

Policy and Investment Recommendations for Trustworthy AI

Commentary and Summary

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Commentary and summary:

Policy and Investment Recommendations for Trustworthy AI

Structure:

This document serves as a short overview of the [Policy and Investment Recommendations for Trustworthy AI](#). I introduce their background and purpose, and then dive into the main summary of the 33 recommendations.¹

Sometimes, I add commentary that does not reflect the original text. Commentary is indicated *in italics* to avoid confusion.

Note that while I aim for accuracy, nuances from the original document may get lost or slightly misrepresented in the summary. If you spot a gross instance of that, please let me know.

In short:

On the 26th of June, the European Commission's High Level Expert Group on AI, AI HLEG, (an independent advisory group to the Commission composed of 52 subject experts from civil society, academia and industry) published their Policy and Investment Recommendations for Trustworthy AI during the first AI Alliance Assembly in Brussels. In the document, the expert group put forward 33 recommendations, focussing on four sectors where the highest positive impact of Trustworthy AI could be had: society at large, private sector, public sector, and the European research and academic community and fields. Following they assess four main enablers to achieve this vision of Trustworthy AI: data and infrastructure, skills and education, appropriate governance and regulation, and funding and investment.

¹ These are, in turn, broken down into more granular recommendations indicated by the main number followed by .1, .2. I put those at the end of the document.

What do the Policy and Investment Recommendations build on?

The European Commission published a range of strategic documents within the past 2 years:

- **a ‘Communication on Artificial Intelligence for Europe’**

This [Communication](#) outlines the European AI strategy and was published in response to a call from the European Council. It lays out a three pronged approach for Europe: (i) to boost its technological and industrial capacity, as well as AI uptake, (ii) to prepare for socio-economic changes, and (iii) to develop suitable ethical and legal frameworks.

- **a ‘Coordinated Plan on AI’**

The [Coordinated Plan on AI](#) builds on the Communication on AI and the [Declaration of Cooperation on AI](#), effectively operationalising a European AI strategy. It is to be revised yearly and lays the foundation for coordination on AI between Member States and other stakeholder groups. It also invites cooperation with international stakeholders who share similar values.

- **a ‘Communication on Building Trust in Human Centric Artificial Intelligence’**

This [Communication](#) reiterates the goal of the European AI strategy: to develop human centric AI. In order to achieve this, trust in AI must be built across society and AI must be proven trustworthy. It is expected that Europe’s strong regulatory framework, in addition to adherence with ethical principles² will allow Europe to set a global standard when it comes to human-centric AI.

These documents serve to outline the greater strategic backdrop. The main foundation, however, for the Policy and Investment Recommendations can be found in the first deliverable of the AI HLEG, the [Ethics Guidelines for Trustworthy AI](#). Trustworthy AI, in this context, denotes AI that is: (i) lawful, (ii) ethical, and (iii) robust, both from a technical and a societal point of view. It equally refers to a human-centric approach, both during the development and deployment phase of AI³.

Charlotte’s notes: [In a report](#) earlier this year, I argue that Europe could become a leader in ‘ethical AI’. It is fantastic to see all the pieces, from Ethics Guidelines to concrete recommendations, coming together and fortifying Europe’s global position in that regard. Europe has a promising track record of working on standard setting, certification, and regulation within relevant areas (see e.g. the GDPR) which should be harnessed and applied to concrete governance efforts.

² As, for example, set out by the AI HLEG.

³ Respectively, throughout the AI lifecycle.

What is the purpose of the Policy and Investment Recommendations?

Building upon the Ethics Guidelines for Trustworthy AI, the Policy and Investment Recommendations aim to help materialise Europe's Trustworthy AI ambition, which includes the goal of harnessing the potential of AI while minimising its risks.

Charlotte's notes: What makes these recommendations especially useful is that they provide advice to all actors, ranging from governments, academia to SMEs. In addition, they often draw on, or point towards, existing frameworks that could be used (e.g. work done by the [High Level Expert Group on the Impact of Digital Transformation](#)), suggest a recommendation that is close to existing strategy, as evidenced by previous European Commission and Member State documents (e.g. efforts to up and re-skill individuals), or initiatives undertaken by budding groups within the ecosystem. Looping in the broader landscape in this manner helps to support the existing ecosystem, as well as to speed up implementation by avoiding duplication and increasing efficiency. At the same time, the recommendations critically identify areas where Europe lags behind and needs to drastically change its approach, e.g. when it comes to talent attraction and retention. Overall, they are balanced and honest about the status quo, which makes them a powerful and useful tool to take forward.

What is the content of the Policy and Investment Recommendations?⁴

I follow the outline of the original document. Chapter 1 contains four areas of impact: (A) Humans and Society, (B) Private Sector, (C) Public Sector, and (D) Research and Academia. Chapter 2 contains four enablers: (E) Data and Infrastructure, (F) Education and Skills, (G) a Governance and Regulatory framework, and (H) Funding and Investment.

⁴ Note that these are quite drastic summaries and may not at all times reflect the exact content of the original document.

Chapter 1: Areas

(A) Humans and Society

Artificial Intelligence (AI) can enable and empower individuals and society, yet, at the same time, it carries risks. New research, as well as novel mechanisms are needed to ensure that risks are minimised and society is safeguarded.

1. Empower humans by increasing knowledge and awareness of AI

It is vital that individuals (+ the larger society) are empowered with sufficient understanding of AI. They should be able to comprehend the limitations, as well as the capabilities of AI systems, which allows them to make informed choices and engage with the technology in a manner that safeguards their rights and shared values.

Charlotte's notes: The document later identifies in enabler (F), 'Generating appropriate Skills and Education for AI', that the necessary changes will most often be the responsibility of Member States' national or regional governing bodies, e.g. modifying school syllabi.

Finland's [Elements of AI](#) course is a good example for increasing the public's understanding of AI and has considerable success in attracting learners.

2. Protect the Integrity of Humans, Society and the Environment

AI must be used in a manner that supports the integrity of public institutions and individual's rights. In addition, it should be sustainable and environmentally friendly. To achieve this red lines must be drawn in cases where the application of AI could threaten the aforementioned, or contribute to harmful power imbalances.

*Charlotte's notes: It is timely to consider the environmental impact of AI, given the recent discussions around AI's carbon footprint (e.g. <https://arxiv.org/abs/1906.02243>). This recommendation also aligns with the requirement on societal and environmental well-being from the *Ethics Guidelines on Trustworthy AI*.*

3. Promote a Human-Centric Approach to AI at work

In this document, a human-centric approach to AI at work covers the workplace, as much as domestic and unpaid labour. While AI can support workers by taking up repetitive, dangerous or otherwise harmful tasks, it is widely debated to what degree AI could impact worker's well being and cause large scale automation. Emphasis should be given to encourage the former and prevent the latter. This section further refers to the [High level Expert Group on the Impact of](#)

[Digital Transformation](#) for more detailed analyses.

Charlotte's notes: I've heard worries that some groups are starting to co-opt the term 'human-centric AI' to denote AI system that act like humans. It is very clear that the AI HLEG does not mean this and truly aims to explore recommendations through which the human is put at the centre of this technology.

4. Leave No One Behind

The benefits of AI should be shared amongst all.

Charlotte's notes: While I think this is an important recommendation, I would've liked it to also speak about the global impact of AI, race dynamics, geopolitical tensions and cooperation, to ensure that truly no one is left behind. It might be valuable, more generally, to think about Trustworthy AI not only as a competitive advantage for Europe but as something that other countries could (and would want to) aspire towards and share. At the same time, I appreciate that this document's intention is to focus on Europe and that such an exploration would be outside of its scope.

5. Measure and Monitor the Societal Impact of AI

In order to build a beneficial future, we must understand and monitor the opportunities as well as the limitations of AI systems, including their impact on individuals and society.

Charlotte's notes: I'm very excited about using monitoring, measurement and metrics to keep track of AI progress more generally, to audit AI systems, and to inform policy making. It seems to be a promising way to test narratives and intuitions surrounding AI, as well as to better understand where AI might be in a couple of years and what sectors could be most impacted. Work along those lines is done by [EFF](#) and [AI Index](#).

(B) Private Sector

Small and Medium Sized Enterprises (SMEs) make up 56% of Europe's total turnover, yet, few make use of AI to scale. In order to yield the benefits of AI, a multi-stakeholder approach should be encouraged.

6. Boost the uptake of AI Technology and Services across Sectors in Europe

In order to keep pace with digitalisation, European industry need to harness and adapt AI. This could best be enabled through suitable policy and investment mechanisms.

7. Foster and Scale AI Solutions by Enabling Innovation and Promoting Technology Transfer

Technology transfer can support innovation and should be incentivised in Europe through e.g. establishing competitions, recognised standards or open access to FRAND terms⁵. Start-ups, scale-ups, SMEs, as well as larger companies must be supported, encouraging their competitiveness on a global scale. Europe's strength in B2B (business to business) should be harnessed.

8. Set up Public-Private Partnerships to Foster Sectoral AI Ecosystems

Networks comprised of various stakeholders can support the uptake and scaling of AI systems within given sectors and should be encouraged.

Charlotte's notes: Preliminary work towards an AI Public-Private Partnership in Europe was started by the BVDA (Big Data Value Association) and euRobotics. They published a SRIDA (Strategic Research, Innovation and Deployment Agenda) for the AI PPP (public-private partnership). Its recommendations are intended to identify barriers for European AI adoption and the highest potential opportunities, with steps to implement them and enable the AI PPP's vision. The document will be reviewed, discussed and updated with feedback from the broader European AI community.

Outside of Europe, Public-Private Partnerships are also gaining traction. Interestingly, the updated [US 2019 AI Research and Development Strategic Plan](#) adds a completely new section on Private-Public Partnerships to its 2016 version.

(C) Public Sector

The EU committed to modernise public administration during the Ministerial Declaration on e-Government adopted in Tallinn (2017).

AI should not replace human relationships within public administration, but instead assist governments to develop better services to the benefit of their citizens, maximise resources and encourage evidence-based policy making. Due to the sensitive areas in which AI can be deployed when it comes to public administration, as well as its access to information about individuals, it remains vital to keep trustworthiness at the core of all endeavours. Through its role as procurer, the public sector in Europe could incentivise the development of beneficial and trustworthy AI systems.

Charlotte's notes: The U.K. Centre for Data Ethics and Innovation ([CDEI](#)) recently closed a call for evidence to help review its work on online targeting and bias in algorithmic decision making. It will be interesting to see what type of evidence groups submit and how that will influence CDEI's thinking, potentially informing governments how to leverage calls such as these in the

⁵ FRAND: fair, reasonable and non-discriminatory

future.

9. Provide Human-Centric AI-based Services for Individuals

Ensure that the entire population can access public services through interfaces, while preserving personal privacy. At the same time, the option to engage with a human interlocutor should be available on public services, e.g. in instances of service failure or to avoid significant negative impact on individuals.

10. Approach the Government as a Platform, catalysing AI Development in Europe

Using European governments as a platform for legitimate stakeholders (civil organisations, research institutes and companies) to access reliable AI data. This can help AI development and ensure that training happens on reliable and accurate data. Educate public servants on data prioritisation, handling and processing.

11. Make Strategic use of Public Procurement to Fund Innovation and Ensure Trustworthy AI

Allocate significant funding for innovative AI solutions in government procurement. Develop and implement the necessary rules, processes and selection criteria to ensure that the AI being funded and deployed is trustworthy.

Charlotte's note: "[Regulatory Markets for AI Safety](#)." by Gillian Hadfield and Jack Clark may be a useful paper for readers interested in the broader topic area.

12. Safeguard Fundamental Rights in AI-Based Public Services and Protect Societal Infrastructures

It should be made possible to investigate governments' decisions and ensure that they were unbiased towards individuals where 'data-driven systems' were involved. AI employed by the public sector must be compliant with the Ethics Guidelines for Trustworthy AI. Individuals should be endowed with greater rights when it comes to the usage of their data for government decisions (e.g. how it informs the algorithm's decision). In addition, governments are encouraged to accelerate the development and deployment of bias prejudice detection tools through the facilitation and funding of relevant areas. 'AI-enabled mass surveillance' is to be ruled out.

Charlotte's notes: While sub-recommendations such as 12.2 go beyond the GDPR, an interesting take on its potential limitations with respect to a Right of Explanation might be found in this piece '[Slave to the Algorithm? Why a 'Right to an Explanation' Is Probably Not the Remedy You Are Looking For](#)', by Lilian Edwards and Michael Veale.

For an excellent analysis of AI used in the criminal justice system and its shortcomings, I recommend looking at the Partnership on AI's report on [Algorithmic Risk Assessment Tools in the U.S. Criminal Justice System](#).

D. Ensuring World Class Research Capabilities

Europe benefits from research excellence (both academic and institutional). This must be harnessed in light of promoting AI that is trustworthy and applied to global complex and societal issues. Future research should encourage Europe's competitiveness and growth, as well as be mindful to be inclusionary and diverse to sustain long-term societal well being. To that end, Europe's research community should strengthen ties with society and industry.

13. Develop and Maintain a European Strategic Research Roadmap for AI

Develop an ambitious research roadmap for AI alongside an implementation action plan. Research should be directed towards several high priority areas: human-centric applications (future of health, work, mobility and industry); high-value opportunities (Cyber-physical-systems, robotics, algorithms for IoT chips and hybrid AI); and research that helps AI products meet Trustworthy AI requirements. These examples are expected to change as a result of research and technological developments. Appropriate adaptations should be made to the roadmap through bottom-up and top-down processes of government policy making and stakeholder consultations.

Charlotte's notes: The [European Processor Initiative](#) is engaged in an existing research programme subtly different from these goals, designing the processors to run AI algorithms more efficiently rather than designing the algorithms to run on the chips. This could be seen as an opportunity of high strategic value for the EU.

14. Increase and Streamline Funding for Fundamental and Purpose-Driven Research

To implement the 'Strategic Research Roadmap for AI', Europe's funding environment requires changes. Research may be fundamental or purpose-driven, including research challenges (e.g. the UN Sustainable Development Goals), and necessitating 'dedicated, significant and long-term research funding'. Barriers between academic silos should be reduced, allowing for greater mobility between education programmes (or through the introduction of more interdisciplinary programmes). The time taken for academic research to reach industry may be reduced through 'mixed academic-industrial transfer labs', primarily funded by industry and supplemented by public funding. Commercialising research outputs should improve the global competitiveness of European AI.

15. Expand AI Research Capacity in Europe by Developing, Retaining and Acquiring AI Researchers

Europe should harness the attractiveness of its ambition to undertake sustainable, ethically aligned and Trustworthy AI research and ensure that this inspires (young) researchers to contribute.

Charlotte's note: This recommendation identifies a pro for researchers to move to (and/or stay) in Europe and strikes me as a good strategy/narrative to pursue. Mega-projects such as a '[CERN for AI](#)' (if indeed [built in Europe](#)) could further inspire younger researchers to contribute to the European ecosystem and build something that has potential high impact locally as well as globally.

16. Build a World Class Research Capacity

Europe houses a variety of large research centres and laboratories (commonly referred to as Centres of Excellence). Nevertheless, to achieve major breakthroughs and apply AI to global complex challenges, Europe's capacity in this area needs to be strengthened, with proportionate focus given to local, large scale pan-European and distributed efforts.

Chapter 2: Enablers

To achieve the topics outlined in Chapter 1, the AI HLEG proposes four enablers: (E) Data and Infrastructure, (F) Education and Skills, (G) a Governance and Regulatory framework and (H) Funding and Investment.

E. Building Data and Infrastructure for AI

To scale Europe's AI capacity, the availability of data and computing infrastructure must be fostered. For the former, infrastructures need to be built to allow for safe and secure data exchange and usage. In addition, the Expert Group considers data donation schemes to allow personal data to be used for beneficial AI applications.⁶ For the latter, edge computing is considered as a particularly interesting platform, given its privacy preserving capabilities. In addition, it is suggested that Europe should focus on cloud infrastructure as well as cybersecurity policies and expertise.

17. Support AI Infrastructures Across Member States

The Digital Innovation Hub (DIH) networks should facilitate the building and maintenance of technical infrastructure, as well as support skilled workers. Infrastructure should include cloud computing and edge computing with suitable hardware, connected by fast networks. This may require significant investment in fundamental research. It is suggested that Member States should build upon recommendations from the 'Electronic Leaders Group' and other initiatives where appropriate.

Charlotte's note: 30 DIHs in the field of AI were selected following a call by the EC. These AI-specific Hubs are expected to kickstart a network for collaboration across the EU, will be involved in training programmes, and support the preparation of relevant EU policies.

18. Develop Legally Compliant and Ethical Data Management and Sharing Initiatives in Europe

In order for all to benefit⁷ from data and its usage, e.g. in deep learning, Europe should build a "safe, secure and high quality data infrastructure". At the same time, varied approaches must be pursued when handling personal or non-personal data.

Charlotte's notes: The European Council recently adopted new rules to make publicly funded data more available, which could be seen as a data sharing initiative. They share similar goals, recognising the value of data in the EU economy, its potential for job creation and leveling the playing field between big tech companies and SMEs. It also extends beyond data held by the

⁶ These would pay special attention to privacy and data protection rules and regulation.

⁷ E.g. AI applied towards projects in line with the Sustainable Development Goals.

public sector, including publicly funded (but privately held) research data and centralising already available datasets.

19. Support European Leadership in the Development of an AI Infrastructure

The current dependency on non-European providers could end up putting data and IP at risk, as well as stifle European innovation, hardware and compute development and infrastructure.

20. Develop and Support AI-Specific Cybersecurity Infrastructures

Europe should develop an AI specific cybersecurity policy that is user centric, taking into account both: AI's role as a solution to cyberattacks, and as a system that is open to cyberattacks.

Charlotte's note: I recommend reading the [Malicious Use of AI report](#) to readers who wish to delve deeper into some of these issues.

F. Generating appropriate Skills and Education for AI

Europe should foster skills, education, increase existing talent pools and promote the uptake of STEM subjects from pre- to higher education. Ensuring that children and the wider population are well-informed may help with positive applications of AI in the future. In addition, workers must benefit from appropriate reskilling and upskilling efforts to be able to engage with a changing work environment. All of this will require significant changes to the current education system and benefit from a multidisciplinary approach.

21. Redesign Education Systems from Pre-School to Higher Education

Digital literacy initiatives will need to be further supported and developed. This includes a strengthening of people's 'human-centric' skills such as socio cultural, entrepreneurial or other complementary skills. Educators, too, should receive training to better their skill sets when it comes to teaching. A reference framework for this is provided by the DigCompEdu framework of the European Commission. AI should be used as a vehicle to increase the reach of education and provide a more bespoke learning environments for individuals.

22. Develop and Retain Talent in European Higher Education Systems

Europe needs to attract and develop AI talent across all disciplines, education levels (primary to tertiary) and fields (cross-sectorial). Though education syllabi remain broadly the remit of Member States' governments, a 'European Curriculum for AI' could harmonise efforts across both borders and disciplinary silos.

23. Increase the Proportion of Women in Science and Technology

Europe should make efforts to close the gender gap in the digital sector to harness its talent pool, currently costing the European economy EUR 16.2Bn⁸. Policy should utilise gender budgeting tools and quotas, targeting 30% female talent in the AI workforce, higher education and eco-systems by 2030

Charlotte's note: This recommendation includes a reference to support Women in AI coaching and networking initiatives. Existing initiatives like [Women Leading in AI](#) receive sponsorship and support predominantly from tech companies. Government support may be appreciated in addition to, or in place of private sector sponsorship, potentially allowing greater freedom from the interests of big tech companies or evading questions as to the impartiality of the work undertaken.

24. Upskill and Reskill the Current Workforce

AI requires upskilling and reskilling on an unprecedented level to mitigate the impact of displacement and to help workers adapt to a human-machine workplace. Employers should be incentivised and rewarded for AI and data related reskilling plans, and employees should embrace a 'work-life-train' balance.

25. Create Stakeholder Awareness and Decision Support for Skilling Policies

The main European stakeholders defining education and training priorities need to take the effect of AI on the labour market into account, and, equally, receive support to design effective policy measures (incl. e.g. training and career guidance for workers).

G. Establishing an Appropriate Governance and Regulatory Framework

Europe must establish a governance and regulatory framework that promotes 'socially valuable AI'. This should be in line with the criteria outlined for Trustworthy AI: ethics, robustness and lawfulness, safeguarding against unacceptable harm to individuals and society.

26. Ensure appropriate Policy-making based on a Risk-based and Multi-stakeholder Approach

Authorities should first assess and categorise risks associated with AI. The highest risk domains should be prioritised and precautionary measures should be put in place to avoid unacceptable risks. Risks may differ even where the same technology is concerned, requiring

⁸ "I'd blush if I could - UNESCO Digital Library." <https://unesdoc.unesco.org/ark:/48223/pf0000367416>. Accessed 4 Jul. 2019.

segment-specific measures to address nuances of the market or deployment (B2C, B2B, P2C) of AI.

27. Evaluate and potentially revise EU laws, starting with the most Relevant Legal Domains

Evaluation of existing EU laws should address: (i) how AI systems impact policy and legal objectives; (ii) whether existing frameworks can provide 'meaningful and effective oversight' to meet legal and policy objectives; and (iii) whether existing legislation promotes the ethical criterion of Trustworthy AI. The document makes recommendations specific to civil liability and accountability, criminal law, consumer protection, data protection, non-discrimination, cyber-security and competition.

28. Consider the Need for new Regulation to ensure Adequate Protection from Adverse Impacts

Investigate areas where new regulation is required to address the concerns identified in the Ethics Guidelines for Trustworthy AI on a continual basis, with special attention on Lethal Autonomous Weapons Systems (LAWS) and AI personalised to children's profiles. This should extend to the private sector where there is potential for significant impact, mandating a Trustworthy AI assessment.

29. Consider whether Existing Institutional Structures, Competencies and Capabilities need Revision to ensure Proportionate and Effective Protection

Adapt policy-making to reflect the agility of AI development and deployment with agile policy-making, e.g. by using regulatory sandboxes. Engage with the affected stakeholders in discussions around unacceptable harm and red lining. Do not grant legal personalities to AI systems or robots.

Charlotte's notes: Although Europe previously toyed with discussions [surrounding legal personhood for robots](#), these discussions ceased. Outside of Europe, the most prominent case is that of Sophia the robot receiving honorary citizenship from Saudi Arabia, which (understandably) got less than thrilled reactions from the AI community.

Inspiration could be taken from 'corporate personhood', where liability may be held, and thus limited to a business. This tends to offer a limit to financial liability, while individual actors within a business are still held accountable for illegal actions they carry out. This topic also reminds me of [a policy I researched years ago](#) which granted legal personhood to a river in order to protect it while empowering the Maori guardians. A similar mechanism may be suitable when it comes to questions of liability and responsibility in light of increasing technological capabilities (and potential 'independence' from a human operator).

30. Establish Governance Mechanisms for a Single Market for Trustworthy AI in Europe

Ensure the success of European companies both locally and against global competition through new regulatory frameworks, harmonising legislation across the EU with greater cooperation between Member States. Encourage and fund private organisations to pilot the Trustworthy AI guidelines and provide guidance on applicable laws and standards related to Trustworthy AI.

H. Raising Funding and Investment

Recommendations are to address the shortfall of investment in European businesses (receiving only around 11% of global VC funding, significantly behind the US and China), and to explore methods to grow private investment from €2.4-3.2Bn in 2016⁹ to €20Bn+ over the next decade. This funding should be directed towards the development of Trustworthy AI.

Charlotte's note: This reflects ambitions outlined in e.g. the [Coordinated Plan on AI](#) and other strategy documents from the European Commission.

31. Ensure Adequate Funding for the Recommendations put forward in this Document

Funding should be secured for (non-exhaustively) the re-training and skilling required as the job market and workplace change, to the InvestEU programme for AI, public funds to support Multi-Stakeholder Alliances, for public procurement for innovative AI, for AI research, data infrastructure, and to create and distribute Trustworthy AI resources (e.g. contributing to the guidelines, sharing best practices, helping to set standards and creating a repository of useful resources).

32. Address the Investment Challenges of the Market

European businesses should be supported in becoming first movers and capturing significant market share in a 'winner-takes-all' digital economy. Public initiatives should be established with the goal of attracting and leveraging private investment, increasing the awareness of European SMEs and ensuring funding avenues are available from early level (series A) funding through to Series C and D extending beyond €100M.

33. Enable an Open and Lucrative Climate of Investment that Rewards Trustworthy AI

The EU should be made an attractive and open environment for innovators and investors. This could be achieved by encouraging collaboration between the European Commission and

⁹ "Factsheet AI - Euralarm."

https://www.euralarm.org/download/87_e78189598ff22b4a957c46350831c66c. Accessed 4 Jul. 2019.

financial institutions to build new investment guidelines, aligning with the Ethics Guidelines for Trustworthy AI.

Conclusion: Summarising the Summary

This document builds upon and complements the earlier deliverable from the AI HLEG, the Ethics Guidelines for Trustworthy AI, which lists three components as criteria for human-centric AI made in Europe: (i) lawfulness, (ii) ethical adherence, and (iii) robustness. The Policy and Investment Recommendations note specific areas where European and national laws should be extended, as well as how the regulatory landscape would be surveyed. Meanwhile, the strategic recommendations tackle investment, signpost high value areas, outline barriers to break down and examine existing funding channels to utilise in order to support public and private bodies in their adoption of Trustworthy AI.

The Policy and Investment Recommendations represent the second deliverable of the European Commission's High Level Expert Group on AI. Their Assessment List¹⁰ is currently piloted across Europe and [participation is highly encouraged](#).

Granular Recommendations

¹⁰ The assessment list is part of the Ethics Guidelines for Trustworthy AI.

1. Empower humans by increasing knowledge and awareness of AI

This could be achieved through: 1.1. Encouraging Member States to increase digital literacy through courses (e.g. MOOCs) across Europe providing elementary AI training; 1.2 Encourage Member States to support and further develop basic education on AI and digital literacy, particularly in primary, secondary, and tertiary education systems, as well as beyond; 1.3. Create an AI competence framework for individuals, including a focus on the core skills required; 1.4. Institutionalise a dialogue between policy-makers, developers and users of AI technology, for instance through the AI Alliance¹¹; 1.5. Inform the public at large about freely available resources on AI that they can use to learn and experiment (e.g. algorithms and data), to discuss (e.g. via blogs) and to share best practices; and 1.6. Establish a yearly European AI Awareness Day.

2. Protect the Integrity of Humans, Society and the Environment

This could be achieved through: 2.1. refrain from disproportionate and mass surveillance of individuals; 2.2. Commercial surveillance of individuals (particularly consumers) and society should be countered); 2.3. Consideration should be given to power asymmetries between institutions, businesses and individuals arising from the growth of digital devices and systems and the rapid expansion of digital data that they generate; 2.4. Introduce a mandatory self-identification of AI systems; and 2.5. Foster the development of AI solutions that address sustainability challenges.

3. Promote a Human-Centric Approach to AI at work

This could be achieved through: 3.1. Promote the research, development and deployment of human-centric AI systems in work contexts without stifling socially beneficial innovation; 3.2. Encourage automation of dangerous tasks and when humans are put at risk; 3.3. Apply a process of representation, consultation and, where possible, co-creation; 3.4. Map value chains in Europe and engage in horizon scanning to gain an understanding of which skills will become less relevant, and which ones will be more in demand or at risk of shortage; and 3.5. Establish a full-fledged European transition fund to help managing the AI transformation in a socially responsible way.

4. Leave No One Behind

This could be achieved through: 4.1. Introduce a duty of care for developers of consumer-oriented AI systems to ensure that these can be used by all intended users, fostering

¹¹ Charlotte's note: The European AI Alliance, is built around a diverse multi-stakeholder online platform. There, members can contribute to ongoing discussions on AI, feeding into the European Commission's policy-making. They can also directly engage with the AI HLEG, which publishes its draft suggestions on the platform for feedback. The European AI Alliance is open to all members of society.

a universal design approach; 4.2. Encourage the development of AI tools and applications that are specifically targeted to help vulnerable demographics; and 4.3. Establish a European Strategy for Better and Safer AI for Children.

5. Measure and Monitor the Societal Impact of AI

This could be achieved through: 5.1. Encourage research and development on the impact of AI on individuals and society; 5.2. Support research and the development of tools to enable independent testing of AI systems by civil society organisations and other independent parties to inform individuals; and 5.3. Establish monitoring mechanisms at national and EU level to continuously analyse, measure and score the societal impact of AI.

6. Boost the uptake of AI Technology and Services across Sectors in Europe

This could be achieved through: 6.1. Earmark significant resources in the InvestEU programme to support the transformation of European enterprises towards AI-enabled solutions; 6.2. Create an easy avenue for start-ups and SMEs to funding and advice; 6.3. Foster the availability of legal and technical support to implement Trustworthy AI solutions that comply with the Ethics Guidelines; and 6.4. Encourage companies to form partnerships with training programmes addressing all levels of AI training.

7. Foster and Scale AI Solutions by Enabling Innovation and Promoting Technology Transfer

This could be achieved through: 7.1. Boost the development and growth of AI technology firms in Europe through the InvestEU programme; 7.2. Facilitate the transition of AI solutions from research labs to testing environments and to commercial markets; 7.3. Create an EU-wide network of AI business incubators that connect academia and industry; and 7.4. Stimulate beneficial innovation by funding EU hackathons, competitions and industry challenge-driven research missions in AI across various sectors.

8. Set up Public-Private Partnerships to Foster Sectoral AI Ecosystems

This could be achieved through: 8.1. In the short term, conduct a sectoral-based in-depth analysis of several selected AI ecosystems; and 8.2. In the medium term, set up Sectoral Multi-Stakeholder Alliances (SMUHAs) for strategic sectors in Europe to build their AI ecosystems with the relevant stakeholders.

9. Provide Human-Centric AI-based Services for Individuals

This could be achieved through: 9.1. Deliver on the Tallinn Declaration on e-Government; 9.2. Where an AI-based service does not run properly or when an individual so requests, he or she should be able to interact with a human interlocutor, when there is a significant impact on the

individual; 9.3. Set up a single point of contact for individuals, for example by deploying natural user interfaces that can redirect individuals to the sought after information or service in an easily accessible manner; and 9.4. Develop tools to ensure that public services can be deployed for all, and in a manner that safeguards individuals' fundamental rights, democracy and the rule of law.

10. Approach the Government as a Platform, catalysing AI Development in Europe

This could be achieved through: 10.1. Foster digitalisation by transforming public data into a digital format; 10.2. Provide data literacy education to government agencies; 10.3. Create European large annotated public non-personal databases for high quality AI; and 10.4. For procurement contracts on public services between a public sector organisation and a company, consider introducing a requirement that data produced in that context which does not infringe the private company's IP and which is of general public interest should be handed back to the public sector.

11. Make Strategic use of Public Procurement to Fund Innovation and Ensure Trustworthy AI

This could be achieved through: 11.1 Within public procurement processes, allocate substantive funding to innovation-driven, AI-based solutions; 11.2. Within procurement processes, ensure that potential risks of the use of AI by the government are identified, assessed and appropriately addressed; and 11.3. Introduce clear eligibility and selection criteria that in the procurement rules and processes of EU institutions, agencies and Member States that require AI systems to be trustworthy.

12. Safeguard Fundamental Rights in AI-Based Public Services and Protect Societal Infrastructures

This could be achieved through: 12.1. Ensure the application of the Ethics Guidelines for Trustworthy AI to AI systems deployed by the public sector; 12.2. Make available to any individual who is subject to an AI-informed governmental decision that produces legal effects or similarly significantly affects that individual, information on the logic of the algorithms and how data is used to inform such decisions, enabling the affected individual to understand, evaluate and potentially challenge the decision; 12.3. Fund and facilitate the development of AI tools that can assist in detecting biases and undue prejudice in governmental decision-making; and 12.4. Ban AI-enabled mass scale scoring of individuals as defined in our Ethics Guidelines.

13. Develop and Maintain a European Strategic Research Roadmap for AI

This could be achieved through: 13.1. The roadmap should include major open disciplinary and interdisciplinary fundamental scientific questions and grand challenges of global relevance, as well as major industrial and societal challenges where AI can be an enabler or a significant part

of the solution; 13.2. The roadmap should focus on areas of strategic value and opportunities; 13.3. The road map should in particular foster research that can help ensuring AI solutions that meet the Trustworthy AI principles and requirements; 13.4. The roadmap should be developed and regularly updated based on new developments in research and technology through a bottom-up process that complements the top-down policy-driven approach of governments and through stakeholder consultation; and 13.5. While ensuring scientific independence, the roadmap should ensure for the needs and concerns of individuals through engagement with civil society representatives.

14. Increase and Streamline Funding for Fundamental and Purpose-Driven Research

This could be achieved through: 14.1. Provide dedicated, significant and long-term research funding for both fundamental and purpose- driven research; 14.2. Create incentives and support for interdisciplinary and multi-stakeholder research for example through large-scale challenge-driven research missions; 14.3. Simplify and streamline the structure of research funding instruments; 14.4. Establish mixed academic-industrial transfer labs, mainly funded by industry, providing specific research for the companies while also providing funding for long-term open research and collaboration in the broader research area; and 14.5. Initiatives funded by the Horizon Europe and Digital Europe programmes related to AI should build in safeguards and conditions to ensure that public funding of these projects benefits the public interest.

15. Expand AI Research Capacity in Europe by Developing, Retaining and Acquiring AI Researchers

This could be achieved through: 15.1. Acknowledge that a holistic strategy is needed to create the conditions for talents to find Europe attractive as a research environment; 15.2. The work environment should offer collaboration between researchers and start-ups, larger companies and organisations, as well as society at large; and 15.3. Create an open innovation culture through a lively, interdisciplinary and multidisciplinary research environment around world-class research centres.

16. Build a World Class Research Capacity

This could be achieved through: 16.1. Strengthen and create additional Centres of Excellence (CoEs) that address strategic research topics and become a European level multiplier for a specific AI topic; 16.2. Nurture and support Europe's AI research centres and laboratories through research funding to scale up to worldwide competition and help them strive to become Centres of Excellence; 16.3. EU institutions together with Member States should also create and fund networks consisting of AI Centres of Excellence, as well as smaller AI research centres and laboratories; 16.4. Develop close collaborations with industry, the innovation ecosystem (e.g. DIH for AI and others) and other stakeholders that can provide feedback, pick up new results early on, and provide important additional funding; 16.4. Create a dedicated

Public-Private Partnership (PPP) in AI; and 16.6. Develop a cross-cutting network focused on Trustworthy AI across European universities and research institutions.

17. Support AI Infrastructures across Member States

This could be achieved through: 17.1. Invest in the necessary intense-computing AI architectures capable to scale-out the ambition for AI in Europe, including distributed clusters (cloud) and edge computing, large RAM and fast networks; 17.2. A network of testing facilities and sandboxes, with high-speed networks interconnecting them must be organised with appropriate governance mechanisms to set legal and ethical standards; 17.3. Invest in fundamental and applied research, innovation and industrial capacity building within edge-based intelligence, empowered by the interplay of hardware, software and AI capabilities; and 17.4. Liaise with EU actions and funding programmes based on the Electronic Leaders Group recommendations regarding dedicated AI co-processors (edge computing), jointly with digital microcontrollers initiatives, as well as optical and quantum computing.

18. Develop Legally Compliant And Ethical Data Management and Sharing Initiatives in Europe

This can be achieved through: 18.1. Set up national and European data platforms for AI that include all necessary tools for data governance, annotation, and storage, next-generation networks, analytics software and, most importantly, datasets³⁵ through a structural and investment fund; 18.2. Consider European data-sharing infrastructures as public utility infrastructures; 18.3. Support an EU-wide data repository through common annotation and standardisation; 18.4. Support research on and development of industrial solutions for fast, secure and legally compliant industry data sharing (e.g. encryption) and stimulate sharing of industry data; 18.5. Foster the creation of trusted data spaces for specific sectors; 18.6. Develop mechanisms for the protection of personal data, and individuals to control and be empowered by their data; 18.7. Create a data donor scheme; and 18.8. Consider the introduction of a data access regime on FRAND terms.

19. Support European Leadership in the Development of an AI Infrastructure

This could be achieved through: 19.1. Support the development of open source AI software libraries including the Trustworthy AI guidelines and in line with the latest achievements in research; and 19.2. Support mechanisms for cutting-edge research, innovation and commercial development of hardware and compute infrastructure for connected devices and the Internet of Things (IoT) in Europe.

20. Develop and Support AI-Specific Cybersecurity Infrastructures

This could be achieved through: 20.1. Develop an infrastructure for cybersecurity, building on the Cybersecurity Act adopted by the EU in spring 2019 to protect our networks, data, and users

from risks; 20.2. Develop user-centric AI cybersecurity policies to protect users' rights online; 20.3. Adopt holistic digital security approaches to address the risk of malware and vulnerabilities; 20.4. Invest in AI-enabled cyber protection systems; and 20.5. Beyond safeguarding public infrastructures, ensure that the entire data transmission system is more secure.

21. Redesign Education Systems from Pre-School to Higher Education

This could be achieved through: 21.1. Set up recommendations and incentives to adapt national education systems to strengthen children in human-centric key skills; 21.2. Besides fostering the development of skills in a holistic manner throughout different disciplines in the education system, embed mandatory ICT and digital literacy classes; 21.3. Direct the DigCompEdu Framework towards educators at all levels of education; 21.4. Recommend Member States to require gender competences for STEM educators in the hiring process in formal education systems; 21.5. Support dedicated initiatives that encourage young people to choose AI subjects and related fields as a career; 21.6. Support the implementation of educational AI technologies in primary and secondary education to facilitate individual learning requirements; and 21.7. Develop and offer career guidance services.

22. Develop and Retain Talent in European Higher Education Systems

This could be achieved through: 22.1. Develop and implement a European Curriculum in AI; 22.2. Implement interdisciplinary PhD schools and Post-PhD programmes in AI; 22.3. Increase disciplinary mobility between AI associated curricula; 22.4. Mainstream and include skills related to data and AI in all academic disciplines and professional fields to increase the potential of areas where AI applications can be developed; 22.5. Foster cooperation spaces between AI researchers and professionals; 22.6. Support the implementation of postgraduate and supplement curricula on entrepreneurship and innovation; and 22.7. Extend existing programmes like ERASMUS, European Schoolnet and e-twinning to AI.

23. Increase the Proportion of Women in Science and Technology

This could be achieved through: 23.1. Prioritise gender equality and gender mainstreaming; 23.2. Attract female talents into the field of AI and related subjects; 23.3. Sponsor initiatives for networking and coaching for Women in AI; 23.4. Incorporate humanities, social sciences, and gender research into AI research programmes; and 23.5. Address gender bias in algorithmic decision-making.

24. Upskill and Reskill the Current Workforce

This could be achieved through: 24.1. Create a right to continuous learning for all and implement it by law and/or collective agreements; 24.2. Define critical skills in sensitive areas with human safety and security critical implications and create measures against skill

deterioration. Address undesirable deskilling of workers through AI, in particular in operations or processes that require human oversight or intervention; 24.3. Develop employment policies that support and reward companies who are setting up strategic up- and reskilling plans for the development of new data and AI-related applications; and 24.4. Upgrade the European Computer Driving License (ECDL) to an AI Driving License.

25. Create Stakeholder Awareness and Decision Support for Skilling Policies

This could be achieved through: 25.1. Increase the knowledge and awareness on AI within EU and national policy-making institutions; 25.2. Foster the development of advanced skills and jobs forecasting algorithms to anticipate and timely address changes on the job market; 25.3. Reinforce or develop strong training and career guidance systems that support workers affected by technological disruption; 25.4. Include critical and ethical awareness of AI in existing European awareness initiatives and networks; and 25.5. In public procurement processes of AI-enabled technology for education, include an assessment of embedded interests, ethics and social impacts.

26. Ensure Appropriate Policy-Making on a Risk Based and Multi-Stakeholder Approach

This could be achieved through: 26.1 Adopt a risk-based approach to regulation; 26.2. For specific AI applications that generate “unacceptable” risks or pose threats of harm that are substantial, a precautionary principle-based approach should be adopted instead; 26.3. Give due consideration to the level of autonomy in AI-based decision-making; 26.4. Foster a principle-based approach to regulation; 26.5. Consider the adoption of a segment-specific methodology when further developing the regulatory framework for AI.

27. Evaluate and Potentially Revise EU Laws, starting with the Most Relevant Legal Domains

This could be achieved through: 27.1. Conduct a systematic mapping and evaluation of all existing EU laws that are particularly relevant to AI systems. This should be done through a Commission Inter-Service group that ensures collaboration across different DGs or the Secretariat-General to avoid “silo”-thinking; 27.2. For civil liability and accountability rules; 27.3. For criminal law provisions; 27.4 For consumer protection rules; 27.5. For data protection rules; 27.6. For non-discrimination provisions; 27.7. For cyber-security rules; 27.8. For competition rules.

28. Consider the Need for New Regulation to Ensure Adequate Protection from Adverse Impacts

This could be achieved through: 28.1. Examine the need for new regulation to address the critical concerns listed in our Ethics Guidelines for Trustworthy AI; 28.2. Monitor and restrict the development of automated lethal weapons, considering not only actual weapons; 28.3. Monitor

the development of personalised AI systems built on children's profiles and ensure their alignment with fundamental rights, democracy and the rule of law; 28.4. For AI systems deployed by the private sector that have the potential to have a significant impact on human lives, for example by interfering with an individual's fundamental rights at any stage the AI system's life cycle and for safety-critical applications, consider the need to introduce.

29. Consider Whether Existing Institutional Structures, Competencies and Capacities Need Revision to Ensure Proportionate and Effective Protection

This could be achieved through: 29.1. Ensure the consolidation of EU institutions' "policy cycle" approach by more systematic monitoring and periodic ex-post evaluation of regulatory measures, and by enhancing stakeholder consultations; 29.2 Consider agile policy-making solutions such as the creation of regulatory sandboxes to help stimulating innovation without creating unacceptable risks; 29.3. Institutionalise a dialogue on AI policy with affected stakeholders to define red lines and discuss AI applications that may risk generating unacceptable harms; 29.4. Develop auditing mechanisms for AI systems; 29.5. Ensure that the use of AI systems that entail interaction with end users is by default accompanied by procedures to support users in accessing effective redress in case of infringement of their rights under applicable laws; 29.6. Foster the availability of redress-by-design mechanisms; 29.7. In addition, we urge policy-makers to refrain from establishing legal personality for AI systems or robots.

30. Establish Governance Mechanisms for a Single Market for Trustworthy AI in Europe

This could be achieved through: 30.1. Harmonise regulation- including its implementation and enforcement mechanisms - across the EU and foster cooperation between Member States; 30.2. Cumulative regulatory interventions at the national level should be avoided; 30.3. Establish a comprehensive strategy for Member State cooperation for the enforcement of regulation relevant to AI; 30.4. Foster the harmonisation of Trustworthy AI standards by contributing to the Guidelines' piloting process and ensuring an appropriate follow-up; 30.5. The European Union should consider setting up institutional structure for Trustworthy AI to fill an existing governance; 30.6. Develop guidance for stakeholders on how to ensure compliance with Trustworthy AI's first component, lawful AI; 30.7. Consider a range of certification mechanisms for AI systems, and assess the necessity of technical standards and other standardisation measures.

31. Ensure Adequate Funding for the Recommendations put Forward in this Document

This could be achieved through: 31.1. Transitions taking place on the job market and the workplace require a European transition fund to help managing this in a socially responsible way; 31.2. The earmarking of substantial funding in the InvestEU programme for AI; 31.3. The proposed Multi-Stakeholder Alliances that will enable AI ecosystems on a sectoral basis; 31.4. Within public procurement processes, both at EU and national level, a substantive amount

should be allocated to innovation-driven solutions; 31.5. Dedicated, significant and long-term research funding is needed for fundamental and purpose-driven research on AI to maintain competitiveness of European companies and address relevant societal challenges; 31.6. A structural and investment fund for European data infrastructure is proposed in order to; 31.7. The establishment of an institutional structure at EU level for Trustworthy AI will likewise require resources to be made available.

32. Address the Investment Challenges of the Market

This could be achieved through: 32.1. Introduce EU level thematic actions to build synergies between national initiatives, to encourage new public initiatives and mobilise and leverage private investments; 32.2. Encourage Member States to create and expand the testing and experimentation facilities proposed in the EU initiative of the Digital Europe programme; 32.3. Ensure financing avenues for larger market deal that can help established companies grow and scale up in the digital economy; 32.4. Set up a European Coalition of AI Investors.

33. Enable an Open and Lucrative Climate of Investment that Rewards Trustworthy AI

This could be achieved through: 33.1. Encourage the Commission to work with European financial institutions, such as the European Investment Bank, to develop investment guidelines that take into account the Ethics Guidelines; 33.2. Ensure the EU remains an open economy, and a lucrative place for innovators and investors.