the energy input for the furnace, as renewable energy will be the primary source of energy by the year 2040, especially in regions such as Europe.



### The urbanisation of plant operations

With exponential urbanisation and the increasing propensity for communities to adopt circular systems into urban areas, across the metals industry will have seized the opportunity to build manufacturing facilities near urban areas.



Logistics operations will be managed semi-autonomously, as logistics managers will have the ability to supervise and control transport fleets from control rooms onsite.





### Digitally-driven employees

With the development and installations of wireless technologies in 5G, processes can be controlled remotely and supervised in real time.

### Smart materials

This means that the new trackability of smart materials will enable metal manufacturers to follow their products even after the sell, enabling them to more efficiently initiate recycling of a high percentage of their manufactured material

smart materials will be able to communicate their attributes directly to the ma-



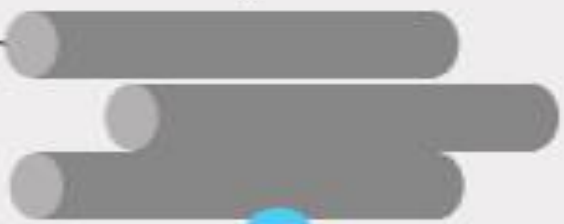
### Hydrogen-based steel production

The introduction of hydrogen-based steel production will be a major breakthrough in developing CO2-free steel production. The process radically changes the reduction process as it replaces the use of coke from coal to hydrogen gas - resulting in an offset of water instead of carbon dioxide.



### Predictive maintenance using artificial intelligence

Onsite or offsite, maintenance can be assisted digitally from start to finish. For example, employees can receive real time assistance and guidance employing augmented reality and digitally connected tools. It can also be scheduled according to the production schedules onsite, reducing lag time and delays. Data collected on processes will be used for improvements automatically.





smart materials will be able to communicate their attributes directly to the machinery in the supplying plant, as well as in the processing steps of the customer. This enables a lean production set-up, requiring less manual configurations. In turn, the data generated during the processing can be utilized to further optimize production processes on a continuous basis.

It can also be scheduled according to the production schedules onsite, reducing lag time and delays. Data collected on processes will be used for improvements automatically.

## The sales process

With adaptations to accommodate recycling and reuse, manufacturing companies are able to benefit from community-wide recycling efforts for their operations

## Secondary production

The progress of automated processes in the metals industry will also take an impact on the sales processes. Metal plants will operate solely on made to order basis, utilizing automated order processes enabled through interconnected ERP systems. Machine learning enabled demand forecast will speed up the reaction time of metal plants significantly.



## End consumer

By saving and generating data, smart materials will simplify the after-sales process, as the customer can receive all needed data directly from their purchased products.



## Digital Evolution & Automation

- Real time productivity & utilisation monitoring system.
- Remote Monitoring solutions  
Intelligent Transport Control System
- Worker Safety and Traceability Solutions

- Vision based furnace monitoring system
- Process and Advanced Control Systems.
- Presence of Cyber Physical Systems and Digital Twins
- Predictive Quality Analytics
- Coke Oven Scheduling and Heat Monitoring

01

Raw Materials

02

Iron Making

03

Steel Making & Casting

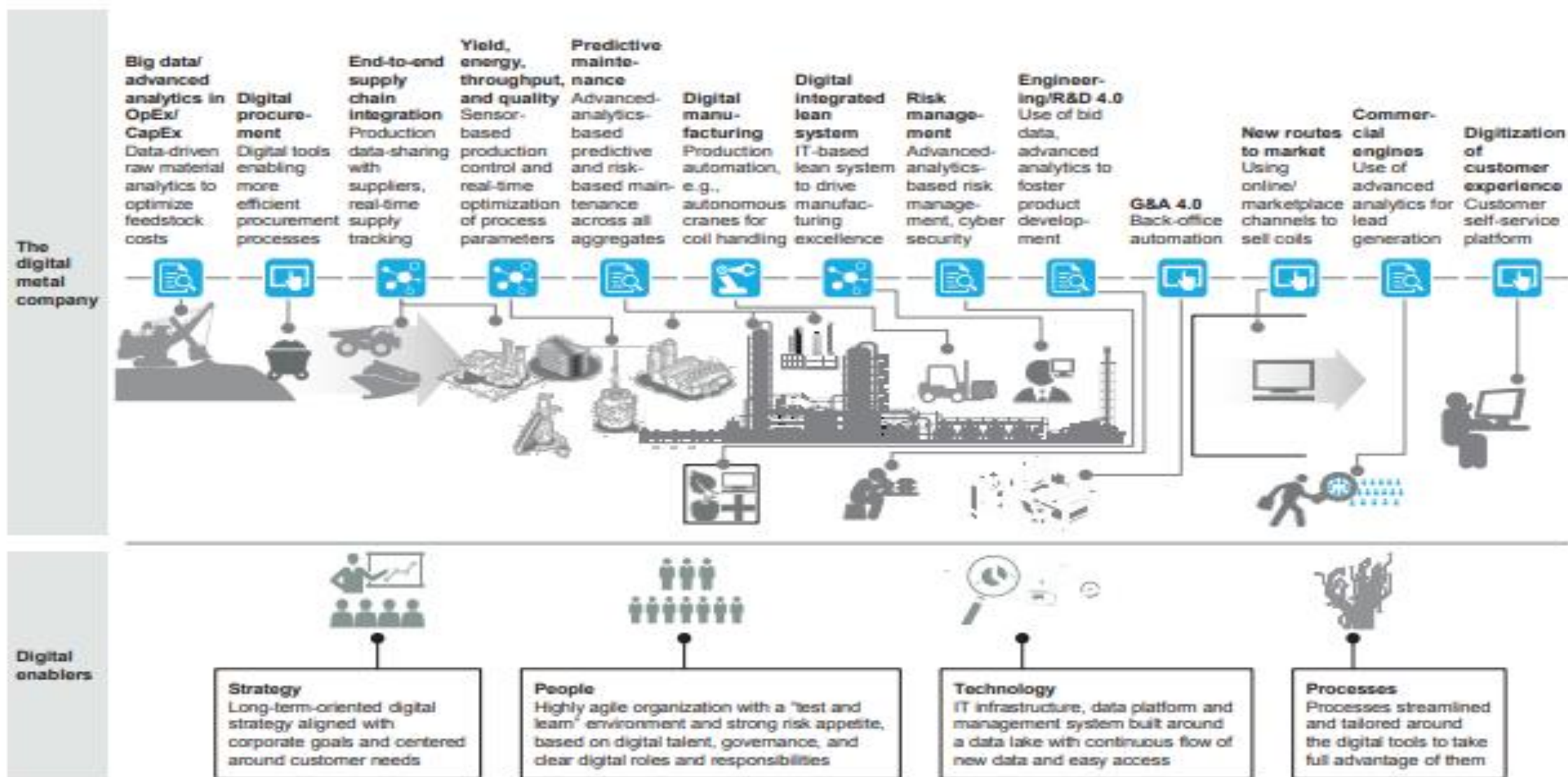
04

Rolling & Finishing

- Dynamic production scheduling and conditional monitoring
- Use of MES and HMIs, advanced control systems.
- RCM solutions
- Slag Monitoring and Detection Systems
- Casting Diagnostics
- Torpedo Ladle Management system

- Online surface quality assessment and width measurement
- Integrated data analytics to identify impact of melt-shop parameters and alloy addition on casting defects
- APC solutions for reheating furnaces and quality control
- Dehole-hole detection

# Digital will change metal players' full value chain





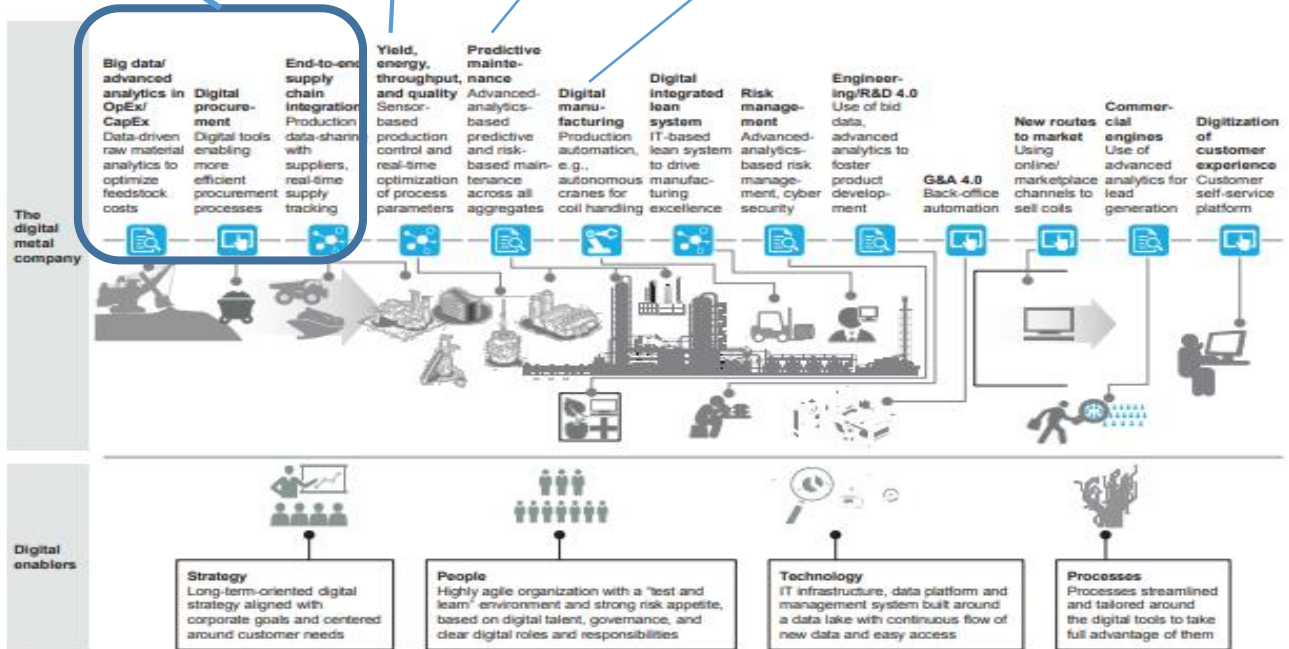
-Analítica de materia prima  
-Abastecimiento deficiente  
-integración de producción y abastecimiento

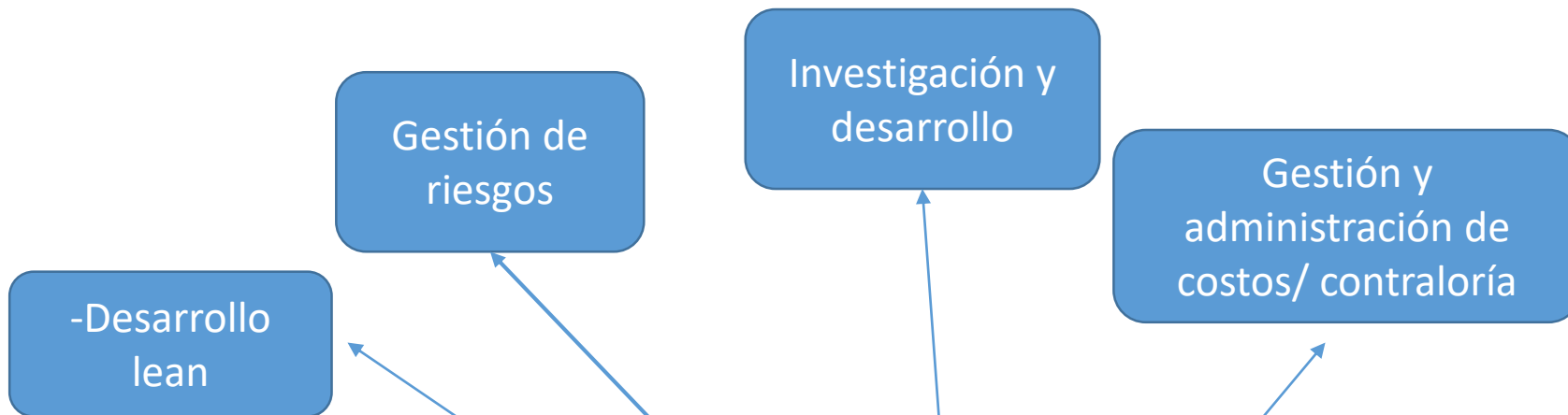
Optimización de energía

Mantenimiento predictivo

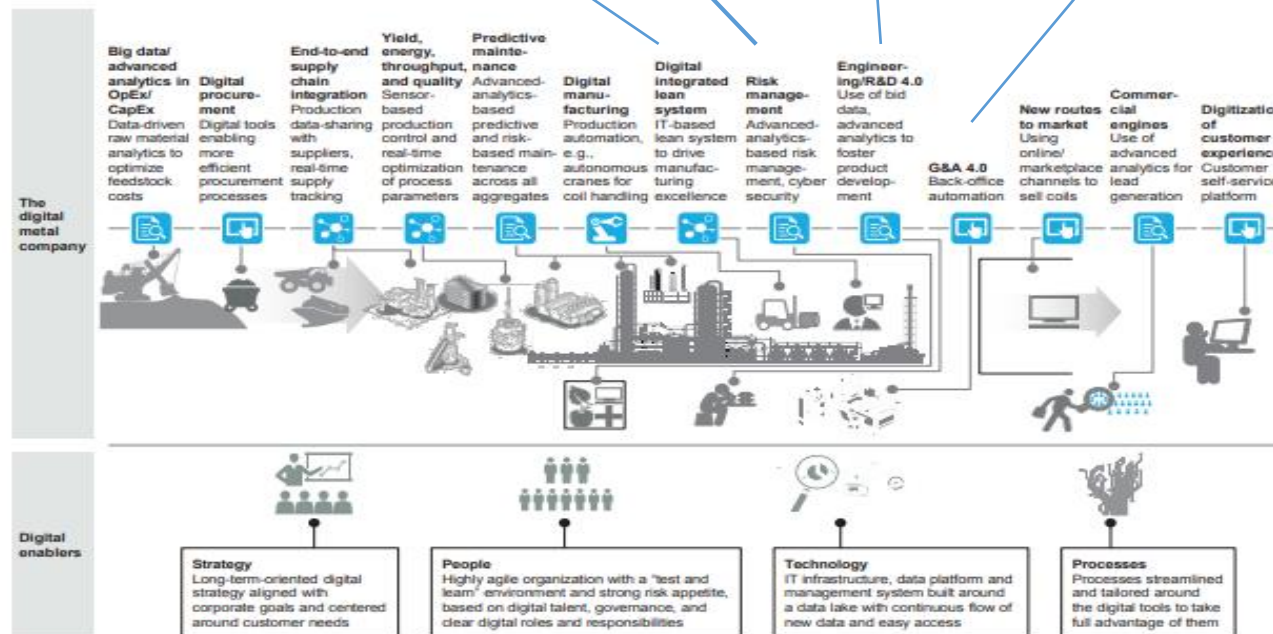
Automatización de manufactura

Digital will change metal players' full value chain





Digital will change metal players' full value chain





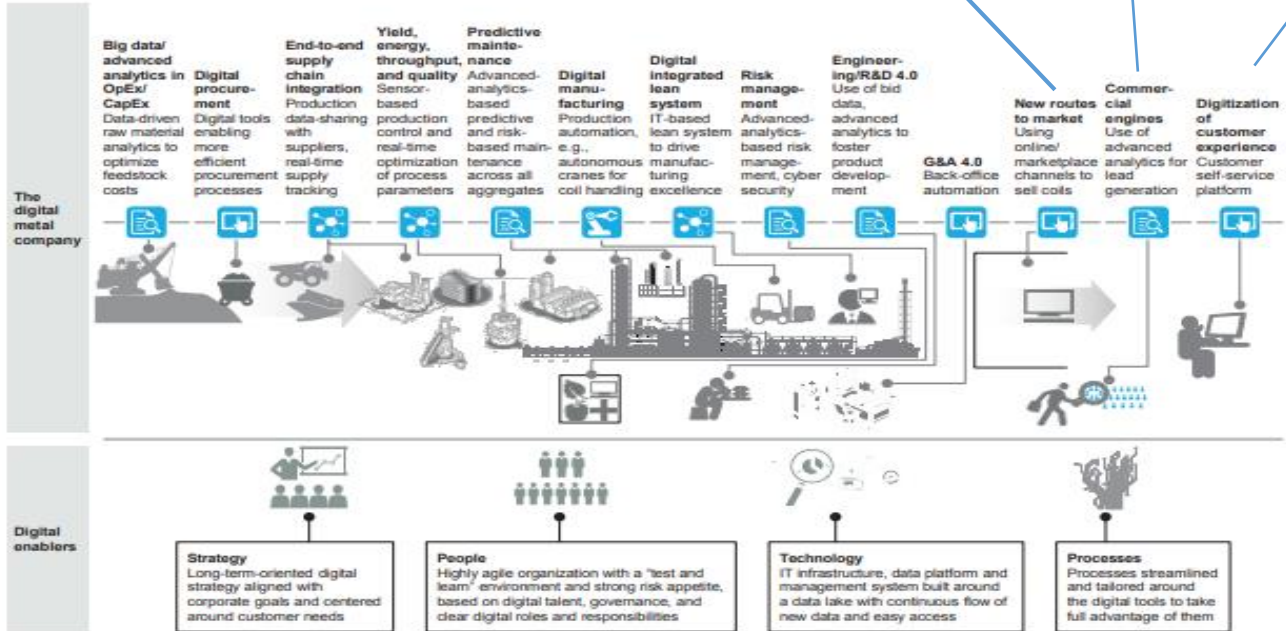
IloT  
Internet de las cosas  
Industrial

Canales de  
mercadeo

Motores  
comerciales

Digitalizar la  
experiencia del  
consumidor

Digital will change metal players' full value chain



# Digital will change metal players' full value chain

3.0 A 4.0 : MAQUINAS AUTONOMAS , SIN INTERVENCION HUMANA



# Digital opportunity map for a metal player

QUANTIFIED OPPORTUNITY HEATMAP  
AFTER WALKTHROUGH DIAGNOSTIC

■ High ■ Medium ■ Low

CHATARRA

Mining and  
beneficiation

Iron making

Rolling and  
coating

Total

Manufacturing

Yield

Energy

Throughput

Value-in-use

Quality

Maintenance

Labor prod.

Commercial

Sales

Supply chain

Procurement

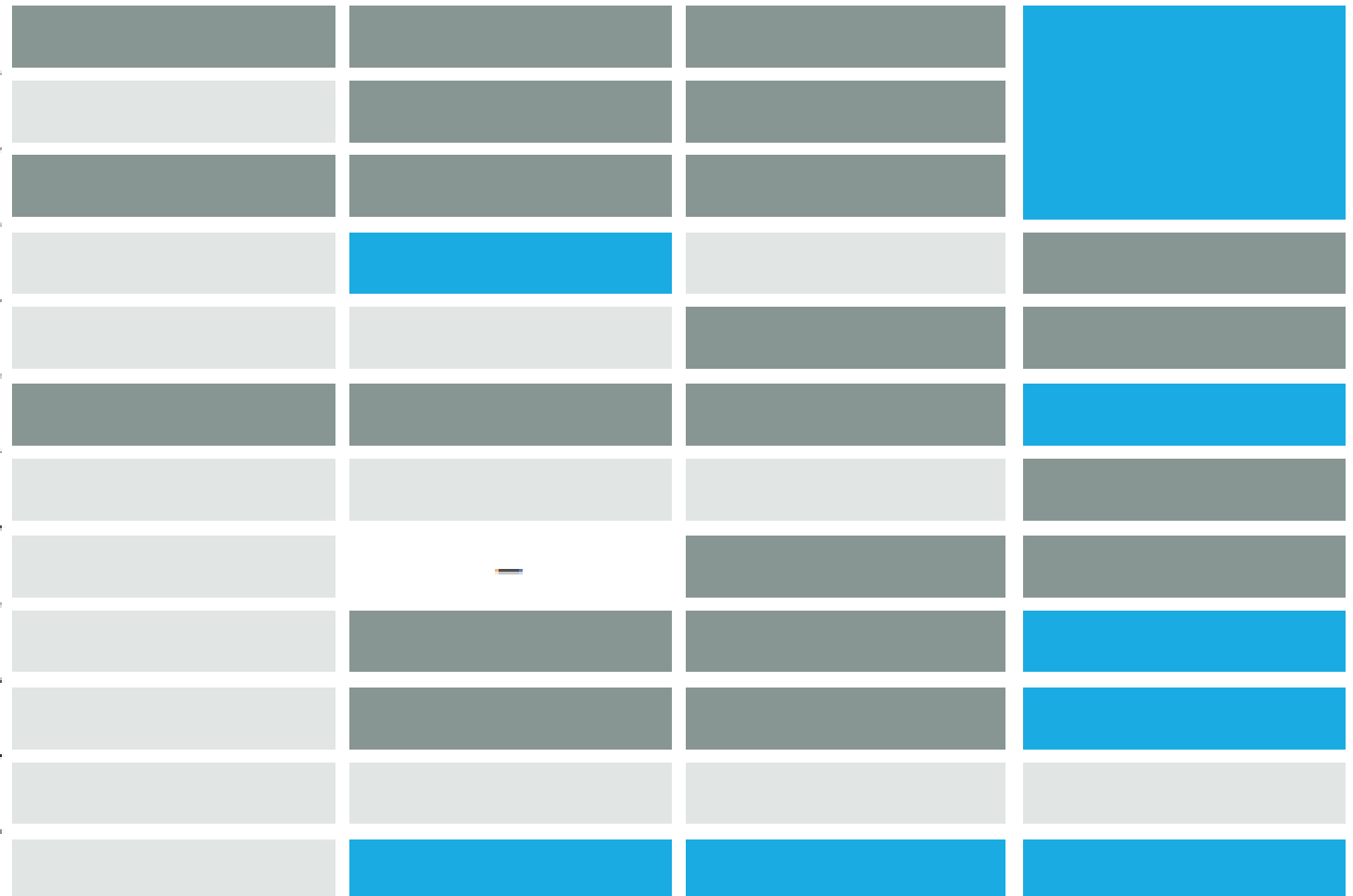
Procurement

G&A

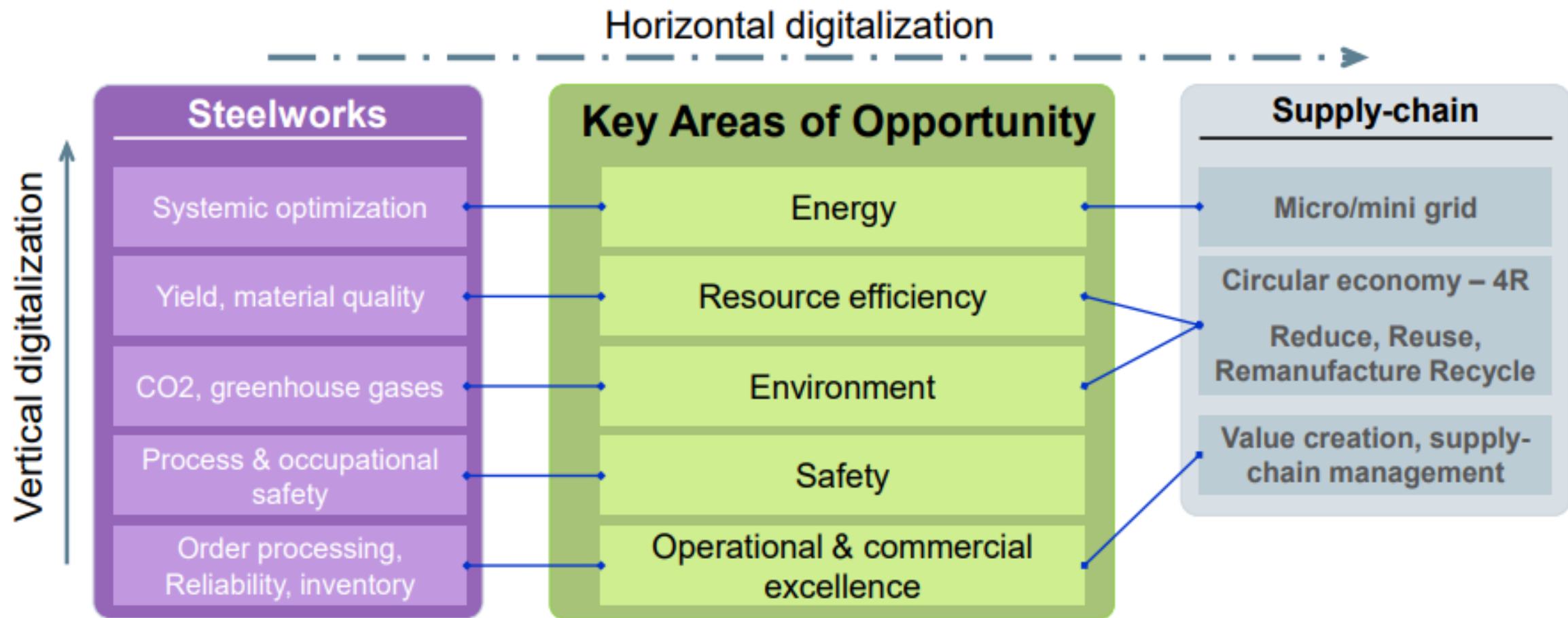
G&A

Optimizar MP

Transporte – inventario  
Planeación

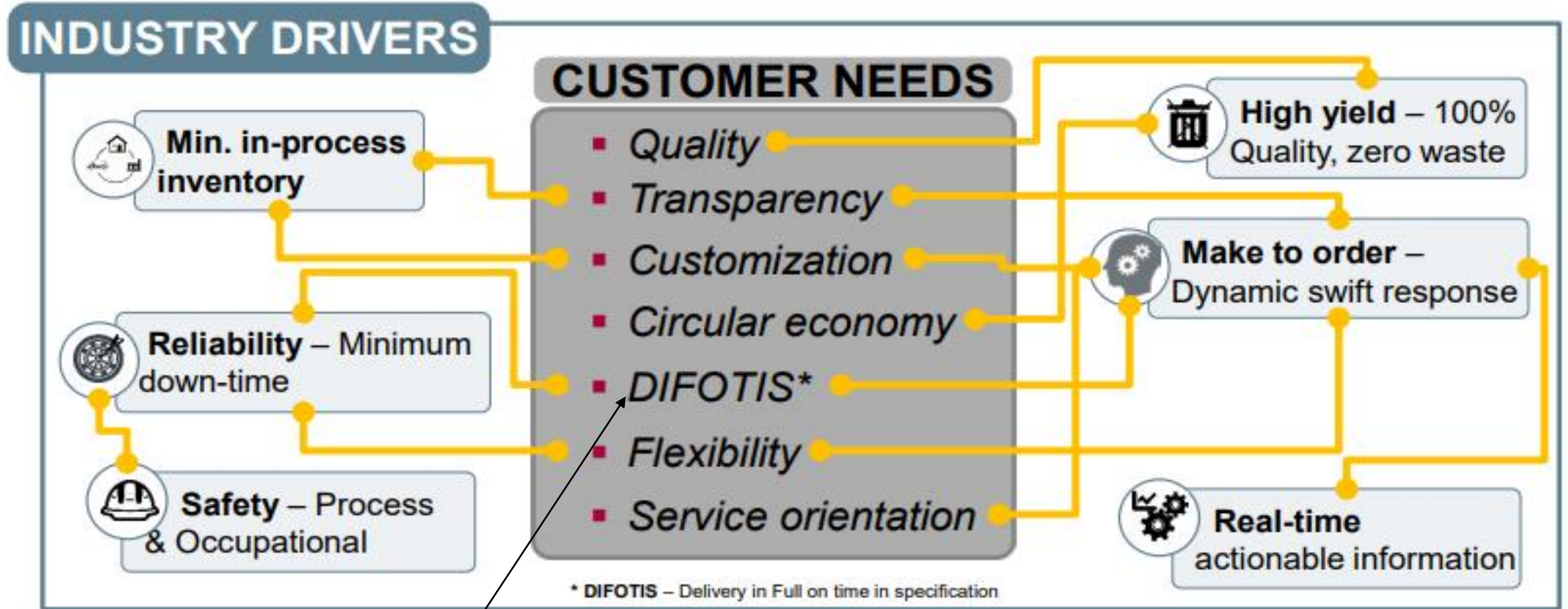


# Digitalization: Areas of opportunity for the steel industry





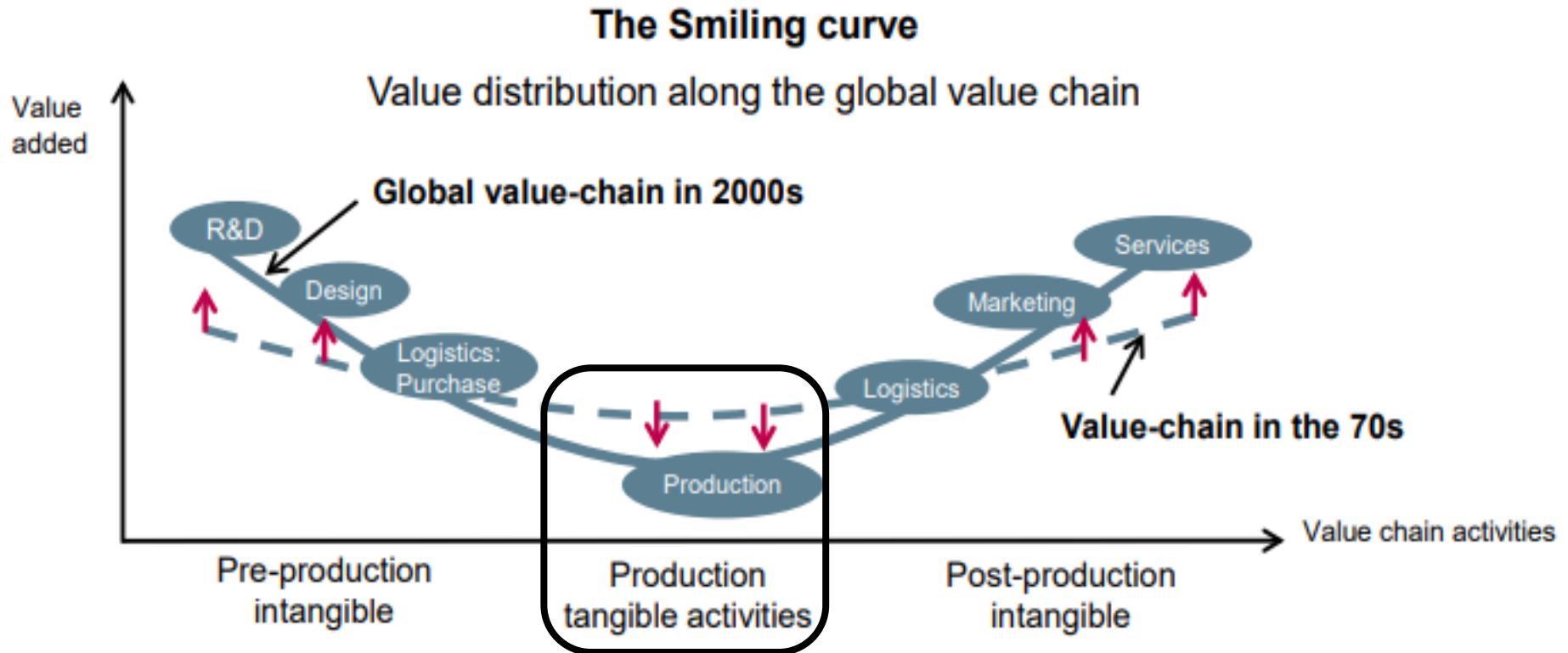
# Vertical digitalisation - Drivers





# Value Chain

- Value addition shrinking in production



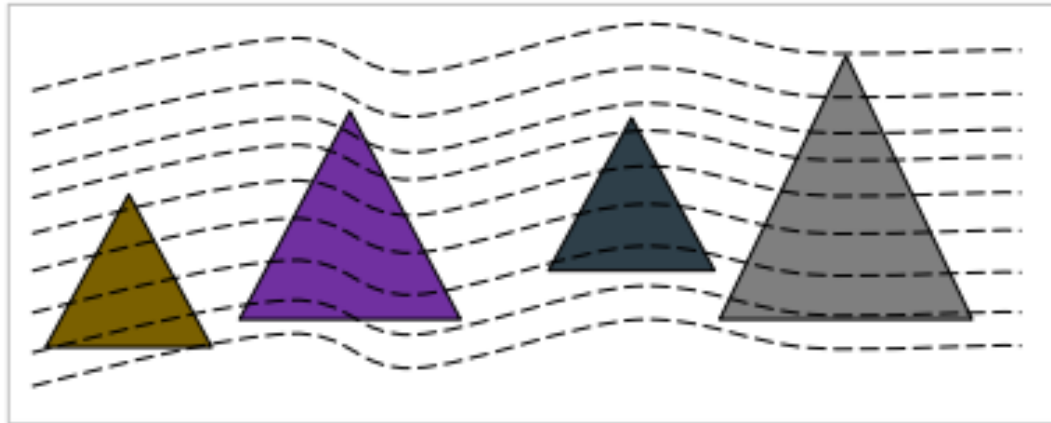
Source: Interconnected Economies Benefiting from Global Value Chains, OECD 2013

# Production planning strategies

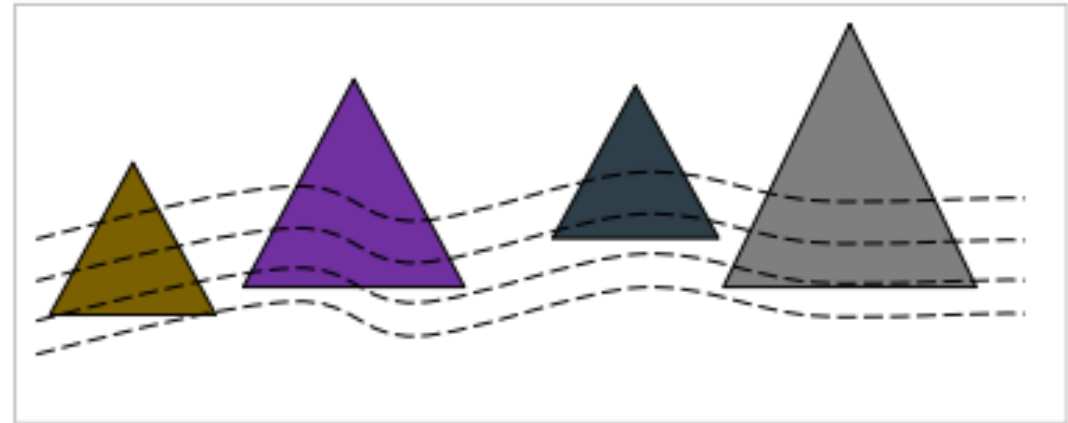
Consumer industries	Process industries
Classic pull system (JIT)	Classic push system (MRP)
Production at one level only happens when initiated by a request at the higher level. That is, units are pulled through the system by request	MRP system computes production schedules for all levels based on forecasts of sales of end items
Deliver right amount of product at the right time –	Once produced, subassemblies are pushed to next level whether needed or not
Each item has a fixed destination	Lot of internal flows, rework
WIP (work-in-process) inventories to an absolute minimum	Large inventories
Eliminate waste – Higher quality & faster error detection	Large quantities of scrap before errors are discovered
High flexibility – fast setups & changes allow small batch sizes	Lower flexibility – bigger batches

# Inventories or Buffer stock can hide problems

- Suppliers' reliability, customers orders
- Equipment failures & delays
- Poorly trained workers
- Defective materials & Waste
- Poor scheduling, Changeover time



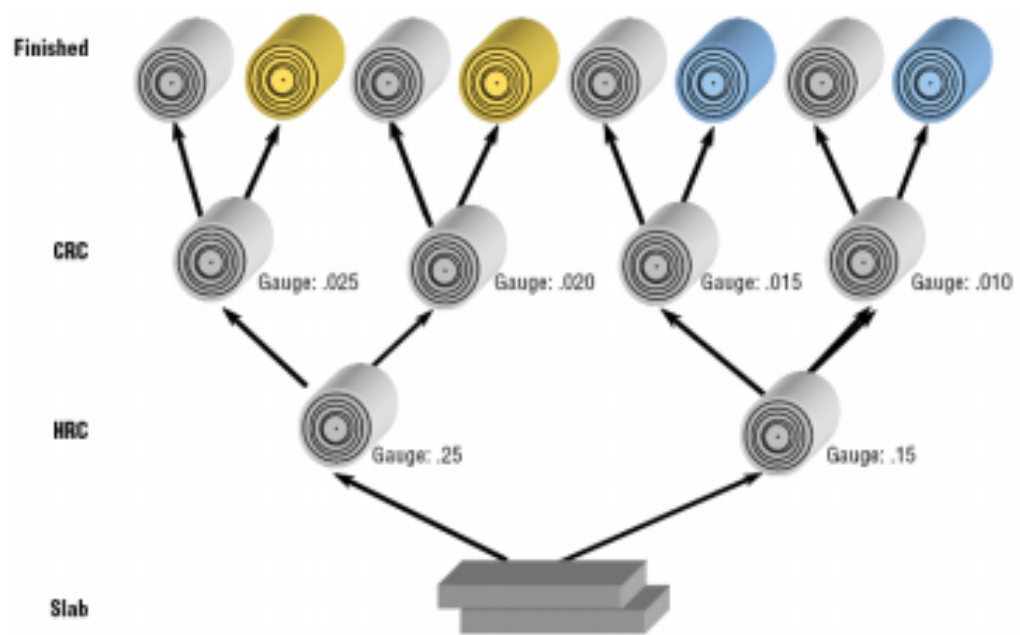
**Excessive inventory masking issues**



**Lean inventory reveals problems**

## Order coupling policy – flexibility

- Steel production follows a ‘V’ shaped bill of materials
- Identification of Customer Order Decoupling Point (CODP) or “order penetration point” depends on product portfolio



- **Low product variety:** Higher performance if the production system exhibits a high degree of process flexibility downstream from the order coupling point.
- **High product variety:** Higher performance when the production system exhibits a high degree of process flexibility upstream from the order coupling point.



## The bullwhip effect

- Amplification of orders occurring within a supply chain in the upstream direction
- Even if the demand is fairly stable it leads to:
  - High working capital (unnecessary inventory)
  - Costs (unstable production, poor reliability of equipment)
  - Lost revenues (supply / delivery shortfall)
  - Increased lead times

Selection and prioritization of use cases need to be evaluated across multiple dimensions

**Geographical distribution**

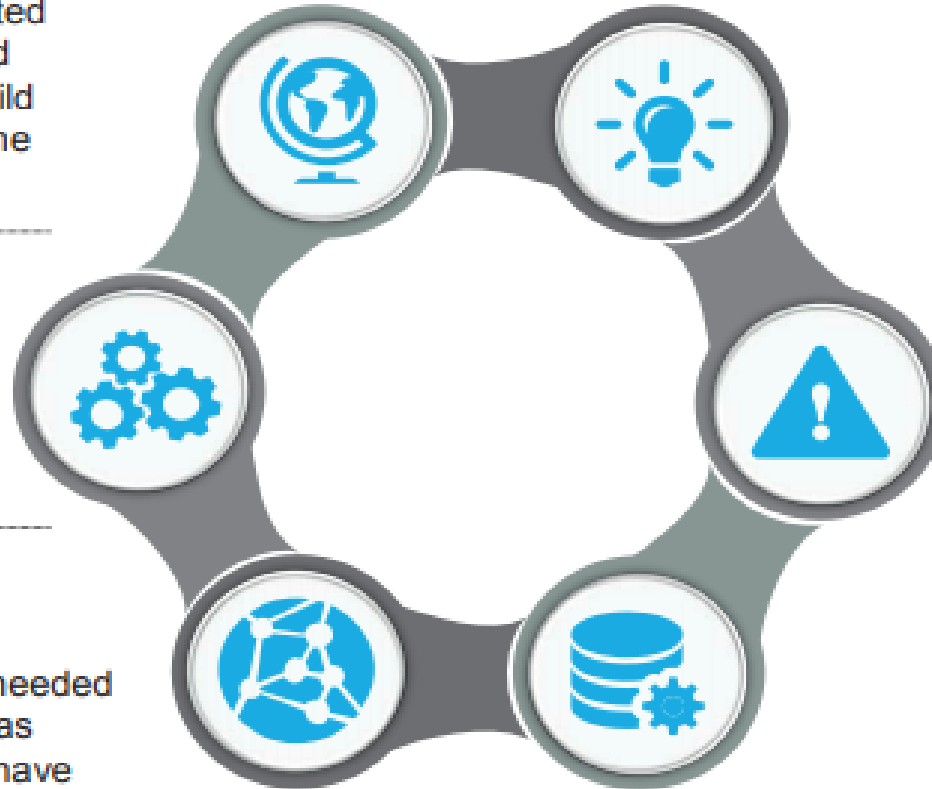
The waves are distributed over different areas and functions in order to build competencies across the organization

**Feasibility**

The solution of the problem investigated is likely to be implementable in a short time

**Complexity**

Advanced analytics is needed to fully solve the issue as conventional methods have been tested and root causes remain largely unknown



**Impact**

Solution of the problem and implementation yield significant recurring value

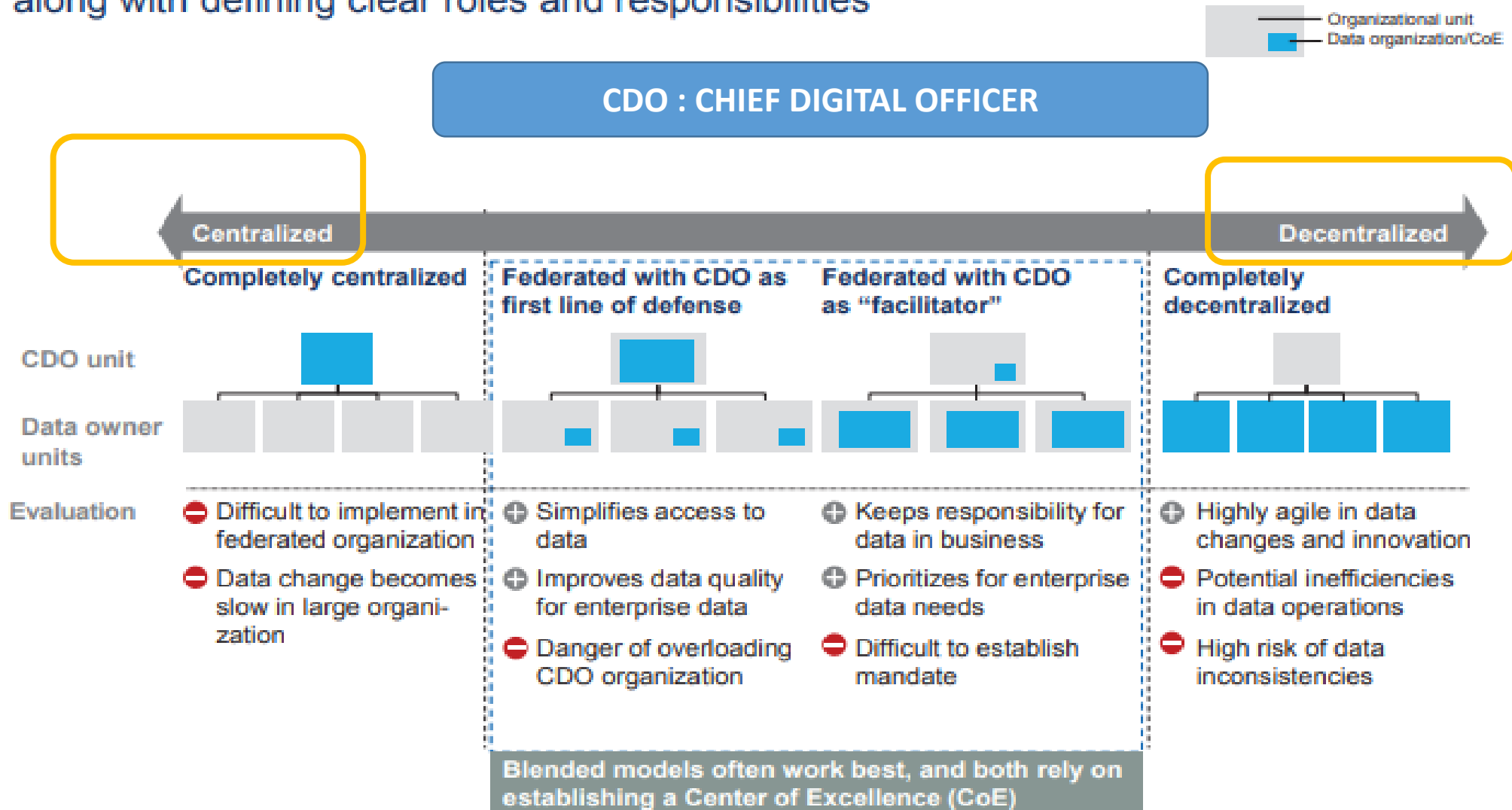
**Problem ownership**

Problem recognized as priority at GM level and resources are made available for the duration of the wave

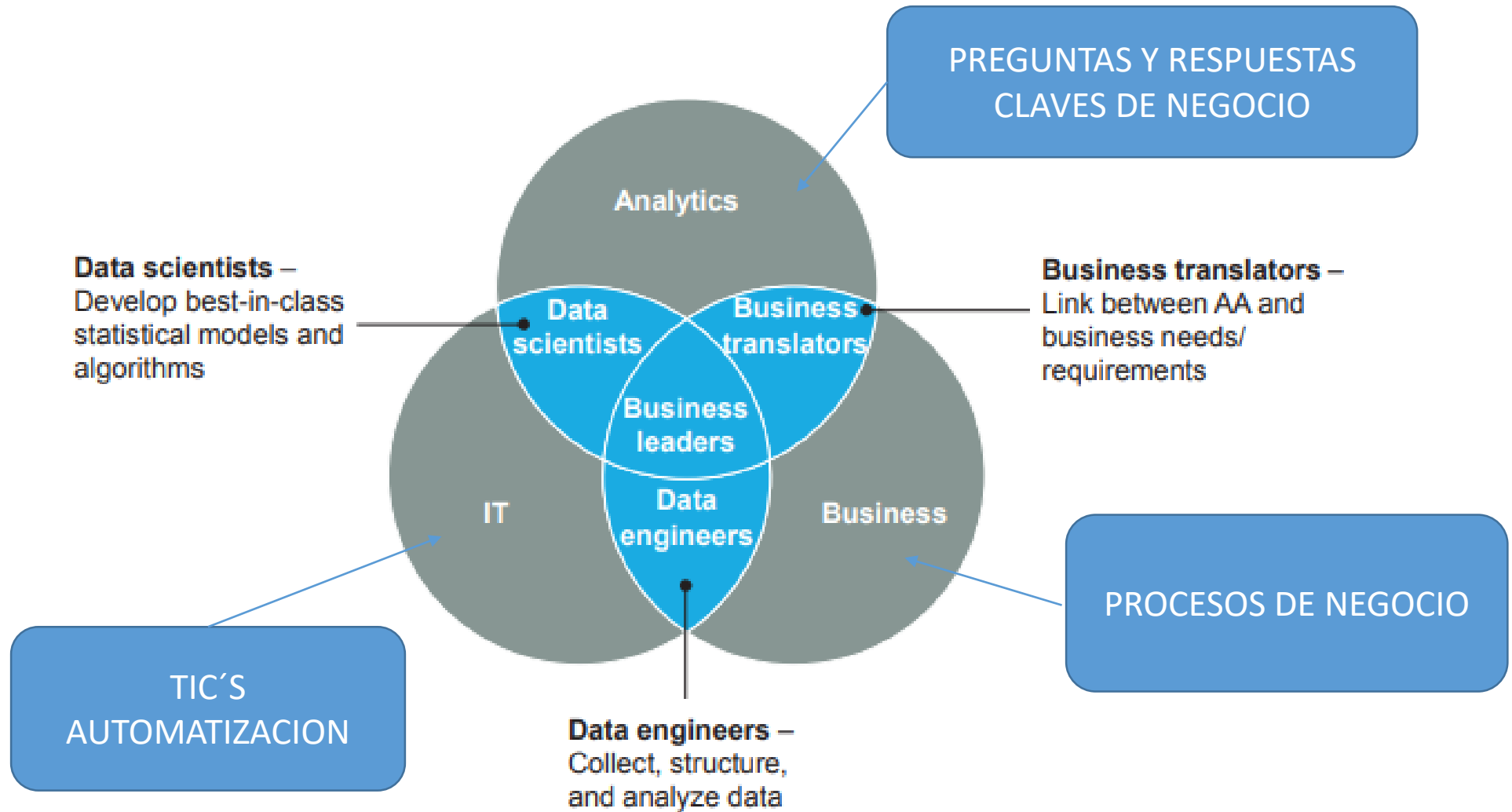
**Data availability**

Data of good quality and with credibility with the line is available

# Choosing the right organizational archetype is key, along with defining clear roles and responsibilities



# Traditional roles are colliding to form new roles required for an effective advanced analytics organization





# 1

Starting a common digital journey, agile quick wins

# 2

Building digital culture, program management

# 3

Implementing digital initiatives, delivering results, scaling up

### Starting a common digital journey



Customer value workshop



Digital maturity assessment & site assessment

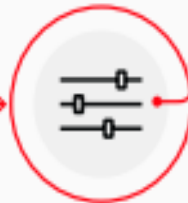


Agile & collaborative approach, POCs, Partners ecosystem

### Digital transformation program foundation & management



Envisioning future plant / mill / mine & digitalized enterprise



Digital transformation roadmap



Business case, Pain points, ROI & Business Models



Human factor, Change management & Culture

### Digital development initiatives



Enterprise digital architecture



IT, ET and OT data integration (on-premise & cloud)



Asset Management and predictive maintenance



Performance / process / energy optimization



Advanced analytics, Machine Learning & AI



Management system, Dashboards & Future control rooms

ABB Enterprise Digital Transformation toolbox helps customers to:

Clarify digital strategy & roadmap

Achieve strategic targets faster

Make decisions based on real-time facts

Focus on right projects with best ROI

Increase revenue & improve OEE & decrease cost

# Understanding your starting point

Defining critical pain points will help identify clear objectives for your transformation initiative

Set a solid base by assessing the existing data architectures, IT systems and communication networks in the context of your business as a whole (operations, people, maintenance, safety). Create a shared understanding of how to maximize your digital competitiveness.



## Digital maturity assessment

Assessment consisting of interviews and plant walk-through maps, key functionalities in your plant and value chain. Benchmarking your plant's digitalization level helps engage in digital initiatives in the right order & evaluate work required. Understand required digital building blocks



## Value discovery workshops

Various formats of on-site or virtual events to ideate potential digital solutions for concrete challenges and quantify estimated customer value.



## Outcomes

- Prioritized list of potential digital solutions for improving plant availability, quality, safety, security, sustainability and productivity
- Solutions mapped according to their impact on performance and ease of implementation

# 1

Starting a common digital journey, agile quick wins





# Defining your digital goals and skills necessary for implementation

2

Building digital culture, program management

Having established an agile approach, explored initial possibilities and formed partnerships, the next steps are creating the vision, launching the larger road map and fostering the right culture for the new digital enterprise

## Your goals could include

- Creating new value in existing customer relationships
- Identifying new business opportunities outside traditional ones
- Demonstrating digital leadership within the industry

## Examples of the three steps to realizing your digital vision

### 360-degree evaluation

- IT/ET/OT integration
- Performance, KPIs, dashboards
- Infrastructure and architecture, including cyber security
- Quick-win solutions

### Modeling & analyzing operational data

- Data aggregation
- Production optimization
- Asset & energy management

### Deploying advanced analytics

- Prescriptive models & AI
- Scenario planning
- Functional modeling & optimization





## Refining the transformation roadmap and business cases

**2** Building digital culture, program management

Clarity, pace and control over digital developments

ABB can help you create future scenarios, describe practical and tangible digital use cases and put them on a fast-track, adaptable roadmap.



### Digital adoption

Reflecting on future experiences and a common roadmap helps better communicate transformation goals and direction to all people involved, creating buy-in within every department.



### Fit for purpose

Envisioning the key technologies involved in future scenarios allows us to evaluate what is feasible with existing solutions and what needs to be newly co-created - without added complexity.



### Value creation

We help organize optimal work streams and action steps for concrete value creation goals, prioritizing low hanging fruit to realize quick wins and milestones in targeted improvement areas - designing for transition.



### Business case

We help identify new business models, match the timeline and budget with a clear financial plan, optimized cash flow and commit key stakeholders to the plan. Our business case estimations are based on an iterative approach - building the digital vision, site assessments, priorities and roadmap - as they are affecting each other.



# Enterprise digital architecture and infrastructure blueprint

## Best practices for core infrastructure and architecture

In real-world scenarios, IT/ET/OT integration can be challenging, especially when enterprise information infrastructure includes heterogeneous information systems. Most industries also live with incompatible legacy OT systems which can become a massive hurdle to integration.

The integration process therefore requires expertise on both the domain and system level, and specific connectivity solutions. ABB's pragmatic and efficient approach is grounded in proven expertise, deep understanding of industries and utilities, and the experience of digitalizing its own factories.

Applying modern design principles provides a modular overall architecture based on functional blocks. Edge devices or servers collect data, normalize

them, and provide data flow mechanisms for bulk as well as transactional data. Serverless computing allows you to focus on working with data instead of infrastructure. Storage components allow you to store structured, highly relational data, and work with unstructured data.

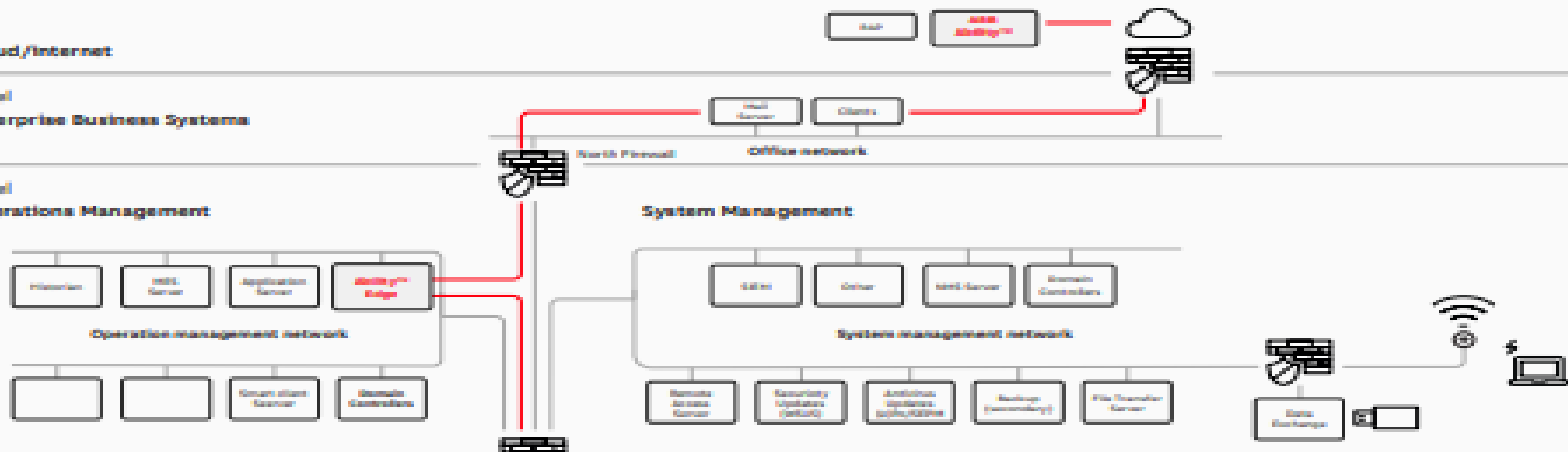
Special emphasis goes to time series transactional data – essential in OT systems. Specific solutions are used to store, evaluate and analyze high volume time series data.

Considering all components of solution architecture together allows us to deliver greater and sustainable value throughout your Digital Transformation.

### 5 Cloud/Internet

### 4 Level Enterprise Business Systems

### 3 Level Operations Management

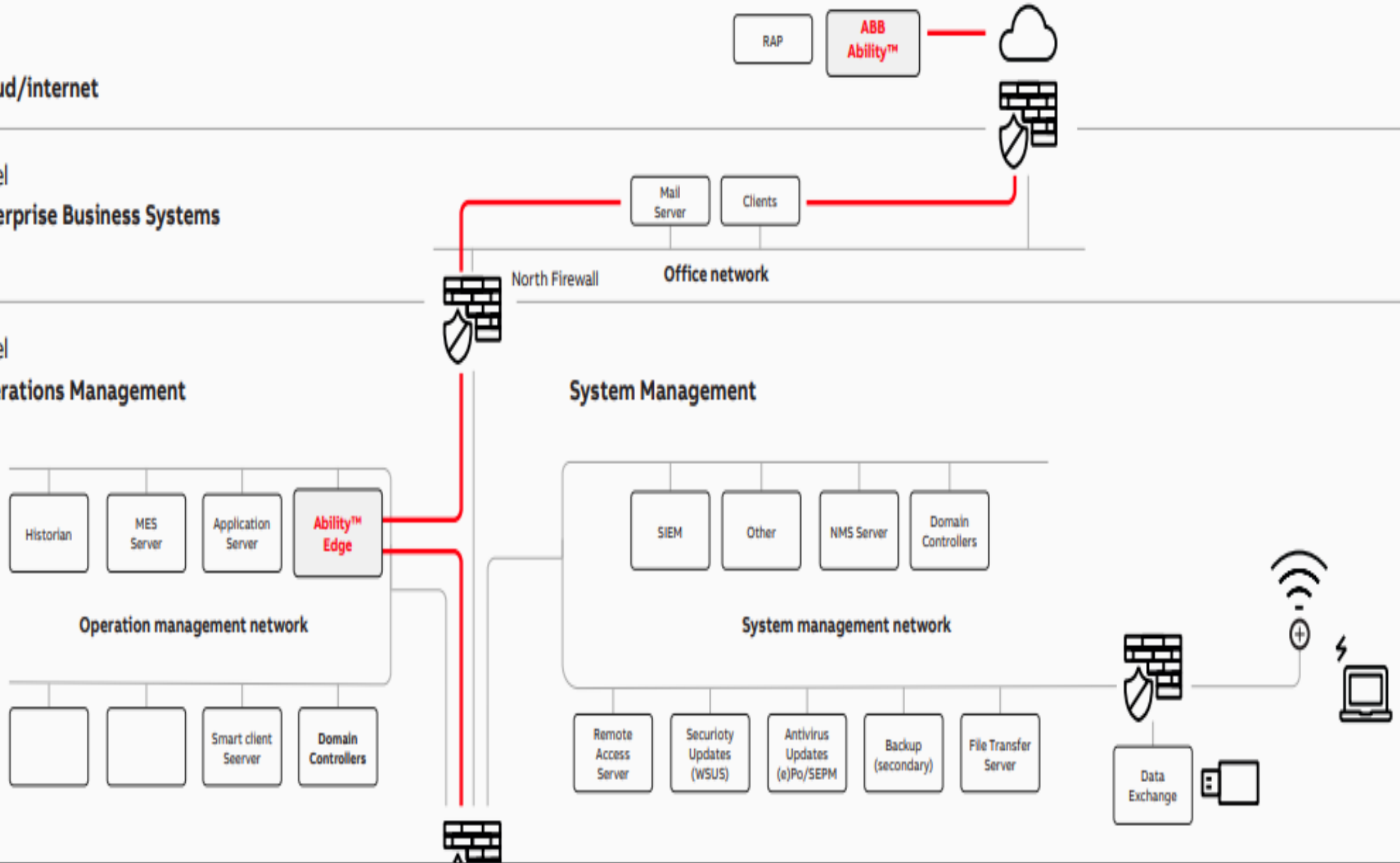


**3** Implementing digital initiatives, delivering results, scaling up

# 5 Cloud/internet

# 4 Level Enterprise Business Systems

# 3 Level Operations Management



# Transformational use cases

# 3

Implementing digital initiatives, delivering results, scaling up

Digital transformation reaches across your entire organization, impacting every aspect of business

Creating meaningful change requires an holistic view of the business landscape, covering process optimization, utility, energy, supply chain and logistics, the mobile workforce, and health and safety.



### Operations planning

Allows for improved profitability, optimized asset use and full transparency.



### Energy optimization

Reduced energy costs through optimized production, power purchasing, and captive power generation.



### Process optimization

Increased yield and product quality with reduced production costs.



### Automation and robotics

Reduce HSE risk. Autonomous, flexible manufacturing with shorter batches and optimized production planning.



### Supply chain management

Full control allows just-in-time delivery, traceability and reduced inventory.



### Logistics

In-transit tracking of product's location, temperature and vibration secures end-to-end availability and quality.



### Control room / remote operations center

Optimized performance via visualized access to asset and operational data.



### Mobile workforce

Connected, mixed reality technologies improve workforce communication and information sharing.



### Health and safety

Alarm analysis, continuous SIL system verification, video analytics and mobile information improve environmental safety. Crisis management service enhances planning and situational awareness.



### Asset management and predictive maintenance

Asset health predictions improve availability and reduce maintenance cost.



### Sustainability

Reimagining production processes from scratch, redesigning existing sites for a low-carbon future.

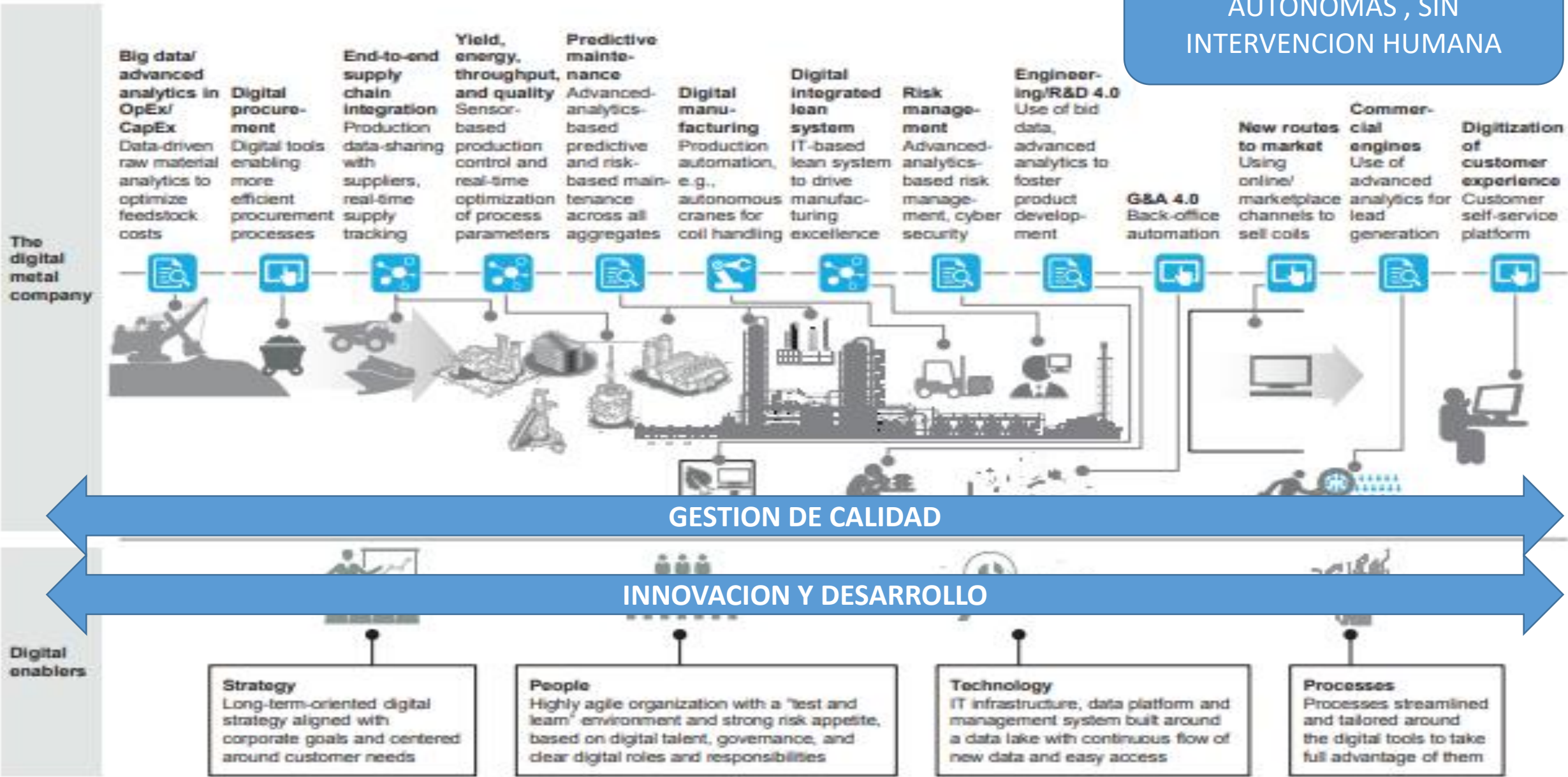


### License to operate

Remote operations to protect people in places they belong to. Greenfield designs with social responsibility in mind.

# Digital will change metal players' full value chain

3.0 A 4.0 : MAQUINAS AUTONOMAS , SIN INTERVENCION HUMANA





## Advanced analytics and visualization

Get the most from your data to maximize business benefits

Analytics is a separate module that uses real-time and stored data. Machine learning (ML) components are integral to the analytics layer and AI is fast becoming a major disruptor in digital transformation. AI and ML based applications can provide great results in areas where standard mathematical and physics models fail.

Customers that are not yet ready to invest in developing their own analytics can tap into our best practices – proven applications that solve specific problems in similar scenarios. We provide them with end-to-end analytics solutions adapted to their needs, as well as continuous remote support.

Customers with their own expertise who want to self-diagnose problems, develop and test new applications can benefit from a powerful enterprise-grade industrial analytics and AI platform, whilst also reducing their IT costs.

# 3

Implementing digital initiatives, delivering results, scaling up

With the domain expertise of ABB, you obtain immediate benefits through end-to-end solutions and services for achieving operational performance, asset integrity, energy efficiency, sustainability and safety leading to improved productivity, quality, optimum utilization of plants and assets, process improvements and cost savings.

Users at all levels across the enterprise can also engage with ABB's industrial analytics and industrial AI platform using a suite of pre-built applications, with the capability of self-service analytics.

Whatever the solution, models improve as more data is added, maximizing business benefits over time. And the ready-made solutions also support a phased implementation approach, with investments in infrastructure generating immediate positive business value.



# CASOS DE ESTUDIO TRANSFORMACION DIGITAL

# Leveraging Hitachi Digital Solutions in Steel Manufacturing

## Safety:



- A safe working environment not only boosts morale, but also increases productivity on the shop floor. Under the extreme conditions of steel manufacturing, safety compliance is of paramount importance.
- Digital tools such as real-time image and video processing can help in ensuring PPE compliance and machine safety.
- Digitized 5S compliance can also ensure better shop floor management.

## Digital Health & Safety Offering:

- Our safety offering leverages live video feeds to analyze the environment and thus creates alerts in case of any safety non-compliance. The tool also brings out compliance in Lock-out, Tag-out (LOTO), 5S and Work Permits.

## Typical Benefits:

- Reduction in Lost Time Injury Frequency Rate (LTIFR).
- Reduction in near miss incidents.

## Quality:



- Advanced data analytical tools and image & video analysis techniques can address quality challenges in steel manufacturing and increase the yield and reduce energy losses by providing better measurement through visualization and better control of quality parameters.
- Output quality parameters can be better predicted and controlled by using past production and quality data with predictive and prescriptive analytic tools.
- Challenges of slag separation in Electric Arc Furnace (EAF), dimension measurement and surface defect measurement in semi-finished and finished products can be mitigated through better visualization using advance image and video processing tools.

## Digital Quality:

- Our quality offering provides predictive insights on quality control and assurance through real-time process parameters analysis and image and video analytics that leverage artificial intelligence techniques.

## Typical Benefits

- Yield improvement.
- Throughput improvement.



## Supply Chain:



- Data integration and visualization tools can be used to strengthen the complex steel value chain by integrating the processes within the company and the processes involving external stakeholders e.g. suppliers and customers.
- Visibility of spare parts inventory, RM/ FG inventory can be improved using tracking and tracing tools thereby leading to better response time during shutdowns or breakdowns and better control over order lead-time.
- Truck TAT can be improved through connected operations and by converting manual processes into a digital format.

### Supply Chain Optimization:

- Our supply chain optimization solution leverages the power of digital for recreating the supply chain in digital format with business rules and connectivity to key systems. This can help to achieve better control over the supply chain.

### Typical Benefits:

- Reduction in time locating spare parts.
- Optimized lead times.
- Optimized TAT.

## Operations:



- With advancement in sensor technology and data capture and processing mechanisms, long standing challenges in operations can be addressed more effectively than ever. With its application in the extreme processes of steel manufacturing, most operations parameters can be captured and optimized to increase operational efficiency.
- Optimization of arcing time in EAF, reducing fluctuations in energy consumption and increasing capacity utilization for reheating furnaces can all be achieved by advanced process parameter optimization models which compute large volumes of process data in real-time to come up with ideal operating setpoints.
- Digital Twins can help create simulations of the process where trial runs can be done before taking actions in the real process.
- Advance imaging and video capturing techniques can help visualize the process inside the furnace for better control e.g. charging distribution in the blast furnace and blockages inside tuyeres.

## Operations Optimization:

- Our operations optimization solution has capabilities in process optimization & simulation, Digital Twins, advanced imaging and video analytics. These technologies can be applied to achieve very positive results.

## Typical Benefits:

- Reduction in Tap-to-Tap time.
- Reduction in energy consumption.
- Increases in throughput.
- Optimized cost of alloying elements.

## Maintenance:



- Extreme environmental conditions in steel manufacturing can increase machine break-downs, leading to loss of availability and production. Data captured from machines can be used to assess the condition of equipment and create an efficient maintenance schedule.
- Predictive analytic tools, when loaded with real-time data from sensors and failure mode and effects analysis (FMEA) in digital form, can help predict failures in advance and thus help maintenance teams schedule shutdowns and be more effective in preventative maintenance (PM) activities.
- Prescriptive analytics tools using self-learning algorithms and predictive analytics help increase meantime between failure (MTBF). As a result, systems reliability and overall equipment effectiveness (OEE) improves.

## Digital Maintenance:

- Our digital maintenance offering uses descriptive, predictive and prescriptive analytics to assess, predict and provide insights on asset condition. This can help prolong the life of machines, predict failures and implement a reliability-based maintenance practice.

## Typical Benefits:

- Increase in MTBF and reduction of mean time to repair (MTTR).
- OEE improvement.
- Throughput.

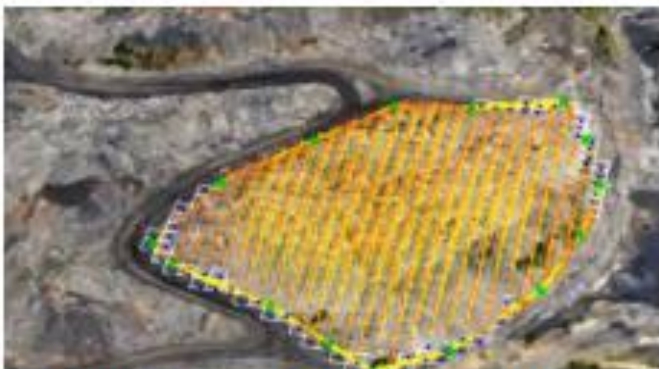


# Digital Transformation Initiatives in Mining & Metals – the Tata Steel approach

*Sarajit Jha, Chief Digital Value Acceleration Team  
Tata Steel, India*



# Glimpses of Digital @TSL



Next-gen Mine Planning



Real-time Rake Tracking



Predictive Asset Maintenance



Real-time video analytics



1st LoraWan enabled city - JSR

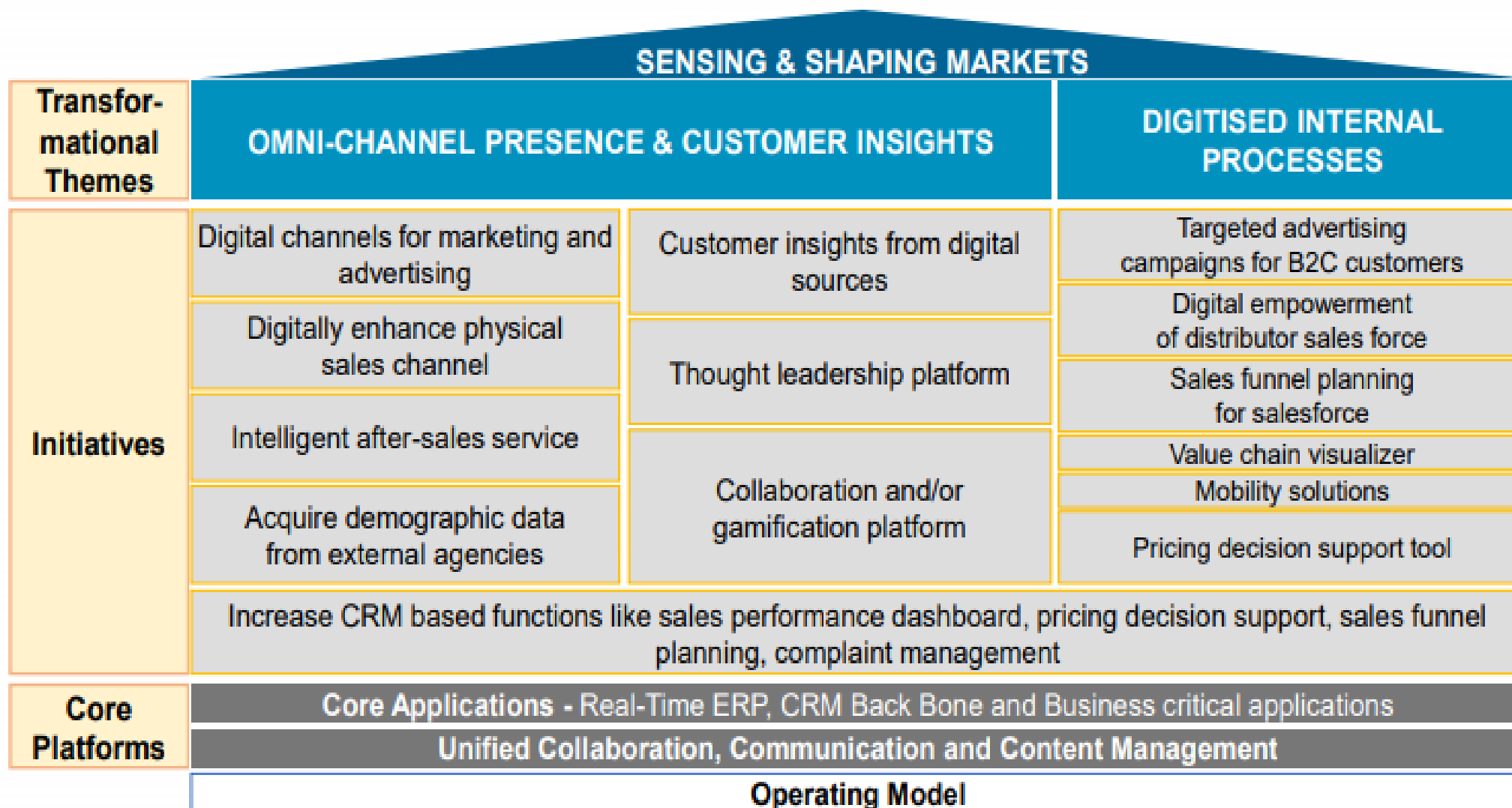


In-plant Uberization





# TSL's Customer focus - Sensing & Shaping Markets



# We need to learn from and mitigate against common digital failure patterns seen globally



“Digital centricity, not customer centricity”



“Thousand points of digital light”



“Treatment of technology as an outcome/solution”



“Over-indexing on short-term gains”



“Lack of clarity on tangible \$ impact, becomes a process redesign exercise”



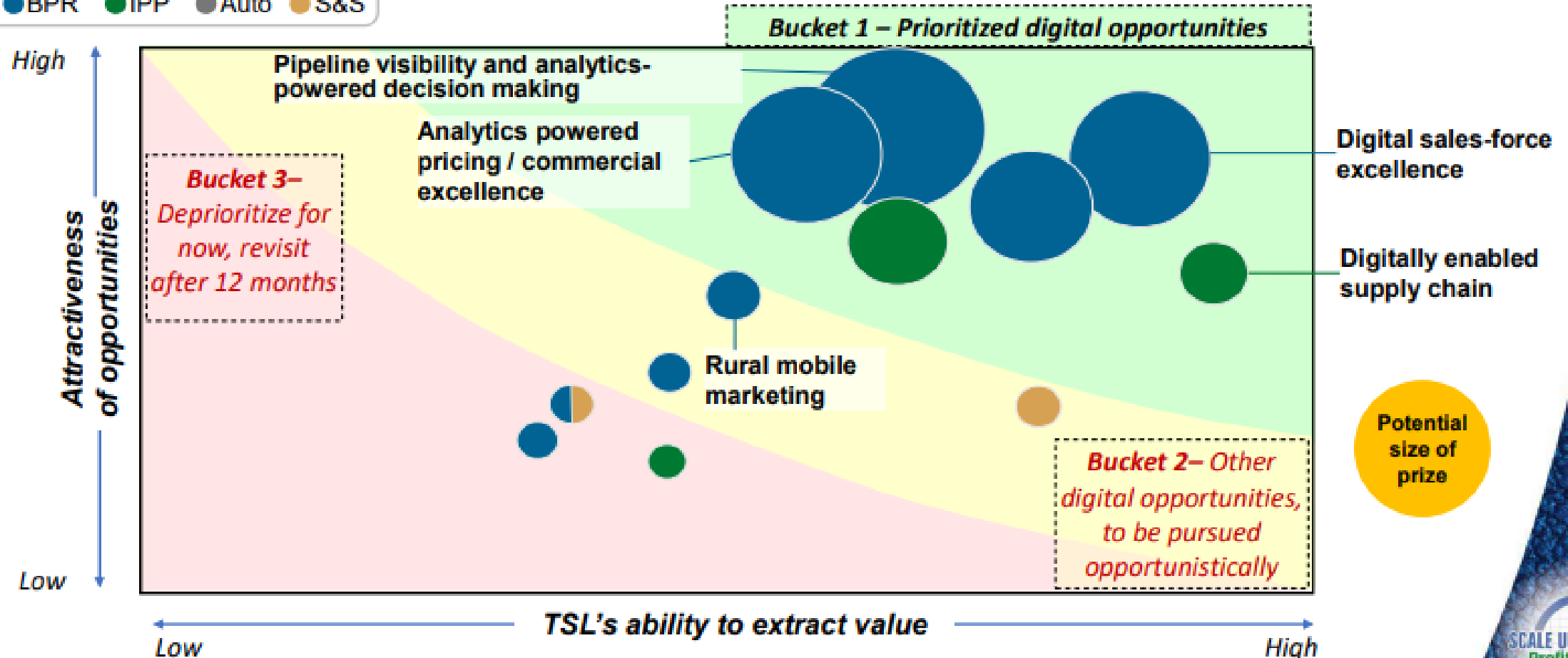
“Focusing on digital alone rather than digital + physical incl. change management”



# Prioritization Matrix used to identify digital opportunities for TSL across customer segments

## Legend

● BPR ● IPP ● Auto ● S&S



Note: Attractiveness determined by degree of business impact based on global / internal analogs and extent of impact on TSL's business, Ability to extract value determined by TSL's readiness (tech / capability / org) and ecosystem readiness (Customers / Partners / Regulations / Risk / Gestation period)

# Digital Radar can help move towards our Digital vision, along 6 key elements

## DIGITAL DEPARTURE

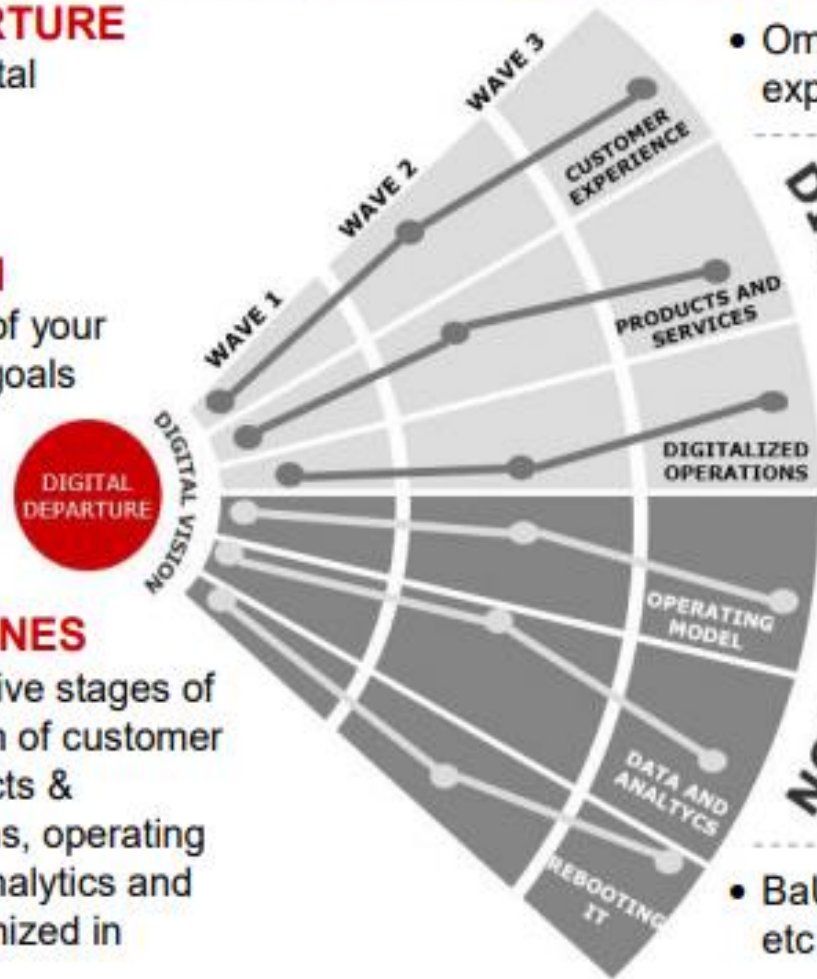
A statement of digital progress to date

## DIGITAL VISION

A clear statement of your company's digital goals

## STEPPING STONES

Concrete, successive stages of the digital evolution of customer experience, products & services, operations, operating model, data and analytics and IT backbone, organized in WAVES



- Omni-channel and seamless customer experience

## ORCHESTRATION

How you move step by step and adapt along the way

- Rapid and collaborative product engineering & design

- Digitally enabled supply chain & sales-force

- Market place for Consumer services

- Analytics driven sales excellence

- BaU initiatives such as EDI, CRM, etc

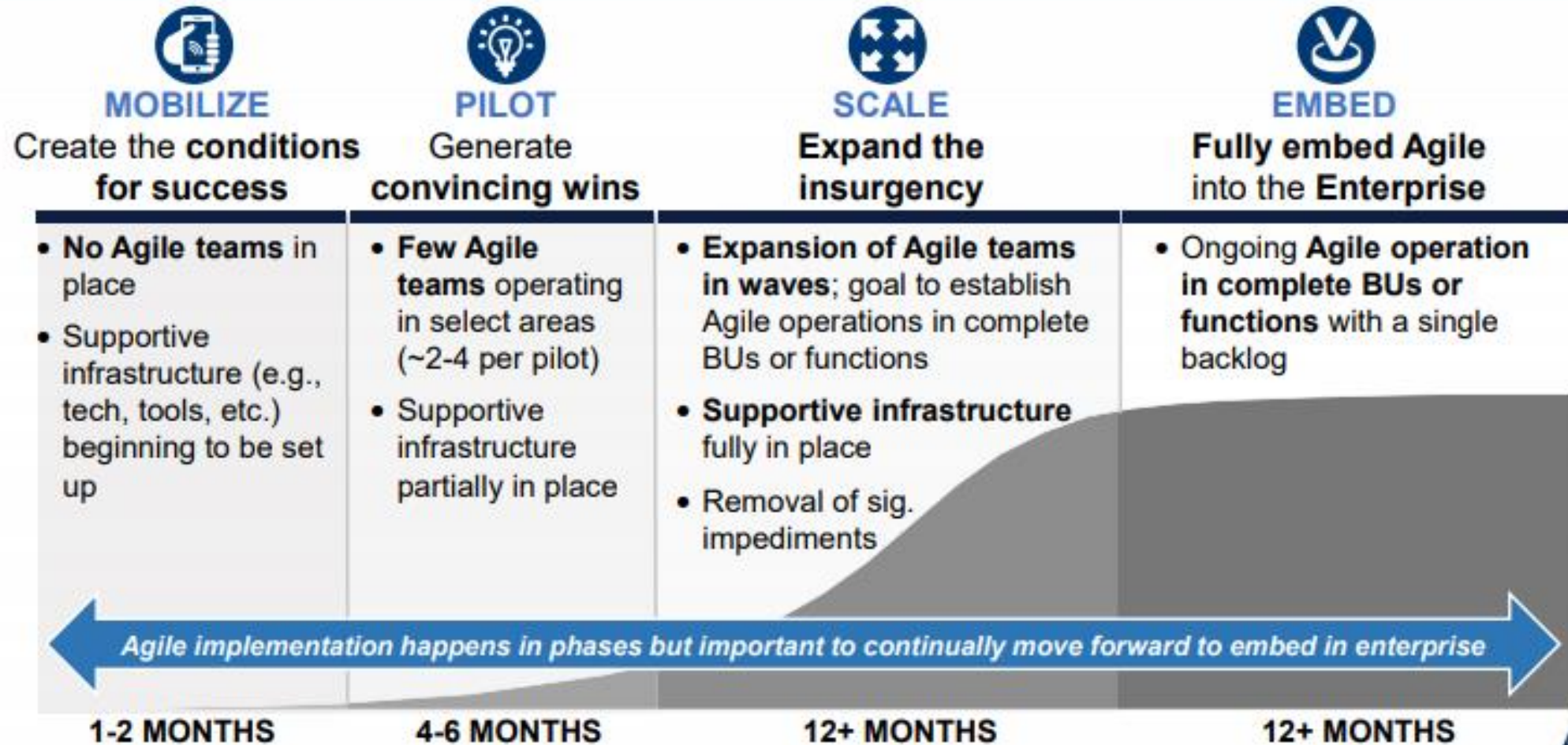
## DIGITAL DESTINATION

A picture of your sector's likely future





# Adoption of Agile is critical to digital, however full transformation may take 2-3 years



Note: Different BUs/functions can be in separate phases of the transformation at a single point in time



# Tata Steel's Digital Script™

Increasing **information intensity** and **connectedness** of **customer and business resources**. Any resource can become digital through the application of technology.

