



HYPERION RESEARCH

# Worldwide Best Practices in Partnerships between HPC Centers and Industrial Users

Study for NCSA (National Science Foundation Award #1560770)

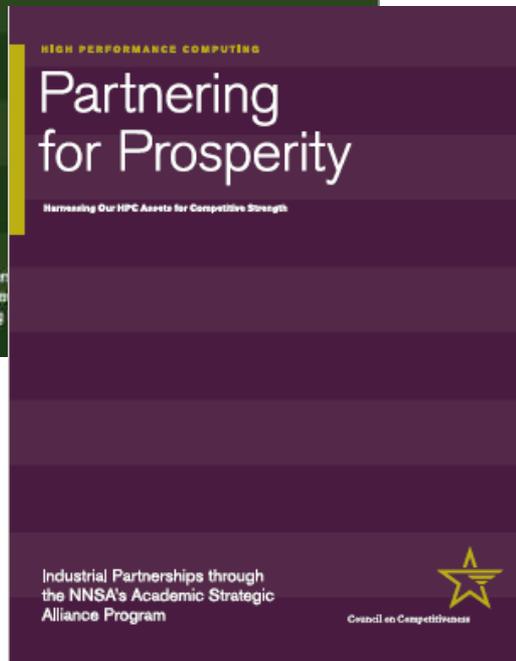
Steve Conway, Hyperion Research



# Thanks To...

- NCSA PIs: Bill Kramer, Merle Giles
- NSF: Ed Walker, Irene Qualters

# 2006 Studies for the Council on Competitiveness



- **NSF: 40 industrial users of PSC, SDSC, TACC**
  - 100%: “highly satisfied”
  - 88%: specific problem solved
  - 93%: want to continue partnership with same center
  - Issue: over-subscribed center resources
- **NNSA/ASAP: 12 industrial users**
  - 33%: breakthrough solution
  - 100%: want to continue partnership with same center
  - Issue: over-subscribed center resources

# Maximizing HPC Benefits for Economic Competitiveness and Scientific Discovery

## NSCI Objectives

1. 100x performance increase in HPC simulations
2. Technical synergy in platform for modeling/data analytics
3. Research into new devices, architectures to scale beyond current limits
4. Increase capacity and capability of national HPC ecosystem
5. Public/private partnerships

## NSF Mission

To promote the progress of science; *to advance the national health, prosperity, and welfare*; and to secure the national defense; and for other purposes.

# *1560770 - EAGER: Supporting the NSCI Effort by Evaluating and Disseminating Effective Practices in Partnerships between HPC Centers and Industry*

## **Study Goals:**

- 1. Conduct in-depth surveys of a substantial number of HPC centers of various sizes in the U.S. and across the world*
- 2. Produce a quantitative-qualitative research report that can serve as a reference guide and compendium of effective practices and lessons learned*
  - Help academic HPC centers jump-start or re-focus existing industrial programs*
- 3. Evaluate practices identified in the survey, especially to highlight those with implications that are more universal, rather than specific to the circumstances of a single HPC center*
  - Advance the state-of-the-art understanding of successful industrial programs*

# Methodology

- Interview HPC centers and industrial partners to capture:
  - Governance frameworks
  - Partnering practices
  - Experiences, perspectives
- Identify best practices for centers and industrial users to consider
- Describe what seems most relevant for NSF and U.S. academic centers

# Major Trends

- More political leaders are viewing HPC's benefits for economic competitiveness as important
- More governments (non-U.S.) are pushing to develop domestic suppliers
- Science will remain primary at academic/open science centers, but more publicly funded HPC centers are expanding access for industrial users (including SMEs)
- More HPC centers are growing their industrial domain expertise
- More HPC centers are marketing to attract industrial users

# Four Main Stances of Publicly Funded HPC Centers vis-à-vis Industrial Users

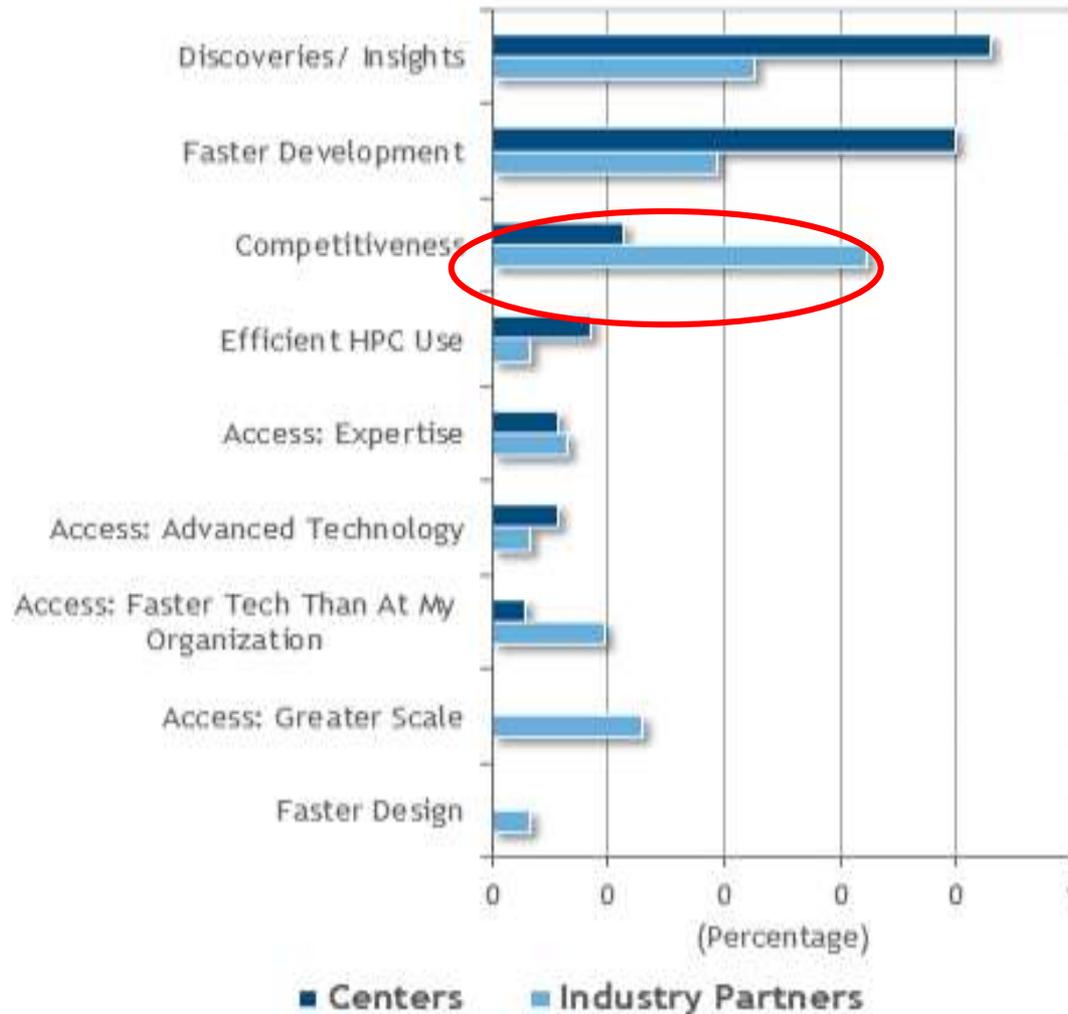
1. Open science only, no industry participation
2. Open science only, industry team members
3. Open science and open industrial research
4. Open science and open industrial research + proprietary research
  - Some centers permit findings to be partly open, partly proprietary

# Benefits of Partnerships

- Industry view
  - Increased competitiveness
  - New discoveries/insights
  - Faster product development
- HPC center view
  - Unexpected new pathways for science
  - Increased motivation/retention of scientific and computational staff
  - Revenue for reinvestment in the center (paid access)

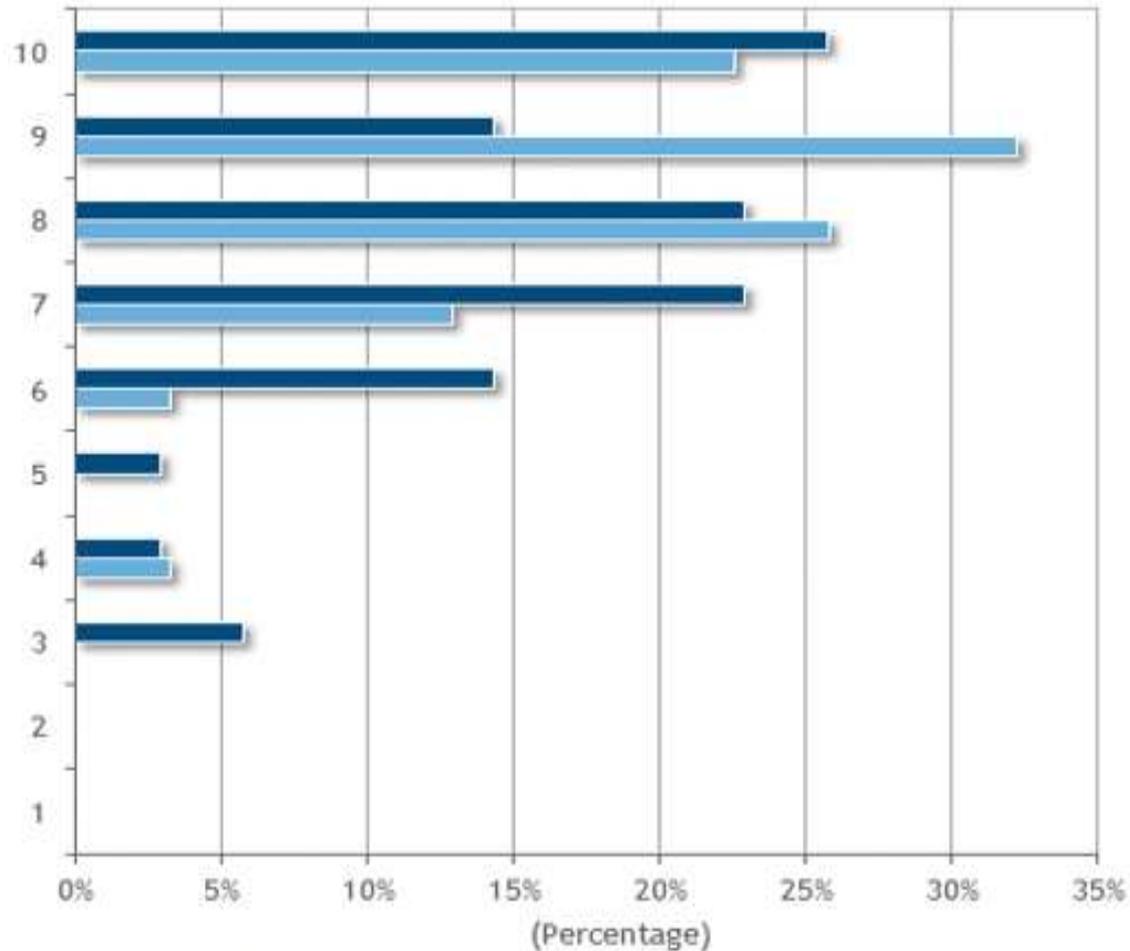
# Most Important Benefit

The MOST Important Benefit of the Program/Partnership



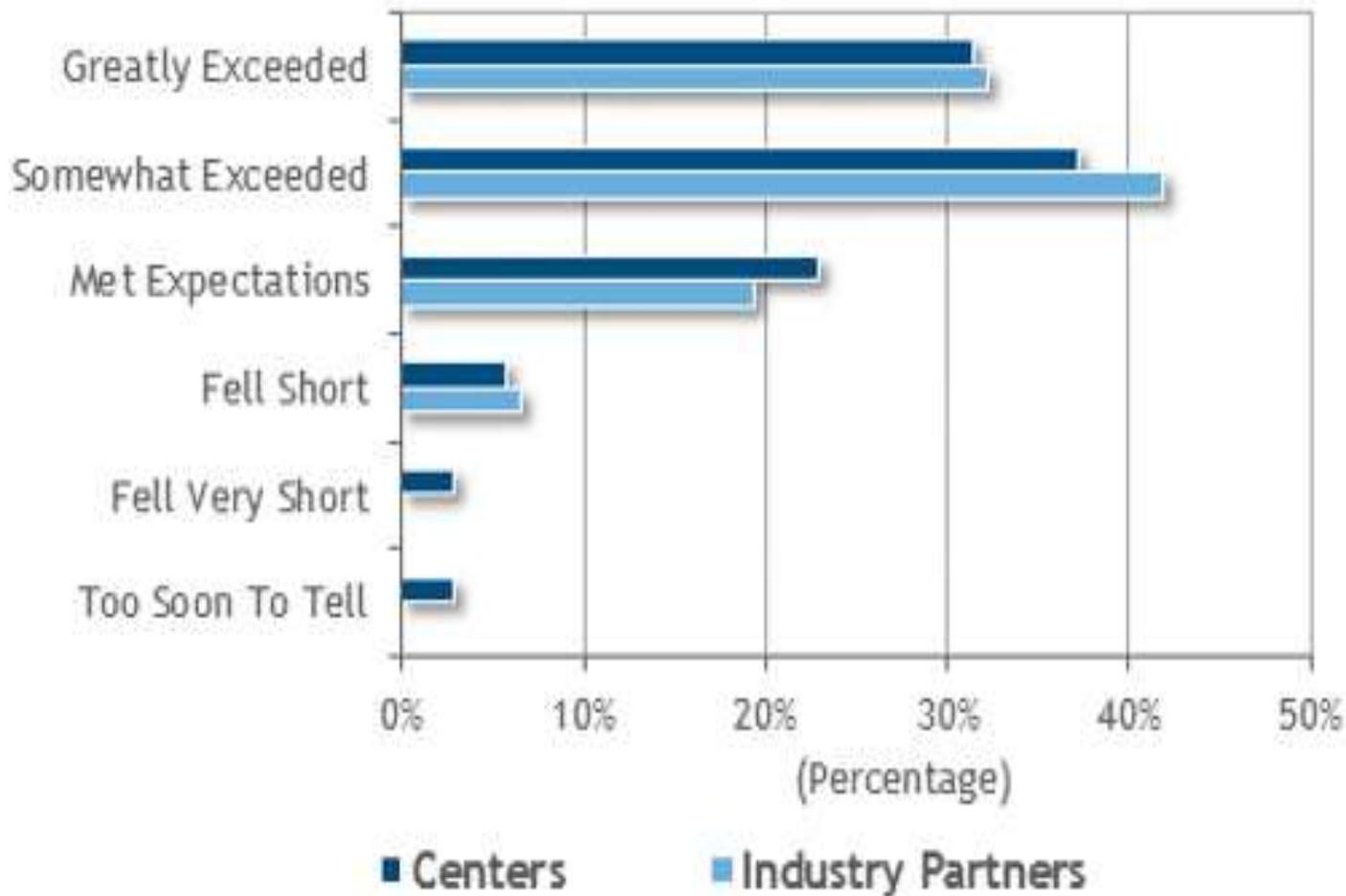
# Satisfaction

Satisfaction with the Partnership



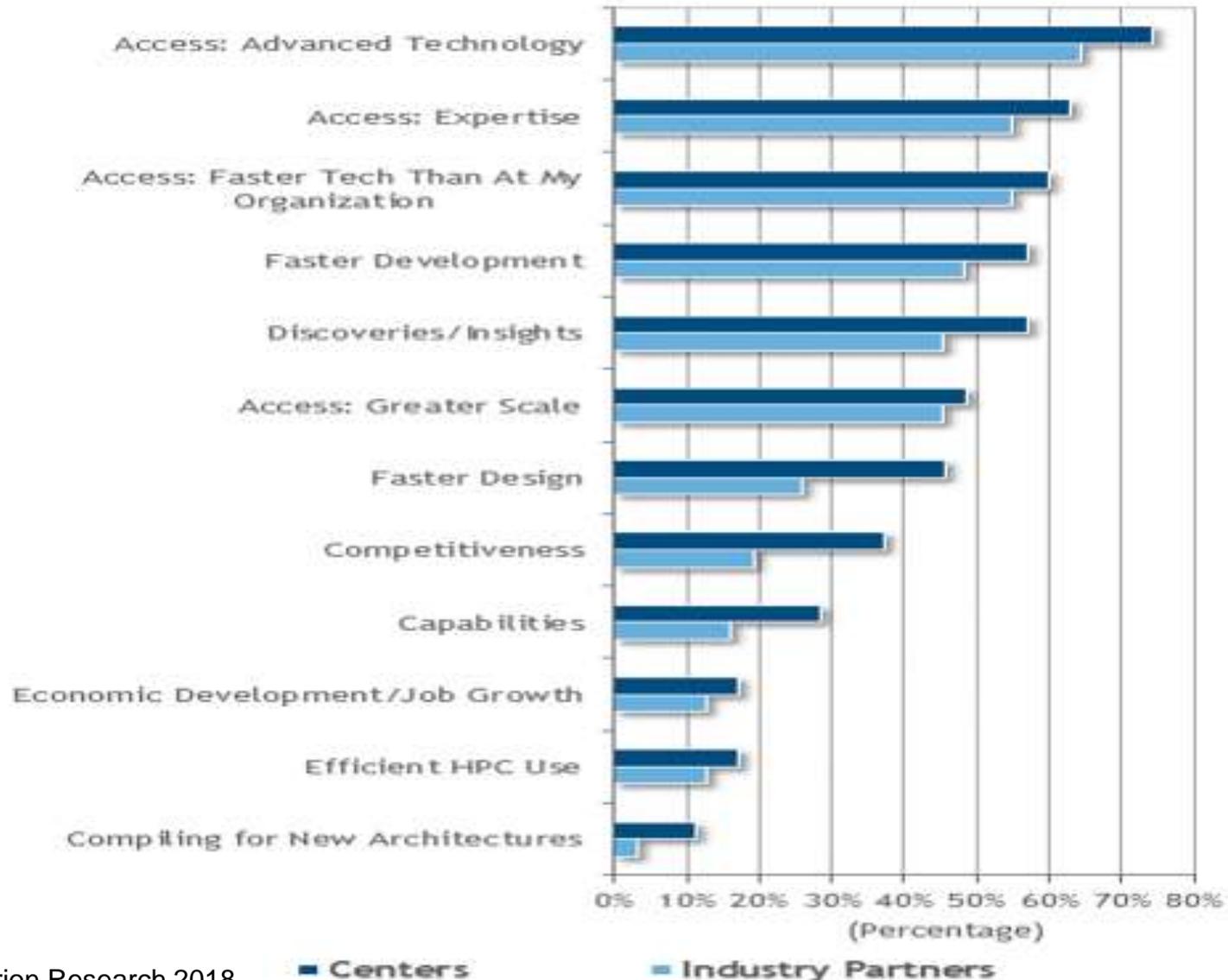
# Results Compared to Expectations

## Results Compared to Expectations



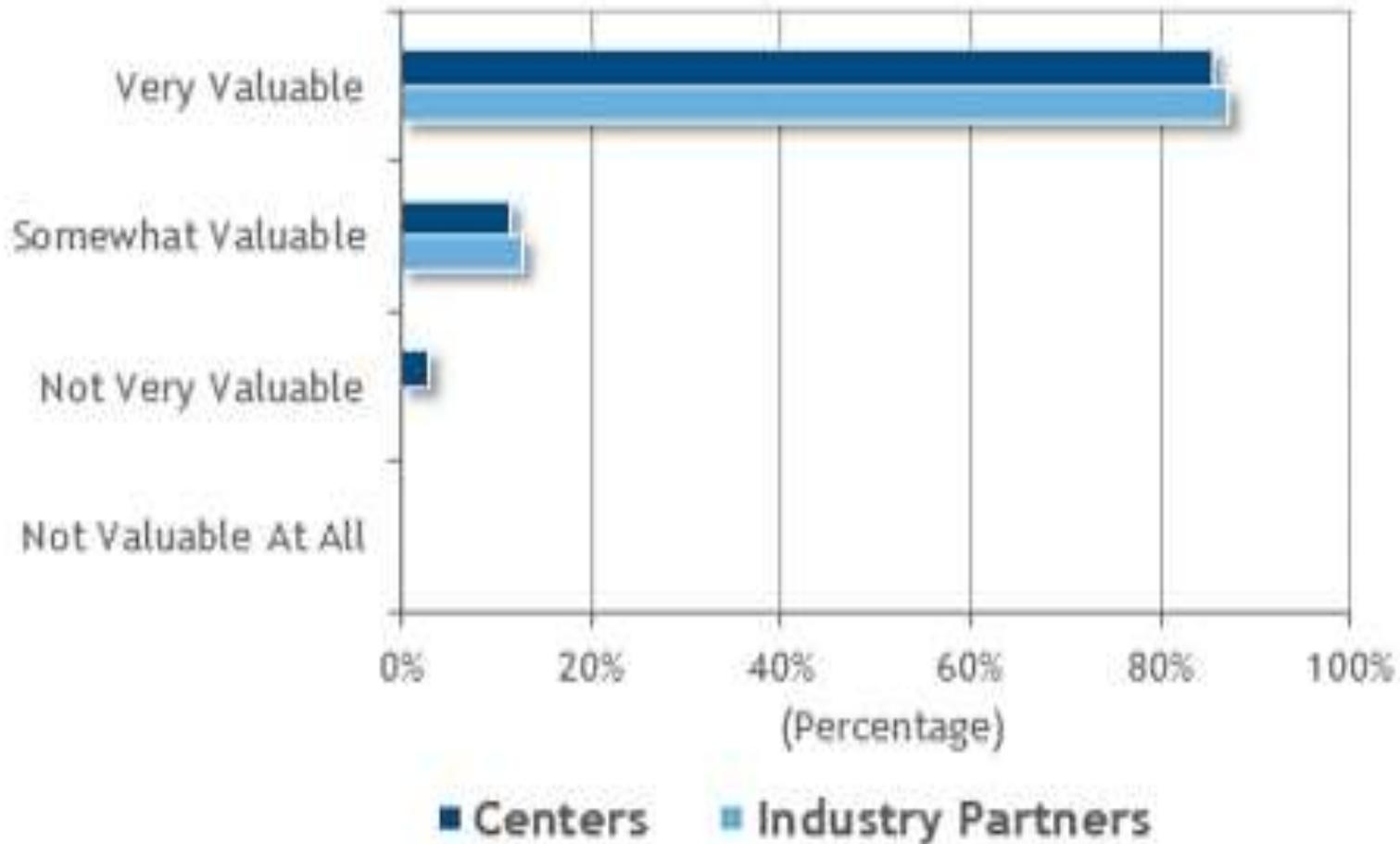
# Comparative Ranking of Benefits

## Benefits: HPC-Industry Partnerships



# Value

## Value of the Partnerships



# Most Important Best Practice: Take Industry Seriously

- Make support for industrial users an explicit part of the center's mission
- If industry is to use the HPC system, consider industry requirements when acquiring the system
- Focus on industrial domains where the HPC center has expertise
- Hire experienced business personnel to lead the partnership program
- Assign some of the center's best people to work with industry

# Provide Opportunities for Both Open and Proprietary Research

- In most areas of the world, governance frameworks restrict public funding from being used to give companies a competitive advantage in the market place.
  - Most industrial projects at publicly supported HPC centers are restricted to open, pre-competitive, peer-reviewed research whose results must be published in part or whole.
  - But many of the interviewed centers also hosted proprietary research for payment, often under a discretionary allocation.
  - Some of the largest centers offer a third category for collaboration, where some results of a project may be kept proprietary while others must be published.
- Each type of industrial research—open and proprietary—can produce benefits for an HPC center.

# Address Cultural Gaps

- Business projects typically operate with shorter timeframes and harder deadlines than their scientific counterparts.
- Hire people with business experience to lead the industry partnership program
- Set clear expectations at the start of the relationship and maintain frequent communication during the project.

# Engage Marketing/PR Professionals to Recruit Industrial Partners

- Active marketing and public relations are needed.
  - Marketing activities can take many forms, from attending industry meetings and conferences to disseminating success stories.
- Focus on domains that make sense,
  - Existing center expertise, nearby industrial firms
  - It may be hard for a U.S. center to specialize in automotive research if the center is nowhere near Detroit.

# Streamline the Process for IP and Contract Agreements

- Reaching agreement on IP rights can be especially difficult and time-consuming.
- In light of the survey findings, a best practice is academic and other HPC centers
- Reinforce that the center's (or agency's) mission supports both scientific and industrial research HPC access to industrial partners—along with public organizations and/or agencies supporting such initiatives—take some or all of these steps —and that these activities can be equally worthy and mutually beneficial.
- Make it clear that collaborating with industry means working with industrial partners, not just HPC technology vendors.
- Periodically review and communicate providing HPC access for industrial partners, along with the attendant rationale. Not everyone in your community may consider industrial R&D to be as worthwhile as scientific research or realize that partnerships with industrial partners can help to advance science.

# Opportunities

- Best practices identified in the study can help promote the vital transfer of scientific knowledge to industry and the important transfer of industrial experience to the scientific community.
- For publicly-supported HPC centers that provide access to industrial partners, the relationships have the potential to open new pathways for the centers' scientific research and further motivate scientific researchers by allowing them to work on industrial problems.
- For industrial partners that access publicly-supported HPC centers, key benefits are accelerating the development of competitive products and solutions, as well as learning how to use HPC systems.
- For public funders (e.g. federal, regional, state and local government, as well as public and private non-profit institutions such as Universities), advanced computational scientific research and advanced industrial R&D in the manufacturing sector often rely on the same foundational science and methodologies (e.g., computational fluid dynamics, finite element modeling, molecular dynamics).
  - investments in advancing the theoretical or applied science can often be leveraged across computational researchers in both science and industry.
  - For government funders, providing private-sector businesses with access to HPC systems and human expertise can help to justify the substantial funding needed to purchase and operate ultrahigh-end supercomputers at publicly-supported facilities.

# Challenges

- Bridging the cultural gap that separates the worlds of science and industry, from missions to deadlines and attitudes.
- For centers that provide access to industrial partners, a key challenge are
  - treating industrial research problems as seriously as scientific research problems,
- For industrial partners that access publically-supported HPC centers,
  - accept the constraints under which a center may operate, such as not accommodating on-demand requests for expanded access to HPC resources, not allowing foreign students to participate in projects, and not using public monies to give any company a competitive advantage.
  - Many challenges can be addressed in the terms of contracts with HPC centers.
- For government and public funders
  - challenges may include missions and governance frameworks that limit collaborations with industrial partners, over-subscribed HPC resources and budgets that are inadequate for expanding resources to accommodate industrial users, and not fully appreciating the potential benefits of collaborating with industry.

# HPC Centers' Partnership Statistics

## Profiles of the HPC Centers: Partnership Time Frames

Attribute	Years
Average Length of the Partnerships (in years)	15.0
Average Number of Participating Businesses (Over Time)	93.9
Average Number of Participating Businesses Today	24.1
Average Duration: Of a Partnership (in years)	3.4
Longest Duration: Of a Partnership (in years)	9.8
N = 35 total respondents	

# HPC Centers' Satisfaction with Their Governance Frameworks

## Profiles of the HPC Centers: Governance Frameworks

	Number of Responses	Percentage of Responses
Satisfactory Governance Framework	24	68.6%
Unsatisfactory Governance Framework	11	31.4%
N = 35 total respondents		

Source: IDC 2015

- What laws, regulations, guidelines govern your partnership program?
- Where do they come from?
- How satisfactory are they? What could make them better?
- What about intellectual property rights – how is this issue treated?

# HPC Centers: Do Any Industrial Partners Pay or Reimburse the Centers?

## Profiles of the HPC Centers: Do the Partners Pay?

	Number of Responses	Percentage of Responses
Partners Pay? YES	24	68.6%
Partners Pay? NO	11	31.4%
<b>N = 35 total respondents</b>		

# HPC Centers: Provide Access on Demand to Industrial Users?

## Profiles of the HPC Centers: Is the Access on Demand?

	Number of Responses	Percentage of Responses
Access On Demand: YES	10	28.6%
Access On Demand: NO	24	68.6%
Not Sure/Don't Know	1	2.8%
N = 35 total respondents		

# HPC Centers: Provide Technical Support?

## Profiles of the HPC Centers: Is Technical Support Provided?

	Number of Responses	Percentage of Responses
Tech Support Provided: YES	34	97.1%
Tech Support Provided: NO	0	0.0%
Not Sure/Don't Know	1	2.9%
<b>N = 35 total respondents</b>		

# HPC Centers: Provide Industrial Domain Expertise?

## Profiles of the HPC Centers: Is Domain Expertise Provided?

	Number of Responses	Percentage of Responses
Domain Expertise YES	29	82.9%
Domain Expertise NO	5	14.3%
Not Sure/Don't Know	1	2.8%
N = 35 total respondents		

# Acknowledgement

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# QUESTIONS?



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