

Synopsis report on the targeted consultation on the High Performance Computing Initiative in Europe

1. Objective of the consultation

The targeted stakeholder [consultation](#) aimed at contributing to the definition of a legal instrument for a procurement framework for High Performance Computing (HPC) as announced in the [Digital Single Market mid-term review Communication](#). The on-line consultation ran from 3 August to 5 September 2017 and received 92 replies. All input received until 8 September was considered.

This consultation was part of a chain of consultative events with stakeholders that began in 2016 in the context of defining European HPC strategy.

2. Identification of key stakeholders

Given the highly specialised domain of HPC, the consultation targeted institutions and individual experts that were deeply involved in HPC development and usage, and had experience in EU-wide projects in this area.

Views were sought from the following types of stakeholders:

- National and EU-funded projects on HPC (*Projects*),
- Scientific user communities of HPC infrastructures (the 29 large ESFRI research infrastructures and the PRACE scientific users, each reaching hundreds of actors, EUDAT, EGI, etc.) (*Scientific Users*),
- Public-private partnerships on HPC and Big Data (*PPPs*),
- Centres of excellence for supercomputing applications, supercomputing centres, service providers, access providers (*Intermediaries*),
- HPC research & industry associations (*Associations*),

A number of activities engaging with these stakeholders had taken place:

<i>Stakeholder engagement activity</i>	<i>Scientific Users</i>	<i>EU Member States</i>	<i>Projects</i>	<i>PPPs</i>	<i>Intermediaries</i>	<i>Associations</i>
Workshop on the European micro-processor on 18 January 2017 in Brussels						
General assembly of ETP4HPC on 21 March 2017 in Munich						
Digital Day of 23 March 2017 in Rome in the presence of 250 HPC stakeholders						
Workshop on EuroHPC governance in Rome on 23 March 2017 with 50 participants						
PRACE days on 15-18 May 2017 in Barcelona, gathering the whole HPC						

community						
Eleven meetings with the Sherpas of the EU Member States						
European Open Science Cloud summit on 12 June 2017 in Brussels						
Multiple meetings with key stakeholders (PRACE, ETP4HPC, visits to supercomputing centres, international conferences...)						

3. Summary of the results of the targeted consultation

As questions were optional, the percentages in this document refer to the number of respondents per group that answered the particular question. The contributions of stakeholders who consented to publication¹ are available online divided in the 4 following categories based on the question "Is your organisation included in the Transparency Register?":

- [Organisations registered in the EC/EP transparency register](#)
- [Organisations non-registered in the EC/EP transparency register](#)
- [No information given on the registration in the EC/EP transparency register](#)
- [Replies requested to be anonymised](#)

This analysis does not represent the official position of the Commission and its services, and does not bind the Commission in any way.

3.1 Geographical coverage

The consultation received a total of **92 replies** from stakeholders from a wide geographical coverage²: 17 EU Member States and 4 non-EU countries³:

¹ 41% agreed that their contribution can be published anonymously, 59% agreed to publication of the full information.

² Status as of 7 September 2017 – end of business

³ Israel, Norway, Switzerland, USA.

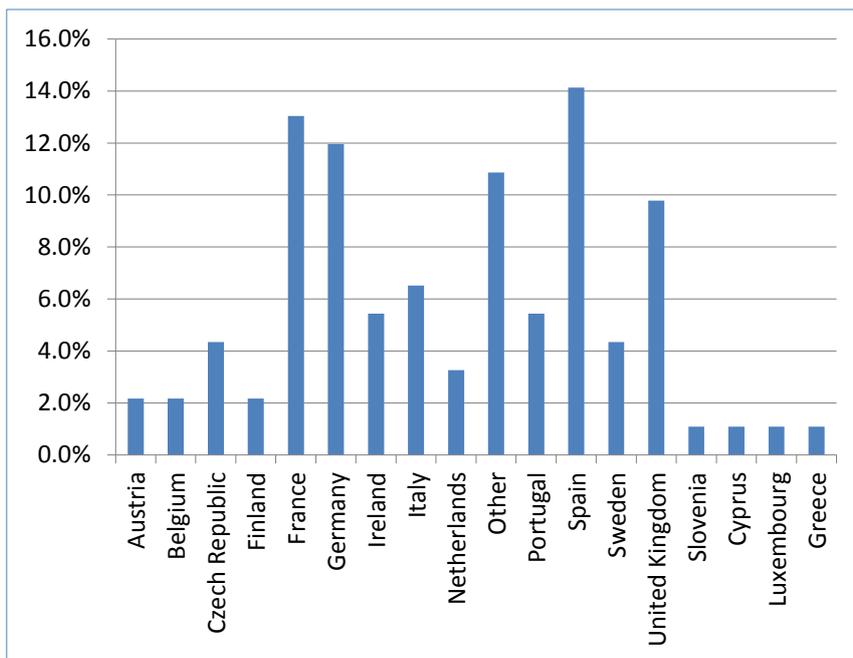


Figure 1 – Country of respondent's origin

The largest number of responses came from Spain (14.1%), France (13%), Germany (12%), UK (9.8%) and Italy (6.5%), totalling ~55% of responses. Smaller Member States⁴ account for ~34% of responses.

3.2 Type of organisation responding

Figure 2 shows that 60% responded as representatives of an academia / research organisation, 24% as of business, 6% as of the public sector and 3% as of industry associations.

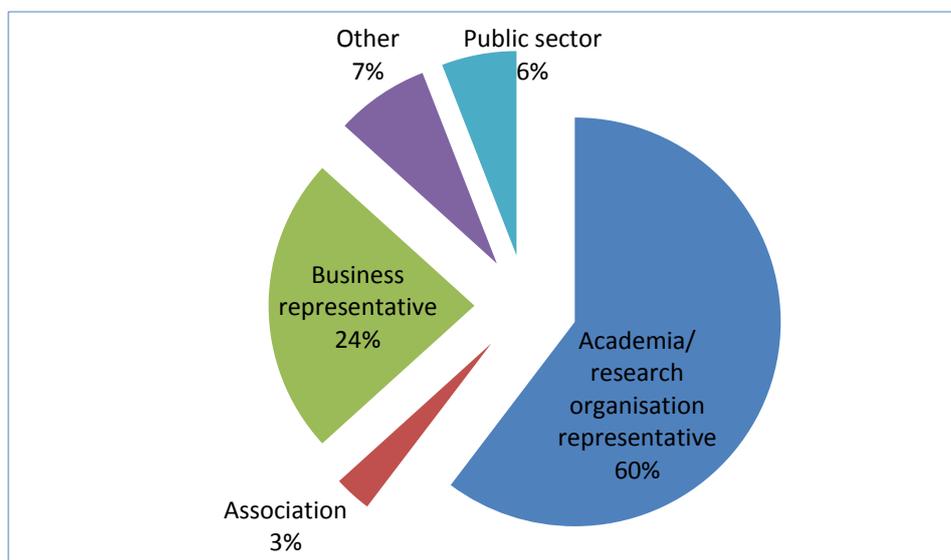


Figure 2 – Type of organisation of respondents

⁴ Portugal, Sweden, Czech Republic, Netherlands, Ireland, Austria, Belgium, Finland, Slovenia, Cyprus, Luxembourg, Greece.

The percentage of industry respondents also gives an indication on the future potential of HPC for European industry, including SMEs. The latter aspect is confirmed by the fact that 45% of business representative respondents originate from small, medium and micro sized enterprises which do not constitute a traditional group of HPC users (see Figure 3).

82.6% of respondents have already applied for funding in HPC-related activities under Horizon 2020 or previous EU Research Framework Programmes, which confirms that respondents belong to the stakeholder profile the consultation targeted.

The participation of respondents that have not yet done so (17.4%) confirms that interest in the EuroHPC initiative is also attracting new constituencies.

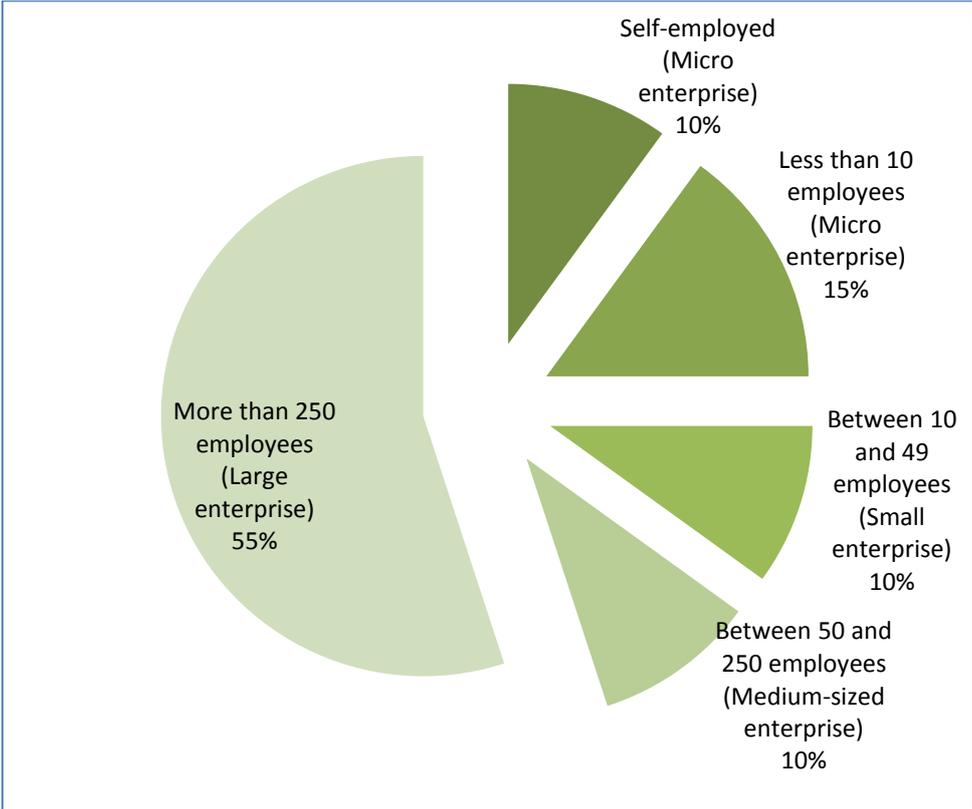


Figure 3 – Breakdown of Business representatives

When analysing the breakdown of respondents by type of organisation, we have grouped respondents as:

- Scientific users
- Industrial users
- Technology supply industry
- Computing centres

As Figure 4 shows, computing centres have reached the widest geographical coverage of 15 EU countries plus Switzerland (Other), followed by the scientific users covering 11 EU countries plus Switzerland (Other). The technology supply industry and the industrial users each received responses from 4 EU countries plus Switzerland, USA, Norway, and Israel.

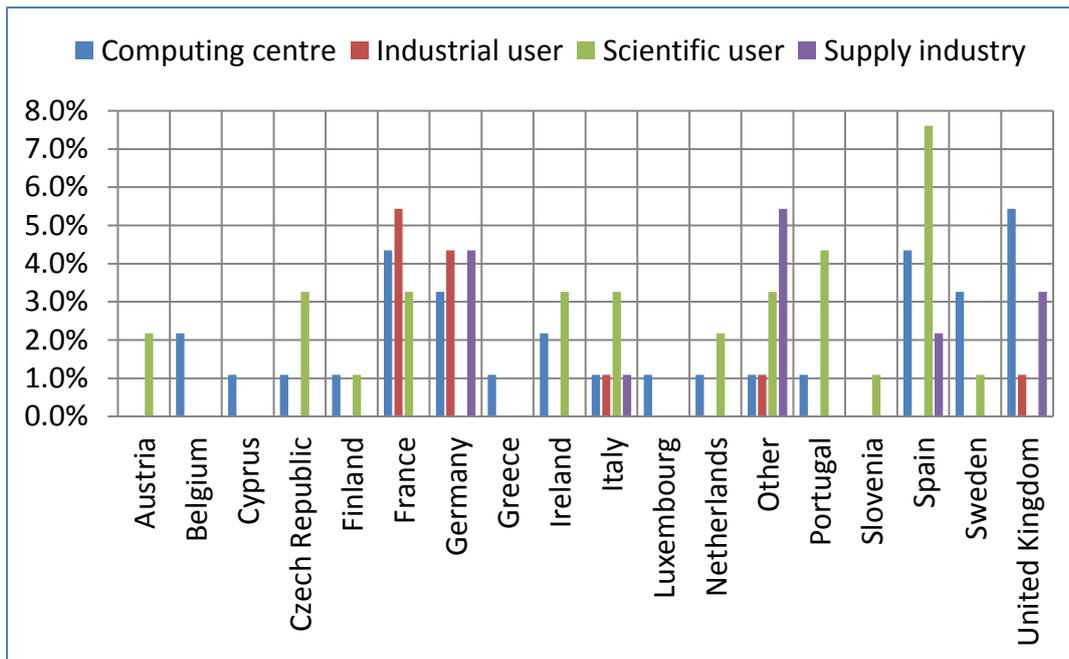


Figure 4 – Geographical split by type of respondents

That distribution reflects computing centres' pan-European involvement in HPC. The industrial users were represented by large Member States like France (5.4%), Germany (4.3%), the UK (1.1%) and Italy (1.1%), who extensively use HPC, plus Switzerland (1.1%).

The participation of the technology supply industry from Spain, the UK, and Germany, respectively amounts to 15%, 33%, and 36% of their respondents, confirming a strong presence of technology supply industry from those EU countries.

Interestingly, the participation of the technology supply industry from non-EU countries (Other) amounts to 50% of their respondents: the largest fraction per country indicating the great interest of non-EU technology supply industry for the European HPC market.

The non-EU technology supply industry respondents are located in the USA (40%), Israel (40%) and Norway (20%). USA alone has the largest fraction of technology supply industry respondents per country, confirming its strategic interest in the European HPC market.

3.3 Identification of the problems

85% of respondents found that there is a problem with the current state of HPC in Europe; only 2% saw no problem while 13% were undecided.

From those who saw a problem with the current state of HPC in Europe, the majority of respondents pointed out the following three issues as most relevant:

- The *interaction between industry and academia* on the exploitation of high-end computing systems, application codes and services is limited, especially regarding the use of HPC for industrial and service innovation (55.6%);
- The *large fragmentation of HPC programmes and efforts in Europe* where the non-coordinated activities and lack of a common procurement framework lead to a waste of resources (55.6%);
- *Europe's supercomputing capabilities depend on non-EU suppliers* for critical technologies and systems (47.8%).

In addition to *lack of sufficient resources* and *insufficient access to HPC resources for science*, a recurring issue in responses was the perception that *too little emphasis is currently given on software developments*, especially against the background of Europe's recognised world-leading role in HPC applications.

The breakdown by type of respondents shows the following issues as the most relevant to each group:

GROUP	MOST RELEVANT PROBLEM (% relative to the group)
Computing centres	There is large fragmentation of HPC programmes and efforts in Europe and the non-coordinated activities and the lack of a common procurement framework lead to a waste of precious resources (69%)
Scientific users	There is large fragmentation of HPC programmes and efforts in Europe and the non-coordinated activities and the lack of a common procurement framework lead to a waste of precious resources (58%)
Industrial users	Europe's supercomputing capabilities depend on non-EU suppliers for critical technologies and systems (75%)
Technology Supply industry	The interaction between industry and academia on the exploitation of high-end computing systems, application codes and services is limited, especially regarding the use of HPC for industrial and service innovation (67%)

The following issues were identified as the second most relevant to each group:

GROUP	SECOND MOST RELEVANT PROBLEM (% relative to the group)
Computing centres	The scientific communities in Europe do not have access to the level of supercomputing performance they need for their research purposes (63%)
Scientific users	The interaction between industry and academia on the exploitation of high-end computing systems, application codes and services is limited, especially regarding the use of HPC for industrial and service innovation (52%)
Industrial users	The interaction between industry and academia on the exploitation of high-end computing systems, application codes and services is limited, especially regarding the use of HPC for industrial and service innovation (75%)
Technology supply industry	The EU does not have the supercomputing power that corresponds to its economic weight because it spends substantially less than other regions on acquiring high-end computing systems (60%)

All stakeholder groups identified the interaction between industry and academia as most pressing, followed by the fragmentation of efforts and resources.

Industrial users' main concern is the dependence on non-EU technology, showing their awareness of the risks related to the dependence of a foreign technology supply-chain for a critical resource for their global competitiveness.

3.4 European added value

Only ~2.2% of respondents said that no action at all should be taken at EU level to improve the current state of HPC in Europe; 15% were satisfied with the level of the current EU

actions. A clear majority of 83% confirmed the need for action at EU level beyond the current actions (see Figure 5).

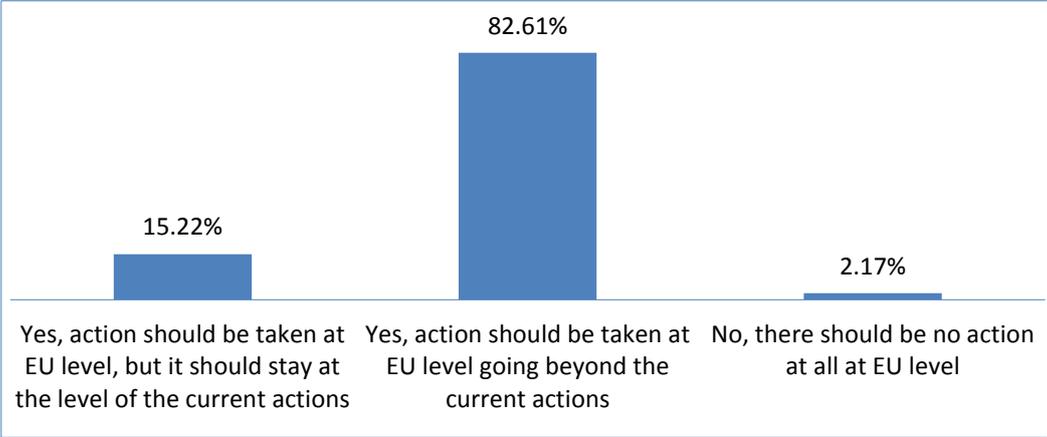


Figure 5 – Should action be taken at EU level?

Those who stated that EU action should be taken beyond the current level justified their responses with the following arguments:

1. The level of EU-wide coordination and cooperation of HPC initiatives is currently insufficient in a qualitative and quantitative sense, resulting in strong fragmentation of individual efforts across Member States, across different stakeholders (e.g. industry/science) and across current EU-wide initiatives.⁵
2. Continuing the current mode of fragmented and insufficient efforts, the EU is relegated against its global competitors (USA, China) in a field as strategic as supercomputing.⁶

This result is confirmed by the top priority⁷ identification by respondents of the need to set-up a coordinated approach for developing a leading HPC and big data ecosystem (hardware,

⁵ Examples:
 "Europe supercomputing power is not comparable to its economic weight mainly because national efforts, even if integrated in PRACE framework, cannot attain the world top level. As a result the scientific communities do not have access to the required computing power for leading edge simulations".
 "Present actions are rather fragmented and non-coordinated contributions of the EU are channelled through supercomputing centres with diverse missions as they observe the national interests of the countries in which they reside. Actions are mostly managed at the supercomputing centres with very limited or non-existent engagement of the broader scientific and industrial community. A coordinated action in Europe with leadership from leading scientists, knowledgeable of HPC, is necessary."
 "Action should be taken at EU level, in order to increase the amount of resources ... and to assure a clear and fair model to fund them and access them. Important economies of scale could be obtained, making it less expensive to Member States to access advanced computing resources. PRACE needs a qualitative improvement in its organisation model."
 "On the European level, HPC access is currently through PRACE and this should continue, but more resources are required as there is a great demand for these resources by European scientists. In order that European scientists remain competitive, an increase in European HPC infrastructure is required".

⁶ Example: "Focused operational and research high performance computing (as oppose to general computing) is one of the key tools of technological progress. US, Japan and China appreciate this quite well and invest heavily in all aspects of HPC. An organised holistic change in the European approach to, and funding of, HPC is required in order to stay competitive worldwide. Europe should aim at the HPC programme as seriously as at the satellite observing programme."

⁷ Rate 4.4 on a scale between 1 (lowest importance) and 5 (highest importance)

software, applications, skills, services and interconnections) for the benefit of Europe's science and industry.

As Figure 6 shows the technology supply industry (93%), scientific users (91%), and computing centres (78%) strongly favour measures at EU level going beyond the current actions. Industrial users are more moderate, although supportive of EU action beyond the current level (58%). This is consistent with the fact that 50% of industrial users have never applied for funding in Horizon 2020 or previous EU Research Framework Programmes (see section 8.2).

Apart from a small minority among computing centres (6%), no one believes there should be no action at all at EU level.

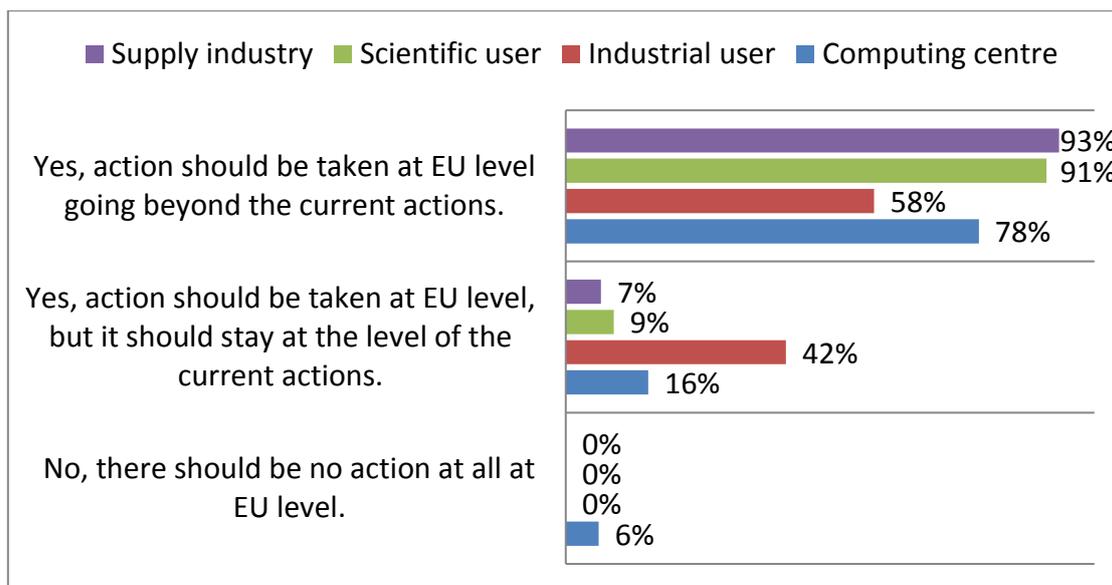


Figure 6 –Breakdown per group of respondents

3.5 Objectives of a future EU initiative on HPC

Respondents confirmed that the following actions rank among the main (>50% of responses) objectives of a future EU initiative on HPC:

- Establish a world-class HPC and Big Data ecosystem (79.3%);
- Support education and training in order to increase HPC skills in Europe (77.2%)
- Stimulate the development and use of the best HPC and data intensive codes in today's and future most innovative scientific and industrial applications (76.1%);
- Set-up a coordinated research and innovation agenda for developing the next generation of HPC technologies and systems (75%);
- Deploy innovative, usable HPC services and competitive solutions satisfying the demands of users from science, industry (incl. SMEs) and the public sector (60.9%);
- Procure world class HPC and data infrastructures and make them widely accessible and available across Europe (56.5%).

These objectives – coordination of efforts, education & training, applications, HPC services to all stakeholders, widely accessible infrastructure – correspond to the goals of the EuroHPC initiative.

The breakdown by group of respondents points out the following main objectives of a future EU initiative on HPC:

GROUP	MOST RELEVANT ACTION (% relative to the group)
Computing centres	Establish in Europe a world-class HPC and Big Data ecosystem (hardware, software, applications, skills, services and interconnections) (87.5%)
Scientific users	Stimulate the development and use of the best HPC and data intensive codes in current and future most innovative scientific and industrial applications (78.8%)
Industrial users	Stimulate the development and use of the best HPC and data intensive codes in current and future most innovative scientific and industrial applications (83.3%)
Technology supply industry	Establish a world-class HPC and Big Data ecosystem (hardware, software, applications, skills, services and interconnections) (86.7%) in Europe

The second most relevant actions identified by the groups of respondents are:

GROUP	SECOND MOST RELEVANT ACTION (% relative to the group)
Computing centres	Support education and training to increase HPC skills in Europe (84.4%)
Scientific users	Support education and training to increase HPC skills in Europe (75.8%)
Industrial users	Establish in Europe a world-class HPC and Big Data ecosystem (hardware, software, applications, skills, services and interconnections) (83.3%)
Technology supply industry	Support education and training to increase HPC skills in Europe (80%)

For all respondents, establishing a world-class HPC ecosystem is among the most relevant objectives for a European HPC initiative, except for the scientific users who prioritise the development and use of applications and skills. For most the education and training aspects are also among the top priorities.

3.6 Duration of a European HPC Initiative

Regarding the time-frame in which the future EU-initiative should run, a clear majority confirmed the need for an initiative that goes well into the next multi-annual financial framework (MFF), see Figure 7:

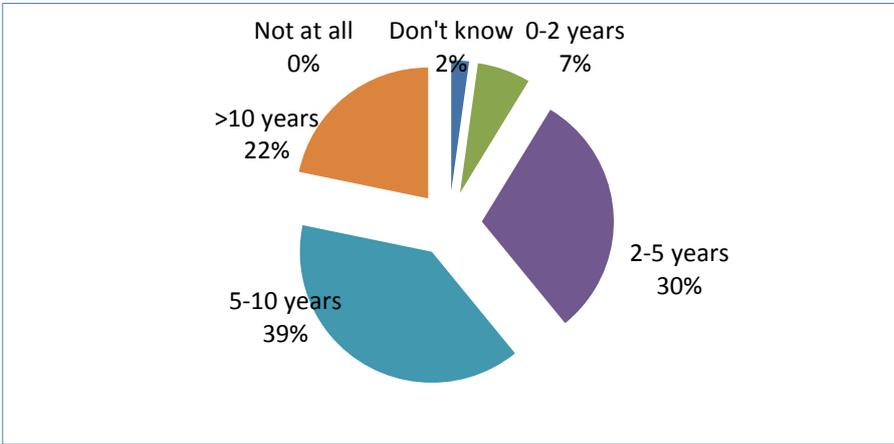


Figure 7 – Time-frame a future EU initiative on HPC should run

Looking at the different groups of respondents, a clear majority of each group confirmed the need for an initiative that expands beyond the last three years of Horizon 2020, as shown in Figure 8:

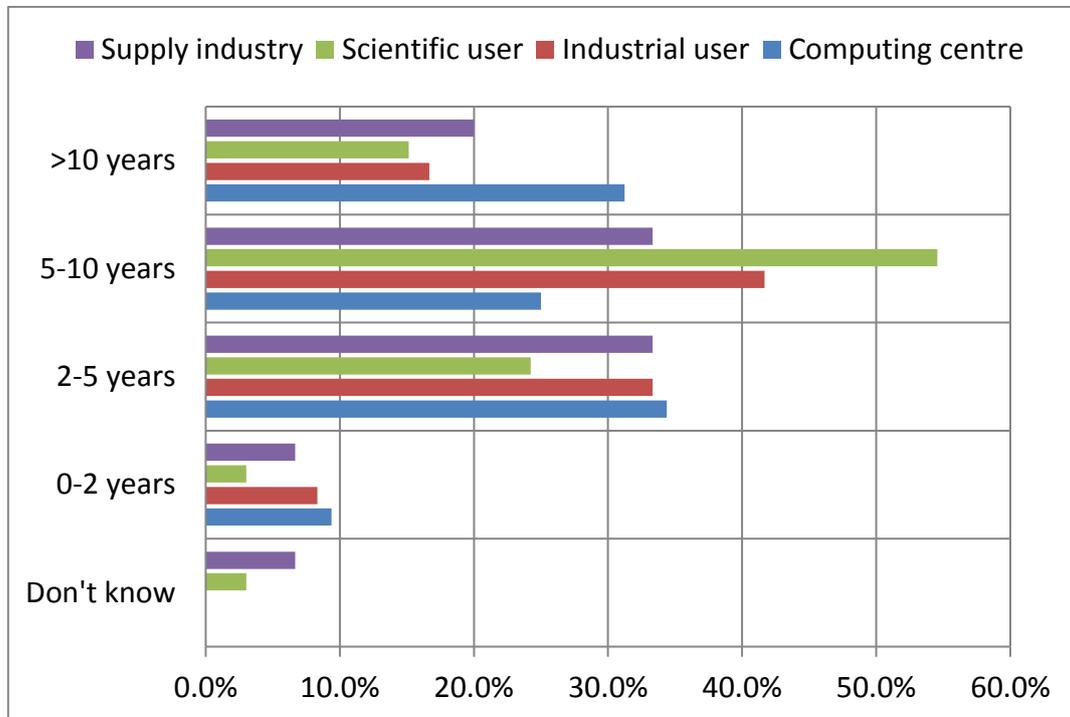


Figure 8 – Time-frame a future EU initiative on HPC should run

3.7 Improvements expected from a future EU initiative on HPC

Regarding improvements expected from a future EU initiative on HPC vis-à-vis the current situation, three main points emerged from the responses for all groups of respondents:

1. Expectation of more EU-based technology with specific support to the EU hardware industry leading to the development of critical technologies within Europe.
2. Reducing fragmentation, better coordination of European HPC resources through the consolidation of the current programs into a single, clear and well-funded program aimed at building an exascale class system based on EU-developed technology.
3. Increasing the competitiveness of European industry through better involvement of SMEs in HPC.

3.8. Options to reach the objectives of a future EU initiative on HPC

Regarding the role of existing EU-funded HPC actions, such as PRACE, ETP4HPC and GEANT in the future EU initiative on HPC, respondents confirmed that existing actions:

- should be improved especially PRACE⁸, and
- collaborate closer so that in a bigger picture provided by EuroHPC existing actions complement each other.⁹

⁸ E.g. by strengthening its scientific oversight, by collaborating closer with industry, if possible.

As Figure 9 shows, the majority (>50%) of respondents propose that participation in the new EU initiative on HPC should be constituted by *academia & research* (90.2%), *industry* (88.8%), *supercomputing centres* (87%), and *HPC intermediaries*, e.g. Centres of Excellence (57.6%).

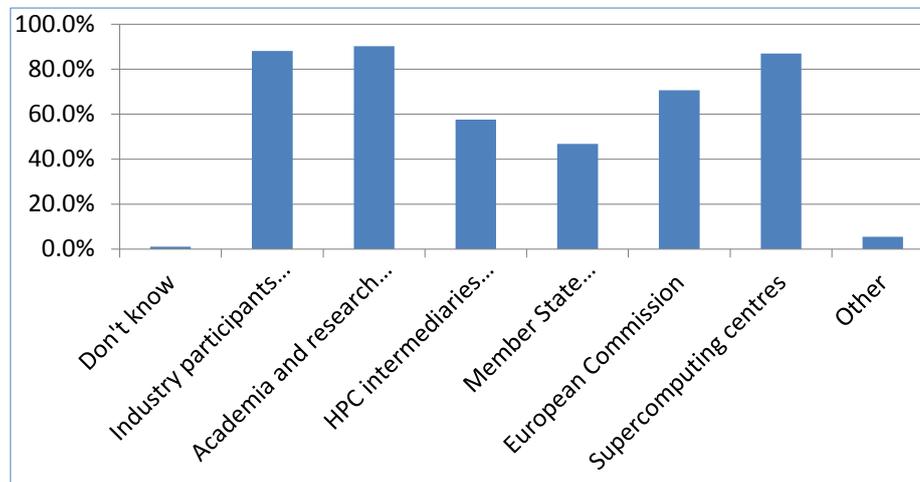


Figure 9 – Who should be part of a potential EU initiative on HPC?

Among those who declared to know how responsibilities in relation to the use of the exascale machines in the context of the new EU initiative on HPC should be distributed (59.8%), a recurrent idea was that HPC machines should be owned, be operated, and maintained by a consortium including but not limited to, supercomputing centres, EU public infrastructures, and PRACE Tier-0 centres.

With respect to the usage and access conditions of the HPC machines, the allocation of computing time, and the decision criteria to allocate computing time, respondents' open-ended suggestions were less coherent. Many scattered ideas were mentioned such as the European Commission with the help of calls, a peer-review process favouring the prioritization of usage, steering committees representing the owners of the machines, existing supercomputing centres, and management boards of public/private partnerships.

Figure 10 shows the breakdown relative to each group. Responses are rather uniform across the different groups of respondents.

⁹ Examples:

"All these instruments have been developed under conditions that are no longer relevant."

"None of them existed before the advent of Big Data and now they are just adapting old structures to new problems. These instruments are in need for renovation and they must find a way to merge their efforts for the benefit of European science and not of the local HPC centres."

"It is very important that PRACE, GEANT and ETP4HPC with their own well-defined goals work together for achieving a sustainable EU HPC eco-system across Europe. As an example, PRACE supports users, however it needs to work very closely with GEANT to foresee how the future demands of users can be serviced through GEANT activities. Similarly through PRACE's input, ETP4HPC can better understand and define the future requirements of EU HPC users."

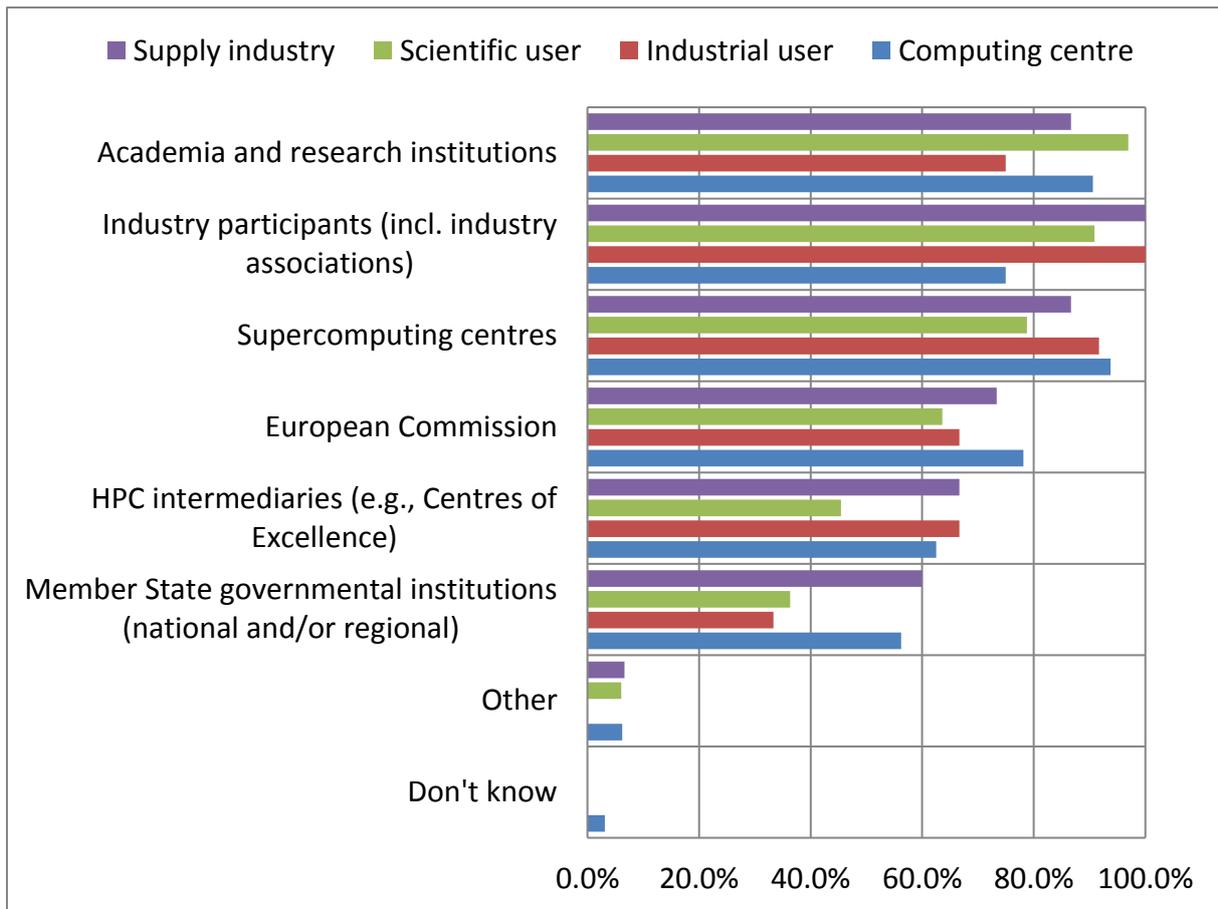


Figure 10 – Who should be part of a potential EU initiative on HPC?

Each group identified itself as a key participant in the new potential EU initiative on HPC, indicating self-engagement and a strong will to contribute to the initiative. Within each group the percentage of self-commitment was as follows: technology supply industry (100%), industrial users (100%), scientific users (97%), and computing centres (93.8%).

By importance, the next actor identified by all groups of respondents was the European Commission as seen in Figure 10. In particular, for each group of respondents the European Commission should have priority over HPC intermediaries and Member States in a potential EU initiative on HPC.

3.9 Expected impacts of a future EU initiative on HPC

The main desirable impact of such an initiative was expected to be on science and technology development (ranking 4.68/5). Respondents' expectations included:

- Underpinning the development of most emerging technologies and applications, from precision medicine and agriculture to deep learning
- Development of new materials, medicine and healthcare and
- Reduced economic losses thanks to better weather or traffic forecast.

The second desirable impact (ranking 4.36/5) was expected to be on economy and growth, including competitiveness of Europe's industry. Expectations included:

- Development of more EU-based enterprises and support to digitisation of traditional EU industries

- Job creation as HPC engineers are and will be needed
- Development of sharper and more competitive products relying on massive optimisation.

Regarding impacts specific for the respondent's institution, responses included:

- Early access to state-of-the-art HPC technologies stimulating more students in undertaking challenging projects with industry,
- Increased opportunities for R&D collaborations with SMEs, and
- Strengthening the own-market position by using HPC as early as possible in the pre-development of products, use of virtual prototypes, reducing costly experiments and waste.

The main desirable impact of such an initiative on a scale of importance between 1 and 5 (with 1=lowest importance and 5=highest) is reported on Figure 11 for each group of respondents.

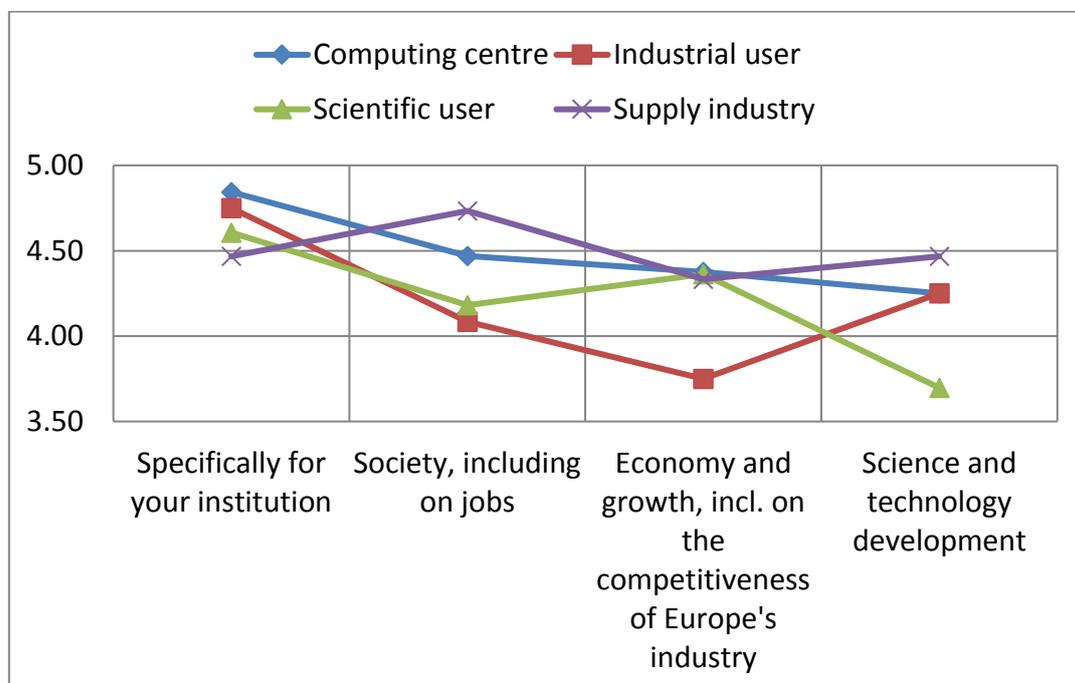


Figure 11 –What would be the desirable impacts from the future EU initiative on HPC?

Except for the technology supply industry group which expects the highest impact on society including on jobs (rating 4.73), all other groups expect the highest impact (rating > 4.5) to be specifically on their institutions.

4. Summary of the Responses to the Inception Impact Assessment Publication

The Inception Impact Assessment was published on 3 August 2017 on the Commission's Better Regulation Website¹⁰ for feedback. Fifteen responses were received¹⁴ (10 from Germany, 3 from UK, 1 from Spain, 1 from Netherlands) with the following main messages:

- four responses agreed to a new EU-wide initiative, and three of them explicitly favoured a Joint Undertaking as the most appropriate instrument;

¹⁰ http://ec.europa.eu/info/law/better-regulation/initiatives/ares-2017-3896569_en

- eight responses criticised the initiative as allegedly being promoted by the weapons manufacturing industry and sponsored by them;
- one response promoted the own consulting type of company as to be best place to play an active role in the future initiative;
- two responses criticised the initiative as creating either too much waste or as diverting money from help to developing countries.

However, all responses which discussed the issue in technical terms supported the new initiative. Three of them explicitly supported a Joint Undertaking as the best instrument.