AI for Industry

WHITE PAPER

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Editorial

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In a world shaken by the COVID-19 health crisis, industries around the world have been severely tested. Production came to a standstill, the global supply chain broke down, and the women and men at the center of these industries were greatly destabilized.

Artificial Intelligence is today at the heart of the transformation of our society and in particular of industrial professions. The promise of progress and value is enormous., and this transformation is leading to an in-depth rethinking of the role and value of humans, especially in relation to machines. The automation of quality controls through image processing, the prediction of defects on production lines, or the optimization of processes involving the most complex of machines, are all use cases where AI has demonstrated its potential.

However, these first examples remain isolated, and the major challenge for manufacturers is to move to AI on a large scale, with massive adoption across all sites, in order to move towards competitive models that are more resilient to shocks. AI can and should be at the center of economic recovery.

Emerton Data is an AI specialist dedicated to the industry sector and its mission is to support its clients in the transformation of their businesses by helping them define their data & AI strategy, by equipping them with tailor-made AI solutions, and by incubating AI SaaS software.

Startup Inside, as a unique platform and engine of AI-driven initiatives, has the ambition to create and nurture sector clusters such as finance, health, industry, environment and retail.

Emerton Data and Startup Inside believe that AI must be at the center of industrial processes and activities, to make their models more efficient and more resilient. We are very happy to partner in the creation of the *AI for Industry* ecosystem. Our goal is to bring together the players in this community through various events, to develop interactions. It seems to us that this is what is sorely lacking today in the industrial sector, as opposed to the steps taken in more mature sectors in AI, such as finance or more recently health.

This white paper is published on the occasion of the first "AI for Industry" conference. It explores the promise and challenges of an industrial world renovated by AI and presents the diverse perspectives of several players in the sector, in the form of interviews and summary articles, from more than 30 expert interviews conducted for the occasion.

We thank all of the people who contributed to the development of this white paper.

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The place of AI in industry

I. The development of AI is accelerating in the industrial sector

Like the retail, health, banking and insurance sectors, French industrial groups have a clear interest in artificial intelligence. Indeed, the disruptions caused by these techniques are **reshuffling the order of priorities of some industry leaders** by placing AI at the top of executives' agendas. The Director of Digital Transformation of a large mining and metallurgical group is clear cut: "*This is our number one priority, by far.*" This translates into concrete strategic decisions such as the creation of dedicated task forces that report directly to management committees, or the allocation of a significant share of investments to digital transformation. Also in the metallurgical industry, another director told us: "*We aim to devote 10% of CAPEX to our digital transformation.*"

The current COVID-19 crisis further reinforces this trend. With the **increased needs for operational efficiency**, AI provides companies with powerful decision-support tools in a context of high uncertainties. In fact, AI has been a real asset during this pandemic period, as one manufacturer attests: "*The fact of being able to visualize, thanks to the sensors and algorithms making it possible to process them, what is happening on production units whatever their location, and the associated risks, has enabled us to be able to make informed decisions*." In addition, AI provides effective solutions to **facilitate cash management and anticipate certain liquidity problems**, particularly through forecasting tools. For example, an executive from the chemical industry specifies that: "*the finance department has requested the creation of AI models to forecast our cash flow over a 4-month horizon.*" This brings us to one of the major AI use cases for industrial groups. Predicting cash flow requires anticipating and predicting production, demand, inventory, payments, etc.

II. AI use cases in industry increase along the value chain

Firstly, AI solutions mainly focused on the **production process**, which is the core business of manufacturers. Then, AI applications were extended to cover the **supply chain**, which inherently presents a high level of complexity due to its cross-functional nature and to the operational hazards, but which nevertheless offers a significant source of cost optimization and reduction of lead times. AI solutions have also extended further upstream in **R&D** and further downstream to appropriate themes directly related to the end consumer such as **marketing and sales**.

1. AI applications for production chains

While production chains have been the subject of many successive process improvements over the years, artificial intelligence makes it possible, by capturing all the dimensions and complexity of processes, to carry out new and high added value optimizations.

One of the most widespread use cases, often appearing to be the most natural due to easy conceptualization, is that of **predictive maintenance**. The goal is then to predict, using AI algorithms, machine incidents and breakdowns, and thus optimize maintenance. The reality that has emerged from the field is that this use case often turns out to be difficult to achieve, due to the scarcity of observations of truly impactful failures. While the large volume of data captured in real time may seem attractive for prediction, the order of magnitude that matters for AI algorithms to learn is that of the number of occurrences of failures at machine level observed over a year, which can be counted on one or both hands. In this case, even the best AI algorithms cannot learn the mechanisms underlying these failures. This very concrete example highlights the criticality of the correct framing of an AI use case, which must necessarily be done in contact with data and strongly involve business and scientific experts, in order to maximize the chances of success.

The optimization of production processes being the engine of the industry represents a significant potential for gain, particularly in the metallurgical, chemical and pharmaceutical industries. It is cited by 60% of industrial leaders surveyed as appearing at the top of the list of priority applications to be implemented on their production chains. Whether for the **optimization of production parameters** or **better production planning**, the proposed AI solutions allow a significant improvement in **productivity, quality and energy consumption**. A first step in these optimizations is often to focus on a target process at the heart of production. The IT & OT director of a group specializing in glass forming indicates: "*after several failures, we have concluded that one of the two major prerequisites for the success of an AI use case is to sufficiently circumscribe the considered scope.*" For example, some players in the metallurgy or chemical industries **optimize the quantities of integrated reagents** in order to **improve product quality**, while reducing the input of raw materials and energy.

The quality of a product is difficult to optimize because it is very difficult to predict. This is true in the process industries, where quality is often only known after a long and complex process. This is also true in the assembly industries, where the quality issues of many parts are also difficult to master. Quality can therefore be impacted by a large number of events and is therefore very often unpredictable. This is why the applications of quality prediction and cost of quality, for example via the performance of its **control, are a vast playing field** for artificial intelligence, particularly thanks to **computer vision**, often applauded by manufacturers. Quality defects are then detected flawlessly and at negligible cost by AI algorithms.

Finally, one of the prerequisites for integrating AI into the heart of industrial processes is to develop **digital factory twins**, mimicking production flows as a whole, in order to optimize them. The manufacturers who have succeeded in carrying out production optimization AI and data projects are those who have been able to **put AI experts as close as possible to their industrial experts, allowing the industrialization of AI use cases**.

2. AI applications for the supply chain

The supply chain, by its complex nature at the interface of many processes, offers a fruitful playing field for artificial intelligence algorithms that allow the simulation and optimization of a large number of scenarios. Several AI players have specialized in supply chain-related topics given the high value potential.

A wide variety of algorithms are used for supply chain use cases. For example, we can cite machine learning models which are used to **forecast customer demand and transport or delivery times**. Thus, the entire supply chain can be adapted accordingly. For example, two supply chain experts in the assembly industry told us that they "*use real-time data to predict transit time between depots*."

The centralization of all data in the chain combined with the use of AI solutions enables not only stronger predictions for decision-makers in the supply chain, but also better **decision evaluation on a global scale**. For example, helping to orchestrate production and internal transfers is a critical application for firms with several factories. In some cases, **manufacturers** go further and **allow the algorithm to make decisions in real time**. An example of the use of the latter technique is the optimization of transport costs, a key element of operational excellence in the supply chain.

3. AI applications for R&D

Beyond the central applications of production and the supply chain, use cases of artificial intelligence are beginning, although to a lesser extent, to be implemented in R&D functions. Thus, AI is becoming a tool of choice for analyzing technical trials. For example, this is the case in the aviation industry where AI solutions are used to analyze the results of vibration tests on certain critical parts. In the food, chemical and pharmaceutical industries, AI also makes it possible to limit laboratory experiments by selecting the most relevant experiments or by directly predicting their results, and above all by correlating them to customer expectations. "*The real contribution of AI to us has been being able to unlock the product portfolio, to create products that meet expectations while limiting R&D investment and testing*," the CIO of a global food giant tells us.

These tools are also used earlier in the **design of products**. We can cite the example of the automotive industry where so-called **generative design tools** use AI algorithms to automatically generate plans for certain parts according to pre-established constraints. Although these methods are still in an early phase of their development, they could accelerate prototyping if they were coupled with 3D printing. The perfume industry illustrates another product design use case where AI tools can predict whether a prototype perfume will be chemically stable.

Despite the rise of use cases in R&D, the main obstacle to a greater democratization of artificial intelligence tools in this function remains the **lack of explainability of the behavior of AI algorithms**, which are often seen by engineers and designers as black boxes.

4. AI applications for sales and marketing

In the B2B segment, the sales and marketing functions of manufacturers have a more limited volume of data than in B2C, and a priori represent less fertile ground for Artificial Intelligence applications. Among the actors interviewed, these themes are handled with lower priority.

Some industrial companies such as more B2C oriented consumer goods, are starting to deploy AI tools to improve their sales. In particular, this is the case in the cosmetics and perfumery sectors which use **algorithms for hyper-personalization** of products or the analysis of online reviews, thanks to **NLP algorithms** (Natural Language Processing).

III. The issues related to human resource management and data quality and governance are the main challenges for scaling AI in the industrial sector

Today, the biggest challenges to overcome in order to scale up AI, that is to say to make it a major lever for gains by industrializing many use cases, are rarely of a technical or scientific nature. The main obstacles encountered by the manufacturers questioned within the framework of this study can be classified into two main categories.

1. Human and organizational factors

Consideration of human and cultural factors is a key piece in implementing AI at scale. AI is seen by leaders as a new tool that would increase employee productivity, improve their working conditions and help them in decision-making. This vision of the place of artificial intelligence can be illustrated by the position of an industrial metallurgy group interviewed, not wanting to replace its engineers with algorithms, but rather "*to enhance its metallurgists thanks to data, by creating data-metallurgists*." However, those involved in the AI transformation of manufacturers very frequently observe a reluctance on the part of employees towards artificial intelligence, resulting from a fear of loss of their usefulness and their function in the company. **Education and change management efforts** are needed to convince employees that artificial intelligence is not a substitute.

Beyond these fears, the development of AI in industry risks creating **a growing mismatch between current and needed skills**. AI tools are generally at odds with the traditional methods and tools of the industrial world. Employees must therefore adapt to the changing way they work and acquire new skills. This can translate more concretely into adaptation to new tools offered by AI and the acquisition of some basic notions in data science. For one interviewed manufacturer, responsible for the AI plan for France, this need is clearly highlighted: "*employees will have to adapt to the evolution of their work, acquire new skills and change their habits.*"

Finally, organizational changes are needed to facilitate the deployment of artificial intelligence. AI applications tend to **break the verticality of traditional organizational silos of industrial companies**. Artificial intelligence projects are often transversal in nature. Take the example of the implementation of a sales prediction algorithm linked to operations optimization (allowing Supply & Operations Planning to be carried out). Such a project requires the intervention of both a data scientist team in collaboration with sales representatives and production engineers, essential for their business knowledge, but also with the IT department responsible for collecting and organizing the data.

2. Factors related to data quality and governance

In recent years, the digitalization of industrial processes has allowed for real progress in the mass collection of data, the raw materials for AI algorithms, thanks to the installation of a large number of sensors in production tools. However, the use of this data by artificial intelligence algorithms comes up against two major problems identified by manufacturers.

Firstly, the **quality of the data collected** is often an obstacle to its use. In fact, these data frequently lack homogeneity, are scattered in their storage, or are not recorded in a relevant way with regard to the AI application that will be made of them (for example recording binary variables while the AI algorithms use continuous data). For a manufacturer in the food industry, "*a lot of our artificial intelligence projects fail due to the poor quality of the input data*."

Secondly, data from production tools is very valuable in the sense that it often contains trade secrets. Thus, issues of **governance and data security** must be resolved (see focus in section 12).

It is interesting to compare the governance of industrial data to other more consumer-oriented sectors, such as financial services or mass distribution. The European GDPR regulation has given a general framework around the protection of personal data (consumers). While such a framework can be seen as a brake on the use of data by AI, it should also be understood that this regulation has made it possible to structure rigorous data governance, with the “positive externalities” of organized and possible access to data of increasing quality. Industrial data is not personal data, and therefore does not fall within this scope. They have therefore not benefited from these positive externalities, and manufacturers must also make the effort to establish a data governance framework.

IV. The ecosystem of startups specializing in the industrial sector is thriving, although adoption is still low among industrial groups

The ecosystem of startups dedicated to artificial intelligence for industry is booming in Europe and the United States. Of the ~ 400 startups drawn from the CrunchBase database, around 65 have been identified as being directly related to the industrial sector. **These startups managed to raise more than one billion euro** in funds between 2016 and 2019.

However, we see that the convergence between **the supply of companies specializing in AI and the demand of industrial groups** could be faster. While the majority of the companies questioned prefer to use external service providers for themes that cut across all industries (for example reducing energy consumption), they are divided in their approaches to implementing AI solutions that affect their core business. Some groups do not want to have in-house developers and prefer to rely on specialists. Other industrial companies prefer to carry out these types of AI projects internally, on the one hand because they already have the business know-how of the processes they want to optimize, and on the other hand because they want to continue to build their internal skills based on the central subjects of their profession. This applies to large industrial groups.

For smaller industrial groups, it is more difficult for them to arm themselves with in-house AI skills. The use of external solutions is therefore necessary, but the latter are then not easily able to judge the relevance of multiple offers. On the flip side, this is also how many startups offering cutting-edge solutions feel, as stated by the founding director of a company offering AI solutions for quality: "*The biggest stake is to make our customers understand the quality and performance of our solutions. Manufacturers are often too immature for such an assessment.*"

V. France is among the European leaders in the deployment of AI in industry

Unlike the topics of mechanical automation and robotization, where Germany seems to have taken a significant lead, **France is one of the most dynamic and successful countries in artificial intelligence for industry**. Part of the reason for this is the education and training system for cutting edge AI engineers, computer scientists and mathematicians. The AI talents are there. This position is also reinforced by strengthened support from public institutions which put artificial intelligence at the heart of growth plans and more recently of the recovery plan, devoting significant funding of up to €1.5 billion to it by 2022.

In the industrial sector, French know-how in artificial intelligence is **attracting major international industrial groups** such as Huawei, Samsung or Fujitsu, which are setting up dedicated research centers there.

However, in order to maintain this leadership position and allow the scale deployment of AI solutions in the industrial sector, companies must meet the **two essential challenges mentioned above**: the adaptation of their organizations, and the resolution of issues related to data quality and governance.

Focus on the barriers to be removed in order to make AI an essential driver of Industry 4.0: sovereignty, data and people

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II Focus on the barriers to be removed in order to make AI an essential driver of Industry 4.0: sovereignty, data and people

With the upsurge of AI use cases in **production processes** (such as **predictive maintenance, intelligent optimization of production processes, quality control via computer vision**, etc.), artificial intelligence is emerging as the **cornerstone of Industry 4.0**. However, three main obstacles remain to develop AI on a large scale and make it the engine of the transformation of the French industrial apparatus: **data security**, the **lack of homogeneity** of systems and production sites, and **adherence of human resources**.

I. Questions related to data security and sovereignty are the major concerns of industrial groups hoping to develop AI solutions

The production tool is **an extremely sensitive part** for most manufacturers. Data linked to the production chain can contain industrial secrets considered to be major competitive advantages. Implementing AI tools requires the **collection, storage and processing of this data**. Therefore, the **security** of this data is a crucial issue for all stakeholders interviewed.

For some manufacturers, this translates into **sovereign** data hosting choices. We can cite the example of an automotive manufacturer who told us that "*the composition of its materials is a major competitive advantage; it is a necessary condition that partner cloud and AI solutions be French*."

Thus, it is clear that the issues of hosting data and AI tools represent a critical point when implementing AI applications in the industrial tool. Particular importance must be given to data storage and computing infrastructure solutions **as early as the design phase**, in order to best anticipate the sovereignty and security constraints that may arise.

II. The lack of uniformity between production sites represents an obstacle to the generalization of AI solutions

The production sites of the same manufacturer can be **very different**, both in **terms of machines and software used**. Such heterogeneity represents a challenge for the generalization, with cost control, of AI solutions, as evidenced by a chemical manufacturer: "*A difficulty arises from the variability of sites. Indeed, we have sites on several continents with different expertise and machines from different suppliers.*"

In fact, this diversity of production sites **is reflected in the data collected**. This represents a major obstacle both for the development of AI algorithms and for the generalization of their use on several production sites: upstream, it is necessary to have **uniform data and in large quantities** to train artificial intelligence algorithms and to guarantee performance. Downstream, scaling an AI solution across multiple production sites requires the **same type of input data**.

It is therefore necessary, before carrying out an artificial intelligence project intended to be deployed on several production sites, to **assess the variety of industrial processes**, in order to establish a **technical data harmonization plan** upstream of the development of AI algorithms.

III. HR buy-in remains the main challenge in order to allow a large-scale development of Industry 4.0 by AI

The **human factor is central** in the deployment of artificial intelligence on production lines. Indeed, human resources remain the **primary productivity lever** in factories. Thus, AI solutions should be designed as tools for the benefit of employees to facilitate their adoption. It is therefore recommended to target, as a priority, AI applications that **improve the working conditions of human resources** in order to improve **their productivity** and avoid those that may be considered intrusive by employees. The various feedbacks indicate that it is crucial to develop tools that are **easy to use** with ergonomic and intuitive interfaces, in order to promote their use. Here, agile development approaches highly developed in B2C must also prevail for products intended for factory operators. This is the case even though AI functionalities remain technically sophisticated.

The development of AI on a large scale is an essential lever for industrial digital transformation and Industry 4.0. To create the conditions for this scaling up, it is necessary to address challenges related to governance and the standardization of data and above all to guarantee the adoption and adherence of human resources. As long as its challenges are identified upstream, it is quite possible to overcome them based on technical solutions.

Focus on the supply chain: AI as a tool for transformation and resilience of the supply chain

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Focus on the supply chain: AI as a tool for transformation and resilience of the supply chain

The management of industrial supply chains is fraught with complexities; the operational issues of stock and transport management are still the subject of much research in mathematics and computer science today. In this context, artificial intelligence can provide great added value. Several startups have thus specialized in the development of AI tools for the supply chain, such as Vekia, Lokad or Deepvu.

I. Specific use cases are emerging at different points in the supply chain

Artificial intelligence provides **very powerful forecasting tools**. These tools can find application cases in the various links of the supply chain, which are procurement, inventory management and transportation to customers. Upstream, AI solutions can be implemented for forecasting supplier shortages. Downstream, forecasting customer demand and delivery times are recurring use cases.

Some AI tools go beyond simple forecasting and use **operational research methods** to determine, based on the forecasts made, what are the best decisions to make, and even go so far as to make them directly. This is the case, for example, for an AI player specializing in the supply chain who has developed a solution that allows *"the management of supply data, the forecasting of demand and the management of this supply by carrying out the automatic sending of orders."*

Other use cases of artificial intelligence in the supply chain aim to improve the **customer experience** by providing forecasts of delivery times in order to give more visibility to customers and improve the OTIF indicator (On Time, In Full).

With regards to the supply chain, operational excellence is a central issue. For this reason, multiple tools and know-how have been implemented for many years. **These historical tools such as Excel models and traditional ERP (e.g. SAP, Oracle) are the main competitors of AI applications** in the supply chain. Although they are effective, artificial intelligence provides additional added value by enabling additional functionalities such as demand forecasting or arbitrage between multiple decisions. This can be illustrated by the example of inventory management, where the performance of AI solutions can exceed that of traditional Warehouse Management Systems by enabling storage decisions to be made based on demand forecasts.

Finally, in these times of health crisis, when customer demand as well as the situation of suppliers are subject to great uncertainty, forecasting algorithms can decrease in efficiency. The so-called operational research techniques are seeing their usefulness increase. They offer a way to continue to optimize operations, and therefore consolidate the resilience of the supply chain.

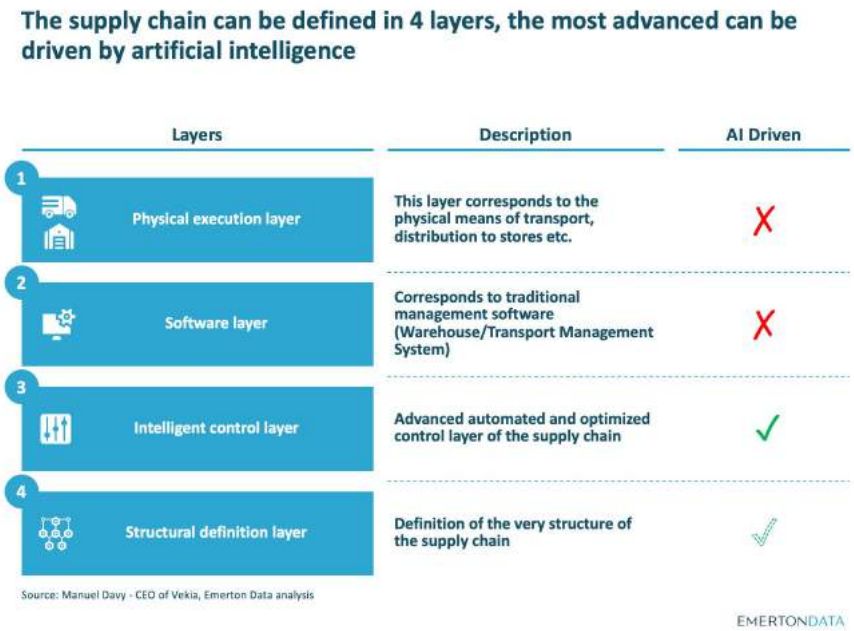
Focus on the supply chain: AI as a tool for transformation and resilience of the supply chain

Manuel Davy
Founder and Director

vekia

Can you describe your company to us in a few words?

Vekia is a company that was created in 2008, providing a **SaaS solution** (Software as a Service) for supply chain **data management**, **supply demand forecasting** as well as **its management using artificial intelligence tools**. These tools make it possible to intervene at the level of dynamic management of the supply chain, increasingly also at the level of its structural definition.



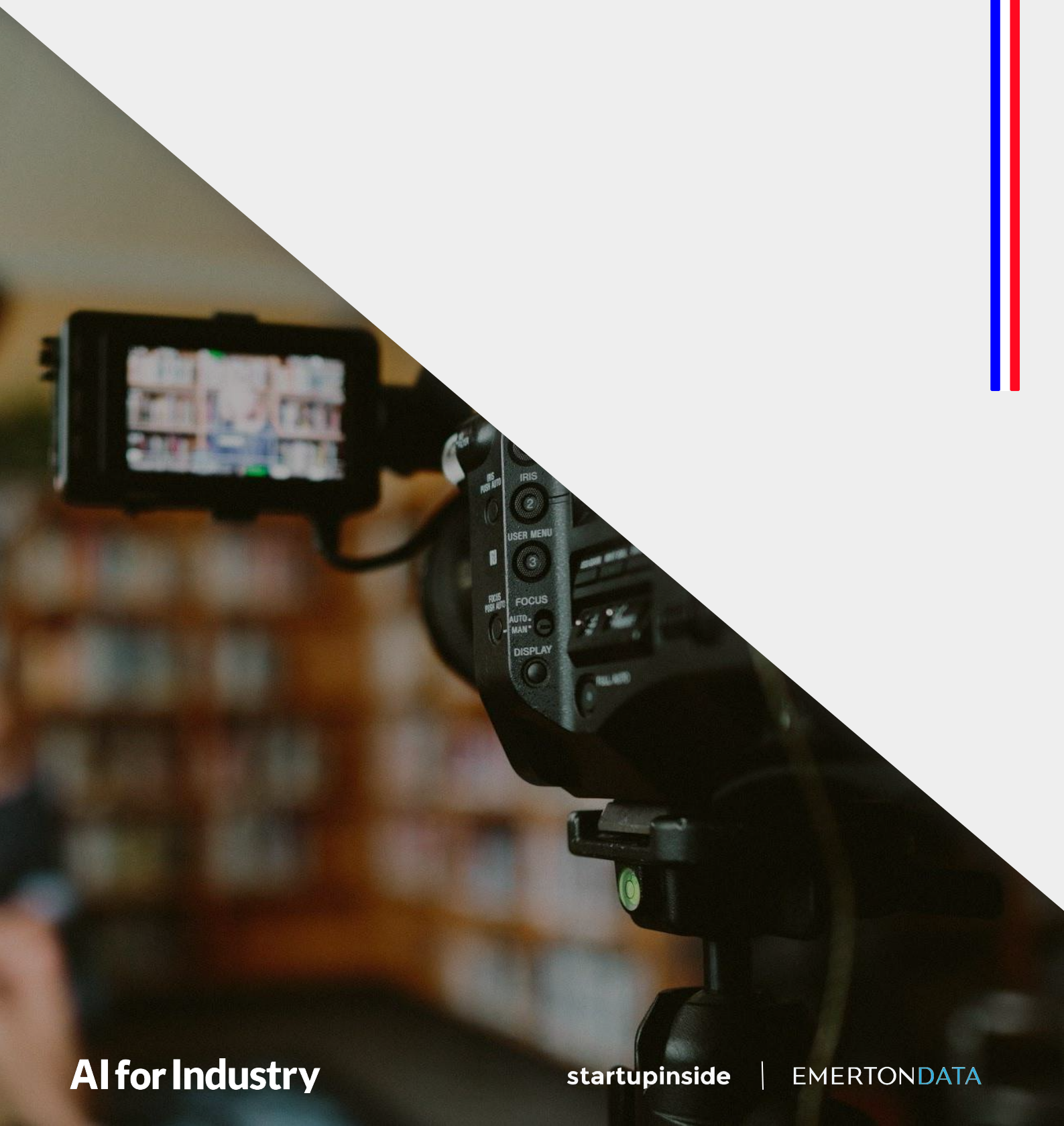
Different layers of the supply chain

Multiple factors are needed to ensure the successful implementation of an AI solution for an industrial supply chain. What do you think are the main conditions for success?

We have identified **5 prerequisites that greatly increase the chances of success for AI projects:**

1. A **clear and shared vision of leadership** vis-à-vis AI
2. The **problems solved** by the AI tool must be part of the **top 3 business issues** for the company
3. The company must have the means to **train a team** made up of **data scientists**, **business skills** and **change management** and be autonomous in accessing the data
4. **Data must be available, in quantity and quality**
5. A **use case** of the tool must be applicable over a **significant scope**, with its own KPIs and objectives and objectives

Interviews



Marko Erman

SVP, Chief Scientific Officer

THALES

Last year you launched to the Ministry of Economy, Finance and Industry, along with other major national industrialists, the Manifesto of Artificial Intelligence. What is the objective of this initiative and how does it materialize one year later?

The Manifesto for Artificial Intelligence aims to bring together the key players in French industry who share the same ambition and the same strategy to meet the AI needs specific to Industry, namely a trusted, sovereign and high-performance AI, serving competitiveness, growth, and therefore France.

Since starting in July 2019 with 8 manufacturers, the AI Manifesto now has 16 members (Airbus, Air Liquide, Dassault Aviation, EDF, Michelin, Naval Group, Orange, Renault, Safran, Saint Gobain, Schlumberger, STMicroelectronics, Thales, Total, Valeo, Veolia) and prestigious academic partners such as Université Paris Sorbonne, Université Paris Saclay, Institut Polytechnique de Paris and Inria.

In terms of actions, we have already launched various academic chairs, we are working on standardization, normalization and on-board AI, an important subject for us. We are also working on attracting talent and training the people in our companies. In this regard, at the start of 2020, Thales joined forces with EDF and Total to create a joint laboratory with the aim of pooling research efforts.

Thales is one of the world leaders in radar manufacturing, how do you integrate AI into radars?

The first case of AI use on radar is the identification of small objects, such as recreational drones, which can be troublesome if they are in the path of a plane carrying people. AI allows us to get better detection in this kind of situation. For example, we will be able to detect the movement and kinetics of each propeller of a drone, making it possible to distinguish it from a bird, but also to identify it.

The second use case concerns the field of intelligence. By putting the radar in listening mode, we use AI to learn the different signatures of radio frequency transmitters and identify transmitting objects. This application is much like Shazam, which allows you to record a song and recognize the singer. We are therefore developing a new generation of sensors, which are smarter, more efficient and now learners.

Marko Erman

SVP, Chief Scientific Officer

THALES

Thales is also a major player in civil protection solutions. To what extent does AI allow you to offer better tools in this area?

To answer you, let's take a very concrete example. At the port of Singapore, thousands of workers and businessmen disembark every day. There is a need to manage the flow of people in the best possible way, while ensuring their safety.

From video streams, we use AI to simulate and predict crowd movements by taking into account many parameters such as infrastructure, speed of movement differentiated by age or even orientation between people. Thanks to the implementation of a digital twin and AI, it is therefore possible for us to anticipate incidents and improve personal safety.

Julien-David Nitlech

Managing Partner

iris capital

Nicolas Iordanov

Principal

iris capital

Which industry AI companies has your fund Iris Capital invested in?

Julien-David Nitlech - We have been looking at this subject for several years and **we have notably invested in several companies specializing in AI for industry such as, in 2018 for example, Braincube and Exotec.**

Braincube is a French software publisher who has managed to find a particular angle in the industrial field: its platform combines both connectivity in manufacturing processes and algorithmic intelligence that allows optimization of industrial performance, particularly effective in continuous processes. By relying on an ultra-advanced digital twin model, the company allows its customers to greatly optimize their performance but also to limit their emissions and chemical releases while directing production towards zero defects.

Exotec is a French robotics company that is revolutionizing the organization and industrial optimization of warehouses. Exotec has thus developed its own warehouse management system which has several AI bricks for prioritizing and automating the warehouse storage and delivery structure using autonomous robots. These robots, adapted to a simple, robust shelving system allowing goods and foodstuffs to be stored up to 4 times higher than a conventional shelving system, are received by preparers at stations guaranteeing less physical effort and greater productivity of the entire warehouse, all suited to distributors needing intelligent and adaptable storage capacities.

How is the deal flow evolving in terms of quantity and quality for companies developing AI solutions for industry?

Julien-David Nitlech - We have been an investor in new technologies for more than 30 years and we have noticed that the industry vertical has only belatedly interested tech entrepreneurs. In order to address this, it is necessary to build specific tools and deal with often complex processes, which was until now reserved for a few industrial giants. **Over the past 5 to 8 years, we have seen the deal flow associated with the industry grow exponentially**. This can be explained by the **development of AI, machine learning but also digital twins**, and especially by the **desire of large industrial groups to extract the value of their data** and connected objects to optimize their processes (in addition to checking the quality of their productions, which was already being done for a long time). The solutions provided today by startups in the ecosystem are diverse, with physical tools via sensors, gantries, robots or even with SaaS software making it possible to act on existing production lines thanks to more algorithmic solutions, like Braincube does.

Nicolas Iordanov - **The main marker of this acceleration is the investment of large groups to structure and centralize their data to extract value directly linked to their industry**, which is in addition to the significant investments of players like Amazon or Microsoft on this topic. This demand from major industrial players is very interesting for Iris Capital and is reflected in the emergence of new models that exploit these connected industrial parks and the masses of data they produce to direct production lines towards greater efficiency at lower cost levels. **These investments and now the emergence of many solid startups in the sector testify above all to a real conviction of the market and confirm the in-depth transformation** underway, towards an industry that can no longer be satisfied with relying on its machines and its teams but must learn to take advantage of everything that is produced in a factory, including data.

What are the main challenges for the development of AI companies for industry?

Julien-David Nitlech - **Many use cases** in industry are emerging and few companies have already managed to move from startups to robust and always innovative companies: they face **great challenges specific to the sector, particularly financial issues and trade-offs between modernization, optimization and relocation**. For example, we are convinced that robotic solutions will only be relevant if they fit into existing processes: AI must adapt to the way industry works in order to revolutionize it.

This is why it is necessary to develop both hardware and software specific to its market, as Exotec has done, to **integrate into existing processes without being slowed down by more necessarily adapted hardware in place**. We can only guarantee performance if we control the "production chain" of this performance. In this context, digital twin or image analysis solutions are key because they allow manufacturers to connect and optimize the production chain, without stopping it, making it heavy or replacing it too quickly. **Manufacturers cannot afford to renew all their machines and equipment** without a guarantee that the existing cannot be improved. **Solutions must be integrated and efficient while limiting financial and structural costs.**

Nicolas Iordanov **-** At Iris Capital, we try to sort out and detect current and future trends in the industry, without losing sight of the reality of the sector. We are looking for startups that will have the fastest but also the most stable expansions, listening to their customers without limiting their disruptive aspect. Finally, the key to success lies above all in **moving to an industrial and international scale: controlling growth and growing steadily is essential to becoming a world leader.**

Julien-David Nitlech
Managing Partner

iris capital

Nicolas Iordanov
Principal

iris capital

Julien-David Nitlech **-** We are indeed looking for companies which "scale" and which move quickly. Unlike the web, the industrial model is complex and **constrained by the temporality which is that of the factory.** This, combined with the material complexity of the solutions developed, can be **hindering for investors who want an ROI in the short or medium term.** As investors look for recurring models, we're seeing a lot of companies with AI solutions in the industry that will have **slow and steep adoption**. These companies with a more traditional turnover model sometimes also need funding partners that are different from what venture capital, very much in search of rapid and exponential growth, can provide.

Is there a French specificity in AI for industry?

Julien-David Nitlech - French companies face the **same challenges** of scaling up and temporality as all countries. What changes is the addressable fleet and the starting volume: if you can quickly win over your first customers in your country, you will go further faster.

Nicolas Iordanov - We see marginal differences even if some historical specificities exist on this subject. Iris Capital invests all over the world, and this international openness has enabled us to note some differences, more cultural than technical, which help us to identify best practices from one country to another, which is useful for understanding the solutions offered locally but also in helping the establishment of our startups in a given territory.

In France, for example, **we tend to adopt a technological approach** to problems, through the use of platforms and software, while **in Germany manufacturers rely more on networks of dedicated experts**. We have also noticed a **greater dynamism in Israel**, particularly on security issues.

What are the possible implications of the recent situation related to COVID-19 on the short- and medium-term evolution of AI in industry?

Nicolas Iordanov - **The crisis induces a varied slowdown depending on the sector, which naturally produces less and therefore leans less easily on a search for increased performance**. As the digital transformation is a fundamental transformation, I think that in the **medium term, there will be little impact. Some sectors are even taking advantage of this situation to accelerate and gain market share.**

Julien-David Nitlech
Managing Partner
iris capital

Nicolas Iordanov
Principal
iris capital

Julien-David Nitlech **– COVID and the lockdown have drastically accelerated the adoption of e-commerce**, the need for performance and speed. At the same time, industrial solutions must be deployed in factories to prove themselves and sometimes find themselves blocked by the inability to travel on site. Even if the health crisis is accelerating digitization, **our startups must learn to operate remotely and their customers to provide off-site access**. There is going to be an emergence of virtual reality solutions to meet demand like there is in real estate, and ultimately the entire industry will benefit.

What segments in particular do you find attractive and tend to follow?

Nicolas Iordanov - Our approach to industry is to identify technologies that have proven their worth in other verticals and that are now applicable in industry. **Image analysis and visual inspection solutions** seem to us to be an interesting segment that will grow, even if we have not made any investment in the subject apart from the detection of damage on vehicles with Monk for example. The **robotics** segment, not only in its logistics dimension, but also in production **process automation dimensions is also accelerating but above all improving, with robots that make it possible to completely change certain production methods.**

In addition, we are seeing more and more **startups launching into security**, a key issue for players who want to accelerate their digitalization. Finally, in the context of COVID mentioned above, **virtual reality solutions** for operating remotely form a fourth segment to follow closely.

Julien-David Nitlech
Managing Partner

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Nicolas Iordanov
Principal

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Interview

Christel Fiorina

Coordinator of the economic aspect of the national AI strategy

What is the DGE's observation on the current situation of French manufacturers, who are strongly affected by this unprecedented health crisis?

In the context of the crisis and the preparation of the recovery plan, a consultation at national level was conducted by our services in spring 2020 with business federations, employers' organizations and businesses themselves, in order to understand the situation in which they found themselves. This consultation showed that companies, and in particular industrial SMEs and midcaps, need to **refocus on their core business and rebuild margins with the risk that this will be done to the detriment of their investment in innovation**. Industries could find themselves out of step with the market within 2-3 years and lose competitiveness.

We are **convinced that the current situation must be seen as an opportunity to initiate major technological and ecological transformations**. This is why we have put in place an ambitious recovery plan.

What are the objectives of this recovery plan and what is the link with the national AI strategy?

Our action and the significant aids that we are putting in place therefore aim to help manufacturers continue to innovate even during the crisis, to use the most recent technologies in order to transform their processes and achieve a move upmarket, as well as to develop the most carbon-free offer possible.

AI is at the heart of technological solutions that achieve these objectives and will, as such, be significantly subsidized by the devices offered. **These devices are primarily intended for SMEs and midcaps** which have, however, acquired a first level of digital maturity. They place great emphasis on change management support, because **AI is much more than a technology: it is at the center of an in-depth transformation of industrial professions.**

Can you describe for us the AI financing mechanisms put in place as part of the recovery plan: their objectives, their format, their targets?

The DGE has put in place three main systems, active from 2020, and which are intended to extend beyond this year.

The first system, managed by the Services and Payment Agency (ASP), is aid for transformative investment in the industry of the future. It is aimed at industrial SMEs and midcaps, with an envelope of €40M from 2020 and €140M in 2021.

The aid takes the form of a state subsidy of 40%, for the adoption of technologies in order to upgrade the offer. These are solutions such as cobotics, robotics, immersive technologies, but also software and equipment based on artificial intelligence.

The second system is AI booster, for an amount of €68M from 2020 to 2022. It will be launched very soon and be operated by the BPI. AI booster is aimed at SMEs and midcap companies in all business sectors and aims to help them in their digital transformation with AI solutions. Companies entering this program will be offered a support program to adopt AI solutions. The system is ambitious and aims to reach more than 500 companies in two and a half years.

The AI booster program will take place in 3 phases. The first phase consists of carrying out an audit in order to determine the processes with the highest potential for transformation, innovation, and reduction of environmental and energy impact. The scope of the audit is intended to be fairly broad, and covers both production processes and customer relations, marketing, management control and human resources. After this first audit phase, the company will be able, with the help of its guide, to choose an existing off-the-shelf AI solution or to create a tailor-made one that will meet its specific needs. The third and final phase consists of support for the implementation of the solution, which may include a study component on the development of these professions and their skills. The resulting training could possibly be supported in addition by other public measures.

The third system, already launched, concerns the pooling of data and represents a budget of €25M over 5 years. This device emanates from the recommendations of the Villani report on artificial intelligence, at the origin of the national strategy announced by the President of the Republic in March 2018. It notes that one of the obstacles to the development of AI in France and in Europe is not the lack of data feeding the algorithms, but rather the fact that this data is compartmentalized and often not shared.

The DGE has therefore launched a call for projects in order to offer groups of public and private organizations, particularly companies, to help them finance data pooling projects. The overall amount of public funding can be up to 50% of the cost of the project, in the form of grants and repayable advances. The two main criteria for project selection are the representativeness of the group that carries the project in the sector or sector concerned, the response to identified needs and the quality of the underlying economic model.

Christel Fiorina

Coordinatrice du volet économique de la stratégie nationale IA

Christel Fiorina

Coordinatrice du volet économique de la stratégie nationale IA

To give concrete examples, we can mention two important projects already funded by this system. The first is carried by the VoiceLab association. Its aim is to develop a voice ecosystem in France and make a powerful French or even European technological offer competitive in the promising development sector. This offer will directly benefit companies including manufacturers. The second, Agdatahub, brings together a consortium representative of the agricultural sector and aims to pool data in order to develop artificial intelligence technologies dedicated to agriculture. It is based on a shared and effective technological infrastructure to guarantee the development of digital agriculture in France and in Europe.

Cross-interview

Didier Bove

Group Chief Information Officer

VEOLIA

Eric Haddad

Managing Director

Google Cloud

Veolia is a major international player. When we talk about AI and data, what is your strategy?

Didier Bove: AI and data are now **fundamental** for everything we want to build. This is the culmination of a journey started in 2012. We started by digitizing collaboration and exchanges between employees by setting up a Workplace. Then, as a second step, we used the SaaS offers but also the offers of PaaS and IaaS platforms.

All this is focused around **3 structuring programs: Satawad (Secure Anytime Anywhere Any Device), Move to Cloud and Data for Business**. Data for Business is precisely this aggregation in a datalake of all the data from thousands of Veolia sites.

For a year now, at Veolia, we have been building **business solutions on top of this data** and these services. These solutions are AI, software or algorithms.

The raison d'être at Veolia places environmental concerns at the heart of your challenges. Can you give us concrete details of how this is broken down, with AI use cases linked to the "Green Industry"?

Didier Bove: We are quite proud to say that Veolia is the first CAC40 company to promote its raison d'être. This essence is to **take all stakeholders into account in our activities**: the planet, employees, customers, the company itself through its shareholders and society. Everything that we are going to put in place requires us to think about each of these axes and to decide which partners, which solutions, and which projects, will make it possible to best respond to these 5 axes.

We can illustrate with an example of a concrete **use case of optimizing the yields of water networks**. A very good water network operated by Veolia provides an efficiency of around 95%: for 100 liters of water produced, 95 liters are returned. In the worst contracts that Veolia recovers, this yield may be only 30%, which leads to a **significant waste of energy used and of water**, which escapes into nature. Today we can no longer accept having so many productions that do not serve the end user. We are therefore putting in place **sensors, datalakes, algorithms and AI** that will make it possible to quickly identify and operate repairs on the networks, but also to make dynamic projections according to the environment, the number of trucks passing on the road, temperature and pressure. We are starting to get some very interesting models and are **able to help our customers achieve much higher network returns than they originally were.**

Didier Bove
Group Chief Information Officer

VEOLIA

Eric Haddad
Managing Director

Google Cloud

Google Cloud supports international companies on the deployment of tools. Is this environmental commitment something that resonates at Google Cloud?

Eric Haddad: Yes, and for a very long time. I joined Google 10 years ago, and I remember we were already talking about optimizing our data centers with machine learning tools.

Since 2007, all of the energies we use for our cloud production have been **carbon neutral**. We announced a few days ago that very soon, a priori before 2030, we will be able to offer carbon-free cloud services. It is not about purchasing renewable energy to offset carbon energy, but really about being completely carbon-free; it is a real **environmental commitment**, which is fundamental to our infrastructure expansion strategy.

When a director wants to deploy artificial intelligence, the real question is the ROI. Didier, at Veolia, are there any use cases on which you can give us a concrete idea of the ROI?

Didier Bove: Yes, for example we can think of a **recent use case for optimizing maintenance**. Veolia's activity involves a lot of factories: a desalination plant, a purification plant, an incinerator. This is a lot of equipment subject to pressure, temperature, external climatic conditions. Very soon, we will have maintenance cycles. In Australia, we combine the scheduled maintenance plan with historical data, contractual and financial elements like the consequence of outages and climate information, which allows us to get **5-10% more performance from lower maintenance costs**. The gains are such that we want to make it an external offer in the future.

When Google Cloud supports executives, are there other ROI metrics that you look at beyond quantified ROI?

Eric Haddad: If we look at the projects over the last few months, I'm thinking of Renault for their supply chain, with data at the center of the production line there is of course an ROI of savings but also of operational efficiency and agility. If we are talking about Sanofi, there is an ROI for speed in drug research. If we are talking about Airbus, we are talking about safety, but also the ability to provide good quality satellite images.

Didier Bove spoke about it, in general, when we talk about ROI, it's often double-digit stories for returns, which of course depend on the parameters of the company and the initial context. There are other types of ROI, two of which are emerging. The first is **attractiveness for talent, the company's positioning**, its modernity and its reputation in the market, and also in the financial market. The second is the **cost variability**, we are seeing it at the moment in times of COVID, the fact of having a good variability in the costs of tools or IT in general, compared to business reversals, is very important.

Finally, I think that the sustainable environment is also very valuable, for the planet but also for the company, in terms of image and positioning.

Is data security an important subject at Veolia?

Didier Bove: Of course, as we see it in the news, not a day goes by that there isn't a great company that comes under attack. This is important at Veolia for two reasons: we are committed to the trust of our customers and the production of drinking water cannot stop, especially in winter. At Veolia, we have a "secured by design" approach on three axes: **securing the infrastructure delegated to cloud providers, securing component updates and securing our own developments**. So, this is a subject that is taken seriously. However, we keep an infinite humility, because every day is a fight between those who would like to enter and those who keep the door tightly closed.

And you Google Cloud, do you also take security seriously?

Eric Haddad: Security is taken very seriously, even if one has to be very humble about the subject of security. For us, security is about providing our customers with the best tools to **secure their data**, for example at the transaction and information storage level, **through encryption**. In general, you have to listen to governments that will have demands such as **sovereignty and independence**. We must also listen to industrial companies who demand more in terms of **reassurance and trust**.

Didier Bove
Group Chief Information Officer

VEOLIA

Eric Haddad
Managing Director

Google Cloud

Interview

Ludovic Donati

Group Chief Digital Officer

You have undertaken the data and AI transformation of your businesses for a few years, Eramet was also very recently nominated for the 6th Simulation and AI Trophies by *Usine Digitale*. What is your take today on the place of AI in your industry, and for your group?

Mining and metallurgy are sometimes considered "old" industries, yet we are present throughout the value chain between mining and the production of parts in high performance alloys, such as for aeronautics with high performance landing gear for Airbus or Boeing, or even for the energy, automotive or defense industry.

When we asked ourselves the question of digital transformation, we were convinced that what was going to allow us to be more efficient operationally, and later perhaps to rethink our business model, was **data and its advanced uses via AI**. This is also true in the more precise context of Industry 4.0 (even if robotization and automation are other recognized levers).

We are world leaders and sometimes even pioneers of certain processes in our various businesses, such as the manufacturing of ferronickel (necessary for the manufacture of stainless steel) in New Caledonia or the manufacturing of manganese alloys for the production of carbon steel for construction. We therefore have very strong business knowledge, and a lot of data since we have already set up many sensors and the necessary industrial computing. It is therefore very important for us to **combine these two aspects of knowledge of our processes and our data**, to enable us, thanks to AI, to be **more efficient in our production** or even to **reduce our energy consumption**.

Our goal is basically to switch from a reactive mode to a predictive mode. That is, instead of explaining success or failure after the fact, the goal is to predict the future state and act accordingly in advance.

What are the most emblematic AI use cases implemented at Eramet, which precisely allow us to move towards predictive?

Whether in Norway or New Caledonia, our most emblematic use case is defined in metallurgy. Take the example of our manganese alloy manufacturing plants in Norway, produced from manganese ore. These alloys are produced in metallurgical furnaces with a height similar to that of a building of 3 or 4 floors and in which we heat these ores to over 1000°C to selectively extract silicomanganese or ferromanganese alloys. Our challenge is to reduce our consumption of energy and reagents (coke or quartz), while optimizing the yields and therefore the quality of our products for the end customer.

So, we worked with metallurgists and data scientists on the data we had at our disposal. We looked for ways to increase our efficiency as well as to better manage processes, by anticipating the phases where we would be in a "bad" configuration and those where we would be in a "good" configuration; this has led us to have high-level scientific discussions to define and arbitrate on the definition of a good or a bad process.

We then developed **algorithms that we connected to two silicomanganese furnaces**, which make it possible to issue **recommendations to metallurgists**, in particular on risk forecasts. It is on this basis that metallurgists, who remain masters of their profession, make informed decisions for the conduct and management of the production of this alloy. In practice, we display the monitoring and recommendation screens in the supervision rooms, which has **transformed the way we make decisions and organize ourselves**.

We have developed a similar project for the conduct of the ferronickel manufacturing process in New Caledonia at *Société Le Nickel* (SLN).

To cite another example, we are the rail operator in Gabon, with a double-stake due to our public service role linked to the concession granted to us by the Gabonese government (passenger and goods traffic) and a logistical role because we use this railway line to bring the manganese ore that we mine into the country. This infrastructure is made up of more than 650 km of railroad, with rather difficult environmental conditions in this region of equatorial forests and a crossing possible only at the station. We have carried out a predictive maintenance project for the railway which makes it possible, from data collected by engines or directly on the tracks, to **determine the areas where maintenance is the most effective in order to avoid rail breaks**, and to ensure the safety of travelers. Due to the context (a lot of rain, animals often crossing the rails), rail breaks are frequent, and we therefore have enough data points to predict them. Similarly, we **favor the development of predictive maintenance tools for industrial equipment** that often breaks down, due to their age or complexity, rather than for critical equipment that is already designed to fail only very rarely, therefore very monitored and preventive maintenance of which is assured anyway.

How do you approach the subject of scaling up and industrializing AI, both technically and organizationally?

In the case of algorithms developed for the manganese alloy production tool in Norway, a metallurgist who strongly believed in this project trained her coworkers. We worked directly with the business teams to **define how AI could be fully integrated into decision-making processes.**

Ludovic Donati
Group Chief Digital Officer

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We have put in place a **benefit management system which allows us to very clearly quantify the gains brought about by this transformation**. After a few weeks, we could demonstrate the attractiveness of such solutions to top management. Our goal for 2021 is to **scale up:** we will deploy our AI solution on the 8 silicomanganese furnaces we have. This way of operating is the same for our project on the ferronickel furnaces in New Caledonia.

One of the key points of our vision at Eramet is to optimize all our processes using artificial intelligence. This is where we have the most data and very good intrinsic business competence. In my opinion, this is one of the strengths of the industry: we are oriented towards process optimization. We already have a lot of data and business knowledge rooted in the culture of our companies. We also combine the AI approach with a more traditional R&D approach.

However, we remain in the profession of engineers, who are used to deeply understanding the models on which they work. They therefore sometimes have difficulty understanding AI algorithms which behave like black boxes. Having **high-level scientific discussions between metallurgical engineers and data scientists** has been a key factor in our success in **demystifying the algorithmic approach**.
We are convinced that in order to scale up, we must avoid leaving AI in the hands of data scientists alone, but on the contrary "democratize" AI; this year, we started to train metallurgists in data science and machine learning methods, in order to give them an additional string to their bow. They will thus be able themselves to improve the algorithms at first level without necessarily having to go through a data scientist. There is a **real issue of dual competence** to go to a **metallurgist or miner augmented by the data**. What we are aiming for is to have data-metallurgists.

How would you position the maturity of AI in French industry and do you think deploying AI at scale is a key competitive advantage?

I think that AI in industry in France is **not late but is not the lead on these subjects either**. In the case of the mining sector, the big international mining majors have already been using algorithms linked to AI for several years, even if it is not necessarily on the same metals that we produce at Eramet.

In the industry more generally, I also don't think we're behind on AI topics. For example, when we talk about Industry 4.0, Germany is very strong in robotics and automation, without being much more advanced than France in terms of AI.

Ludovic Donati
Group Chief Digital Officer

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We clearly identify AI as a **competitive advantage**. These methods can reduce our costs or meet the challenges of energy sobriety.

Certain competitive advantages can also be brought to the top line, as we have demonstrated by introducing lead time prediction tools for the high-speed steels that we produce (cutting steels for drills or for the automotive industry) on the basis of production and management data from our Erasteel subsidiary. We are moving towards the concept of customer service even if we still often remain very upstream in the value chain of our businesses.

If we want to keep or relocate industries in France, **AI is a key element to be or remain competitive.**

To what extent do you think that data and AI can be levers in facing the current crisis?

Being able to connect from anywhere to production units in Norway, New Caledonia, Gabon to view what is happening in production as well as the associated risks has enabled us to take decisions much faster and in a much less compartmentalized way than before. This has been a real plus during this pandemic.

Ludovic Donati

Group Chief Digital Officer

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About

AI for Industry

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Startup Inside is a leading ecosystem of open innovation, AI and intrapreneurship experts operating in four countries to help Fortune 500 companies in their digital transformation.

Startup Inside brings together the players in the European artificial intelligence ecosystem in the health and finance sectors by operating the AI for Health & AI for Finance initiatives. Startup Inside contributes significantly to positive impact projects by supporting the AI for Good initiative.

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AI for Industry

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