Key Steps to Adopting Cyberinfrastructure at Research Universities

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Introduction

There are long histories of capacity building in organizational management, especially in the non-profit context (Eisinger, 2002; Yu-Lee, 2002). Capacity building impacts how efficient an organization operates. In this poster, the organizations we study are the supercomputing centers at research universities that serve as resource centers for cyberinfrastructure (CI) adoption. Schrock and Kee (2018) define CI as "layers of inter-related hardware and software with affordances that users draw on in combination to perform virtual scientific work." This demonstrates how CI is beneficial to research universities by enabling faculty scientists and their students access to data and information on a virtual platform and become knowledgeable about the future of their scientific domains. CI adoption at these research universities require four key elements to operate effectively: espoused mission, strategic personalization, ongoing training, and feedback & evaluation.

Literature Review

Past research has demonstrated that capacity building is crucial for keeping up in today's fast paced society. McKinsey (2001) notes how capacity building offers organizations guidance and tools that enable them to grow and adopt new ideas and innovations. Research universities aspire to adopt new technologies that put their faculty scientists and students at a competitive edge need to provide the highest quality innovations, such as CI. In order for universities to fully adopt CI into their programs, officials and decision-makers must understand the complexities of building a CI community through improving the organizational capacity of their in-house supercomputing centers.

In growing an advanced community, there are challenges that research universities will face. In every organization, corporation or university, there are key steps to follow in order to successfully develop new systems, programs, and innovations. In order to investigate that, we collected interviews with CI experts across the US about capacity building that supercomputing centers must note in order to advance CI adoption. More specifically, we explored in this poster the research question—*What are the key steps that a supercomputing center must take in order to build capacity for CI adoption at a research university?*

Methodology

This poster analyzes common occurrences of themes in capacity building by coding 13 interviews conducted with domain scientists, technologists, and administrators involved in XSEDE (Extreme Science and Engineering Discovery Environment, the largest supercomputing consortium in the US). We then identified four key steps for adopting CI at research universities. Interviewees were based from different parts of the United States including Utah, Wisconsin, Connecticut, District of Columbia, Montana, etc.. The interviews for this investigation were collected through face-to-face discussions and telephone calls. By applying the grounded theory coding techniques, we analyzed the interviews that resulted in the findings presented in this poster.

The four key steps to adopting cyberinfrastructure at research universities:

1 ESPOUSED MISSION

Stated mission and articulated goals allow a supercomputing center to work towards a organization-wide culture enthusiastic about helping scientists as CI users to do big data research. These mission and goals are key, much like navigating out at sea, everyone can get to the same city but it's important to reach the same port.

"Our mission is to help the faculty [scientists]... A lot of times that's the end goal, to advance research computing and to get [scientists] to use the resources that they need and that would allow them to be more competitive [in their scientific endeavors]" (Administrator, South Carolina).

"They call them SMART goals… [goals that are] specific, measurable, attainable,... the R [realistic] and T [timely]...basically being on the same page with people" (another Administrator, South Carolina).

2 STRATEGIC PERSONALIZATION

Having strategies to understand and identify a match between a scientist's need as a CI user and the supercomputing center's resources as a CI provider overcome challenges of simply taking a generic approach.

"I try to understand what their [i.e., scientist users'] pain point [is] and what they want to achieve [in their research],. . . also the science behind what they are doing, [so I can] deliver the best [CI] solution that they can use [for] the results they need [in their scientific endeavors" (Technologist, Indiana).

"So being aware of when and which [CI] resources, which techniques, which programs, and which environments they [i.e., scientist users] need to use for that kind of workflow is important as well" (Administrator, South Carolina).

3 ONGOING TRAINING

Building capacity requires training that enables adopters and users to understand how to use the tools.

"Our classes or courses to get some [faculty scientists] more familiar with new technologies is important, and also that they can try it somewhere, that they can see that it's nice to use, that it's faster to use, or whatever benefit the new cyberinfrastructure has" (Technologist, Indiana).

4 FEEDBACK AND EVALUATION

Evaluation highlights a center's unnoticed mistakes / issues, providing unbiased feedback for improvement that is necessary for helping scientists adopt and implement cyberinfrastructure.

"[We asked] 'Give us your feedback. . .Would this help your research?' And we got all kinds of feedback. Very positive! And then the work that we made them [i.e., scientist users] do afterwards was 'write us a two paragraphs of what your research is and how this [CI] would help' (Administrator, New Hampshire).

Conclusion

In order for cyberinfrastructure to be adopted, supercomputing centers within various research universities must establish goals they intend to achieve, strategies to achieve those goals, implement appropriate training for adoption, and constantly evaluate and seek out feedback from users for improvements. Cyberinfrastructure will ultimately attract more faculty scientists and their students as users, and facilitate the next generation of science research and education with advanced technologies. In conclusion, by considering and understanding the steps to adopt cyberinfrastructure into the research landscape of universities, there should be a smooth transition to this new innovation of cyberinfrastructure. By being on the forefront of a new movement, universities will ultimately achieve more monetary success in terms of external research funding, donations from prospective donors and even to alumni— as the reputation of their alma mater is increasingly respected and improving. Improvements in technology mean improvements in education— ultimately helping future students. Therefore, universities should support their supercomputing centers in promoting cyberinfrastructure to their faculty and students. Adopting cyberinfrastructure is about the continuance of growing knowledge and intellect; working towards a national to global level of collaboration for not just universities, but for all organizations.

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