European Economic and Social Committee

TEN/659
High Performance Computing

OPINION

European Economic and Social Committee

Proposal for a Council Regulation on establishing the European High Performance Computing Joint Undertaking
[COM(2018) 8 final – 2018/0003(NLE)]

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Consultation	Council of the European Union, 21/02/2018
Legal basis	Articles 187 and 188 of the Treaty on the Functioning of the European Union
Section responsible	Section for Transport, Energy, Infrastructure and the Information Society
Adopted in section	04/05/2018
Adopted at plenary	23/05/2018
Plenary session No	535
Outcome of vote (for/against/abstentions)	196/2/4

1. Conclusions and recommendations

1.1 The EESC endorses this initiative for a **EuroHPC Joint Undertaking** as a concrete step in line with the European cloud strategy as well as part of a wider EU strategy (which includes Cybersecurity, the Digital Single Market, the European Gigabit Society, Open Science, etc.). This initiative brings clear **EU added value** with a **key technology** which will help to tackle the most challenging issues of our modern society and will ultimately be beneficial for our well-being, competitiveness and jobs.

1.2 The EESC considers the starting **investment** of EUR 1 billion for the acquisition and operation of world-class supercomputing machines as significant but not too ambitious compared to its competitors the USA and China. However, the EESC is convinced that a substantial increase in the investments (in EU Member States) combined with a strong European **research and innovation programme** will be necessary to maintain a world class level in HPC applications. As the race will continue, there is no doubt that similar efforts will be necessary for the next MFF in line with the global competitors' ones.

1.3 The EESC endorses the **industrial approach** for developing the next generation of low-power microchips in Europe. This would make the EU less dependent on imports and secure access to top HPC technology. The EESC points out that the development of such microchips also has an impact on small-scale computing because the high-end integrated circuits can be adapted (downscaling) to appliances in the **mass market** (PCs, smartphones, automotive sector).

1.4 The EESC would encourage the Commission to put more emphasis on the strong position that this initiative is starting from and on the fact that it is key to continuing the European **success story** based on the existing pillars of PRACE and GÉANT, which provide since many years high-end HPC services to science and industry and interconnect research, education and national research networks and HPC centres with secure, high-capacity networks, respectively.

1.5 The EESC, therefore, emphasises the utmost importance of **integrating** the new EuroHPC Joint Undertaking with already existing structures and programmes as the best way to jointly deploy European resources. For example, the peer review being organised by PRACE should be retained to maintain the world-class standard.

1.6 The EESC would like to encourage **more Member States** to join the EuroHPC Joint Undertaking and use it as an opportunity to profit from world-class computing power. In view of the complexity of a Joint Undertaking, the EESC asks the Commission to put adequate efforts into explaining and promoting the advantages and opportunities of this legal instrument, in particular for smaller countries and with regard to the possibility for in-kind contributions.

1.7 The EESC welcomes the fact that two of the Commission's partners in the contractual public-private partnership (cPPP) could become the first private members, which is key for the participation of **industries**, including **SMEs**. The EESC welcomes the possibility of more partners but would also insist that for any new partner, in particular for those from outside the EU, **reciprocity** be fulfilled. The EU should have to profit from the opportunity represented by the development of HPC technology to complete the European industrial sector in order to cover

all of the production chain (design, manufacturing, implementation, application). The European Union should establish as a mid-term goal the achievement of the capability to plan and realise an HPC with European technology.

1.8 The EESC recommends **informing citizens and enterprises** about this new important initiative to recover citizens' confidence in the European integration process, and to help European enterprises, SMEs in particular, to be aware of its benefits. Also universities and research centres must be involved through a specific communication activity aimed at raising interest and encouraging projects on HPC.

1.9 The EESC recommends strengthening as much as possible the **social dimension** of the digitalisation process as a fundamental part of the European Social Pillar. The implementation and use of high-level machines must have an evident and measurable positive impact on all citizens' daily lives.

2. Introduction

2.1 After being deployed originally in climate research, numerical weather prediction, astrophysics, particle physics and chemistry, **high-performance computing** (**HPC**) has now also been used in most other scientific fields, from biology, life sciences and health, high fidelity combustion simulations, and materials sciences to social sciences and humanities. In industry, HPC has been widely used in oil and gas exploration, aeronautics, the automotive sector and finance, and is now becoming crucial for ensuring personalised medicine, developing nanotechnologies and enabling the development and deployment of renewable energies. Finally, HPC is becoming a tool of growing importance for supporting public decision-making by simulating scenarios related to natural risk events, industrial risks, biological risks and (cyber)terrorism risks, thus being essential for national security and defence.

2.2 In computing, floating point operations per second (**FLOPS**) is a measure of computer performance. HPC performance represents the upper end of what is technologically possible. This high-end performance is increasing steadily, due to the ever smaller integrated circuits (Moore's law) and the shift from vector to parallel processing. Every 10 to 12 years there was a shift of computational speed by a factor of 1 000; thus it has gone from gigascale (1985), to terascale (1997), to petascale (2008). The transition from petascale to **exascale** (Giga = 10^9, tera = 10^{12}, peta = 10^{15}, exa = 10^{18}) is expected to happen between 2020 and 2023.

2.3 So far each Member State in the EU has been investing in HPC on its own. Compared to its competitors from the USA, China and Japan, Europe is clearly underinvesting in HPC with a funding gap of EUR 500-700 million per year. Therefore, the EU does not have the fastest supercomputers and moreover the existing HPC machines in the EU depend on non-European technology. The next steps in HPC technology can be best achieved through **joint European efforts** with investments on a scale beyond the possibilities of individual Member States.

2.4 The development of the next generation of microchips in Europe would help to achieve EU independence in access to top HPC technology. But the European HPC technology supply chain can only be improved with clear prospects of a lead market and of developing an ecosystem of

machine sized up to exascale. The public sector has to play a key role in this objective, otherwise the European suppliers will not take the risk of developing the machines on their own.

2.5 Consequently, the European Commission is initially planning to invest EUR 1 billion jointly with the Member States in building a **world-class European supercomputer infrastructure**. Such a shared infrastructure and common use of existing capabilities is intended to benefit everyone, from industry, SMEs, science, the public sector and especially the (smaller) Member States without self-sufficient national HPC infrastructures.

2.6 The importance of HPC has been clearly outlined by the European Commission in 2012 in its strategy on "High-Performance Computing: Europe's place in a global race"[1]. In April 2016, the European Commission launched the **European Cloud Initiative**[2]. This initiative comprises two main elements: the **European Data Infrastructure** (EDI) with world-class supercomputing capability and high-speed connectivity and the **European Open Science Cloud** (EOSC) with leading-edge data storage and management and interfaces for cloud-based service delivery. The first one is now to be delivered with the ***Proposal for a Council Regulation on establishing the European High Performance Computing Joint Undertaking***[3].

2.7 The proposal is a follow-up to the **EuroHPC declaration**, signed on 23 March 2017 at the Digital Day in Rome by seven Member States – France, Germany, Italy, Luxembourg, the Netherlands, Portugal and Spain. They were joined during 2017 by Belgium, Slovenia, Bulgaria, Switzerland, Greece and Croatia. These countries agreed to build a pan-European integrated exascale supercomputing infrastructure. Other Member States and associated countries are encouraged to sign the EuroHPC declaration as well.

2.8 Following an impact assessment, the Commission[4] found that a **Joint Undertaking** was the best option for implementing the EuroHPC, which would enable the joint procurement, ownership and operation of the supercomputers to be efficiently combined.

3. Gist of the proposal

3.1 The European Commission is proposing a Council Regulation on establishing the European High Performance Computing Joint Undertaking (EuroHPC). This new legal entity will:

- provide a **funding structure** to acquire, build and deploy across Europe a world-class high-performance computing (HPC) infrastructure;
- support a **research and innovation programme** to develop the technologies and machines (hardware) as well as the applications (software) that would run on these supercomputers;

1 COM(2012) 45 final and OJ C 299, 4.10.2012, p. 148.

2 COM(2016) 178 final and OJ C 487, 28.12.2016, p. 86.

3 COM(2018) 8 final and Annex 1.

4 SWD(2018) 6 final.

- provide financial support in the form of procurement or **research & innovation grants** to participants following open and competitive calls; provide European industry and in particular small and medium-sized enterprises (SMEs) with better **access** to supercomputers.

3.2 The **EU's contribution** to EuroHPC will be around **EUR 486 million** under the current Multiannual Financial Framework, matched by a **similar amount from Member States** and associated countries. Private members of the initiative can also add **in kind** contributions. Overall, around EUR 1 billion of public funding would be invested by 2020.

3.3 The activities of the EuroHPC Joint Undertaking operating from 2019 until 2026 will consist of:

- **acquisition and operation** of two world-class **pre-exascale** supercomputing machines and at least two mid-range supercomputing machines (petascale), providing and managing access to these supercomputers to a wide range of public and private users starting from 2020;
- a **research and innovation** programme on HPC: to support the development of European supercomputing technology including the first generation of European **low-power microprocessor** technology, and the co-design of European **exascale machines**, and to foster applications, skills development and a wider use of high-performance computing.

3.4 The proposal wants to reach exascale performance by 2022-2023. An intermediate step (50% of exascale performance) should be reached by 2019. The planned infrastructure will be **jointly owned** and operated by its **members** consisting at first of the countries that have signed the EuroHPC declaration and private members from academia and industry. Other members can join this cooperation at any moment, provided they make a financial contribution (including in kind contributions).

3.5 The proposal establishes that two infrastructures will be created and implemented in parallel. Such infrastructures will be hosted by two EU countries subject to specific criteria.

3.6 The Joint Undertaking will be managed by a governing board, composed of representatives of the public members of the Joint Undertaking. It will be responsible for strategic policy making and the funding decisions relating to the Joint Undertaking procurement and R&I activities. The members' voting rights and procedures will be in proportion to their financial contribution. The Joint Undertaking model is based on lessons learnt from other joint undertakings in operation, such as the ECSEL. Both joint undertakings are similar in terms of goals and structure. The main difference lies in the large-scale procurement activities in Euro HPC which is absent in the ECSEL. This difference explains the attribution of voting rights in proportion to the contribution of participants.

3.7 The governing board will be supported by an Industrial and Scientific Advisory Board, composed of representatives of the private members of the Joint Undertaking. In order to avoid conflicts of interests, the advisory board will have only a consultative role.

4. Specific comments

4.1 The EESC endorses this initiative as a concrete step in line with the European cloud strategy: the strategic choice of an open European computing cloud geared to the scientific community and industry, as part of a strong political and economic commitment to digital innovation[5]. This initiative brings clear **EU added value** with a **key technology** which will help to tackle the most challenging issues of our modern society and will ultimately be beneficial for our well-being, competitiveness and jobs.

4.2 More generally, the HPC initiative is a crucial part of a wider EU strategy (which includes the Cybersecurity Act[6], the Digital Single Market strategy (review)[7], the European Gigabit Society[8], Open Science, etc.) aimed at recovering Europe's digital sovereignty and independence, in order to make the EU a crucial player in digital development with a direct impact on competitiveness and citizens' quality of life.

4.3 The EESC considers the starting investments of 1 billion for the acquisition and operation of two world-class pre-exascale supercomputing machines and at least two mid-range supercomputing machines as significant but not too ambitious compared to its competitors. However, the EESC is convinced that a substantial increase in the investments (in EU Member States) combined with a strong European research and innovation programme will be necessary to maintain a world class level in HPC applications. As the race will continue, there is no doubt that similar efforts are necessary for the next MFF in line with the global competitors' ones.

4.4 The EESC would like to point out that a fast computer alone is not sufficient to be successful. High-end software developments and applications based on a strong research and development programme are also indispensable for real progress. In this area, the EU is not at all lagging behind its competitors and the EESC would encourage the Commission to put more emphasis on the strong position that this initiative is starting from and on the fact that this initiative is key to continuing the European **success story** based on the existing pillars of PRACE and GÉANT, which for more than a decade now have taken the responsibility of bringing together and federating the areas of HPC and networking, respectively.

4.5 The EU co-funded Partnership for Advanced Computing in Europe (**PRACE)** created in 2010 and comprising 25 Member States provides high-end HPC services to science and industry, deploying the largest national supercomputing systems in Europe. In 2017, PRACE provided access to a network of seven leadership-class systems, provided by five hosting members (France, Germany, Italy, Spain and Switzerland) who have invested more than EUR 400 million in PRACE since its inception). PRACE allocates HPC resources on the basis of peer-reviewed calls for proposals, based on scientific excellence, to research projects coming from academia and industry including small and medium-sized companies.

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5 OJ C 487, 28.12.2016, p. 86.

6 EESC opinion on Cybersecurity Act (not yet published in OJ).

7 OJ C 81, 2.3.2018, p. 102.

8 OJ C 125, 21.4.2017, p. 51.

4.6 The pan-European network **GÉANT** launched in 2000 interconnects research, education and national research networks and HPC centres with secure, high-capacity networks. The network is essential for supporting open science with services for trusted access. The GÉANT network is the largest and most advanced R&D network in the world, connecting over 50 million users at 10 000 institutions across Europe and supporting all scientific disciplines. The backbone network operates at speeds of up to 500 Gbps (2017). GÉANT has created the very successful eduroam service to allow R&D users to connect to any wi-fi network where the eduroam SSID is present – a scheme which has been proposed by the EESC as a role model for wi-fi access for all Europeans in the context of the strategy Connectivity for a competitive Digital Single Market – Towards a European Gigabit Society[9].

4.7 The EESC, therefore, emphasises the utmost importance of integrating the new EuroHPC Joint Undertaking with already existing structures and programmes. For example, the peer review being organised by PRACE should be retained to maintain the world-class standard. Other best practice should be integrated or adapted. An **integrated approach** of EuroHPC, H2020 or its successor in FP and corresponding national activities is the best way to jointly deploy European resources. In this context, the EESC welcomes the Commission's plan to use the EuroHPC JU for coordinating the H2020 funding instrument (and its successor) in the field of HPC. The EESC notes that building infrastructures requires a top-down scheme, while good science, as fostered by PRACE, needs a bottom-up approach where scientists have to be the driver.

4.8 The EESC would like to encourage **more Member States** to join the EuroHPC JU and use it as an opportunity to profit from world-class computing power. Networking is crucial for the scientific use of HPC. In view of the complexity of a Joint Undertaking, the EESC asks the Commission to put adequate efforts into explaining and promoting the advantages and opportunities of this legal instrument, in particular for smaller countries and with regard to the possibility for in kind contributions.

4.9 The EESC welcomes the fact that two of the Commission's partners in the contractual public-private partnership (cPPP) have submitted letters of support for the implementation of the EuroHPC Joint Undertaking: the European Technology Platform for High-Performance Computing (**ETP4HPC**) and the Big Data Value Association (**BDVA**). They could become the first private members, which is key for the participation of industries, including SMEs. The EESC welcomes the possibility of more partners but also insists that for any new partner, in particular for those from outside the EU, **reciprocity** be fulfilled. The EU should have to profit from the opportunity represented by the development of HPC technology to complete the European industrial sector in order to cover all of the production chain (design, manufacturing, implementation, application).

4.10 A 12 petaflop CPU-based supercomputer has a **power consumption** of about 1.5 MW. With a linear scaling to exascale, HPC based on technology existing today would lead to a power consumption in the range of 150 MW, which is unacceptable; therefore the development of low-power microchips is an important objective of the EuroHPC. The EESC points out that low-

9 COM(2016)587 final and OJ C 125, 21.4.2017, p. 51; OJ C 125, 21.4.2017, p. 69.

power microchips will thus play an important role in the objectives of the EU's energy strategy, irrespective of the aim to make the EU independent as regards imports. In line with the above mentioned goals, the European Processor Initiative, launched by the European Commission in 2018 and supported by a consortium of 23 partners from 10 Member States and financed with EUR 120 million, will play an important role in realising the HPC initiative.

4.11 The EESC points out that the development of advanced low-power microchips also has an impact on small-scale computing (PCs, smartphones, automotive sector) because the high-end integrated circuits can also be adapted (downscaling) to appliances in the **mass market**. This will benefit all citizens directly and could open new markets for the EU's industry. HPC is therefore in many ways a key technology for a modern society.

4.12 The EESC recommends informing citizens and enterprises about this new important initiative undertaken by the EU. On the one hand, it will be useful to recover citizens' confidence in the European integration process. Organised civil society could be a useful tool for disseminating such information. On the other hand, a focused campaign will help European enterprises, SMEs in particular, to be aware about the ongoing initiatives. For this reason it is important to support through a specific path the SMEs with high added-value production in accessing and using the new infrastructures.

4.13 Universities and research centres must be involved through a specific communication activity aimed at raising interest and encouraging projects on HPC. Such a process could also stimulate the creation of new school, vocational and academic curricula in order to bridge the European skills gap with respect to the main global competitors[10].

4.14 The EESC recommends strengthening as much as possible the social dimension of the digitalisation process as a fundamental part of the European Social Pillar[11]. For this reason, the Committee proposes the establishment of a series of societal challenges to be achieved using the new digital infrastructure. The implementation and use of high-level machines must have an evident and measurable positive impact on all citizens' daily lives.

4.15 The EESC considers that HPC and quantum technology represent two strategic goals for European growth and competitiveness. The Committee thus recommends developing both technologies in parallel in order to ensure that the EU can benefit from the best performance and opportunities in the medium and long term.

Brussels, 23 May 2018.

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The president of the European Economic and Social Committee

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10 OJ C 434, 15.12.2017, p. 30; OJ C 173, 31.5.2017, p. 45.

11 OJ C 125, 21.4.2017, p. 10.