



The Recursive Cycle of Sustainability in e-Science Organizations

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Introduction

Projects in e-science are usually funded between three to five years, presenting a challenge for collaborators to coordinate and produce deliverables in such a limited time (Kee, 2015). Under such a funding condition, many of the e-science projects are one-off efforts. However, the goal of most of e-science projects is to achieve long-term sustainability with continuous funding. This poster examines the sustainability of e-science projects by looking at its relationship with funding, organizational structure, and track record. Ultimately, a well designed organizational structure leads to a successful track record, which in turn leads to more funding opportunities. These three components make up a recursive cycle of necessary practices for sustainability in e-science organizations.

Theoretical Perspective

Institutional theory has gained traction to explain individual and organizational behavior (Dacin, Goodstein, & Scott, 2002). Institutional theory (DiMaggio & Powell, 1991) predicts that nonprofit organizations will primarily base their organizational structure on the current funding environment. Oftentimes, these nonprofit organizations will engage in more general activities designed to enhance their identification and alignment with legitimated aspects of their environment (Bielefeld, 1992).

The life of these organizations is dependent on if they receive funding from third parties so it creates a competitive environment for most organizations involved in e-science. On the institutional level, communication sustains these organizations, which allows the groups to align with funding organizations, organize their structure, communicate within their environment, and to function around a common goal (Lammers & Barbour, 2006). In this case, the main goal is to increase their legitimacy as an organization to receive more funding.

Affected by the funding environment, projects and teams work to establish legitimacy and proven track records. When organizations succeed in establishing a positive track record, they can further extend their next effort through additional funding, which in turn, enhances their legitimacy (Hooper, 1978). It is evident in the literature that these components (i.e., funding, organizational structure, and track record) are interrelated and have a complex relationship with one another.

The current study aims to examine sustainability in e-science organizations. We ask the research question, "What is the relationship between funding, organizational structure, and track record?"

Methodology

This poster employed the grounded theory approach (Corbin & Strauss, 1990), analyzing 133 interviews conducted with domain scientists (e.g., informatics researchers, computational chemists, theoretical physicists) and computational technologists. Thirty-five of these interviews were member check interviews conducted in the final phase of the investigation. Participants were from across the US (including CA, IL, IN, SC, MI, TX, etc.) and a small portion was from the UK (Scotland). Interviews were conducted either in person or by telephone. Following the grounded theory coding techniques, we performed multiple iterations of data analysis and literature integration, yielding preliminary findings presented in this poster.

Findings

Funding → Organizational Structure

In the first stage of the cycle, a person/organization must receive funding to establish organizational structure for their project

- "So it was really putting the right kind of people together, as well as being able to do that in the first place because of the funding." (Computational Scientist, TN, 4/2/14)
- "We're going to have to pay for a grad student or something like that, so that – the user wants to use our software and doesn't have funding to sort of support us and kind of have us support them basically, then it's unlikely to happen. So you need to kind of start writing proposals and things like that to try to get the funding. And it's open-source, but it's not free. There's costs." (Computational Technologist, NY, 7/17/14)

Organizational Structure → Track Record

In the second stage, a well-established organizational structure is necessary to maintain a positive track record.

- "I think the leadership matters a lot. The leadership can set the right tone and I've seen – and actually this is true for any organization, you can look at any group – a lot of times who's at the top influences how the rest of the organization looks like." (Administrator, CA, 11/21/13)
- "So there'd be a review every couple of years, make sure that the laboratory is making good progress, producing good papers that are well-cited and so forth. There wasn't a lot of micromanagement of how the money was allocated to projects. So that allowed you do to longer-term thinking." (Administrator, IL, 11/20/13)

Track Record → Funding

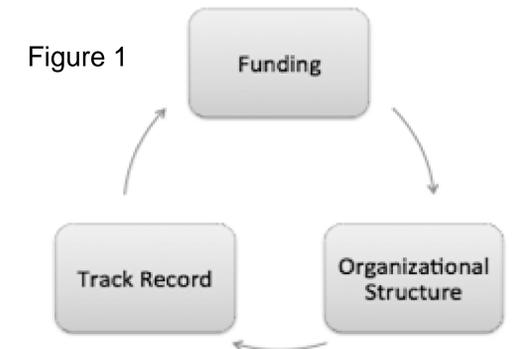
In the final stage of the cycle, a good track record is necessary to receive funding for the next e-science project.

- "So first of all, when you have a successful project that is funded, several million dollars, and you do a great job, then the department is very likely to get other grants coming because they know that now you have an expertise and you already had successful projects, so why not just give you more money next time?" (Liaison, IN, 11/19/13)
- "There are places like the nanoHUB that you can go and establish your credibility as an organization. The first thing you have to do is go back and look at the professors you worked with. Look at the people you studied with, look at the people that you've written papers with, and you have to get them on board...otherwise, you might as well just go into industry and fight." (Liaison, LA, 11/19/14)

Funding → Organizational Structure → Track Record

In addition to the relationship between each of the two components, these three dyads construct a recursive cycle representing three important aspects of sustainability:

- "A good example is NAMD, which is used by a lot of chemists. It's been around for ten years, but that is only because they had some good publications initially, they have good performance, and they solved the problem really well. And they got funding to grow their lab and now they have a really big group working on it... It's hard to pull out any one factor, but I think keeping a stable research program and being able to kind of focus on a tool for many years is the key for success." (Application Specialist, GA, 7/16/14)
- "Another big challenge that we have with presenting to the NSF is the funding agency: why should you continue to do this this way? ...And in some cases there's things that you do, that you're able to do as a distributed organization that you can't do as a separate set of independent centers, and so those are real value adds. And what is the value of those? And assessing that is difficult and fundamentally in our case what matters is that we're having science impact. And everything I've been talking about has nothing to do with science itself. But it has to do with how do we create an organization that can effectively support science." (Administrator, IL, 7/16/14)



Conclusion

The current study demonstrates a recursive cycle based upon the three factors: funding, organizational structure, and track record and details the relationship between each dyad. The nature and degree of these relationships is contingent upon several internal and external influences on cyberinfrastructure. Further research may reveal alternate relationships between these three components. E-science projects often face issues with sustainability and funding; however, this poster demonstrates the importance of quality leadership and proven track records. Given the context of short term funding, it is critical to have quality leadership to quickly establish an effective organizational structure, which in turn, will promote sustainability.

References

Bielefeld, W. (1992). Non-profit-funding environment relations: theory and application. *Voluntas: International Journal of Voluntary and Nonprofit Organizations*, 3(1), 48–70. Retrieved from <http://www.jstor.org.libproxy.chapman.edu/stable/27927323>

Corbin, J., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology*, 13(1), 3-21.

Dacin, M. T., Goodstein, J., & Scott, W. R. (2002). Institutional theory and institutional change: Introduction to the special research forum. *The Academy of Management Journal*, 45(1), 43–56. Retrieved from <http://www.jstor.org.libproxy.chapman.edu/stable/3069284>

DiMaggio, P. J., & Powell, W. W. (Eds.). (1991). *The new institutionalism in organizational analysis* (Vol. 17). Chicago, IL: University of Chicago Press.

Hooper, R. (1978). Some new approaches to research and development funding. *Higher Education*, 7(1), 13–26. Retrieved from <http://www.jstor.org.libproxy.chapman.edu/stable/3445884>

Kee, K. F. (2015). Three critical matters in big data projects for e-science. In H. Ho, B. C. Ooi, M. J. Zaki, X. Hu, L. Haas, V. Kumar, S. Rachuri, S. Yu, M. H. I. Hsiao, J. Li, F. Luo, S. Pyne, and K. Ogan (Eds.), *Proceedings of the 2015 IEEE International Conference on Big Data* (pp. 2001-2007). New York: Springer.

Lammers, J. C. & Barbour, J. B. (2006). An institutional theory of organizational communication. *Communication Theory*, 16(3), 356–377. doi: 10.1111/j.1468-2885.2006.00274.x