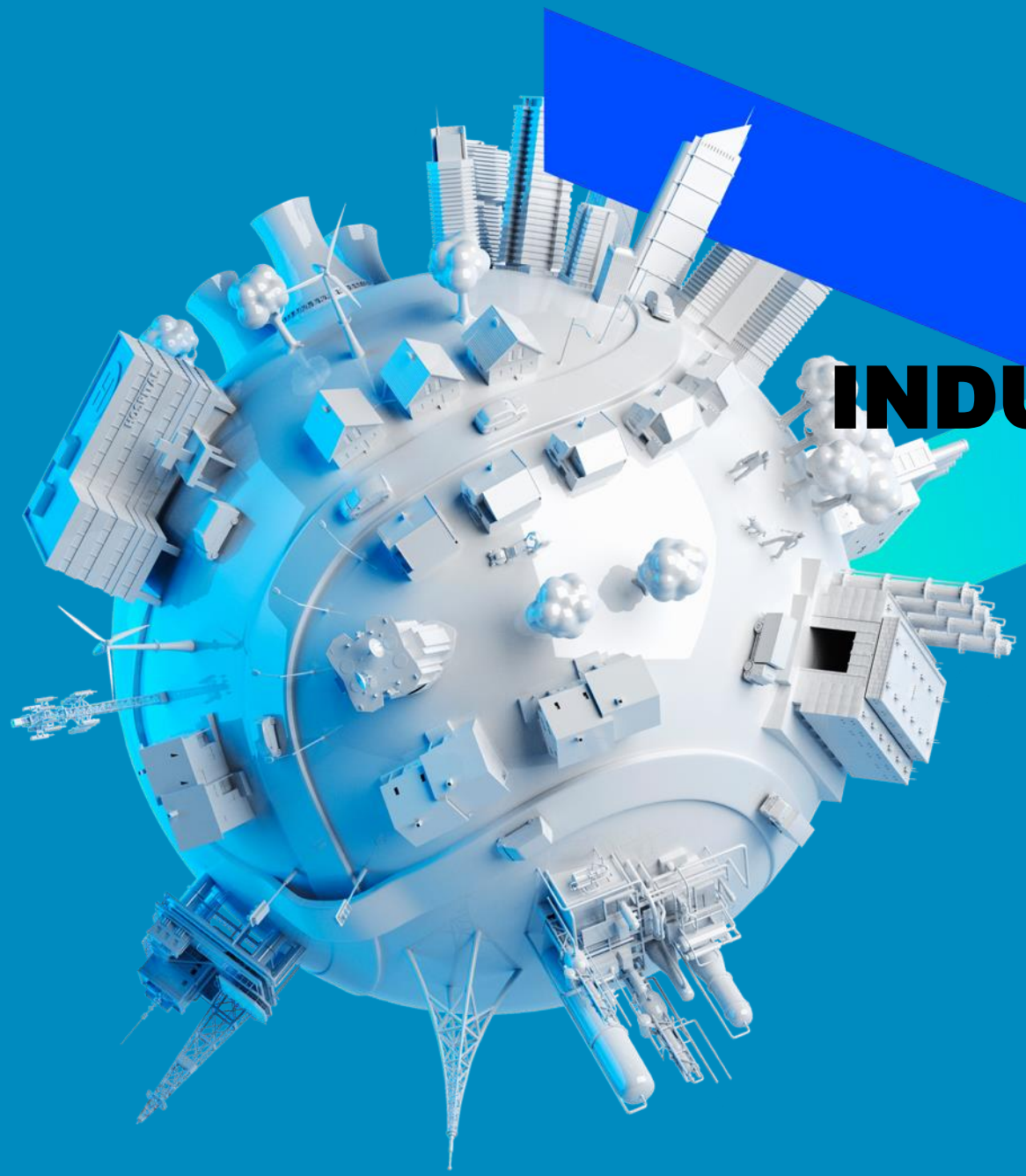

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INDUSTRY X.0

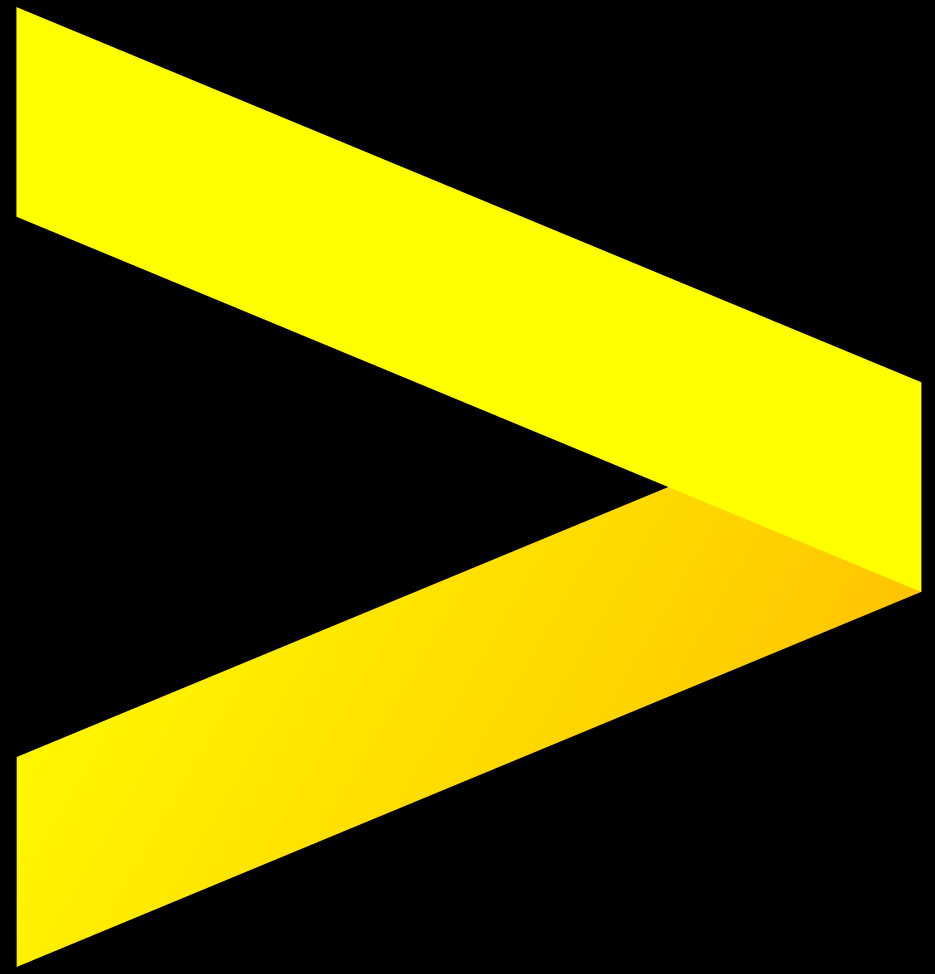
FIEMG

SEMANA DA INDÚSTRIA

A INDÚSTRIA MINEIRA NA QUARTA REVOLUÇÃO INDUSTRIAL

Strategy | Consulting | Digital | Technology | Operations

ACCENTURE E INDUSTRY X.0



accenturedigital

ACCENTURE NO BRASIL

Escritórios São Paulo, Rio de Janeiro, Brasília, Belo Horizonte, Porto Alegre, Recife, São José dos Campos, Campina Grande e Vitória.

+10,900
funcionários

- IT Solutions Delivery Centers em Barueri/SP, Rio de Janeiro e Nova Lima/MG.
- Innovation Center em Recife.
- Centros de Inovação e Excelência em Agribusiness e Automotive, em São Paulo, e em Energy, Communications e Analytics, no Rio de Janeiro.
- Shared Services Delivery Center em Curitiba (Paraná).

No Brasil nós servimos:

Source: Melhores & Maiores 2018, Exame

35 Das 50 maiores organizações

10 Maiores bancos

6 Das 7 maiores seguradoras

Nossas aquisições:

Gapso
Um fornecedor avançado de serviços e soluções de analytics, especializado na solução de desafios complexos de cadeia de suprimentos e logística.

Accenture Interactive
Uma agência digital, fortalecendo marketing digital, ofertas de comércio eletrônico e propaganda.

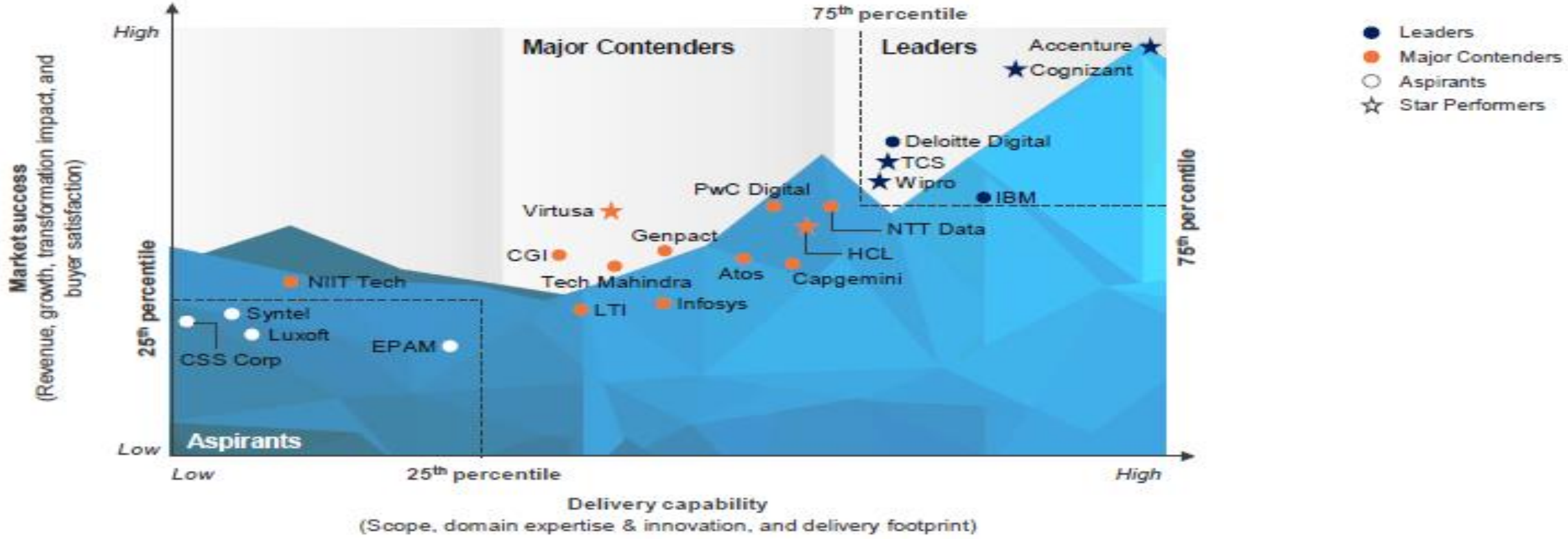
Concrete Solutions
Um líder em aplicações web móveis na nuvem.

Industry X.0
Líder em Automação e Soluções Industriais de TI, abrangendo as indústrias de Mineração, Metais, Petróleo e Gás e Utilities.

Everest Group PEAK Matrix™

Digital Services – PEAK Matrix Assessment and Market Trends 2017: "Redefining Customer Experience with Digital"

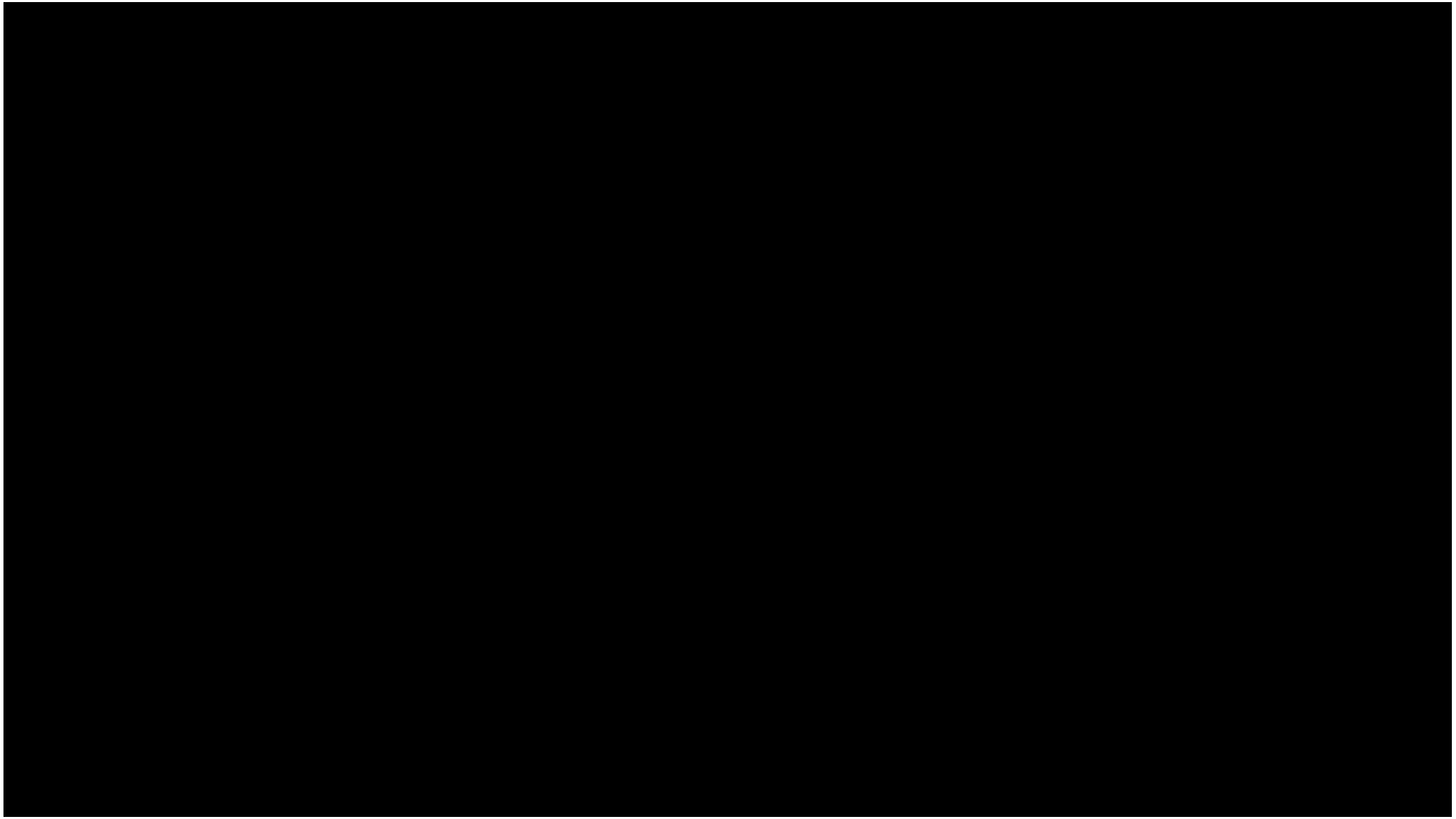
Everest Group PEAK Matrix™ for digital services 2017



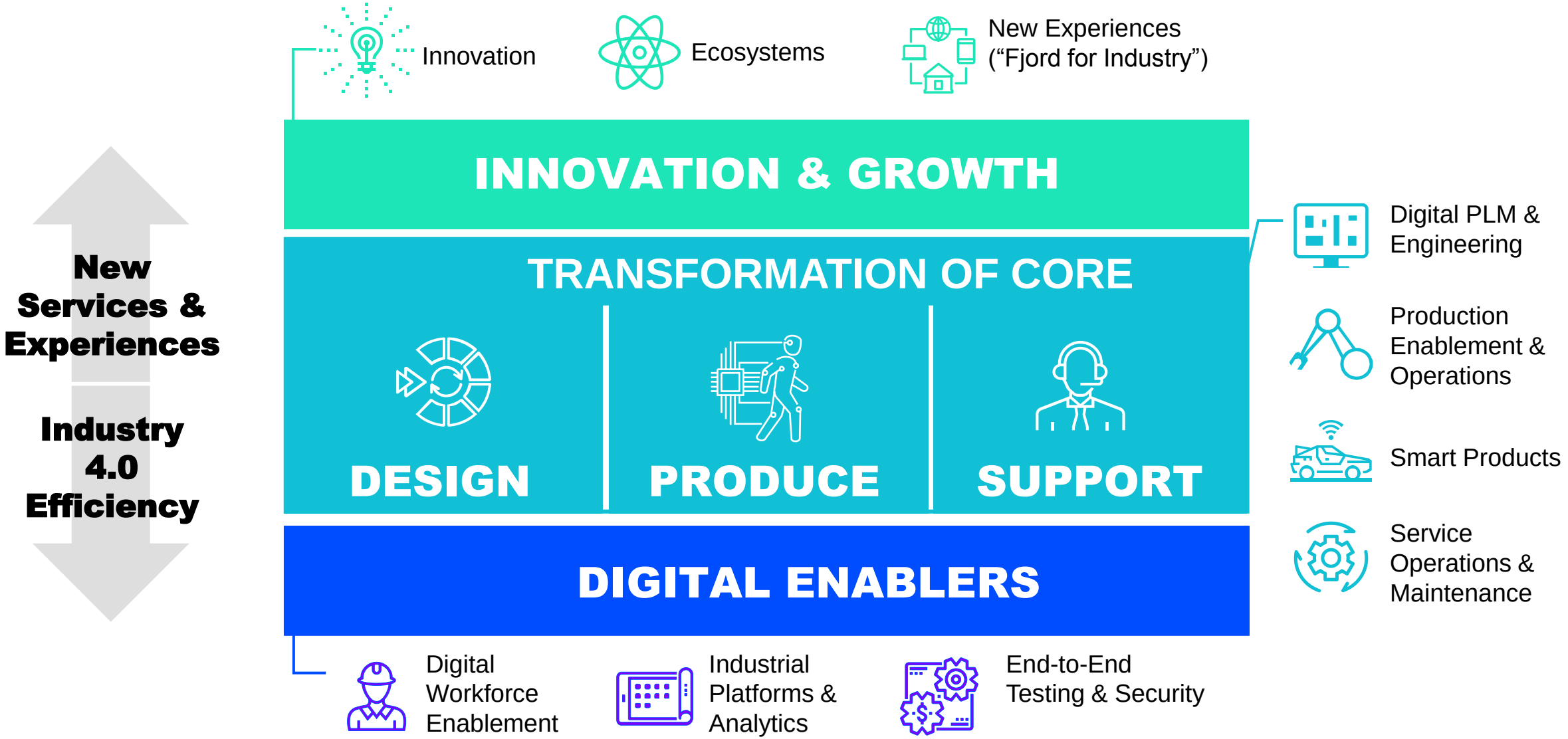
Note: Assessment for Capgemini, Deloitte Digital, EPAM, Infosys, and PwC Digital excludes service provider inputs on this particular study, and is based on Everest Group's estimates which leverage Everest Group's proprietary Transaction Intelligence (TI) database, ongoing coverage of these service providers, public disclosures, and interaction with buyers

Source: Everest Group (2017)

INDUSTRY 4.0 – INTRODUCTION - VIDEO



DIGITAL FRAMEWORK - LEVEL1



THE THREE MAIN OPPORTUNITIES

Delivering Hyper-Personalized Experience

Across different stages of product lifecycle

Extracting higher and operational efficiency

With connected and intelligent products

Creating a new Business

with connected and intelligent products

EXAMPLE: DISNEY MAGIC BAND

FAST CHANGE IS NOT A RECENT INVENTION

Easter morning 1900: 5th Ave, New York City. Spot the automobile.

Source: US National Archives.

Easter morning 1913: 5th Ave, New York City. Spot the horse.

Source: George Grantham Bain Collection.

INDUSTRY X.0 IMPACT IN MAIN INDUSTRIES

ACCENTURE CONTRIBUTED WITH THE WEF PRODUCING THE REPORTS ON THE ECONOMIC IMPACT OF THE INDUSTRY 4.0 IN THE MOST DIVERSE INDUSTRIAL SEGMENTS

DIGITAL HAS A POTENTIAL TO TRANSFORM METALS AND MINING COMPANIES ACROSS ALL DIMENSIONS OF THE BUSINESS

MANUFACTURING OPERATIONS

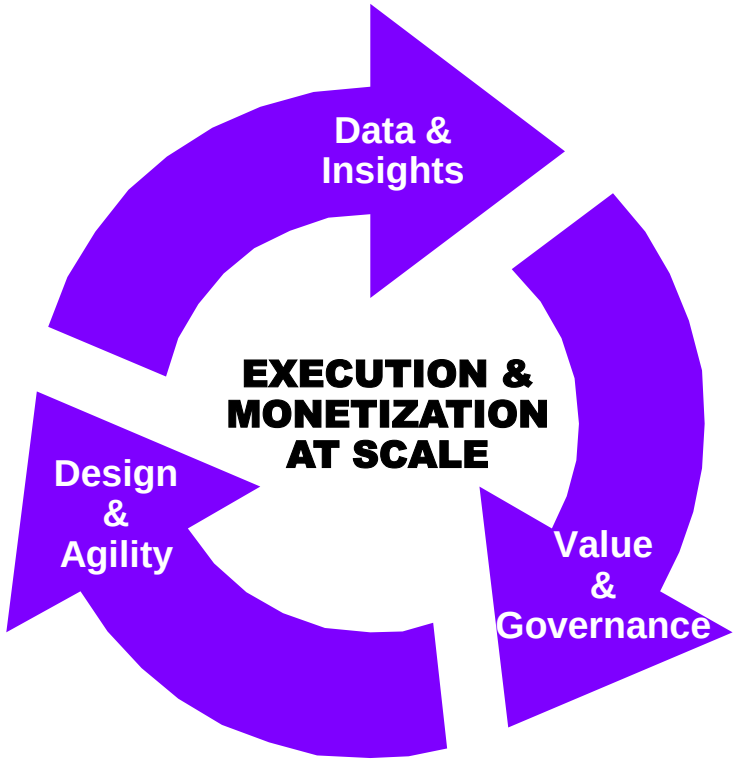
- IT-OT Integration or Convergence
- Remote Operating Center
- Digital Safety & Security
- Artificial Intelligence for operational control
- Robotics
- Wearables
- Potline Performance Optimization
- Predictive Process Performance

MARKETING & SALES

- Digital Customer Experience & E-commerce
- Pipeline Analytics
- Real time Pricing Optimization
- Product Definition
- Transforming Commodity Trading

WAREHOUSING & LOGISTICS

- Supply Chain Control Tower
- Automated Warehousing Operations
- GPS Logistics Tracking
- Augmented reality for warehouse mgmt.



CORPORATE

- Digital IT Transformation
- Finance as a Value Architect
- Connected worker
- Integrated Business Services Model
- Intelligent Infrastructure
- Workplace Transformation
- Digital Collaboration & Social media
- Digital Project Lifecycle Management

ASSET MAINTENANCE

- Predictive Maintenance
- Digital Work Order Management
- Mobile Maintenance Worker

SOURCING & PROCUREMENT

- Dynamic Raw Material Sourcing and Pricing
- Cost Visibility & Control

PLATFORM & DATA

- Centralized, Standardized robust infrastructure
- Multi-layer platform

SOURCE: ACCENTURE STRATEGY ANALYSIS

INDUSTRY X.0 IMPACTS IN MINING

Autonomous Operations:

- Autonomous drilling
- Autonomous trucks
- Autonomous Stackers
- Autonomous Reclaimers
- Autonomous Car Dumpers
- Autonomous Train Loading

Digital Twins + IA

- Predictive Maintenance
- Predictive Operations
- Advanced Process Control
- Regulatory Control Optimization

Digital Worker

- Safety Improvement
- Field Services Optimization

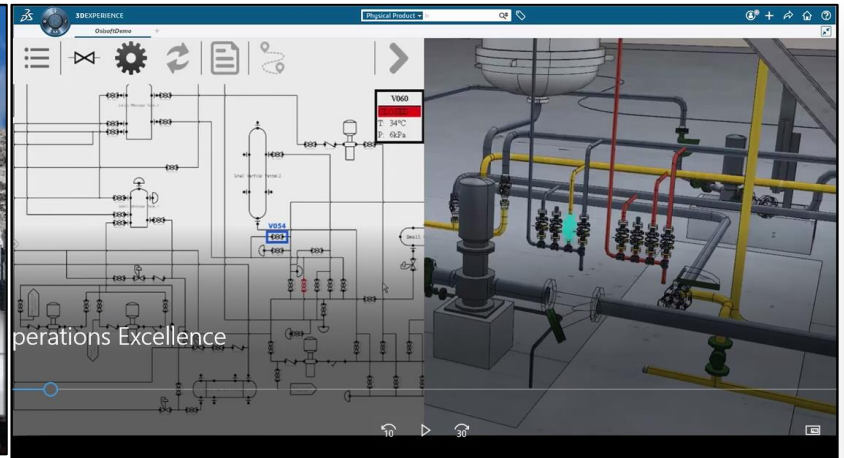
Production Planning & Scheduling:

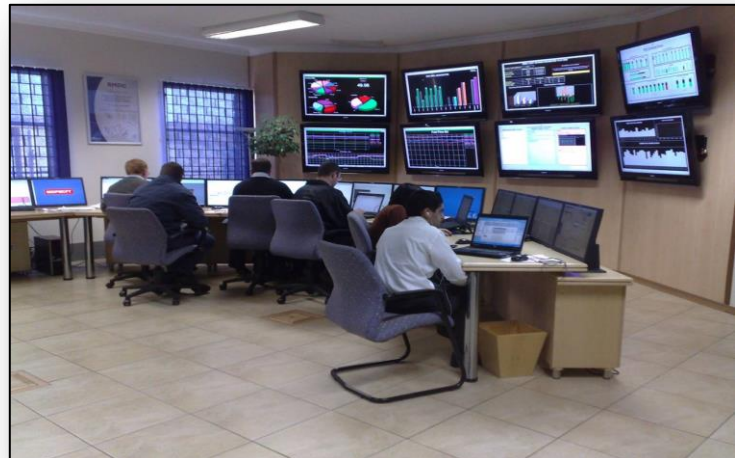
- Holistic Production Chain Planning
- Holistic blending Optimization
- Mine Fleet Optimization
- Demurrage Reduction

Remote Operating Centers/ Integrated Operating Centers:

- Rio Tinto
- BHP
- Codelco
- Roy Hill
- FMG
- VALE

Source: Dassault Sistemes





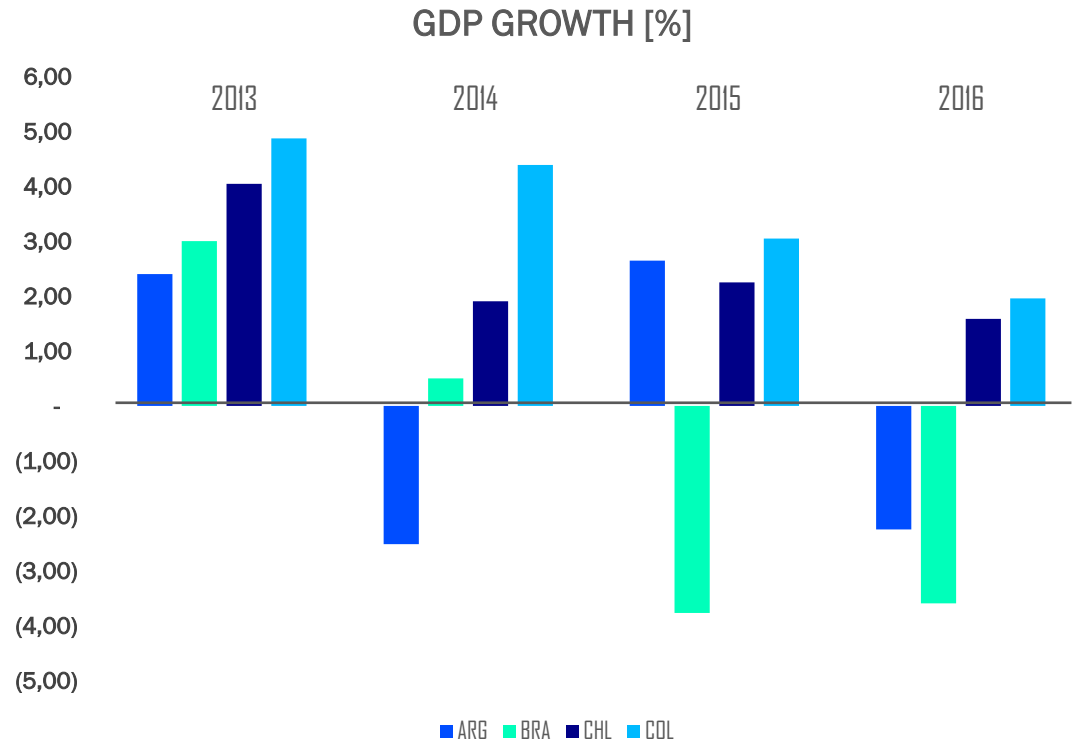
INDUSTRY 4.0

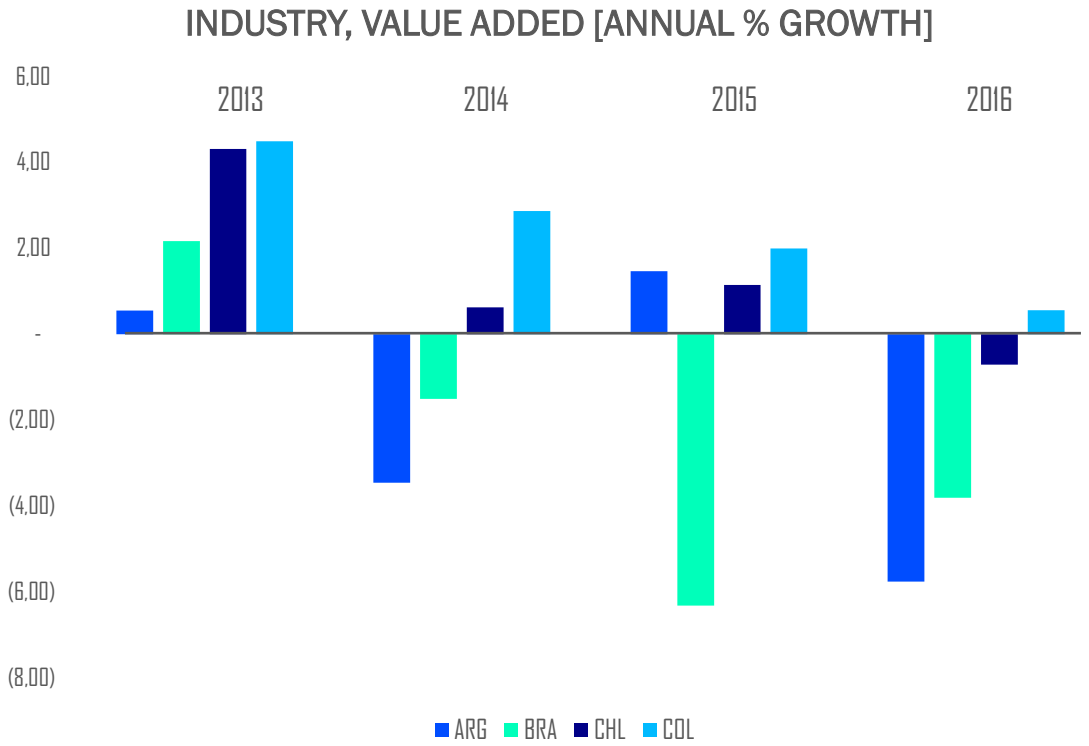
ONLY 13% OF COMPANIES ARE NOW IN THIS JOURNEY AND HAVE A DEFINED DIGITAL ROADMAP

DIGITAL

THE KEY TO BREAKING THE LOW-GROWTH DEADLOCK

Growth in South America has stagnated over the past four years…

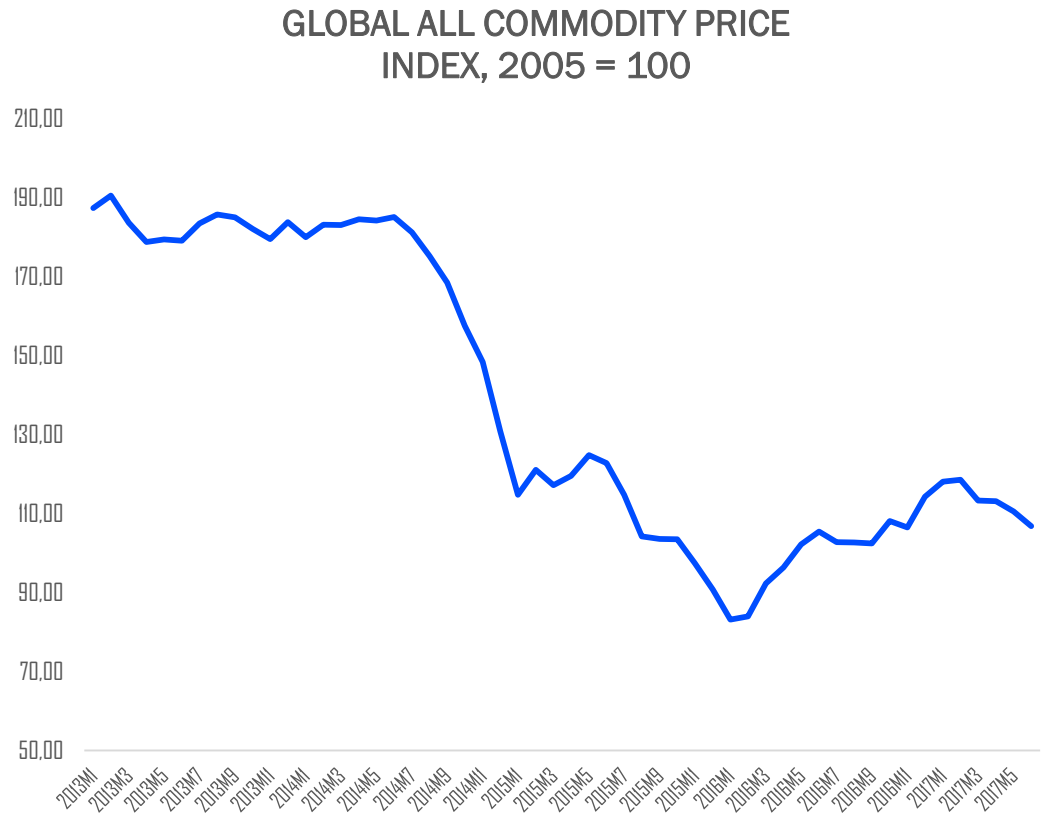


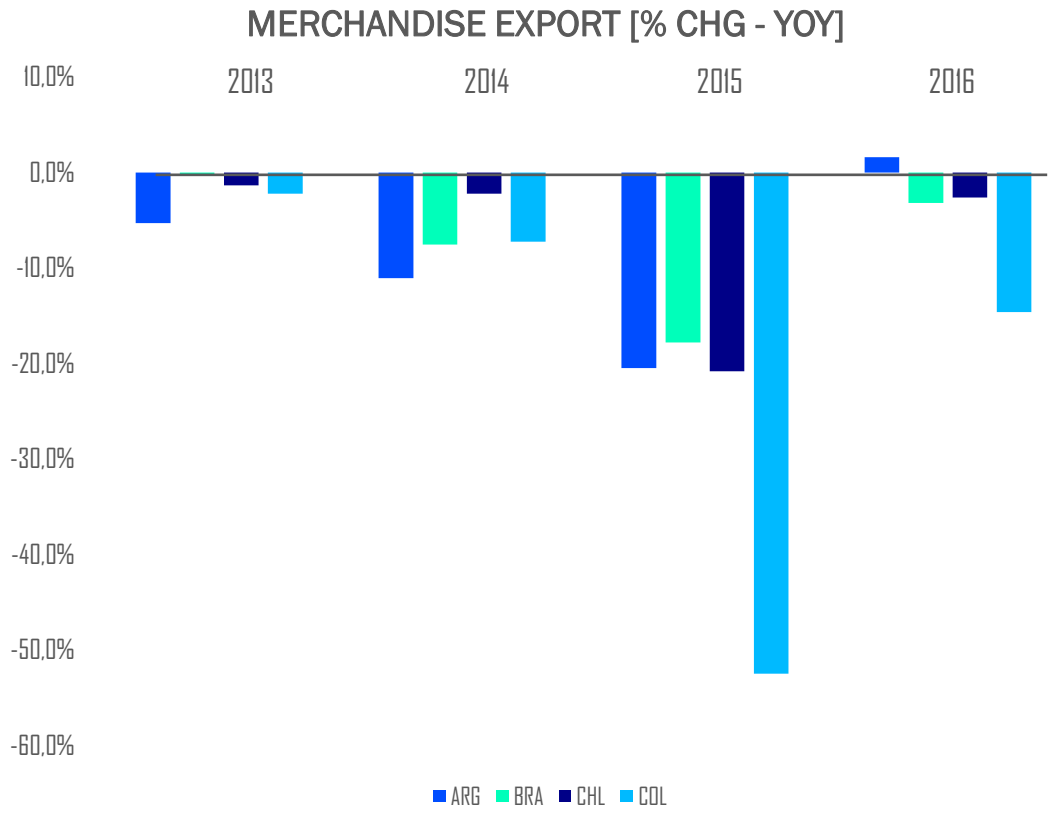


Source: World Bank

… and their industrial has followed suit - contracting

Depressed commodity prices aren’t helping either…

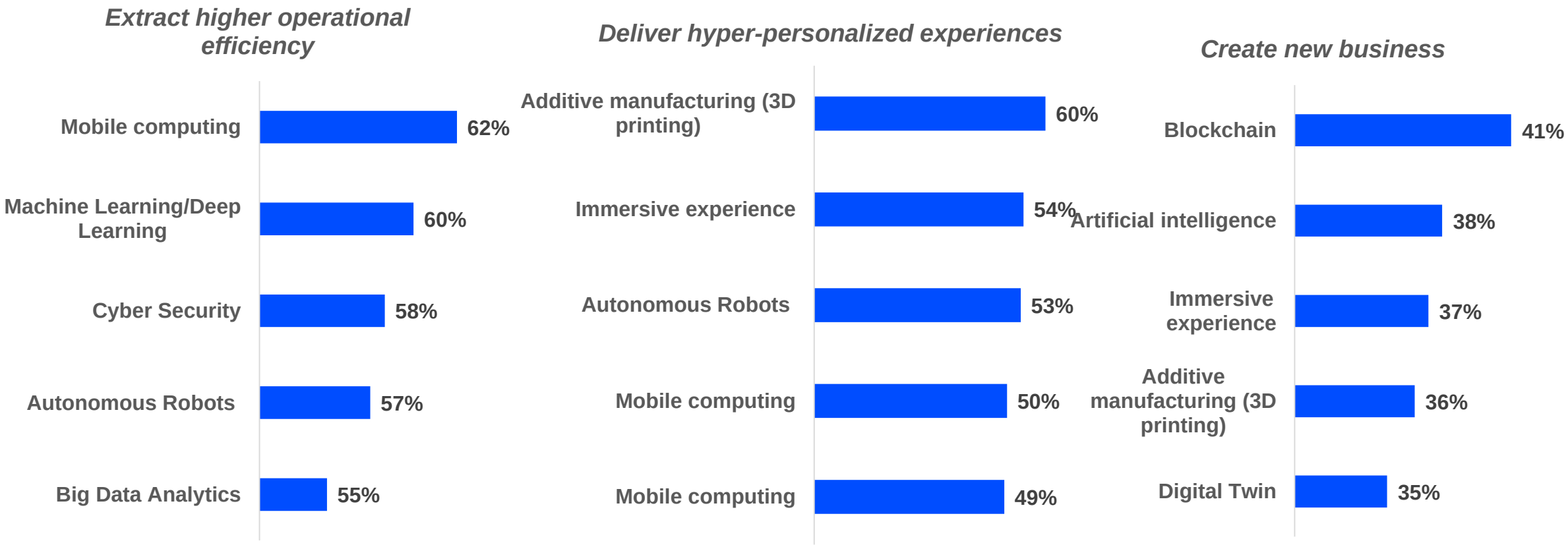




Source: IMF, UNCTAD

… Lower prices of key commodities such as metals, fuel, and industrial inputs have hurt export earnings of South America.

South American executives consider the following digital technologies as critical to drive innovation with connected and intelligent products to realize the following key opportunities in parallel



Source: Accenture Industry X.0 South America Survey, 2018

IS THE DIGITAL TRANSFORMATION REAL OR IS IT JUST A HYPE ? WHERE IS THE DISRUPTION ?

Automotive Industry is one of the most advanced in the adoption of robotics, AGVs, Autonomous warehouses, but…

Infotainment

My car has a panel built-in GPS, but I need to go to the car dealer if I want to update my maps…

What ????

Electric cars

German government: 1 million electric cars by 2020
•BY GEIR MOULSON
•ASSOCIATED PRESS WRITER

BERLIN

Germany is getting 12,000 new electric car charging stations by converting distribution boxes
Fred Lambert
- Mar. 5th 2018 7:40 am ET
@FredericLambert

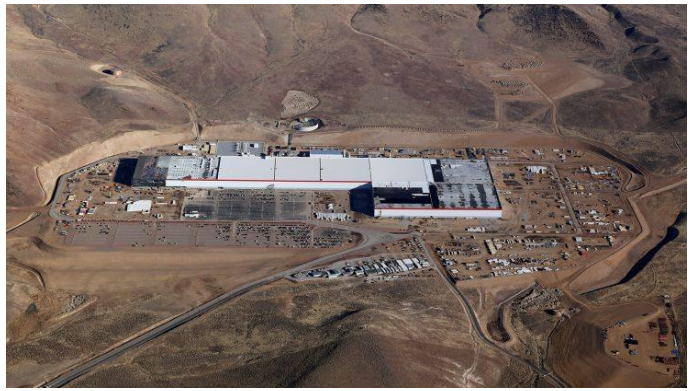
Shared Mobility

“Rent don’t own”
Salim Ismail – Singularity university

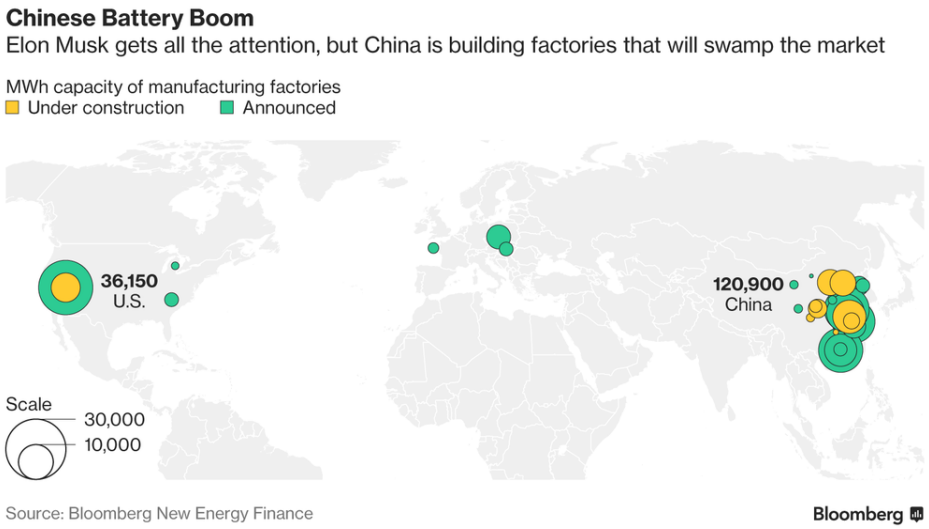
Flying Vehicles

Uber quer testar táxis voadores em 2020 e fecha parceria com Embraer

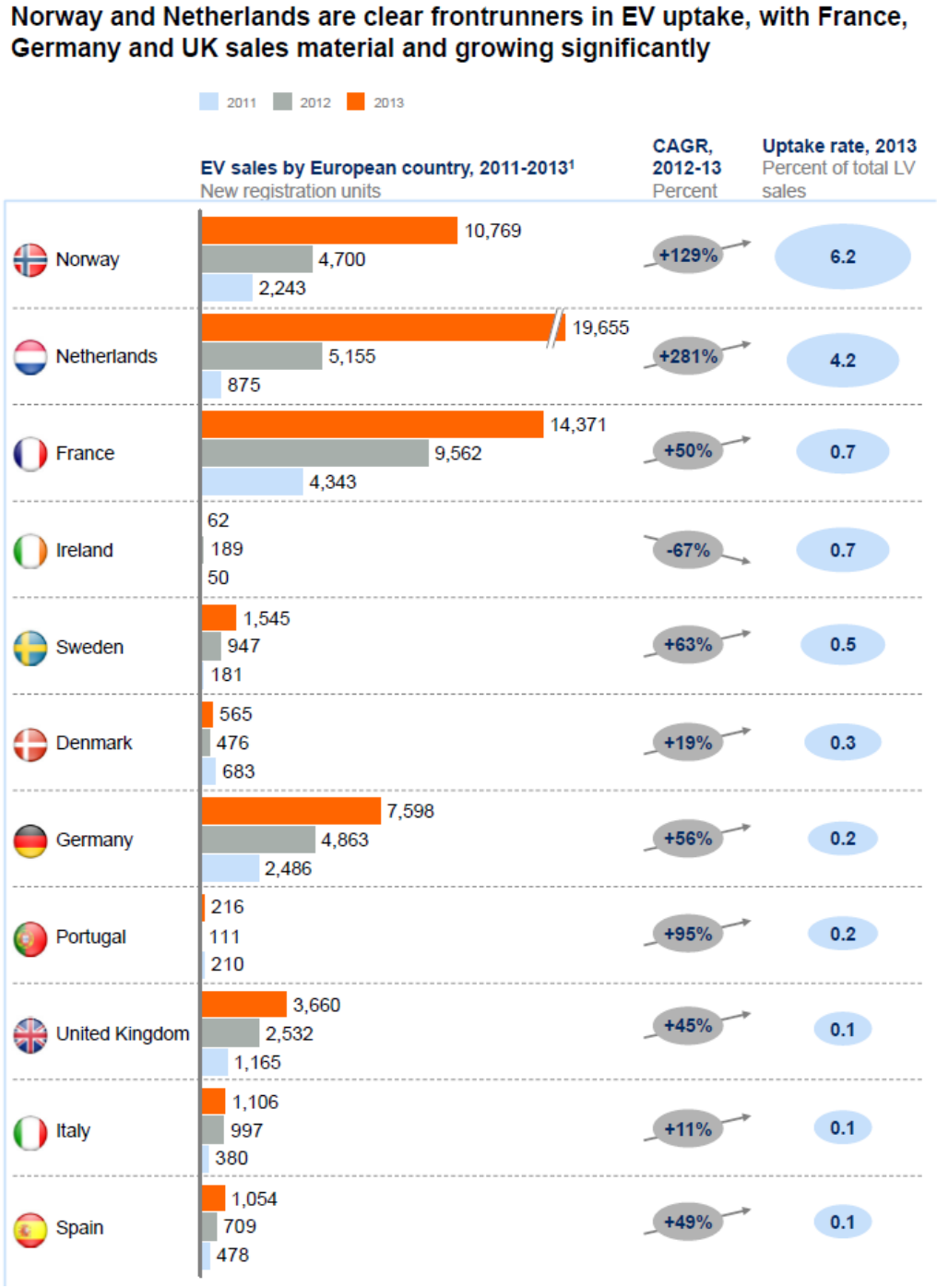
ELECTRIC CAR



Lithium Giga Factory in Nevada
35GWh



Chinese expanding Battery production capacity



TECHNOLOGIES & USE CASES

accenture digital

DIGITAL TURN AROUND OPTIMIZATION

The Accenture Digital Turnaround as a Service solution incorporates contractor and asset **tracking technology**, **mobility applications**, **tablets** and **cloud analytics** to drive industry transformations.

Turn Around Challenges

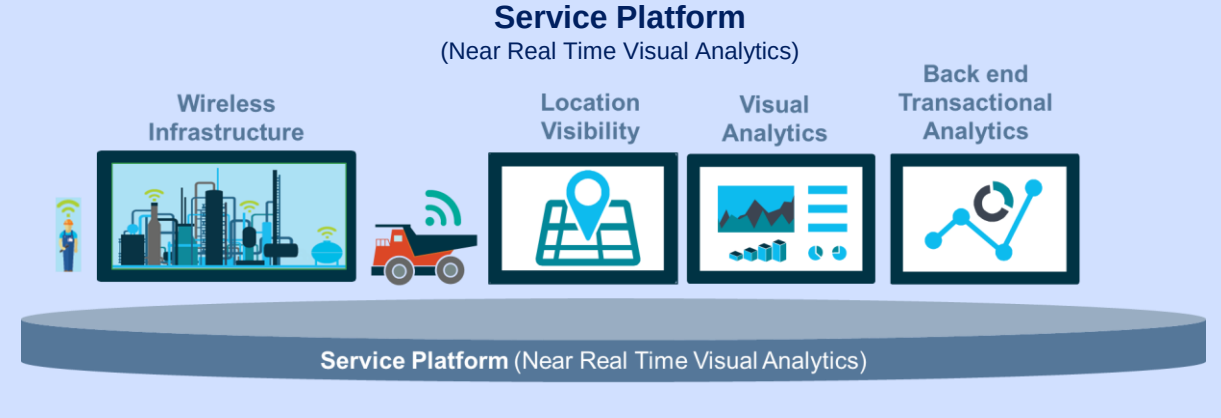
- Safety risk heightened due to 1000's being on site
- **Schedule and Budget** overruns on average **15-30%***
- Contractor **time on tools** averages less than **50%***
- **5-15 %** discrepancies in **contractor billings**

Example Case Study

- Used tags to perform asset tracking, productivity monitoring, travel time reduction, and other activities
- Accelerated Implementation time frame and operational in **70 days**
- **Wi-Fi already installed., e**xtended mesh wireless network w/ **35 access points**
- **~2000 contractors** on site per day
- High degree from participation from **40 vendors**
- Tagged rented equipment and vehicles for location and usage tracking

VALUE PROPOSITION:

Enhance Safety
Increased Productivity (5-15%)
Reduced billing discrepancies (3-5%)
Potential for shorter outage cycles

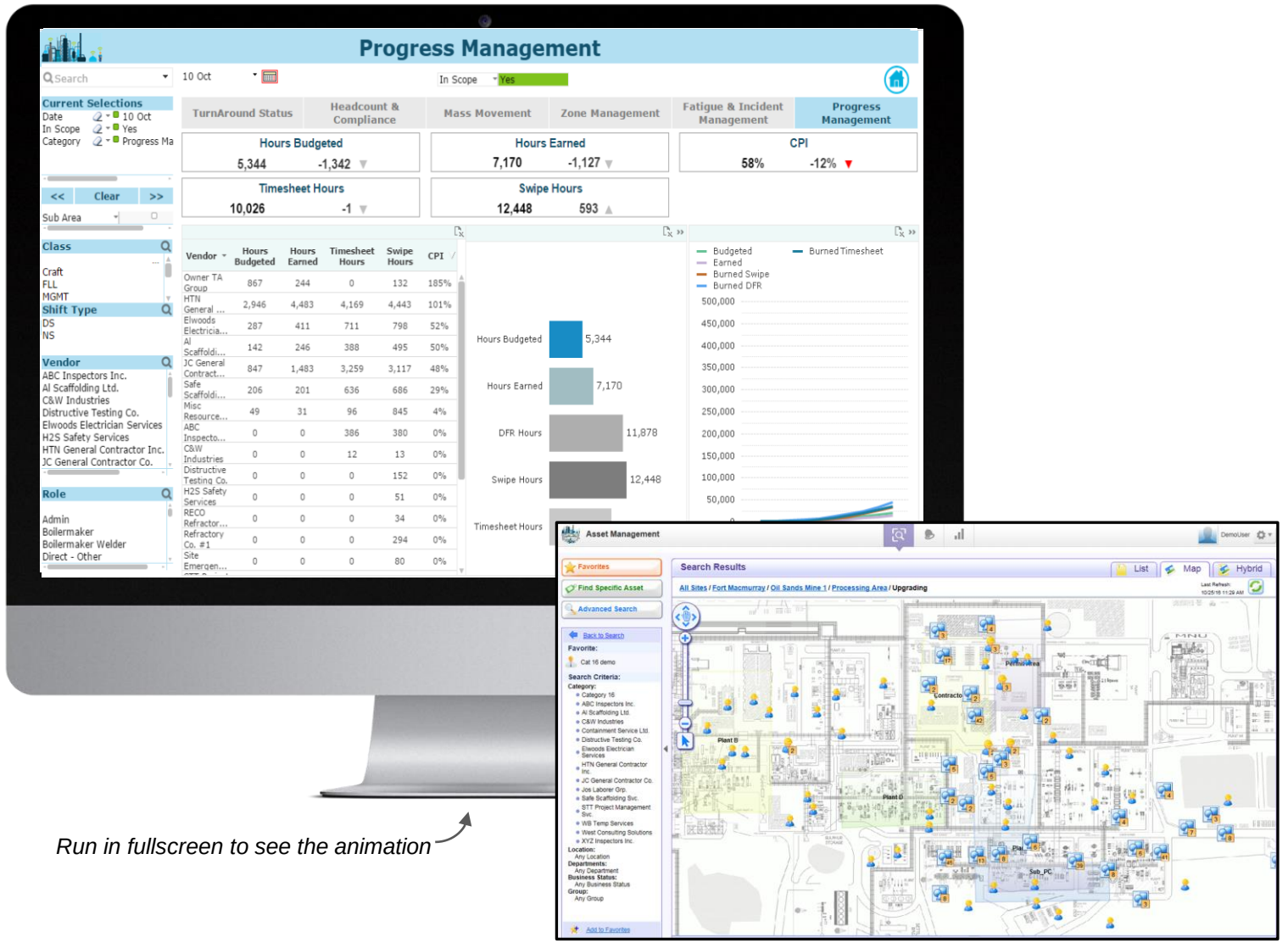


* AP Networks Turnaround database covering more than 200 turnarounds

DIGITAL TURN AROUND SOLUTION (DEMONSTRATION AVAILABLE)

Digital Worker

- **Headcount and Compliance:**
  - View different count values (plan, DFR, swipe , tag)
  - Compare values by attributes (vendor, role, etc.)
  - Highlight compliance discrepancy / action approach
- **Zone Management:**
  - View overall workface percentage by day
  - Compare workface percentage by vendor
  - Show analysis for % time in workface zones (Frequency, average, time groupings, shift, etc.)
- **Mass Movement:**
  - Evaluate overall movement between shifts and breaks
  - Filter to different groups (Plants, vendors, roles) to understand potential issue areas of focus
- **Fatigue and Incident Management:**
  - Highlight fatigue risk (consecutive days, long days)
  - Review / evaluate incident trends
- **Progress Management:**
  - Visualize integration of budget, earned, timesheet, and scan
  - Evaluate by vendor, Workorder, or WO Groups
- **Cost Management / Look Back analysis:**
  - Data driven analysis capability including data integration / data integrity, evaluation levels, data drive planning parameter improvement, vendor evaluation



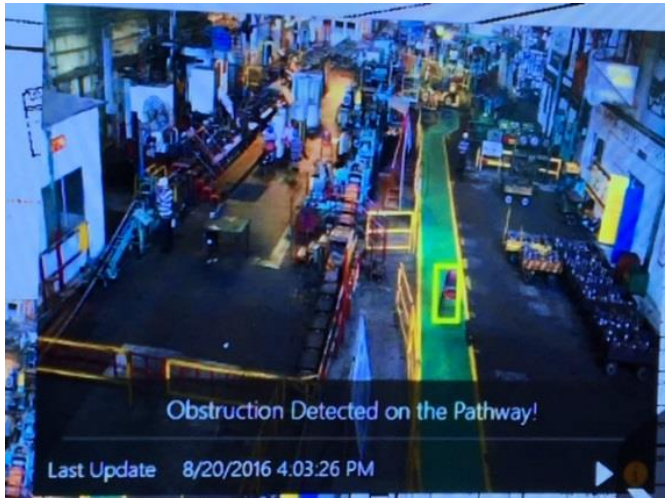
Run in fullscreen to see the animation

DIGITAL TURNAROUND VIDEO

SAFETY REINFORCEMENT: IMPERATIVE DESIGN

Cameras with data analytics are installed to reinforce worker safety:

- Worker without PPR: vest, hard hats, etc.
- Unmanned critical zone
- Electronic fence invasion
- Other abnormal situations



"*Walking the talk*" with Digital

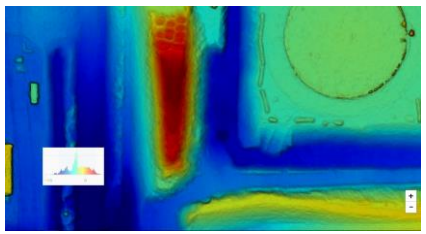
DRONES - APPLICATIONS

- Inspeção de Redes Elétricas

- Inspeção em Mina

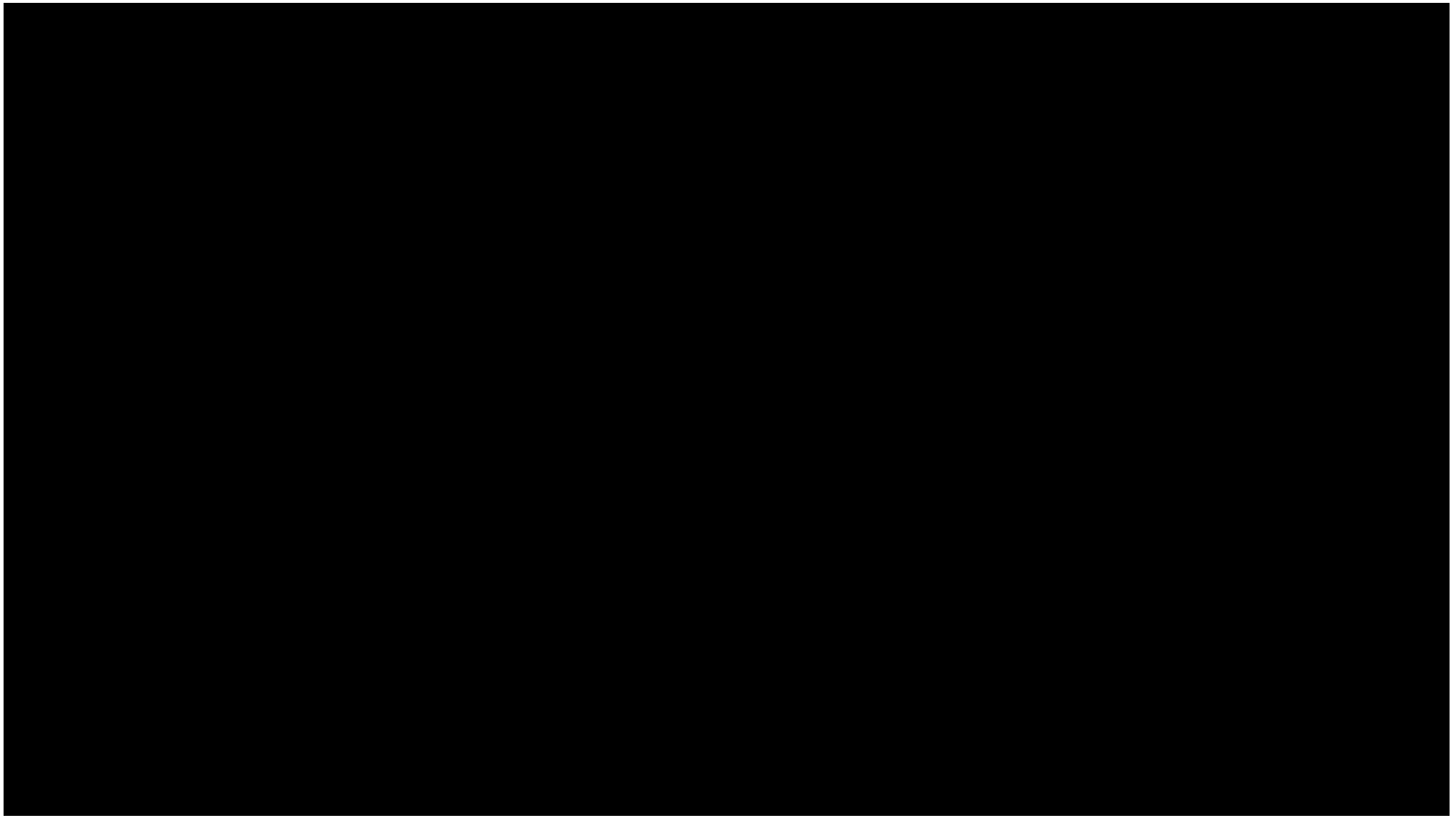
- Inspeção em Oleodutos / Minerodutos

- Inspeção de Correias Transportadoras

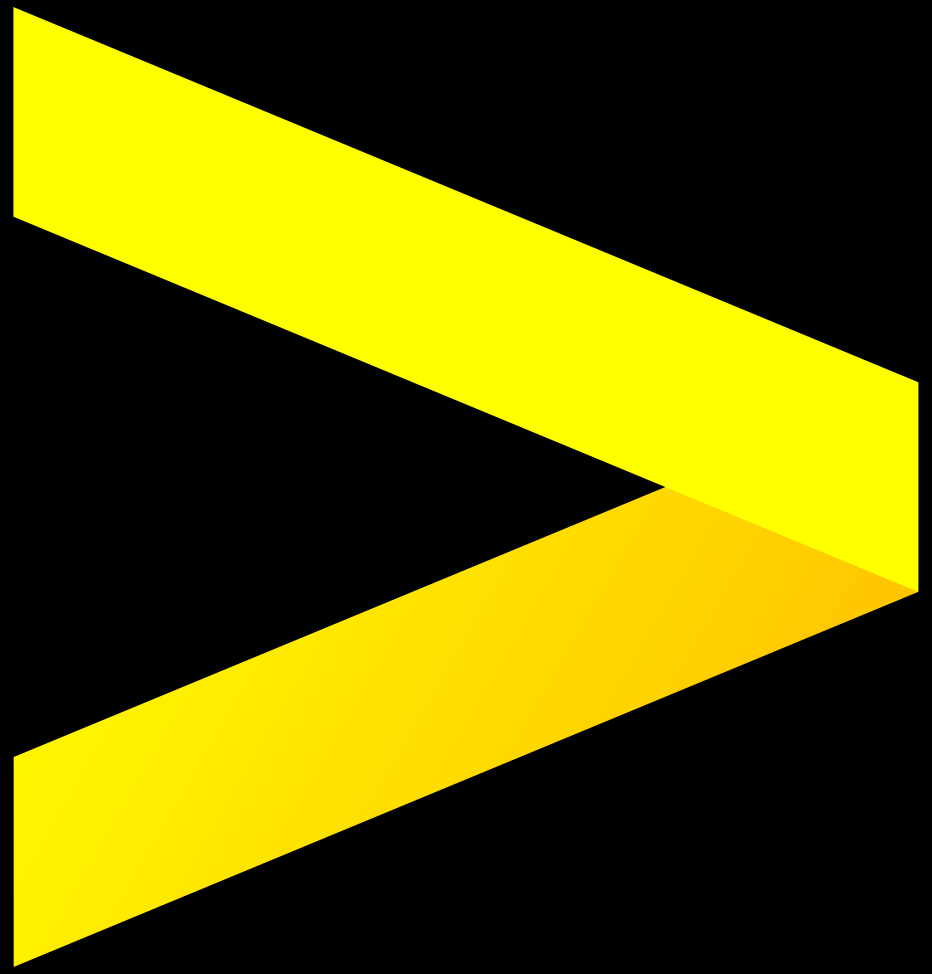


- Mapeamento de Pilhas

VIDEO DRONES



PREDICTIVE OPERATIONS ANALYTICS



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WHERE IS THE BIG REVOLUTION ?

Before

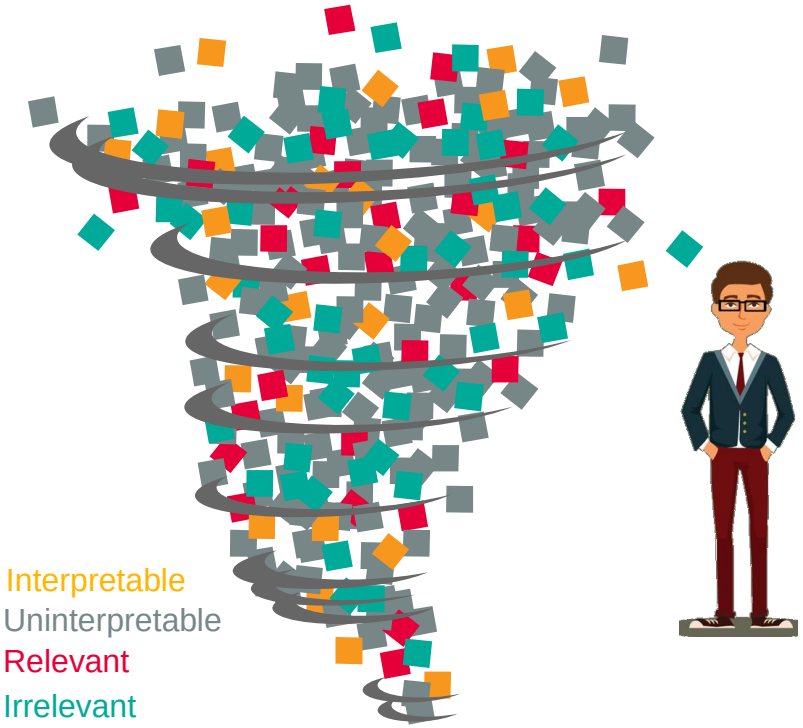
- Best option were First Principles Models
- It requires process/equipment specialist
- Slow to develop
- Model has difficulty to capture asset behavior

Engineers - SME

- Math tools
- First Principles
- Rule based expert system to include heuristics

Today

- Data Driven Solutions
- IT driven solutions
- Faster to develop



Answer:

- When ?
- Why ?
- What to do ?

Data Scientist

- Deep Learning
- Decision Trees
- Pattern Matching
- Neuro Fuzzy
- PCA/PLS

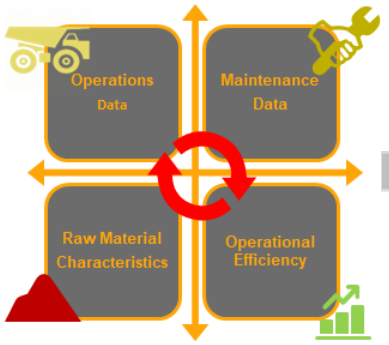
MACHINE LEARNING

CASE: PREDICTIVE OPERATIONS ANALYTICS

Business Problem: identify possible causes for low feed rate of MangCo's Manganese Concentrator Plant.

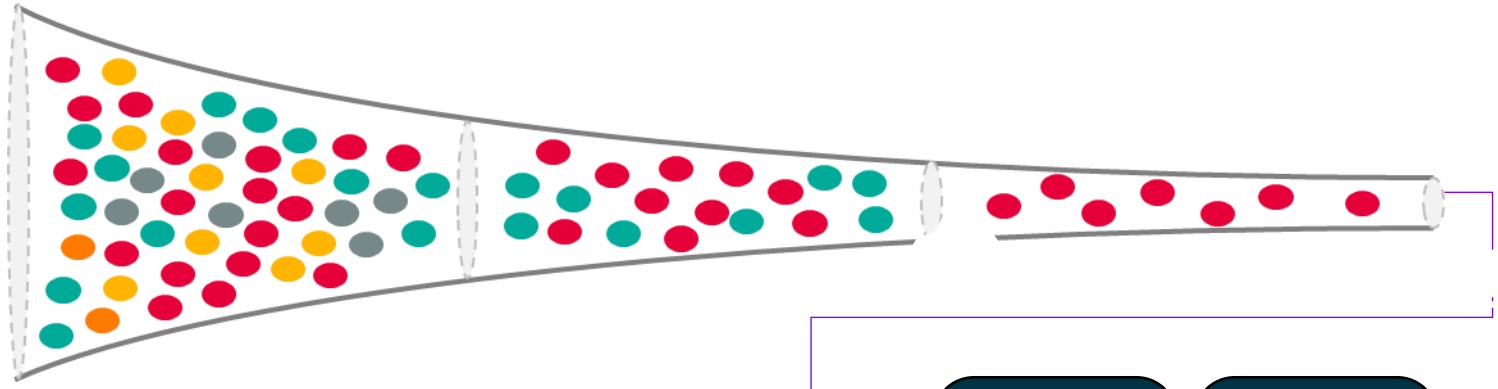
MangCo case:

Approach Definition / Process Understanding Data Gathering, Integration & Preparation → **Exploratory Data Analysis and Data Pre-processing** → **Variable Selection and Modeling** → **Process Findings and Root Causes Determination**



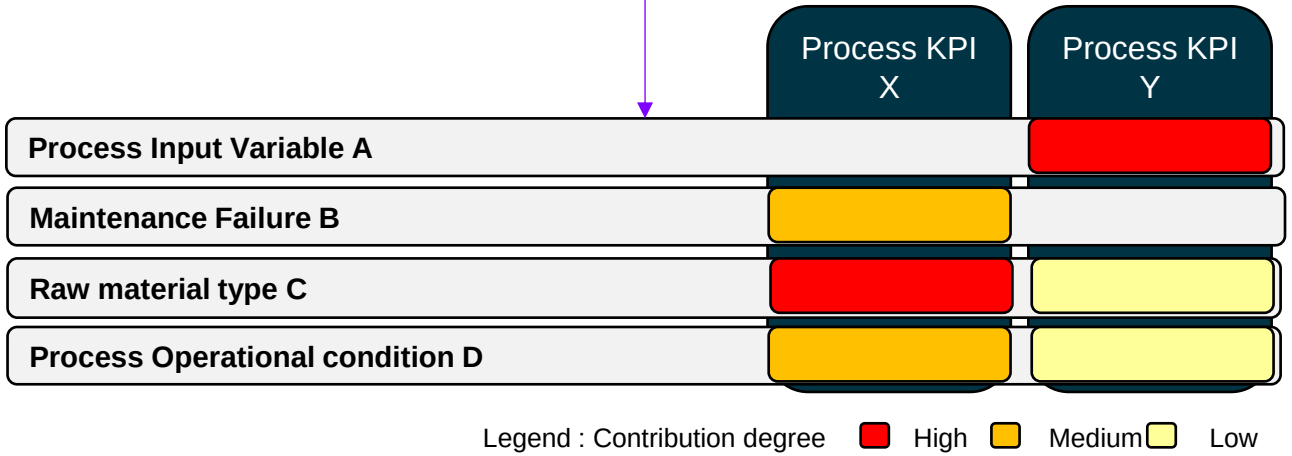
INPUTS

- Production Data
- Chemical Component
- Maintenance database
- Historian Database
- Mine Operation



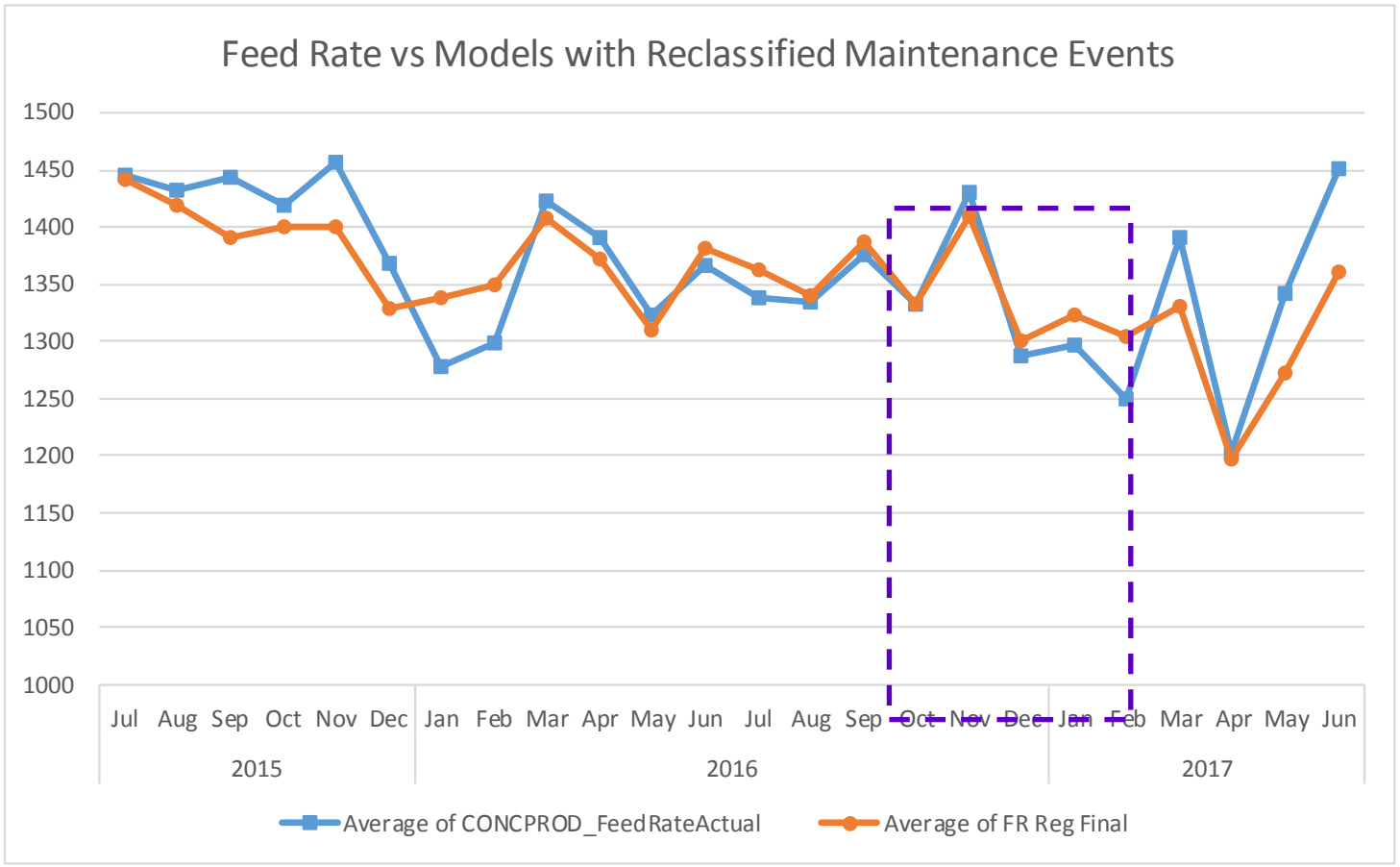
Main Achievement

The use of Data Analytics contributed to identify four main root causes of process performance drop.
For next steps, a specific action plan should be prepared to define improvement actions for those 4 input variables. We also suggested to the client further initiatives to proceed with its journey of process continuous improvements through Analytics.



PRODUCTION DIGITAL TWINS

Our models are able to forecast the value of a variable in the future based on current plant data



PREDICTIVE MAINTENANCE

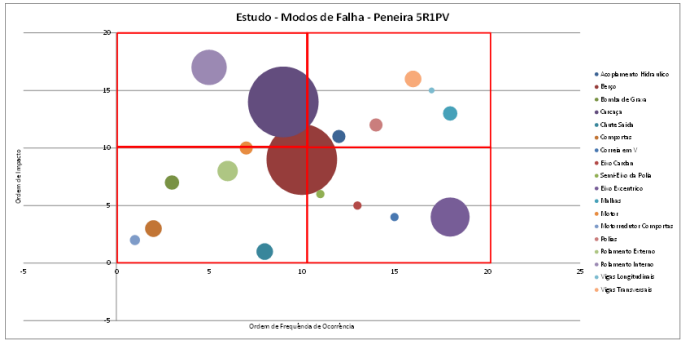
Process + Condition Data

Data Scientist (GAPSO)

Process Engineer (Industry X.0)

Data driven approach combining the skills of Data Scientist and Process Engineer.

Equipment



Failures Modes Prioritization

Algorithms
logistic_regression_l1
logistic_regression_l2
random_forest_classifier
decision_tree_classifier
gaussian_naive_bayes

Results

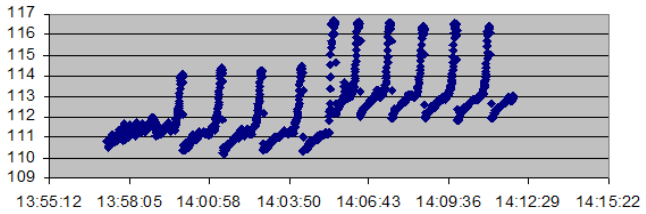
- Problem detection 2 weeks before equipment trip.
- Moves maintenance paradigm from reactive to predictive.
- Prevent Downtime
- Reduce Maintenance Cost

SCORE Zinc Pilot Implementation

Advanced Analytics

BUSINESS CHALLENGE

Some harmful events in the electrolysis processes are very difficult to be identified promptly. Those events, like short circuit, poor contacts and low electrolyte flux have huge impact in production efficiency and also in energy and maintenance costs. The challenge was to provide accurate and efficient detection of those events, enabling prompt action by the plant operators. Other important challenge was to provide process visibility, allowing better understanding of electrolytic cells behavior and dynamics. This ultimately allowed a fine tuning of the operational procedures.



BENEFITS

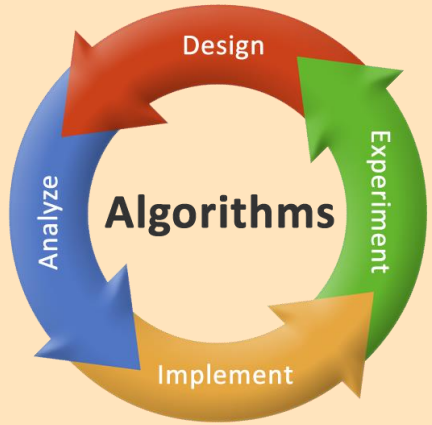
- The deployed solution achieved an **increase of current efficiency of 1,5%** and a **reduction of energy consumption of 3,8%.**
- The accuracy of the algorithms pointing out the process problems was over 96%. The main features of the solution were:
  - Cell voltage and line current real time monitoring
  - Identification of the main harmful events: short circuits, poor contacts, low zinc concentration and low electrolyte flow
  - Uninterrupted real time operation
  - Real-time trend analysis
  - Generation of alarms and events
  - Data acquisition and storage for historical graphs and reports
- Powerful historical trend monitoring

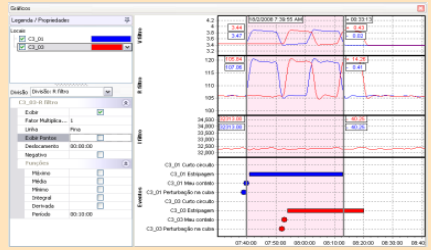
PROJECT HIGHLIGHTS

- Accenture designed an unique and efficient set of algorithms in order to detect short circuits, poor contacts, low zinc concentration, low electrolyte flow and low zinc concentration.
- The algorithms work based on just line current and pot cells voltage measurements, using advanced machine learning and pattern recognition techniques.
- The supervision system, called “Score Zinc” provided a friendly user interface, powerful historical trend monitoring, graphs and reports, allowing process engineers to have a better control of process parameters and also have the ability to analyze the process in real-time in order to take timely and proper decisions.
- Whenever a process event occurs, alarms are generated, guiding the operators to correct the problem.
- A pilot system was successfully deployed in 40 pot cells.

LOCATION

- Large Zinc Producer in Brazil





CONDITION BASED MONITORING & INTELLIGENT DIAGNOSTICS – SCORE ZN

Score Zinc

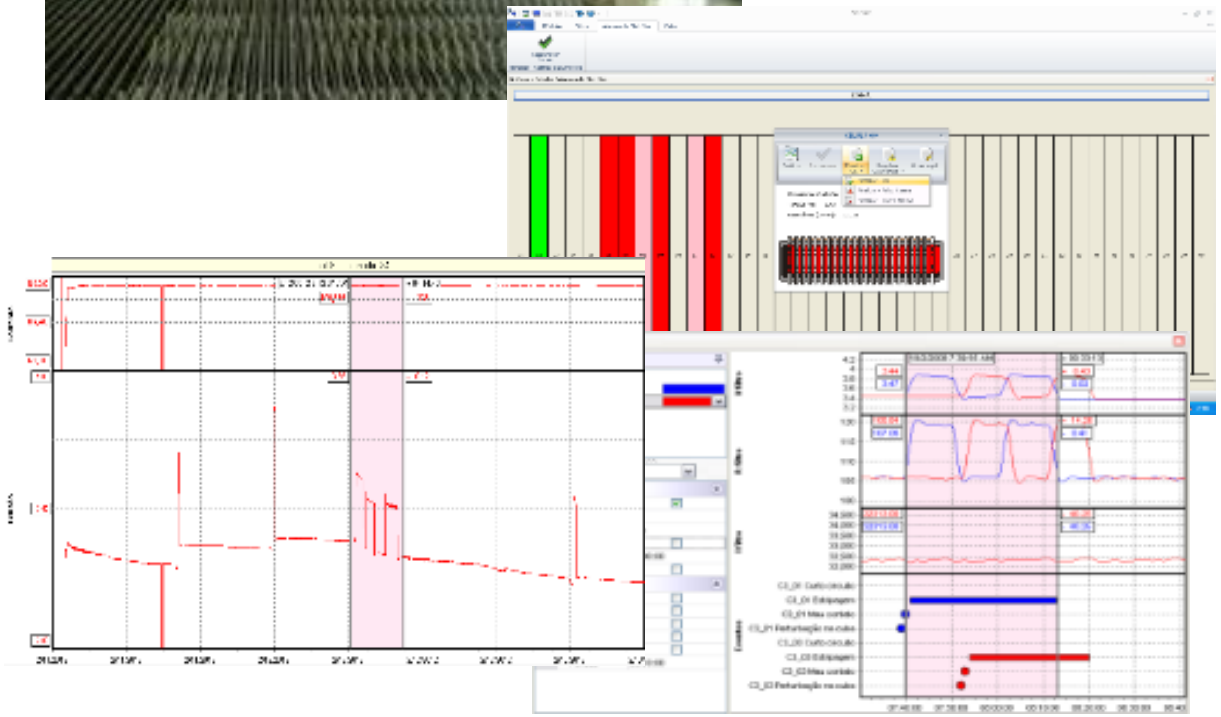
SCORE Zinc™ monitors Zn electrolysis pot line in real time and detects typical process failures automatically using a collection of statistical and first principles model algorithms

It is able to detect:

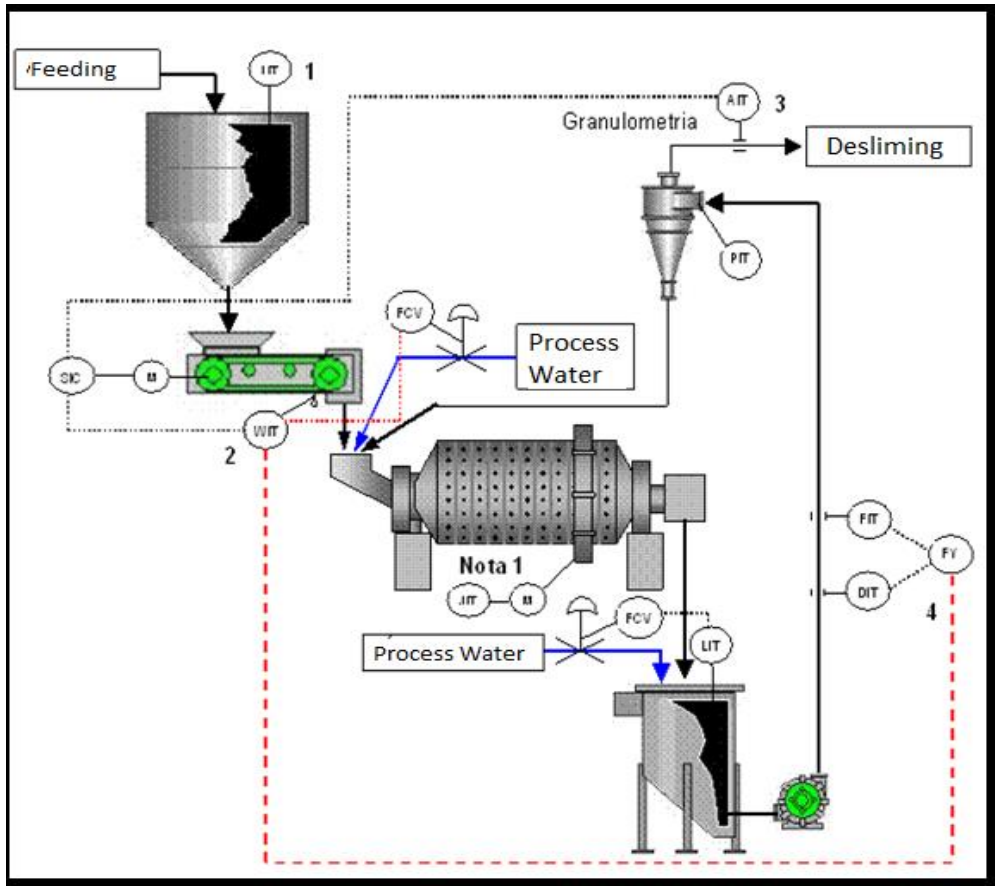
- Anode – Cathode short circuits
- Anode – Cathode bad contact with feeding bars
- High impedance in the feeding bars
- Electrolyte contamination
- Temperature disturbances

The final result is:

- Increase in the current efficiency
- Increase in energy efficiency
- Reduction in maintenance costs

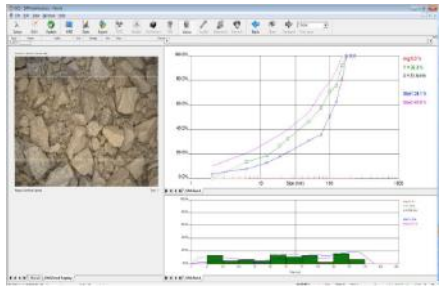


ADVANCED PROCESS CONTROL

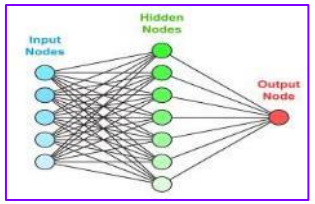


MULTIPLE APC APPROACHES IN THE CONTEXT OF EXACT REQUIREMENTS

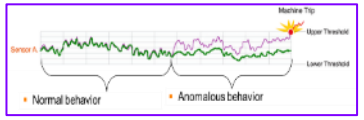
- **SPECIAL MEASUREMENTS**
  Soft Sensors + Image Processing
- **MPC**
- **EXPERT SYSTEMS**
- **FUZZY CONTROL**



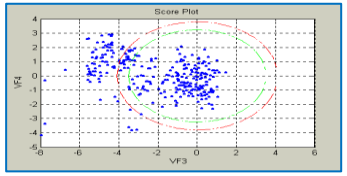
Models:



NN



SBM



PCA/PLS

$$\dot{M}_1 = r_1 - r_2 - \mu \cdot M_1$$
$$\dot{M}_2 = r_2 - r_3 - \mu \cdot M_2$$
$$\dot{M}_3 \equiv \dot{E} = r_3 - \mu \cdot E$$
$$r_1 = r_{1,max} \cdot S/(K_s + S)$$

First Principles

APC:

i. Manages “big” variability of ore character e.g. quality: size, composition, etc. to support target specification in the processing plants
ii. Deals with frequent perturbations that deviates process from steady state
iii. Addresses “big” delays between variable measurements and its utilization
iv. Infers in relation to variables that are difficult to measure
v. Adjusts for soft degradation arising from damage to sensors exposed to harsh conditions

EXAMPLE OF AI IN MINING INDUSTRY

Problem Statement

❑ Crushing circuit was detected as the plant production bottleneck. The client was experiencing high variability in the crushing circuit due to:

- High variability on the ROM feed rate and ore type
- Frequent unplanned downtime events
- Lack of sensors reliability

How Accenture helped

Accenture implemented an optimization solution focused on throughput increase considering current process variability to avoid safety interlocks activation

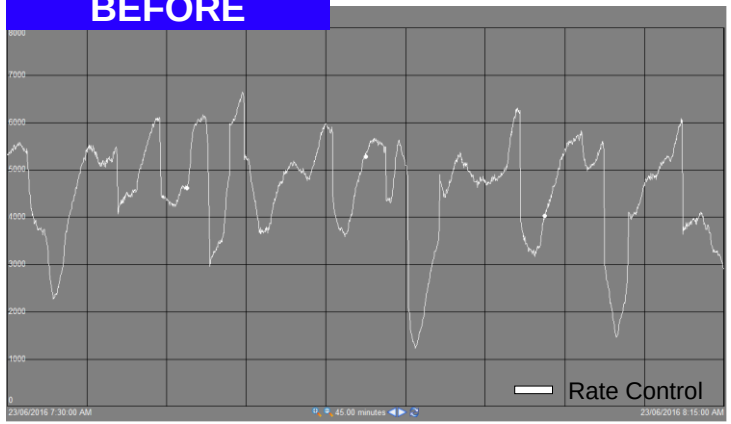
<u>Artificial Intelligence solution deployment</u>
Remote implementation of an **innovative Artificial Intelligence** solution based on Fuzzy technology which automatically generates the control rules thereby bringing the **implementation time to less than a month**.

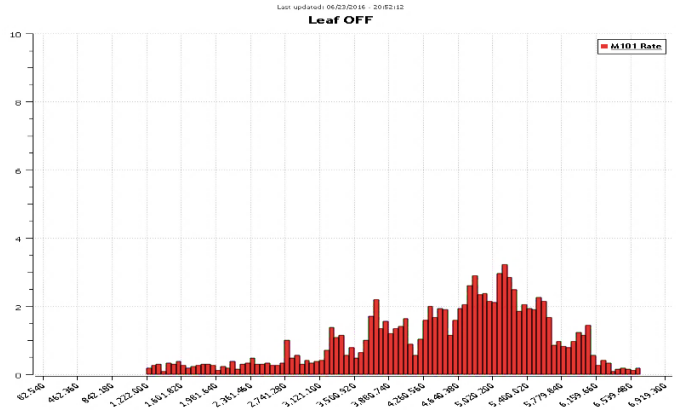
<u>Fine-tuning in process operational parameters</u>
Accenture also proposed **changes in process operational point** to address detected problems on the feeders which were critical to achieve the variability reduction expected.

<u>Equipment maintenance advice and diligence</u>
Maintenance actions were executed along with the client to increase equipment reliability.

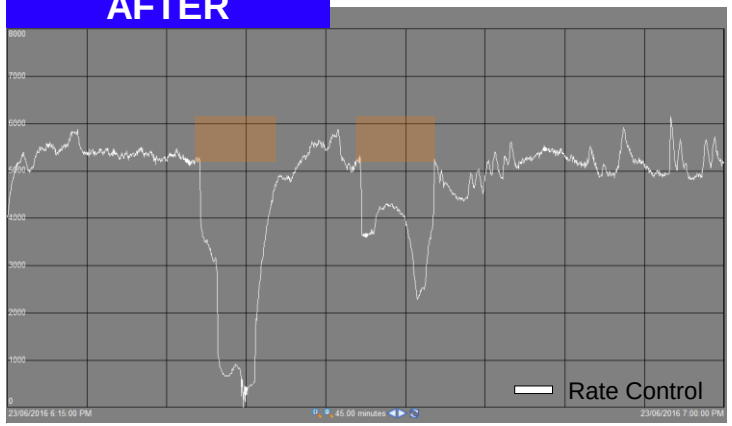
Results: *6% increase in throughput*

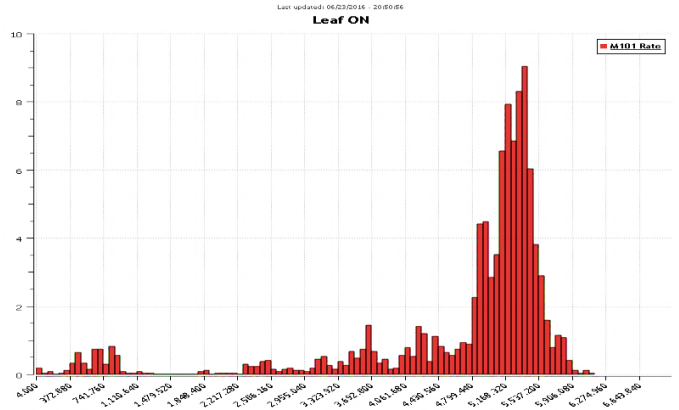
BEFORE





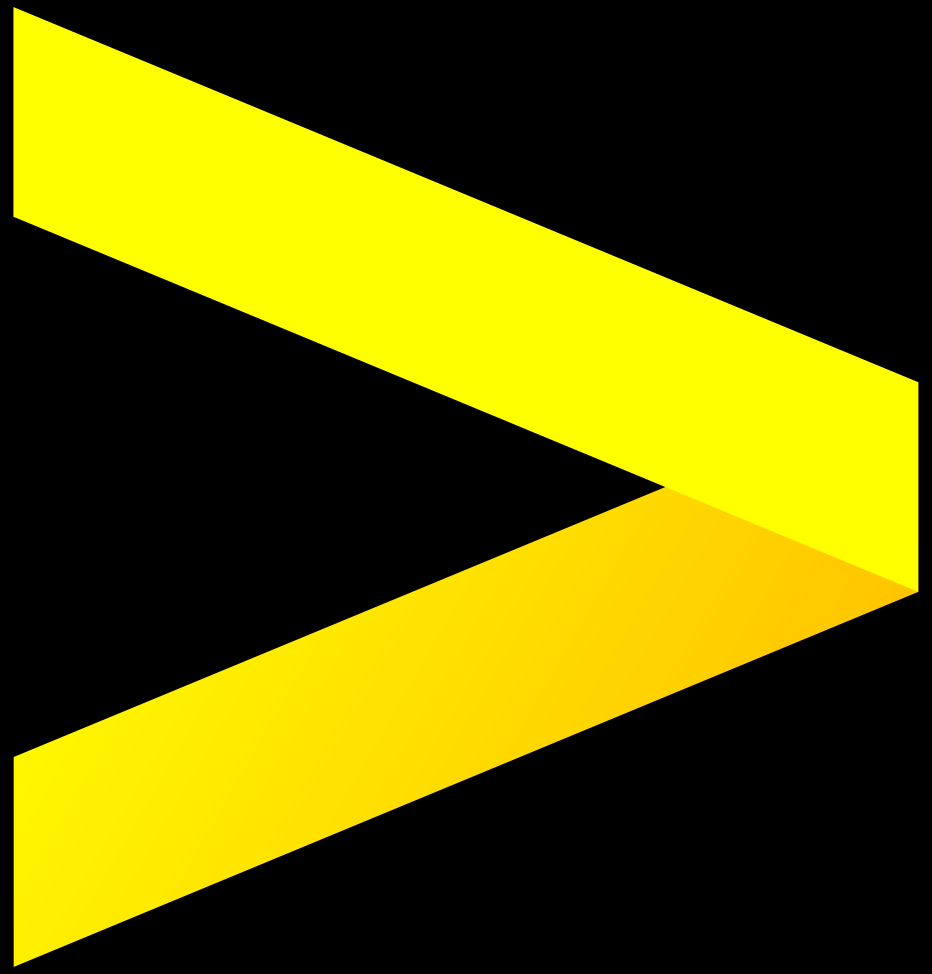
AFTER





Awaiting Trucks / Feed

IIOT + AUTONOMOUS SYSTEMS



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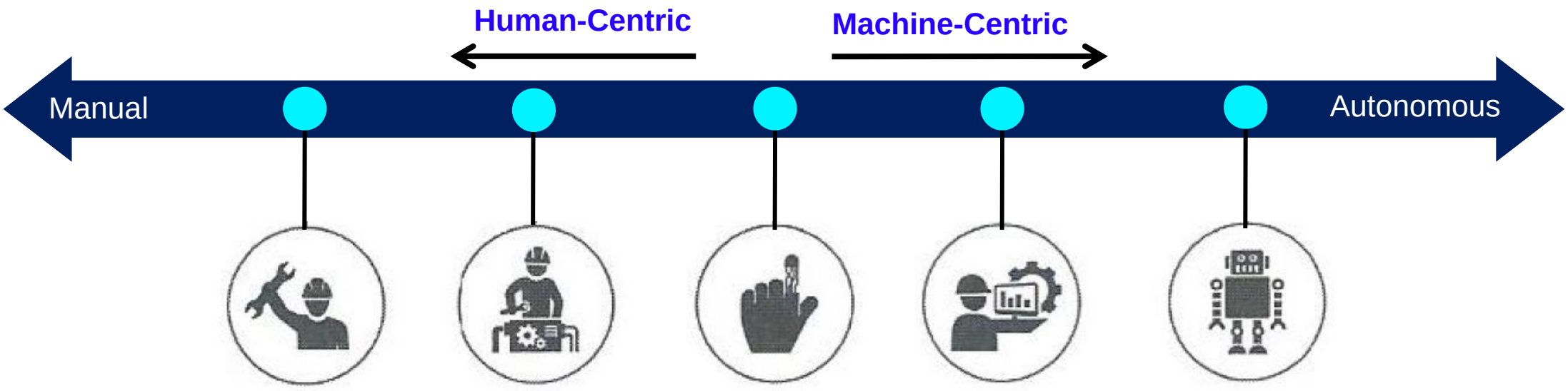
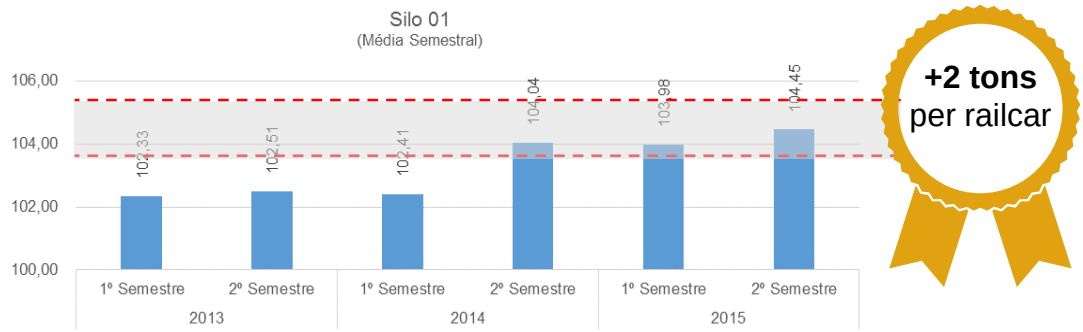
THE JOURNEY TO AUTONOMOUS AN INEXORABLE WAY



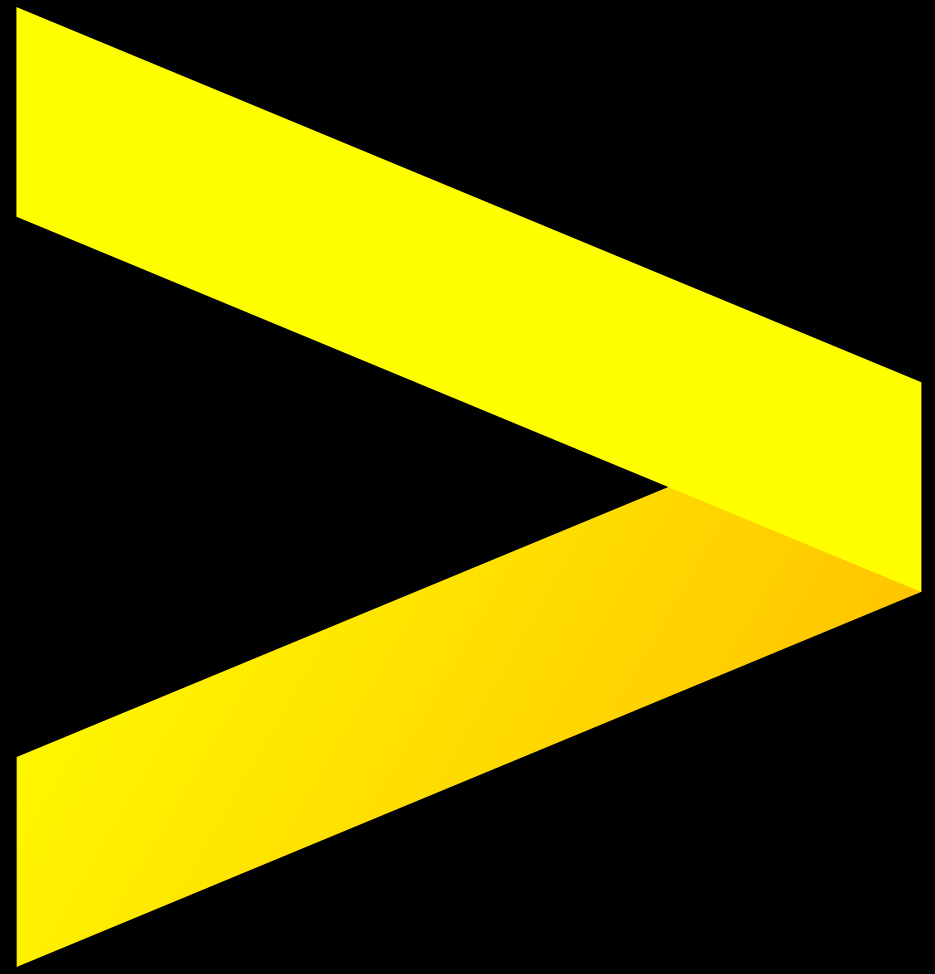
	Human with Tools	Machine Augmenting Human	Collaborative Machines	Human Augmenting Machine	Autonomous Machines
Today	27%	**35%**	24%	11%	3%
Future	4%	11%	29%	**30%**	26%
5 Year Difference	-23pts	-24pts	+4pts	+18pts	+13 pts

INDUSTRIAL INTERNET OF THINGS

Annual earnings: US$ 50 M/y
Increase the average load per railcar
Better axles distribution load
Faster loading time
Improved safety conditions



REMOTE OPERATIONS



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INTEGRATED OPERATING CENTER - DECISION MAKING – EHS MONITORING CENTER CONTROL TOWER

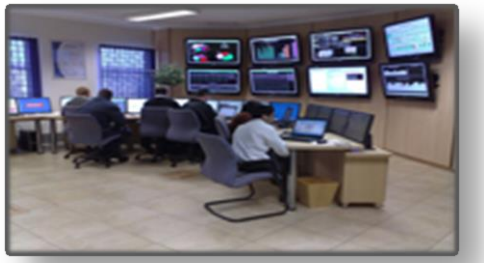
A Remote Operations Centre (ROC) is a collaborative environment organized to gather all necessary resources for decision making targeting operational improvements.

- Analytic Tools
- People
- Information
- Decision Processes

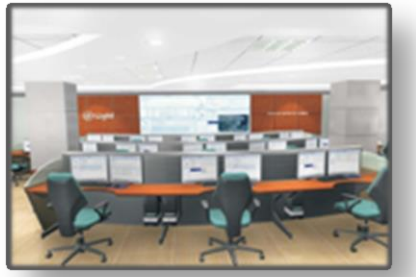
The value of a ROC lies in broadening the scope beyond the operating room and into strategic and tactical management. The ROC also includes data analytics and decision making. ROC is adopted to all types of industries.

DECISION MAKING – REMOTE OPERATING CENTER

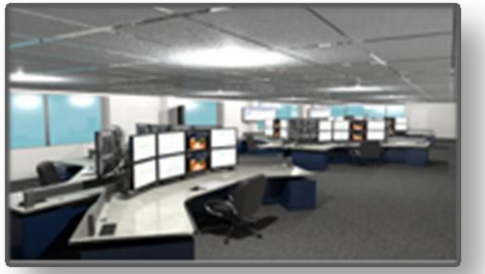
2008 ROC Conceptual Design and PMO for Iron Ore Mining Company in Brazil



2009 RMC implementation for Utility G&T in South Africa



2009 RMC Implementation of Energy Metering Control Center for Utility D in Brazil

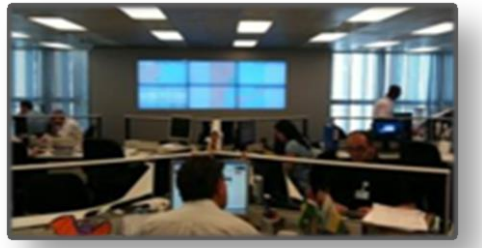


2009 Roc Blueprint for Mining Company in Canada

2017 Roc Blueprint for Sugar & Ethanol Company in Brazil

2017 RMC Blueprint for ONG responsible for mitigation of Environmental Accidents in Brazil

2017 ROC Blueprint for Operation & Maintenance of renewable generation plants in Brazil/

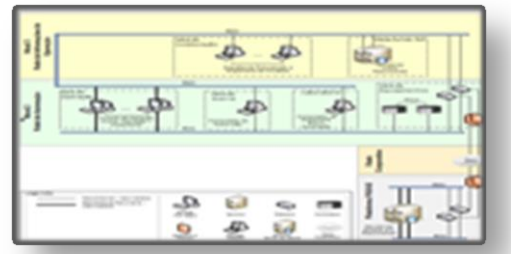


2010 Blueprint and implementation of logistic center for Oil and Gas Company in Brazil

2014 - ROC Business Case for Codelco

2009 ROC for Oil and Gas company in Brazil

2012 Blueprint of Asset Management Center for Utility D in Brazil

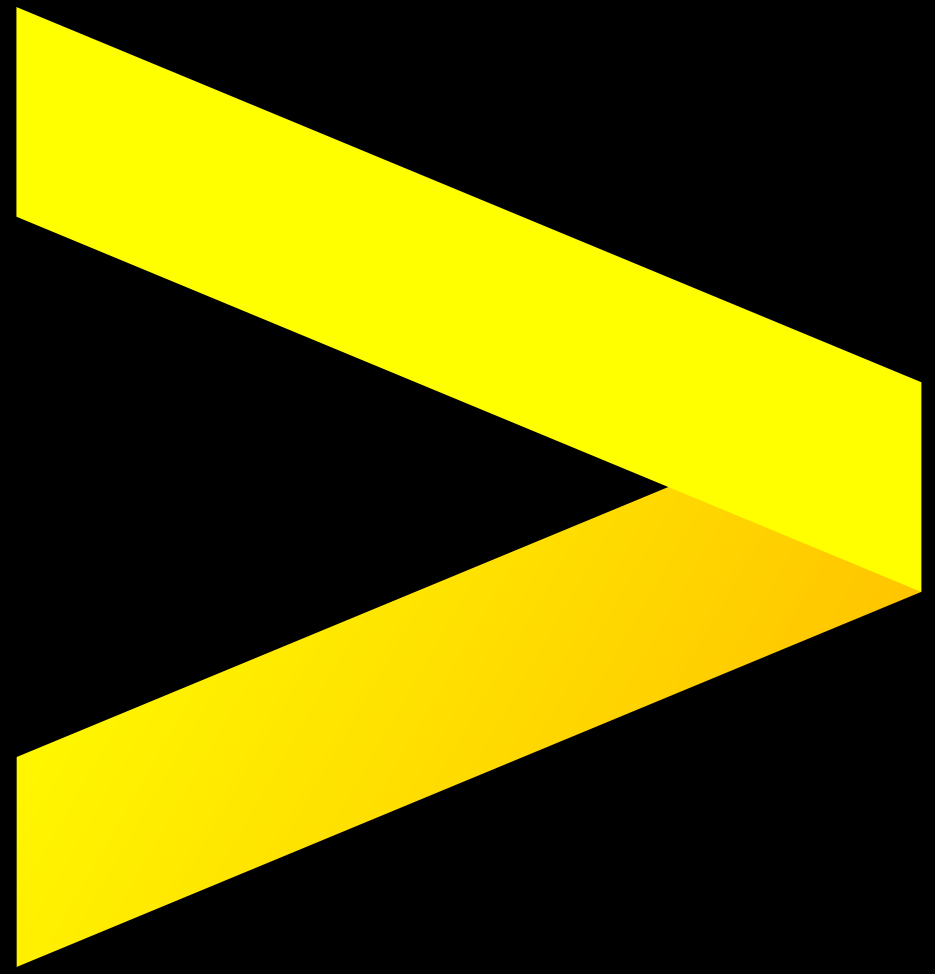


2014 ROC Blueprint for Oil & Gas Upstream company in Brazil

ROC FOR SAFETY EXAMPLE

AN OPERATOR BREAKING BIG ROCKS IN THE CRUSHER ENTRANCE CAN BE HIT BY AN EJECTING ROCK. IF THE OPERATOR IS PLACED IN THE INTEGRATED OPERATION CENTER AND EXECUTES ITS WORK REMOTELY, THIS WILL NEVER HAPPEN. THE RISK IS 100% ELIMINATED

CONNECTED MINE



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CONNECTED MINE

Client Problem

Equipment	Hardware Solutions	Software Solutions
Trucks	Fatigue Monitor	Fleet Mgmt
Dozers	Weather Monitor	SharePoint
Shovels	Slope Monitor	OSI PI
Crushers	Cameras	Dispatch
…	…	…
From dozens of manufacturers…	From dozens of h/w vendors…	From dozens of s/w vendors…

Accenture Connected Mine Solution

Alerts
At-rest analytics
Data storage
In-motion analytics
Data ingestion

THE CONNECTED MINE – IOT FROM MINE TO MARKET

Value Chain

Exploration and Feasibility

Value optimisation

Increased accuracy

Deeper exploration

Water & Energy

Connected Mine

Cloud-based platform that aggregates data from various types of data sources (heavy equipment, h/w, and s/w solutions), runs analytics, distributes alerts, and displays it in a tablet-based dashboard

Heavy Equipment	Hardware Solutions	Software Solutions
Drills	Fatigue Monitor	Fleet Mgmt
Shovels	Weather Monitor	Geology & Mine
Trucks	Slope Monitor	Planning
Dozers	Pit Cameras	Data Historian
Loaders	Piezometers	EDW
...	Network	Telemetry
	...	SharePoint
		...

Connected Plant

Production Intelligence Services

Renewables Monitoring Services

Intelligent Operations Centres (IOC)

Asset Reliability Services

Connected Vehicle

Safety and security

Downtime reduction

Preventative maintenance

Remote monitoring

Malfunction alerts

Automated parts ordering

Tracking and geo-fencing

Driver behaviour monitoring and coaching

Connected Industrial Worker

Turnaround Maintenance as a Service

Digital Supply Network
(pit to port)

THE CONNECTED MINE – UNLOCKING VALUE FROM PIT TO PORT

Value Chain

Connected Mine

Platform that optimizes mining operations by aggregating pit-to-port data from equipment, hardware, and software systems, running complex analytics, delivering key alerts & notifications, and displaying everything in user-friendly dashboards --- all in near real-time!

Foundation (out-of-box features)

- Library of 'agents' for top mining packages
- Rule-Based Analytics
- Mobile dashboards
- Notification Framework
- Cloud or On-Premise

Feature Packs (optional)

- Drill & Blast Optimization
- Crusher Optimization
- Truck Optimization
- Tire Optimization
- Predictive Fuel Cons.
- Predictive Fatigue
- Leach Pad Optimization
- Port Optimization
- Predictive Maintenance
- …and more!

Related Accenture Solutions (optional)

People

- Driver Coaching
- Life Safety Solution
- Work Order Management
- Fast Feedback Wearables

Assets

- Connected Asset Mgmt.
- Fleet Management
- Predictive Asset Maint.

Plant

- Turnaround Management
- MES Framework
- Energy Management

Digital Twin

- Planning Optimization
- Simulation /What If
- Inventory Accounting
- Next Best Action

Connected Mine

Last page update
Up to date

Bruce Garcia
Operations Supervisor

OVERVIEW
MATERIAL
EQUIPMENT
OPERATORS
ALERTS
ANALYTICS
SETTINGS

Current Shift | Previous Shift

MONDAY, 31-OCT-2016

Total Material Mined

MINE PRODUCTIVITY	ACTUAL	SHIFT TARGET
	39,170 tons/hr	19,479 tons/hr

TOTAL MATERIAL MINED
147,894 tons
143,573

HEAP LEACH MINED
13,860 tons
11,056

DUMP LEACH MINED
14,551 tons
18,657

ROM LEACH MINED
119,483 tons
104,478

CRUSHERS

CONE | JAW

Material Delivered to Cone
33,908 tons
Long Queue Time

Heap Leach	24,144
Dump Leach	9,764

TERRAIN

EQUIPMENT

20	Active	▸	Running
17	Active	▸	Delayed
2	Inactive	▸	Available
11	Inactive	▸	Unavailable

ALERTS

ALARMS | DELAYS

Kaycee Tolman
TR18's tons per hour is 75% below target
31-OCT-2016 10:20:11 AM

Jerry Medina
TR32: Jerry Medina - Fatigue Detected : Critical (88%)
31-OCT-2016 10:19:22 AM

Overtruck Alert
Excess of 5 trucks
31-OCT-2016 10:21:47 AM

Crusher Warning
ConeCrusher1 has a long queue time
31-OCT-2016 10:21:35 AM

Connected Mine

Last page update
Up to date

Bruce Garcia
Operations Supervisor

BLASTED STOCK

67,850 tons

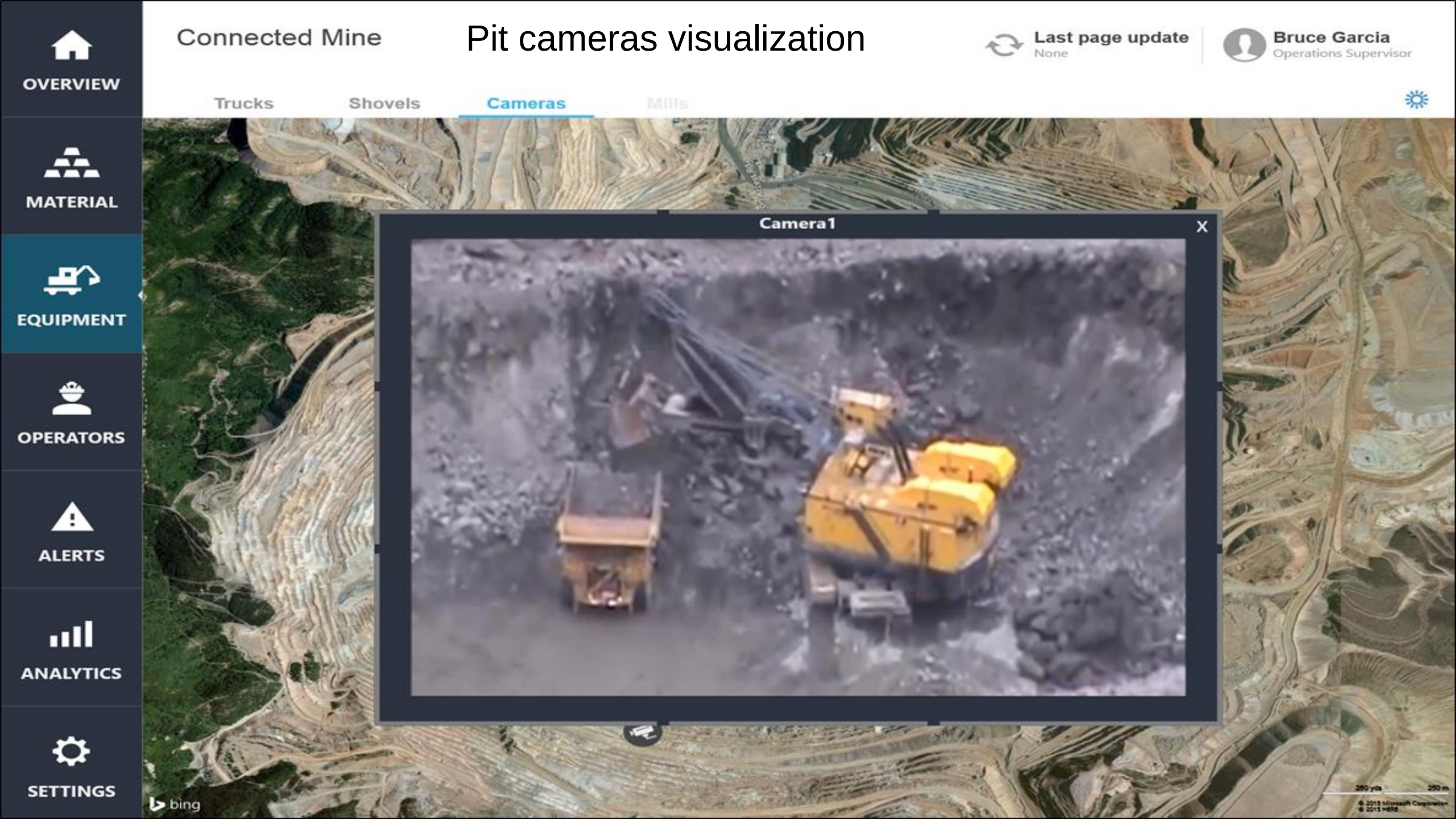
69,917

	Actual	Plan	Cu	Au	As
Northern	30,546t	29,563t	0.60%	0.8g/t	0.25%
Western	16,935t	20,540t	1.20%	0.9g/t	0.50%
Southern	20,369t	19,814t	0.90%	0.3g/t	0.72%


OVERVIEW
MATERIAL
EQUIPMENT
OPERATORS
ALERTS
ANALYTICS
SETTINGS
Connected Mine
Last page update
Bruce Garcia
Terrain Visualization
Crusher Matrix Visualization
Mine Planning Documents
FULL VIEW
SH03
2,451
0.09 mins
Active-Delayed
5.7 mins
2.81 mins
2
High Grade
4106.05 ft
SH01
SH02
SH03
SH04
SH05
SH06
SH07
SH08
SH09
SH10
SH11
SH12


Connected Mine
Last page update
None
Bruce Garcia
Operations Supervisor
OVERVIEW
MATERIAL
EQUIPMENT
OPERATORS
ALERTS
ANALYTICS
SETTINGS
Terrain Visualization
Material Flow
Crusher Matrix Visualization
Mine Planning Documents
FULL VIEW
DRILL01
DOZER1
Show daily cuts
On
Show dozers
On
Show trucks
On
Show drills
On
Show drill holes
On
TR03
TR13
SH03
DOZER8
SH11
A24
TR01
DOZER6
SH03 >
COMPLIANCE TO PLAN
N/A
AVG QUEUE TIME
1.75 mins
TONS PER HOUR
704
SPOT TIME
0.25 mins
CURRENT STATUS
Active-Delayed
OF TRUCKS WAITING
0
IDLE TIME
2.27 mins
ELEVATION
4106.85 ft
LAST MATERIAL MINED
High Grade
SH01
SH02
SH03
SH04
SH05
SH06
SH07
SH08
SH09
SH10
SH11
SH12

Pit cameras visualization



OVERVIEW
MATERIAL
EQUIPMENT
OPERATORS
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ANALYTICS
SETTINGS

SH03

REASON
Short shovel move

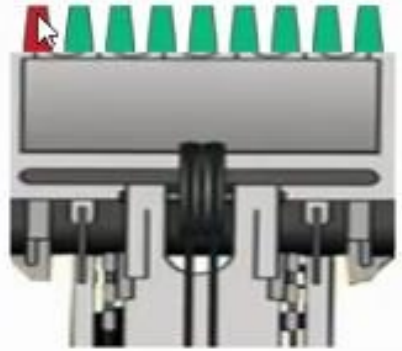
LOCATION
B5750SR1

OPERATOR
Brittney Reiner >

TIME IN STATE
02:02:41

Spot Time (mins)	0.25
Load Time (mins)	1.21
Idle Time (mins)	2.27

TOOTH METRICS SYSTEM HEALTH



Data Age	766 s
Ping	16
Points / Hour	1335

SHOVELS PAYLOAD

	TPRH	AVG PAY	# LOADS	UNDER LOADED	BELOW TARGET	ON TARGET	ABOVE TARGET	OVER LOADED	INVALID PAY
Crew 0	704	43	131	1%	11.5%	6.9%	5.5%	1.4%	18%

PREDICTIVE MAINTENANCE ALARMS

ALARM NAME	ALARM CONFIDENCE	TTF	URGENCY

No Available Record

Connected Mine

Last page update
Up to date

Bruce Garcia
Operations Supervisor

OVERVIEW
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Terrain Visualization | Material Flow | Crusher Matrix Visualization | Mine Planning Documents

BLASTED STOCK

67,850 tons

69,917

	Actual	Plan	Cu	Au	As
Northern	30,546t	29,563t	0.60%	0.8g/t	0.25%
Western	16,935t	20,540t	1.20%	0.9g/t	0.50%
Southern	20,369t	19,814t	0.90%	0.3g/t	0.72%

OVERVIEW
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SETTINGS

TR02 Earl Roberts EQUIPMENT / TRUCKS / ACTIVE-RUNNING

TR02

REASON
Production

LOCATION
S12

LAST SHOVEL
SH01 >

OPERATOR
Earl Roberts >

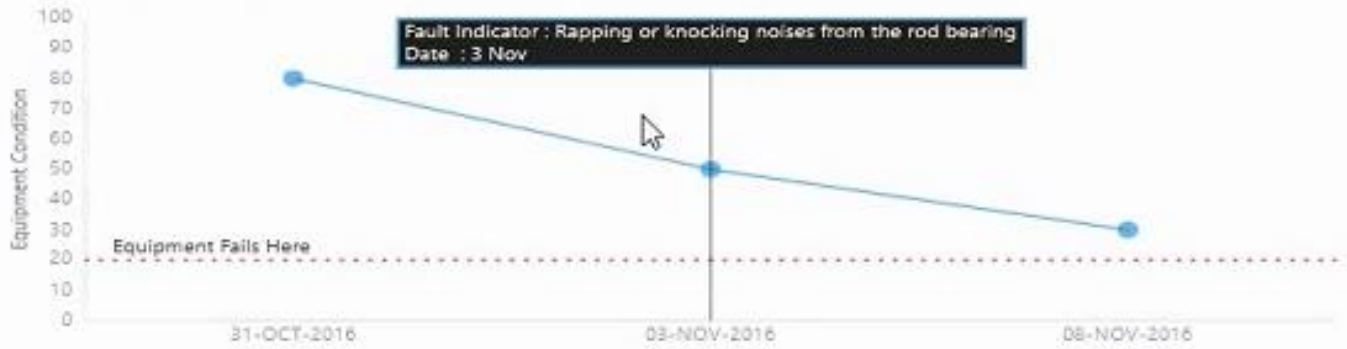
TIME IN STATE
03:10:24

Truck Productivity (tons/hour)	860
Average Payload (tons)	251
Tons Hauled (tons)	2,048

PREDICTIVE MAINTENANCE ALARMS

ALARM NAME	TTF	URGENCY
> Indication of low oil pressure	10 days	Moderate
Engine Vacuum leak	15 days	Urgent

INDICATION OF LOW OIL PRESSURE



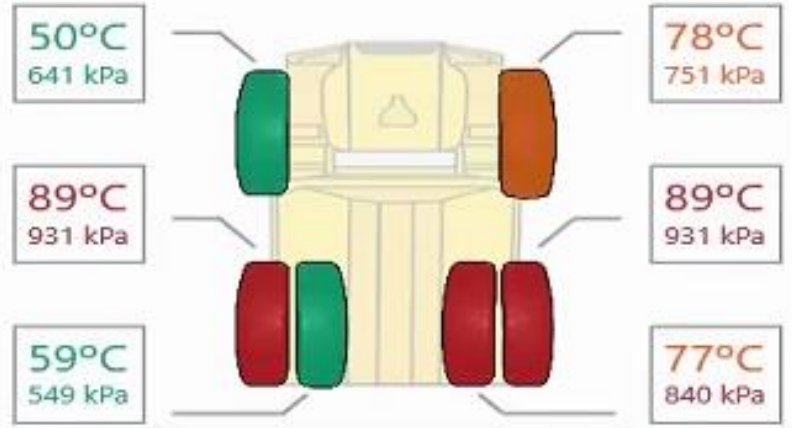
NUMBER OF DUMPS

TOTAL 27

12
Number of dumps at crusher

15
Number of dumps at stockpile

TIRE STATUS



OVERVIEW
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SEAN JENKINS TR47 OPERATOR / TRUCKS

GENERAL

OPERATOR NAME
Sean Jenkins

ASSIGNED TRUCK
TR47 >

TONS HAULED
1,931

CREW
7

FATIGUE PREDICTION SCORE (TIME TO EVENT)

TTE < 2hrs	TTE 2-4 hrs	TTE 4-8 hrs	TTE 8-12 hrs
85%	1%	2%	1%

LIST OF ALARMS

REASON	TIME
TR47's tons per hour is 50% below target	10:20:08 AM
TR47's status is now Inactive (Unavailable)	10:17:52 AM
TR47: fatigue - other eye-closure (drowsiness)	10:13:45 AM
TR47: Sean Jenkins - Fatigue Detected : Critical (84%)	09:19:22 AM
TR47's equivalent flat haul is 34% below target	06:19:01 AM
TR47: Sean Jenkins - Fatigue Detected : Critical (83%)	05:19:22 AM

TONS HAULED

TPRH	TONS HAULED	IDLE AT CRUSH	TONS DELIV CRUSH
97,130	1,931	8.1 mins	322

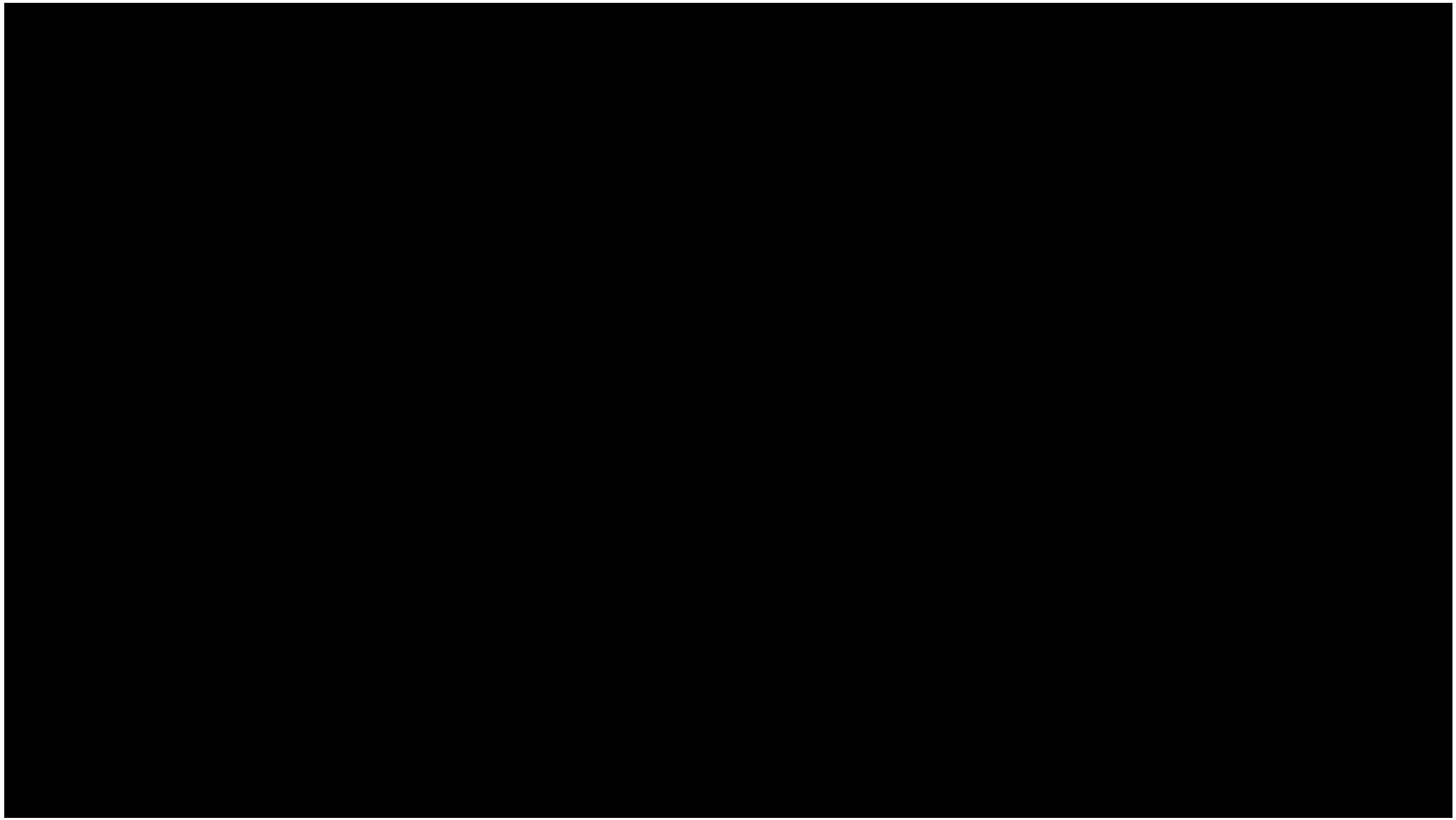
FIRST HOUR TONS	LAST HOUR TONS	SHIFT CHNG EFF	EFH
316	264	741%	5,680

PREDICTIVE FATIGUE

LIST OF DELAYS

REASON	TIME IN STATE	TIME
Road block	00:52:22	10:16:46 AM
Delay at shovel	01:55:42	10:04:15 AM
Delay at dump	02:08:31	09:28:13 AM
Safety inspection	00:16:34	09:08:12 AM
Fueling	00:29:48	06:42:00 AM

CONNECTED MINE - VIDEO



QUESTIONS ?

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Industry X.0 Capability Lead

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