Discussion Paper for Breakout Session

Theme 2: Unleashing Innovation

Unleashing Innovation - Reducing Barriers to Innovation / Enhancing Market Confidence

G7 Multistakeholder Conference on Artificial Intelligence
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Executive Summary

Artificial Intelligence (AI) has matured considerably over the past years and is becoming the main driver for the digitalization of value chains and development of autonomous systems generating new value for citizen, economy and society. AI is now finding its way from research into an increasingly broad base of usage scenarios. This is complemented by increasing investments from public and private side to leverage the usage of AI technology for a wide range of applications.

Realizing the broad potential of AI technologies will require thoughtful investments and coordinated action on a national as well as global level. All G7 countries have released their own AI strategies to promote the use and development of AI aiming to foster leadership in AI.

For instance, the U.S. has established four pillars to guide industry, academic, and government efforts to realize the full potential of AI. These pillars include i) supporting the national AI R&D ecosystem ii) developing the American workforce to take full advantage of the benefits of AI iii) removing barriers to AI innovation in the United States, and iv) enabling high-impact, sector-specific applications of AI. The U.S. has begun implementing this strategy through guidance to Federal agencies to prioritize R&D investments in AI and the establishment of a Select Committee on AI.

In Europe to fully exploit the potential of AI in the economy and society earlier this year a new EU Strategy on AI was published in the Communication on Artificial Intelligence for Europe. Underpinning the EU ambition to become a world leader in responsible and trusted AI, the new EU strategy takes a three-pronged approach of: i) boosting the EU's technological and industrial capacity and AI uptake across the economy, ii) preparing for socio-economic changes brought about by AI, and iii) ensuring an appropriate ethical and legal framework.

With its strategy on AI, the German government fosters the application of AI in all areas of society to reach progress for the whole society and in the interest of all citizens. The strategy aims to strengthen Germanys leading position in research and focuses on the transfer of research findings to the private sector. This goal will be achieved by activities supporting ecosystem development with special support for SMEs, measures to foster mutual exchange between science and industry, activities together with European partners, and measures to improve access to and usage of data assets. Further, it emphasizes the importance of skills and qualification.

Although the mentioned three strategies are emphasizing different areas of AI policy, a few common key elements for boosting AI-driven innovation in G7 countries can be identified:

- To strike careful balance between *innovation and regulation*, unnecessary barriers of innovation in AI could be investigated.

- The *creation of cross-national research* networks and activities are promising endeavors to bundle forces of G7 nations to speed up innovation in AI.

- Cross-national research in *Explainable AI* could be promoted to create more trustworthy AI and to help increase public acceptance and trust in AI.

- *AI evolution* that is by design intertwined with *cyber-security* could help to protect AI algorithms as well as to make AI available as tool for increasing cyber security.

- The access to large scale, high quality data is central for improving AI outcomes and offerings. Fostering the *open access to training data* could boost the development of AI applications.

- Creating opportunities for *workforce development* could help G7 nations prepare workers with the skills needed for the AI-based jobs of the future.

Discussion Questions for the Breakout Session

- Q1: How can regulatory approaches speed-up, or obstruct, AI innovation and adoption? How have different sectors approached AI to enable innovation such as in the case of UAS or UVs? Does a sector specific approach make more sense?
- Q2: What can G7 members do to foster a favorable international environment for AI innovation?
- Q3: What are promising topics for cross-national research activities? And how to set them up?
- Q4: What are potential actions of G7 members to promote research and development of "Explainability" of Algorithms that will foster acceptance and confidence of industrial and private users?
- Q5: What are potential initiatives G7 members can kick-start to increase/foster availability of open data and training data?

Introduction

Over the past few years, artificial intelligence has matured considerably and is becoming the main driver for digitalization and autonomous systems in all areas of life. The public sector, society, business, administration and science are all called upon to embrace the opportunities it provides. Complex algorithms, increased computing power and the exponential growth of human and machine-generated power are drivers for the current progress in AI.

AI is now finding its way from research into an increasingly broad base of applications in business. These technical advances allow addressing industrial challenges and the development of intelligent industrial applications in shorter time and with higher performance. The advances in AI will lead to a wide range of applications and the private and public side are investing substantially in the development and use of AI technologies. They expect these investments to raise the efficiency of existing business models and/or open up new markets. In addition, AI technologies are increasingly penetrating sectors of industry, business and aspects of daily life. Machines and industrial processes supported by AI are augmenting human capacities in their decision making and providing digital assistance in very complex processes.

The era of "AI everywhere" is not only the era of algorithms; it is equally to the era of organizing digitalized knowledge and giving it meaning. Therefore, successful strategies for AI adoption have to master the new paradigms which combine AI algorithms, data, human expertise, regulations and policies into digitized knowledge and memory.

Successful use of AI also depends on access to data, the systemic embedding of AI technologies in complex products, services and business models, and a well-founded trust for the new technology among the general public which is based on transparency of the processes used and an understanding of how it works and why it is beneficial.

This paper explores possible joint G7 actions for promoting the benefits from AI through innovative and open R&D activities. It will also discuss ways to reduce barriers to innovation as well as potential measures that could enhance market confidence.

Progress to Date

US Initiatives and Programs

The freedom to explore and invent is a hallmark of the human spirit. Emerging technologies, born from this creativity, have the potential to create new jobs, fuel the economy, and improve quality of life. The United States is focused on the opportunities that emerging technologies provide. Artificial intelligence (AI) describes a constellation of technologies that hold promise for tremendous societal and economic benefit. AI technologies have the potential to revolutionize how we live, work, learn, discover, and communicate.

The American worker should be empowered to develop the skills necessary to make the most of the digital revolution. And we should work together to encourage approaches across the globe that will lead to greater prosperity for all. The U.S. is therefore focused on removing barriers to innovation and establishing supportive policies that will advance the potential benefits of emerging technologies and not slow down innovation.

The U.S. approach to AI is a multi-pronged approach that builds upon the strength of the American research and development ecosystem that is based on a strong partnership across industry, academia, and government. Key aspects of this approach include the following:

- Identifying opportunities to use AI in growing the economy, improving public health, and building upon our national security.

- Promoting innovation and enriching the lives of our citizens by harnessing AI and integrating it into the economy.

- Investing in fundamental AI R&D, computing infrastructure, autonomous systems, and machine learning.

- Removing regulatory barriers and promoting regulatory approaches that enable AI innovation.

- Accelerating AI R&D through the use of public data sets.

- Fostering collaboration in basic and early-stage R&D to establish a foundation for future AI innovation and utilization.

- Promoting trust and understanding to allow the realization of AI's full potential.

- Developing a capable workforce for AI-related technical skills through apprenticeships, reskilling programs, and computer science and STEM education.

- Enhancing public-private partnerships to accelerate technology transfer and create value for our citizens.

The U.S. approach to governance of the use of AI reflects our approach to most emerging technologies: (i) recognize the importance of emerging technologies for our future economic growth and security, (ii) assess the adequacy of existing regulations before establishing new ones, (iii) incorporate input from non-Federal stakeholders, and (iv) avoid precautionary domestic or international regulatory approaches. The Administration has focused on advancing American AI strengths by increasing AI research and development (R&D) cooperation among our allies, removing barriers to AI innovation, and preparing for the future of work and promoting workforce development.

Key examples of ways in which the US government is actively seeking to remove regulatory barriers to AI development include:

- **Medicine** - In April 2018, the Food and Drug Administration approved the first ever AI-based device for medical diagnostics. The device uses AI to detect diabetic retinopathy, the leading cause of blindness among working-age Americans.

- **Transportation** - AI and machine learning are making significant inroads into how the U.S. transportation system functions, powering not only systems that allow automated vehicles and drones to observe and move through their environment, but also systems that can enable more effective management of transportation networks. The United States Department of Transportation's (U.S. DOT's) role is to enable the safe integration of AI applied technologies into the operation of the transportation system across modes — automated vehicles, accessible transportation, drones, vertical takeoff and landing aircraft, and smart communities. This also includes safe integration of AI-based decision-making, traffic management, and mobility tools. Example actions have included:

  - In September 2017, U.S. DOT released *Automated Driving Systems 2.0: A Vision for Safety*, providing non-regulatory guidance to automated vehicle developers to enable the safe integration of driverless cars onto American roadways. This October, DOT updated this guidance in *Preparing for the Future of Transportation: Automated Vehicles 3.0 (AV 3.0)*, expanding the scope to provide a framework and multimodal approach to the safe integration of automated vehicles into the Nation's broader surface transportation system. *AV 3.0* advances multi-modal safety, reduces policy uncertainty, and outlines a process for working with U.S. DOT across a range of issues related to the safe integration of automation into the surface transportation system.

  - In October 2017, President Trump signed a Presidential Memorandum to permit States and localities to conduct innovative commercial and public unmanned aircraft systems (UAS or "drone") operations. Under this pilot program, U.S. DOT entered into agreements with State, local, and tribal governments to establish innovation zones for testing complex UAS operations and explore different models for integrating drones into local airspace. Using existing Federal authorities, the program will accelerate testing of currently restricted UAS operations – such as beyond-visual-line-of-sight flights and flights over people. This program will open the skies for the delivery of life-saving medicines and commercial packages, inspections of critical infrastructure, support for emergency management operations, and surveys of crops for precision agriculture applications. The pilot program will also allow testing of new UAS traffic management systems and detection and tracking capabilities, which are needed to fully integrate UAS operations into the national airspace system.

European Initiatives and Programs

The European Commission has long recognised the opportunities offered by AI and taken action to ensure that the EU stays at the forefront of the AI revolution. As an important milestone in this direction, on 25 April 2018, the European Commission published a **_Communication on Artificial Intelligence_** together with a set of initiatives to complete the common European data space. The EU Initiative on AI is taking a comprehensive approach, which is above all human-centric, having at the very heart of its endeavours the interests of people and their security and prosperity.

Within the framework of the new initiative, the EC is planning increased investment in research and innovation in AI to strengthen European industrial leadership, excellence in science, and the development of AI applications in sectors such as health, transport and agrifood. Concretely, the Commission is planning to increase its own investment by 70% over the next three years. The ambition is to leverage a similar increase from the Member States and businesses, and thereby collectively achieve an overall investment of more than 20 billion Euros by 2020. The European Commission will further increase its investment in AI in the next budget period, mainly through two programmes: the research and innovation framework programme, **Horizon Europe**, and the new **Digital Europe programme**. Out of a total of nearly €100bn in Horizon Europe funds for 2021-2027, the Commission proposes to invest €15bn in 'Digital and Industry', which includes AI as a key activity involving diverse areas. Digital Europe is a new €9.2bn programme which will support industrial deployment and the strengthening of Europe's strategic digital capacities. AI is one of the main areas the EU wishes to invest in via this programme, comprising at least €2.5bn.

Given AI's disruptive potential for economic and societal development, it will be crucial to address the socio-economic effects of AI. To prepare for changes in the labour market, the EU Initiative on AI put emphasis on helping workers in jobs that are most likely to be most transformed by automation, robotics, and AI and training more specialists in AI.

Throughout its new initiative the EU also aims to ensure that AI is developed and applied within an appropriate framework that promotes innovation but at the same time also protects European values and fundamental rights. Europe has the ambition to be a world leader in responsible and trusted AI, which has the potential to become an important competitive advantage, because users everywhere value their own safety and rights, and investing in ethical AI will raise market confidence in the new technology. In addition to ethics-related work to ensure that all possible gaps are addressed, the European Commission is currently assessing whether the EU safety and liability frameworks are adequate in face of the new challenges posed by AI. The guiding principle of these activities is striking a careful balance between innovation and legislation.

Within the framework of the EU Initiative on AI, the European Commission is working with the Member States on drawing up and agreeing a **coordinated plan on AI** to maximise the impact of EU and national investments by the end of 2018. As the President of the European Commission Jean-Claude Juncker indicated in his letter of intent to the President of the European Parliament Antonio Tajani and to Austrian Chancellor Sebastian Kurz, the coordinated plan on the development of artificial intelligence in Europe is one of the proposals that the EU will need to adopt swiftly. Discussions on the coordinated plan on AI with the Member States focus on a number of key topics, including investment in research and innovation, the availability of quality data for a broad range of users, the fostering of technology transfer, reaching out to start-ups and SMEs, attracting and retaining talent, and skilling and upskilling the workforce. The current plans for joint efforts between the Commission, Member States and the private sector are also building on existing initiatives like Public-Private Partnerships (PPPs) in AI/Robotics – SPARC and big data – BDVA, which aim at facilitating and reinforcing investment in AI, and maximising its impact in both the public and the private sectors.

In addition, the European Commission will foster wide uptake of AI across Europe, via a toolbox for potential users and a focus on small and medium-sized enterprises, non-tech companies and public administrations: this will include a **network of AI-focused Digital Innovation Hubs** facilitating testing and experimentation; the set-up of **industrial data platforms** offering high quality datasets; and an **AI-on-demand platform** to facilitate access for all potential users to relevant AI resources in the EU.

German Initiatives and Programs

The German Federal Government is committed to achieve and maintain leading excellence by global standards in research and development and application of AI in Germany and Europe. The *German strategy on AI* has just been adopted and published on November 15th. In a nutshell, the German government aims to establish "AI made in Germany" as a global standard. This means a responsible, human-centric and ethical use of AI in a way that serves the good of society. Therefore, the German government will raise awareness with developers and users regarding ethical and legal questions of using AI. The German government commits itself to strengthen and to expand German research in AI and focus on the fast and comprehensive transfer of research findings to the private sector and industrial AI applications. To achieve this, numerous initiatives are proposed in a horizontal approach ranging from increased funding for research centres, expansion of AI chairs, French-German research and development collaborations, strengthening of regional AI clusters and ecosystems and various supportive measures for SMEs and start-ups. As the availability of data is a prerequisite for developing AI, the German AI strategy focuses on initiatives to increase the available data and to ease the use of available data. These initiatives are complemented with measures to attract international talents and to respond to the changing nature of work. In addition, it is envisioned to integrate AI into government services, to revise the regulatory framework, to start standardisation initiatives and to engage in dialogue with society and continue the development of the framework for action. All actions are in line with the Federal Government's High-Tech Strategy 2025.

In addition to its AI strategy, Germany already has several policies and initiatives in place aiming to foster AI applications in industrial settings. For instance, the flagship program *Industrie 4.0 platform* has successfully improved networking and cooperation in the field of manufacturing, earning global recognition for this work and setting standards. The recently established *platform "Learning Systems"* aims to improve networking and cooperation in different areas of AI. The German federal government has been funding projects in the field of AI for the development of AI specific projects and with the focus on basic and applied research. Within the strategy it is envisioned to make successful projects more visible. In addition, AI is already being used in parts of the federal administration, e.g. by Federal Office for Migration and Refugees or the German Patent and Trademarks Office. In June 2018, the German parliament has installed a new commission for AI jointly staffed with members of the parliament and AI experts to investigate how AI decision making will affect society. The commission shall publish its final report with recommendations by mid-2020. In July 2018, the German government has founded a data ethics commission which will publish recommendations regarding the use of AI and digital innovations under ethical aspects.

What We Heard

Stakeholder Perspectives from US

In May 2018, the White House convened a meeting of over 100 senior government officials, technical experts from top academic institutions, heads of industrial research labs, and American business leaders who are adopting AI technologies to benefit their customers, workers, and shareholders. Participants at this AI Summit emphasized the following priorities:

- **Supporting the national AI R&D ecosystem**. Attendees discussed the strong American R&D ecosystem, and the U.S.'s free market approach to scientific discovery that harnesses the combined strengths of government, industry, and academia. The attendees also examined new ways to form stronger public-private partnerships to accelerate AI R&D.

- **Developing the American workforce to take full advantage of the benefits of AI**. AI and related technologies are creating new types of jobs and demand for new technical skills across industries. At the same time, many existing occupations will significantly change or become obsolete. Attendees discussed efforts to prepare America for the jobs of the future, from a renewed focus on STEM education throughout childhood and beyond, to technical apprenticeships, reskilling, and lifelong learning programs to better match America's skills with the needs of industry.

- **Removing barriers to AI innovation in the United States**. Overly burdensome regulations do not stop innovation – they just move it overseas. Participants in this session addressed the importance of maintaining American leadership in AI and emerging technologies, and promoting AI R&D collaboration among America's allies. Participants also raised the need to promote awareness of AI so that the public can better understand how these technologies work and how they can benefit our daily lives.

- **Enabling high-impact, sector-specific applications of AI.** Finally, attendees organized into industry-specific sessions to share the novel ways industry leaders are using AI technologies to empower the American workforce, grow their businesses, and better serve their customers. Industries represented included: food and agriculture, energy and manufacturing, financial services, healthcare, and transportation and logistics.

Stakeholder Perspectives from EU

In June 2018, the European Commission appointed the **High-Level Expert Group on AI (AI HLEG)** to examine AI-related opportunities and challenges in Europe and make policy, legislative and strategic recommendations. It consists of 52 world-class experts with a wide range of backgrounds and experience, including representatives from civil society, industry and academia. The concept behind such a structure is to obtain various types of expertise from the AI HLEG members reflecting the interdisciplinary and complex nature of AI.

The AI HLEG is working on two deliverables, namely (1) draft AI Ethics Guidelines and (2) AI Policy and Investment Recommendations. The Ethics Guidelines will offer

practical guidance on the ethical development and use of AI, and all relevant stakeholders will be invited to voluntarily sign up thereto. The deliverable will look at the impact of AI on European fundamental rights including privacy, dignity, and non-discrimination, and suggest best practices to ensure the AI development and use is aligned with our core values. The final version of the AI ethics guidelines is expected to be presented to the Commission in March 2019.

The AI HLEG experts have identified the overall framework of core values and principles to be considered when dealing with AI. It is underpinned by a concept of trusted AI that takes into account the need for trust in the technology itself, trust in outcomes, trust in developers and manufacturers, and trust in the rules and norms governing AI. Such an approach, based on layers that include principles, values and rights, and industrial and sectoral governance, will create a trustworthy ecosystem of responsibilities and accountable agents fostering market confidence and uptake of AI.

In addition, opportunities for boosting AI innovation and increasing market confidence in AI will be reflected in the policy and investment recommendations, the final version of which will be presented by May 2019.

Public discussions on this work as well as on the activities related to the EU AI ethics guidelines take place via the **European AI Alliance**, a broad multi-stakeholder forum acting as a bridge between the AI HLEG and society at large. Engaging with this broader stakeholder group aims to ensure that the process of preparing the AI HLEG's deliverables – which touch upon a subject with major societal implications – is conducted in an inclusive and comprehensive manner. The European AI Alliance now has over 1 700 members from 51 countries, representing a wide range of fields and organisations. The European AI Alliance is open to anyone who is interested in discussing any aspect of AI and who would like to contribute to the work on the draft AI ethics guidelines and the policy and investment recommendations.

Stakeholder Perspectives from Germany

The before mentioned German strategy on AI was elaborated with the input of various stakeholders. The German government asked stakeholders to participate and give their recommendations in an online tool and during several workshops.

The recommended initiatives include that Germany should aim to achieve that a *higher percentage of AI expertise* being developed at German research institutes and universities will be made available for creating value in Germany and Europe. It is also seen of importance to *support SME*'s to get easier access to AI technologies, computing capacities and data analytics infrastructures. As the economic success and sustainability in AI will be mainly driven in ecosystems enabling seamless access to data and partners, wide range of *activities in ecosystem development* are rated as promising. This includes, for instance, the support for data sharing and access to partners by creating platforms for data exchange or the support for regional-level cluster development that follow the blueprint of the already established cutting-edge clusters and AI ecosystems, i.e. the Digital Hub in Karlsruhe or the so-called "Kompetenzzentren Maschinelles Lernen[i]". Those activities should involve the use of existing structures and can be implemented as joint projects between science and business in various application fields in Germany.

To reach larger scale and impact, it is recommended to foster joint projects and activities with European partners whenever this is possible as well as the *exchange between science and industry*. The latter can be implemented by special short-term programmes engaging partners from academia and industry to connect the innovator/supply side with the demand side or by *establishing living laboratories and test fields* that provide support in AI-based model building allowing to explore and assess opportunities of new technologies and business models in practical settings. Such sandbox set-ups are also seen as promising to guide the identification of areas in which regulatory framework require adaption, to promote cooperation between companies within the framework of competition law as well as to support the creation of consortia that strengthen the global competitiveness of German and European business.

The *access and quality data* is seen as central pre-conditions and determining factor to increase the quality and outcome of AI algorithms. At the same time, data protection is of equal importance. Thus, both objectives, the access to data as basis for innovation on the one side and data protection and its transparent usage on the other side needs to be balanced. In particular the access to data from public sector and academic communities as well as the interoperability of data assets, for instance in the health sector and regarding data platforms, are important leverages to boost innovation in AI.

For international corporates a simple and clear regulatory framework fostering AI innovations in international markets by reducing unnecessary constraints is of particular interest. By relying on regulatory sand-boxes unnecessary constraints of new regulations in complex cross-national settings can be explored and avoided. Also the concept of cross-national large scale domain-focused test fields for AI research activities simulating complex interactions in real-word settings by establishing means for data sharing and collaborative AI model building are seen as promising endeavors for developing future AI applications in complex environments, such as autonomous driving, energy supply or healthcare.

Looking Forward

Although the US, European and German AI strategies and stakeholder perspectives are emphasizing different areas, a few key elements for boosting AI-driven innovation in G7 countries could be identified:

Identification and removal of unnecessary barriers that could stifle innovation. Flexible regulatory and governance frameworks which deliver legal certainty and predictability for stakeholder could be the ultimate goals for law and regulation. While AI is a transversal technology, it is nonetheless applied differently in different sectors and application scenarios. Thus, horizontal principle-based frameworks could be complemented by appropriate legal and regulatory amendments in various vertical domains in cases as needed. Industrial stakeholders could be actively engaged in designing governance framework and policies. It is essential to establish environments (regulatory sandboxes) where novel AI technologies and regulatory solutions can be tested, improved and verified.

Identification of potential cross-national research infrastructure and activities
Application / use-case driven AI research and innovation superclusters with strong industry involvement could be established and/or networked globally. There are promising AI programmes at several research institutions internationally that could be scaled up and better coordinated at the global level, including the controlled data sharing and access as well as test fields for experimentation. With the creation of superclusters, AI talents and relevant stakeholders would be able to bundle forces for fast innovation and avoid dispersed efforts.

Sharing of Approaches: Circulation of use cases for beneficial deployment of AI methods and technologies

Promote Cyber-security and AI Innovation: AI evolution could be by design intertwined with cyber security. Algorithms need to be protected (and encrypted) according to the level of (cyber) security determined by the criticality of the application. At the same time, AI algorithms can be used as a tool to detect anomalies in communications or processes to increase cyber security.

Promote research and development of "Explainability" of Algorithms to send signal to industrial users and support public acceptance and confidence. In general, AI algorithms contain proprietary know-how and might remain a trade secret or be considered as Intellectual Property. However, for critical applications (where "critical" needs to be defined with sufficient clarity), it is beneficial to provide explanations of how the AI application came to a specific result ("Explainable AI"). This will ensure the commitment of industrial users to ethical values and principles in using AI, foster responsible technology development (e.g. avoid bias) and enhance transparency. Explainable AI could provide transparency regarding the input data as well as the "rationale" of the algorithm leading to a specific output. The algorithm itself need not necessarily be revealed.

Foster the access to voluntarily provided open training data: The identification and availability of voluntarily-provided training data for AI is seen as a potential leverage factor for global economic growth. The greater the volume and quality of data available, the more that certain types of AI algorithms can learn, leading to potentially better AI outcomes and offerings. Government, industry and citizens are creating a wealth of valuable data assets. How can those data assets be made available for AI applications? International policy in terms of data protection could find a fair balance ensuring a high level of data protection without undermining innovation and the possibility for international economic growth in AI.

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[i] Competence Center Machine Learning