



Digital Transformation: Unlocking the value of ore deposits in radically different ways.

Africa Accelerating – Innovation & Digital Opportunities in Mining
October 25, 2018



Rick Howes
Chief Executive Officer
Dundee Precious Metals

DPM's Global Assets

Create Value through open innovation and strong partnerships

Sabina Gold & Silver Corp. (Nunavut, Canada)

- Ownership: 11%
- Stage: Permitting
- Operation: Open pit/
underground

Khalkos JV
Val D'or,
Quebec

Chelopech Mine (Bulgaria)

- Ownership: 100%
- Operation: Underground

Krumovgrad Gold Project (Bulgaria)

- Ownership: 100%
- Operation: Open pit
- Commissioning: Q4 2018

Exploration JV
Armenia

Timok Gold Project (Serbia)

- Ownership: 100%
- Stage: Advanced exploration

Tsumeb Smelter (Namibia)

- Ownership: 100%
- Operation: Specialty smelter

- Operating assets
- Development asset
- Late stage exploration assets
- Early stage exploration assets



The Next Big Change

A recent Forbes survey said: “88 % of companies surveyed said they were undergoing digital transformation efforts (but only 25% had an understanding of what it is.)”

PWC says : 40 % of businesses in the top 20 of every industry will be disrupted by Digital Transformation.

45 % of companies in the Fortune 500 ten years ago are not here today.

By 2020 the cost per hour to deploy and operate a generic robotic system will fall below the level of human minimum wage.

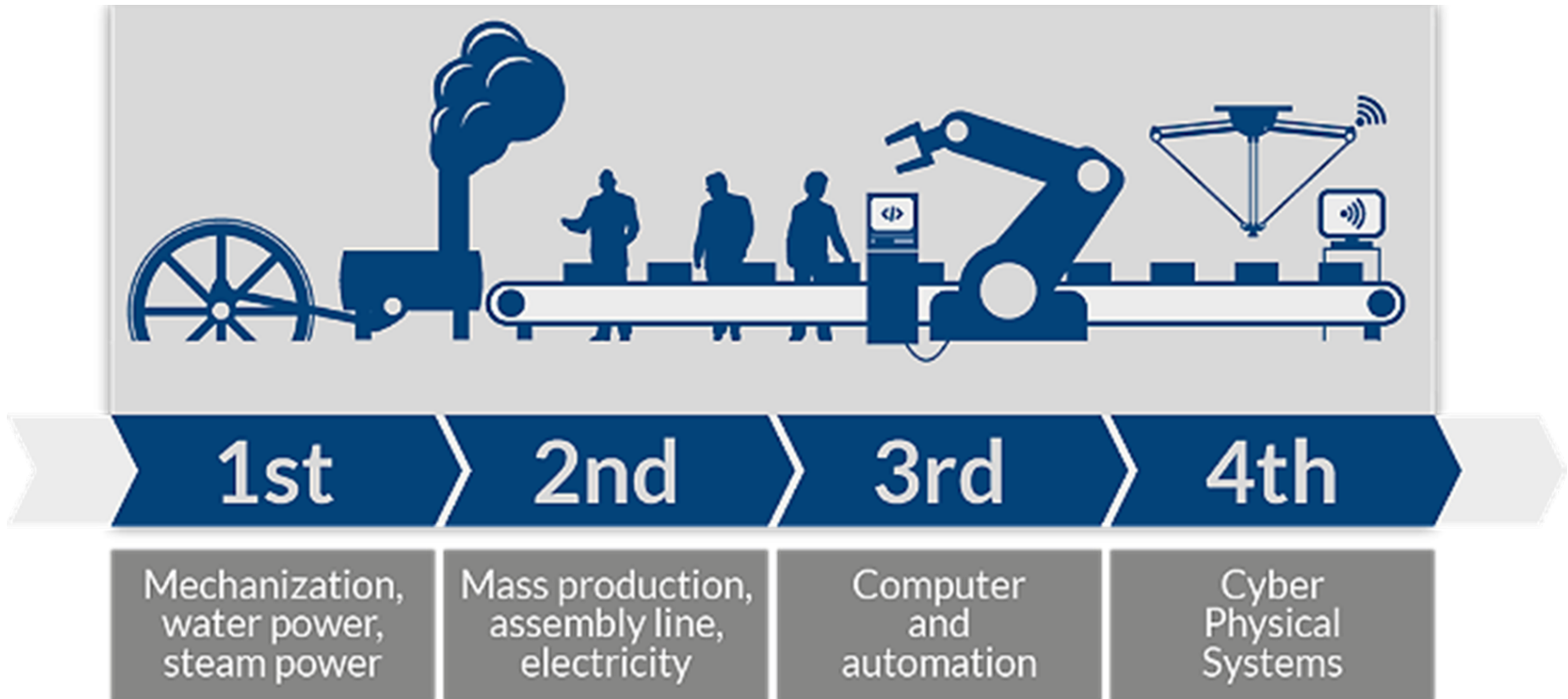
... and we are experiencing the least amount of change we will ever see

Key Challenges Facing the Mining Industry

- Low Returns on Capital and low long term total shareholder returns
- Declining productivity and slow to innovate
- Slow response to market changes and disruption
- Declining grades, fewer discoveries and longer timelines to production
- Execution track records are not great (both builds and operate)
- Attracting and retaining skills needed
- Increasing societal expectations and demands

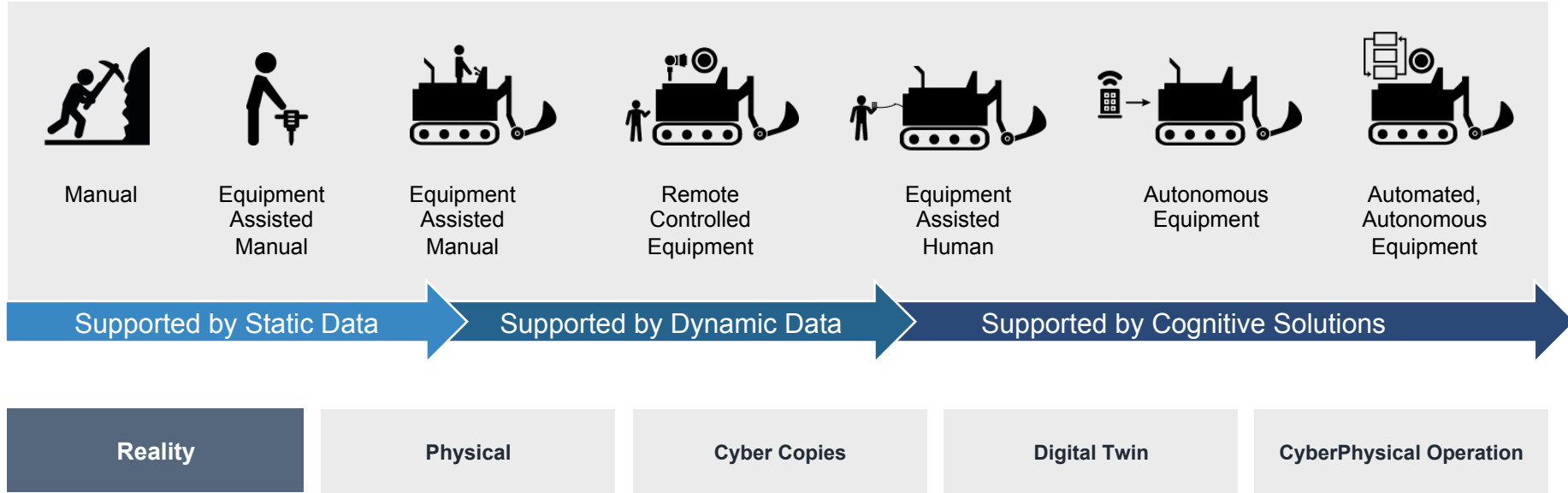
Creating a burning platform for change

Fourth Industrial Revolution



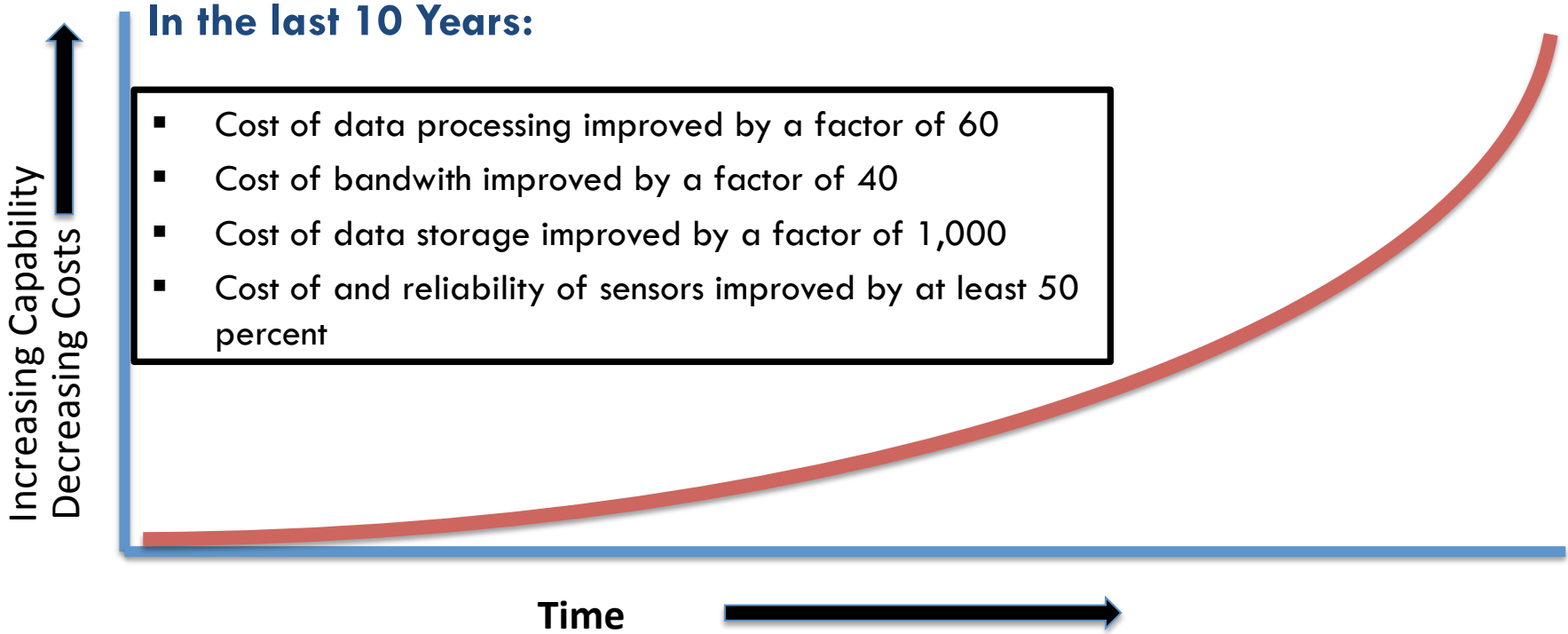
...will change the way we live, work and the way entire industries operate

Mining is lagging other industries ...



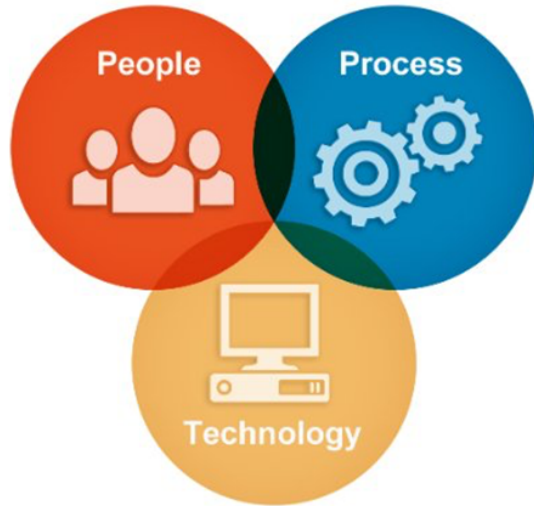
Mining is lagging other industries with majority of mines working with multiple, fragmented copies of time and space

Speed of Technological Change is increasing



What was not possible to do in the past could be possible today or in the near future.

What is Digital Transformation?



- Moving to a data driven economy and enterprises
- Data is now the new resource for wealth creation
- Opportunity for increasing productivity, accelerating innovation and new disruptive business models
- Creates new challenges of data access, ownership, privacy and security

Digital transformation is not just a technology trend, but rather a core business approach at the center of enterprise business strategies across all industry segments and markets.

Implications to Society

- Affects every aspect of human, social, political, and economic activity
- Control of data, IP and knowledge will determine economic, social and political power
- Governments play an important role in constructing, limiting and enabling data driven economy, particularly control over data usage
- Government support (or not) of innovation will create differential rates of economic growth and new economy jobs



How are we being impacted?

Our physical world is merging with the digital or virtual world.



- Hyper awareness
- Sensors on everything
- Smart connected homes and cities
- Changing way we receive services
- Changing transportation
- Merging virtual with real

...making our lives easier but also more aware & connected.

Differences in Data Driven Economy



- To people, Big Data is meaningless; to computers it is a 'gold mine'
- Knowledge is no longer accessible by all
- Significant up front capital required to exploit Big Data, but cost to scale is low
- First to capture and exploit commercialization of data has advantage, resulting in 'superstar' companies
- Creates new forms of trade and exchange not captured by traditional accounting systems
- Creates new systemic risks due to vulnerabilities in information infrastructure

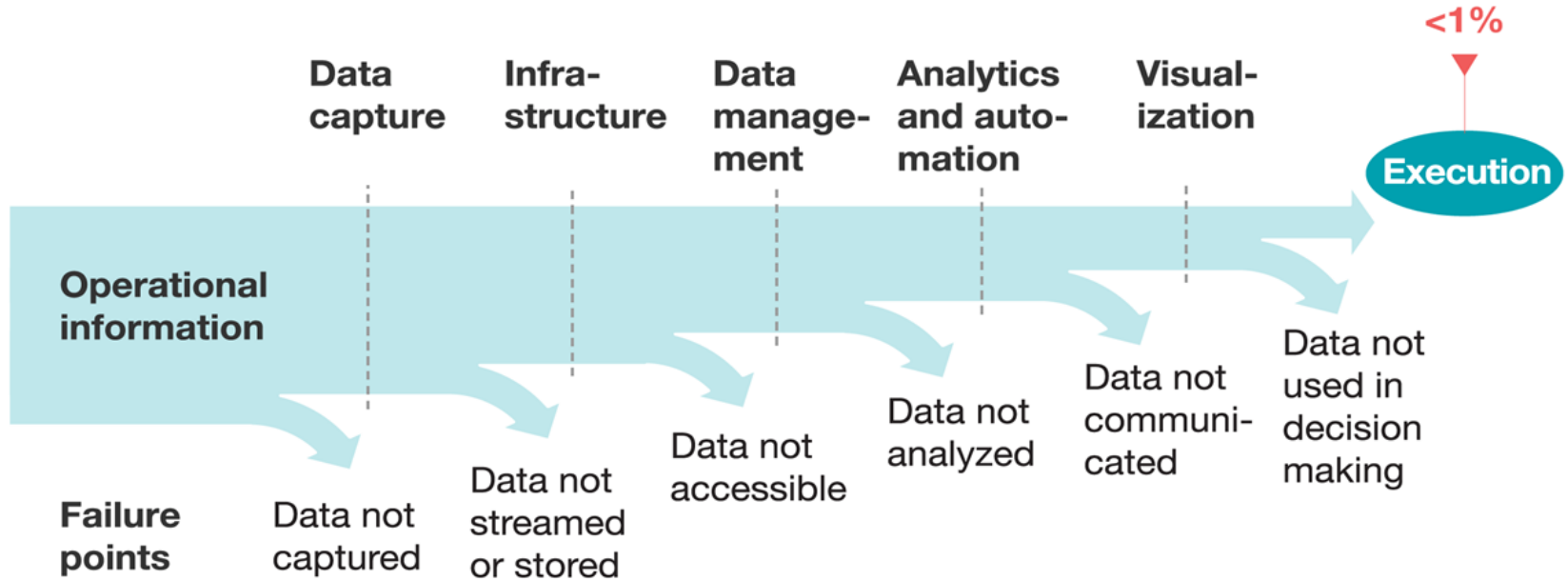
How Data Leadership Affects Industries



- Most valuable companies are underpinned by sophisticated capacity to collect, organize, control and commercialize data and intellectual property
- Data and IP are becoming an essential part of business strategy
- New and disruptive business models are being created based on data collection
- Shifting where profits and wealth are created and commoditizing physical assets
- Restructuring work and jobs; in some cases upsetting entire industries
- In order to survive, businesses must adapt or lead the disruptive change

Opportunity for the Mining Industry

Mining companies are using only a fraction of their data



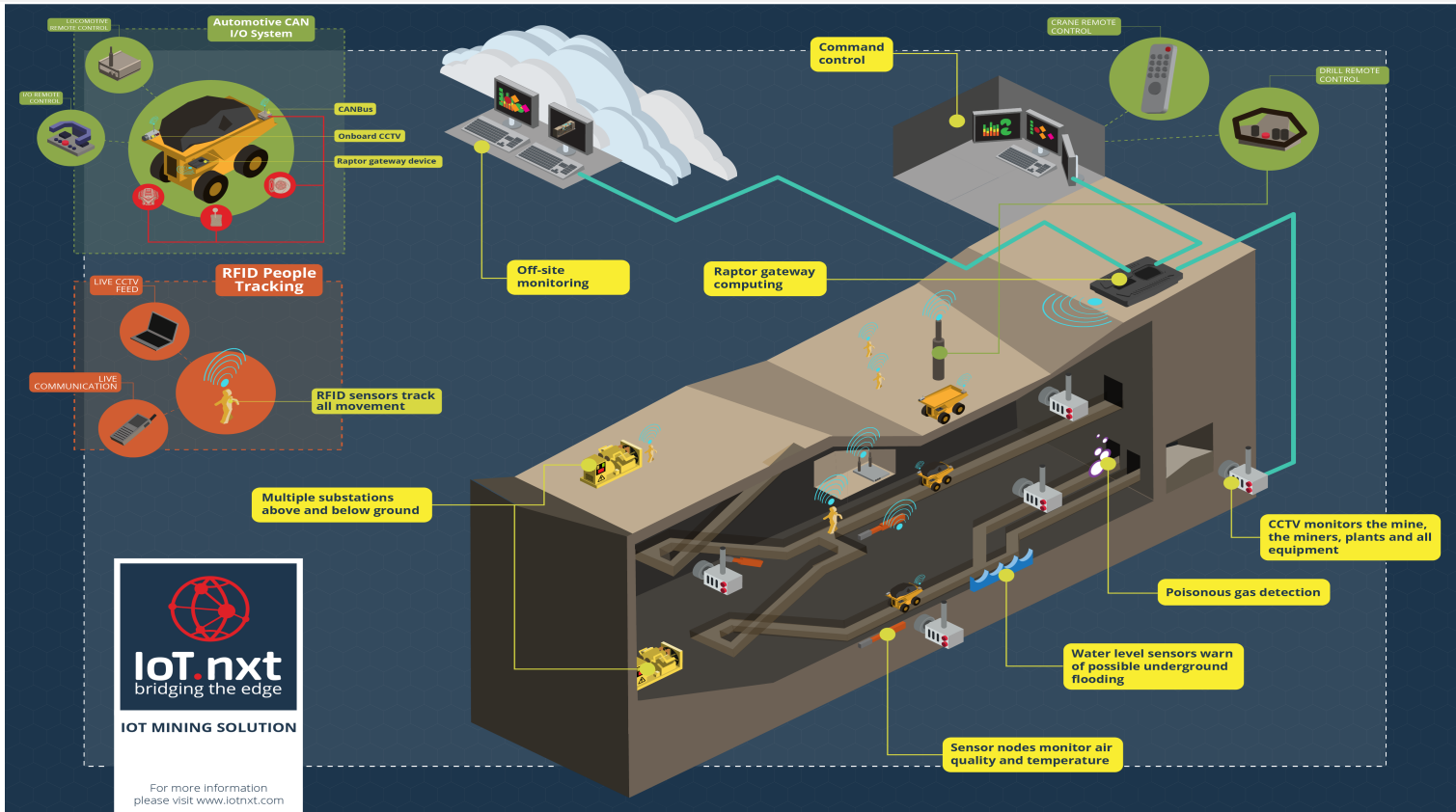
Source: Mckinsey

Improvement Opportunities for our Industry



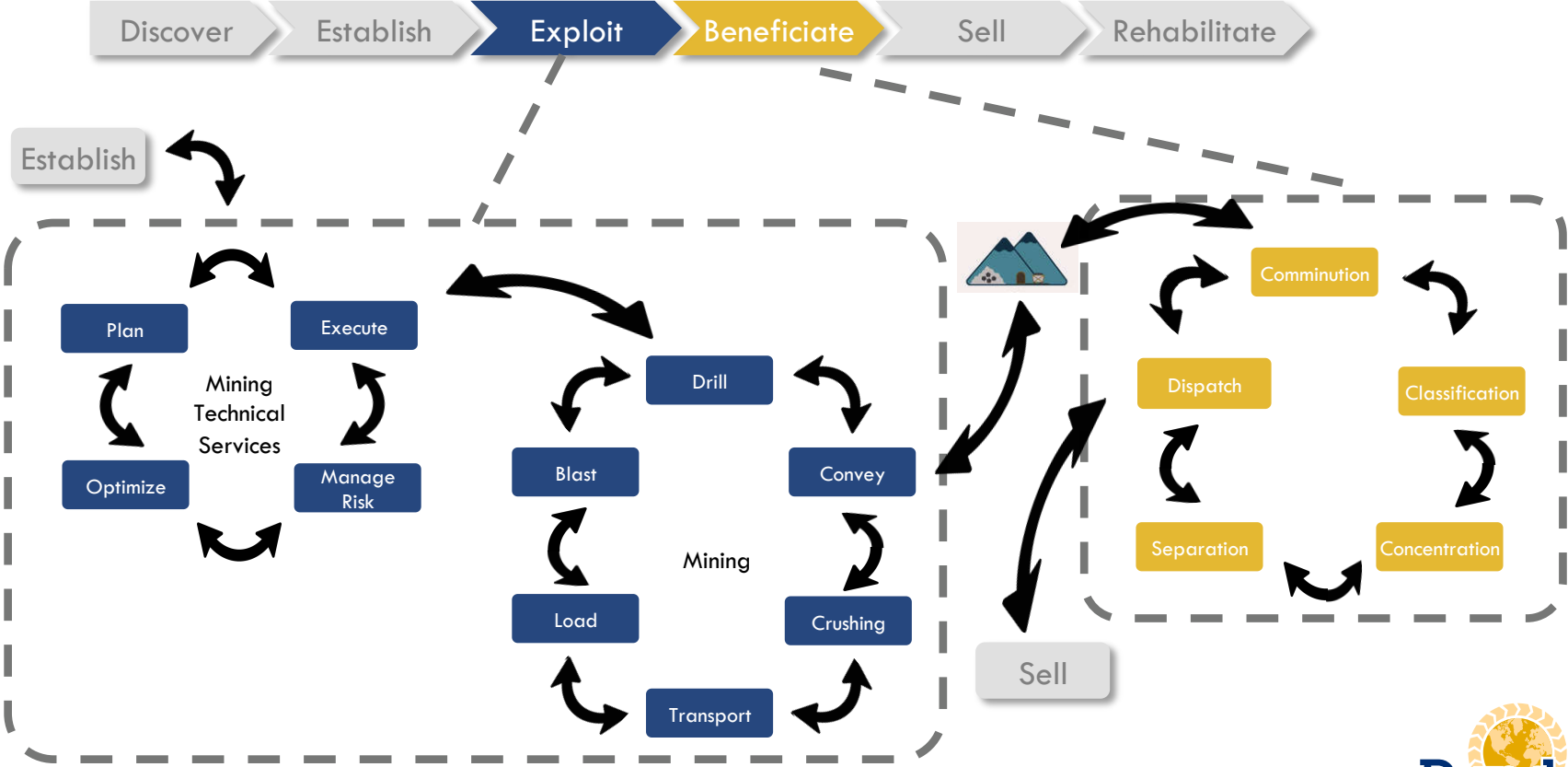
- Reduce costs
- Improve performance
- Improve safety
- Reduce environmental impacts
- Speed up innovation
- Improve societal benefits
- Improve industry image

The "Smart" Connected Mine

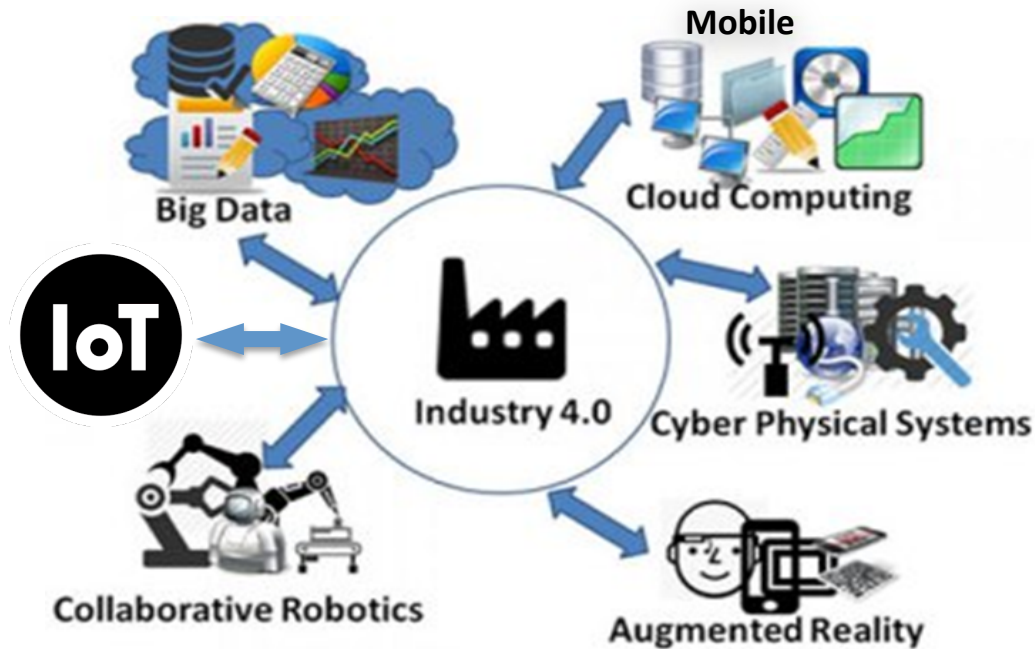


For more information
please visit www.iotnxt.com

Change the way we do things



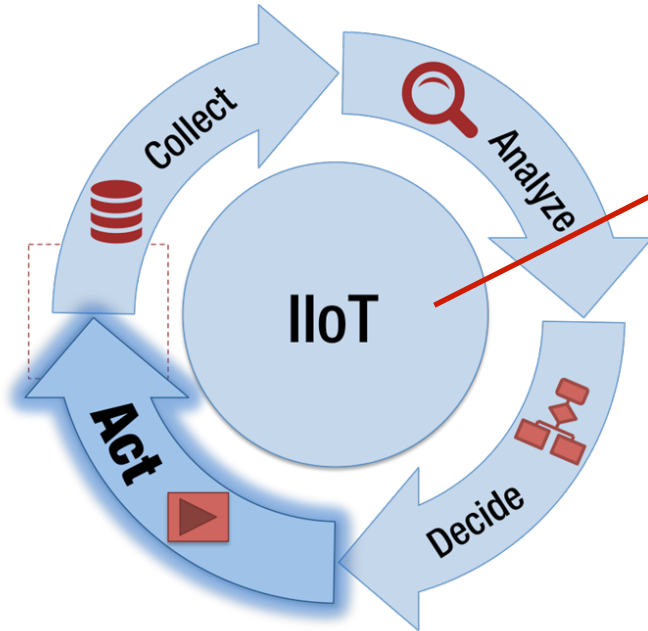
Key Digital Technology Drivers of the Change



- Principle drivers of digital transformation
- Comprises a platform for change
- Drive a need for more enterprise systems
- Requires new standards for interoperability & connectivity
- OT/IT convergence

... and this is just the beginning

What is the Internet of Things?



THE 3 BASIC COMPONENTS OF THE INTERNET OF THINGS



1 THE THINGS

Things, like equipment, vehicles or lightbulbs are fitted with sensors.



2 THE NETWORK

These things are connected to a private network or the Internet.

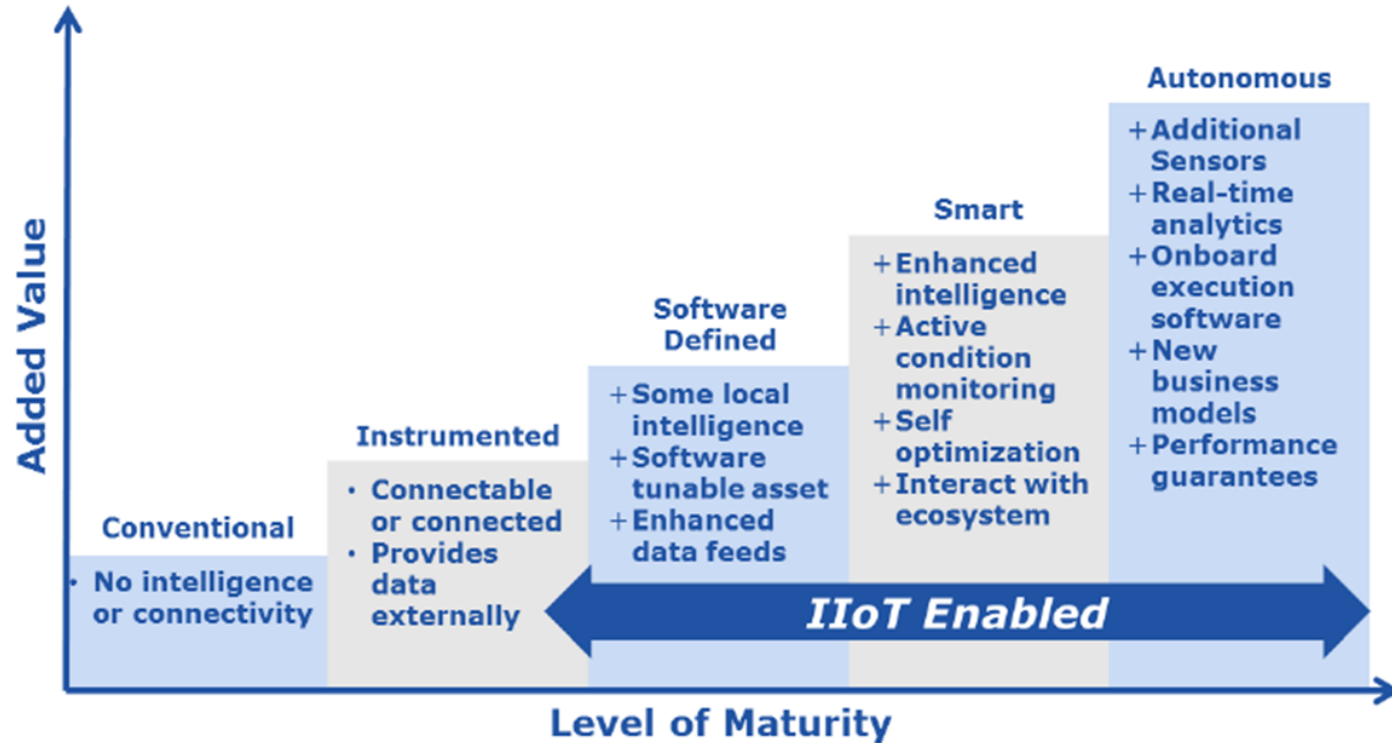


3 THE SYSTEMS

Systems, or users with web-enabled devices, monitor and control "things" remotely.

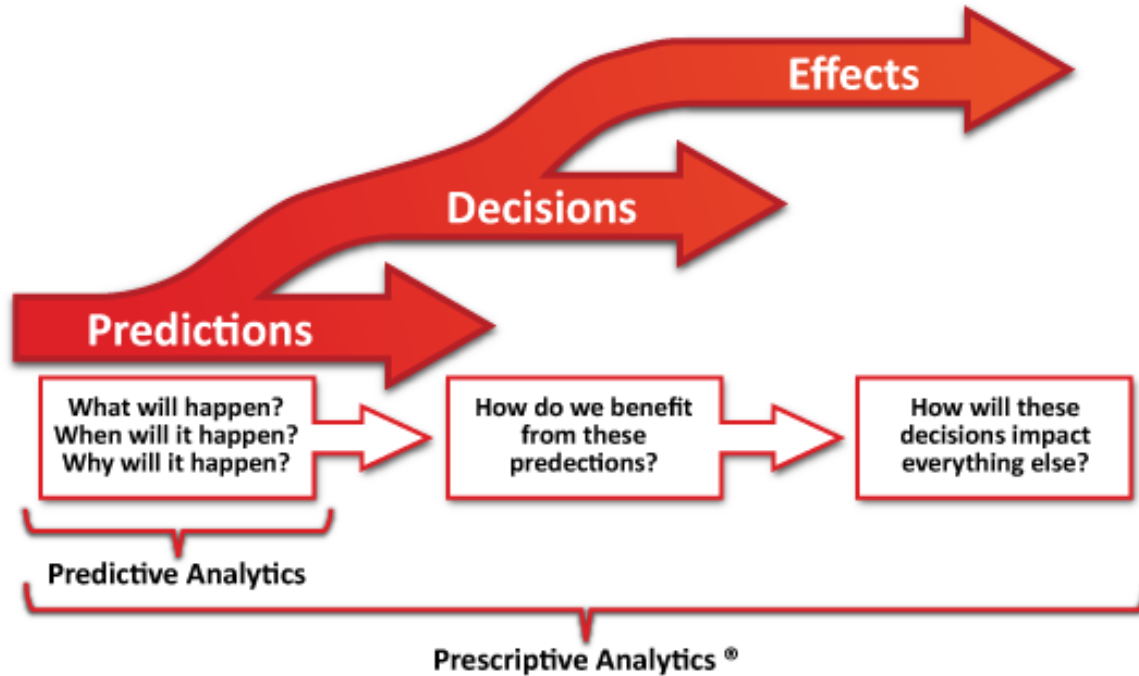
Software Advice

IIOT - Asset Maturity Model

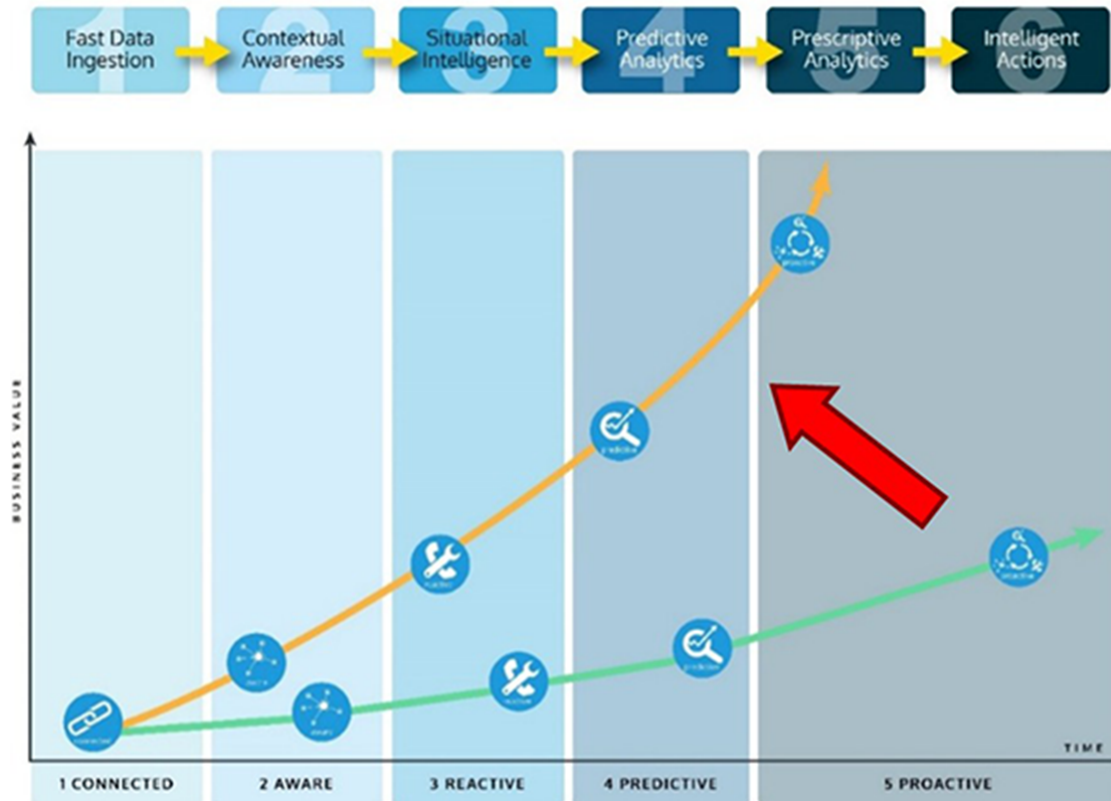


Analytics- Enhanced Decision Making

Involves the fields of Machine Learning and Cognitive Computing



Analytics Maturity Scale



Digital Twin (Cyber Physical)

Digital

Software Programs/BOTs

Physical

Home | Public Space | Industrial/Business Space



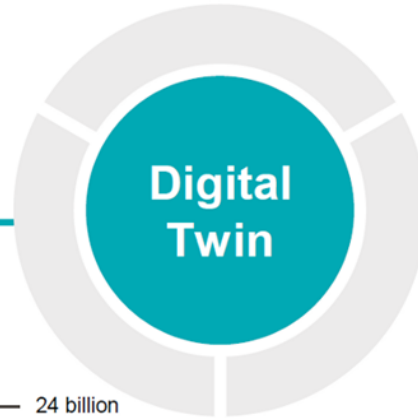
Physical **Objects**



Controlled Machines



Intelligent Autonomous Machines



— 24 billion
RFID tags
in 2020
>100 billion
QR Codes

Biological

Implantable Tech

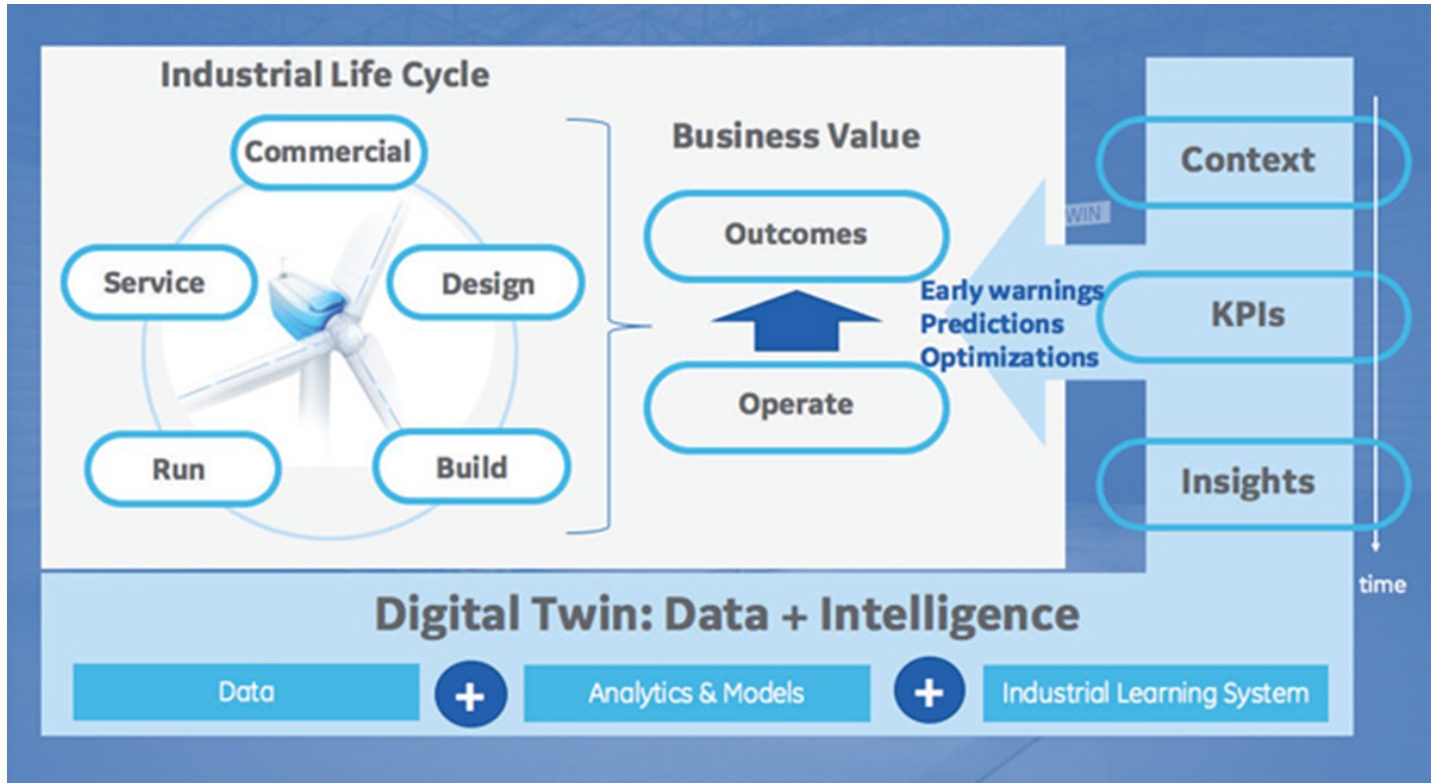


Organisms/Living Species

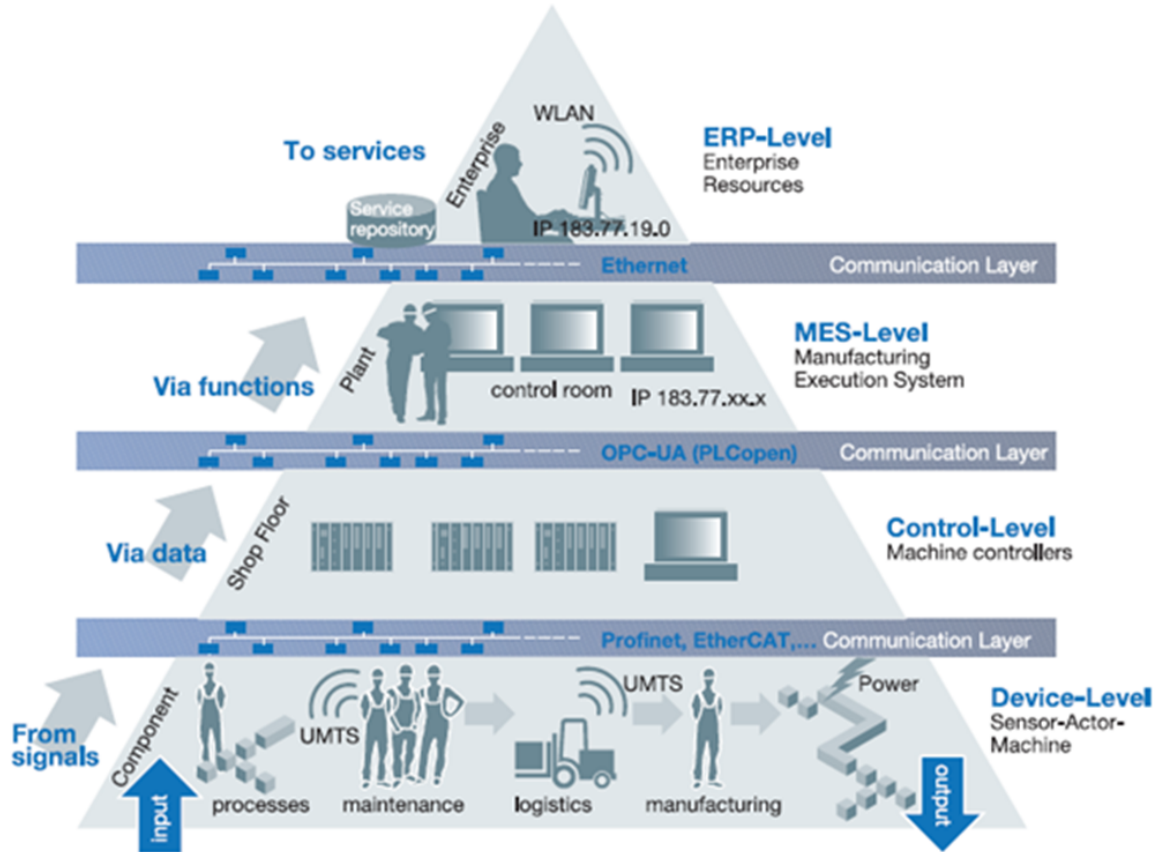


— 1 billion
cattle
8 billion
humans

Integration and Optimization



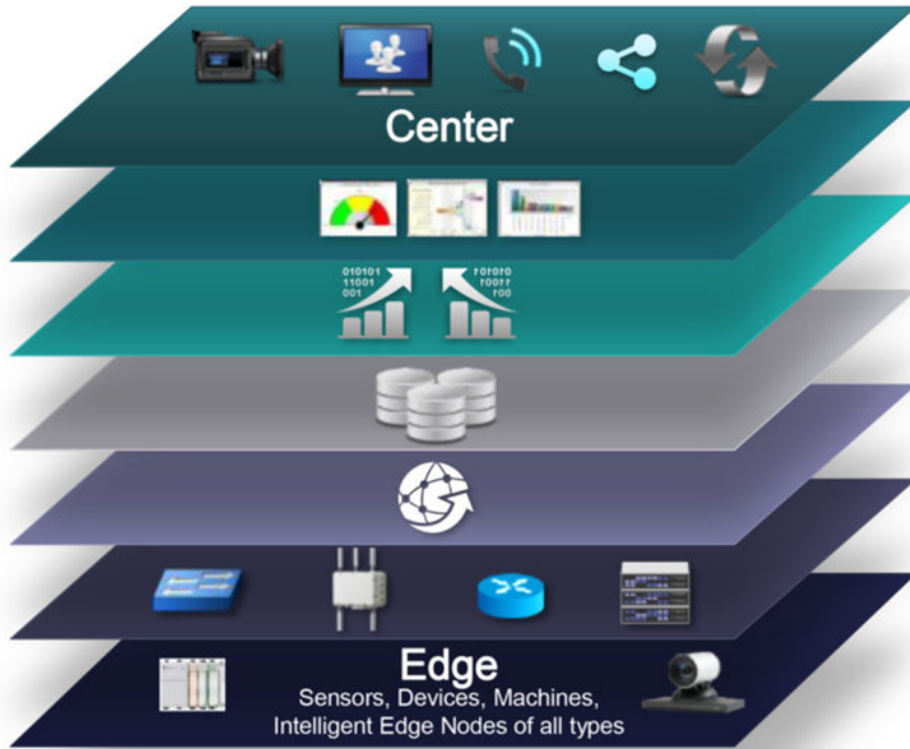
Industry 4.0 - Architecture



Industry 4.0 - The Data and Application Stack

Levels

- 7 Collaboration & Processes**
(Involving People & Business Processes)
- 6 Application**
(Reporting, Analytics, Control)
- 5 Data Abstraction**
(Aggregation & Access)
- 4 Data Accumulation**
(Storage)
- 3 Edge Computing**
(Data Element Analysis & Transformation)
- 2 Connectivity**
(Communication & Processing Units)
- 1 Physical Devices & Controllers**
(The "Things" in IoT)



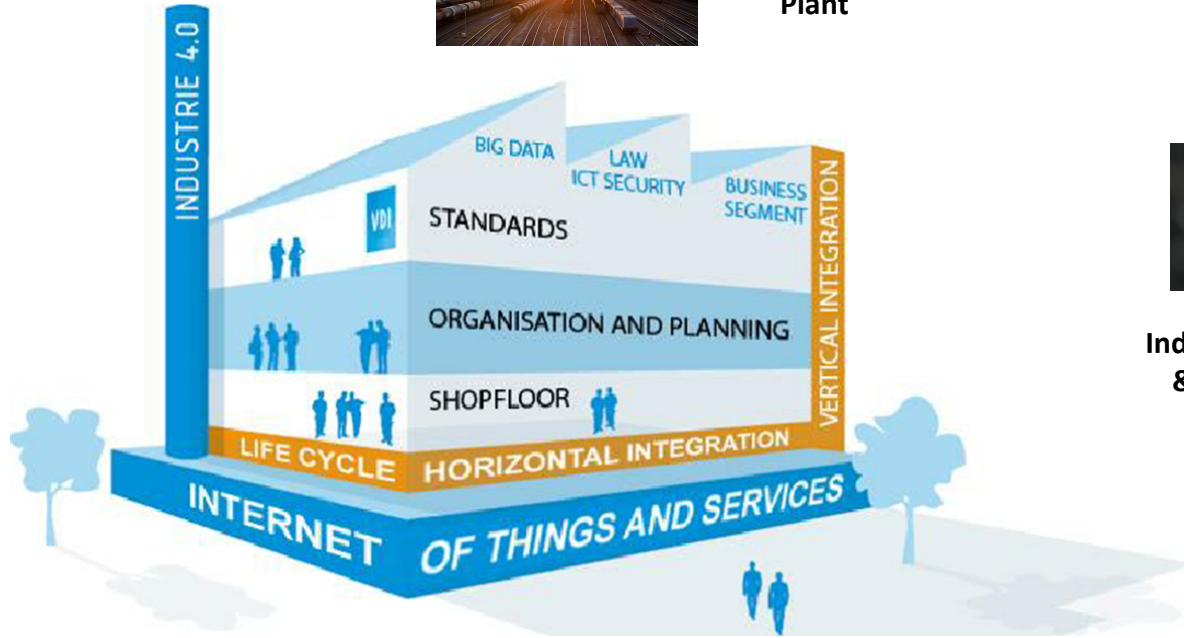
Industry 4.0 - The Fully Integrated Digital Enterprise



Connected Assets & Service Transformation



Autonomous Plant



Industrial Wearables & Augmentation

A Blending of Traditional and Digital Business Models

Typical Use Cases of Digital Technology in Mining

Exploration & Design

- Exploration targeting with Big Data
- Enhanced Ore body characterization
- E to E design optimization using Modelling & Simulation

Asset Management

- Predictive & Prescriptive Mtce
- Life-cycle optimization
- Anomaly detection & correction

Production & Safety Performance

- Real-time prod monitoring(SIC)
- Hazard monitoring & control
- Advanced analytics for improvements
- Wearables for human capability augmentation

Work Automation

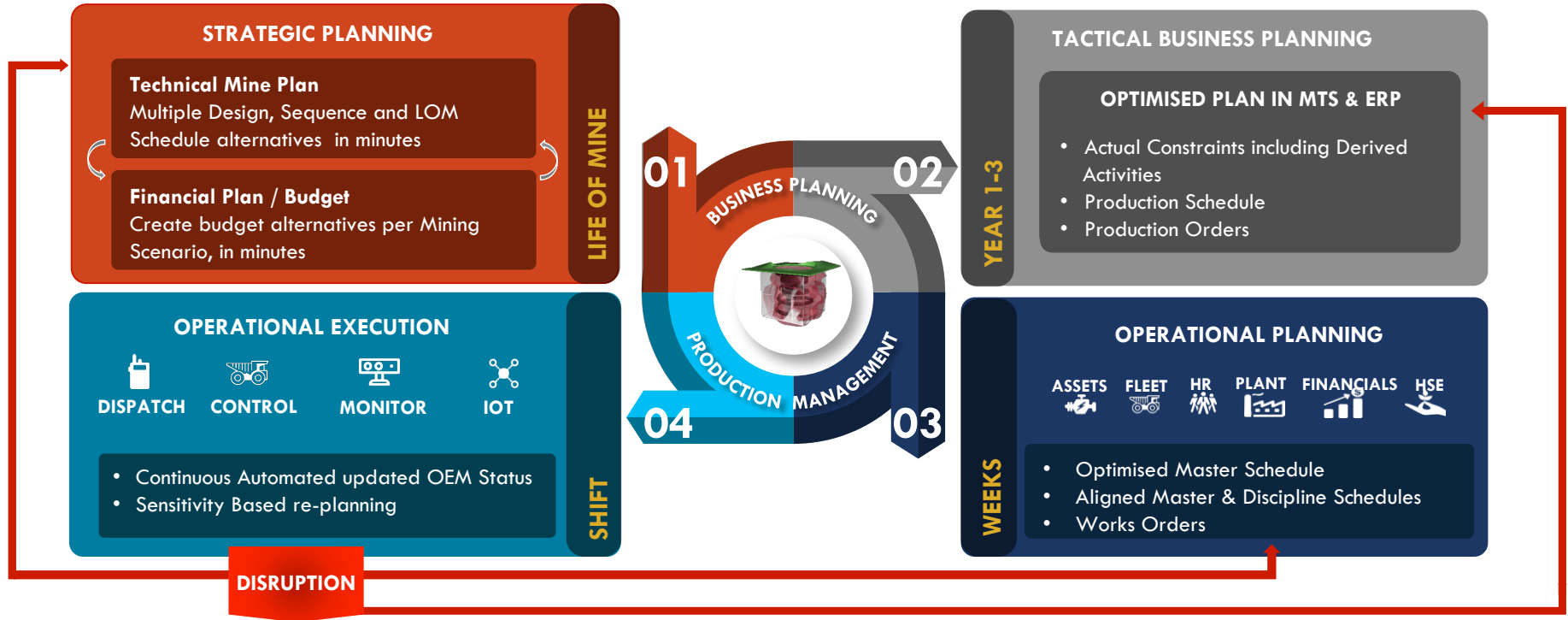
- Mining(operational) Process Automation
- Back office automation (RPA)
- Robots & drones to carry out tasks
- Remote monitoring
- AI Enhanced decision making
- Supply chain automation

Strategy & Optimization

- Strategic Optimization
- Dynamic planning & execution
- Tactical and Operational optimization
- Supply chain optimization

Reinventing the way we do things in mining

Art of the Possible : Dynamic & Integrated Planning and Execution



Managing by discrete planning events will not keep up with the fast paced business world we now live in.

The Future of Work



Significant change will occur both onsite and in the back office

- Automated equipment, remote operating centers, robotic process automation, machine learning & AI.
- Will require re-envisioning **how** and **where** work gets done
- Requires new skills like data scientists, software engineers and automation specialists but still need experienced people
- Reskilling of displaced workers
- New talent development models and HR processes to attract and retain the new workforce

Culture + Modern Infrastructure + Smart People

Requires creating a new culture

40% some or good progress¹

60% little or no progress¹

What makes the difference?

CLARITY

WHY?

vision & necessity
for change

What/When/Who?

timelines & roadmap, clear
roles & responsibilities

COMMITMENT

BUY-IN & SUPPORT

from the boardroom to the
mining face

UNITY & COLLABORATION

Mutual goals, trust &
empowerment,
democratisation of ideas

¹ McKinsey

MODERN INFRASTRUCTURE: Benefits Possible

REAL TIME CONTROL & MONITORING

Connected Equipment & Tools. M2M analytics for Predictive Maintenance and Asset Optimization

+20% productivity PER YEAR¹
+10% THROUGHPUT²

SMART & EVOLVED SUPPLY CHAINS

Smart Inventory Tracking & Hyper-local production for robust & transparent supply chains

60% COST SAVING³
**20% IMPROVED
PRODUCTIVITY⁴**

PROCESS IMPROVEMENTS

Protect quality and brand using Data Analytics, Visualisation and Computer Vision

50% YIELD IMPROVEMENT⁵
20% SPAREs COST REDUCTION⁶

1. Bosch ([link](#)) 2. Stanley Black & Decker ([link](#)) 3. BAE Systems ([link](#)) 4. 5. Pharma Industry ([link](#)) 6. Intel ([link](#))

SMARTER PEOPLE : Benefits Possible

SAFE WORKER

Monitor vital signs and environmental factors associated with health & safety, via wearables
85% REDUCED INJURY

RISK¹

**17% PRODUCTIVITY
INCREASE²**

EFFECTIVE WORKER

Deliver real-time insight to workers at the point of decision, via unobtrusive digital devices
25% REDUCED REPAIR

TIME³

35% COST REDUCTION⁴

SKILLED WORKER

Enhance knowledge transfer and training via P2P connection and enhanced realities
70% REDUCED INJURY

RATE⁵

**<1 year ROI for VR
TRAINING⁶**

1. DorsaVi ([link](#)) 2. DorsaVi ([link](#)) 3. Boeing ([link](#)) 4. NNS Shipbuilding ([link](#)) 5. Ford ([link](#)) 6. SB Automotive ([link](#))

Mining Industry Paradigm Shifts

The major industry paradigm shifts that need to occur with digital transformation

Current

- Firm-centric thinking & behaviour
- Profit Oriented
- Vertical Focus
- Fragmented & siloed systems
- Traditional Supply chains
- Closed innovation and slow adoption
- Partnership focus

Future

- Ecosystem thinking & behavior
- Purpose Oriented (Societal benefits)
- Horizontal value creation focus
- Platform centric orchestration
- Co-created value proposition
- Open continual innovation and accelerated adoption & learning
- Collaborative networks

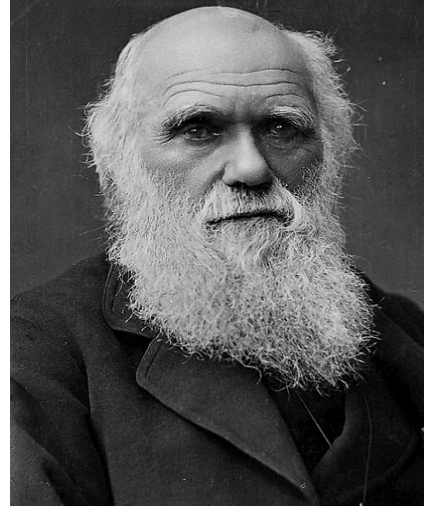
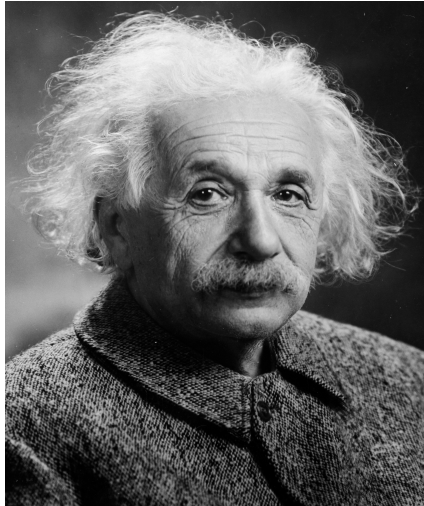
New Culture : Innovative , Open, Agile & Accountable

Digital Transformation change will be inescapable

“It is the definition of insanity to do the same thing over and over again and expect different results.”

Albert Einstein

(1879 – 1955)



“It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change.”

Charles Darwin

(1809 – 1882)

“The new differentiator for mining companies will likely be their ability to leverage data and successfully adopt the technological change.”



Thank you

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