A Study on Users' Perception of HPC Environment and Policy

Myoung-Ju Koh, Kujin Cho, and Kim Nam Gyu

Abstract— With the emergence of issues such as the Fourth Industrial Revolution and AI, interest in HPC is also increasing. Developed countries recognize HPC resources as a key factor to improve science and industry competitiveness and are promoting various HPC policies. Korea also has laid the foundation for HPC policy and has been pushing for a variety of support after enacting the HPC Act(`11) and establishing the first basic plan(`13). In order to increase the efficiency of the policy, it is important to grasp the real situation. In this study, we analyze users' perception of HPC environment and policy in various aspects. To do this, we use the data of the 'National High Performance Computer Survey' conducted by KISTI. In particular, this study suggests HPC development policies based on survey data of HPC users and operators.

Research Keywords— HPC Policy, Survey Research on HPC, Supercomputer

1 INTRODUCTION

Recent emerging trends such as the Aritificial Intelligence (AI) and the 4th industrial revolution are based on high computing capability. It encourages HPC's strategic significance. Considering the HPC as one of key factor to boost scientific and industrial competitiveness, developed countries such as US, China, Japan, EU try to strengthen HPC technology through various policy portfolio.

The United States enacted the first HPC Act [1] in 1991 and has actively invested and supported the HPC program and policy. The US tries to improve leadership in the HPC field, including setting up the National Steategic Computing Initiative (NSCI) [2] and establishing the NSCI Strategic Plan [3].

China is emerging as strong HPC power through state-led massive investment in HPC. It has come from development of top 1 HPC in the world [4]. Japan tries to develop ExaFlops HPC by Ministry of Education and Science [5].

- *Myoung-Ju Koh (first author) is with the Korea Institute of Science and Technology Information, Deajeon, 34141, Ref. of Korea, E-mail: myju.koh@gmail.com*
- *Kujin Cho is with the Korea Institute of Science and Technology Information, Deajeon, 34141, Ref. of Korea, E-mail: kcho@kisti.re.kr*
- *Kim Nam Gyu (corresponding author) is with the Korea Institute of Science and Tech-nology Information, 245 Daehak-ro, Yuseong-gu, Daejeon, 34141, Korea. E-mail: ssgyu@ kisti.re.kr*

Korea also enacted the HPC law as a second country in the world, after the US. In 2012, Korea set up the policy foundation based on the First HPC master plan(`13~`17) [6]. Recently, the Second master plan(`18~`22) was established to secure HPC capability to cope with the 4th industrial revolution [7]. It is time to design specific policies based on the master plan.

For feasible and effective policies, we need to grasp the perception of policy targets and actors such as industries, universities and research groups. It is helpful to design customized policies and secure policy acceptance.

In this context, this study suggests HPC development policies based on survey data of HPC users and operators.

First, this study explores the perception of the importance of HPC depending on user groups such as industry, academia, research, and government departments. Second, we also investigate which area or part need to strengthen. Lastly, we examine the parts that need to invest for the development of HPC industry based on users' perception.

2 RELATED WORK OR LITERATURE REVIEW

Intersect360 Research examines the current state of the HPC market and estimates its future market size. According to a recent study from Intersect360 Research[8], the global market for HPC reached $ 35.6 billion in 2016, up 3.5% from the previous year. The global market for HPCs is expected to

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grow at a CAGR of 4.3% from 2016, reaching $ 43.9 billion by 2021.

KISTI, which is the national supercomputing center by the law, has only public HPC resources in Korea and provides open HPC platform services since the introduction of first supercomputer in 1988. KISTI carried out survey for underatanding of HPC environment [9] according to the purpose of the institution, but it includes only fragmentary and piecemeal information. We need to investigate status and demand of HPC policy and reflect the demands for policy planning. In this reason, KISTI did survey for HPC. Based on the survey data, we analyze specific policy demand depending on sectors and suggest more feasiable and effective policy direction.

3 Model

Based on the KISTI's HPC survey data, we explore some implications to enhance feasibility and effectiveness of HPC policies focusing on analysis of following items.

First, how important the executive leaders perceive the HPC as a strategic resource?

Second, which areas or parts need to be strengthened for the medium and long-term development of the HPC industry?

Third, which areas or parts should be invested with top priority?

Fourth, which one of specific resoureces related HPC is most vulnerable?

4 Analyses

KISTI's HPC survey in 2017 looked at 106 HPC users and operators. Depending on actor groups, it includes public sector 11.3%, industrial sector 10.4%, academic sector 60.4%, and government-funded research institutes 17.9%.

First, the executive learders' perception of HPC is presented at the figure 1. It indicates perception of executive leaders about HPC as a significant strategic resource.

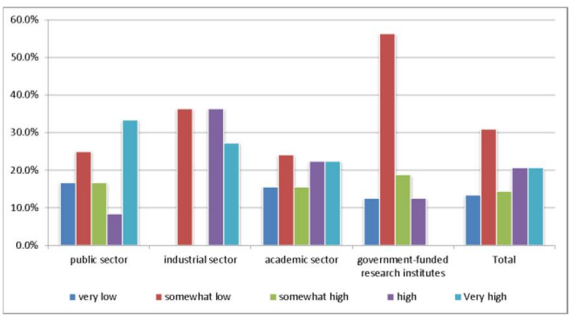

Fig. 1. The executive learders' perception of HPC

Overall, the proportion that answered 'somewhat low' was the highest (30.9%), 'high' and 'very high' were each 20.6%. In case of group or sector, the leaders in industry recognized HPC as the most important strategic resource, followed by academia, public sector. The government-funded institute had the lowest perception of HPC.

Second, the figure 2 indicates what needs to be enhanced for medium and long-term development of HPC industry.

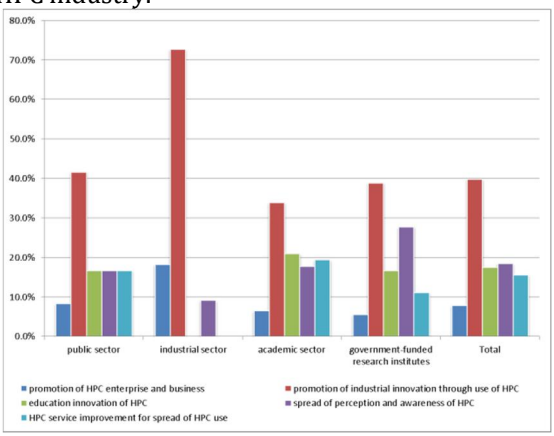

Fig. 2. HPC industry's medium and long term development policy priorities

The 'promotion of industrial innovation through use of HPC' was the highest (39.8%), followed by 'spread of perception and awareness of HPC (18.4%)', 'education innovation of HPC (17.5%)', 'HPC service improvement for spread of HPC use (15.5%)', 'promotion of HPC enterprise and business (7.8%).

In the results of analysis, we can find that actors of all sectors recognized 'promotion of industrial innovation through use of HPC' as most important long-term policy. Particularly, indusrial sector answered that with the largest portion (72.7%). The other sectors recognized that 'education innovation of HPC' and 'HPC service improvement for spread of HPC use' are more important than industrial sector. The 'promotion of HPC enterprise and business' was relatively high in the perception of industrial sector, whereas the other sector considered it as relatively considered as low priority.

Third, we expolores perception related investment priority for development of HPC industry. The figure 3 reported that 'HPC service improvement for spread of HPC use(44.8%)' was the high-

est perception and followed by 'promotion of HPC use in industry (25.7%)', 'development of source proprietary technology of HPC (19.0%)'. The 'commercialization of HPC technology' was the lowest. Similar response patterns are observed in all sectors except industrial sector.

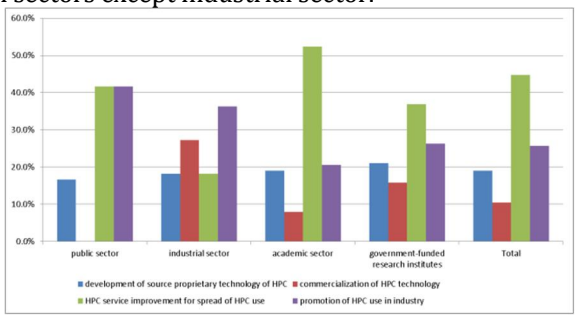

Fig. 3. investment priority for development of HPC industry

On the other hand, in the industrial sector, 'promotion of HPC use in industry' is most significant investment, followed by 'commercialization of HPC technology' that had the lowest perception of other sectors.

Lastly, the figure 4 indicates vulnerable points of specific resources for HPC.

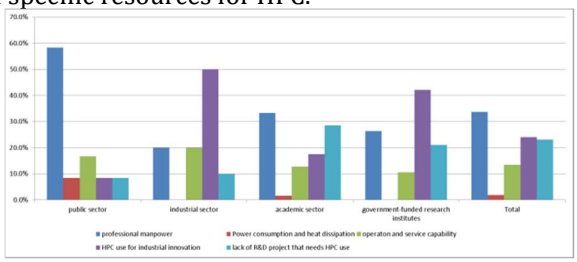

Fig. 4. vulnerable points of specific resources for HPC

We can see that the 'professional manpower' (33.7%) is the weak point, followed by 'HPC use for industrial innovation'(24%), 'lack of R&D project that needs HPC use'(23.1%), 'operaton and service capability'(13.5%). In case of each sector, the industrial sector and government-funded institute recognize that 'commercialization of HPC technology' is the weakest while the public sector answered that 'profrssional manpower' is most vulnerable point.

5 Conclusions

This research expolores HPC policy demand and status and analyze different demand and perception depending on sectors (public, industrial, academic and government-funded institute).

The analysis results show the difference among sectors. First of all, the excutive leader in the industry has higher perception HPC's value as important strategic asset. However, government-funded institute has relative low perception. It means that we need conversion of recognitions through policy instrument such as education and public-relation.

Secondly, all sectors emphasize 'promotion of industrial innovation through use of HPC' among HPC industry's medium and long term development policies. Furthermore, the industrial sector focuses on 'promotion of HPC enterprise and business' as development strategy of HPC industry. This policy is the lowest in other sectors. It means that we need to focus more on industrial policy for HPC industry.

Third, in terms of investment, the industrial sector emphasizes the promotion of HPC use as well as commercialization of HPC technologies. Other sectors focus more on 'HPC service improvement for spread of HPC use'.

These analysis results mean that demand and perception can be different and various depending on sectors. It suggests the necessity of customized policy formation.

References

[1] United States Congress, "High-Performance Computing Act of 1991", https://www.congress.gov/bill/102nd-congress/senate-bill/272

[2] E.O. 13702, "Executive Order Creating a National Strategic Computing Initiative", July 29, 2015, https://obamawhitehouse.archives.gov/the-press-office/2015/07/29/executive-order-creating-national-strategic-computing-initiative

[3] NSCIEC, "National Strategic Computing Initiative Strategic Plan", july, 2016

[4] Jack Dongarra, "Report on the Sunway TaihuLight System", 2016

[5] NARS, "Legislation and Policy Trends in Developing Super High Performance Computers in Major Countries", pp.57-62, 2016

[6] NARS, "Legislation and Policy Trends in Developing Super High Performance Computers in Major Countries", pp.72-79, 2016

[7] MSIT, "A Study on Strengthening Computing Capabilities in Intelligent Information Society", 2018

[8] Intersect360 Research, "Worldwide High Performance Computing 2016 Total Market Model and Forecast: Vertical Markets", 2018

[9] KISTI, "Computational Science Convergence National R & D Trend Analysis and Survey", 2015

Myoung-Ju Koh received the B.S. degree in Systems Management Engineering from Sungkyunkwan University (SKKU), in 2005 and M.S degree and Ph. D. degree in Industrial Engineering from SKKU, in 2007 and 2014 respectively. She worked in Science and Technology Policy Institute (STEPI) for six years from 2009. She has been serving as a Senior Researcher at Korea Institute of Science and Technology Information (KISTI) since 2015. She does research on research policy and strategy management of Korea National Supercomputing Center

Kujin Cho is a senior researcher at Global Science experimental Data hub Center, Korea Institute of Science and Technology Information (KISTI), where he does research on open research data strategy and management & policy of data center.

Kim Nam Gyu is the senior researcher of Korea Institute of Science and Technology Information (KISTI) in South Korea. He obtained his bachelor's de-gree and master's degree in Computer Science and Engineering at Chung-Ang University in 2002. And now I am a Ph.D candidate in Management of Technology at Sungkyunkwan Univer-sity. He per-formed lots of SW R&D projects including the national e- Science project, the AMGA development project, and etc. Also he was the collaboration member of LIGO and KEK Belle projects as the site administrator to construct and manage the data grid site in South Korea. Besides I participated in planning the second 5-year national supercomputing in 2017. At present he participates in EDISON (ED-ucation-research Integration through Simulation On the Net) project which is a web-based simulation service for education and research. He is interested in technical policies for HPC and com-putational science and engineering.