EuroCC@Greece Report

July 2021

1 Background – General Information

The EuroCC project aims to advance competitiveness in research, improve effectiveness of government services and promote innovation in industry through High Performance Computing (HPC), Big Data, and Artificial Intelligence (AI) across Europe. EuroCC@Greece is one of 33 national nodes of the EuroCC project, in the framework of the European High Performance Computing Joint Undertaking (EuroHPC JU).

This survey is carried out to help us to map the ecosystem of HPC, Big Data, and AI users and providers in Greece, identify and understand the distinct needs of the Greek users as well as those that want to become HPC, Big Data, AI users and gradually build up the necessary support accordingly. The survey is publicly accessible at the following link:

https://eurocc-greece.gr/competence-mapping/

The survey launched on April 2021, getting up to now **_more than 40 replies_**. We have received answers from participants from the following sectors:

- 28 Academia

- 12 Industry
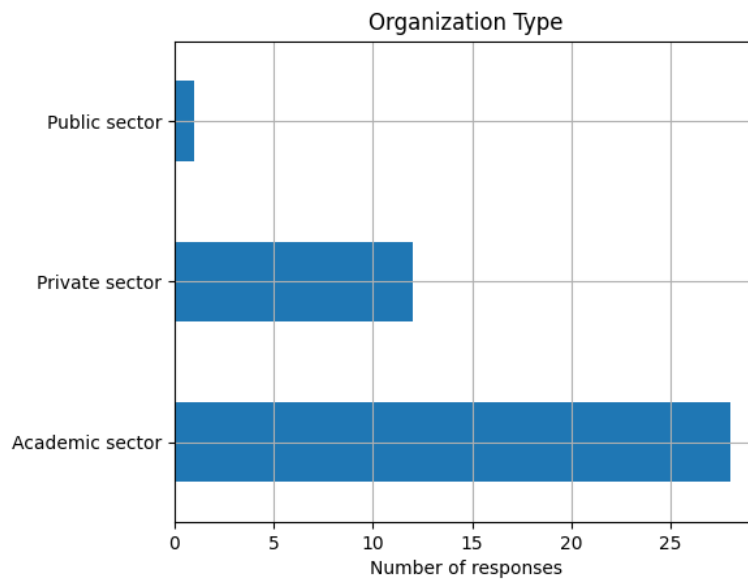
- 1 Public sector

as depicted in Figure 1.

Figure 1: Organization Type

Most of the organizations that took part in our survey occupy more than 250 employees (Figure 2). Looking at the distribution of responses by sector, the largest share of respondents belong in the IT/Computer Science sector, followed by the share from the Life Sciences & Health, Engineering and Education sector as can be seen in Figure 3.
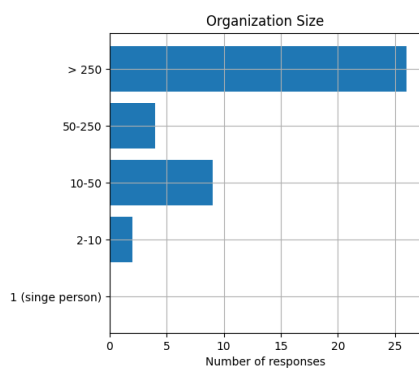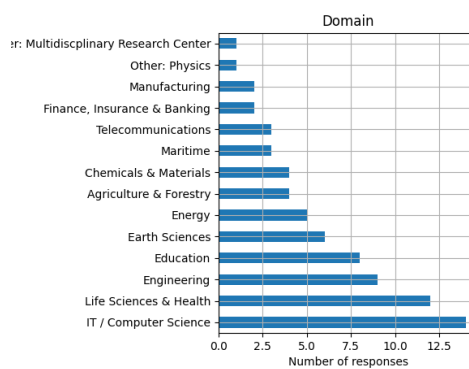

Figure 2: Organization Size

Figure 3: Organization Domain

2 Industry

Most of the participants that come from the Industry sector characterize themselves both as providers and users of HPC, Big Data and AI services as depicted in Figure 4. Although, there are some respondents that have not used HPC, Big Data or/and AI services so far, they claim that they need to use them (Figure 5).
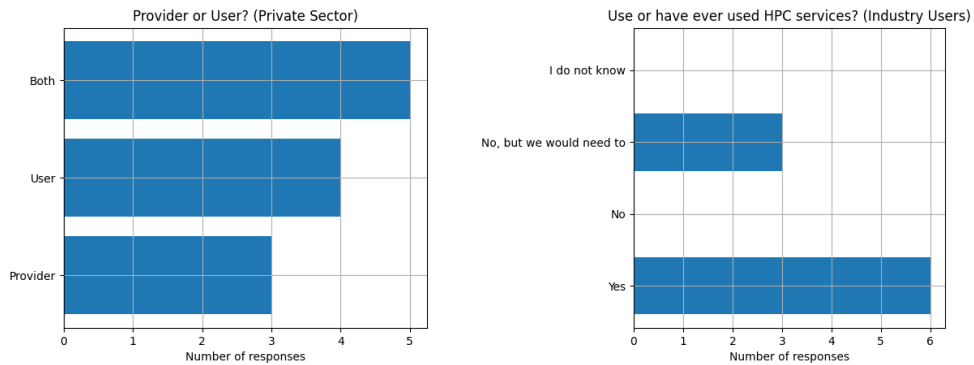

Figure 4: Providers and users from the Industry

Figure 5: Industry users of HPC services

The most commonly mentioned benefits that arise from the use of these technologies are the use of predictive models, and the provided speed to process the needed data, followed by the possibilities for innovation through advanced research as shown in Figure 6.
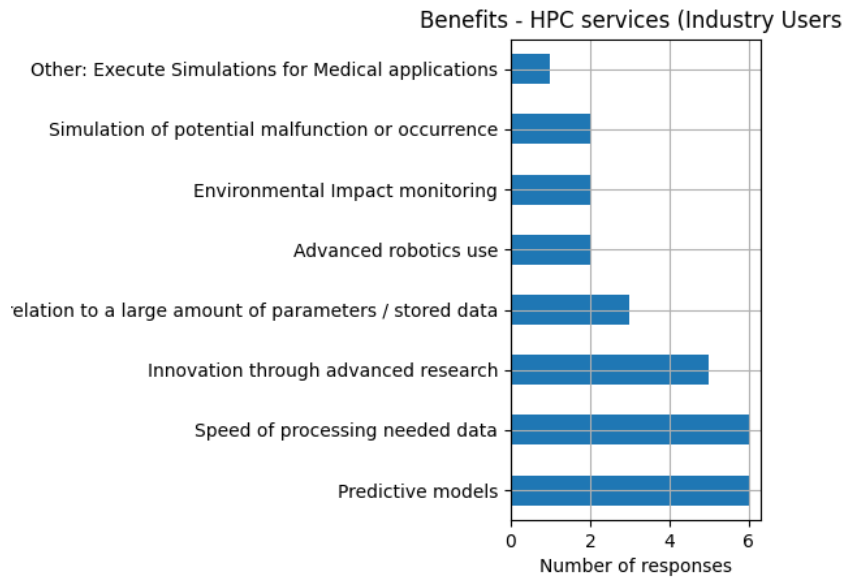
Figure 6: Benefits of HPC services

It is hopeful to see that most participants have in house qualified personnel with HPC, Big Data and AI. However, the majority of them believe that they need support regarding their personnel's training, HPC/AI consulting and the needed infrastructure as we can see in the figures below.
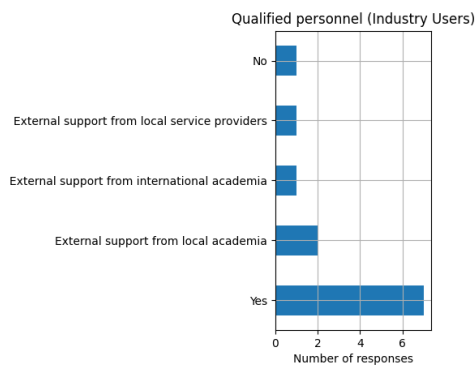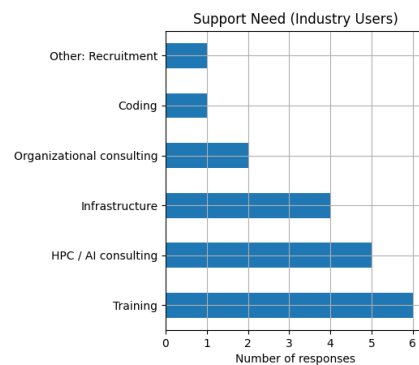

Figure 7: Qualified personnel

Figure 8: Need for support

The most commonly mentioned expectations and business objectives of the Industry regarding the use of HPC, Big Data and AI are the access to a range of new products and services, the delivery of goods or services that meet the customer needs, the forecasting ability that derives fro the

exploitation of appropriate models, and of course the competitive advantage that can be gained (Figure 9).

Figure 9: Expectations and benefits from the use of HPC/Big Data

3 Public Sector

Till now, we have received only one answer from the Public sector, hence, we omit here any analysis results.

4 Academia

Regarding the participants that come from the Academia sector, the strong majority use or at least has used HPC services as depicted in Figure 10. Although a few respondents have not used HPC services so far, they all need to process Big Data for their operations.Most of them responded that they need support to train their personnel to obtain the necessary skills. Basic information as to how HPC can have an impact for their activity, information about successful use cases, and access to local experts would also be of great importance to several respondents from this sector (Figure 11).
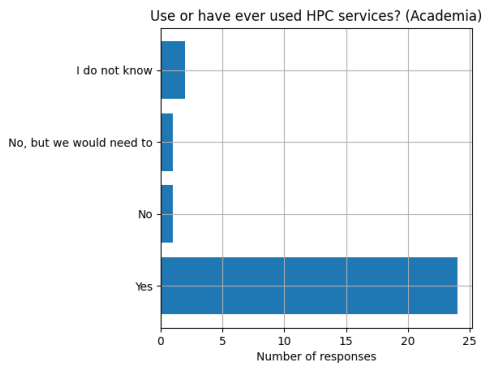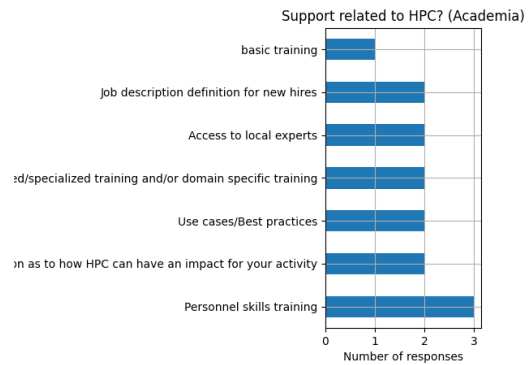
Figure 10: Use of HPC services   Figure 11: Aspects to be supported

For those who use or have used HPC services, the speed of processing the needed data seems to be the most important benefit that arises from this use, followed by the exploitation of predictive models and big data analytics, and the application of heavy mathematical algorithms to Big Data. The need to take advantage of Big Data and machine learning techniques nowadays, rises to the top in this sector, as these are two research challenge areas, which the researchers and data scientists should focus on to improve the efficiency of data science.
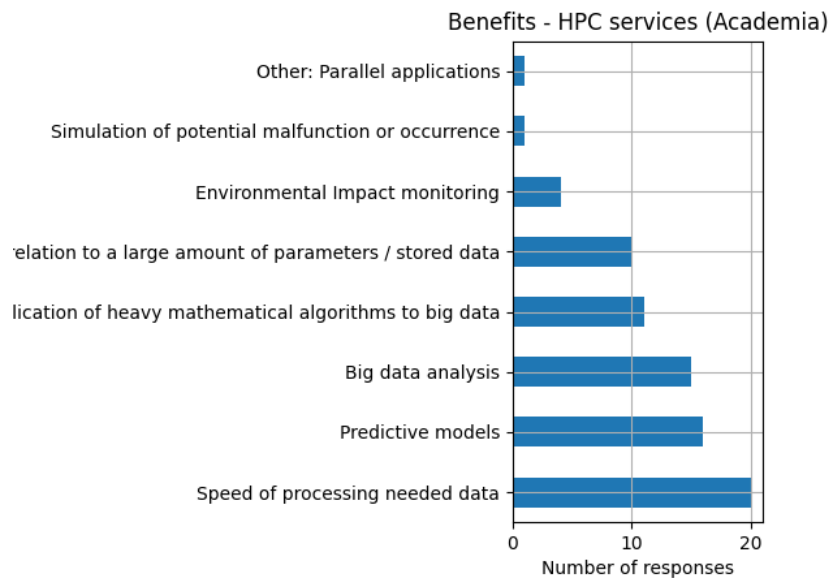

Figure 12: Benefits form the use of HPC services

Most respondents indicated that they need support regarding the needed

infrastructure, although most of them already have in house infrastructure suitable for HPC/Big Data exploitation as depicted in Figures 13 and 14. Their available capacity regards mainly Tier-2 and Tier-3 systems but the majority also uses external HPC infrastructure to cover its needs (Figure 15).
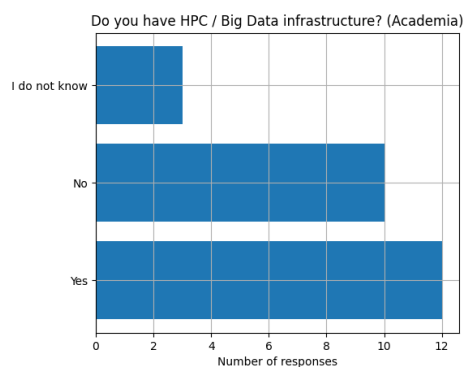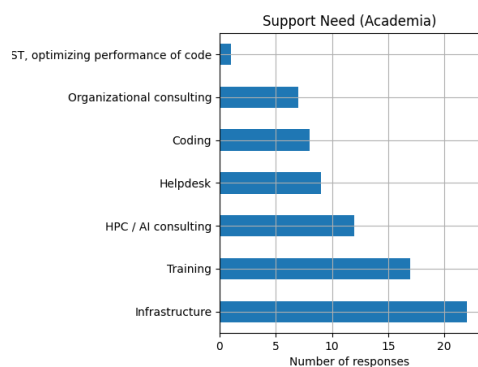

Figure 13: Aspects to be supported   Figure 14: Infrastructure availability
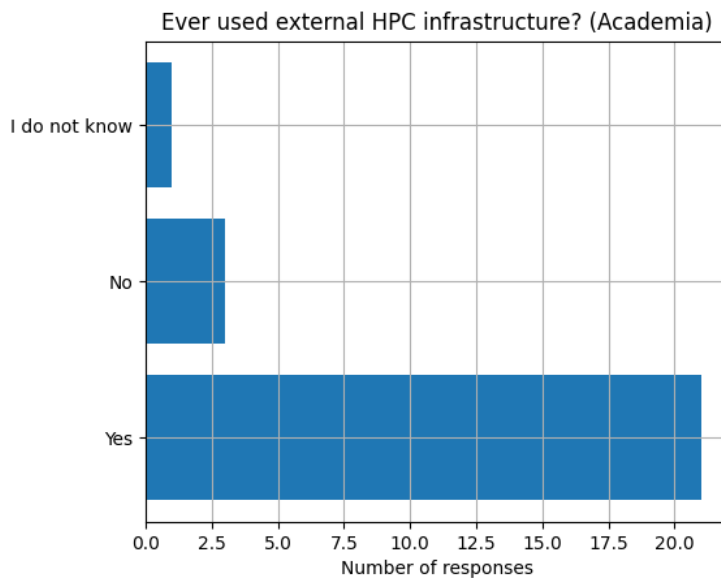
Figure 15: Use of external HPC infrastructure

The main providers of HPC infrastructure are probably other collaborating Universities (although most of respondents do not provide HPC/HPDA/AI services as seen in Figure 16), the Partnership for Advanced Computing in Europe and the Greek Research and Technology Network (GRNET). Training and consulting on HPC/AI are also considered highly necessary as depicted in Figure 13.

Specify the service provider of HPC infrastructure? (Academia)

|	
1	Collaborating University HPC system, UC Riverside
2	PRACE, DECI, HP-SEE
3	Aris
4	GRNET
5	Barcelona Supercomputing Center
6	LRZ, EPCC
7	https://hpc.grnet.gr/
8	https://hpc.grnet.gr
9	https://www.bsc.es/, https://www.criann.fr/
10	GRNET ARIS
11	ARIS- HPC cluster in Athens Greece
12	ARIS HPC, Cytera HPC, Juelich HPC
13	GRNET ARIS
14	GRNET
15	Various providers, e.g. Amazon, have been used
16	ARIS HPC
17	ARIS national supercomputing centre, Piz Daint supercomputer
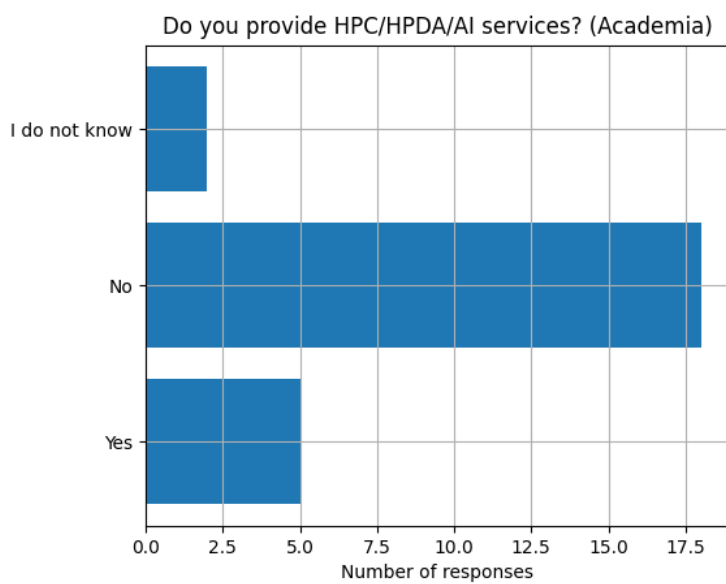
Figure 16: Providers of services

5 Providers

This sections refers to participants that provide HPC, Big Data, or/and AI services and come either from the Industry or the Academia sector. As depicted in Figure 17, the most commonly provided service regards expertise (i.e. consulting, independent experts, etc.) on Big Data and AI, followed by infrastructure and software solutions. It seems, though, that there are only a few respondents, able to provide any kind of service regarding HPC as can be seen in Figure 17.
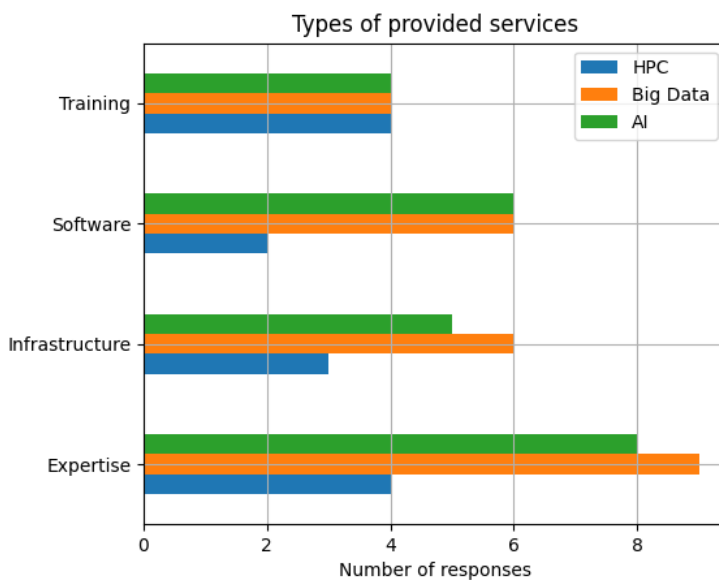

Figure 17: Types of services

As far as big data services are concerned, the most popular services offered by participants are big data analytics, vizualization, storage & management, and warehousing services.
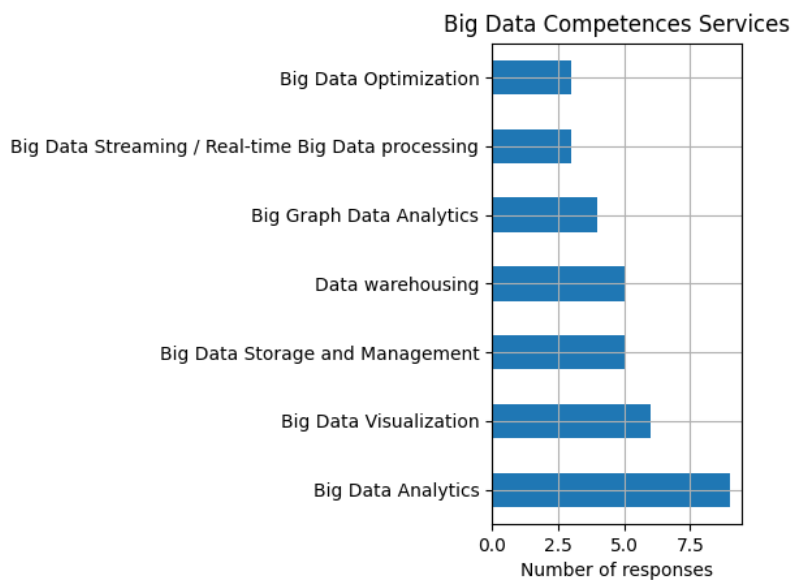
Figure 18: Provided big data services

When it comes to technical skills regarding AI, most respondents are able to provide machine learning and deep learning skills, followed by skills on visualization techniques (Figure 19). Moreover, the most popular AI applications provided regard decision optimization and predictive analytics, followed by applications regarding recommendation systems, expert systems and natural language processing (NLP) (Figure 20).
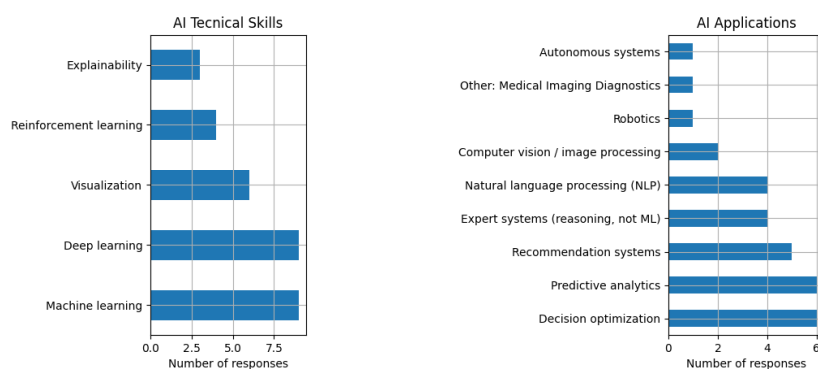

Figure 19: Provided AI technical skills Figure 20: Provided AI applications

The provided HPC provided regard hardware, software and consulting or other services. The small number of participants offering this kind of

services does not allow for safe conclusions to be drawn. As far as hardware solutions are concerned, CPU architectures, storage space, networking and compute co-processors are usually offered from this small share of respondents (Figure 21). Regarding software solutions, compilers, libraries and parallel applications are usually offered as can be seen in Figure 22. When it comes to other services in this category, providers most commonly offer parallel programming for CPUs (MPI, OpenMP, POSIX Threads, GASPI, etc) and configuration for HPC resources (Figure 23).
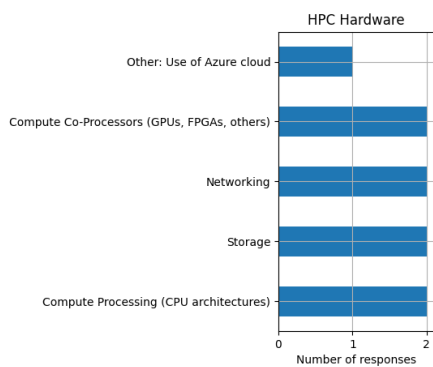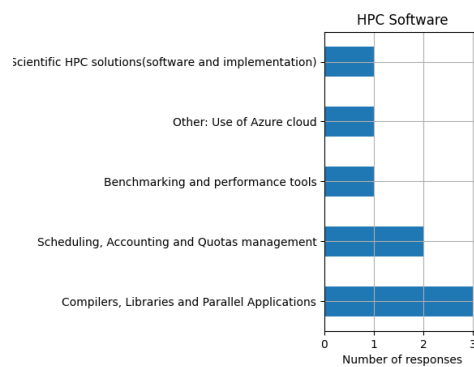

Figure 21: Provided HPC hardware
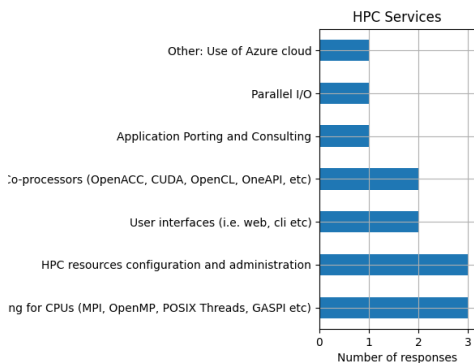

Figure 22: Provided HPC software

Figure 23: Provided HPC services

Most of the participants have customers and provide them with their services (Figure 24). These customers are usually large and medium enterprises and come mainly from Greece or the rest of Europe as depicted in Figures 25 and 26. It seems that smaller enterprises do not have the ability to have access to HPC/Big Data/AI services in Greece. Most customers belong to

the Life Sciences & Health and the Telecommunications domain, followed by the domains of IT/Computer Science, Finance, Insurance & Banking, and Retail (Figure 27).
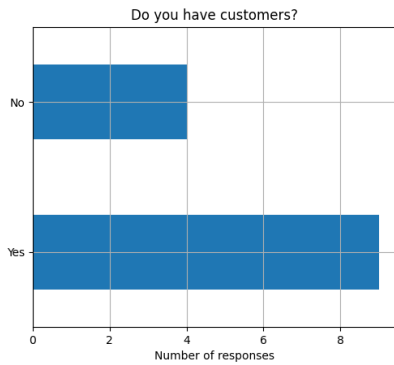

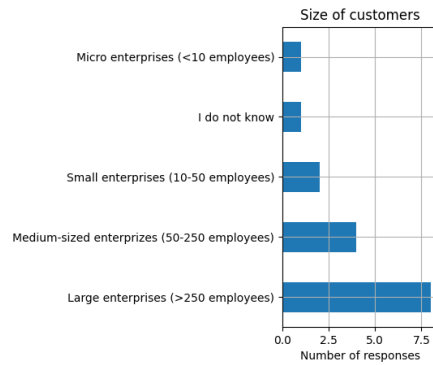Figure 24: Working with customers

Figure 25: Customers' size
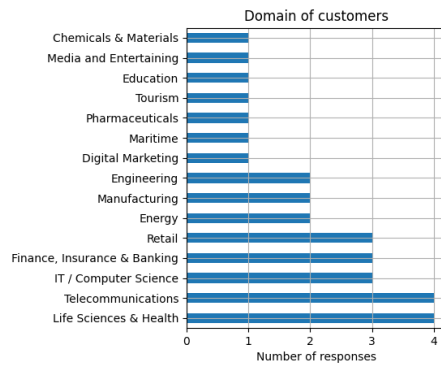

Figure 26: Customers' location

Figure 27: Customers' domain

The providers were also asked about the technologies and tools they use themselves. The two main tools regarding the use of Big Data are Hadoop and Spark, probably because these two platforms are famous open-source solutions with active community support. The most popular by far AI tools are Tensorflow and Pytorch and as regards as the HPC technologies used, MPI, OpenMP and CUDA seem to be the three most preferable technologies used (Figures 28, 29, and 30).
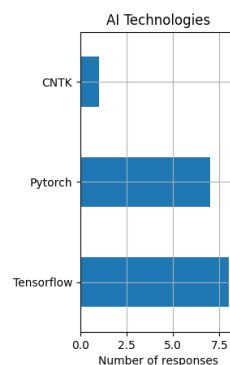
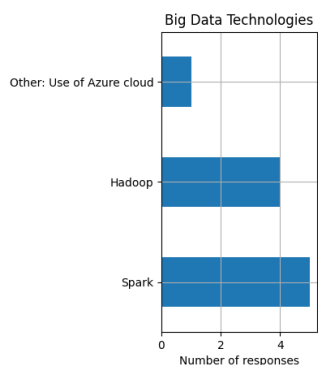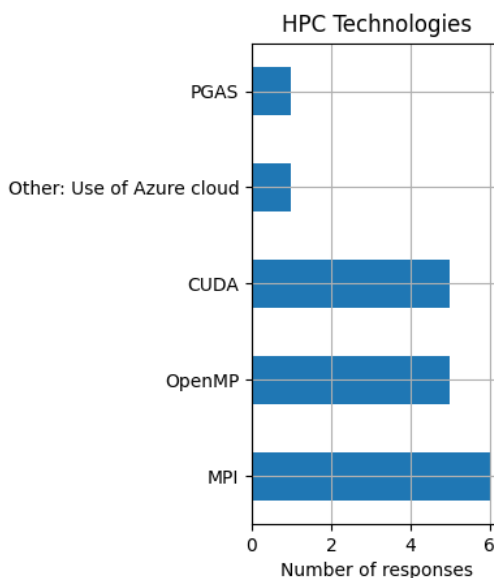Figure 28: Big Data technologies used   Figure 29: AI technologies used

Figure 30: HPC technologies used

The majority of the providers that took place in this survey has received national or European funding for providing, developing or enhancing HPC, Big Data or/and AI services so far, and all of them are willing to become members of EuroCC@Greece's network, as depicted in Figures 31 and 32.
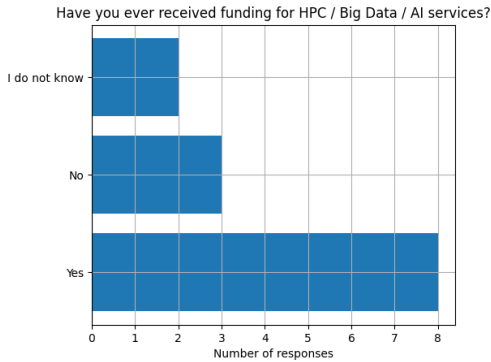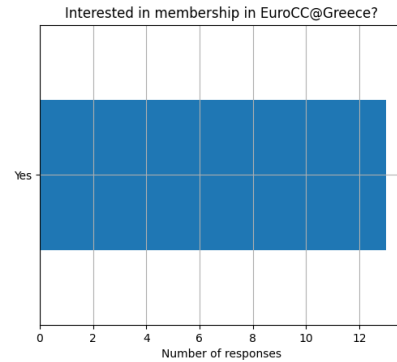
Figure 31: Funding receivers

Figure 32: Membership interest

6   Conclusions

The rapid growth of cloud computing and Internet of Things (IoT) promote the sharp growth of data even more. Consequently, managing the produced data and gaining insights from it, is a challenge and possibly a key to competitive advantage for industries that try to find ways to collect and integrate massive data. The need to use models to process and analyze it, becomes imperative. Under these circumstances, although most industries have their personnel to face these challenges, their main need remains the support for training and consulting.

Since data science is expansive, with strategies drawing from computer science, statistics, and different algorithms, and with applications showing up in all areas, these challenge areas address the wide scope of issues spreading over science, research, and innovation. Although, Big Data and machine learning are the highlights of operations nowadays, there are still issues or difficulties the analysts try to address and the Acedemia sector in Greece tries to support their work towards this direction. However, it is clear that this sector also needs support regarding the training of its personnel and the necessary infrastructure that should be used.

Providers of HPC, Big Data and AI services come mainly from the Industry. They seem able to provide big data analytics, visualization and data management skills, machine learning expertise and predictive analytics to support decision making but they don't usually provide HPC services regarding either hardware, software or any other expertise. Most of their customers are large enterprises in Greece as smaller companies may not have the ability to access this kind of services.

Most of the participants from academia, *public administrations* and in-

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dustry have used necessary funding to cope with the new challenges posed by the rise of big data analytics, machine learning, and AI over the last few years and the need to take advantage of high-performance computing (HPC) within data centres. They realize that managing the produced data and gaining insights from it, is a challenge and possibly a key to competitive advantage. Consequently, they are willing to become members of EuroCC@Greece to cover their needs from access to resources and technological consultancy to the provision of training courses.