

Challenges and advancements in the era of data and artificial intelligence



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Editorial

What we once thought was impossible, often becomes a reality. Our world is marked by **volatility** and **complexity**. In times of Covid-19, who could still doubt it?

We believe that in this world, our best response is, on the one hand, our ability to imagine and create beyond our limits, and on the other hand, our agility and capacity to adapt, to learn from our success as well as from our mistakes, while staying on course. Let's take a look back: every decade, even every year, what we thought was impossible has become a reality... like developing a vaccine in less than a year when it used to take a decade.

These challenges bring many opportunities that empower us to focus on what matters the most to better **prepare for the future** while **building a present that helps us simplify and enrich our lives**.

Artificial intelligence contributes more than ever to building this present by having an increasingly significant impact on our daily lives and promises to bring many economic and societal benefits. To ensure that it is used in a **sustainable** and **trusted** manner, Orange has formed an Ethical Council for Data and AI in March 2021.

Software-AI combination will enable an **ultra-personalization** of digital services combined with **the contextualization** of the user's experience. **Our services will become more and more proactive, thus anticipating our needs**, based on our habits but also on the experiences of millions of other users. For example, we will be able to benefit automatically from a simultaneous translation when we communicate with a foreign interlocutor, without even launching an application. AI will also increase our safety by alerting us to potential dangers and by notifying emergency services in the event of an accident.

AI will also drive business transformation: enterprise 4.0, factory of the future, logistics optimization, smart buildings, digital transformation of companies... **AI will serve as a transformation agent to continuously improve business processes, as well as a compass to make our working methods more efficient**. It will also facilitate decision-making and will be able to guide us, step by step, in the development of projects, the resolution of complex problems, the planning and holding of meetings, the monitoring of actions and performance, just like the computer suggests possible strategies in a chess game.

We are confident that Artificial Intelligence must contribute **in developing innovations that have a positive impact**, for the benefit of the individual, the economy and society.

Business in the Era of DATA-IA

Data and AI are driving a cultural revolution that will transform our future. This evolution is at the heart of the corporate decision-making process to make informed, logical and relevant choices.

It is gradually penetrating all areas of the company: from customer relations to the production line, through marketing, distribution...or human resources.

The major part of enterprises has clearly realised how important data and AI are to optimize its business, and in particular its strategic decision making. However barriers persist, between the main ones we found the lack of skills and data from siloed organizations.

So how can they integrate the benefits of DATA-IA and anticipate its impacts? How to match economic ambitions with ethical responsibility? And how to create a form of distributed collective intelligence and lead to an efficient mobilization of skills?



The challenges of DATA-AI for operators

Interview with Steve Jarrett, SVP Data and AI, Orange Group



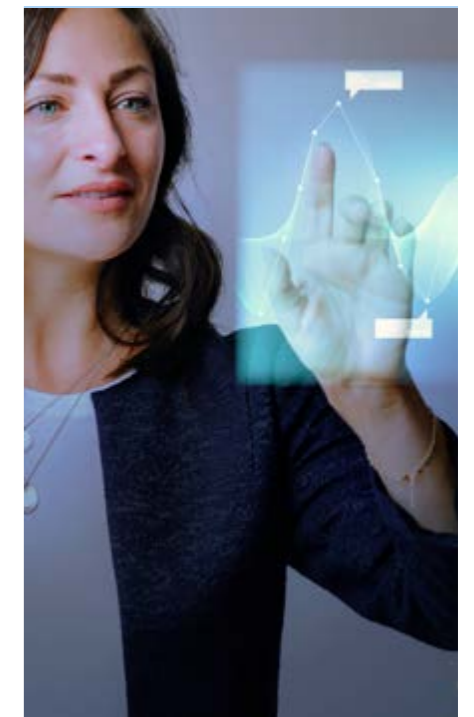
The exponential growth in the volume of data produced worldwide, combined with the growing ability to process it, notably through artificial intelligence, opens up vast opportunities for individuals, economies and society as a whole. The development of a data and AI ecosystem represents for telecom operators, as well as for all companies, a revolution as structuring as that of the Internet.

The revolution of data and artificial intelligence has already begun, it is already part of the telecom operators' strategy. However, it will take years for operators to make data and AI central to their business practices, and thus become both "data-driven" and "AI-driven". Indeed, the deployment of a data- and AI-driven strategy must irrigate all businesses. This deployment relies on team training and support programs. It requires the definition of a usage framework so that data and AI can serve the largest number of people.

The drivers of data and AI revolution

Data and AI revolution can be compared to the revolution of the Internet 25 years ago. It too will take many years to reach its full potential because it will involve a major cultural change in our societies.

Although data-AI offer, via their various business use cases, many opportunities for value creation, data management remains a complex task. They require good infrastructure and powerful tools that can deploy AI at scale. Moreover, the biggest challenge for a data-driven business is to find currently scarce skills and to develop a data culture across all businesses. The operator will therefore have to set up programs to develop skills and support change. The operator will have to consider how to break down the silos between the different departments of the company, as well as its needs in terms of technical tools and data sources. Data-AI must be seen as a "common good" accessible to all the company's business lines, at the service of value creation. While this challenge is real for telecom operators, it applies to any company.



Turning into a data- and AI-driven telecommunications company...

Turning into a data- and AI-driven company leads to greater agility, efficiency and profitability. We, at Orange, expect many benefits from data and AI:

- **Improve customer experience:** Over the years, the operator has collected diverse data: quality of service data, connectivity data, billing data and usage data. Their analysis enables us to improve the experience and quality of service provided. In addition, thanks to predictive algorithms, we are able to have a deeper knowledge of our customers, their purchase habits and their behavior, and thus anticipate new needs and uses. Consequently, Orange offers more attractive and relevant services or products to its customers, thereby building customer loyalty. The first benefit is therefore essentially customer-centric.
- **Master network complexity:** Our business transformation is very software-centric. The network itself is becoming virtualized: it is more advanced, with greater data sophistication. Artificial intelligence is a necessity to master the complexity of this new virtualized network. It is used to optimize the operator's core business.
- **Anticipate the potential emergence of new data-driven competitors and remain competitive with these new market entrants.**
- **Giving employees tools for faster, fact-based decision making:** The internal benefits are in how operators will make their employees more efficient in their daily work and how we can enable them to make better and faster decisions. Therefore, moving from simple decision-making to computers allows them to focus more on the more challenging part of their job, managing customer needs or managing the network itself.



Being at the heart of the data-AI ecosystem

In order to succeed in this transformation and become a data-centric enterprise, operators need to be at the heart of the data-AI ecosystem. To do this, they need to partner with existing players in the market. The opportunities for partnerships are numerous and the risk would be failing to partner quickly enough with all these companies focused on the public cloud and thus failing to manage this transformation effectively. Companies like Google, Amazon, Facebook, and Microsoft have huge compute and storage capacities that operators can use to increase the utilization of their systems. These companies also have great data and AI tools that allow us to focus on issues where our engineers can add value and leverage cutting-edge technologies, including open source technologies.

For example, at Orange, we have just signed our first agreement with Google Cloud, specifically to have access to these tools and infrastructures. We also support start-ups via the Orange Fab gas pedal and have participated in the fight against the Covid-19 pandemic by providing health authorities in several European and African countries with statistical data, thanks to our Flux Vision solution and our mobile network, enabling them to analyze population movements and anticipate the evolution of the disease.

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Acting as a socially responsible company

Data and AI bring new services and uses to humanity. But, like any new technical advancement, they raise new concerns. Telecommunications operators need to steer AI-related risks through cautious governance that can mitigate them.

Our teams are also considering ways to make the use of AI more responsible, notably by contributing to numerous working groups such as "Impact AI", which has elaborated an operational guide on how to deploy AI in a reliable and ethical manner. We also signed the Arborus Fund's international charter for inclusive

AI, and obtained, after an audit by Bureau Veritas, the GEEIS-IA (Gender Equality European & International Standard) label. Most recently, we started a project called "Women in AI", which is a certification process to encourage and promote women in the AI industry. We have a lot of senior women engineers on our team who are real role models for our organizations. Finally, an ISO standardization is starting to define a reference standard for trustworthy AI especially to combat bias.

Data and AI at the heart of Orange's innovation and digital transformation

Innovation in data and AI will support Orange's strategic plan "Engage 2025". Indeed, one of its areas of focus places data and AI at the heart of our innovation model and digital transformation.

At Orange, our mission for data and AI is based on four priorities:

1. Smarter networks;
2. Better efficiency in our operations;
3. A reinvented customer experience;
4. Responsible and sustainable data and AI across our enterprise.

One of the Group's key initiatives has been the deployment of AI algorithms that improve our radio access network efficiency and thus avoid traffic overloads by accurately predicting network congestion. Smart management of network resources ensures our quality of service while optimizing the allocation and use of our resources, resulting in a significant reduction in energy consumption.

Other examples: the cross-collection of regulatory-compliant profiling data will improve customer knowledge management and enable more personalized offers.

Enhancing Orange's multi-service assistants' capabilities, text and voice bots dedicated to customer relations, notably through NLU (Natural Language Understanding) technologies, will improve customer experience and satisfaction.

In terms of operational efficiency, some initiatives have already been successful:

- In Spain, to optimize the deployment of mobile network antennas thanks to Big Data and Machine Learning that analyzes commercial and technical KPIs.
- In Senegal, with the optimization of the mobile subscription process thanks to the AI-powered image and text recognition tool that checks the conformity of ID card files and photos.

Our challenges during this first part of the transformation are to set rigorous priorities and to understand the impacts on these areas.

The partnership we have with Google Cloud will accelerate our transformation around data and AI.

GAFAs, BATX and operators on the hunt for data and AI



Clotilde Marielle, Consulting Director, Market Intelligence, Sofrecom

Champions of data collection, the GAFAs have developed powerful and lucrative technologies to exploit data. This success finances their massive development strategy in AI, through organic growth and acquisition of start-ups. The BATX, Chinese tech champions, are following in the footsteps of their American counterparts with different diversification strategies. However, the need for tighter regulation of these contested monopoly giants could reshuffle the deck. Operators that have been investing in services and networks until now, already have major assets to invest in the Data-AI ecosystem.

Data, GAFAs' lucrative DNA

Since the very beginning, GAFAs have focused their strategy on the collection of public data in order to monetize this data and/or better target uses. Each has developed its own search engine platform, online sales, social networking or content offering to meet or create new needs. The innovative aspect and the simplicity of use have attracted millions and then billions of users.

Google, for example, with more than 2.5 billion active users per month and 74% of internet traffic from Android devices in 2019, collects both personal data (name, mobile number, date of birth, credit card) and usage data (applications and websites visited, location). Chrome, the world's leading browser (65% market share) also collects user data from mobile devices and desktop computers. According to the Vanderbilt University study, a passive Android phone with Chrome in the background communicates its location information 340 times a day to Google, representing 35% of the data sent. By comparison, iPhones in normal use send 18 bits of information per hour to Apple's servers compared to 90 bits per hour for Android

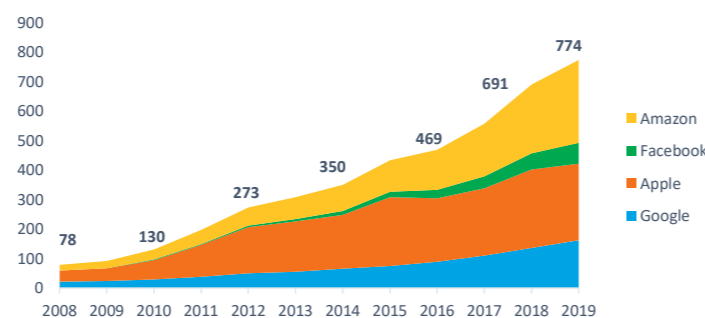
phones to Google. Google collects more data from iPhone users than Apple itself. In addition to Android and Chrome, Youtube, Gmail, Waze and Google maps provide many opportunities to collect data.



Offering continuous improvement and revenues multiplied by 10 in 11 years

GAFAs exploit the data they collect to improve their algorithms and targeting technologies (Google, Amazon), their products and services (Apple, Amazon) or to generate advertising revenue (Facebook, Google). The more data GAFAs have, the more they train their machine learning models. The more accurate the data, the better the conversion rate and therefore the revenues: it's a virtuous and lucrative circle. By placing themselves at the center of market share and customer knowledge, GAFAs have gone from a cumulative turnover of \$78 billion in 2008 to \$773 billion in 2019 and a cumulative market capitalization of over \$3.7 trillion.

GAFAs' revenues 2018-2019 (in billions of dollars)

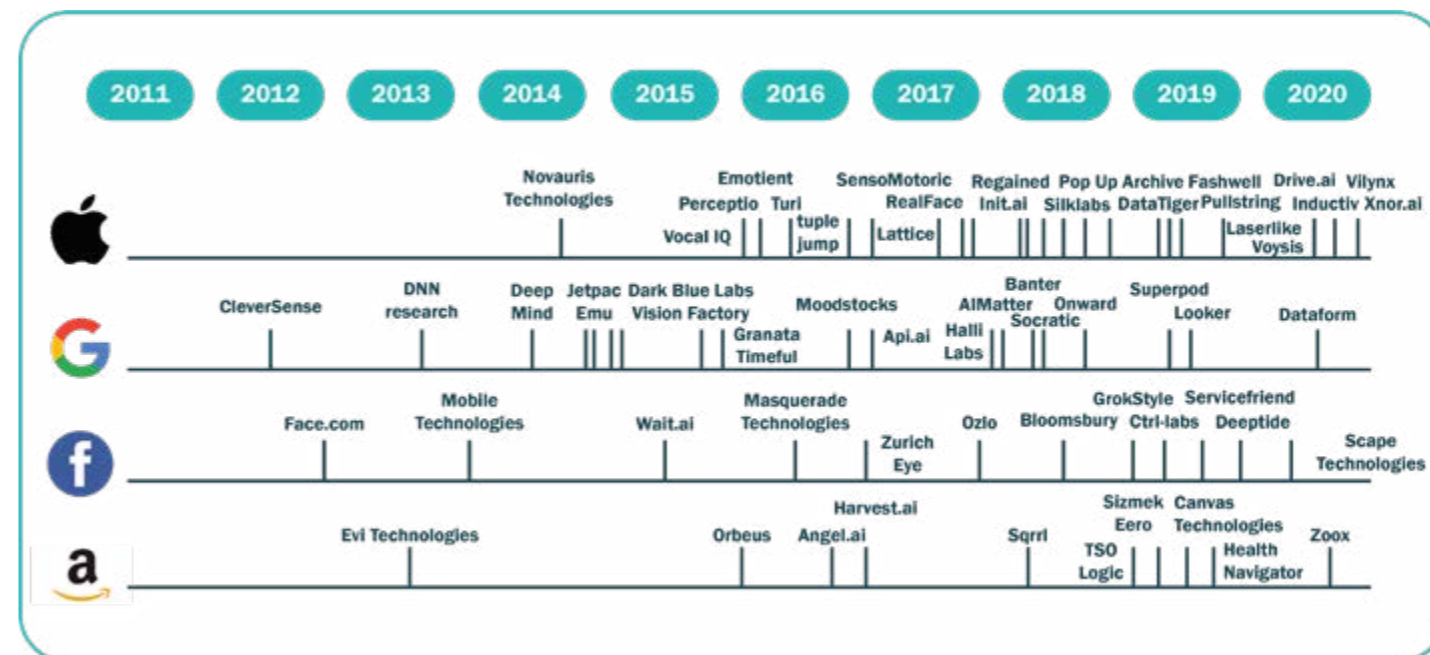


Source : rapport annuel des entreprises, 2008-2019

platform. Google, with 19 AI-positioned startup buyouts since 2011, comes second. Its most emblematic buyout is of course the acquisition of DeepMind in 2014 (\$400 million), the foundation of its organic growth and AI research lab.

priority to investments in networks and services. The monetization of data, although raised (e.g.: sales of subscriber data in the Yellow/White Pages era), has always remained a peripheral strategy.

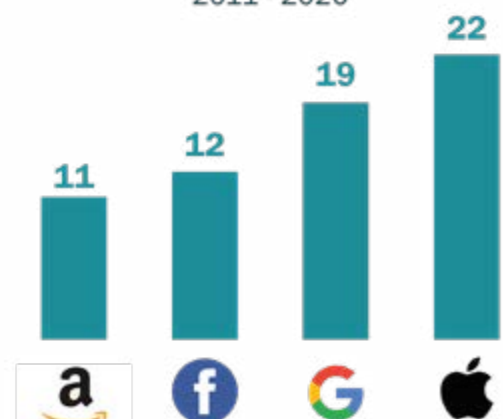
Thus, according to estimates, Google has spent \$4 billion since 2009 on the acquisition of AI companies, Apple \$886 million, Facebook \$1 billion, and Amazon around \$871 million. Their selections were therefore radically different from those of operators, who gave



Source : Sofrecom

With their massive data and financial strength, GAFAs are investing massively in artificial intelligence

Number of GAFAs acquisitions in AI 2011 - 2020



Source : Sofrecom

Benefiting from a powerful positioning and technological assets as well as comfortable revenues, GAFAs have a double strategy in data-AI: on the one hand they bet on organic growth (development of their own technologies and research laboratories).

On the other hand, they are adopting an external growth strategy (see graphs below). Acquiring start-ups has a threefold objective: to outpace incumbent players in their markets, eliminate potential competitors and attract rare skills. Some analysts speak of "acquisition-recruitment" rather than acquisitions.

Apple is the GAFAs that has acquired the most AI startups, including Siri in 2010 (\$200 million), Turi in 2016 (\$200 million), and most recently Xnor.ai (\$200 million) and Voysis, a natural language processing

BATX following in the footsteps of GAFAs

BATXs (\$329 billion in cumulative revenue in 2018, half the revenue of GAFAs and three times the market capitalization) were initially built by transposing the GAFAs model into the Chinese ecosystem: Xiaomi is Apple's Chinese counterpart, Baidu is that of Google, Alibaba is that of Amazon and Tencent is that of Facebook. Their model, based on captive users, has enabled them to acquire a leading position in China.



With different diversification strategies in AI

Alibaba started by using AI for its services (robotization of its supply chain, chatbot...). Its recommendation engine was thus backed by machine learning to link visitors' interests to its media and entertainment platforms. On its Alibaba Cloud service, used for decision support or predictive analysis in the industrial, transport or medical sectors, it introduced natural language and image recognition in 2015. Alibaba's AI cloud platform analyzes 1.2 million hours of video and 550,000 hours of voice messages every day, and its Dian Xiaomi chatbot records 5 million voice or written queries per day.

Baidu is leveraging mostly autonomous cars and AI. Like Google, it uses artificial intelligence for the referencing of its search engine. Simultaneously, it is opening up the sources of its AI algorithms and offering deep learning infrastructure (PaddlePaddle with different building blocks (NLP, video recognition, recommendation...) used by more than 1.9 million developers. As of December 2020, more than 230,000 deep learning models have been created using the platform.

Tencent initially gained recognition in AI through healthcare with online medical appointment management via chatbots, medical diagnosis assistance, cancer screening... It later expanded its AI offerings to other areas such as road transportation, voice recognition/synthesis and translation. The latest to get on board with AI, Xiaomi announced in early 2019 its intention to invest nearly \$1.5 billion in artificial intelligence and Internet of Things. Xiaomi is targeting connected homes in particular.



Implementing AI in the real world requires case-by-case learning models, situation labeling, image labeling, emotion labeling and making predictions.

The increasingly contested monopoly of GAFAs and BATX could benefit operators

The recent fines imposed on GAFAs for lack of data protection, unfair competition or the recent reactions to the sharing of personal data between WhatsApp and Facebook, show that the market perception of GAFAs is changing. Discussions have even emerged to force GAFAs to make certain key data available (e.g. Google search engine queries, Amazon.com sales), just like legacy operators were once forced to open their network to new players. More than dismantling, it is therefore a tighter regulation that GAFAs may fear and that could shuffle the cards.

Mobile, vertical approaches, IoT: operators have not said their last word

First of all, operators have a major advantage with mobile, extremely widespread: a 102% penetration rate and 5.124 billion unique customers in the world. The mobile and infrastructure data they can retrieve is valuable information, as we have recently observed with the use of anonymized data to assess travel during COVID.

Secondly, GAFAs and BATX are today more focused on autonomous cars or health sectors than on the operator's business, with the exception of banking. They therefore leave a space for operators to seize.

Thirdly, there is a concern about the ability of GAFAs to manage "living" data. With their global approach, they increasingly need to rely on local players to ensure that the data is up-to-date, of high quality and well-labelled. This requires preparing and cleaning the data to be processed, having large samples, but above all knowing the sector and the business well to avoid bias and errors.

Fourthly, data held by GAFAs and BATX are mainly open data indexable on the internet and those provided by users. Operators, through the customer relationship they have with large and small companies, have the opportunity to develop the B2B market and to accompany them in their production, marketing, monitoring and maintenance processes.

The implementation of AI in the real world requires learning models on a case-by-case basis, to label situations, images, emotions and to make predictions. For this, it is necessary to prepare and clean the data to be exploited, a model, time, large samples to work well and especially to be familiar with the sector and the business to avoid bias or errors. It is therefore not in their traditional business that operators will find the most revenue, as telecom markets are mature today.

On the other hand, by choosing their diversification axes (Internet of Things, banking...) or B2B verticals, operators have the possibility to collect new and multiple data that will allow them to position themselves sustainably.

Although operators have neither the financial surface nor the investment capacity of GAFAs (774 billion in turnover, 3700 billion in capitalization and 84 billion devoted to R&D in 2019), they will nevertheless be able to capitalize on 3 success factors of GAFAs in Data-AI:

- Value continuous improvement through the systematic exploitation of data and AI and develop their operational efficiencies (use of chatbots, integration of AI in business processes);
- Dare to venture into new territories by leveraging AI;
- Know how to invest, buy out or form partnerships, particularly with B2B sectors, to take advantage of data, pool it and turn it into a lever for creating value and revenue.

Just as Orange, OVH, Atos, Deutsche Telekom or Siemens are cooperating in GAIA-X, for example, operators could replicate this approach in the AI field. Operators therefore have more than one card to play in the data-AI market.

Ethics: Lever of trust in the development of an inclusive and responsible AI

Interview with Professeure Amal El Fallah-Seghrouchni



International expert in Artificial Intelligence,
Professor of exceptional class at Sorbonne University (LIP6 laboratory),
Head of AI movement - International Artificial Intelligence Center of Morocco,
Member of the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) of UNESCO.

The advent of 5G and its future developments will accelerate the emergence and adoption of powerful and often revolutionary AI tools by many players. Capable of benefiting humanity as a whole in many areas of activity, including the fight against Covid-19, smart technologies can also drift towards manipulation, worsening inequalities, discrimination. Ethical rules are essential to guide an inclusive and responsible development of AI. Scientific insights...

You've spoken at many debates about AI in 2020. Why all this hype about a field that has been tackled for over 30 years?

The history of AI goes back to the end of the 19th century! The hype around the topic is very real. I would say that its magnitude is not sudden, but rather exponentially accelerated by three factors:

- **Hardware evolution:** supercomputers integrating graphics processing units provide unprecedented computing power. They accelerate the performance of High Performance Computing and AI applications.
- **The GAFAM craze:** they offer, almost as a turnkey solution, powerful tools allowing non-experts to use very sophisticated AI algorithms. These massive deployments have raised ethical questions related to the "black box" effect of certain learning algorithms: conclusions are proposed following

such complex paths that humans cannot explain. They have given rise to a new AI research field: "explainability".

- **The ability to collect massive amounts of data** thanks to the deployment of connected objects and the universalization of the Internet. The almost permanent hyper-connection encouraged by the creation of new country evaluation indexes (digital maturity, digital well-being), massive tracing of daily interactions (social networks), generalization of online services, routing of data... are all factors that enabled the massive and sometimes even wild collection of data – hence the new regulations such as the GDPR - as well as training on these databases.

Data and AI are frequently associated. What is the link between these two very distinct fields?

I like to say that data is AI's fuel. Even if they have different objectives, these two fields complement each other. For example, data is necessary for AI algorithms to make predictions. AI is focused on modeling, understanding cognitive processes and often exploration. In turn, AI can produce data.

How will 5G enable AI to reach its full potential? How do 5G and AI depend on each other to thrive?

Coupled with IoT, 5G is bringing out smart applications requiring:

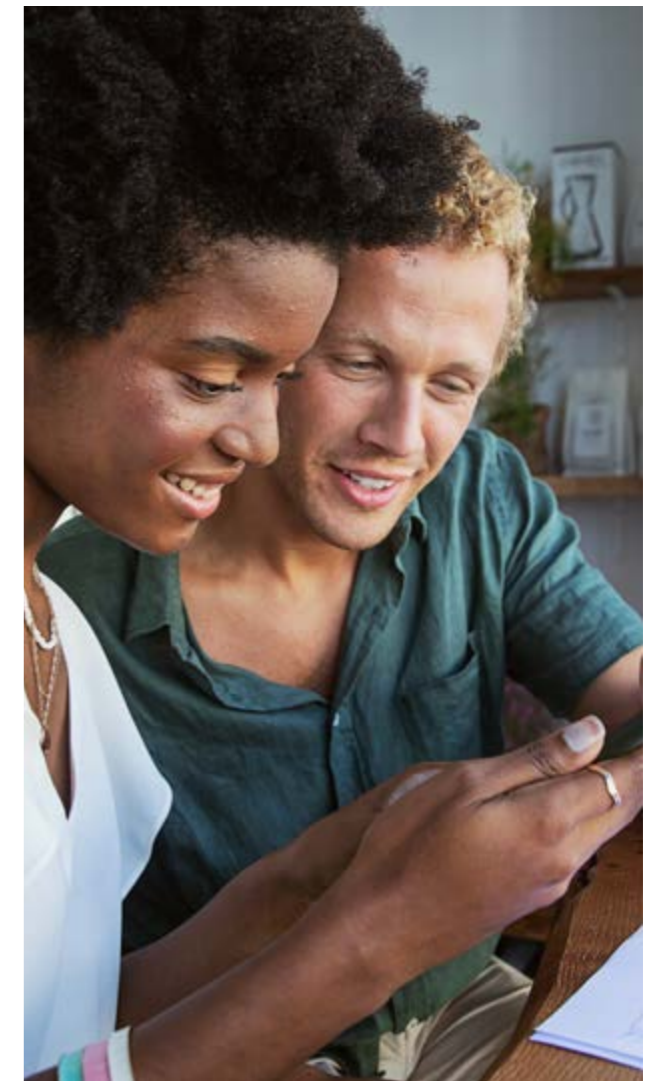
- Increased download speeds, reduced latency and more accurate user location;
- The coexistence of numerous objects connected to the Internet, which are required to make autonomous decisions while being immersed in scalable environments.

In smart cities, for example, 5G will foster the development of smart building and smart home solutions, as well as ubiquitous services to help citizens: geolocation, mobile games, e-commerce, autonomous cars (V2V, V2P, V2I).

In medicine, it will enable remote surgery and medical monitoring. In industry 4.0, it will accelerate the development of digital twins, these virtual replicas of physical devices allowing either remote control of industrial processes, or to perform calculations that are impossible to do onboard. In the post COVID-19 world, 5G combined with IoT also have a huge potential in the online education and remote working fields.

Regarding the contribution of AI to 5G, we are moving towards 5G datafication. Already, so-called smart networks use AI techniques in routing and resource allocation.

The specifications for 5G evolutions, currently being defined, foresee that it will soon host data centers. This will be the real revolution: 5G will use AI at its heart⁴.



A brief historical overview of AI

1890: the American psychologist William James introduces the concept of associative memory which defines the premises of what will become in 1949 the Hebb theory (learning rule of artificial neural networks) and gives birth to research works on the subject.

1943: Warren Mc Culloch and Walter Pitts are the first to theoretically demonstrate that simple formal neural networks can perform complex logical, arithmetic and symbolic functions.

1946: David P.C. Lloyd publishes a well-known founding article: "Integrative pattern of excitation and inhibition in two-neuron reflex arcs" <https://doi.org/10.1152/jn.1946.9.6.439>

AI is as fascinating as it is mistrustful. How be explaine?

Unlike other developing sciences such as quantum science, AI challenges humans in their most intimate aspects. It can therefore be intrusive.

Indeed, AI generates text, speech (chatbots), vision and pattern recognition such as facial recognition, which is controversial.

It has cognitive capabilities, to the point of arguing with users. It can generate emotions in humans.

It can be used to manipulate individuals in the context of nudges², a well-known concept in marketing and behavioural theory that encourages a person to make a decision that they mistakenly believe they have freely chosen.

They have access to privacy and personal data and may not forget anything. In the workplace, many believe that robots and automation will lead to massive unemployment. AI is also frightening in movements like transhumanism...

However, at the same time, it is fascinating to see that robots provide very powerful solutions in many fields: to treat autism, to accompany cognitively impaired people, to make recommendations in record time, to help make relevant decisions, to carry out very deep underwater drilling, to pilot drones, to beat the world champions in chess and other non-trivial games...

What role do you play in UNESCO's prestigious COMEST?

COMEST is an advisory body and a forum of reflection set up by UNESCO in 1998. Together with 17 other experts, we reflect on ethical issues related to the advent of science and technology. Currently, our Commission is working on the ethics of connected things (IoT) and other critical topics such as the ethics of land-use. Last August, UNESCO released a report of the work on AI ethics, which is currently being discussed with all its member states.



Artificial intelligence challenges humans at their most intimate level.

What are the safeguards to be foreseen in the field of AI?

In my opinion, several principles should be respected:

- **Respecting human rights and ensuring their dignity.** Objective: not to discriminate people who do not have access to digital tools.
- **Respecting privacy:** ensuring that data collection is proportionate and defining the legal time limits for their use.
- **A democratic logic of deployment:** in my opinion, technologies must be adapted to the "technological IQ" of users so that their consent is free and informed; a public debate must warn on the technical and societal stakes.
- **Regular, transparent, fair and understandable information must be communicated to all.**
- The possibility for the user **to revoke his/her consent.**
- The possibility for the citizen **to have his/her data erased or modified.**
- A very important point linked to Big Data: **the eradication of any kind of bias** (cognitive, economic, selection...), now well documented in research.
- **Respecting privacy:** the right to keep one's personal affairs and relationships secret, a subject on which Alan Westin has conducted seminal work³.

How can we reconcile technological innovation and ethical rules in order to put progress to serve everyone in a spirit of trust?

Tension often arises between efficiency and ethics. But we must not open Pandora's box under the pretext of accelerating innovation. Trust must be key! For me, the real question is: which society do we want? Several initiatives by countries and institutions are evidence of a global awareness. In October 2020, the Chilean Congress presented a draft amendment to the constitution that defines mental identity as a right to be protected from manipulation (Cognitive rights). A world first!

Many institutions are working on AI ethics. UNESCO has launched a global consultation in 2020. The OECD has formed an expert group to develop a draft in June 2020. The European Parliament adopted 3 new resolutions (October 20, 2020): the liability regime of AI; AI and intellectual property; and the ethical framework of AI developments (the right to information). On January 20, it published the last report of the European Parliament Resolution on AI. From Montreal to Melbourne, many AI research centers are addressing this topic.

The advances of AI appear to be disruptive. The acceleration of its development and its popularization raise questions and concerns. Ethics, respect of human rights and the privacy of citizen-users will be major drivers for creating confidence in an inclusive and responsible AI, likely to help with technical progress, the resolution of health crises and the development of emerging countries. The work of multidisciplinary ethics commissions aims to enlighten governments, the scientific community, decision-makers and the general public.

The Enterprise in the AI's era



Samia Bendali-Amor, IT & Network Services Consulting Director, Sofrecom

The health crisis has put the spotlight on the interest of digital technology and, in particular, the efficiency of data-AI technologies. In France, its deployment in companies is at its restructuring stage. In fact, AI projects are deeply transformative. Their success requires organizational changes, working methods changes, adapted technological choices and an ethical and legal framework definition. It requires the integration of these transformation projects in the global strategy of the company and an adapted support to contribute to the creation of the augmented company.

The health crisis has accelerated the recognition of data-AI benefits

The emergence of the digital age has undoubtedly contributed to the fight against COVID-19 and to the reduction of the impacts of the unprecedented health crisis we are going through. Among the various technologies of this new era, data-AI or Data Intelligence has contributed to the assessment, projection, analysis and management of the pandemic. There are many examples. The best known are those related to pandemic assessment and medical diagnosis:

- **Mapping of the pandemic:** Big Data combined with Geographic Information Systems (GIS) have enabled the development of dynamic maps to visualize the extent of the pandemic, by performing spatio-temporal analyses from several different sources of information.
- **Predicting the evolution of the pandemic:** Data Science has performed predictions of the evolution of virus spread at the regional, national and global levels and its projection in time.
- **Medical diagnosis:** facial recognition coupled with thermal capture is used to identify people with high temperatures (in transportation for example). The implementation of telemedicine platforms has enabled the first diagnoses to be carried out and patients to be sorted.



The pandemic has had catastrophic consequences on our economy and our society. But, in the midst of the emergency, we had to deal with it and find innovative solutions. And, ironically, the crisis has also had positive impacts: it has accelerated innovation and reinforced the use of digital tools, including data-AI. Although this technology has been gaining interest for a few years, it continues to intrigue, question and raise issues of ethics, responsibility and privacy.

The advantages of data-AI and its capabilities of detection, prediction and natural interaction with humans (automatic natural language processing) have become apparent. This transformative field opens the door to new innovative services.

However, its use in companies, especially those that inherit a significant "legacy", in other words an

information system based on outdated technologies and/or a heavy functional heritage, remains at the exploration stage. A study conducted in 2018 by TCS & IDC on a panel of 300 French companies shows that only 36% of them have already implemented AI tools, while 16% indicate that they intend to develop AI projects within the next 1 to 3 years [TCS]⁵. Companies are still in the structuring phase, which leads them to face several new challenges.

Define the new organisational schemes of the augmented enterprise

Organizations need to transform themselves in order to federate initiatives, pool skills, and break down the barriers between departments by bridging the gap between business and IT departments. The challenge is to encourage cross-functional work and to manage digital, data and AI in a coherent way.

Above all, the transformation implies a cultural and human change at all company levels. New skills will have to be integrated: data scientists, chatbot coaches, psy-designers in charge of designing AI interfaces or ethicists responsible for the governance of decisions made by AI tools. New jobs are emerging

and we will have to face the shortage of these new profiles on the market. Training, acculturation, acquisition and partnership strategies, including startups, will be crucial.

This hybrid enterprise transformation, requiring the management of existing information systems while creating new intelligent systems - knowing that some can interact with others - contributes to the construction of an augmented enterprise [CIGREF report]⁶ through intelligent collaboration capabilities between man and machine.



Changing the way we work: Agility as a driver of cooperations

Cross-functional collaboration is crucial to the successful integration of data-AI in companies: business lines, IT specialists, statisticians and data scientists must be able to work together.

Since data-AI culture is not sufficiently mature in companies, working in agile mode allows us to move forward in small steps (Think Big, Start Small and Show Value Fast) and to capitalize on failures as soon as possible. We are witnessing the emergence of

MLOps (Machine Learning Operations) and DataOps (Data Operations) methods, an adaptation of DevOps⁷ to data-AI projects.

The challenge is to create multi-disciplinary teams and collaborative spaces (data lab, fab lab, etc.) to catalyze synergies and converge projects by aligning all stakeholders through a shared methodology and a common culture.

The transformation brought by the DATA-AI implies a cultural and human change at all company levels.

Make technology choices adapted to business use cases

Data-AI is a broad field that covers several technologies: robotics, natural language processing, pattern recognition, machine learning, deep learning, predictive analysis, uncertain reasoning, knowledge representation, semantic web, multi-agent systems... These different technologies allow the creation of a multitude of business use cases such as virtual assistance, automatic detection of breakdowns or fraud, predictive marketing... The choice of technological solutions cannot be made without taking into consideration the business use cases to be implemented.

Companies should also consider the question of technology choice - "make-or-buy" - and seriously consider defining a strategy around open source. Indeed, the GAFAs have developed many open source technical platforms and frameworks⁸. They are ahead of the game in this area since their business model has always been based on data. Using their tools allows you to get started quickly, to check the relevance of use cases and to evaluate the benefits at the lowest cost.

Defining an ethical and legal framework to keep technology under human control

Data-AI relies on the processing of large amounts of data, in particular for machine learning and prediction algorithms. Consequently, it raises many questions about the use of this data while respecting privacy and individual freedoms, and triggers mistrust.

It also raises transparency and algorithm control issues: how to guarantee that these learning algorithms do not generate inequalities or exclusion? How to manage the issue of responsibility for AI-based decisions? A collective challenge must be met to ensure that these new tools are under human control, at the service of humans, respecting transparency and responsibility [CNIL]⁹.

The challenges of data-AI¹⁰ are numerous, and its success will depend heavily on how well it is integrated into the company's overall strategy, its coherence with the digital transformation program underway, the governance of the data, and the inherent change management.

The future of marketing will be driven by AI



Claire Khoury, Marketing, Communication & CSR Director, Sofrecom

To evolve towards personalized marketing, following the new aspirations of customers, marketers will have to make the most of the growing volume of data collected by developing a certain expertise in the use of enterprise AI. Their challenge will be to harness artificial intelligence to make it an ally in cognitive analysis and individualized projection.

Insufficient use of AI and data

22 How can you offer a unique and exclusive experience to each customer when interactions take place across all channels with thousands, even millions of individuals?

Until recently, sales departments and community managers, whose role has been enriched by the use of chatbots (more interactive conversations, 24-hour online assistance, contact with an advisor, etc.), seemed to be the solution to deal with the exponential volume of data and customer requests.

Today, 61% of customers believe they receive offers that do not always correspond to their interests, indicating that brands do not understand their desires. Various reasons can explain targeting errors:

- 59% of customers believe that brands use outdated data when offering them services.
- Brands, especially in France, are struggling to compete with GAFAs who are ahead of the curve when it comes to understanding customer needs.

In addition, marketing departments continue to under-utilize customer data, despite growing awareness of the promise of AI in their businesses: they do not yet rely sufficiently on this data to develop scalable offers based on customer needs and desires.



Using customer data as a strategic starting point: the data-driven approach

23 It is no longer possible to base your strategy on a single channel, or even on a limited number of channels. Digital technology has introduced many new parameters.

Interactions on social networks imply permanent availability on all social media and an adaptation of the speech and its format. User opinions and direct interactions between targets via social networks require a high level of reactivity and transparency. These new requirements change the fundamentals of a marketing strategy.

Indeed, the marketing approach is evolving, becoming more customer-centric. It requires a detailed analysis of the customer's journey through all contact channels, a knowledge of their regular and specific needs and their evolution over time, as well as their digital footprint.

Managing the multitude of information available requires **mastering the data collected, which is made possible by the use of AI.**

The data-driven approach consists in choosing, among the many categories of data, those that best inform the needs and expectations of customers with regard to the offer, and then implementing the marketing strategy around these data.

By centralizing these efforts on a single database from different channels, marketing teams will be able to have a global vision and therefore develop a detailed knowledge of their customers to develop personalized approaches.

Towards a personalized marketing approach

While we are used to measuring the average, in terms of purchase frequency or performance in particular, AI takes us much further. The personalization of customer approaches implies breaking away from the "average" to adopt an individualized approach, based not only on the customer's tastes, but also on all the factors that will influence the purchasing act in real time.

Mood, contact choices, interests on social networks or relational links, behaviors in marketing campaigns or the frequency of use of contact channels are all information that **can be collected thanks to data**. AI

refines customer knowledge by monitoring **real-time changes in customer needs** and expectations that will determine the strategy to be applied.

Loyalty marketing operations, such as the Welcome Pack, promotions or invitations, are more easily customizable, with the effect of individualizing the customer relationship and intensifying it.

Predictive marketing will then enrich forecasts in terms of performance, and allow to associate an action with the impact it can have and the benefit it will bring.

Making artificial intelligence an ally

While we should not fear AI replacing humans, it would be dangerous to ignore its impact on the future of marketing.

Methods based on pure experience and past behavior will gradually give way to predictive algorithms that have a superior learning capacity and can store billions of data that a human brain cannot handle.

However, **AI needs to be supervised, guided in its learning, and fuelled by the right sources**. It is therefore necessary to start thinking about restructuring marketing departments now, so that they are in control and can determine the way in which artificial intelligence will organize and exploit the information collected.

New jobs will emerge, such as the orchestrator of augmented customer knowledge. Cognitive analysis and individualized projection will be the spearhead of a marketing strategy driven by artificial intelligence. An open and agile attitude that listens to customers' needs is now vital for companies. This is how they will be able to position themselves as companions of the AI revolution, and avoid suffering its effects...



Data-AI skills development at the heart of operators' transformation

Céline Ribière, Human Resources Director, Innovation & Technology Division, Orange Innovation
Lionel Cambos, Director of the Innovation School, Innovation & Technology Division, Orange Innovation

To continually reinvent the experience of its individual and business customers, Orange has placed data and AI at the heart of its innovation model for the coming years. The success of this data-centric strategy relies mainly on the promotion of a data-driven culture in all countries and on an ambitious training program for employees in data, AI and cloud-related professions. HR insights.

Accelerating the operator's IT and digital transformation

For Orange, accelerating the use of data, AI and the cloud in all our businesses and throughout the world is a major innovation challenge. This will be a powerful driver of value creation to:

- **Personalize our customers' experience** and further digitalize our interactions with them.
- **Make our networks more intelligent** by automating certain functions.
- **Increase operational efficiency and agility** in all our businesses.

The success of this data-centric strategy will be based on a profound company transformation: the operator's historical skills, centered on server configuration, will have to evolve massively towards IT development, the cloud, AI, data, cybersecurity...

Humans as a transformation driver

To ensure a competitive advantage in these areas, Orange created in 2018, a data-AI Excellence Group in charge of identifying new business lines to emerge in the company.

Among them, particularly those of:

- Researchers and data scientists, generally mathematicians who design the mathematical models at the beginning of the project. User experience designers, who guarantee the ergonomics of chatbots.
- Developers
- Data architects
- Data analysts
- Data protection officers for data security
- Data engineer (many needed).

In addition, there are cross-disciplinary skills such as ethics, CSR, ergonomics, sociology, etc. Orange ensures that each of its AI projects follows an ethical and socially responsible approach.

The success of a data-AI project requires the combination of these multiple and complementary skills, which are increasingly joined by those of cloud experts. Orange's recent strategic partnership with Google Cloud symbolizes this convergence.

For Orange, there is still a major challenge to be met: that of the diversity of its teams.

A dedicated organization to meet the challenge of skills

To support the transformation of its historical businesses and accelerate the rise of new ones, Orange has created a **data-AI department within its innovation division** in 2019. Its mission is to be the Group's center of excellence on these matters. Anticipate the company's future needs. Define programs and resources to ensure that the right skills are available at the right time. Create a data-AI business line with common governance across all the countries and divisions concerned.

The department, which at its inception consisted of around 100 innovation employees, has already doubled its workforce through the recruitment of internal and external experts. These specialists will **act as support points** to increase the number of data and AI skills throughout the Group.

In addition, an **internal community of data-AI experts**, selected on the basis of applications by a jury, will help countries to transform with the support of Orange Campus.

Finally, a **Data and AI Ethics Council** has been set up at Group level.



The challenge is to make employees more aware of the importance of data in order to be more efficient on a daily basis.

Ambitious and innovative training programs

To help employees retrain and upgrade their skills, we have launched innovative e-learning programs through a partnership with the e-learning platform **COURSERA**: 5000 employees will benefit from entire training courses to develop skills in data, AI, cloud or even switch careers.

They can follow a training course certifying the management of data science projects within the framework of our partnership with the **École Polytechnique**, as well as **other courses** for data engineers and data analysts. We also fund numerous **PhDs in AI** at universities.

As for **Business & Decision**, the Orange Business Services subsidiary specialized in business intelligence and data science, it has launched a **data school** in 2019 for the specialization of young graduates.



Inspiring a data-driven culture

Another challenge is to make employees more aware of the importance of data in order to be more efficient on a daily basis. In the HR department, for example, we are studying an AI project to process responses to the recurring requests we receive by e-mail and devote more time to supporting employees' careers.

To promote this culture, we have launched:

- The "data-AI starter" tool. This welcome module, adapted to each profession, allows everyone to test their knowledge, to understand that data/AI is everyone's business and not just that of specialists, and to discover a training offer adapted to their profession.
- A network of data-AI ambassadors to raise awareness, mobilize and support their colleagues in the development of AI projects.

We are convinced that in order to demystify AI, to convince people of its utility, to democratize its uses and to accelerate change, communication and deployment of AI must be done as close as possible to the businesses, starting first and foremost from their needs and uses and focusing on the value produced by the projects, both operational and financial.

Having the right skills in sufficient quantity is the prerequisite for delivering data-AI projects. The approach requires a strong political will, supported by appropriate methodology and the allocation of human and financial resources. In a data-centric company, data-AI is not only a matter for specialists. The AI culture must spread to all activities, as close as possible to the business lines.

The benefits of DATA-IA for telecom operators

Telecom operators around the world are under constant pressure to deliver high-quality services. These challenges will grow as we enter the 5G era. This transition will underpin an increasing number of connected devices and services. To address this technological acceleration to 5G, many industry leaders have already bet on artificial intelligence.

The areas of AI applications are numerous and diverse, of which we can mention: improving customer experience or predictive management of customer churn, monitoring and managing network/IT operations, reducing fraud...

How can we capitalize on the progress made with AI to develop new operational efficiencies and generate value?



Improve the quality of service on mobile networks

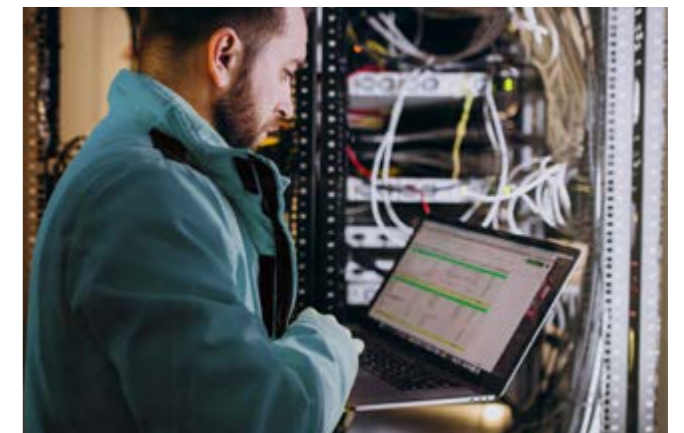


Paul-Michel Bognier, Head of E2E Network Performance, Sofrecom

What network engineer has never dreamt of having the right tools to predict and even solve a problem before it occurs? With AI, the dream might come true... It promises to provide operators that will know how to leverage it, the opportunity to significantly improve their quality of service and boost their competitive edge.

Quality of service: A fundamental challenge for telecom operators

To maintain its leadership and attractiveness, an operator must provide its customers with the best possible quality of service (QoS) on its mobile network, in particular: optimal coverage, accessibility and continuity throughout the operated territory, good voice quality, and convenient data rates.



Collection, measurement and analysis tools: Precious allies of network engineers

Since the emergence of mobile networks, operators have developed and evolved an ecosystem of tools that allows them to monitor the quality of service of their network on a daily basis.

Some commonly used methods include:

- Collecting counters on mobile network equipment to continuously monitor the performance and health of the network;
- Field measurements (Drive tests) and the collection of technical data from customers' smartphones (Crowdsourcing) provide an accurate view of the real customer experience;
- Real-time collection and analysis of networks links traffic via probes installed at key points;
- Self-organising networks (SON) technology that allows the auto-configuration, auto-exploitation and auto-optimisation of mobile networks equipment.

AI's role in the quality of service

AI is still in the early stages in the field of quality of service, but it seems very promising. New generation SON (NG SON) tools based on 5G and machine learning are an illustrating example. Indeed, what network engineer wouldn't dream of having tools capable of accurately predicting the appearance of a quality of service problem in a zone, or even tools capable of automatically modifying network settings before the problem appears?

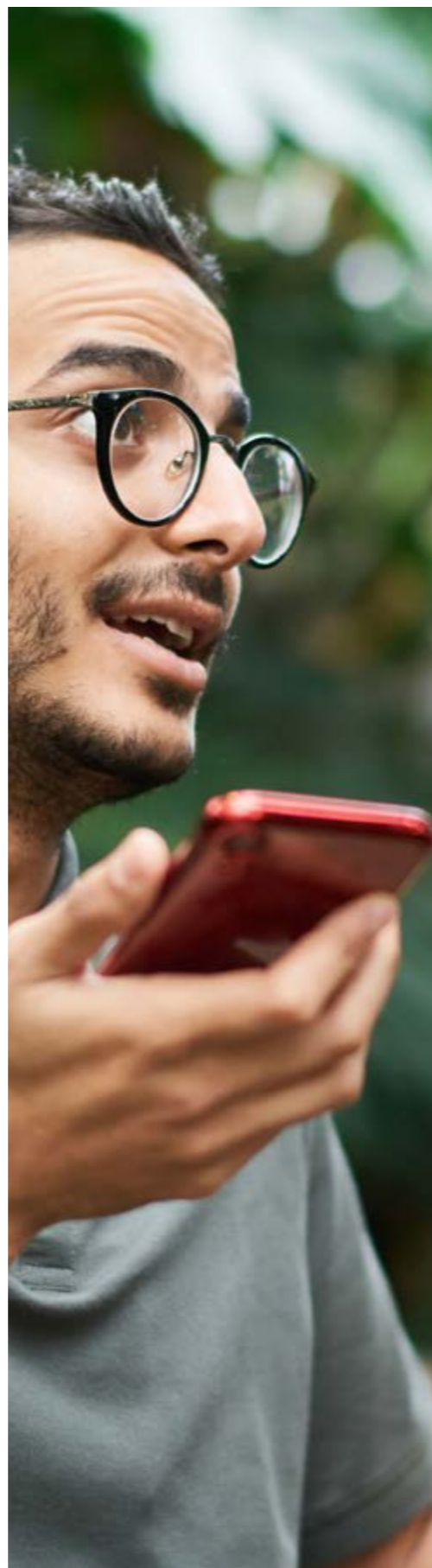
However, for these AI-enabled tools to be fully effective, the operator will need to collect, store and process even more technical data than they do now.

The gains brought by AI functionalities will therefore have to be significant to justify the necessary investments (infrastructure, equipment, software, increased skills of technical teams...).

AI or field of possibilities?

With the promise of AI, the ecosystem of tools for managing a mobile network and its quality of service will evolve significantly over the next five years. Tools that we don't even know exist yet will gradually be implemented. The job of network engineer will no longer be the same as it is today, and the "Network Data Scientist" component will become increasingly important.

The operator that can most effectively leverage AI to operate its mobile network will undoubtedly have an advantage over its competitors.



Advances in conversational AI are shaping the future of customer relationship management



Clément Aincy, Digital Innovation Practice Director, Sofrecom

Telecom operators are part of one of the most solicited industries on customer relations channels. Conversational agents or 'chatbots' are proving to be an ideal ally to contain incoming calls and improve customer satisfaction. As a proof, Orange has announced a target of 50% of customer interactions managed by its chatbot Djingo in 2023, while Vodafone has set a target of 60% by 2021. By becoming the essential gateway to human support, chatbots create a form of collaboration with customer advisors, which will evolve as conversational AI progresses.

Chatbots, an indispensable and critical asset in customer relations

The emergence of smart robots capable of interacting in natural language with clients has paved the way for a new standard in the digital experience offered by the operator. By simplifying access to digital paths and ensuring 24/7 availability, virtual agents have become an indispensable lever of customer autonomy for account management, assistance or complaints. In France, Total Direct Energie estimates that chatbots have contributed to 40%¹¹ of calls avoided.

The specificity of the conversational experience is to create a very strong polarization of customer satisfaction. Chatbots are a layer of intermediation with human support. They therefore represent a critical component of the customer experience, requiring

significant investment to make them effective in understanding customer intentions, adapting them to the experiential codes of the channels on which they are deployed, and integrating them with the company's information systems to offer a personalized customer experience.

The new sources of value generated by voice and vision

If chatbots first appeared in the form of a text conversation window (chatbot), voice chatbots (VoiceBots or Callbots) may generate even more value.

Indeed, 40% of customer service calls could be automated thanks to AI¹² while customer service calls still represent about 55% of the flows¹³ and they have not decreased drastically in the last years in France.



+50%

of client interactions via a chatbot by 2023 at Orange



40%

of customer service calls could be automated thanks to AI



40%

of interactions are autonomously managed by chatbots and callbots

The first challenge is therefore to improve customer autonomy on interactive voice interfaces (IVR) by allowing customers to express themselves naturally and by offering personalized voice paths thanks to CallBots. With 50% of customers dissatisfied with their IVR experience and only 14% of IVRs embedding natural language understanding¹⁴, the opportunity is huge. And the technologies are mature: Isabelle, Bouygues Telecom's CallBot in France, for example, supports 150 customer intentions and the customer autonomy rate reaches between 60% and 90% on simple calls according to the provider Calldesk¹⁵. The second challenge is to make it acceptable to customers to be called by CallBots. A use case is deployed by Orange in Eastern Europe with the Lekta AI solution for bill collection, in countries where it is common for a customer advisor to call for this type of action.

But for the main reasons of contact in customer service of an operator, i.e. installation help, technical assistance on internet boxes and bill explanation, the text or voice experience can be limited. For these customer cases, the implementation of vision on bots, thanks to the artificial intelligence technology 'Computer Vision', becomes crucial in a context of boom of video chat in customer service. By coupling computer vision to augmented reality, the user experience for installation or troubleshooting on internet boxes is simplified thanks to the indications on the connections to be made in superposition of the equipment filmed by the smartphone.

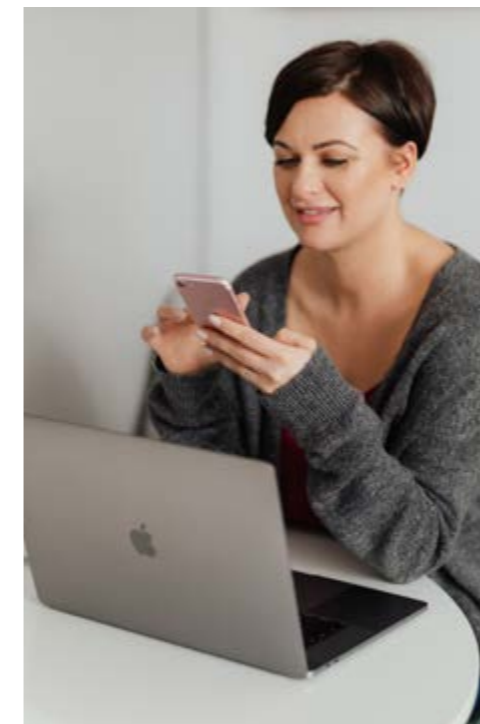
Augmented customer advisor

The other side of customer relationship virtualization is the impact on the customer advisor's job. The chatbots currently deployed by operators are capable of handling more than half of the conversations autonomously. The customer advisor's job is thus focusing on complex technical issues and augmenting it with new capabilities to achieve this.

This form of chatbot-customer advisor collaboration can be found, for example, in the ability of conversational AI to detect a customer's negative feeling and refer him to an advisor (e.g. Orange Bank with IBM Watson technology), to route customer requests to the most qualified agents (affinity matching), to issue recommendations or to transcribe conversations in real time. The advisor can even invite a chatbot into his or her conversation with a customer, as proposed by certain customer relations solutions such as LivePerson.

The result will be a shorter processing time and first contact resolution as well as a greater relevance of sales proposals thanks to a better focus of consultants on their technical and commercial skills rather than on tasks related to back-office processes.

Generative AI could enable autonomous management of complex contact patterns with learning directly supervised by customer advisors.



Towards a bi-directional collaboration between customer advisors and chatbots?

This collaboration remains unidirectional for the time being; customer advisors cannot enrich the knowledge of a chatbot without risking altering the performance of the conversational AI. Training a chatbot remains an expert activity and advisors can at best collaborate with development teams.

This AI, based on a machine learning architecture called "Transformer", is capable of creating answers from scratch by relying on knowledge acquired in other contexts (transfer learning). This means that it will be able to manage increasingly complex customer contact patterns autonomously, without necessarily having been pre-trained on these patterns.



Data and AI: What value for operators?



Coralie Muratet, Data & AI Practice Manager, Sofrecom

Organizations sometimes find themselves confronted with technological innovations which question their strategies and operating methods. Just like digital, (Big) Data and AI are among the innovations that change the rules of the game and push companies to reinvent themselves. While most telecom operators have embarked on this path, they have not necessarily managed to model with a high degree of confidence the value, in the sense of financial benefits, linked to data and AI.

A favorable context for value creation

Although neither of these technologies is particularly new, their continuous progress and the concomitant drop in the costs associated with their use, marked by an acceleration since the end of the last decade, have made their democratization possible. AI algorithms have indeed gained in performance by feeding on the ever-increasing volumes and variety of digital data, especially unstructured data, covering almost all areas of human activity.

The efficiencies of the hardware and software ecosystems that enable Big Data processing are now available to enterprises, which was once reserved for the research world: computing power at the (un)scale of AI, both cheaper and more powerful. While the cost of training a neural network to recognize images was as high as \$1,000 on a public cloud in 2017, it was only \$10 just two years later, in 2019¹⁷.

And this trend continues. Data explosion is also unlikely to end: in the next three years, more data is expected to be generated than in the last 30 years¹⁸.



In telecoms, the opportunity is huge

Telecoms are indeed among the most data-rich industries. According to IDC, 9% of all enterprise data stored in the world was created by telecoms and utilities¹⁹. Just like energy or water players, telecom operators provide essential services.

Unlike the AI technologies commonly used in Natural Language Processing, generative conversational AI feeds on unstructured data and can therefore be trained with huge databases with limited effort. Amazon, for example, tested generative conversational AI in the context of service in 2020 after testing it with 5 million responses from 350K customer chats, which is the equivalent of several years of experience for a customer advisor¹⁶.

In addition to having demonstrated a contribution in the flexibility of the training process and an improvement in customer autonomy, this experimentation materialized a probable evolution of chatbot-customer advisor interactions towards a bi-directional collaboration. Indeed, during this test, the advisor could select or modify an answer proposed by the AI without putting at risk the global understanding of the chatbot. In addition to saving time for customer advisors, this shows that customer advisors could increasingly support chatbots in their customer interactions.

Going further, we could imagine chatbots personalized by each customer advisor according to their own editorial and behavioral style (on the model of the Replika.ai service) and thus becoming true digital doubles.

Today, chatbots and AI are deployed in various forms across all customer relationship channels to handle simple customer cases and support customer advisors in handling complex cases.

New generative conversational AI technologies could change this paradigm by enabling bots to handle increasingly complex cases and by giving customer advisors an active role in improving the quality of the bots' interaction. We could see the emergence of fully hybrid conversational agents where each component - human or digital - would augment the other.

For the time being, operators must accompany these advances in conversational AI, which are synonymous with productivity gains and customer satisfaction. This requires to engage now in a transformation of the Customer Relationship orchestrated by AI.

Their customer bases can therefore represent significant fractions of the population and businesses in a given territory. Their data is therefore likely to have a certain statistical representation.

Fixed-mobile convergence, omnichannel and diversification into new services are also increasingly varied: operators' customers can often use their mobile or the Internet at the same time, watch IPTV, use mobile financial services and contact their customer service department through multiple channels (on the Internet, in a store or by telephone, in particular); each time, they generate data.

However, it is mainly because the networks and their equipment are the transit points for all digital exchanges, that the volumes and variety of data in the hands of operators are potentially gigantic. Of course, not all this data is intercepted or stored, and the data that is intercepted or stored is often anonymized and aggregated.

But the methods for collecting and analyzing this data - fortunately very well regulated in most countries - have existed for a long time, such as deep packet inspection (DPI).

Add to this the arrival of 5G and its promise of IoT data development, and the prospects for data valuation by operators quickly become dizzying.

The evaded question of value destruction

It is true that Data and AI arouse the fear of seeing certain jobs become obsolete, including - and this is the novelty - so-called "skilled" jobs, but operators were quickly relieved to realize that they were much less of a threat to them than digital was: they do not entail the risk of disintermediation, the appearance of new over-the-top entrants and, ultimately, the loss of revenue. This difference could be major in the speed with which operators will seize Data and AI.

The thorny issue of profitability

There are many examples of successful applications of data and AI in areas critical to operators: from fraud detection to planning network deployments to ensure the most profitable investments, from optimized management of network resources to increasingly personalized direct marketing campaigns.

But these concrete examples are not enough to estimate the profitability of Data and AI on a company-wide scale. And for good reason: once operators have identified the priority Data and AI use cases for their various businesses, they should ideally make several cross-functional expenditures to create the conditions for deploying these uses.

Vodafone highlights operational efficiencies equivalent to 3,500 FTEs.

In particular, they need an infrastructure that allows for collection and integration (sometimes in real time), storage (if not centralized, then at least avoiding duplication and favoring the cross-referencing of sources) and sufficiently rapid processing (increasingly deported to the edge of networks, or even embedded).

This infrastructure must be adapted to the governance of their data and its security, in compliance with regulations, particularly those concerning confidentiality and sovereignty. These investments potentially benefit all of the operators' data and AI use cases, and their costs should therefore ideally be shared between all the projects and entities that benefit from them. However, infrastructure expenses can represent a significant portion of operators' total Data and AI expenses, especially since models must be continually trained

with new data to remain efficient.

At the same time, operators must spend money on transforming their organizations, often going so far as to create entities dedicated to data and AI. In particular, they have to finance the required transformation of their employees, their acculturation, their skills upgrading or their evolution towards new professions, and recruit the skills they lack and which are often expensive, because the context is one of shortage.

Moreover, the exploratory nature of some of the projects around the data, the uncertainty of obtaining exploitable results, the fluctuating time of learning and the quality of the data itself make the cost of this common technical base and the expected value difficult to predict.

Finally, operators' spending is rarely confined to one technology or technique: the use of AI is often coupled with automation, especially in telecoms. Moreover, technology is only one lever among others to explain the creation of value: beyond the machine, there is of course and above all the human factor, the interactions between one and the other, the data without which the machine could not learn and many other explanatory factors. It is therefore complex, if not impossible, to use AI or data alone to enhance their individual contribution to the benefits of a company or a specific project.

Proving value by example

Even if the international operators communicating on the cost of their investments in the field of data and AI, as well as on the expected and actual returns of these investments, can be counted on the fingers of one hand, it seems that the efforts are beginning to bear fruit for some. At least, this is what the first of them to have invested significantly in the field are reporting.

For example, Vodafone points to operational efficiencies equivalent to 3,500 FTEs over the past 2 years thanks to robotics and AI²⁰ - no small feat for a group of 93,000 employees.

Telefónica²¹, for its part, launched Luca in 2016, a Big Data subsidiary aimed at enterprise customers, which has since become a Big Data and AI subsidiary. Shortly afterwards, Telefónica²¹ embarked on an ambitious strategy to create a "fourth platform" of cognitive intelligence, Aura, based on natural language, which was to become the orchestra conductor of an organization that until then had been structured around three components: physical infrastructure, information systems, and products and services. Telefónica's



financial communication didn't say much about the marginal cost of Aura, except that 48 billion euros would have been spent from 2012 to 2017 to finance the prerequisites for its creation. Little do we know about the revenues or cost savings that could be attributed to it; Telefónica preferring to communicate on the benefits of digitalization in general, to which it associates Big Data and AI, among other technologies. At the end of 2019, however, Aura claimed 3 million monthly active users and a deployment within 1000 use cases.

Even if the examples and figures are still few and far between, they constitute a precedent that has emerged quite recently. However, if the pioneering operators of data and AI start to see a tangible gain, and know how to express it on the scale of their company as a whole and not only of singular projects, it is certain that those who are less advanced will want to follow suit.

Data and AI spending continues

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According to Omdia²², more than 50% of operators plan to increase their spending on AI tools and data lakes in 2021, despite (or because of) the pandemic. Just as digitalization accelerated at a rapid pace in 2020 - offsetting years of cautious investment by operators in the field - so did the use of AI, to enhance engagement with consumer customers lacking access to traditional human channels (stores and contact centers, in particular).

A movement is also beginning to gain momentum among operators: the migration of part of their data and IS to the cloud and the few solutions on the market, mainly American. However, the issues of security, confidentiality and data sovereignty, to name but a few, have long been very strong brakes on this movement. But with the development of data and AI, other considerations seem to prevail.

First, the technical strategies adopted earlier by operators to extract value from their data, such as on-premise Hadoop architectures, have revealed their limitations and hidden costs. Second, the



cloud and its promise of elastic storage and computation have simplified access to resources and made much of their costs variable.

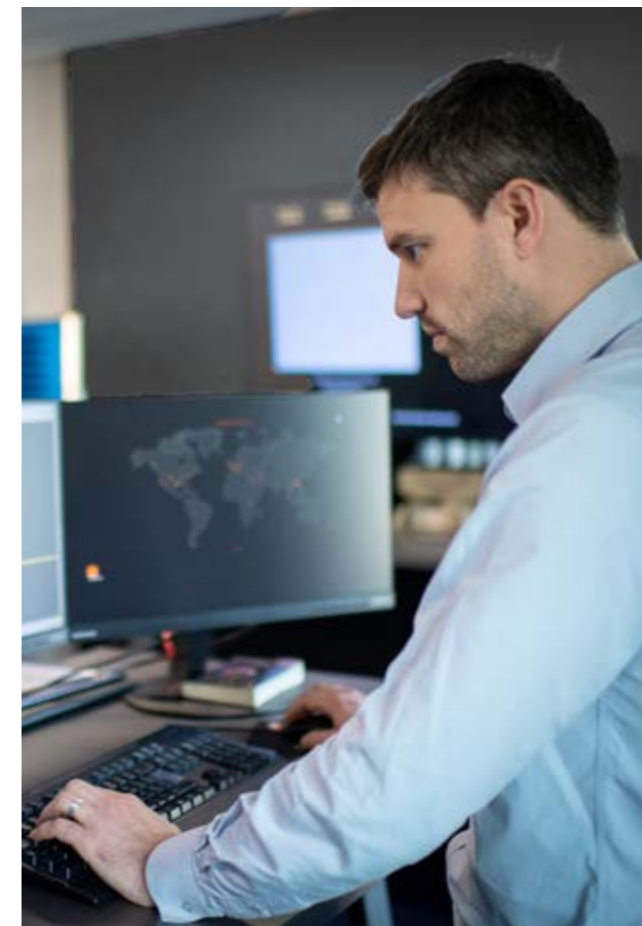
While the cloud is helping to control the costs associated with data and AI, the question remains as to the exact value of these technologies to telecom operators.

Data science: the pragmatic approach to AI



Mohamed El Mrabti, IT & Networks Maintenance Director, Sofrecom

Putting data at the heart of a company's decisions by adopting a "data-centric" approach is not trivial. Companies will have to face several challenges: skills, technological choices, organization... If Data Science has been on the rise in recent years, it is not by chance. This new discipline allows to structure projects thanks to a pragmatic approach.



The term AI encompasses data-driven challenges, opportunities and technologies. While the core technologies of AI have been around for several decades, it is only recently that interest in AI and its potential applications has accelerated among large enterprises. The advent of Big Data has profoundly contributed to this evolution, with an exponential increase in the ability to collect and process huge volumes of data.

One of the main challenges for companies now is which AI technology to go for. There are two main characteristics that help guide this choice:

- The research of reproduction, by artificial systems, of the cognitive capacities of the human being, not definable by rules in a simple way (example: facial recognition, vocal recognition, understanding of images...),
- The notion of learning (supervised or unsupervised) of the machine, i.e. its capacity to improve its performance from the autonomous and iterative analysis of its results (e.g.: prediction, fraud, anomaly detection, recommendation...)

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The different stages of Data Science

In recent years, the science of data analysis or Data Science has developed strongly. This new discipline allows the exploration and analysis of raw data to transform it into valuable information for companies. In other words, Data Science aims to put data at the heart of decisions!

Therefore, each step of this approach is key to making the best decision. We have identified **6 main steps** that we will illustrate with an example for a better understanding: customer churn (loss of customers or subscribers).

Understanding the business

This involves defining the business perimeter and expectations in order to reformulate the request and establish the precise framework of the study.

In our example, the challenge is to identify the customers with the highest risk of churn in order to better target marketing campaigns.

In the telecom domain, the data related to churn are the reasons (termination, suspension, portability...), the period and the type of churn (total or relative).

Knowledge and preparation of the data

It is important to master the information that will solve the problem. This step, which is often time-consuming, allows us to identify different categories of data: irrelevant data (duplicates, incomplete data, outliers, etc.), missing data, relevant data and data to be transformed for analysis.

In our example on customer churn, it is important to define the sources of the data to be collected, such as type of usage; revenues detailed by type of usage; calls to the service center, complaints and contract information (end date, duration, and segment).

Data analysis

The objective of this step is to cross-reference the different types of data and establish correlations between them. It can be interesting at this stage to explore the data using graphs and descriptive statistics in order to identify:

- Fields with atypical distributions (difficult to model);
- Highly correlated fields (keep the most relevant according to the business);
- Fields that need to be transformed for the analysis (number of modalities too high to be grouped, dates, time stamps...).

In our churn case, we need:

- Collect the identified data with a significant history (6 months for example);
- Define a certain number of indicators to look for possible correlations, such as the "churn rate" which determines the ratio expressed as a percentage of the number of customers who discard an offer;
- Draw a number of analyses such as: the churn rate is high for accounts with more lines and X% of customers cancel at least Y% of their lines; Z% of churn is related to line suspensions and high churns are more likely to come from customers who pay in cash, have no commitment contracts and very low data and roaming usage.

Knowledge modeling

This step corresponds to the machine learning phase where we choose the type of statistical model (supervised or unsupervised) to use.

There are many grids that allow to classify the learning use cases and the algorithms to be used to solve the associated problems.

Here are some examples:

<https://www.rankred.com/machine-learning-cheat-sheets/>

<https://docs.microsoft.com/en-us/azure/machine-learning/algorithm-cheat-sheet>

<https://www.hebergementwebs.com/news/beat-the-heat-with-machine-learning-cheat-sheet>



In this step, consider separating the data randomly into three subsets:

- The first set of data will be used to build the training model (training data);
- The second will be used to test the relevance of the model and choose the best one (test data);
- The third will be used to validate the model and evaluate the performance (validation data).

This allows us to build the models on the training data (optimized by the test data) and to keep the best performing one on the validation data.

In our example, after the cross-analyses of the data, we could conclude that the churn model should be used to:

- Prioritize at-risk customers in proactive retention campaigns;
- Assign a probability between zero and one to each customer (the closer the probability is to one, the more likely the customer is to leave).

For these use cases, the recommended algorithms are based on supervised learning. To choose, we could rely on one of the following algorithm selection help trees: Logistic Regression, Decision Trees, Random Forest, GBoosted Trees and Naive Bayes.

Performance evaluation of the different models before industrialization

At this stage, the aim is to select the best model, as the model selected at the previous stage is not

necessarily the best in terms of performance. Performance evaluation is a discipline in its own right. It requires strong skills in statistics (a possible method is AUC - Area Under the [ROC] Curve).

Industrialization

The ability of the data scientist to present the results in a clear and pedagogical way is at least as important as his ability to collect and analyze the data.

After selecting the best model, the company will have to decide to deploy it (performance in line with the objective), to improve it (by injecting more data) or to abandon it (the model has not proven itself (bad predictions)).

Each of these steps is crucial in the implementation of a "data-centric" project to give it every chance of success.

The implementation of a data science approach is not neutral and can disrupt the way businesses operate, sometimes for several years. Beyond the necessary data science skills, the success of a "data-centric" project depends on the company's ability to adapt its way of doing things, to change certain aspects of its organization by taking into account the results of the modeling.

Artificial intelligence to promote SOCIAL PROGRESS

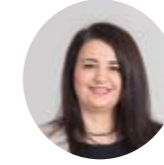
Artificial intelligence is destined to play an essential role in our daily lives. It has a great potential for social good. It offers unprecedented opportunities to find solutions to reduce poverty and reverse environmental degradation.

This potential of AI is reinforced by the increasing focus of companies and investors on social good: a growing number of real-world applications are emerging from these dynamics. If these scalable opportunities could be properly leveraged, AI could quickly accelerate the achievement of the United Nations' Sustainable Development Goals (SDGs).

However, the transformative power of artificial intelligence comes with complex challenges: trust issues including security inequality, and employment risks. Unprecedented collaboration among all stakeholders will be required to address these challenges.



Artificial intelligence can help bridge the digital divide



Claire Khoury, Marketing, Communication & CSR Director, Sofrecom

Launching participatory communication platforms for citizens without internet access, offering lifelong learning via digital technology to all populations, and putting AI at the service of essential sectors of activity are all solutions for reducing the digital divide and contributing to the social progress of humanity. As this approach is aimed at the most vulnerable people, it requires a reinforced ethical framework.

Worldwide, there are large disparities in access to health, education and many other areas. The UN Sustainable Development Goal #10 aims to reduce inequality by helping the world's most vulnerable people. According to a recent report by the Global System Operators' Association (GSMA), 80% of the population in developing countries own a cell phone, but nearly 1.7 billion women do not!

In wealthy countries, artificial intelligence and machine learning are becoming part of everyday life. People who live in connected places have access to the information they need to survive, as well as access to quality education and medical care. These advances remain out of reach for many of the world's poorly connected or unconnected populations, who risk missing out on the artificial intelligence and machine learning train.

These systemic challenges are based on a lack of infrastructure (insufficient number of cell phone base stations in the community, lack of means to acquire a cell phone) and a lack of appropriate content, not to mention prejudices related to ethnic origin, beliefs and culture.

According to the ITU, 2 billion people still did not have access to the Internet in 2020 and were therefore excluded from the artificial intelligence revolution. **So how do we bridge this divide?**

Insufficient exploitation of AI and Data

The inequitable distribution of information sources and content deprives a significant portion of the world's population of access to the information they need to succeed in life.





Ensure the representativeness of the data

According to a 2016 report by the United Nations Educational, Scientific and Cultural Organization (UNESCO), there are currently 758 million illiterate adults in the world, about two-thirds of whom are women.

AI specialists need to think of everyone when innovating in this field: for example, incorporate local languages that have few resources devoted to them, so that AI knowledge can be disseminated to more diverse populations.

From a gender equality perspective, particular attention must be paid to the data itself, so as not to further exacerbate disparities in the multiple communities where they are observed.



80%

of the population in developing countries own a cell phone



1,7 billion women do not have one



2 billion people still do not have access to the internet in 2020



The convergence of computing power and mega-data enables artificial intelligence applications that help bridge the digital divide and create an inclusive society.

In many systems, it is the engineers who choose the characteristics of the data from which the algorithms will build their models. Thus, although a computer is not inherently biased, the code it executes may contain assumptions that reflect the implicit or unconscious biases of its human authors. Therefore, exploiting artificial intelligence in its current state, without careful scrutiny by experts, risks widening the digital divide and harming the most vulnerable people in the societies concerned.

Providing participatory communication platforms

The massive digitization of human activities is producing a huge volume of data that artificial intelligence applications and solutions need.

The convergence of computing power and mega-data is enabling data scientists and engineers to create artificial intelligence applications and solutions that can solve increasingly complex problems. Many of these applications and solutions are helping to bridge the digital divide and create an inclusive society. For example, during the Ebola campaign in Sierra Leone in 2014, IBM Research (Africa) created a participatory communication platform for the country's residents to inform the government of their situation.

Providing lifelong learning

Artificial intelligence will remove repetitive tasks and "to thrive in a digital work environment, workers will need not only digital skills but also a variety of skills, both cognitive and socio-emotional," according to the 2019 edition of the Skills Outlook published by the Organization for Economic Cooperation and Development. In order to include all populations in the digital shift and the removal of repetitive tasks taken over by artificial intelligence, the OECD notes that "strengthening lifelong learning is key for all workers and citizens to adapt to changes in the world of work and society." The organization is therefore calling on governments to make training systems more responsive to changes in the labor market by improving the continuous training of teachers.

Putting AI solutions at the service of human capabilities

The most effective, but still under-researched, approach to leveraging artificial intelligence to bridge the digital divide is to combine AI solutions with human capabilities.

The Food and Agriculture Organization of the United Nations recommends, for example, that there be one agricultural extension specialist for every 400 farmers. In Africa, however, there is an average of one specialist for every 3,000 farmers. These specialists have proven critical to the transformation of agriculture in the United States, and they could play an equivalent role in the developing world.

Importance of ethics in technology implementation

Artificial intelligence experts have a considerable responsibility to work with the most vulnerable people in the world. It is imperative that they be ethical and transparent with these populations when implementing AI-based technologies.

In order for AI to deliver on its promises in the field, a framework on a number of practical issues needs to be defined. It is therefore up to governments to develop the means to understand and challenge all aspects of the data value chain.

As for artificial intelligence specialists, they will ensure that the population is well informed about the data they are exploiting. They will validate the way they analyze the data as well as the assumptions that underlie the insights derived from their analyses.



GAIT: The GSMA's initiative to reduce gender inequality in mobile usage

Interview with Aramé Awanis, Senior Insights Manager, Mobile Money, GSMA



Developed by the GSMA as part of the Women Connected program, the GAIT toolkit for machine learning and subscriber usage analysis provides mobile and mobile money operators with valuable information on the barriers that prevent women from accessing these services. It is a lever for digital inclusion for women and growth for operators.



What is 'GAIT' in a nutshell?

Targeted at Mobile Network Operators (MNOs) and Mobile Money Providers (MMPs), GAIT is a machine learning and customer analytics toolkit that analyses mobile and mobile money usage patterns to estimate each customer's gender.

Additionally, GAIT provides MNOs and MMPs with customer usage analytics, which can help them better understand the gender gap in mobile ownership and usage in their customer base, and take better informed action to close it.

Note that GAIT's initial version did not support mobile money data and did not have any usage analytics function. These two features are being added to the toolkit at the moment, as part of a project to upgrade GAIT.

Why and how was this initiative born?

GAIT was initially an initiative from the Connected Women, whose mission is to reduce the gender gap in mobile internet and mobile money services. To tackle this, the programme works with mobile operators and their partners to address the barriers to women accessing these services. The team initially commissioned GAIT because of a recurring challenge they were facing: the lack of accurate gender-disaggregated subscriber data at the MNO-level, which has been a consistent hindrance to assessing the magnitude of the gap, conducting sound usage analysis based on accurate gender data, as well as measuring operator progress.

While gender data is usually available at the country level, thanks to survey data, You can read more about it about GAIT's first version in the report about it: <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2018/09/GSMA-Gender-Analysis-and-Identification-Report-GAIT-August-2018.pdf>

What are the benefits it offers and to whom?

Accurately identifying your customers' gender composition is the first step in closing the gender gap. By enabling MNOs and MMPs to better understand the gender composition of their subscriber base, as well as gender-disaggregated behavioural patterns, GAIT really aims to reduce the gender gap in not only mobile handset ownership, but also encourage the uptake of services such as mobile internet and mobile money.

To us, this goal benefits all parties involved:

- **For women:** Greater digital and financial inclusion for women directly leads to a wide range of social and economic benefits, by unlocking access to life-enhancing services such as information, education, and more sophisticated financial

services. In turn, improving women's access to mobile money and the mobile internet can improve livelihoods and wider socio-economic circumstances of women, who are often disproportionately underserved compared to the general population

- **For MNOs and MMPs :** on-boarding more female subscribers directly leads to sheer growth in revenue and market share. Beyond "simply" handset ownership, the use of sophisticated services such as mobile internet and mobile money also means a higher average revenue per user.



How does it work technically?

GAIT comprises two core functions:

Gender identification – labelling each customer as either female or male. This is achieved via machine learning, implemented through three main stages:

- Step 1: Identify the gender of a representative subset of customers via a carefully worded telephone survey.
- Step 2: Build a predictive model based on the mobile usage patterns of this accurately-identified subset of customers. Mobile usage metrics used to compute this model include Call Detail Records (CDRs, including voice and SMS), internet usage and/or mobile money data.
- Step 3: Apply the predictive model to the remainder of the customer base, labelling each customer as female or male.

Usage analytics – a platform with a set of data charts dashboards to better understand customer usage patterns and inform strategic decisions. These consist of custom-made charts on customers' GSM (airtime, SMS, data) and/or mobile money usage patterns, broken down by gender. The platform includes three menus: GSM, mobile money and GSM vs. mobile money – the latter allowing users to observe correlations between voice, data and payments usage.

What evolutions of GAIT are planned, if any?

We have just upgraded GAIT's initial version to add the following features:

- GAIT now handles mobile money data, on top of purely gsm data. This makes it capable of measuring the gap in mobile money account ownership, but also usage
- It now has a usage analytics functionality, through a set of customisable charts dashboards.
- It is now simpler to use, and really doesn't require an advanced IT skillset.

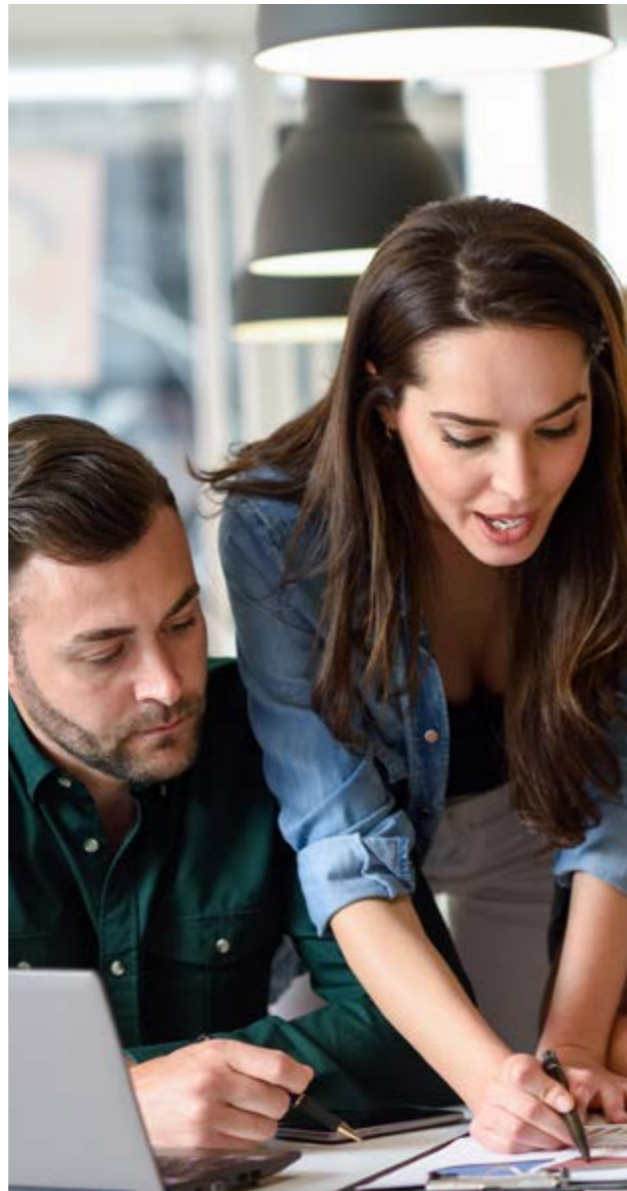
Is data and AI development impacting the GSMA missions or practices?

The GSMA has been supporting many data and AI-related initiatives, notably through our AI for impact initiative. We are very enthusiastic about the use of data and AI to achieve social good, especially in the context of the pandemic (initiatives that can help combat the pandemic).

This specifically involves supporting public-private partnerships between MNOs and governments. However, we are also very conscious of the data protection and privacy implications and have ourselves formulated some guidelines on this topic.

What about those of telcos, from your perspective?

Absolutely. Again, in the context of the pandemic, we have seen operators stepping in and supporting multiple initiatives to mitigate the impact of the pandemic, notably in developing countries.



Public-private partnership around mobile data: Assisting in managing the COVID-19 health crisis

Stefania Rubrichi, Data-AI Expert, Orange Innovation

Erwan Le Quentrec, Data-AI Expert, Orange Innovation

Zbigniew Smoreda, Data-AI Expert, Orange Innovation

The COVID-19 pandemic has presented to the world unprecedented challenges, calling on countries to take urgent and decisive action to address the health emergency and mitigate the associated economic and social consequences. In this context, mobile data has become a crucial source of support for decision-making.



Governments, public health authorities, and scientists are strongly committed to rapidly developing solutions to better address and combat coronavirus infections. These actions include the development of diagnostics, treatments and vaccines, as well as the use of technology and digital data. Among these, mobile phone data is part of the crisis management system. Federated by the Challenge Data for Development²⁴ and the flagship conference NetMob²⁵, the data generated by our cell phone uses have become one of the leading sources of accurate, near-real-time data for studies of human presence, mobility, and social interactions²⁶. In particular, their utility has been proven in many epidemiological settings^{27 28 29 30 31 32}.

Within days of the start of the epidemic, during the first wave, there was considerable pressure from a broad community of scientists who mobilized and called on governments and telecommunications companies to act. They argued for the need to access aggregated human mobility data³³, and cell phone data in particular³⁴, as a crucial source of information to better understand and control the spread of the COVID-19 virus.

At the same time, in March 2020, the European Commission promoted initiatives to mobilize anonymized and aggregated telecommunications data from EU mobile operators in the fight against COVID-19³⁵. Subsequently, in April, it published a roadmap for the gradual lifting of containment measures and supported the collection and use of this data to manage it³⁶.

As the epidemic worsens and containment policies are implemented, researchers and private companies around the world have joined forces and started working together to manage the epidemic. Some have focused on detecting and locating close contacts of infected people, others on identifying transmission 'clusters' or evaluating mobility restrictions and social interactions^{37 38 39 40 41 42 43 44}.

Orange Group, too, immediately deployed a taskforce to contribute to the COVID19 cause with several actions around the use of telecommunication technologies.

In this article, we report on a data sharing and use initiative between private and public sector actors in France that brought together researchers from the French National Institute of Health, Medical Research (INSERM) and Orange Labs in a collaborative research project. We review the main results obtained so far and analyze the issues, limitations and implications of this type of initiative.

The EVALCOVID-19 collaborative project

In March 2020, when the French National Research Agency allocated exceptional funding for a call for research on the epidemic⁴⁵, the INSERM-Orange Labs consortium was able to respond quickly with the EVALCOVID-19⁴⁶ project proposal, building on a collaboration already initiated on the Ebola epidemic in Africa.

This project proposes to use aggregated indicators on population mobility built in near-real time from the cell phone network to inform public health authorities throughout the successive phases of the epidemic.

The work began in the second half of March when the epidemic took hold in France with exponential dynamics. During this acceleration phase, heavy restrictions on mobility and social contacts through national containment were implemented, to delay and contain the epidemic and relieve the pressure on the health system. At this stage, mobility analysis is essential to identify the behavioral and societal dynamics that shape but also limit the extent of the

restrictions. To do so, we used indicators provided by Flux Vision⁴⁷ (Orange Business Services) and studied changes in French people's mobility behaviors in response to the epidemiological situation and the interventions imposed by the French government, at different spatial and temporal scales⁴⁸.

This study showed that confinement strongly reduced work- or school-related mobility, especially during peak hours, as well as long commutes. But these decreases were variable across regions because of demographic and socioeconomic factors as well as differences in industries (fig. 1).

In addition, significant reductions were observed in regions with the highest level of epidemics, suggesting that awareness of the risks may have strengthened the follow-up of recommendations. Highlighting these explanatory factors is important in order to best define current and future movement restrictions.

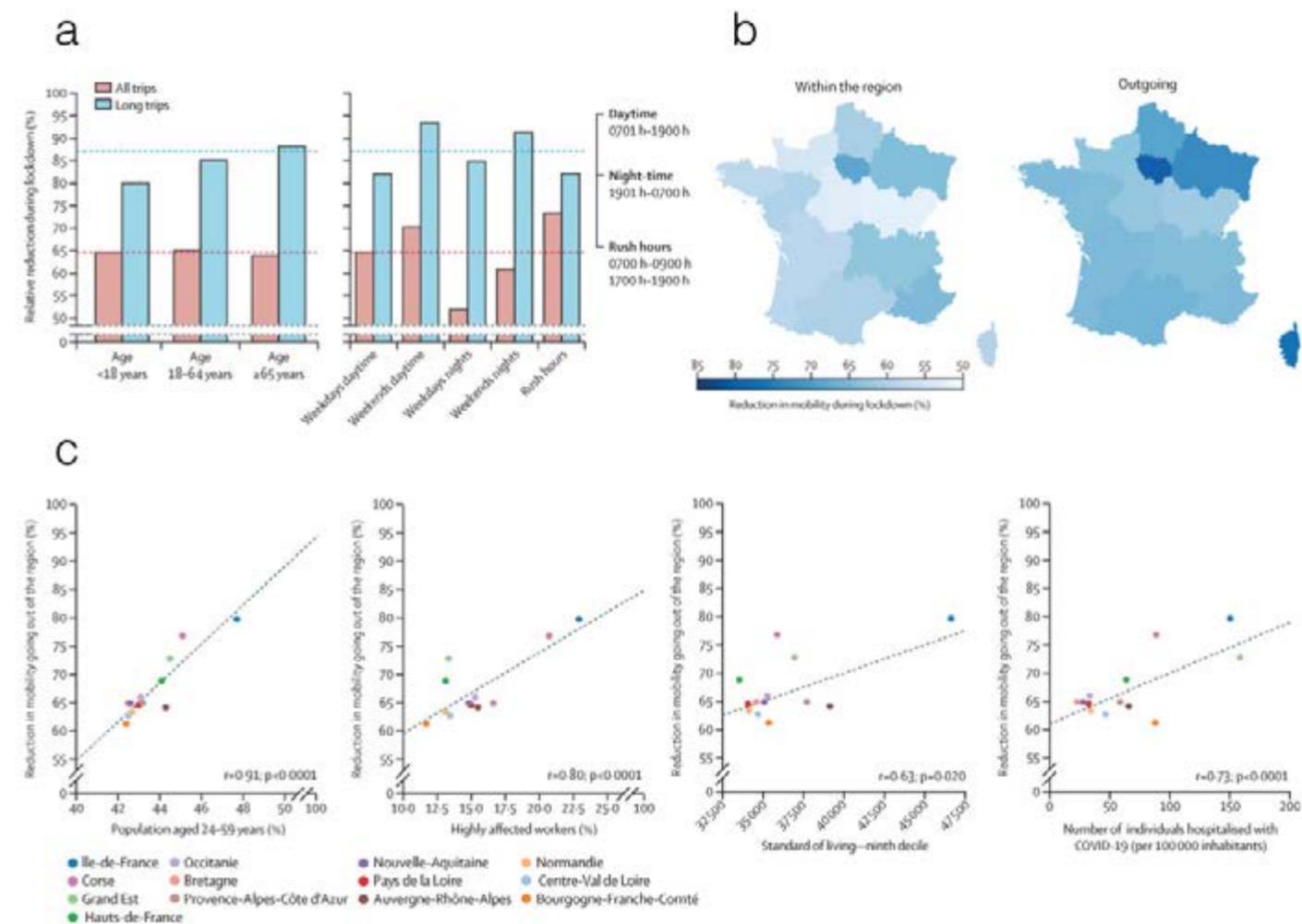
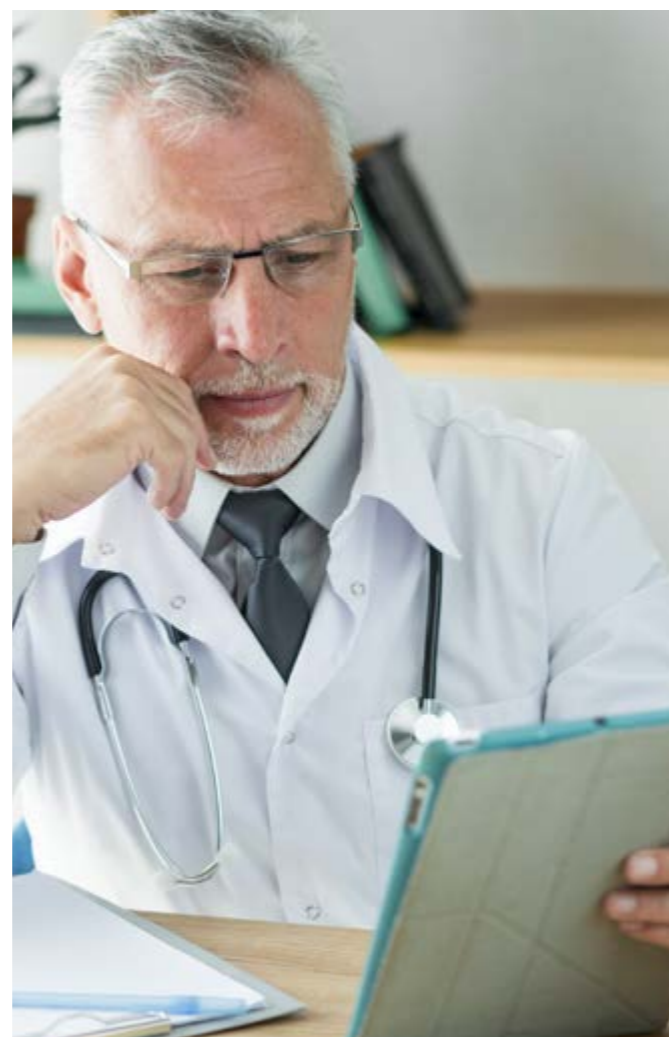


Figure 1. Mobility reduction induced by the first containment: (a) Mobility reduction by age, time of day, and (b) region; (c) mobility reduction by demographic, socioeconomic, and epidemic indicators.

During the decelerating phase of the epidemic, when the peak of infections was reached, the results of this first study were used immediately to precisely parameterize a stochastic transmission model based on age profile and social contact data⁴⁹. This model made it possible to (i) assess the situation of the COVID-19 pandemic in France according to short-term projections; (ii) assess the impact of containment on viral dissemination; (iii) explore possible exit strategies, in terms of type of intervention (which ones, which combinations), time (best time to implement them, duration) and space (which regions, departments); (iv) assess the capacity needs of the health system for all the epidemic situations below (fig 2).

This research, published quickly, was made available to public health authorities. When lockdown was eased in spring 2020, this work did not stop in order to monitor and anticipate possible rebounds.

As of the moment the article was written (early 2021), a new wave of the epidemic has hit the country, forcing authorities to introduce further restrictions. On October 17 and 24, a curfew was gradually implemented in 54 departments of mainland France. A second generalized curfew was implemented from October 30 to December 13, 2020. A national curfew is currently in place. Further restrictions are likely in the future, as vaccination is just beginning and new variants are circulating⁵⁰. The measures taken and their acceptance may change rapidly, justifying the perpetuation of the tools built⁵¹.

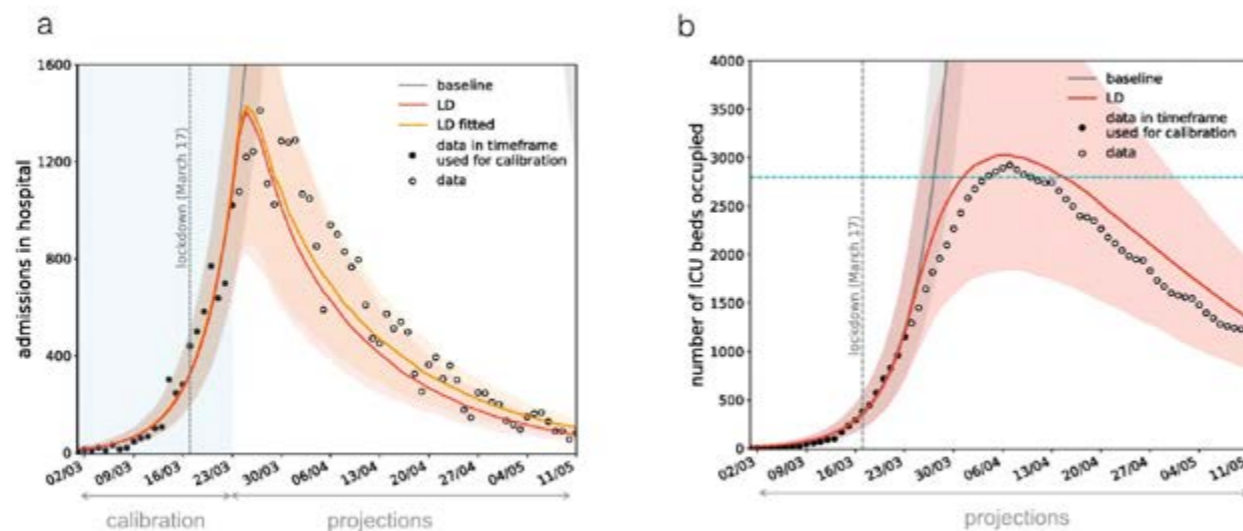


Figure 2. Analysis of the impact of the first confinement on epidemic activity in Île-de-France: (a) Calibration of the model on daily hospitalization data in Île-de-France before confinement and projections for the phase containment; (b) projections of the number of ICU beds occupied during confinement.

However, these solutions are proprietary and closed, so it is difficult to base public policies on them. At the same time, the idea of transparency also comes into tension with intellectual property law, as algorithms are akin to a trade secret, the disclosure of which could jeopardize a business model⁵⁸.

Finally, as with any system designed to meet other needs (in this case the tourism or transport sectors), the indicators are not necessarily always adapted to the specific context of the current epidemiological crisis. Adjustments must therefore be tested.

This pre-existing solution allowed an immediate response to the crisis. It was initially designed with regulatory and technological requirements in mind, particularly the e-privacy directive and its national transposition. Moreover, as a proprietary solution, the entire process of their construction is not shared from the outset, which may raise questions.

While the current crisis offers the opportunity to demonstrate the value of mobility indicators, it also highlights the problems of their governance.

54 Access and sharing of personal data: open ended questions

In this context, it is clear that rapidly delivered mobility indicators are an essential source of information for policy makers and authorities.

While the current crisis provides an opportunity to demonstrate their value, it also highlights the problems of their governance.

These indicators, built from our clients' uses, are very sensitive in terms of their collection, storage, use and even sharing. All of this raises legitimate questions in legal, economic and ethical terms⁵².

In the context of this collaborative research, only the aggregated, anonymized mobility indicators - in the form of origin-destination matrices - needed for the explicitly defined objectives of the project are shared between the two institutions.

More precisely, these indicators are produced by the commercial solution Flux Vision, based on the on-the-fly processing of cell phone data previously anonymized in accordance with strict

privacy requirements, audited by the French data protection authority (CNIL, Commission Nationale de l'Informatique et des Libertés).

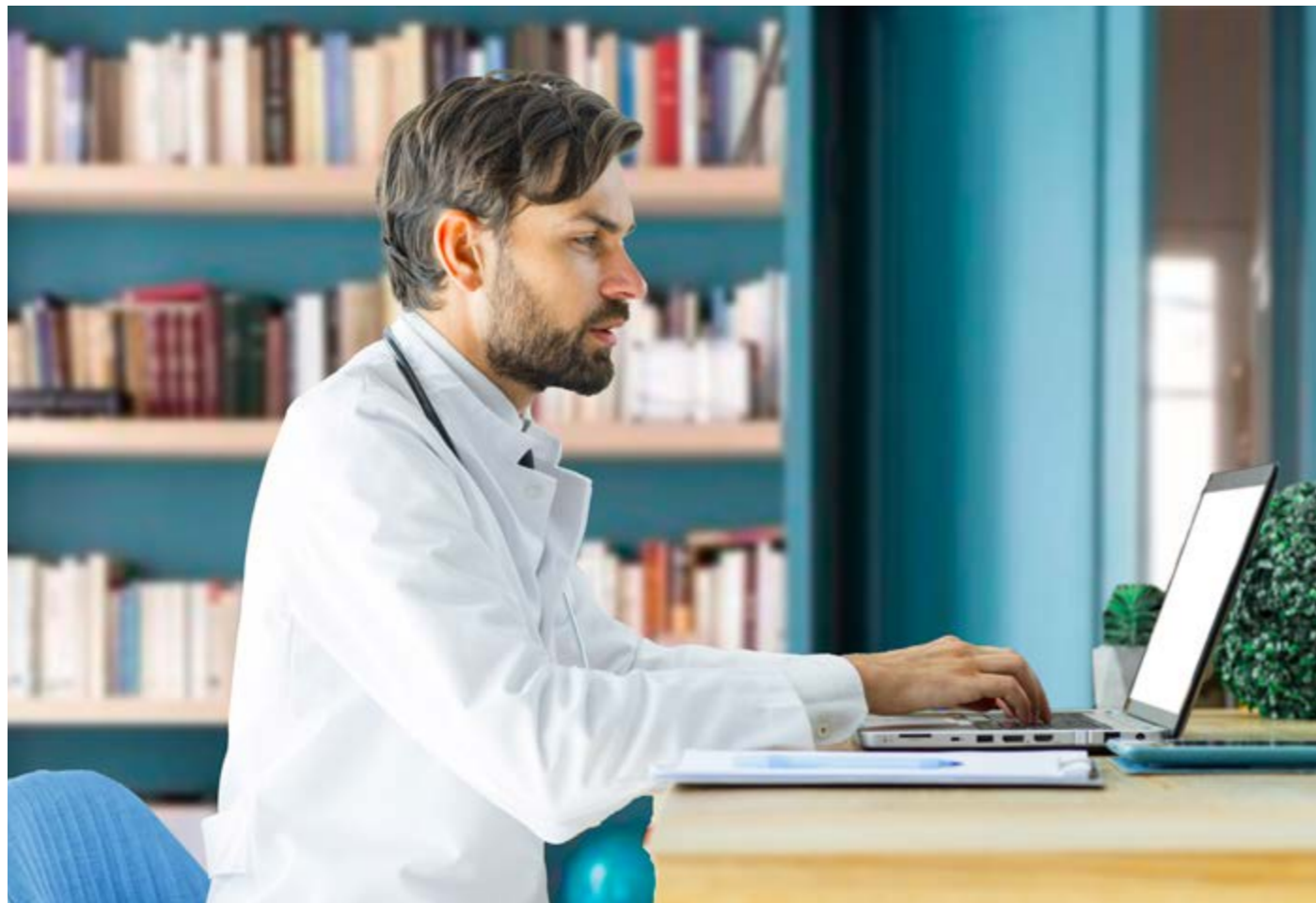
This pre-existing solution provided an immediate response to the crisis. However, it has some limitations.

It was initially designed taking into account regulatory and technological requirements, particularly the e-Privacy Directive⁵³ and its national transposition.

Moreover, as a proprietary solution, the entire process of their construction is not immediately shared, which may raise questions^{54 55 56}.

As the authors of the report Using Data to fight COVID-19⁵⁷ illustrate: "Some telecom companies, such as Telefonica with SmartSteps, Orange with FluxVision or Vodafone with Vodafone Analytics, have developed commercial systems and products.





A complementary approach could be based on secure access to pseudonymized data - in this case the call reports (CRA) already collected for billing reasons - following a 'privacy-conscious' usage model proposed by some researchers⁵⁹.

For example, it could be useful to mobilize indicators that aim to better understand the problem of mixing populations in time and space or to better qualify the semantics of displacement. Indicators that would be constructed in a transparent manner with all stakeholders on the one hand, while respecting the confidentiality of clients thanks to advances in algorithms on the other⁶⁰.

Despite numerous initiatives in recent years on best practices for a new model of sharing and using pseudonymized data that respects privacy, regulatory obstacles remain.

The current health crisis has reminded us of the urgency of addressing this issue⁶¹. On February 10, 2021, the Council of the European Union, which brings together the ministers of the member states,

reached a consensus for a final text on e-privacy regulations which authorize the use of metadata, in particular to monitor epidemics and their spread or in humanitarian emergencies⁶². It must, henceforth, be submitted to the European Parliament for deliberation and vote.

This ongoing research project is a reminder that the data in our networks contains singular uses that are also part of our commitment as a socially responsible company. Just like many projects were initiated out of a sudden as a result of an unknown disease, this one has condensed different issues and controversies around the use and sharing of personal data for research purposes.

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Challenges and advancements in the era of data and artificial intelligence published by

Sofrecom

24, avenue du Petit Parc
94307 Vincennes cedex, France
Capital social : 7 120 000, RCS Créteil

Publication manager:

Claire Khoury

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Graphic design :

Clémentine Marc, Aurore Guichard

Printing: Printed in France on site Imprim'Vert - PEFC FSC Papier Creator Silk Blanc 135g et 250g



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