Ten recommendations for a co-programmed European partnership in AI

Prepared by the Confederation of Laboratories for Artificial Intelligence Research in Europe (CLAIRE).

In cooperation with the European Artificial Intelligence Association (EurAI), HumanE AI, and AI4EU in consultation with the Big Data Value Association (BVDA) and euRobotics.

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The Commission has announced its intention to establish a contractual co-programmed partnership in the area of Artificial Intelligence (from here on shortened "AI"), an instrument based on the contractual public-private partnership (cPPP) instrument in Horizon 2020.

When designing and establishing a co-programmed partnership in AI (from here on, called "AI cPP"), there are a number of issues that should be taken into consideration. In this note, key organizations from Europe's AI community are putting forward 10 recommendations for a cPP. The recommendations have been prepared by the Confederation of Laboratories of Artificial Intelligence in Europe (CLAIRE), in cooperation with the HumanE AI consortium, the European Artificial Intelligence Association (EurAI), and the AI4EU consortium, and in consultation with the Big Data Value Association (BVDA) and euRobotics. Please see the appendix for a description of these.

The objective of this document is to bring to the public, potential partners in a future cPP, and to the Commission, our views on which qualities a cPP in AI should hold to be successful and effective.

The recommendations, not listed in any sequence of importance, are the following:

1. *The AI cPP should embrace an ambitious global mandate.* The objective of the AI cPP should be to help bring Europe to the forefront on AI-driven innovation and value creation, to the maximum benefit for individuals, society, and its economies. The AI cPP should, therefore support, by bringing together the relevant key stakeholders, ambitious instruments towards that goal (see also Recommendation 10 below) and focus on growth.

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[1] Version 1,8, October 15, 2019.

2. *The AI cPP should build on Europe's existing strengths and develop new ones, focused on trustworthy, human-centred AI[2].* Europe industrial strength and strong position in high-quality AI research across the full spectrum of AI make a powerful platform for an AI-based industry (see also Recommendations 4 and 7). In addition, Europe has some particular strengths that can be utilized, including Europe's well-developed and legally founded citizen's rights, strong competence in human-centric, trustworthy and transparent systems, and strengths in the B2B, Government to-citizen, and embodied AI. However, Europe needs to develop strengths in a number of areas, including in innovation driven entrepreneurship and B2C markets.[3] The AI cPP needs to build on strengths while developing new ones.

3. *The AI cPP should reflect the complexity of modern, AI-driven innovation.* In the real world, there is not a simple transition of knowledge from academia to industry. Rather, innovation happens through complex interactions between actors in (unorganized) ecosystems. The AI cPPP should not merely regard academia as a producer of scientific progress, and neither regard other actors in the innovation ecosystem as merely consumers of these results. A way to say this is that the AI cPP should use a non-linear model of innovation that captures the complex interaction between the various actors in the innovation system.

4. *The AI cPP should be about AI.* AI is not a single technology or a single field of research, but a rich collection of methods and technologies to build systems that exhibit traits of human intelligence. The AI cPP should not be about a subset of AI. It should be focussed on AI at the core, with clearly defined mechanisms for interfacing with closely related areas of relevance to AI, such as big data, robotics, ethics, and law.

5. *The AI cPP should take an "all of Europe" approach.* There are excellent research and innovation possibilities across all of Europe, but the opportunities are not evenly distributed. We encourage the AI cPP to devise programs specifically focused on mobilizing resources and talents across Europe.   There is considerable value to be found.

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[2] Human-centred AI refers to machine intelligence that aims to augment, rather than replace human intelligence; we use trustworthy in the sense of the recent Ethics Guidelines by the European Commission's AI High-Level Expert Group (see https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai)

[3] https://ec.europa.eu/digital-single-market/en/news/policy-and-investment-recommendations-trustworthy-artificial-intelligence

6. *Europe's startup and SME sectors should be partners in the AI cPP.* European incumbent industries deliver strong innovation and will of course be a strong part of the cPP. Digitalization makes it possible for small and medium sized enterprises (SMEs), which make up the backbone of European industry, to find growth paths and play stronger roles in the economy. In addition to SMEs, particular care must be taken to give a clear representation in the cPP to the innovation driven entrepreneurial sector. Innovation outside incumbents, including innovation focused on disrupting incumbents' markets, is an important component in the technology driven knowledge economy. We recommend the cPP is built on the six key sectors of both the incremental and disruptive AI markets; academia, industry, entrepreneurs, investors, civil society organisations, and the public sector. (The is an extension to the triple helix model, forming a hexa helix model.)

7. *Academia and research organizations should be an equal partner.* Co-programmed partnerships have their roots in innovation-directed public-private partnerships, which again have their roots in the triple-helix model for innovation, where innovation is seen as a result of interaction between industry and academia, and the government funds the academic participation, and where curiosity-driven academic research[4] in sum and in the long run is seen of crucial importance for industry. True partnership is necessary for this to work.

8. *The AI cPP must leverage existing organizations and structures.* We recommend that the Commission partner with relevant well-known partnerships, stakeholder groups, and networks, that are important for AI and for which AI is important. They should, to the extent possible, have mandates of representing or covering all EU member states and associated members of Horizon Europe.

9. *The AI cPP should be established through a transparent participatory process.* We ask that the Commission when designing the AI cPP engage in a structured dialogue with relevant existing well-functioning organizations, networks, and partnerships from academia, industry, Europe's startup sector, and civil society.

10. *The AI cPP should be only one of several instruments aimed at European excellence and leadership in AI.* The cPP instrument is designed for addressing particular objectives in the complex AI innovation ecosystem[5]. However, Europe needs different instruments to

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[4] Whether focused on challenges with known importance for society or not, whether driven purely by curiosity or external need, or whether driven by a wish to solve formal or practical problems.
[5] Notably, mobilizing commercial actors to create strong, value driven collaboration with academia.

address different parts of its AI innovation ecosystems; in particular, instruments are needed to mobilize Europe's academic researchers in curiosity-driven and mission-focussed academic research.

As this is a set of recommendations, not a proposal, some crucial details are not addressed. An important example is the governance model. There are a number of ways a governance model can be structured to reflect the recommendations listed here. We see these points as starting points for a discussion of the structure of a cPP.

Each of these recommendations will be discussed in more detail in the remainder of this document. The recommendations are based on the broad experience from the organizations that developed and endorse this document, and on the five main dimensions defined in the cPPP Terms of References: Efficiency, Relevance, Coherence, Effectiveness and EU Value Added.

The organizations that have signed this document are willing and ready to join a partnership under the cPP structure with the European Commission, and also with actors from other sectors in the hexa-helix model described in this document. We will take responsibility as partners in the cPP to deliver on clearly defined parts of the Commission's AI strategy.

Europe's future position in the global knowledge economy is dependent on its ability to establish the continent as a well-functioning and effective ecosystem of research and innovation, bringing new insights all the way to market, successfully.

The need for an AI cPP

Europe needs a strong investment in AI. There is really only one main reason: Europe shouldn't leave its future to others to build. Technology in general and AI applications in particular is now shaping the world we live in, the way we work, live and think. AI has already become a particularly important component in the global technology-driven knowledge economy, and the winners in the global market competition will be AI-driven. Also, AI accelerates science and innovation, and thus creates a positive feedback loop for the knowledge economy.

AI shapes the world we live in

Technology shapes the world we live in, to such a large extent that it shapes us as humans – the way we think, the way we interact, the way we work, the way we spend time with each other, and

the way we decide to organize ourselves, our education systems, our health care, our communications, our national debates.

When designing and developing new technologies, applications and products, many assumptions are made - assumptions about how we work, how we communicate with each other, what our rights are, how a company should function, how decisions are made, what the roles are for different actors in work life and in society, and who actually is going to use the systems and for what purpose. These assumptions, whether they are conscious or not, influence the overall design, the selection of the data the system is trained on, and so on.   Technology is never neutral, never context independent and never culturally unbiased.

Artificial Intelligence in all its shapes and forms, embedded in consumer products, public service systems, industrial production and media, is an important component in the development of the reality that surrounds us. As it often has been said in the last few years, AI will have such a systemic impact that it should be considered as a resource like electricity, rather than as a mere technology - a resource that will impact every aspect of society and every aspect of our lives.

AI accelerates science and innovation

Scientific disciplines are increasingly becoming "computational". Modern scientific discovery increasingly makes use of the power of AI to arrive at new insights and progress faster. Over time, this will represent a scientific transformation in most technological domains and beyond. A similar development happens in parallel in innovation. Industry and SMEs are increasingly relying on AI to develop new insights, products, processes, and solutions, reduce costs, and increase quality.

Investing in science and innovation is in itself both smart and necessary to develop our scientific, technological and economic progress. Investing in AI-focused science and innovation, however, provides a much stronger accumulated effect, as the results of the investments are fed back into the scientific and commercial innovation processes, creating a positive feedback loop.

Value creation from AI happens to a large degree outside of Europe

Today, the majority of advances in AI, whether it concerns research, scientific development, innovation or consumer products, happens outside Europe. In AI innovation, Europe is lagging

behind the USA and China. The AI-investments of American and Chinese companies[6] far exceed those made by companies in Europe.

And while the USA is still in the lead, China's ambition in AI is to reach parity by 2020 and to become the world's leader by 2030, when the gross output from core AI industries should reach EUR 120 billion, with a further EUR 1,120 billion from industries incorporating these AI technologies. In order to reach those goals, China is investing strongly in basic and applied research.

Further competition comes from Japan, where authorities are spending EUR 190 billion on building a "super-smart society" by 2020. Across the Korean Strait, South Korea, plans to invest in research and innovation capabilities in robotics with around EUR 40 million a year and in self-driving cars, smart cities, VR, and AI with around EUR 500 million a year, including the establishment of six new AI research institutes.

At last year's International Joint Conference on Artificial Intelligence, only 19% of the 800 scientific papers were from Europe.

Finally, it should also be mentioned that startup companies, boosted by venture capital, are flourishing, too, in the US and Asia: they are a vast source of dynamism in the AI world.

Europe should take control of its future

Squeezed between Asia and the USA, Europe risks losing out on the opportunities offered by AI, even though Europe has the highly skilled talent that could revert this fate. But this talent pool is also under pressure; Europe is experiencing a dramatic brain drain and is at great risk of being left as a consumer of solutions developed by North American and Asian competitors. Using the term introduced in the French AI strategy[7], Europe may become a "cyber colony".

It is sometimes said that the best way to predict the future is by creating it. Similarly, the best way to *control* the future is by creating it. Today, to a large extent, Europe is leaving it to others to shape its future. Our position is that swift and bold action is required to ensure that Europe's future is not left to a large extent to others.

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[6] Notably the GAFAMs (Google's parent company, Alphabet, Amazon, FaceBook, IBM and Apple) and the BATX (Baidu, Alibaba,Tencent and Xiaomi).
[7] Commissioned by the French government from a team led by Cédric Villani.

This is the main reason why Europe should pool its resources, thinking, science and investment in the area of AI. Another reason, more often discussed, is Europe's role in the global economy. The global economy is increasingly a technology-driven knowledge economy. Here, actors outside of Europe are leading the way, notably the United States, China, South Korea and Japan. AI is a fast-growing industry, and European suppliers should be able to participate in this growth - Europe has the skills needed to produce globally competitive AI technologies and achieve global leadership in a number of areas. European scientists and companies have specific needs that should be addressed by European suppliers, in order to facilitate economic growth and academic research. Europe should have independent access to AI technology in order not to rely on foreign, competing regions or globalised industry head-quartered elsewhere.

Co-programmed European Partnerships

Europe's future, its ability to tackle environmental and societal challenges while also strengthening European competitiveness and positioning the continent in the global knowledge economy, is dependent on its ability to establish well-functioning ecosystem of research and innovation. There is ample evidence that governments play an important role when supporting value creation in a systematic way through research and innovation.

To that end, the European Commission has a number of instruments and initiatives that mobilize research and innovation actors, and that are oriented towards coordination, collaboration, and alignment of national strategies and programmes.

For Horizon Europe, the European Commission is planning to use an instrument called "Co-programmed European Partnerships" (cPP), which are partnerships between the EU, Member States/ Associated Countries, and/or other stakeholders, based on Memoranda of Understanding or contractual arrangements with partners. The model for the cPP is a contract between partners, based on an instrument used in the Horizon 2020 Programme, called Contractual Public-Private Partnerships (shortened "cPPP") [1]. These partnerships were established as non-for-profit organisations[8] to serve as contractual counterparts to the Commission for the implementation of each instrument. A number of organizations and institutions are mobilized as partners in the cPPP, and are represented in the governance structures of the cPPPs.

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[8] Often under Belgian law.

In some sense, the cPPPs were inspired by the so-called triple-helix model of innovation, where, simplifying the picture, innovation is achieved through collaboration between industry, academia, and government. In this model, the role of academia is long-term basic research, the role of the government is to fund this research, and the innovation process is a value-chain starting from basic research in academia and ending up with industry turning this research into products and services in the commercial market. The cPPP then becomes an instrument to facilitate both the division of labor and the knowledge transition from academia to industry necessary to accelerate innovation.

The cPPP instrument was designed to achieve some particular objectives that were more difficult to achieve through the Commission's other instruments, including

- implementing strategies to increase the competitiveness impact of European R&D funding through the Framework Programmes;
- offering a more active role to industry in defining roadmaps and contributing to work programmes and calls;
- mobilizing industry and engaging it in the management of stimuli activities towards agreed goals;
- mobilizing proposals with higher technology readiness levels (TRLs) than in the general calls;
- fostering cooperation between academia and industry actors at early stages of the research and innovation process;
- giving Europe's industry an important role in devising the programmes' research priorities;
- offering industry a more active role in the management of the instrument than for other programs;
- enabling long-term, strategic approaches to research and innovation;
- establishing projects with higher competitiveness impact than other European R&D funding programs;
- ensuring long-term commitments across sectors;
- sharing financial, human and infrastructure resources;
- pooling resources and gather critical mass;
- achieve projects of a larger scale than other programs.

The European Commission established 10 cPPPs, see Table 2, with typical funding from the Commission of around €700 million.

Table 2: Existing cPP and their funding

cPP	Short	Launched	EU funding
Factories of the Future	FoF	2013	1,150
Energy-efficient Buildings	EeB	2013	600
Sustainable Process Industry	SPIRE	2013	900
European Green Vehicles Initiative	EGVI	2013	750
5G Networks for the Future Internet	5G	2013	700
High Performance Computing	HPC	2013	700
Robotics	euRobotics	2014	700
Photonics21	Photonics21	2014	700
Big Data Value Association	BDVA	2014	500
European Cyber Security Organization	ECSO	2016	450

Horizon Europe will also include some other, similar instruments, notably "Institutionalized European Partnerships" (IEP). The IEPs are based on Articles 185 / 187 of TFEU and the EIT Regulation supported by Horizon Europe. These should be considered in the context of the larger push for European excellence in AI and may in fact complement a cPP or even serve as a useful alternative. The Commission's Strategic Plan[9], produced by the Commission's 'Strategic Planning' process in 2019, outlines the priorities of the first work programme, translates mission areas into missions, specifies institutional partnership areas, and defines cPPs and IEPs.

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[9] The implementation of both the Horizon Europe Framework programme for Research & Innovation and for the Digital Europe programme will be heavily influenced by the Strategic Plan. (The European Commission released the legislative proposals for Horizon Europe and Digital Europe in June 2018.)

Desired characteristics of a strong AI cPP

Recommendation 1: The AI cPP should embrace an ambitious global mandate

The objective of the AI cPP should be to bring Europe to the forefront globally on AI-driven innovation and value creation, to the maximum benefit for its citizens and its economies. The AI cPP should therefore develop or be strongly linked with otherwise independent instruments for supporting AI research in Europe.

Examples of instruments to consider include the following: innovation districts, project schemes suitable for startups, scale-up programs, talent strategies, a network of centres of AI excellence across Europe, entrepreneurship schools, technology adoption programs, industry professorships, and a European AI hub where the continent's best scientists and innovation companies collaborate.

The AI cPP should be synergistic with and supportive of the networks of excellent AI research centres across Europe to be established starting from ICT-48-2020 call. We note that merely investing in networks of existing groups and research institutes is ineffective and insufficient.

Recommendation 2: The AI cPP should leverage Europe's values and strengths while developing new ones

In addition to considerable industrial strength, Europe holds a strong position in high- quality AI research across the full spectrum of AI. In sum, this provides a powerful potential for an AI-based industry as well as an AI-based industry.

The main developments have been in Europe's strong B2B markets and embodied AI. Clearly, the AI cPP should build on this strength. While the cPP should build on Europe's strengths in such markets, it should also develop strengths in areas like innovation driven entrepreneurship and consumer markets (B2C).[10] Neither the European AI strategy or the AI cPP should retreat to a

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[10]

https://ec.europa.eu/digital-single-market/en/news/policy-and-investment-recommendations-trustworthy-artificial-intelligence

B2B industry. The consumer market changes constantly, and Europe has strong potential in the B2C market as well, especially in the context of human-centred, trustworthy AI.

Europe has some particular strengths that can be utilized, including Europe's well-developed and legally founded citizen's rights, and strong competence in human-centric, trustworthy and transparent systems, and Government to-citizen solutions.

European values should be a pillar in an AI cPP. These include topics such as human-centered designs and technologies, trustworthy and transparent systems and products, and well-developed and legally founded citizen's rights. These values also are or can be turned into strengths in the market.   The European Commission has demonstrated excellent leadership in calling for a focus on human-centred AI, on machine intelligence that augments rather than replaces human intelligence - a focus that we support and believe

Recommendation 3: The AI cPP should avoid common, simplistic models of innovation

Innovation is often seen as a result of interaction between industry and academia[11], and in particular as a value-chain starting from basic research in academia, through applied research, and ending up with industry turning this research into products and services in the commercial market.

In the real world, however, innovation is not a simple knowledge transfer chain from academia to industry, hexa[12]. For instance,

- in reality, there is no chain from academia to industry, but an ecosystem where actors engage with each other in complex ways;
- in reality, research is not only done in universities, but in universities of applied sciences, public and private research institutes, industry, SMEs and startup companies [2];
- in reality, it is not only industry that turns science, research and innovation into use in society, this is also the role of public sector, entrepreneurs and investors.

To understand how innovation takes place and can be strengthened, it is more useful that the cPP uses a much wider model of innovation, i.e., as an ecosystem where innovation occurs

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[11] In other words, a diplo helix of overlapping, yet relatively independent institutional spheres, academia and industry.
[12] As all models are simplifications of reality, their value resides solely in their usefulness.

through complex interactions between actors, with information and knowledge going between all actors and in cycles[13].

Designing the cPP for an ecosystem approach may also help Europe succeed in establishing an organisational structure that fits the multidisciplinary and heterogeneous field that AI is[14], both on the academic and industrial side. Existing cPPs are commonly addressing more coherent and unidisciplinary fields, and their structures reflect that.

Recommendation 4: The AI cPP should follow an "all of AI" approach

Artificial Intelligence is sometimes called a "broad church". AI is not a single technology or a single field of research, but a collection of approaches aimed at building systems that achieve key aspects of human intelligence. Indeed, much research in AI aims at solving problems that do not require the full spectrum of human intelligence, such as locomotion, visually recognizing faces and images, or understanding text and speech, while other directions aim to enable machines to carry out tasks that traditionally require highly specialized human skills and expertise, such as complex logical reasoning, planning, and optimization.

The AI cPP should not pick among these many subfields of AI, whether it is big data, robotics, machine learning, reasoning, or planning, but rather establish excellent growth possibilities for the full spectrum of AI techniques. It is notoriously difficult to pick winners, and much of next-generation intelligent systems will be enabled by techniques from multiple areas of AI.

While the AI cPP should be about AI, it should not be insular. It is clear that the success of AI over the last few years is not only a result of developments in AI, but of a confluence of other developments, including increased processing power and speed, miniaturisation, access to data, advances in robotics, and the fact that more than 3 billion people and twenty billion things now are connected to the internet.

The AI cPP will be situated in this context, as well as within a European AI strategy, which again is situated in broader policies and strategy documents covering areas such as ICT infrastructure, ethical guidelines for AI in Europe, and public data access policies.   The cPP can't isolate itself from the technological, social, political, legal or ethical realities and strategies surrounding AI.

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[13] Another way of saying this is that the innovation process is nonlinear.
[14] As we have seen above, is that AI is a "broad church".

When designing the cPP, care should be taken to define its role in and interfaces to areas outside of and overlapping with AI. When doing that, the temptation to expand the scope too broadly should be resisted, since an overly broad mandate or scope would "water down" the cPP, make it less effective and undermine its intent[15]. It is therefore important that the AI cPP communicates clear demarcations to the broader technological context it inhabits.

What should then the AI cPP cover? AI intersects with a large number of areas, as indicated in Figure 1. AI is shown as the centre of a flower, where the many petals are areas that have important intersections with AI, but which are distinct, at least in part, from core AI and involve areas and aspects that fall outside AI as commonly defined. While we caution defining the scope of the AI cPP as the union of these areas, we see value in defining a structure that, while focussed on core AI (the centre of the flower in Figure 1), connects explicitly and strongly to related areas (the petals).

Figure 1: AI and adjacent areas
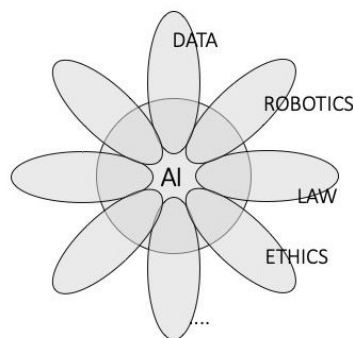
Recommendation 5: The AI cPP should take an "all of Europe" approach

We believe in an "all of Europe" approach. When establishing a cPP in AI, it may be easier to find alignment between a small group of committed nations and businesses, and it may be easier to focus on the strongest economies, but as often, what initially is easiest may not be the most beneficial approach in the long run. First, European AI will benefit from leveraging to the greatest possible extent the broad and diverse pool of talent found across the continent. Secondly, AI is

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[15] It is understood that AI research and innovation will receive substantially more attention and funding in the years ahead, which makes it tempting to collect related activities, research groups, and innovation work under this umbrella.

too important to create a two-tier Europe. For Europe to play any sort of leadership role in AI, a coordinated initiative, supported by the national governments is needed.

The cPP should therefore involve stakeholders across all of Europe, including associated countries with a strong AI ecosystems, such as Norway and Switzerland. It is therefore important that the management, board and governance structure reflect not only a public/private (or industrial/academic) balance, but also a geographical distribution, in order to be able to mobilize European stakeholders broadly.

To be successful in the global push for AI, Europe needs to pull together; weakly coordinated national AI initiatives are insufficient to compete globally.

Recommendation 6: The AI cPPP should include Europe's startup and SME sectors

One key purpose of the cPPP instrument was to offer a more active role to industry in the management of the Commision's funding instrument Horizon 2020, and in increasing the number of funded projects with with higher technology readiness levels (TRLs).   It must be taken care of that small and medium sized enterprises (SMEs) get a role in the cPP. First, they make up the backbone of European industry, secondly, digitalization makes it possible for SMEs to find growth paths and play stronger roles in the economy.

In addition to SMEs, we believe care must be taken to provide a clear representation in the cPP to the innovation driven entrepreneurial sector.   Innovation outside incumbents, including innovation focused on disrupting incumbents' markets, is an important component in the technology driven knowledge economy.

While we can arrive at a good formal innovation system using the triple helix model described above, we may miss many innovation opportunities by doing so and leaving startup companies and entrepreneurs out of the loop. Indeed, entrepreneurship is a bottom-up process, usually initiated by individuals. In the triple helix model, the entrepreneur is missing. This also means that the triple helix model overemphasizes formal learning and underplays the value of experience-based and tacit learning in innovation. An effective AI cPP must be able to combine both.

In other words, if Europe's industry is to grow stronger, a larger parts of its innovation ecosystem need attention. This includes the sectors representing industry, public sector, entrepreneurs,

investment and research. These sectors pursue different objectives and face different challenges. A strong European cPP in AI can play an important role in developing effective communication and collaboration between these ecosystem components.

Also, the classic triple helix model is likely to have a too strong representation of the interests of incumbent industries[16], whereas much of the innovative value creation in the modern, technology-driven knowledge economy, starting with AI, is by disrupting the incumbents, their markets and their business. A successful cPP in AI must avoid to be turned into an instrument that resists disruptive market development.

In order for a cPP in AI to become the instrument the innovation ecosystem in Europe needs, it must ensure that all key sectors are strongly represented. In particular, we believe the cPP should include two sectors that are missing in the current PPPs, namely venture capital and entrepreneurs, who are major drivers for the disruptive innovation. We therefore recommend that the established cPP be a partnership between industry, government, academia, entrepreneurs and investors. This is known as a *penta helix* model.

We believe that a penta helix partnership will increase the focus on, and support for, the more disruptive part of the European AI-based value creation. We also believe that it will bring the partnership closer to applying a more effective and powerful non-linear model of innovation discussed above. In addition, a sixth sector could strengthen the partnership, civil society, forming a hexa helix model.)

We assume that the Commission's move from cPPPs to cPP was, at least partially, to create partnerships from a broader set of actors, as well as partnerships with higher impact and improved visibility. Our recommendation is in line with this.

If, however, a full penta- or hexa helix partnership proves challenging, the Commission should consider establishing more than one cPP - for instance, by establishing an AI cPP to mobilize incumbent industry, and another cPP (or a different instrument) to mobilize European venture capital, entrepreneurs and disruptors. Academia should be a strong partner in both these instruments.

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[16] For most of the cPPs, inclusion and participation of SMEs are higher than on average in Horizon 2020 [1].

Recommendation 7: Academia should be an equal partner

Innovation is often seen as a result of interaction between industry and academia [3]. This two-party model is then expanded by pointing out the governments' roles in compensating for classic market failures[17]: Financing curiosity-driven research, with a long time horizon, is something that industry can hardly do well. This division of labor between government, industry and academia is known as the triple-helix model for innovation[18] [19].

However, public-private partnerships are essentially based on this model. At the same time, making academia and industry work well together towards the overall objectives of the partnerships is sometimes challenged by differences in culture, experiences, reward structures and sense of mission. In order for these partnerships to work, the partners need equal and balanced participation. If one partner is a junior partner in an advisory role, there is no true partnership, engagement drops, and the partnership may become a system for one of the partners to provide benefits to its stakeholder base[20]. This must of course be avoided. The solution is to involve the partners equally in governance of an AI cPP, and to design its governance structure accordingly.

Recommendation 8: The AI cPP should leverage existing organizations and structures

We have recommended that academia and industry have strong, active and equal parts in the co-programmed partnership, with the governance possibly involving also other partners, such as representatives from Europe startup sector. In addition, we recommend that the partnership is based upon existing relevant well-known networks and organizations, as well as stakeholder groups.

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[17] In some ways, we can see the shift from an industry-university dyad to a triadic relationship between university, industry and government as a result from the shift from the industrial economy to the knowledge economy represented.

[18] The model pointed at something important: Fostering interactions between academia, industry and governments increases the capability of creating wealth and social and economic development. The model has therefore been extensively used to understand innovation dynamics and to develop innovation policies.

[19] A triple helix of overlapping, yet relatively independent institutional spheres.

[20] Industry partners are expected to be contributing to the pool of resources available, for instance through financial or in-kind contributions. The role of the government, here the Commission, is to fund the participation of the academic partner, as per the triple helix model. Academia's role is not only substantially important for the objectives of the PPP, but also substantially funded.

These partners should not only be groups important for AI and groups for which AI is important, but they should also, to the extent possible, have mandates of representing or covering all EU member states. Furthermore, care should be taken to ensure strong and balanced participation from all sectors in the proposed penta helix model.

Table 1 shows a list of candidates from these five sectors. We strongly believe that the governance structure of the AI cPP should involve a selection of these organisations. We believe the list covers a good part of the AI innovation ecosystem actors, and all aspects of the European Commission's AI strategy in Horizon Europe.

Table 1: Examples of organizations an AI cPP could include in the governing board. The list does not try to distinguish between types of organizations, only their sectors.

Sector	Organization
Academia	Confederation of Laboratories of Artificial Intelligence Research Europe (CLAIRE, also representing projects, such as HumanE AI)
	(European Laboratory for Learning and Intelligent Systems (ELLIS)
	European Association for Artificial Intelligence (EurAI)
Industry	AI4EU
	Big Data Value Association (BDVA)
	Digital Europe
	euRobotics
	European Entrepreneurs CEA-PME (Confédération Européenne des Associations de Petites et Moyennes Entreprises)
Government	The European Commission
	The European Institute of Innovation and Technology (EIT)
Entrepreneurs	European Business Association
	Yes for Europe
	Young Entrepreneurs Organization of the European Union
Investors	European Private Equity and Venture Capital Association (EVCA)
	Invest Europe (previously European Private Equity and Venture Capital Association, EVCA)
	The European Investors' Association – European Investors
	The European Long-Term Investors Association
	The European Trade Association for Business Angels, Seed Funds and Early Stage Market Players

	(EBAN)

Recommendation 9: The AI cPP should be established through a transparent participatory process

We ask that the Commission in designing the AI cPP establishes a structured dialogue between EU institutions and relevant stakeholders, leading to *de facto* co-decision.

We particularly ask that the Commission makes use of Europe's relevant existing well-functioning networks, organizations and partnerships, including those that have prepared and endorsed this document. We particularly ask that both academia and industry have strong, active and equal part in these discussions, and that also representatives for Europe's startup sector (including venture investors, entrepreneurs and startups) are brought to the table.

The Commission's dialogue partners should not only be groups important for AI and groups for which AI is important, but they should also to the extent possible have mandates of representing or covering all EU member states. We, the organizations who have signed this document, consider ourselves to belong into this category. We believe that such a participatory process provides an important component in a transparent impact assessment based on objective evaluation criteria.

Recommendation 10: The AI cPP should be only one of several instruments

It is clear that to lift Europe's competitive edge in AI, a cPP should not be the only instrument.

One reason is that AI is a broad and varied field. Most previous cPPPs[21] are more narrow in scope and field than AI[22].   If an AI cPP can't effectively take an "all of AI" approach, more than one cPP or a set of other instruments must be used. As an example, if robotics turns out to be a major focus for the Commission, it should consider extending the existing cPPP in robotics while establishing a separate cPP in AI which does not cover robotics.

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[21] Which include areas like big data, robotics, energy-efficient buildings, green vehicles, sustainable process industry, photonics, high performance computing, 5G networks and cybersecurity.
[22] It may be a limited set of experiences we can draw from these cPPs when establishing a cPP for AI.

However, that would not be optimal. For maximum cohesion, impact and synergy across a broad spectrum of applications, the best approach is a single AI cPP with several sector-specific components that strongly interact. The significant public and private investment will be utilised most efficiently if critical mass is created within a single cPP rather than a system of several, linked cPPs, through sharing of personnel, infrastructure, and a single, top-level governance structure.

The main reason why the cPP should be only one of several instruments, is that it is designed for addressing particular objectives in the complex AI innovation ecosystem, notably, mobilizing commercial actors to create strong, value driven innovation in close collaboration with academia.

Europe needs different instruments to address different parts of the bold push required to ensure its global positioning as a leader in AI. Such different instruments already exist, or will exist soon, that also contribute to the innovation ecosystem, instruments designed to mobilize Europe's academic researchers and strengthen Europe's mission driven and curiosity driven academic research. An example is HumaneAI, that, with science and a long term horizon as the starting points, develops both the new insights and innovation collaborations that industry is not equipped for. Other examples include the AI4EU platform that will benefit both research, startups and industry; the "Vibrant networks of AI excellence centres" that will come out of the currently-going ICT-48 call; and the organizations currently built by the CLAIRE and ELLIS initiatives, notably the push for a network of regional centres of excellence and for a European AI hub as a global magnet for talent and a symbol for European ambition in human-centred AI.

The cPP should be strongly coordinated with (rather than subsume) independent measures for ensuring European excellence and independence in academic AI research. Furthermore, since the cPP must be seen as an instrument that is designed to address some clearly identified challenges in the European AI ecosystem, it needs to have clearly defined demarcations to other instruments and initiatives funded by the European Commission and national governments. The cPP should be integrated in a coherent strategy of priorities and objectives with other EU instruments, avoiding duplication and overlapping and exploiting synergies with national and regional policies, including structural funds.

On governance

A number of these recommendations (for instance strong representation of research, a penta- or hexahelix participation model, and the intentions of covering all of AI and all of Europe) can be

met through a well designed governance model. In this document, we deliberately refrain from proposing a particular governance model, but expect that its design will take into account the ten recommendations listed here. However, we believe that in order to achieve this, it is necessary that the associations and representatives making up the governance of the cPP ensure transparency of the management processes and update reference roadmaps focussing on reaching the highest number of stakeholders and the broader society. Also, they should ensure the establishment of a strong KPI framework that in turn support an effective and transparent management of the cPP.

Appendices

About CLAIRE

CLAIRE (Confederation of Laboratories for Artificial Intelligence Research in Europe, claire-ai.org) is an initiative by the European AI community that seeks to strengthen European excellence in AI research and innovation, with a strong focus on human-centred AI. CLAIRE aims to establish a world-wide brand recognition for "AI made in Europe" (on the level of CERN), and to position Europe in control of its own future.

The initiative was launched in June 2018 and now has the support of more than 3,000 people, most of them scientists, technologists, and researchers in Artificial Intelligence. The supporters represent the vast majority of Europe's AI community, spanning academia and industry, research and innovation. Among the supporters are more than 140 fellows from various key scientific associations. CLAIRE has opened administrative offices in The Hague, Saarbrücken, Prague, and Rome, with additional offices to be opened this year in Oslo, Paris, and Zürich. Furthermore, nine advisory groups with 48 members from 18 countries have been established, covering all areas of AI, along with the topics of ethical, legal and social implications of AI.

CLAIRE also consists of a membership network of over 320 research groups and research institutions, covering jointly over 19,000 employees in 34 countries. In addition, CLAIRE is working on setting up an industry network in order to follow up its commitment to foster close links between non-profit research and impactful industrial applications. The initiative has received official letters of support from the governments of seven European countries, from 28 scientific associations across all of Europe, from the European Association for Artificial Intelligence (EurAI, which is the key European association for AI researchers), from the

Association for the Advancement of Artificial Intelligence (AAAI, the key international association for AI), and from the European Space Agency ESA.

CLAIRE is also actively liaising, on an ongoing basis, with other important organizations, including ELLIS, the HumanE AI consortium, the Big Data Value Association, euRobotics and AI4EU, as well as ESA. CLAIRE strongly endorses the general direction mapped out by the European Commission in its communication of 25 April 2018. CLAIRE's bottom-up, community-driven approach complements the top-down process put into place by the European Commission.

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About EurAI

The European Association for Artificial Intelligence EurAI (formerly ECCAI) was established in July 1982 as a representative body for the European Artificial Intelligence community. Legally established in Belgium, the association is governed by a board elected by its membership; there are no special board positions and the membership of the board rotates according to a long-standing constitution. The primary aim of EurAI is to promote the study, research and application of Artificial Intelligence in Europe. Its members are the national AI associations of Europe and their individual members. Every even-numbered year, EurAI, jointly with one of the member associations of EurAI, organizes a European Conference on AI. This conference, abbreviated ECAI, has become the leading conference for this field in Europe: ECAI 2020 will be the 24th conference in the series. Usually on odd-numbered years, but not always, EurAI sponsors a specialized course in Artificial Intelligence, called Advanced Course on AI (ACAI). The EurAI Fellows program was established in 1999 to recognize individuals who have made significant, sustained contributions to the field of artificial intelligence (AI) in Europe. Fellows' accomplishments range from pioneering advances in the theory of AI, to unusual accomplishments in AI technology and applications. Usually only individuals who have made contributions to AI for a decade or more after receiving their Ph.D. (or are at an equivalent career stage) will be selected. Leadership in EurAI or EurAI member societies, support of forums for the exchange of ideas, and extended service for the international AI community also play a role in the selection process. Evidence of technical contribution will often be in the form of publications, but other evidence will also be considered, such as patent awards or statements of longstanding contribution to an industrial group effort. The EurAI Fellows Program honors only a very small percentage of the total membership of all EurAI member societies (up to a maximum of 3%).

Since 1998, EurAI has awarded the annual Artificial Intelligence Dissertation Award for the best AI PhD defended in Europe. Since 2012, and every two years since, EurAI has awarded a Distinguished Service Award to a European AI leader who has provided exemplary service to the European AI community.

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About HumanE AI

The European commission released its AI strategy in April 2018, which puts human-centric and responsible AI based on fundamental human rights and values at its center. Furthermore, the Commission has selected six so-called preparatory actions (out of 33 original applicants following an EU-wide competition) that have each received a one-year grant of € 1 million to develop ambitious research agendas with the potential to have a transformational impact on science and technology and deliver competitive advantages to European industry and substantial benefits to society. One of these six initiatives – HumanE AI – is specifically focused on AI.

Accordingly, the Humane AI project (https://www.humane-ai.eu/) will develop the scientific foundations and technological breakthroughs needed to shape the ongoing AI revolution. The goal is to design and deploy AI systems that enhance human capabilities and empower both individuals and society as a whole to develop AI that extends rather than replaces human intelligence. The core challenge is the development of AI systems capable of what could be described as "understanding" humans, adapting to complex real-world environments and appropriately interacting in complex social settings. The focus is on human-centered AI, with a strong emphasis on ethics, values by design, and appropriate consideration of related legal and social issues. The HumanE AI project will mobilize a research landscape far beyond the direct project funding and create a unique innovation ecosystem that offers substantial return on investment. It will result in significant disruption across its socio-economic impact areas, including Industry 4.0, health & well-being, mobility, education, policy and finance. It will spearhead the efforts required to help Europe achieve a step-change in AI uptake across the economy.

To realise this bold vision, the project consortium, with 35 partners from 17 countries, including four large industrial members, will define the details of all aspects necessary to implement a full scale Europan action and project, and mobilize major scientific, industrial, political and public support for the vision. Members of the consortium will also help to produce a research roadmap

based in part on the recommendations from different existing EU policy and research papers, but with a distinctive focus towards a new and original scientific approach to AI based on enhancing European expertise.

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About AI4EU

AI4EU is the community set up around the European Union's landmark Artificial Intelligence project AI4EU and the European AI On-demand platform aiming at developing a European AI ecosystem. To that end, it brings together stakeholders through exchange of information, virtual events, knowledge, algorithms, tools services and resources and works to make it a compelling solution for users. With this project and by collaborating with existing and future Networks of Excellence, European regions, DIHs and multiple communities, AI4EU is building the basis of a European wide federated infrastructure and set of AI services to support and facilitate the use of AI by all kinds of stakeholders in Europe.

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