Executive summary

Part 1 —
Building a Data-Focused Economic Policy

In this area AI heavyweights, such as China and the US, and emerging AI powers, such as the UK Canada and Israel, are developing extremely different approaches. Thus, France and Europe will not necessarily take their place on the world AI stage by creating a "European Google", instead they must design their own tailored model.

European Data Ecosystem

A whole range of uses and applications rely on the availability of data, so this is usually the starting point for any AI-based strategy. Yet data currently mostly benefit just a handful of very large operators, so greater data access and circulation will be required to restore a more even balance of power by extending these benefits to government authorities, as well as smaller economic actors and public research.

For this to happen, the public authorities must introduce new ways of producing, sharing and governing data by making data a common good[1]. This should involve encouraging economic players to share and pool their data, with the State acting as a trusted third party. In some circumstances, public authorities could impose openness on certain data of public interest. Meanwhile in Europe, a number of reforms currently underway must provide for greater access and wider circulation of data. The forthcoming revision to the directive on the re-use

of public sector information must provide an opportunity to speed up the opening of public data and outline the terms and conditions for access to personal data on public interest grounds. The current reform of EU copyright rules should at last authorize text and data mining and enable our public research to be more competitive.

This data policy must be designed with the aim of safeguarding sovereignty: it is vital for France and Europe to maintain a firm stance on data transfer outside the European Union. The AI strategy must also capitalize on the high protection standards enshrined in the incoming European General Data Protection Regulation (GDPR). Recent laws on individuals' rights to data portability[2] could therefore be part of a broader citizen-based rationale, to enable the State and local authorities to recover data with the aim of developing AI-based uses for public policy purposes.

Raising Visibility for AI Players

France has all the required assets to take its rightful place on the international arena, yet our companies and academic networks suffer from a lack of visibility both in Europe and overseas. Large companies sometimes opt to rely on dominant world actors in the sector, rather than entrusting their data to our home-grown talent, either because they are not aware of this wealth of skills within the country or because they prefer to adopt a very cautious approach. Our mission therefore suggests bringing together French AI actors under a unique and strong banner, which would include certifications and "innovation in the

1. Common goods refer to resources where use and governance are defined by a community.

2. Users' ability to receive their personal data for their own use or to transmit to another data controller.

field" awards aimed at singling out the most innovative AI solutions and attracting potential buyers.

This approach must also be set alongside a more organized approach to demand for AI, which could involve the creation of an information one-stop shop aimed at helping potential AI buyers outline their requirements more effectively and ascertain the companies that could best address their needs.

A Clear Policy to Focus on Four Strategic Sectors

It is vital to take advantage of our economy's comparative advantages and its areas of excellence in order to bolster the French and European artificial intelligence ecosystem. In this respect, our task force recommends avoiding spreading efforts too thinly, but rather focus on four key sectors: healthcare, environment, transport-mobility and defense-security. These sectors are all crucial from a public interest standpoint, all require strong impetus from the State, and they can all be the focus of interest and ongoing involvement from public and private stakeholders.

The business strategy for each of these sectors must allow for the creation and organization of ecosystems based on the different major sectoral challenges. Artificial intelligence should not be developed as an objective or an end in itself, but rather it must be a way to channel this energy to develop practical applications and uses that help improve our economic performances while contributing to the public interest i.e. early detection of diseases, the 4 Ps of healthcare[3], elimination of medical deserts,

emission-free urban transport, etc. These various business policy issues and challenges, each specific to its own sector, go beyond the boundaries of AI, but could help provide a ripe breeding ground for its development.

The second key point of this strategy involves setting up shared sector platforms, which must provide secure and tailored access for the various participants in these different ecosystems (researchers, companies, public authorities) to useful data for the development of AI, as well as to software resources and extensive computing infrastructure. In a public-private continuum, these platforms must enable the various stakeholders to develop new functionalities that are tailored to the individual features of each sector.

Lastly, it is vital to streamline the AI innovation track with the implementation of innovation sandboxes, involving three key features: a temporary easing in certain regulatory restrictions in order to give free rein to innovation, support for participants as they address their obligations and lastly resources for use in field testing.

The State Both Transforms and Shows the Way

It is vital for the State to be a key driver in these various areas of transformation. Public authorities must ensure that they adopt the necessary material and human resources to factor AI into the way they address public policy, with the aim of both pursuing modernization and acting as an example to be followed.

3. Personalized, preventive, predictive and participatory healthcare.

Executive summary

This transformation will obviously take time and the various ministries and government bodies display varying degrees of progress in the field of AI. An inter-ministerial coordinator role should therefore be created, devoted to implementing this strategy, with support from a shared specialist center consisting of around thirty staff tasked with acting in an advisory capacity for the different government bodies.

Meanwhile, public procurement needs to be reviewed: this budget is estimated at close to 70 billion euros for the State, public authorities and local bodies each year and it is insufficiently oriented towards innovation. Our task force recommends a number of measures aimed at using public procurement to support European industries and at breathing fresh momentum into innovative public spending.

Part 2 — Promoting Agile and Enabling Research

The French academic research is at the forefront of worldwide exploration on mathematics and artificial intelligence, but the country's scientific progress does not always translate into concrete industrial and economic applications. The country is hit by the brain drain towards US heavyweights, and training capabilities on AI and data science fall well short of requirements.

Bringing Academics Together Within Interdisciplinary Research Institutes on Artificial Intelligence

It is key to bolster our position worldwide on AI research by setting up a network of independent but coordinating Interdisciplinary Institutes for Artificial Intelligence within defined number of public higher education institutions. These bodies would house researchers, engineers and students, and should be located all across the country, each one devoted to specific aspects of AI, and with a very strong focus on an interdisciplinary approach, notably by including social scientists.

First and foremost, it will be crucial to attract French and international academics, and these institutes will therefore have to create an attractive working environment in order to effectively address competition from "Big Tech". They should therefore be set up as AI "free zones", with a considerable reduction in administrative formalities across the board, hefty salary top-ups, and support in improving quality of living. These institutes could offer full-time positions as well as intermediary affiliate status for researchers who remain in founding establishments.

It will also be important to attract private partners, such as large groups, SMEs and start-ups, which can deliver brand new AI solutions, by enabling them to train their own engineers, recruit premium quality engineers, and make or consolidate technological breakthroughs. A range of options could be provided to enable participants to get involved on a tailored basis, based on personalized framework contracts that provide for a simple fast-track cooperation process.

These institutes should heavily invest to increase the supply of attractive and diversified AI training programmes. The presence of internationally renowned academics with the support of premium teams,

the opportunity to interact with world-class corporations via internships and innovation competitions, multi-disciplinary training programmes with joint degrees, and scholarships for Masters' degree and Ph.D. students should help significantly boost the number of students taking AI training at these institutes.

Lastly, it is essential to take a nation-wide approach to coordinate this interdisciplinary institute network from both scientific and administrative standpoints, in order to ensure that they are run efficiently and transparently. From a scientific standpoint, this involves the coordination of seminars, pooling training resources, coordination of internships and consolidation of their results. Meanwhile, in administrative terms, this will involve assessing the red-tape fast-track provisions granted to all institutes and ensuring that each one benefits from this set-up, while keeping procedures streamlined and ensuring that each institute can operate independently.

Research Computing Resources

AI research institutes need to have the computing resources required to compete with the virtually unlimited resources of private dominant actors. To do so, our task force therefore suggests setting up a supercomputer designed specifically for AI usage and devoted to researchers and their economic partners during their shared initiatives.

This supercomputer is vital but should also be rounded out by an access package to a private cloud set-up, developed European-wide and tailored to meet the specific features of AI in terms of computing time and data storage space.

Make Public Research Careers More Attractive

It is unrealistic to try to compete with GAFAM's salary scale, but the gap is currently so wide that it tends to discourage young graduates, even those who are extremely interested in public research and contributing to the common good to join public research institutions. Doubling salaries in the early stages of their careers at the very least is a vital starting point, otherwise the pool of young graduates interested in higher education and academic research will definitively dry up. It is also important to make France more attractive to expatriate or foreign talents, with financial incentives for example.

Part 3 —
Assessing the Effects of AI on the Future of Work and the Labor Market, and Experiment Adequate Policy Responses

The labor market is undergoing vast changes, but it is not yet fully equipped to address it. There are considerable uncertainties on the effects of the development of artificial intelligence, automation and robotics, particularly on job creation and destruction. However, it looks increasingly certain that most sectors and companies will be widely reshaped. We are entering a new era of major technological transition and history shows us that previous periods of transition did not always run smoothly. Indeed, they sometimes involved drastic political

Executive summary

readjustment, which often hit the most fragile portions of the population the hardest. So it is important to face this issue head-on and take resolute action, while not giving in to panic or fatalism.

This firstly involves looking into the complementarity between humans and artificial intelligence: if we are to assume that, for most jobs, individuals will have to work with a machine, then it is vital to find a complementarity set-up that does not alienate staff but instead allows for the development of truly human capabilities, such as creativity, manual dexterity, problem-solving abilities, etc. This can take several forms. Firstly, it might involve a shift in labor relations to fully integrate digital challenges and develop a 'positive complementarity index'. More broadly speaking, legislation could be implemented to deal with working conditions at a time of increasing automation in order to factor in new risks. Lastly, formal education and lifelong learning should be overhauled in order to promote experimental teaching methods that can help graduates and staff develop the creative skills that are becoming increasingly vital.

Setting up a Public Lab for Labor Transformations

The top priority is to ensure that the ability to anticipate is sustainable, continuous and above all articulated with public policies. The publication of studies on the future of the labor market often sparks off fascinating collective debate, but does not always result in concrete actions, with public policy being only slightly adapted without fully taking into account the results of these forecasting exercises yet. Transformation can be extremely fast, while public policy implementation procedures are complex and difficult to steer. For example, professional training is worth 32 billion euros per year, with a vast array of funding channels and a whole range of different stakeholders involved.

It is therefore crucial to create a space where both prospective capacities, macroeconomic forecasts and analysis of changes in uses can be linked to concrete experimentation capacities articulated with actions aimed at certain categories of workers. A permanent structure could therefore be created to spearhead these subjects within labor and professional training public policy, with a twofold role: to anticipate and experiment.

This experimental approach can then be used to initiate logics different from those currently in force in vocational training, i.e. it is now broadly left up to employees, who take personal responsibility for their own training. Yet in light of the potentially swift or even exponential speed of transformation, it is difficult for current general programmes to incorporate all possible situations and take on board both the requirements of the entire population and the need for a fast but targeted approach. Furthermore, staff do not all react in the same way to the transformation of their jobs and do not all have the same ability to build a new career path.

In this respect, trials could be carried out to design programmes that target certain groups, whose jobs are deemed to be more at risk from automation and who would have more difficulty addressing their professional development without guidance. This approach involves moving somewhat away from the current strategy whereby employees

alone are responsible for their own career development.

Trying out New Professional Training Funding Methods to Successfully Deal with Value Transfer

Funding for staff training is calculated on the basis of a company's total payroll, yet the development of AI further promotes the transformation in value chains and reduce the link between those funding professional training and those who derive the value-added from it. Companies with a very small payroll can therefore create a large portion of the value-added in an overall value chain that they are responsible for extensively changing, e.g. by developing software for self-driving cars. Yet for the moment, they do not take part in funding the career transition of staff employed by other companies that operate across the value chain.

We therefore propose initiating dialogue with industrial partners on how value-added is shared across the entire value chain. This type of negotiation cannot be based on the usual formats for social dialogue, which mostly operate nationwide with a vocational branch approach. Trials could be organized by the International Labor Organization or sector social dialogue committees focused on products and value chains that are particularly affected by these value questions.

Training Talents in AI at Each and Every Degree Level

One clear target must be set: triple the number of people trained in artificial intelligence in France in the next three years, by ensuring that existing training programmes focus more on AI on the one hand, but also by setting up new programmes and new courses on AI on the other e.g. law-AI joint degrees, general modules, etc. All degree courses should be involved, i.e. 2-year, 3-year, Masters, Ph. D, etc.

Part 4 —
Artificial intelligence Working for a More Ecological Economy

Carving out a meaningful role for artificial intelligence also means addressing its sustainability, especially from an ecological standpoint. This does not just mean considering the application of AI in our ecological transition, but rather designing natively ecological AI and using it to tackle the impact of human action on the environment. This is an urgent matter as world data storage requirements, inherently correlated to the development of digital technology and AI, could exceed available worldwide silicon production out to 2040.

First and foremost, France and Europe can spearhead this smart ecological transition by raising awareness on the international arena. The primary task is to consider both the impact of AI on achievement of the UN's sustainable development goals, how it puts pressure on certain goals and how it can accelerate others. AI must be included in initiatives emerging as part of the Paris Climate agreement and the Global Pact for the Environment.

Players in both digital and ecological transition must join forces, which require setting up a devoted space for AI research and energy resource optimization research to meet, and

Executive summary

promoting projects at the crossroads of life sciences and ecology, climate and weather research.

Consumers must also play a part in making these technologies greener. Our task force therefore proposes the creation of a platform devoted to assessing the environmental impact of smart digital solutions. This platform should also include a simple calculator to enable all citizens to gain greater awareness of these impacts and compare the environmental footprint of the various products, services, software and hardware.

Fostering Greener AI

It is also important to tackle breakthrough innovation in the semiconductor sector, one of the physical building blocks of AI. In this respect, neuromorphic[4] technology can allow for considerable energy savings, and France is already a pioneer in this area.

Public authorities must also act to make the value chain greener and support the European cloud industry to promote its ecological transition. Some market participants already provide excellent examples of energy optimization and these best practices now need to be extended to the entire sector. A certification process could also be set up to reward the most outstanding solutions.

Lastly, making the AI value chain greener will clearly require open hardware and open software, which are not only a confidence indicator but can also lead to significant energy savings and provide inspiration for initiatives currently underway in Europe.

Dissemination of Ecological Data

The development of green AI is only feasible if ecological data can be open. So it is vital to make currently available public data open to all, both researchers and European companies alike, out to 2019 in order to develop AI solutions to promote ecological transition i.e. data on weather, agriculture, transport, energy, biodiversity, climate, waste, land registry and energy performance assessments. Access to more sensitive data could be managed on the basis of more specific situations, e.g. to address sector challenges. It is also important to open privately-owned data where necessary.

Part 5 — Ethical Considerations of AI

Recent AI-led progress across a number of sectors (self-driving cars, image recognition, virtual assistants) and its increasing influence on our lives are driving public debate on the issue. This debate included extensive analysis of the ethical challenges raised by the development of artificial intelligence technologies and more broadly speaking by algorithms. Far from the speculative considerations on the existential threats of AI for humanity, the debate seems to focus on algorithms that are already present in our daily lives and that can have a major impact on our day-to-day existence.

If we want to develop AI technologies that comply with our values and social

4. Neuromorphic chips are based on the workings of the human brain.

norms, then it is vital to act now to rally round the scientific community, public authorities, industry, business owners and civil society organizations. Our mission has endeavored to put forward some humble suggestions that could lay the foundations for the ethical development of AI and promote debate on this issue within society at large.

Opening the Black Box

A large proportion of ethical considerations are raised by the lack of transparency of these technologies. AI provides spectacular results for reasons that researchers sometimes have difficulty to explain: this is known as the black box phenomenon, where we can see input data and output data for algorithm-based systems, but we do not really understand what exactly happens in between. AI can reproduce bias and discrimination and is becoming increasingly present in our social and economic environments, so opening the black box is a key democratic issue.

Explaining machine-learning algorithms has become a very urgent matter and is now actually a separate field of research, which must be supported by public authorities. Three areas in particular require an extra focus: obviously the production of more explicable models, but also the production of more intelligible user interfaces and an understanding of the cognitive mechanisms used to produce a satisfactory explanation.

Transparency is clearly key, but looking beyond this issue, it is also vital to facilitate audits of AI systems. This could involve the creation of a group of certified public experts who can conduct audits of algorithms and databases and carry out testing using any methods required. These experts could be called on in the event of legal proceedings, during an investigation undertaken by an independent administrative authority or on request by the Defender of Rights (*Défenseur des Droits*).

Implementing Ethics by Design

Research staff, engineers and business owners who contribute to designing, developing and marketing AI systems play a decisive role in tomorrow's digital society, so it is vital that they act responsibly and factor in the socio-economic effects of their actions. With this in mind, it is important to make them aware of the ethical issues involved in the development of digital technologies right from the start of their training. This aspect is lacking in today's courses at engineering school and in universities' IT programmes, yet the extent and complexity of ethical issues these future graduates will face continue to grow.

Looking beyond engineer training, ethical considerations must be fully factored into the development of artificial intelligence algorithms. A discrimination impact assessment could be introduced, similar to the privacy impact assessments already made compulsory by General Data Protection Regulation for some data processing. The overarching aim here is very simple: have AI developers consider the right questions at the right time.

More broadly speaking, the increasing use of AI in some sensitive areas such as policing, banking, insurance, the courts and in Defense (with the question of autonomous weapons) raises a real society-wide debate and implies an analysis of the issue of human responsibility. We must also consider the role of automation in human decisions: are there areas where human judgement,

Executive summary

fallible though it is, must not be replaced by a machine?

Setting Up an AI Ethics Committee

Our mission recommends the creation of a digital technology and AI ethics committee that is open to society. This body would be in charge of leading public discussion in a transparent way, and organized and governed by law. It should work alongside sector committees and combine short-term considerations, such as economic and industrial impacts, with the ability to take a step back and take the long view.

Recommendations from the committee, which would operate entirely independently, could help inform researchers', economic players', industry's and the State's technological decisions. Its recommendations could act as a benchmark for resolving ethical matters (e.g. on self-driving vehicles) and hence provide a standard for AI developments.

Part 6 — Inclusive and Diverse AI

Artificial intelligence must not become a new way of excluding parts of the population. At a time when these technologies are becoming the keys to opening the world of the future, this is a democratic requirement. AI creates vast opportunities for value creation and the development of our societies and individuals, but these opportunities must benefit everyone across the board.

Parity and Diversity: Acting to Promote Equality

Despite the slow but steady feminization of scientific and technical sectors, digital technologies remain something of an exception, with gender balance still very far off. As digital technologies and, in the very near future, artificial intelligence become widely present in our lives, this lack of diversity can lead algorithms to reproduce often unconscious cognitive bias in programme design, data analysis and the interpretation of results. One of the major challenges of AI is ensuring greater representation within our societies.

Educational efforts on equality and digital technology are obviously vital, but greater diversity could also be achieved with an incentive policy aimed at achieving 40% of female students in digital subject areas in universities, business schools and their preparatory classes out to 2020.

All moves to promote diversity in digital companies could be further fostered by a nation-wide approach to promote diversity in technology via a national database aimed at documenting gender inequality in the workplace and the provision of funds devoted to supporting diversity in AI.

Developing Digital Mediation and Social Innovation to Ensure AI Benefits All

Given the extent of future AI-led transformation, we have a collective responsibility to ensure that no-one gets left behind. For everyone to truly benefit from breakthroughs made in AI, our procedures for access to rights must change and our mediation capabilities must also be considerably bolstered. So our mission puts forward a proposal to set up an

automated system to help manage administrative formalities, aimed at improving public awareness of administrative regulations and how they apply to each individual's personal situation. In addition, fresh mediation capabilities must be developed to support those who require help, in cooperation with care networks already present nation-wide.

Lastly, it is crucial that public authorities support the development of AI-based initiatives in the social arena. AI-led innovation capabilities remain very focused within a small number of companies. Setting aside healthcare, social fields receive only a tiny portion of private investment. This set-up for the AI-led innovation ecosystem has consequences on the speed of progress made in social matters. In order to redistribute these innovation capabilities, public authorities could embark on specific programmes to support AI innovation in the social arena and provide the necessary systems for the various parties in the sector so that they can benefit from AI-related progress.