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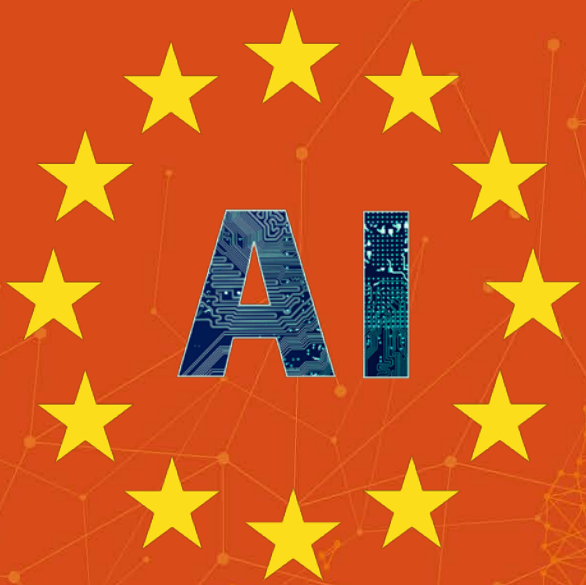

DELIVERABLE 4

SECTORAL CONSIDERATIONS ON THE POLICY AND INVESTMENT RECOMMENDATIONS FOR TRUSTWORTHY ARTIFICIAL INTELLIGENCE

This document was written by the High-Level Expert Group on AI (AI HLEG) as listed at the end of the document. They support the broad direction of the document, although they do not necessarily agree with every single statement therein. It is the fourth deliverable of the AI HLEG and follows the publication of the group's deliverable of the Policy and Investment Recommendations for Trustworthy AI, published on the 26th of June 2019.

The High-Level Expert Group on AI is an independent expert group that was set up by the European Commission in June 2018.

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Table of Contents

I. Introduction 3

II. Synthesis of the sectoral workshops 6

The Manufacturing and Industrial IoT Sector 6

Public Sector: the e-Government domain 9

Public Sector: Justice and law-enforcement 10

The Healthcare Sector 11

III. Concluding remarks 13

I. Introduction

The European Commission has put at the core of its strategy for artificial intelligence (AI) the need for a human-centric approach, rooted in fundamental rights and European Union (EU) law. This approach was directly shaped by the work of the High-Level Expert Group on Artificial Intelligence (AI HLEG), encompassing both the Ethics Guidelines for Trustworthy AI,[1] and the Policy and Investment Recommendations for Trustworthy AI.[2] The resulting focus is on Trustworthy AI,[3] defined as AI that is legally compliant, ethically adherent, and socio-technically robust. The AI HLEG put forward this vision already in its Ethics Guidelines on Trustworthy AI, published in April 2019 and confirmed it in its Policy and Investment Recommendations for Trustworthy AI adopted in June 2019. Since then, the EU has further consolidated its position as international leader in the definition of responsible uses of AI, in particular with the publication of the White Paper on Artificial Intelligence and the Communication on A European Strategy for Data in February 2020.[4] The White Paper, in particular, advocates the development of an ecosystem of excellence, alongside an ecosystem of trust in AI solutions. It posits the belief that AI, if adequately supported and responsibly developed and used, can bring enormous opportunity to society as a whole, tackle global challenges, support new business models and spur innovation, contribute to longer and healthier life of citizens and encourage better public services.

In the Policy and Investment Recommendations for Trustworthy AI, the AI HLEG outlined the contours of a proportionate, holistic policy framework that would allow EU policymakers and stakeholders to maximise the benefits of AI, while at the same time preventing and mitigating its associated risks. In that document, the AI HLEG presented 33 recommendations on how to use Trustworthy AI to build a positive impact in Europe (by empowering and protecting humans and society, transforming Europe's private sector, tapping the potential of the public sector as a catalyst of sustainable growth and innovation, and ensuring world-class research capabilities); and how to leverage key enablers such as data and infrastructure, skills and education, governance and regulation, and public and private investment.

These recommendations were general in nature, and therefore did not address the problems emerging in specific economic or societal domains. After their publication, the AI HLEG decided to explore their possible implementation with respect to a limited number of areas. In particular, the AI HLEG took the decision to further discuss three sectors that it considers to be of utmost importance for the sustained well-being of society as well as for enhancing Europe's sustainable growth thanks to AI development, deployment and uptake. The sectors chosen are: (i) the Public Sector; (ii) Healthcare; and (iii) Manufacturing and Industrial Internet of Things (IoT). This choice has become, in our opinion, even more appropriate with the publication of the White Paper and the EU data strategy, which outlined the creation of data spaces in all these sectors;

[1] These are available at: https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai.

[2] These are available at: https://ec.europa.eu/digital-single-market/en/news/policy-and-investment-recommendations-trustworthy-artificial-intelligence.

[3] As defined in: https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai.

[4] https://ec.europa.eu/info/publications/white-paper-artificial-intelligence-european-approach-excellence-and-trust_en.

as well as with the COVID-19 pandemic, which highlighted both the opportunity of enhanced use of data and Trustworthy AI by public institutions, particularly in the health domain; and the associated challenges and risks, which deserve proper and careful consideration and public debate.

This sectoral perspective allowed us to further discuss our Policy and Investment Recommendations for Trustworthy AI published in June 2019. Despite the problems created by the COVID-19 pandemic during the first half of 2020, we managed to organise three successful sets of workshops in April 2020, in which we collected feedback and engaged with stakeholders. While this exercise cannot be considered as representative as a full-fledged open stakeholder consultation, it nevertheless shed light on a number of issues that deserve careful consideration by EU institutions in the months to come, and were highlighted by workshop participants as important to ensure a successful AI policy in Europe. In this document the AI HLEG presents a number of themes that have emerged throughout the organised workshops, as collected and understood by the AI HLEG members that acted as Rapporteurs and considered by the AI HLEG in making its final conclusions. The AI HLEG encourages the European Commission to pursue further investigations into the specific sector contexts, to develop appropriate policies to support Trustworthy AI.

Against this background, a number of themes have emerged in all workshops, and are briefly described below.

- *The AI HLEG Policy and Investment Recommendations for Trustworthy AI are perceived as important and relevant in all three sectors.* The recommendations address a comprehensive and appropriate set of impacts and enablers and constitute an important basis for developing a more granular perspective in individual sectors where this might be necessary.
- *There is merit in refining the AI HLEG Policy and Investment Recommendations for Trustworthy AI to account for sectoral specificities*. The ongoing effort of the AI HLEG to further explore the applicability, completeness and usefulness of the Policy and Investment Recommendations for Trustworthy AI for various sectors was commended.
- *Trustworthiness is seen as a crucial feature of European AI.* Workshop participants endorsed the definition of Trustworthy AI and the seven requirements put forward by the AI HLEG.[5] They stressed in particular:
    - The need for safeguards in terms of transparency, explainability and safety, including due respect for fundamental rights, democracy and the rule of law, which were considered to be necessary to encourage AI uptake across all sectors.
    - The need to respect diversity and inclusion was also raised in various contexts during the workshops, especially in relation to the inclusion of employees throughout the deployment of AI in organisations (considered to be essential when it comes to decisions made with regard to the work environment); and the inclusion of broad and

[5] https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai.

diverse stakeholder groups, which can ensure that AI systems are developed and deployed in a way that is broadly beneficial for society as a whole.

- The need for AI systems to reduce, rather than exacerbate, existing biases and discriminations; and avoid widening the digital divide, be that through lack of connectivity, access, or relevant essential skills.
- The importance of transparency and accountability. The greater the risks generated by an AI system, the broader its prospective societal impacts, the more transparent, understandable and accountable the system (and its deployers) should be. Mechanisms to explain the behaviour of AI systems in accessible language and format to all involved stakeholders should thus be supported, at the same time following a risk-based, proportionate approach to the imposition of regulatory duties and responsibilities.[6]

- *There is widespread concern about the need to close the skills gap.* There was consensus, in all three workshops, that Europe needs to upskill and reskill its workforce, harness technical AI talent from a young age, and support those that are asked to handle AI systems in their daily work environment. In addition, the need for a broad set of relevant competencies was highlighted, including *i.a.* the ability to handle legal and ethical questions in developing and using AI systems to avoid downstream risks and harms to individuals and society. Finally, participants broadly agreed that data and AI literacy needs to be encouraged and supported across all sectors and all stakeholder groups.
- *Europe should be a leader in responsible research and innovation in the field of AI*. The stakeholders that participated in our workshops stressed the importance of establishing research and experimentation facilities, as well as excellence centres to boost European AI research and development. While a number of initiatives are already underway, additional resources will be needed to ensure that the EU achieves its ambitious goal to be a leader in Trustworthy AI. Moreover, existing and new funding programs could be adapted to increase agility when it comes to testing and developing AI technologies that address global complex issues such as climate change, encouraging actors of all sizes to engage in their development. Public procurement could be used strategically to fund innovation-driven, Trustworthy AI-based solutions.
- *Good governance and the widespread sharing of best practices can promote regulatory certainty.* The challenges and risks accompanying certain AI systems and use cases are not easy to detect and address. Awareness and uptake of best practices are needed: for developers to consider values and ethical implications by design; to mitigate and assess potential risks; for end users to trust AI systems they interact with; to monitor ongoing community and industry efforts; to establish commonly shared benchmarks and encourage broad stakeholder participation and to include meaningful participation of stakeholders that may be particularly at risk or potentially disadvantaged. Stakeholders perceived the need for strong guidance in a fast changing environment.
- *Data quality, availability and interoperability must be at the core of EU policy*. Workshop participants highlighted the importance of promoting access to high-quality data and data sharing in trusted spaces, and noted that well-governed, sectoral European data spaces

[6] https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai.

hold great promise for AI development and uptake. Non-personal data should be made accessible to those looking to develop and deploy Trustworthy AI solutions. Interoperability of data between administrations, and mandatory access to key public datasets for research and innovation should be promoted, in full respect of data protection and privacy laws. The purpose for which the data is used should be transparent, and protocols ensuring trust should be put in place. Given the limited availability of publicly accessible data, sustainable incentives for business-to-government (B2G) and business-to-business (B2B) data sharing should be introduced. Moreover, data literacy within society should be promoted to raise users' awareness of the value of their data, and of the way in which insights algorithmically generated from that data may be used to inform decisions about them.

Below, we provide a synthesis of each of the three sectoral workshops, as understood and summarised by the members of the AI HLEG that acted as Rapporteurs in those workshops, and considered by the AI HLEG in making its final conclusion.

II. Synthesis of the sectoral workshops

The Manufacturing and Industrial IoT Sector

The manufacturing and industrial IoT sector is of strategic importance for Europe. As indicated by the European Commission in its Strategy on Shaping Europe's Digital Future,[7] Europe can leverage digital technologies such as AI and the industrial IoT to retain its technological and digital sovereignty and be a global digital leader. This requires, among other things, speeding up investment in high-quality research and the responsible deployment of technology, and creating the preconditions for sustainable innovation. As mentioned already in the AI HLEG Policy and Investment Recommendations for Trustworthy AI, studies estimate that two thirds of the value created by AI is attributable to the Business to Business (B2B) segment, where European industry has a strong footprint, and some of its sectors feature extensive experience of using AI as a technology to improve their products, processes and business models or create new ones.[8] It was widely agreed in the manufacturing and industrial IoT workshops that Europe has a very strong card to play with deploying AI in the manufacturing and industrial IoT field.

The manufacturing and industrial IoT sector was consequently identified by the AI HLEG as one of three sectors that should be analysed more deeply. The AI HLEG organised two (virtual) workshops in April 2020 with representatives of the sector and other stakeholders, and agreed not to limit manufacturing to a specific use case, but rather to consider it as an industrial process applicable throughout the entire sector and involving the following stakeholders and their organisations: manufacturers, developers, technology providers, workers, researchers, regulators and civil society.

[7] https://ec.europa.eu/digital-single-market/en.

[8] See Notes from the AI Frontier: Modelling the Impact of AI on the World Economy, McKinsey Global Institute, 2018.

The discussion in the workshops confirmed the relevance of the AI HLEG Policy and Investment Recommendations for Trustworthy AI. In particular, the following issues were considered to be of particular relevance for the sector, and may warrant enhanced attention by EU policymakers in the months to come.

- *A proactive, forward-looking strategy is needed to promote new skills and lifelong learning*. The skills issue is very strongly felt in manufacturing. Here, stakeholders that participated in the workshops called on the European Commission to support and further develop public education on AI and digital literacy, in primary, secondary, tertiary as well as lifelong learning education systems. Dedicated initiatives are also needed to encourage young people to choose AI subjects and related fields as a career. Governments should map value chains 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. The European Commission could also encourage the development of employment policies that support and reward companies who are setting up strategic up- and reskilling private sector education plans for the development of new data and AI-related applications; and encourage companies to form partnerships with training programmes addressing all levels of AI training. The participants in the workshops also stressed the importance of developing specific AI-focused initiatives in areas related to smart and additive manufacturing, robotics, and industrial IoT.
- *Research and education: boost training and promote the deployment of human-centric AI systems in manufacturing and industrial IoT.* Participants in the workshops observed that the European Commission should explore the potential for developing initiatives for research-based training in areas related to AI, manufacturing, and IoT. These should promote research, development and the deployment of human-centric AI systems in work contexts without stifling socially beneficial innovation. On the education side, multidisciplinary and interdisciplinary PhD schools and post-PhD programmes focussed on Trustworthy AI would be extremely helpful. In addition, increased mobility between AI-associated curricula would enable more flexible and inter-disciplinary career progressions.
- *The European Commission and Member States should consider developing close collaborations with industry, the innovation ecosystem (e.g. Digital Innovation Hubs focused on AI, centres of excellences for AI and related centres in manufacturing and industrial IoT) and other stakeholders to support the scale-up of promising results and facilitate the transition of Trustworthy AI solutions from research labs to responsible testing environments and market deployment.* To help Europe build upon its leadership in manufacturing, consideration should be given to creating an EU-wide network of AI business incubators that connect academia and industry. In addition, interdisciplinary research should be incentivised, for example through large-scale research missions in response to industrial challenges.
- *Action at the EU level should be coordinated with funding programmes for dedicated AI co-processors (edge computing), jointly with digital microcontrollers initiatives, as well as optical and quantum computing.* Participants to the workshops noted the importance of promoting cutting-edge research, innovation and commercial development of hardware and

computing infrastructure for connected devices and industrial IoT in Europe. Cooperation spaces between AI researchers and professionals should also be fostered.

- *The European Commission should consider working with other EU Institutions and Member States to promote an open innovation culture* through a lively, interdisciplinary and multidisciplinary research environment around world-class research centres in AI, smart manufacturing, additive manufacturing, supply chain, operations management, and industrial robotics. In this respect, it would be important to build upon, and link to, the existing networks of Centres of Excellence in AI.
- *Support the creation of the foundation for a European data-driven ecosystem in AI, manufacturing and industrial IoT*. In view of the launch of the European Data Space on Manufacturing,[9] European data sharing strategies and schemes should be launched. This may include large annotated public non-personal databases for the development and testing of high-quality AI solutions. Forthcoming national and European data platforms for AI in manufacturing and industrial IoT may include necessary tools and funding for developing platforms as a service (PaaS), including but not limited to data governance, data annotation, data processing and storage, next-generation networks and analytics software. These platforms, crucial in industrial AI settings, should enable fast, secure data sharing, enshrined in an appropriate legal framework to support sustainable industrial innovation. All this will require adequate infrastructure, including most notably intense-computing AI architectures capable to scale out Europe's leadership and ambition in industrial AI; and a network of interconnected testing facilities, with an emphasis on innovation in Trustworthy components of AI and appropriate governance mechanisms to set legal and ethical standards.
- *Leverage public investment and procurement to accelerate the uptake of Trustworthy AI.* The European Commission should earmark significant resources in the InvestEU programme to support the transformation of European enterprises towards Trustworthy AI-enabled solutions. Likewise, and more generally, within public procurement processes the European Commission and Member States should, where legally permissible, award priority to innovation-driven, Trustworthy AI-based solutions in the field of manufacturing and industrial IoT.
- *In pursuing a competitive and sustainable innovation culture, the European Commission should not lose sight of diversity and inclusion*. Rather, as observed by workshop participants, policy-makers should ensure that diversity is particularly promoted in research and innovation related to AI-enabled engineering, manufacturing, robotics, and industrial IoT. To this end, Member States should require gender competences for STEM educators in the hiring process in formal education systems. It is important to attract female talents, members of Black, Asian and Minority Ethnic communities and other currently under-represented groups into the field of AI and AI-enabled engineering, manufacturing, robotics, and industrial IoT.
- *Participants to the workshop called on the European Commission to consider a risk-based approach to regulation, in line with the orientation already expressed by the AI HLEG*. A tailored approach could be followed when designing the regulatory framework, in order to adapt it to the specificity of the manufacturing and industrial IoT sector (e.g. existing industry

[9] https://ec.europa.eu/digital-single-market/en/policies/building-european-data-economy.

standards and rules, current industry practice, specific use cases and associated risk levels). In particular, agile policy-making solutions such as regulatory sandboxes (allowing for experimentation of AI solutions before deciding to admit them to the market) could be introduced to help stimulate innovation and experimentation without creating unacceptable, uncontrolled risks and without hampering the public interest and the protection of individuals. To the extent necessary for the full completion and functioning of the EU Single Market, regulation might be further developed and harmonised, where appropriate, across the EU and entail cooperation between Member States to further reduce discrepancies in implementation and enforcement.

Public Sector: the e-Government domain

The Policy and Investment Recommendations for Trustworthy AI devoted significant attention to the public sector, which the AI HLEG considers as a catalyst for achieving progress in this domain. However, it is also an area with significant potential for fundamental rights violations, ethical issues and potential undesirable societal and socio-economic impacts. In 2019, the AI HLEG put forward several recommendations aimed at ensuring that Trustworthy AI development, deployment and use in the public sector is promoted and encouraged. The AI HLEG considers that AI has the potential to play a significant role in improving public services, including empowering public servants and citizens, for example through improving the accessibility and availability of information concerning public services. To this end, almost half (15 out of 33) of the recommendations put forward by the AI HLEG in June 2019 were dedicated to public services and, in particular: the provision of human-centric AI-based services for individuals; the need to approach Government "as a Platform", catalysing AI development in Europe; the importance of strategic use of public procurement to promote Trustworthy AI; and the need to safeguard fundamental rights in delivering AI-based public services.

In addition to these recommendations, the exchange with stakeholders in this domain, through five workshops organised in April 2020, has led to a number of additional observations and proposals, that warrant particular attention from EU policymakers in the months to come. These are summarised below for consideration by the European Union Institutions and Member States.

- *It is essential to ensure that AI systems and interfaces used for the provision of public services do not compound the digital divide.* Citizens and legal entities should continue to benefit from equal access to public services, regardless of their digital capabilities. This requires that public administrations maintain multiple interfaces for the provision of public services including telephone calls, paper documents etc. These can be handled automatically or through internet services and service kiosks that suit the populations.
- *AI-enabled e-Government services should be accompanied by adequate arrangements in terms of accountability and traceability, enabling ex post verification*. This requires the adoption of auditable AI solutions, as well as the digitalisation and storage of records of background information and data relevant to decisions adopted by public administrations.

The ability to describe, contextually and ex-post, the reasons that led to a specific decision or course of action by a Public Administration should be a foundational element of the relationship between government and citizens (and as a realisation of the right to "good administration", as included in Art. 41 of the EU Charter of Fundamental Rights).

- *Take action to promote data and algorithmic literacy amongst the public administration.* Civil servants need to be trained in: data collection, management, cleaning and storage practices; prioritising quality, conducting ethical and social impact assessments; and, securing compliance with relevant privacy and data protection rules. In a nutshell, civil servants should be increasingly acquainted with the ethical, legal, social and economic impact of AI while remaining wary of potential adverse impacts on fundamental rights, democracy and the rule of law.
- *Develop AI and data strategies within all relevant branches of governments.* This requires that at the EU level an effort is made to benchmark AI uptake across countries, regions and municipalities. It also requires that inter-agency and inter-administration cooperation, as well as interoperability, is vibrantly promoted in the rolling out of AI strategies, and as part of the forthcoming "public administration data space" announced in the European Strategy for Data.[10]
- *Promote interoperability to enable efficient and secure communication between jurisdictions.* Develop and deploy interfaces that facilitate and promote cross border and other stakeholders, in line with the work already underway in the European Interoperability Framework and more specifically the ISA2 programme,[11] which is still only a voluntary framework for Member States. Alongside interoperability, it is essential to put in place enhanced cybersecurity measures to protect Government platforms and services against adversarial attacks, which increasingly use advanced forms of AI.
- *Operationalise Government as a Platform.* Data-driven innovation can and should be promoted by developing application programming interfaces (APIs) enabling access to specific publicly held data that can enable the deployment of value added services and Trustworthy AI solutions. EU institutions should consider promoting a process for auditing algorithmic decision-making systems with the definition of measuring indexes, to be implemented at the EU level and in Member States.

Public Sector: Justice and law-enforcement

In the sectoral workshop on public services, specific attention was devoted to justice and law enforcement. AI-enabled solutions in this sector can be potentially beneficial for the public and professionals, but are controversial at the same time. Some participants called for AI-applications that could help them in their work in a number of legal areas, such as AI to improve access to justice, natural language processing (NLP) to support legal text reviews and AI to help detect bias and errors in cases. The expectations as to the capabilities of current

[10] https://ec.europa.eu/digital-single-market/en/policies/building-european-data-economy.
[11] https://ec.europa.eu/isa2/home_en.

AI systems to perform these tasks reliably are, however, generally too high. Although such systems are already used in specific law enforcement and justice contexts, the AI HLEG considers that their deployment at greater scale generates risks and opportunities that are not yet fully understood. More research, scrutiny and deliberation are needed prior to formulating legal, ethical or policy guidance. It would be, therefore, important to launch a wide-spread policy debate in Europe (and beyond) on the development, use and impact of AI-assisted and AI-enabled decision-making systems in justice and law enforcement.

The Healthcare Sector

Despite the difficult circumstances due to the COVID-19 pandemic, through April of 2020 a series of three workshops were held with stakeholders from across Europe's healthcare sector, attracting a total of 43 participants. The workshops sought to explore the extent to which the sector found the Policy and Investment Recommendations for Trustworthy AI helpful and complete in the context of the healthcare sector, and to what extent there was need for further specialisation or refinement. There was unanimous appreciation from the participants for the AI HLEG Policy and Investment Recommendations for Trustworthy AI; the view was that the report was of excellent quality and comprehensively captured the various issues that were deemed important. The focus in the discussion was in relation to six specific categories of recommendations: empowering and protecting humans and society, private sector issues, research, education, data and infrastructure and regulation. For the remaining two categories (Europe's Public Sector as a Catalyst of Sustainable Growth & Innovation; and Raising Funding & Investment) the consensus within the workshops was that the existing recommendations were comprehensive.

The following major topics emerged, which may warrant enhanced attention by EU policymakers when addressing AI in the healthcare sector.

- *Promote and recognise AI skills applied to healthcare.* Given the possible impacts of the use of AI in healthcare, consideration should be given to mechanisms for assuring that the developers of AI systems are competent in the context of health.
- *Invest in upskilling and reskilling to harness the potential of Trustworthy AI in healthcare.* Specific upskilling, training, and education, in AI at all levels and for all roles in the domain of healthcare should be provided in order to ensure that humans and AI work together to achieve significant progress in this domain. Users of AI systems and tools in the practice of health should have the required level of competence to understand the associated limitations and risks, as well as the understanding to explain and critique AI-generation plans, decisions, actions, or advice. Such assurance could be achieved through certification, accreditation, or regulation. Special attention should be given to those in patient-focused roles, such as doctors and nurses. The latter is a very relevant grouping given the level of acute and operational support they provide in all healthcare settings.
- *A Nuanced Approach to AI Regulation.* The development of general regulation of AI is challenging, and unlikely to be sufficient to fully account for the peculiarity of the healthcare

sector. In considering the value and potential scope of any regulatory framework, an in-depth analysis of the regulatory needs for the use of AI in healthcare should be undertaken, both from the point of view of doctors and patients. In particular, existing regulation already includes detailed provisions on the levels of safety and performance that medical devices should achieve, but, to fully make it fit for the use of AI an evaluation of the possible need to update the existing regulatory framework should be undertaken.

- *Establish an inclusive AI development and policy framework.* The participation of all stakeholders in the policy-making process in relation to AI in healthcare is critically important. Stakeholders include, but are not limited to, patients, patient groups, consumers, healthcare professionals at all levels, entrepreneurs and innovators, health insurance representatives, and member state health authorities. EU institutions should thus consider setting up a sectoral multi-stakeholder alliance to ensure constant participation and the co-creation of policy decisions. This, in turn, would increase the sense of ownership in the healthcare stakeholder community, and consequently contribute to policy compliance and effectiveness.
- *Availability of high quality health data is key for building Trustworthy AI solutions in Europe that can improve public health outputs and help manage patients efficiently.* AI systems can be a major tool in many healthcare applications spanning from hospital and healthcare centre management and services, to building models for detecting and preventing epidemic spread, monitoring individual patient health, or finding new cures. Health data is sensitive data that must be of highest quality and integrity (i.e., robust, representative and pseudonymized or anonymized, as appropriate) for building Trustworthy AI solutions.
- *There are concerns on a possible trade-off between access to quality treatment and privacy*, as well as possible discrimination as a result of AI use. To prevent discrimination and deepening of health inequalities, AI use in the healthcare sector has to be thoroughly and independently monitored. Transparency should be sought in relation to data access and the purpose for which the data is used. Best practices in communicating the potential risks and challenges from using AI on sensitive health data (e.g. genomic data) should be developed and shared. The security of healthcare data and the resilience of AI-based healthcare systems is of particular importance. Investments in anonymisation and encryption techniques for healthcare data should be strongly considered.
- *There is a great benefit in digitizing the healthcare data and building a European Health Data Space*, stored in accordance with European law, to enhance cooperation among healthcare professionals and AI developers and provide resources for AI-based healthcare research and innovation across Europe. For that to be realized, European healthcare data sharing strategies and schemes should be launched and include necessary tools and funding for data annotation, storage and governance, as well as enable fast, secure and legally compliant data sharing. Medical data standardization and certification of AI solutions should be explored. The establishment of data donor schemes should be considered. Initiatives enabling curated health-data across Europe should be encouraged, with accessibility of common pool(s) of health data with possible decentralization of processing.

III. Concluding remarks

In June 2019, we, the AI HLEG, published our Policy and Investment Recommendations for Trustworthy AI. In that document we made a set of 33 recommendations that were agnostic of any particular industrial or societal sector in which AI might be applied. With this document, we have made a first step towards a more in-depth understanding of the challenges and opportunities raised by AI, by organising three sets of workshops in the following sectors: (1) Manufacturing and Industrial IoT, (2) the Public Sector and (3) Healthcare. The consensus from those workshops was that the Policy and Investment Recommendations for Trustworthy AI adopted by the AI HLEG in June 2019 were comprehensive, highly relevant, and have the confidence of a wide variety of stakeholders.

In the process of developing sectoral analyses over the last few months, our attention was pointed at a number of outstanding issues, which we believe should be carefully considered by the European Commission. The workshops demonstrated the importance of discussing the requirements for Trustworthy AI at the sectoral level. We believe it is crucial that policymakers recognise the importance of sectoral perspectives at a European and Member State level. As a next step, we call upon policymakers at national and European level to further conduct in-depth analyses of sectors that are crucial for Europe's sustainability, growth and competitiveness, and inclusion, with the aim to secure individual and societal well-being. Our document can serve as inspiration for these in-depth analyses, and we hope that other essential sectors will be addressed as well.

It is crucial that Europe develop strong Trustworthy AI ecosystems,[12] and creates the environment for world-class innovation in this strategic domain. Policy instruments and incentives must be targeted to position Europe at the cutting-edge of innovation in Trustworthy AI that caters to the needs of Europeans and is based on European fundamental rights, rule of law and democracy. It is only by understanding and responding to the nuances, complexities, risks and opportunities presented by AI, and its effects on specific sectors and use cases, that Europe can realise its ambition to become a global AI centre of excellence and innovation.

Our group, and the work we produced over the past two years, has been a precursor for mapping the benefits and risks generated by AI systems and to affirm the brand of a Trustworthy AI. We now hope to pass the baton and inspire other initiatives to continue the work.

[12] This is referenced in Deliverable 2 of the AI HLEG, the Policy and Investment Recommendations for Trustworthy AI.

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