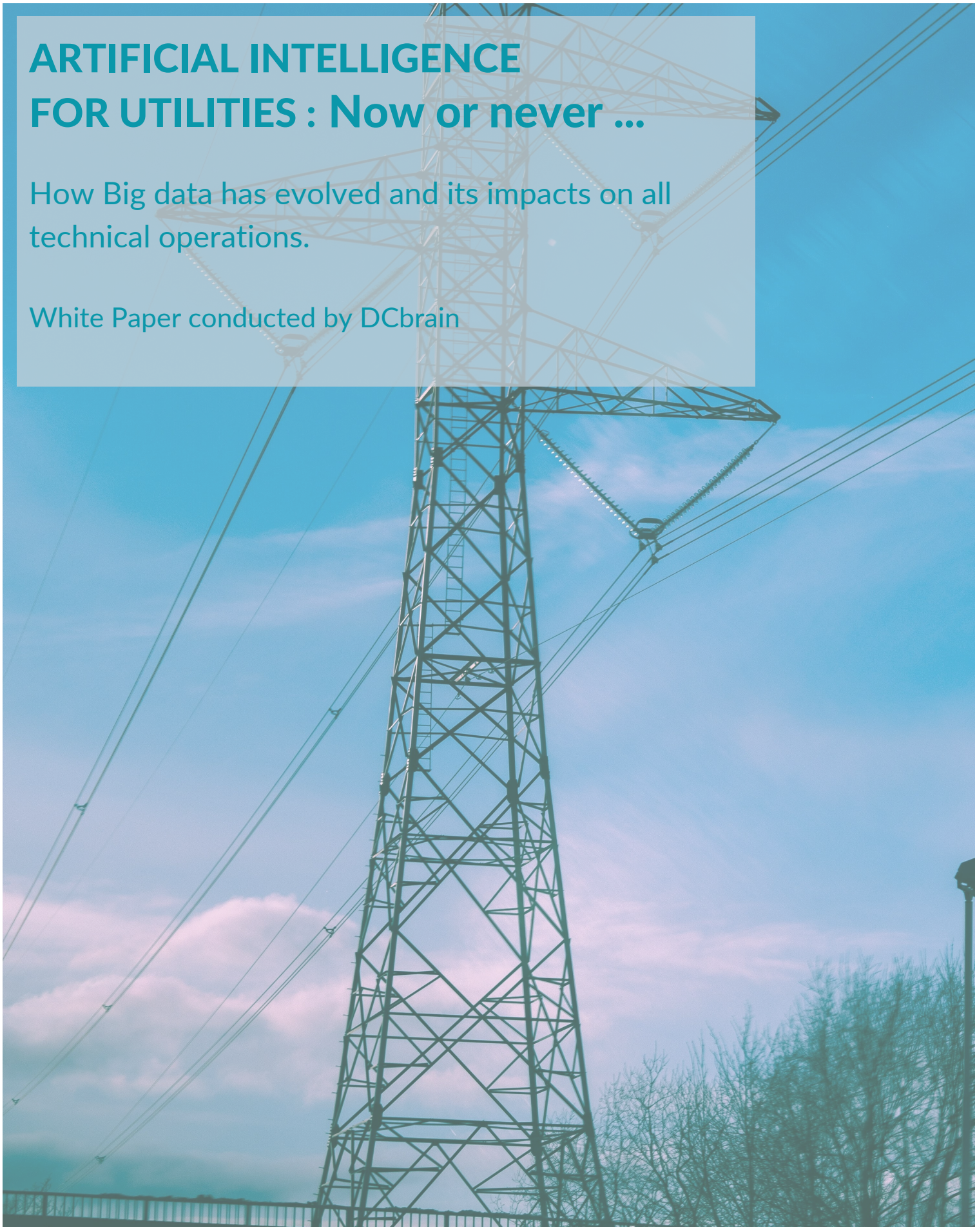


ARTIFICIAL INTELLIGENCE FOR UTILITIES : Now or never ...

How Big data has evolved and its impacts on all technical operations.

White Paper conducted by DCbrain

DCbrain

Who is DCBrain?

Created in 2014, DCbrain is a software provider, specialized in Artificial Intelligence. Our software, INeS (Intelligent Network Solution) helps complex networks managers to improve reliability and optimize their flows.

DCbrain is a European B2B SaaS provider that supports network companies creating more value from their networks in a growing market facing multiple constraints.
We have developed a proprietary Artificial Intelligence software dedicated to networks and flows.

Our solution is field proven and used by tier1 companies.

Visit our website www.dcbrain.com for more information.

Big Data,
Big Money?

Big Data : not such a new thing

We have been talking about **Big Data** since 1980 but the operational use of Big Data appeared around 2010. By implementing data lakes, the original use was to keep all the original data in order to refine the analysis with the help of data scientists and algorithms.

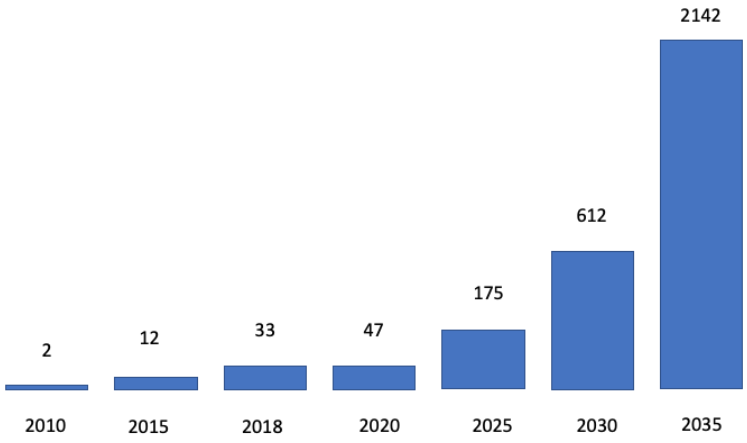
This trend was caused by **2 main factors**:

- The cost decrease of generating data (through the development of new generations sensors, allowing non critical activities to be better monitored)
- The cost decrease of data storage

At first, it's important to remind ourselves the 3 rules of Big Data:

- **Volume** is how much data could be generated by business or people
- **Speed** means how often data could be generated and also shared
- **Variety** represents all the different data we could ever find

Big Data ; A skyrocketing volume (zettabytes)[1]



And Data is obviously getting bigger: the volume of data continues to double every three years as information pours in from digital platforms, wireless sensors, virtual reality applications, and billions of other sensors. Data storage capacity has increased, while its cost has plummeted.

In the beginning of this trend, Big Data was hoped to be the new paradigm-shifting technology, with strong impacts on both Opex and Capex. For example, McKinsey[2] estimated in 2011, that in the private sector, data has the potential to increase operating margin by more than 60%.

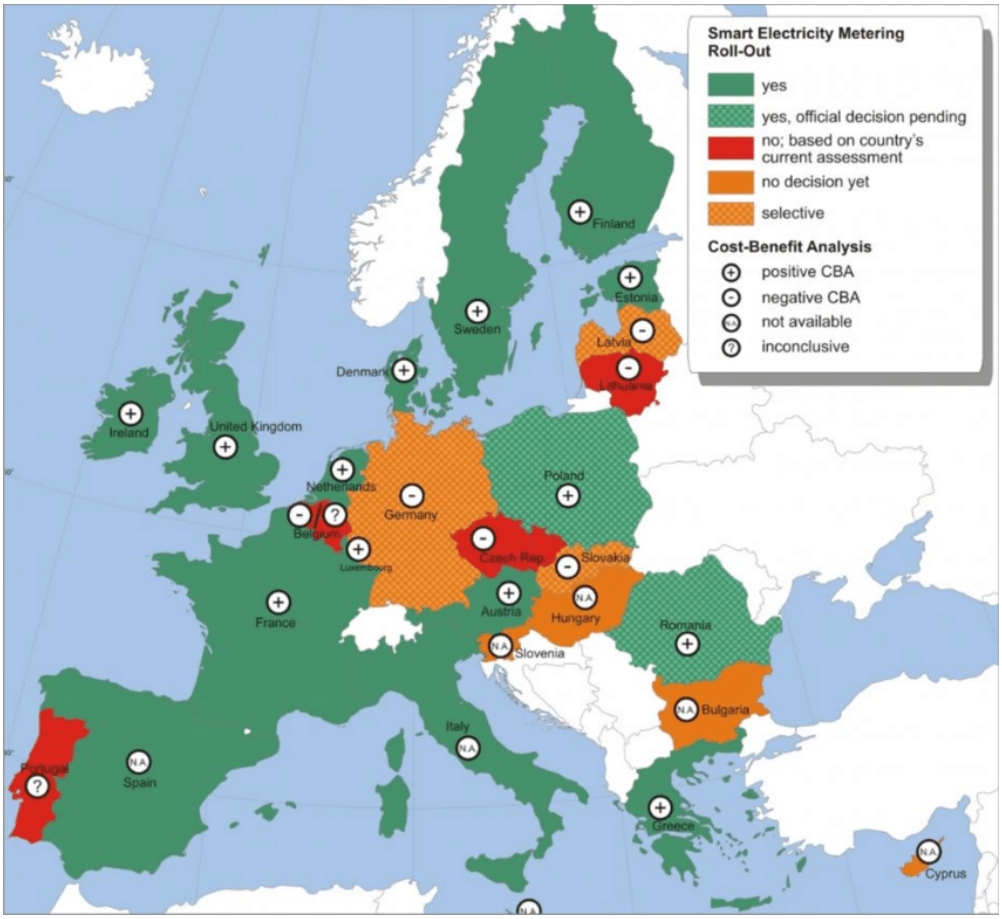
1. https://fr.statista.com/infographie/17800 /big-data-evolution-donnees-numeriques-creees-dans-le-monde/
2. McKinsey, the next frontier for innovation, competition and productivy - 2010

Especially not in the utilities sector

Meanwhile, companies have tried to shift from old legacy system to Data-ready layers, massively investing in IT. In 2020, it is estimated that more than 11% of IT expenditure in Europe are linked to Big Data layers / tools.

This **Big Data** trend has also heavily impacted utilities companies.
Most European countries have launched or finalized their smart meters deployment. In the gas sector only Italy has reached the finalization stage at the moment. In the electricity sector: respectively 90% and 99% of final customers are already equipped with advanced meters in Italy and Sweden whereas France and some other European countries are still in the testing phase.

Smart Meters are deployed massively in Europe[1]



1. https://ses.jrc.ec.europa.eu/smart-metering-deployment-european-union

Big Data was supposed to be a game changer

This sector was also impacted by several other trends : energy transition, renewables development, flexibility, demand response, electrical mobility.... At the heart of this paradigm shift, one word was often placed : **DATA**.

Thus, most companies have tried to use Data to cope with these trends on manyu use cases:

- **Invoicing**
- **Load forecast**
- **Asset Management**
- **Demand Response**
- **Operations Optimisation**
- **Workforce Management**
- **Planification**
- **...**

"Big Data analytics" actually encompass various technologies, with different pros and cons, different use cases, different pre requisites... Those technologies, which are often referred to as “Artificial Intelligence” are often seen as unique by technical teams. You can actually distinguish 2 main families.
Several technological families can be used to tackle those use cases: Machine learning & Deep Learning / Deep Reinforcement Learning.

Big Data was supposed to be a game changer

Machine learning / Deep Learning

Machine Learning / Deep Learning (ML / DL) are technologies that are used to identify and replicate patterns based on huge amount of data.

Classical use cases include:

- Predictive maintenance
- Load forecast
- Fraud detection

Basically, through "learning" technologies, teams can fine tune classical statistical approaches

The main prerequisite of these two technologies are the presence of historical data sets, which need to be perfectly cleaned in order for the algorithms to be efficient.

Reinforcement Learning

Reinforcement learning is based on the concept of creating a winning decision strategy by testing multiple combinations and identifying the right one.

Classical use cases:

- Optimisation of exploitation activities
- Fine tuning of CAPEX decisions
- Energy management optimisation

Through Reinforcement Learning, complex decision-making processes can be automatized and fine tuned.

This technology is very useful when data is scarce / uncomplete, especially when companies want to fine tune complex decision making processes.

Those technologies have been developed by academics and are now mature and ready to be deployed. Nevertheless, Big Data has, by now, failed to prove its image as the "Next Big Thing". Why?

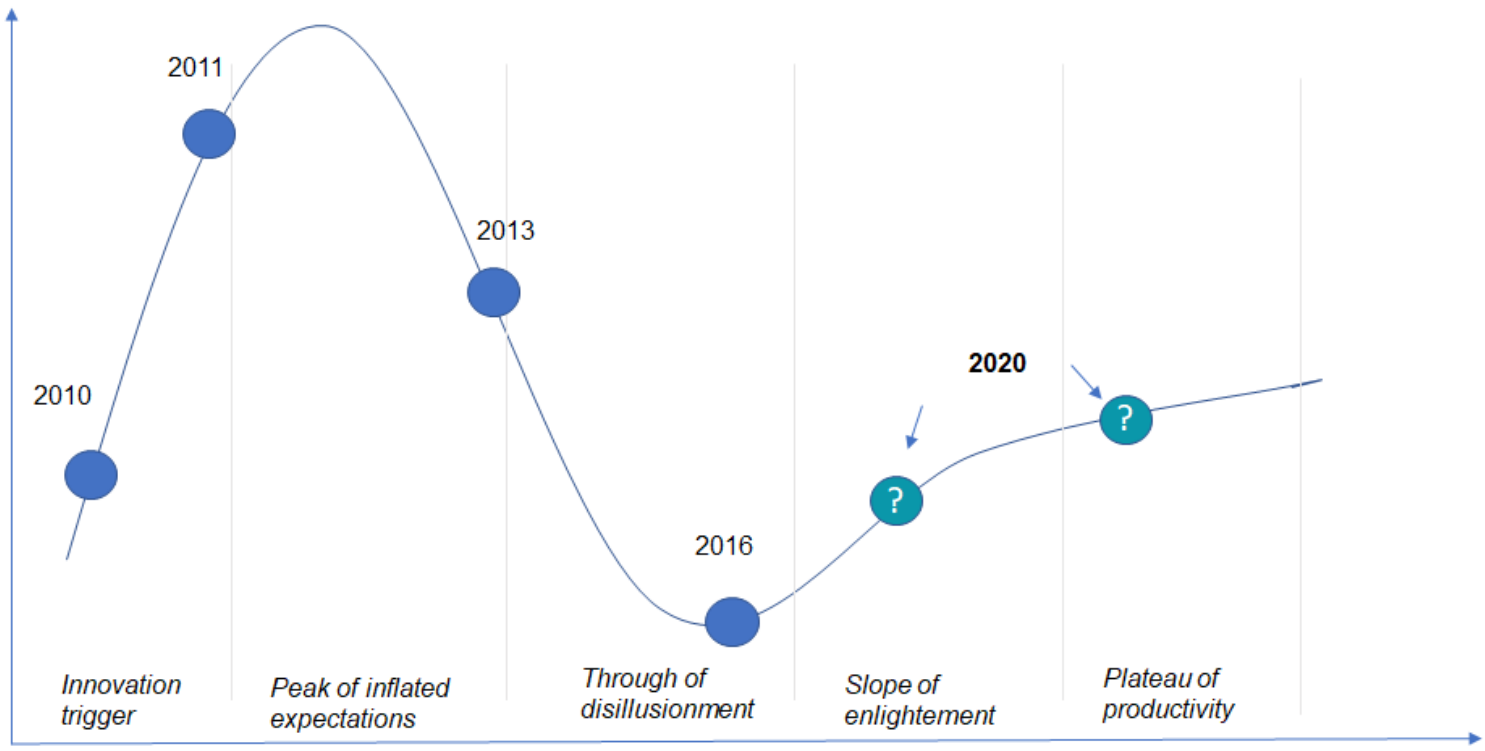
But also Big problem?

Are we still in the valley of death of Big Analytics?

In 2020, this potential value is still not met, as stated by a recent McKinsey Study: 10-20% of the potential "Big Data "value has been captured in the public and manufacturing sector. One can now question whether we are still in the "Valley of death" of big data and Artificial Intelligence technologies

A recent study by the French Association "Think Smart Grid"[1] has shown that almost all utilities companies in Europe have tried Big Data projects through Proof of Concepts with either start ups or more classic companies. But only two third have industrialized big data related projects, especially in non core processes. Is Big Data really the next new big thing for exploitation activities of utilities?

2020 : Which future for Big Data?



2010 : The beginning of Big Data in utilities, experimentation stage.
2011 : Big Data « Big Bang »
2013 : Big Data : not that easy !
2016 : we need Data Scientists !!!
2020 : It is working but can we really industrialize it ? and how ?

1. https://www.thinksmartgrids.fr/wp-content/uploads/2018/11/ThinkSmartgrids_etude_data_nov2018.pdf

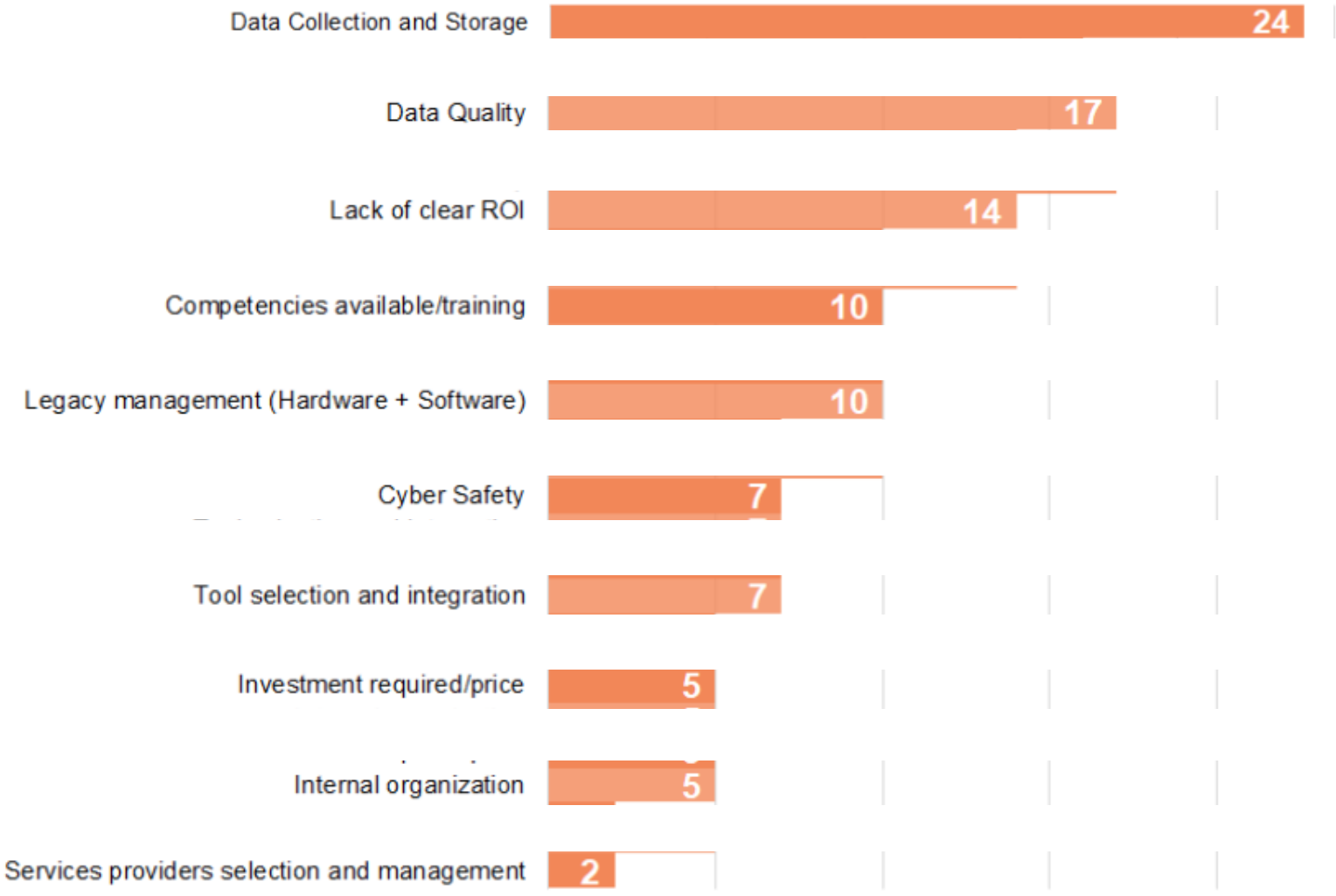
Many barriers to capture value

The same study states that the biggest barriers companies face in extracting value from data and analytics are organizational; many struggle to incorporate data-driven insights into day-to-day business processes. Another challenge is attracting and retaining the right talent—not only data scientists but business translators who combine data savvy with industry and functional expertise.

Some of the challenges that Utilities companies face with big data are:

- Data related issues : Collection / Storage / Quality
- Lack of clarity on the return on investment
- Lack of right talent to deliver the right use cases

Pain points preventing a higher industrialization of data use (%)

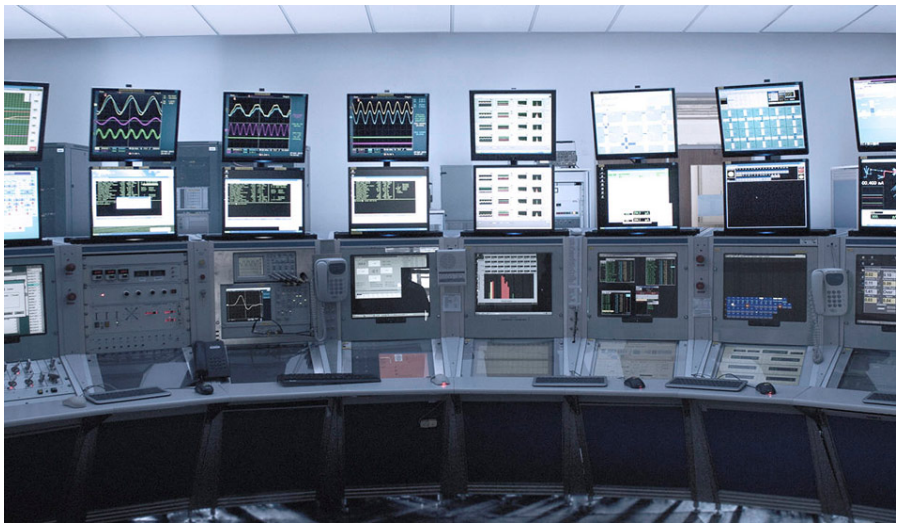


The right time for real Data value!

From data visualization to Data recommendation

From Big Data to "Too much data ": now, most of the time, data is only used to monitor activities. Hence the multiplication of Business Intelligence tools… and screens used by Operators. these operators now often complain that Big Data has made their jobs less effective...
Moreover, while Big data is constantly evolving, new data will appear and it will thus impact the number of KPIs used by operational teams....

Control room : or “Where's Wally” room...



At DCbrain we believe that **data potential value will not be met as long as we stay in this data visualisation era.** The true value of data will be found when it will be integrated into day to day operational activities, especially the core processes of utilities companies.

We are now at the end of the “valley of death” of big data hype cycle… meaning that we know which prerequisites to implement and which technologies to use to reach this value.

At DCbrain we have developed an integrated software able to answer utilities operational needs, especially the ones related to network management.

Technologies are helpful, especially when they are processed

Today, we are convinced that AI technologies (machine learning, reinforcement learning, digital twin) could make a massive difference for utilities companies, especially in order to embrace the Smart Grids revolution.

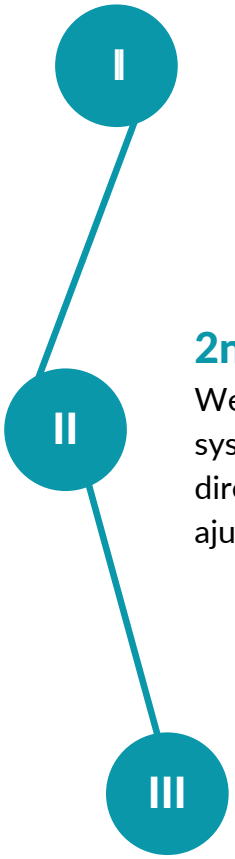
But at the core of AI Value lies processes. In fact, no data is perfect:

Datasets will always have anomalies (the sensors can drift, the communication chain may not work, Data is not saved etc). But, not identifying these anomalies makes the data models ineffective:

- If the data input is unreliable, the entire processing chain will be impacted
- If this instability is not managed, no added value on the data can be produced

The challenge today is to be able to base models on a robust and durable Data Bases. That's why in 2017, DCBrain launched the IVOCI project: A 15-months R & D project to develop an automatic filter module for data. In other word, at DCbrain we have a very precise data management and cleaning process.

This module, now integrated in our INeS Software, is based on 3 layers:



1st layer, prior analysis

Identification of abnormal data with robust statistical and machine learning methods (MAD, Isolation Forest, DBSCAN). The points are designated as abnormal only in a statistical view, in other words having no prior expert knowledge. Then, the next step is to integrate expert knowledge into the analysis.

2nd layer, model fine tuning through expert exchanges

We now have to make the difference between anomalies due to measurement and proper system malfunctions, which are hardly identifiable without expert knowledge. This done directly by users (clients experts) through the INes interface. The anomaly detection model is ajusted permanently to be more and more consistent.

3rd layer, more complex tasks, such as drift detection

We measure the evolution of performance of a system component. Such a measure is done by building a model of the normal behavior of the component based on expert knowledge. The drift is then defined as the difference between the recorded data and the model.

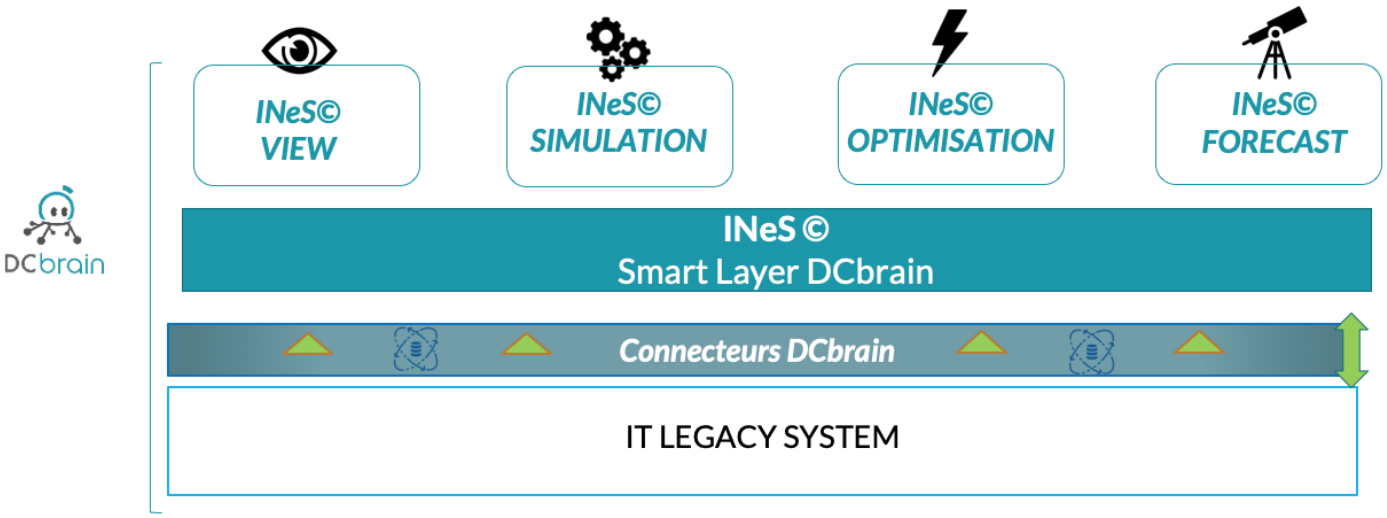
At DCbrain, one of our strengths is to be able to easily plug our INeS software to legacy systems. The INeS software has the ability to understand, optimize and simulate networks.

The INeS software is based on classical AI modules (Machine Learning, Deep Learning and Reinforcement Learning) that allow to learn / identify phenomena via the data, with relational graph bases that enable us to integrate the complexity of a network.

But what is also important for our clients, is our ability to quickly integrate this innovative technology into your processes. Indeed INeS is what we call a "smart layer", ie a software that can easily be added to your legacy system and bring your collaborators innovative functionalities:

- Forecast
- Simulation
- Optimisation

At the end of the day, you do not need to change your global system, preventing massive IT investment.



EXAMPLES

DCbrain is now used by several players in the utility sector

DCbrain is bringing Artificial Intelligence power to every utilitiy (gas, water, DHN, electricity)!

DISCTRICT HEATING NETWORK

Optimisation of geothermal energy for a complex district heating network

- Creation of a digital twin of the network (less than 4 weeks)
- Model Forecast of the heat demand for each substation
- Optimization of the energetic mix and the different parameters of boilers

Energy savings : between 7 and 11 %

idex
Efficience Energétique

ELECTRICITY

Simulation of maintenance operation

- Creation of a digital twin of the network
- Use of graphs algorithms couples with classical approach (Hybrid AI)
- Operational teams can simulate the entire process

Selection of the optimal way + gain in € and reliability

ENEDIS
L'ELECTRICITE EN RESEAU

GAS

Network balancing

- Multiple data integration and digital twin creation
- Fine tuning of propagation algorithm
- Deployment / training of the engineering team

Optimization of the invoicing process

RÉGAZ BORDEAUX
Porteur d'énergie

WATER

Implementation of a condition-based maintenance program

- Through data logs analysis, identification of anomaly patterns
- With clients' expert classification of patterns
- Training of ML algorithm to detect in real time patterns
-

Early identification of anomalies

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