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SME/HPC

Erasmus + KA2: Cooperation for innovation and the exchange of good practices

Knowledge Alliances

SME/HPC

Enabling SMEs to gain competitive advantage from the use of HPC

D8/9 – HPC for Dummies

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Table of Contents

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1. Introduction

The HPC for Dummies online platform is an additional tool within the project's website (https://www.smehpc.eu/) and will be used for both dissemination and exploitation purposes, as well as contribute to the project repository. This tool will support both HEIs and SMEs to evaluate their respective levels of preparedness and potential mutual engagement, through carefully designed questionnaires catered to specific needs of both type of institutions.

The results of the questionnaires will help understand each institution's HPC maturity level and provide a challenge map with actual data on HPC landscape in the region as well as propose steps to take next in order to establish a HEI-SME collaboration.

2. Level of maturity and challenge map

The HEI and SMEs questionnaire were developed in a form of closed ended questions. Each question and the subsequent answers identify the perspective of how the HEIs and SMEs fit into the maturity level of an institution.

There are three levels of maturity (Low, Medium and High), which correspond to different actions that the organizations have to proceed:

Low – if the maturity level is **low**, the institution should contact the **SME/HPC team** on the following email: sme.hpc@fis.unm.si. The institution will get access to **HPC knowledge** to both young researchers and entrepreneurs as future HPC practitioners, hence with the need to stay up-to-date with the **current trends in HPC** or to learn about them.

Medium - if the maturity level is **medium**, the institution should access the **InnoHPC LAB** (https://innohpclab.fis.unm.si/) to seek new business opportunities. InnoHPC LAB is a multi-purpose platform, which provides tools to encourage development of **transnational linkages** between innovation actors, leading to transnational clusters. Through this platform, the o institutions **can gain transnational access to HPC infrastructure** and boost their innovative process through simulations of business processes, manufacturing or services.

High - if the maturity level is **high**, the institution should access the **Fortissimo** project webpage (https://www.fortissimo-project.eu/). The platform provides **one-stop, pay-per-use, on-demand access to advanced simulation**, modelling and data analytics resources including software, hardware and expertise. Additionally, the organizations can access the **KnowING IPR** (https://knowing-ipr.fis.unm.si/) institutional platform (*supported by online platform*), where different stakeholders will be able to **retrieve information on importance of technology transfer, IP protection, opportunities arising from IP protection and on tools to properly manage own IP**.

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3. Questions / Answers for SMEs: to assess the maturity level for the usage of HPC services and technologies

1. What is your current level of HPC environment knowledge?

High Performance Computing (HPC) or Supercomputing is term used for using of systems with massive numbers of processors and parallel processing for solving complex computational problems. HPC environment consists of hardware, software employing parallel computational techniques and administration of those systems. Terms for HPC includes **Distributed or Cloud Computing** where hundreds or thousands of computers are distributed across a network, **Computer clusters and Supercomputers are also terms used.**

A.	**None**	I have heard of cloud computing or computer clusters in general media but I know nothing or very little, and my company has never used any, to my knowledge.
B.	Basic	I have basic knowledge of HPC environment, and I understand the difference between cloud computing and HPC.
C.	Advanced	I have a very good knowledge of HPC environment, and understand terms such as MPI and OpenMP and the differences.

2. Describe the present state of computing infrastructure available in your region?

Attribute: **Infrastructure**

Prior to advanced internet connections, most computing was carried out in company premises. However, with advanced high bandwidth internet, computer simulation and computation can be carried out off site in HPC Centres or use cloud resources. There are different service models available: ***Software as a Service (SaaS); Platform as a Service (PaaS); Infrastructure as a Service (IaaS).***

A. None	The company does not have any computing infrastructure available for simulation in the region/
B. In-house infrastructure	The company is using in-house infrastructure for simulations.
B. IaaS or Paas	The company is renting the compute power with different service level (IaaS or PaaS) from a third party. However, the Simulation Software is not included in a service.
C. SaaS	The company is renting the compute power together with the Simulation Software from third parties.
Combination	This scenario is a combination of the own infrastructure usage and IaaS, PaaS or SaaS service models.

3. How would you rate the applicability of advanced technologies (for simulations) in your sector?

A.	**Not applicable**	The company believes that advanced technologies are not directly applicable in the sector. There is a lack of theoretical or practical foundation, software and tools.
B.	Applicable	Advanced technologies are applicable in this sector. Many companies apply simulation with some success. Results from simulation are acceptable and may yield benefits (such as costs savings, faster development, etc.), and there are software tools and procedures available.
C.	***Great potential***	Advanced technologies are applied successfully and has demonstrated high economic benefits. Software and procedures are well established, there is long tradition in using simulations in the sector. It is accepted that by using simulation the company can significantly reduce development times, realize major costs savings, or similar.

4. Describe your level of knowledge on simulation methods and tools.

Attribute: **Methods & Tools**

By simulation we mean the main computational tasks that are important for your business. In some cases, it may also be described as data analysis, prediction or in some other way.

In this question we would like you to assess the company's knowledge of the main methods and tools that are used in your sector or application area. Example of tools and methods include mathematical methods like Finite Volume, Finite Elements Analysis, Computational Fluid Dynamics etc.,. In data processing examples include Map Reduce, Deep learning. The tools may also be software libraries or packages, or middleware such as Hadoop.

A.	**None**	The company does not have any knowledge and no knowledge of external expertise.
B.	Basic	We possess basic knowledge, but tend to depend on services from external experts.
C.	***Advanced***	The company has extensive knowledge of the methods and tools used in our application area.

5. How important is real time simulation and data processing for your company?

Where the simulation needs a lot of interaction with the expert while running it, the bandwidth of the internet connection becomes of vital importance, and any latency that occurs that could affect the simulation process. So, if you have any interaction during the simulation, do you need a response within seconds, minutes or hours?

A.	**Not important**	No interaction with user needed while simulation running. Latency is not an issue
B.	Normal	Limited interaction during the simulation run or response within 10 mins is acceptable.

C.	**Very important**	A lot of interaction during the simulation verifying or directing the progression of the simulation requiring immediate response times within 1 second

6. How important is the simulation duration for you? (i.e. time between start and end of each iteration)?

HPC Centres offer access to additional compute power when needed, which can speed up the process and secure results sooner when time is a critical factor. This question is focused on the Importance of the duration of the simulation,

A.	**Not important**	The results of simulation are important but not time critical
B.	Normal	Time for every simulation iteration is a factor to consider, and speeding up the process is useful
C.	**Very important**	Duration is critical – ie there is limited time in which to secure the results, and if appropriate, carry out iterations for example: weather forecasting.

7. How often do you perform the simulations?

If your organisation is carrying out computing simulations, you may have already invested in an in-house computing environment. As the company grows in the future, e.g. in terms of the scale of production or the amount of data being processed, you may require faster computing simulations.

You will have the opportunity to make a decision as to buy or outsource all or some of your computing simulations to an external agency or use the 'cloud'.

This question asks you to estimate the frequency of potential simulation requests you may generate in one year.

A.	**Never**	Never performed computing simulations and do not see any added value in the upcoming year.
B.	Rarely	Have occasional need
C.	***Monthly***	Tend to require monthly
	Weekly	At least once a week
	Daily	Most days

8. Rate the importance of the simulation and data processing for your company.

A.	**Not important**	We don't use simulations and data processing in our business processes.
B.	Some	Simulations make it easier or more cost-effective to develop new products.

C. ***High*** We can't develop new products without access to simulations.

9. How likely is that your company would rent Hardware & Software instead of buying it?

Attribute: **BMI - Purchase Policy**

Renting or buying Hardware & Software depends on the company's needs and requires understanding the technology and calculating the financial aspects of the options, and the Return on Investment (RoI).

Renting, which includes buying cloud-based solutions (IaaS–PaaS-SaaS), requires much smaller upfront cost, short-term commitment and enables a company to keep up with their competitors without draining their financial resources. The services are more flexible in turning them on/off when needed and expanding significantly as required, offering vast scalability and potentially lower storage costs

Buying hardware/software (on premises) gives the company control and flexibility, may overcome any internet connectivity issues, and mitigates external security risks, should either be an issue.

There is also a 'hybrid' solution, which leverages the best of both ownership and cloud-based solutions.

A. **Not very likely** Company owns their equipment (hardware) and software (or licenses), and there is a team for maintaining it.

B. Possibly Company uses a hybrid (mixed) solution of renting and buying hardware and software, for example to meet additional need, and provide 'burst' capacity or for special one-off simulations.

C. ***Very likely*** Company willing to rent solutions, including computing equipment and software.

10. Quantify your company's investments in **Research & Development** (R&D) and Innovation.

Attribute: **R&D and Innovation**

Research & Development expenditure refers to any expenditure that seeks to develop, design and enhance the company's products, services, technologies or processes. R&D allows a company to come up with innovative new products or features that increase market share.

To quantify a company's investments in R&D and Innovations, choose from the following options.

A. **less than 5%**
B. between 5% to 10% of Company Turnover
C. ***more than 10%***

11. How confident are you with HPC provider from your region?

Attribute: **HPC provider**

As mentioned earlier, trust and confidentiality can be critical factors in deciding whether to use the services of an HPC Centre. Most HPC Centres have security standards and data governing procedures in relation to administering data transfer, storage and backup, which you may wish to review. Furthermore, a suitable None Disclosure Agreement (NDA) can be put in place to govern and guide the data management policy between the HPC provider and client. The question here is to establish the confidence in the HPC provider.

A. Don't trust	Consider your data to be at risk
B. Acceptable risk	Consider that there are measures in place, but may not be full-proof
C. Trust	Trust the HPC provider to protect your data or the data are not highly confidential, so it doesn't matter

12. How confident are you that your Telecom services provider will deal with your data in a trustworthy manner?

When accessing the Internet through any Telecom Service Provider, all the exchanged Data/ Information will be available to the Service Provider. How confident are you that no-one will access your data?

A.	**Don't trust**	Consider your data to be at risk
B.	Acceptable risk	Consider that there are measures in place, but may not be full-proof
C.	**Trust**	Trust the telecom provider to protect your data or the data are not highly confidential, so it doesn't matter

Maturity Level (readiness for HPC):

Most Answers A: Low

Most Answers B: Medium

Most Answers C: HIGH

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4. Questions /Answers for HEIs: to assess the maturity level for the usage of HPC services and technologies

1. **Is there an institute/department/working group dedicated to HPC at your institution?**

D.	**Not applicable**	The HEI does not have an institute/department/working group dedicated to HPC
E.	Applicable	The HEI has one institute/department/working group dedicated to HPC
F.	***Great potential***	The HEI has more than one institute/department/working group dedicated to HPC

2. **How would you rate the applicability of advanced technologies (for simulations) in the Higher Education Institution?**

A.	**Not applicable**	The HEI believes that advanced technologies are not directly applicable in academia. There is a lack of theoretical or practical foundation, software and tools.
B.	Applicable	Advanced technologies are applicable in academia. Many HEIs apply simulation with some success. Results from simulation are acceptable and may yield benefits (such as costs savings, faster development, etc.), and there are software tools and procedures available.
C.	***Great potential***	Advanced technologies are applied successfully and have demonstrated benefits. Software and procedures are well established, there is long tradition in using simulations in academia. It is accepted that by using simulation HEI can significantly reduce development times, achieve major costs savings, or similar.

3. **Rate the importance of the simulation and data processing for your Higher Education Institution.**

A.	**Not important**	We don't use simulations and data processing in our academic processes.
B.	Some	Simulations make it easier or more cost-effective to innovate.
C.	***High***	We can't have academic success without access to simulations.

4. **How likely is that your Higher Education Institution would rent Hardware & Software instead of buying it?**

Renting or buying Hardware & Software depends on the company's needs and requires understanding the technology and calculating the financial aspects of the options, and the Return on Investment (RoI).

Renting, which includes buying cloud-based solutions (IaaS–PaaS-SaaS), requires much smaller upfront cost, short-term commitment and enables an institution to keep up with their competitors without draining their financial resources. The services are more flexible in turning them on/off when needed and expanding significantly as required, offering vast scalability and potentially lower storage costs

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There is also a 'hybrid' solution, which leverages the best of both ownership and cloud-based solutions.

A. **Not very likely** The HEI owns its equipment (hardware) and software (or licenses), and there is a team for maintaining it.

B. Possibly The HEI uses a hybrid (mixed) solution of renting and buying hardware and software, for example to meet additional need and provide 'burst' capacity or for special one-off simulations.

C. ***Very likely*** The HEI is willing to rent solutions, including computing equipment and software.

5. Describe your level of knowledge on simulation methods and tools.

By simulation we mean the main computational tasks that are important for your business. In some cases, it may also be described as data analysis, prediction or in some other way.

In this question we would like you to assess the institution's knowledge of the main methods and tools that are used in your sector or application area. Example of tools and methods include mathematical methods like Finite Volume, Finite Elements Analysis, Computational Fluid Dynamics etc.,. In data processing examples include Map Reduce, Deep learning. The tools may also be software libraries or packages, or middleware such as Hadoop.

A. **None** The HEI does not have any knowledge on simulation methods and tools and no knowledge of external expertise.

B. Basic We possess basic knowledge, but tend to depend on services from external experts.

C. ***Advanced*** The HEI has extensive knowledge of the methods and tools used in our application area.

6. How important is real time simulation and data processing for your institution?

Where the simulation needs a lot of interaction with the expert while running it, the bandwidth of the internet connection becomes of vital importance, and any latency that occurs could affect the simulation process. So, if you have any interaction during the simulation, do you need a response within seconds, minutes or hours?

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This question asks you to estimate the frequency of potential simulation requests you may generate in one year.

A. **Never** Never performed computing simulations and do not see any added value in the upcoming year.
B. Rarely Have occasional need
C. ***Monthly*** Tend to require monthly
Weekly At least once a week
Daily Most days

9. Quantify your HEI's investments in Research & Development (R&D) and Innovation.

Research & Development expenditure refers to any expenditure that seeks to develop, design and enhance the HEI's products, services, technologies or processes. R&D allows to come up with innovative new products or features that increase market share.

To quantify institutions' investments in R&D and Innovations, choose from the following options.

A. **Less than** 5%
B. Between 5% to 10%
C. ***More than*** 10%

10. What is your current level of HPC environment knowledge?

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Maturity Level (readiness for HPC):

Most Answers A: Low

Most Answers B: Medium

Most Answers C: HIGH