Organizational Attributes of Successful Science Gateways and Cyberinfrastructure Projects

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Abstract: *While much of the adoption and diffusion of science gateways and/or computational tools for e-science is driven by the attributes of the tools [see 1], the organizations behind the tools play a critical role in determining the ultimate diffusion. This paper reports 10 organizational attributes of successful gateways and cyberinfrastructure projects. Based on a systematic analysis of 135 interviews, the organizational attributes include having leaders with credibility, multidisciplinary expertise, collaborative environment, shared goals, a common language, strategic structure, productive routines, organizational capacity, sustainable funding, and personnel continuity.*

1. Introduction

In order for science gateways to have the greatest impacts on grand challenges, the emerging tools need to be widely adopted and diffused in the global scientific community. However, much of the adoption and diffusion to date is driven by serendipity and accidental successes. That said, a planned and intentional approach could improve the likelihood of adoption and diffusion of science gateways. In Kee and colleagues' [1] paper on successful computational tools within the XSEDE community, they laid out 10 attributes of computational tools, such as relative advantage, simplicity, compatibility, adaptability, etc. In this paper, the focus to understand technology adoption shifts from looking solely at the tools, to characterizing the inception teams behind the tools. More specifically, the research question pursued in this paper states, "*What organizational attributes promote successful adoption and diffusion of science gateways and/or computational tools for e-science?*" This paper fits the conference them of

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"The management and governance of gateways, such as securing funding, attracting users, monitoring content, and organizing the development team".

2. Methodology

The findings of this paper were generated by taking the grounded theory approach [2] to systematically and iteratively analyze 135 in-depth interviews with a diverse range of domain scientists (as lead users), computational technologists (as tool developers), and supercomputer center administrators (as key facilitators) across the US (n=130) and EU (n=5).

The first interview was conducted at the 2013 Supercomputing conference in Denver, and the last interview was conducted at the 2015 XSEDE conference in St. Louis. Interviews were transcribed verbatim, and analyzed using the NVivo qualitative software [3].

The next section briefly describes the 10 organizational attributes emerged from interviews asking informants to reflect on what drives a successful inception team to create successful science gateways and/or computational tools.

3. Findings

1.1 Leaders with Credibility

Successful science gateways and/or cyberinfrastructure (CI) projects are usually led by leaders with credibility. Having a credible leader(s) gives potential adopters confidence in the quality and long-term trajectory of a gateway/tool. A gateway team can reflect on this organizational attribute by asking, "Do we have someone among us to give the scientific community confidence in our tool? If so, who?"

1.2 Multidisciplinary Expertise

Successful gateways and/or CI projects often

consist of a team of multidisciplinary experts. When synergy is created among these experts, a robust and transdisciplinary product can be developed to tackle a grand challenge. A gateway team can reflect on this organizational attribute by asking, "Do we have the right combination of expertise and perspectives to create a robust tool in order to address the grand challenge?"

1.3 Collaborative Environment

Successful gateways and/or CI projects usually maintain a collaborative environment. In such a team, members fully recognize that no one person can carry the project forward. A gateway team can reflect on this organizational attribute by asking, "Does the organizational environment enable synergistic collaboration?"

1.4 Shared Goals

Successful gateways and/or CI projects usually established shared goals among diverse participants. While multidisciplinary members may have personal goals during the collaboration, successful teams usually are able to create an over-arching goal(s) that hold the team together. A gateway team can reflect on this organizational attribute by asking, "Are we all heading in the same direction? Can everyone's personal goal also be met through achieving the common goal(s)?"

1.5 Common Language

Although many science gateways and/or CI projects are diverse, successful ones generate a common language that keeps everyone on the same page. A gateway team can reflect on this organizational attribute by asking, "Do we have a shared language for understanding each other? Do we use terminologies we all understand?"

1.6 Strategic Structure

Successful gateways projects usually have a strategic structure. In such a team, there is usually a clear division of labor, and everyone has a clear understanding of their own and others' roles. A gateway team can reflect on this organizational attribute by asking, "Is there an organizational structure in place for the team? If so, what is it?"

1.7 Productive Routines

Alongside with having a strategic structure,

another key organizational attribute is having productive routines. This idea can be as simple as having weekly teleconference meetings and quarterly in person meetings on the team's timeline. A gateway team can reflect on this organizational attribute by asking, "Are there productive routines (and timeline) in place for the team? If so, what are they?"

1.8 Organizational Capacity

Successful science gateways usually are able to develop sufficient organizational capacity. Organizational capacity includes dimensions such as expertise, knowledge, personnel, technologies, policies, funding, etc. A gateway team can reflect on this organizational attribute by asking, "Do we have the (human, technical, and financial) capacity to carry out the project?"

1.9 Sustainable Funding

Successful science gateways and/or CI projects usually can secure sustainable funding. In such a team, members do not feel as "at risk" as in the case of a project that faces short-term or unstable funding. A gateway team can reflect on this organizational attribute by asking, "Are we able to bring in continuing funding to sustain the work?"

1.10 Personnel Continuity

Similarly, successful science gateways and/or CI projects usually can maintain a lower turnover rate of personnel, although a 100% retention rate is not possible, given the involvement of post-docs, graduate and undergraduate students. A gateway team can reflect on this organizational attribute by asking, "Are we able to keep our staff and/or maintain continuity, smooth transition, and knowledge management?"

4. Conclusion

The list of 10 organizational attributes can be used as a checklist to facilitate reflections on how to better design a stronger organization behind science gateways for wide adoption and diffusion.

5. Acknowledgments

6. References

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