Algoritmi predittivi sui processi di produzione

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WHO IS PIRELLI

PIRELLI IN A NUTSHELL

A start-up that's 147 old.

Focusing on high value products and catching the new challenges of mobility 2.0.

An iconic brand able to engage far beyond the tyres world.

A WIDE RANGE OF HIGH VALUE CONSUMER TYRE

The company's consumer focus starts at the tyre development stage. For **High Value products** this takes place within a longstanding set of solid **partnerships** with **the most prestigious car and motorcycle manufacturers.**

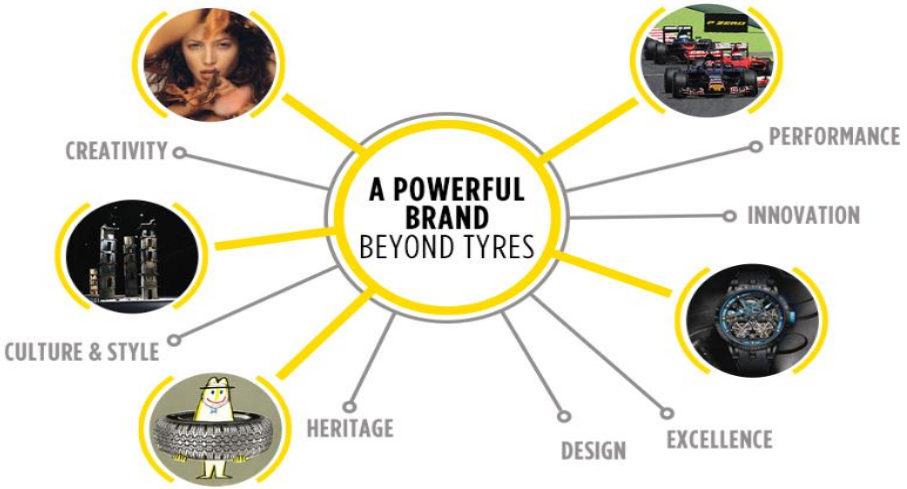
These collaborations allow Pirelli to develop **tyres tailored** to the different types of vehicles, in order to meet the specific needs of the most sophisticated consumers.

A POWERFUL BRAND

The Pirelli brand is known around the world as an icon of technology and excellence.

Represented by the “capital P” logo for more than a century, the Pirelli stands for a premium, high-end style with an Italian heritage.

The fame of the Pirelli name and brand also stems from its involvement in multiple activities beyond tyre manufacturing. It is the FIA global tyre partner and It has a record of 110 years supporting motorsport. It sponsors multiple sports and it has a commitment to the arts and culture represented by the Pirelli Calendar, the Pirelli Foundation and Pirelli HangarBicocca, one of Europe’s largest exhibition spaces for contemporary art.
The company is also involved in numerous initiatives for the community.



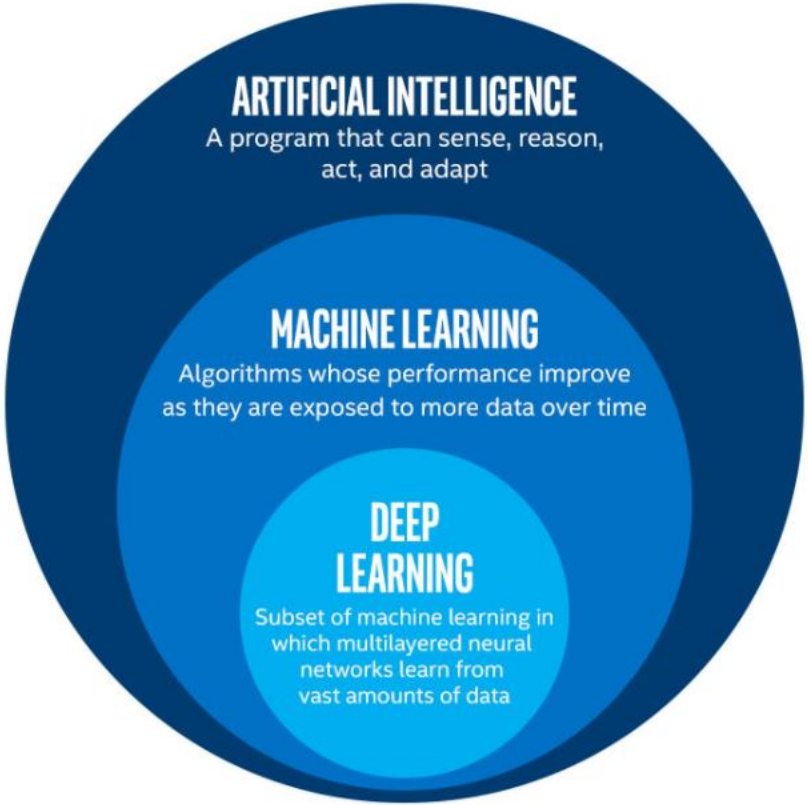
DATA SCIENCE IN PIRELLI

Data Science Definition

“
Data Science
is the art of
turning data into
actions
”

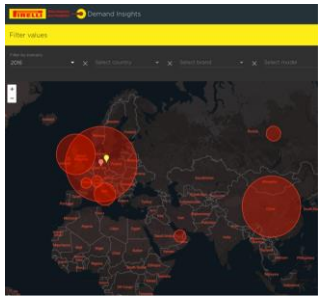
Source: Booz Allen Hamilton

Artificial intelligence definition



CLUSTERS OF ACTIVITIES

Data science cluster of activities



Market Intelligence

Services built on top of Cyber Technologies

Smart Manufacturing

Research and Development

MARKET INTELLIGENCE

How Data Science supports Market intelligence

1 MARKET POTENTIAL ESTIMATION

From the Geolocalized **Car Parc**

Through the **statistical study** of the Tyre Replacement Rate based on the vehicle typology/brand

Tyre Replacement Rate	Audi	BMW	Mercedes-Benz	Porsche	Volkswagen
CAR	1,4	1,6	1,4	2,2	1,2
SUV	1,4	1,5	1,7	1,5	1,6

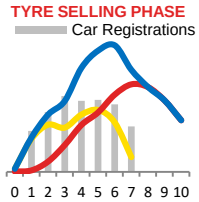
With the best extimation of the proper **fitment mix** by country

Thanks to the information of the **OE share by size/year** and the **destination markets**

- Tyre potential extimation
- **Pull Through/Fitting Potential extimation**
- Gap analysis
- **Target Setting**

2 PULL THROUGH ANALYSIS

Understanding of historical levels of pull-through by brand/model/rim



Support for **OE business selection** («ideal» share definition)

integrated profitability

Replacement **opportunity identification** (e.g. for OEXS sizes)

3 ROLLING STRATEGIC PLAN

Continuous monitoring and estimate of the market value to provide

Target setting for **pull-through volumes** and shares

Target setting for **push-through volumes** and shares

Target setting for standard volumes to fill capacity

Support the integrated **long term planning tool**

CYBER TECHNOLOGIES

Cyber technologies

Cyber technologies are the core of the new Pirelli's strategy.

Sensors are installed within the tyre allowing to **collect information and data**

Main products

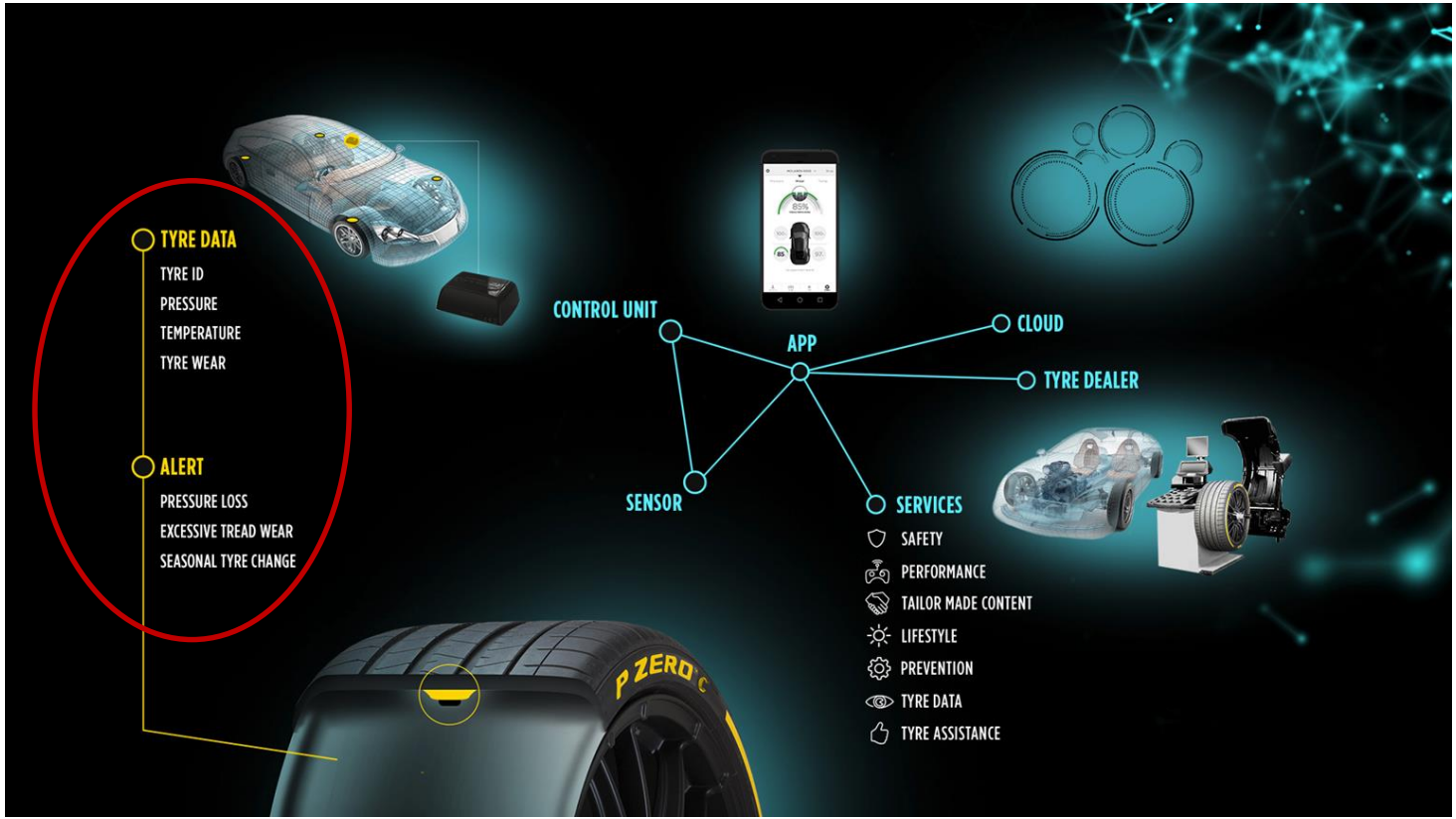
CYBER CAR

Sensors are installed on top of car vehicles and **directly interacts with car CANBUS** to provide services and analytics

CYBER FLEET

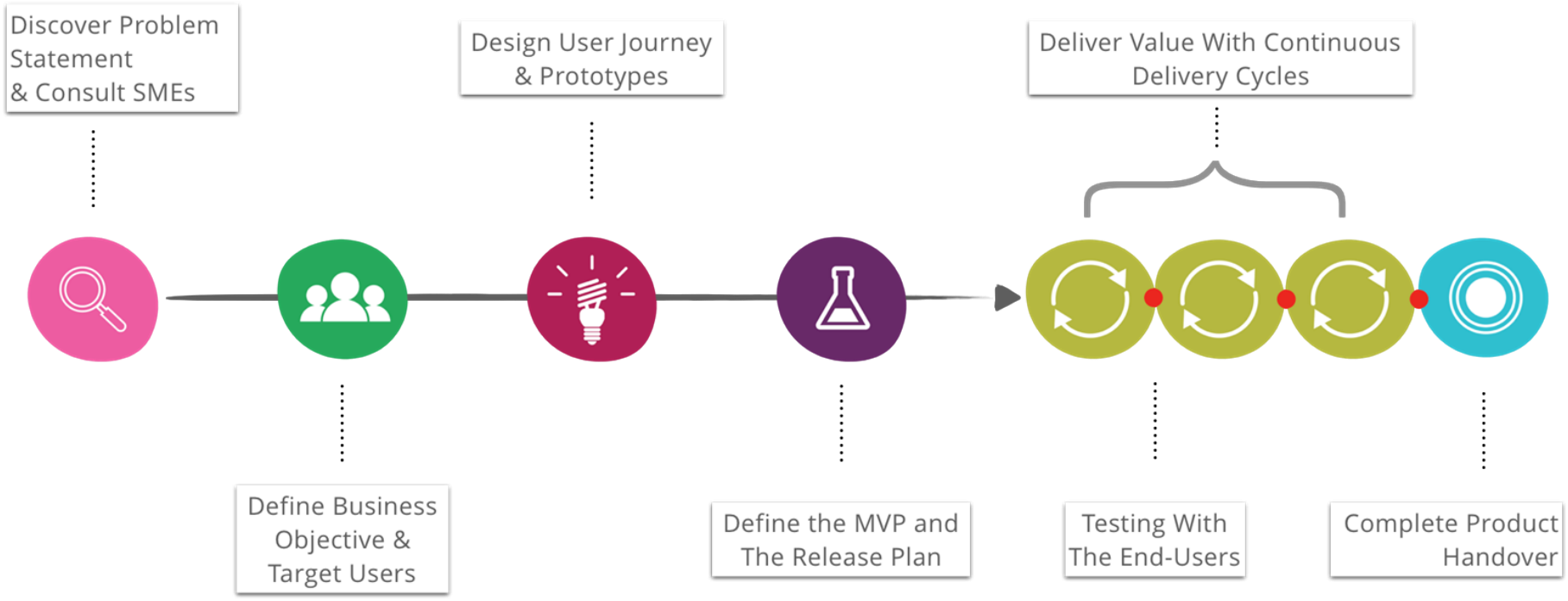
Sensors are installed **on top of truck vehicles**, providing product services and insights

Overview : feature examples

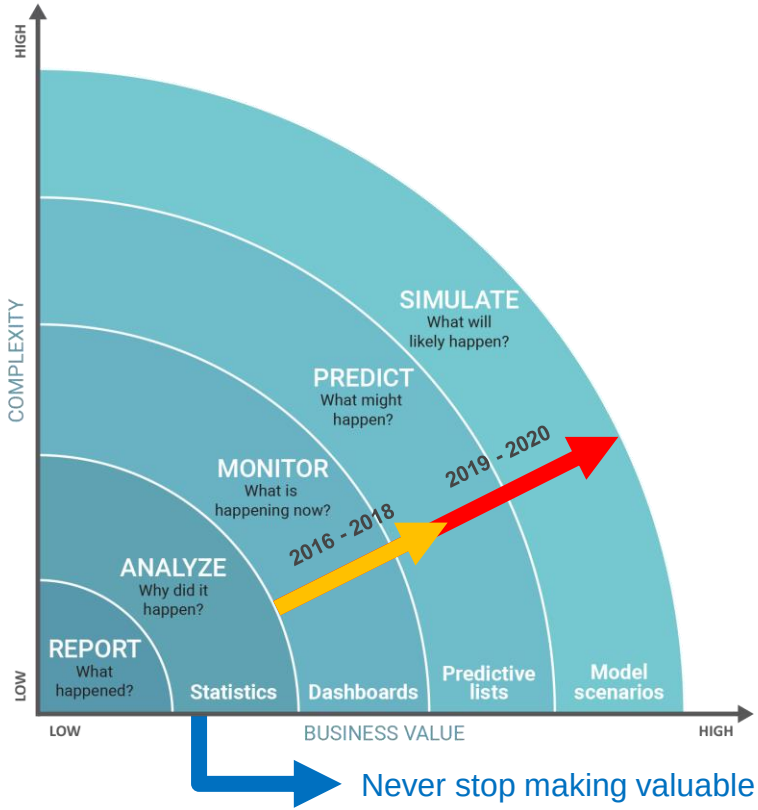


DATA SCIENCE APPROACH AND KEY FACTORS

Data Science Product Lifecycle



Data Science evolution



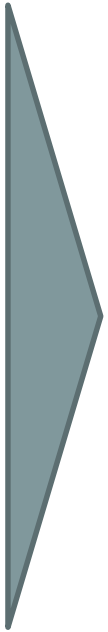
PREDICT : based on historical data being able to predict short-long terms evolution of phenomena

SIMULATE : create possible scenario based on historical data and different configuration of system inputs

Never stop making valuable statistical analysis

What did you do differently?

- **People**
  a. Org structure
  b. Team
- **Ways of working**
  a. Agile to break silos
  b. Trust is the key
- **Technology**
  a. Right tools for the task
  b. Technical excellence

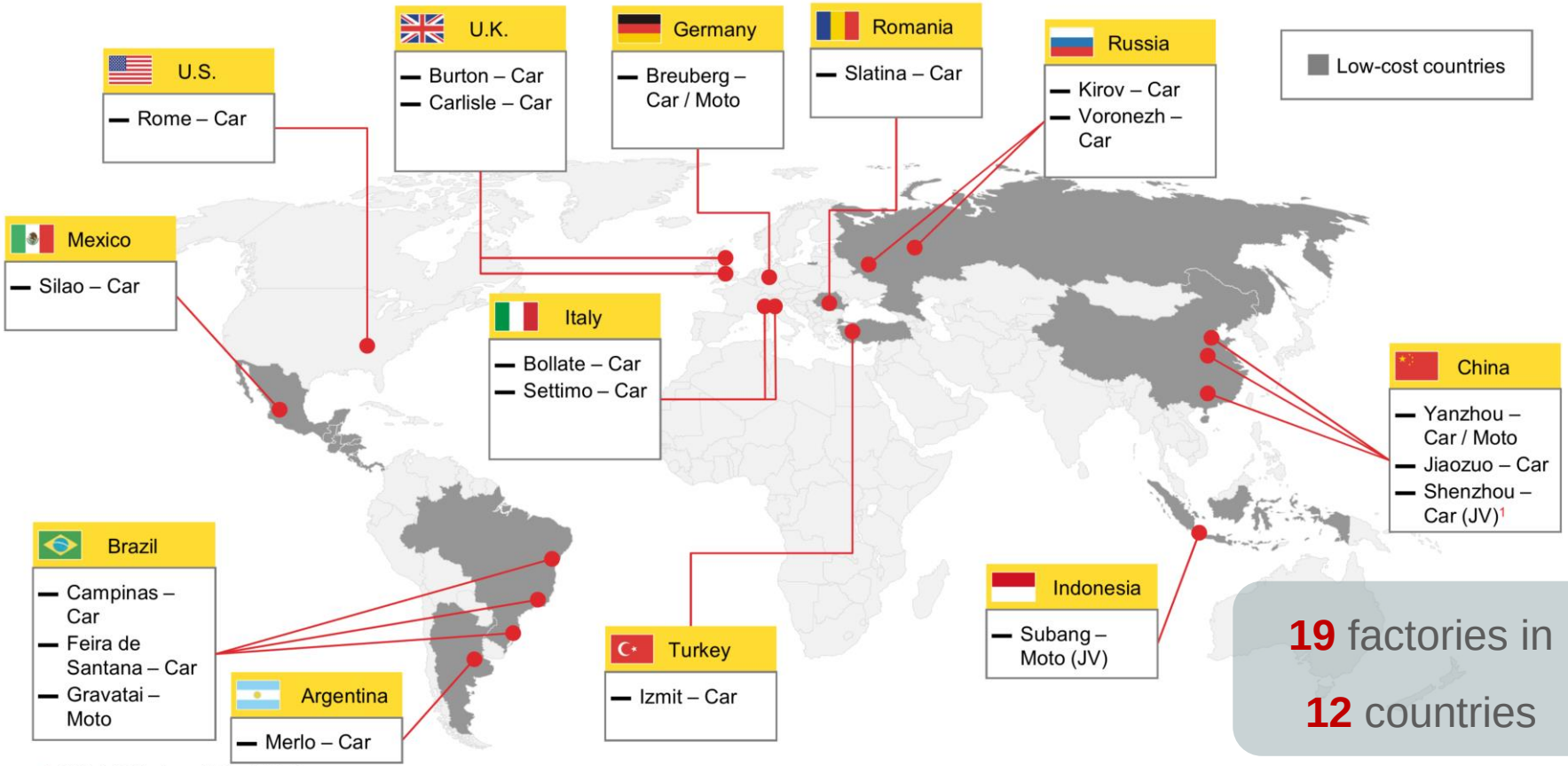


- Expectations and portfolio management
- Recruit and maintain talents
- Adapt to change

DATA SCIENCE FOR MANUFATURING

The art of making tyres

Manufacturing Footprint



19 factories in

12 countries

1. 49% Joint Venture with the Hixih Group

Product Complexity

More than **100** components for each tyre

More or less **5000** data points for each tyre during manufacturing

Capacity plan: more than **70 Mln** tyres (worldwide)

DSA OUTCOME

Real Time Analytics

Trend, outliers

Advanced Data mining
Data products

Predictive Manufacturing

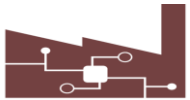
Forecast product quality

Predictive Models
Algorithms

Prescriptive Manufacturing

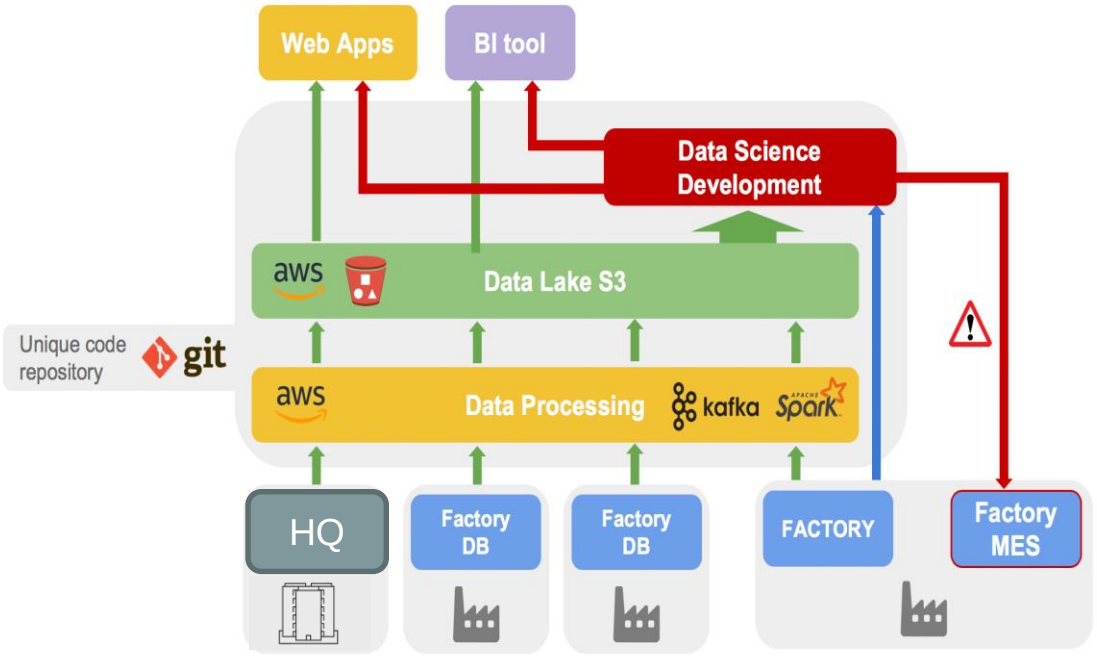
Process tuning and resource allocation

ML + Smart integrated communication



Virtual Factory

Infrastructure



- Data Lake stores both the factories data and Head Quarter information (Sales, ERP, digital mktg)
- Each **plant** is able to provide analysis by **python** and local app development
- **Advaced analytics** are provided by **HQ Data Science** team

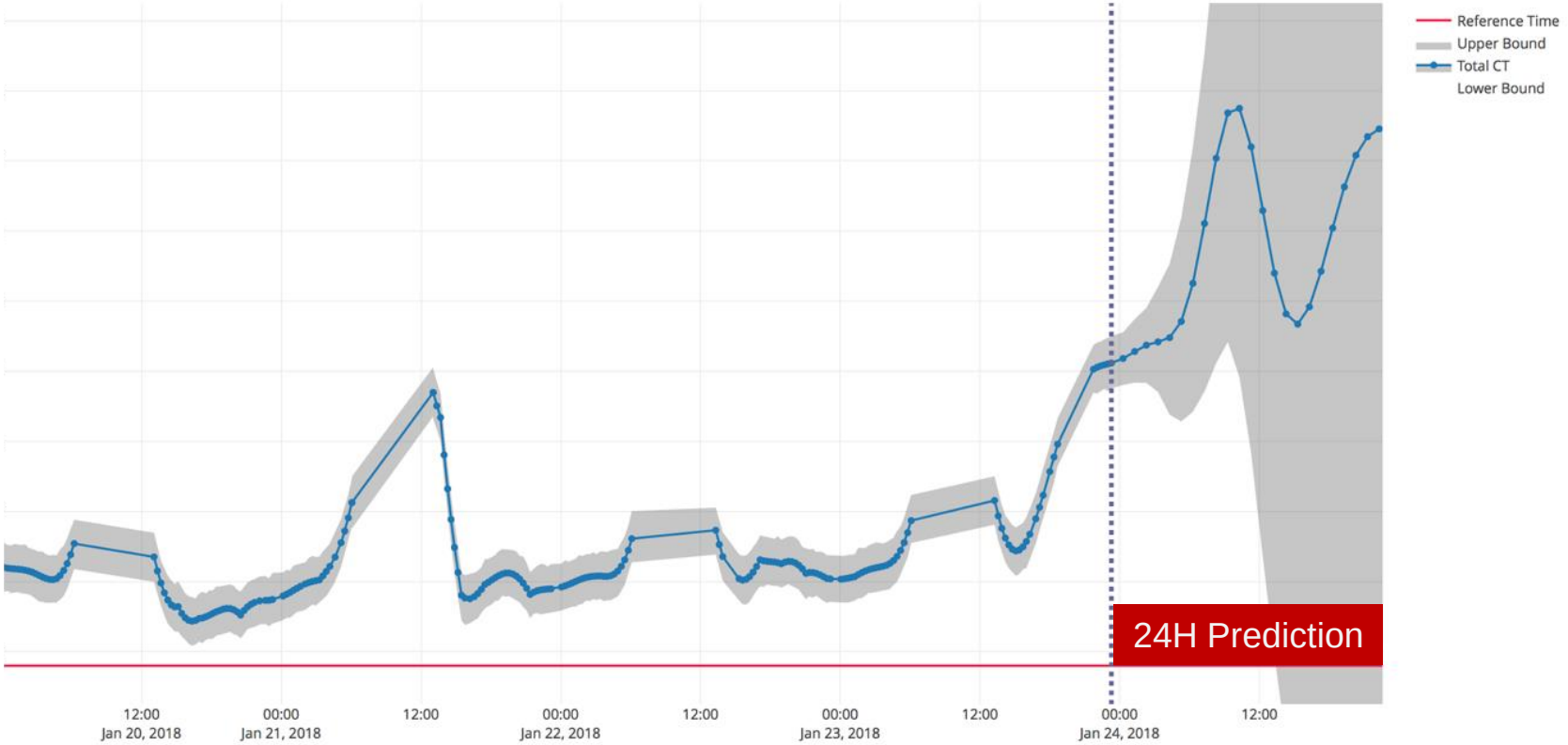
Example on different complexity level

1 – time series prediction

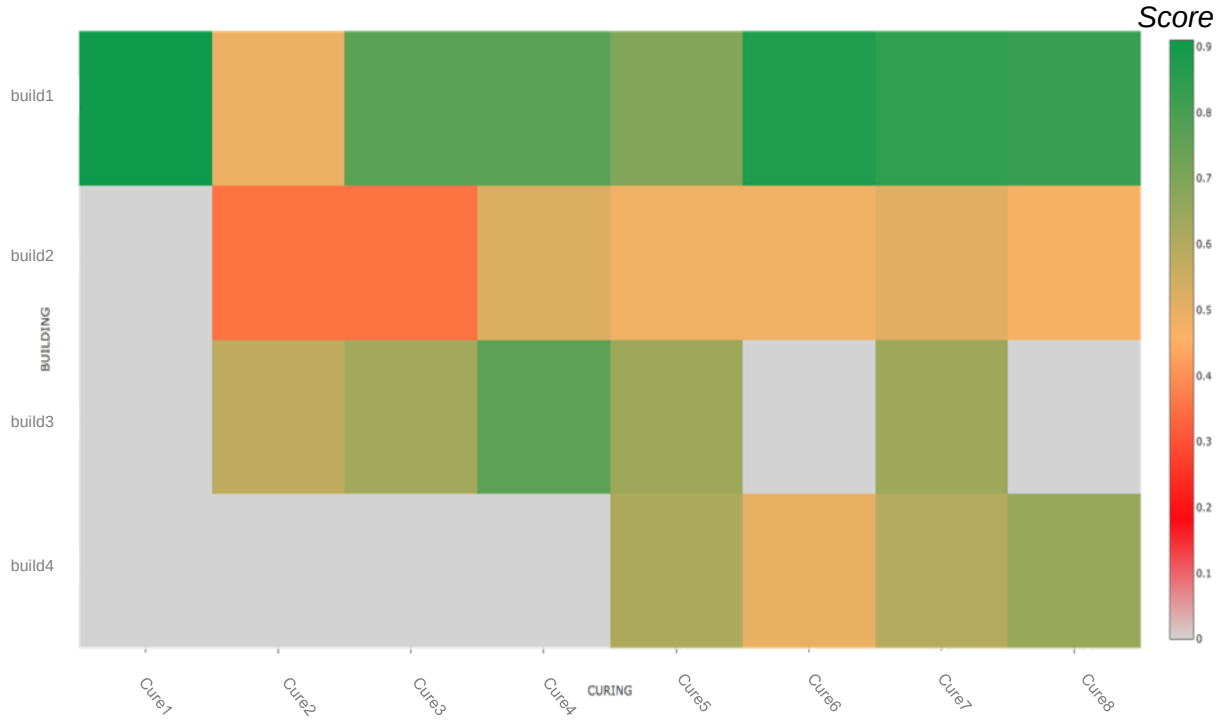
2 – identify best production path (and related root cause)

3 – reinforcement learning

1 - Cycle time prediction



2 – Identify best production path

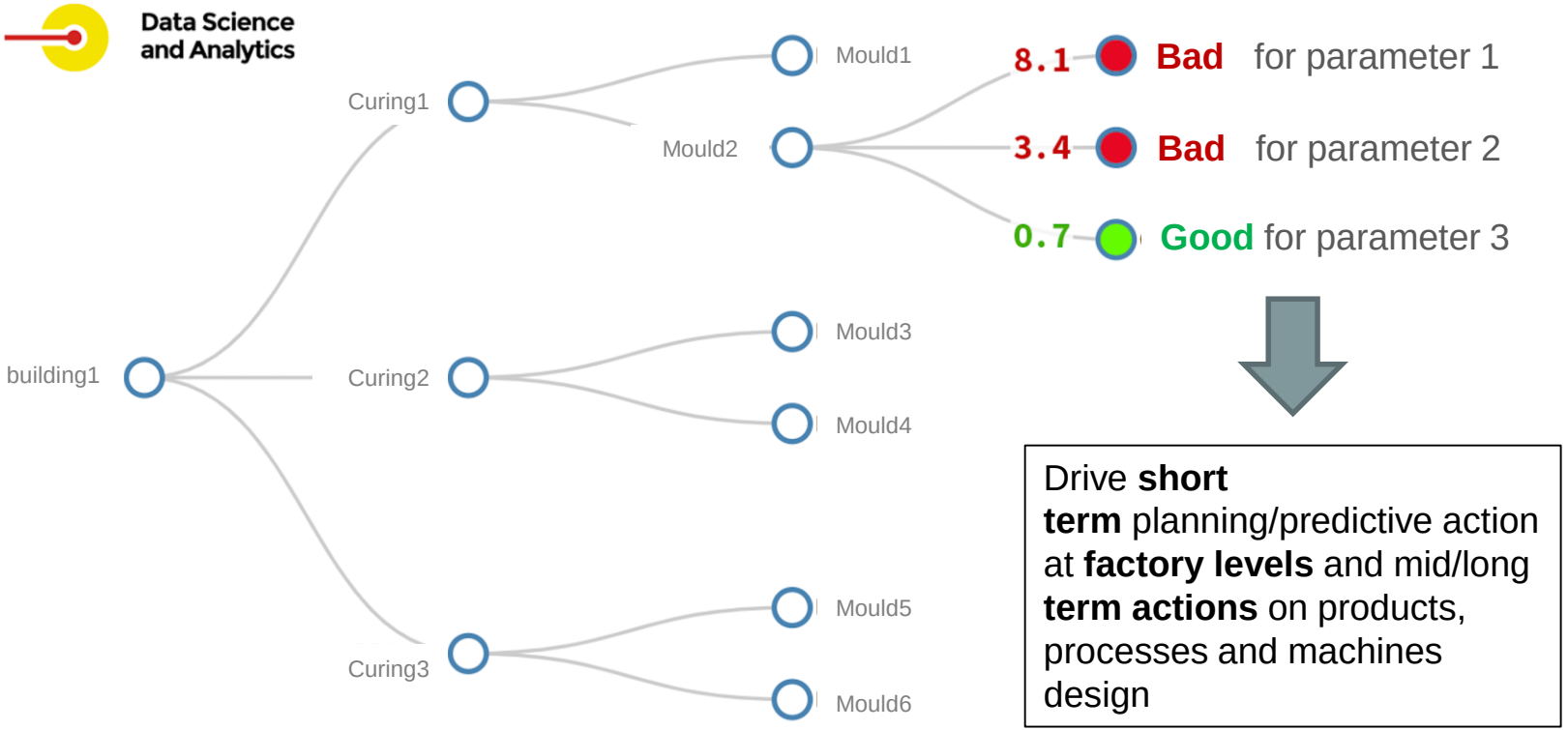


PLANNING

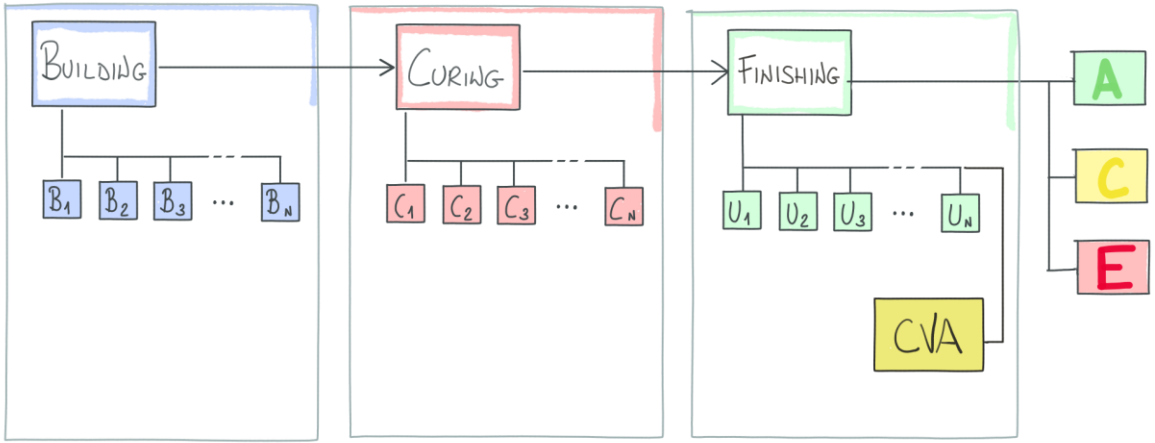
MAINTENANCE

QUALITY

2 – Identify negative production path – root cause



3 - Reinforcement learning



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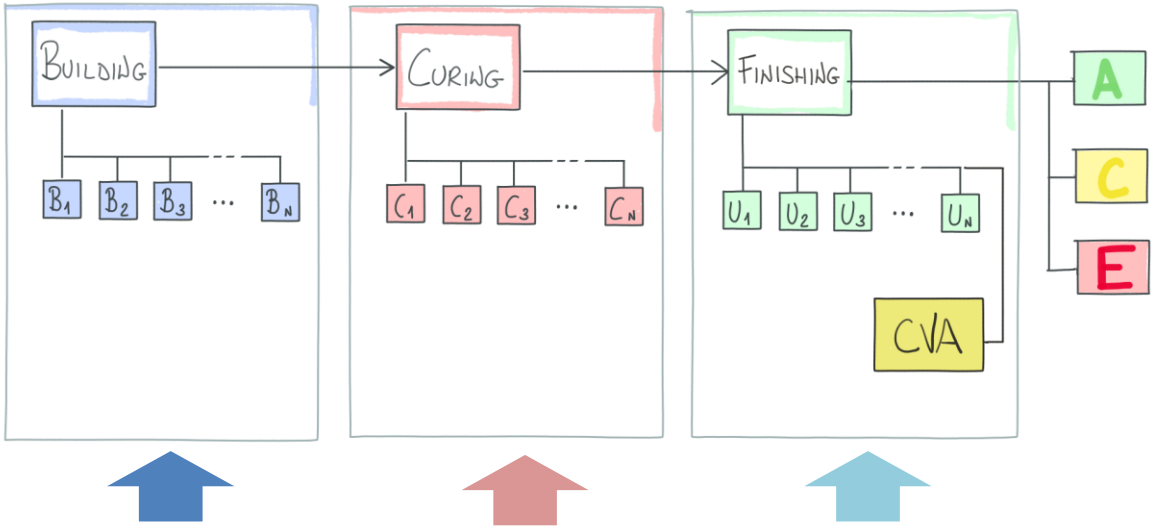
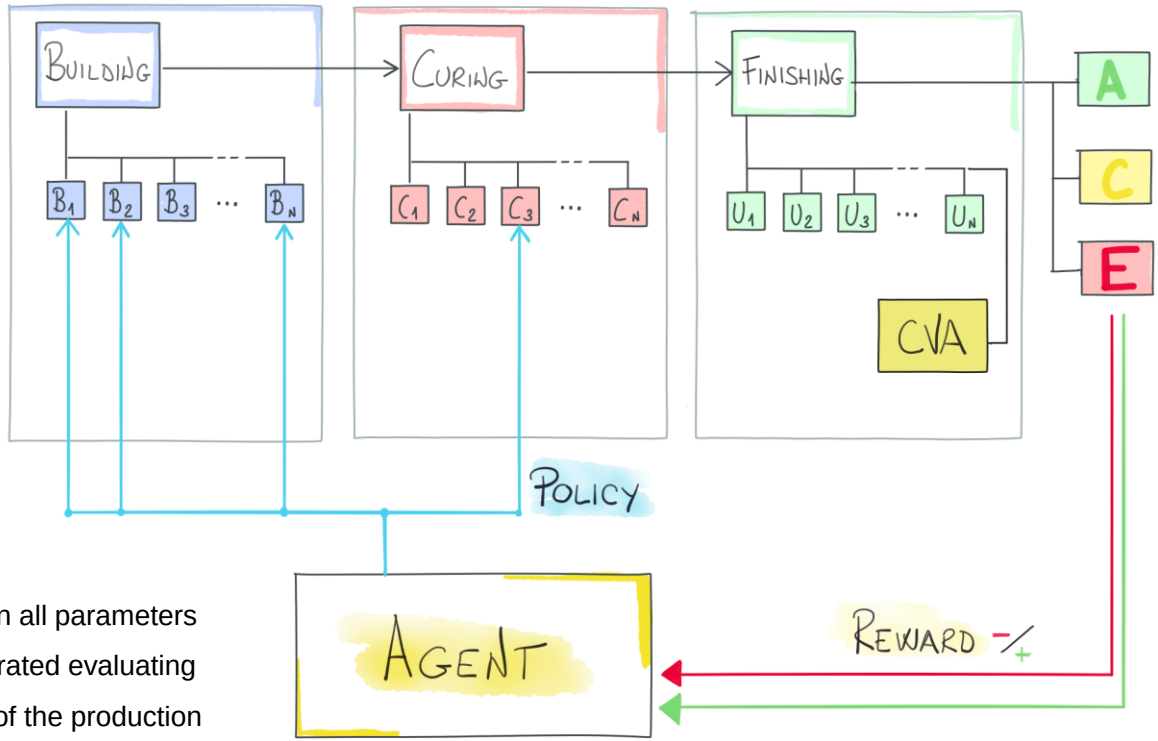


Each phase has its own inputs to manage production.

Balancing all inputs parameters together is too complex and
real time adaptability is not possible

3 - Reinforcement learning



A virtual **agent** is acting on all parameters based on a "**policy**" generated evaluating **rewards on final quality** of the production