Overcoming Challenges of Geographic Dispersion in Virtual Organizations for Big Data Science

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Introduction

The big data movement is gaining increasing attention and big datasets are growing exponentially, providing more potential for analysis and information. However, many big data projects in the sciences rely on virtual organizations and dispersed teams. Spread across the nation and the world, dispersed teams oftentimes experience challenges due to communication breakdowns, and ultimately, fail to succeed. Therefore, there is an urgent need to understand the key ingredients for successful virtual work for big data science.

Literature Review

Virtual organizations enable e-science projects to bring together dispersed experts in order to tackle grand challenges in big data science (Lee et al, 2007). Although some research (see Olson & Olson, 2000; Rhoten, 2003) has argued that face-to-face communication is still essential for problem solving, virtual workers must be adaptive to how technologies are changing today's process of organizing (Leonardi, 2009). Past research has concluded that face-to-face interactions generate emotional energy, group solidarity, and group social cohesion among members (Hackett, Parker, Conz, Rhoten, & Parker, 2008; Yuhyung & Kyojik, 2011) and these social interactions lead to durable bonds and productive group behaviors (Collins, 1998; Durkheim, [1893] 1997). Through virtual communication complemented by face-to-face interactions, dispersed collaborators must be able to establish mutual knowledge/common ground in order to facilitate a shared understanding and clear vision of the project (Cramton, 2001). With virtual organizing becoming a common form of collaboration in big data science, this poster seeks to answer the research question, *"What key interactions constitute productive virtual organizing in e-science among geographically dispersed collaborators?"* By studying the interactions between people in virtual organizations, we can better understand the relationship between technology and organizing, and, ultimately overcome the obstacles faced by geographically dispersed groups.

Methodology

This poster employed the grounded theory approach (Corbin & Strauss, 1990) and analyzed 25 interviews conducted with domain scientists (e.g. bioinformatics, computational chemistry, theoretical physics) and computational technologists. Participants were from across the US (including CA, IL, IN, SC, MI, TX, etc.) and three from the UK (Scotland). Interviews were conducted either in person or by telephone. Guided by the stated research question, the co-authors performed multiple iterations of data analysis and literature integration, yielding preliminary findings presented in this poster.

Findings

Real-Time Interactions Structured by Routine

Due to the geographical spread of expertise, contributors must agree upon and commit to a structured routine of communication. This collaboration between dispersed professionals may occur via telephone, email, video conferencing, or other channels of communication. Through the preferred channel(s), collaborators must convene at the pre-determined time. A routine schedule will reduce transaction costs of coordination (Shirky, 2008) and create stability.

- "So actually for my purposes, this worked in that it forced us to schedule things and do things a little more formally. So when we had records of what was done and what was said and objectives and we knew [we] had weekly meetings. So we had weekly timelines. So it was critical to our process that we really structured and organized ourselves because we were at remote sites. And we had to make some real solid commitments." (Computational Molecular Biologist, Louisiana, 4/22/14)
- "I think it is crucial – we personally try to do weekly telecoms and monthly webinars, and quarterly physical meetings." (Computational Environmental Scientist, Illinois, 3/19/14)
- "So usually we have bi-weekly meetings, or weekly meetings and during those phases we have hour-long Skype meetings." (Computational Scientist, Illinois, 11/20/13)

Periodical Face-to-Face Meetings for Relationship Building

Face-to-face and nonverbal communication is essential for building trust in social interactions. While virtual organizing through technologies can be productive, there is still a necessary element of face-to-face interactions in order to establish trust and credibility. With periodical face-to-face meetings, collaborators can lay the foundation to be productive when they connect and reconnect via technologies.

- "One of the biggest challenges with working with virtual organization, simply by the fact that it's virtual,… you miss out on a lot of stuff that can occur in face-to-face communication... So, often things will be overlooked and that can lead to problems later." (Bioinformatics Researcher; California; 3/19/14)
- "I have had some experiences with researchers who have come for a workshop, I have met with them in person, I have understood their problems face-to-face, and then it's much easier to get things going after that, after you can sit down and figure out exactly what the problem is or what you need to do and you can make sure you are on the same page and then continue via email." (Computational Chemist, Texas, 4/23/14)
- "We would try to co-locate and then and work together, for a few days... And we find opportunities to do that… as often as possible, because the physical presence matters quite a lot." (Computational Scientist, Illinois, 11/20/13)

Strategic Communication of the Common Goal to All Dispersed Participants

In order for dispersed participants in an e-science project to succeed, all participants must fully understand and buy into the visionary goals. In the mean time, these goals need to be flexible to adapt and evolve during subsequent face-to-face interactions, virtual communication, and a series of a/synchronous communication related to the project.

- "You need a well understood objective. You'll be amazed by how many times, we don't know exactly what it is we're doing… So it sounds strange to say it, but a well defined clear objective… having clear objective is number one." (Computer Scientist, California, 11/21/13)"
- "…by roadmap here I'm not necessarily saying a strict, set-in-stone sort of set of milestones, deliverables, and so on, but rather the document, the object that allows the understanding to be propagated for all the people in the project and also the process that allows this to be changed. So it is not a static document; it is a dynamic document that helps with communication." (Theoretical Physicist, Edinburgh, UK, 11/18/13)

Conclusion

In order for geographically dispersed collaborators to be successful, they must construct a routine schedule to convene virtually (e.g. telephone calls, Skype meetings), engage in periodical face-to-face relationship building (e.g. all collaborators meet in one city for a weekend), and understand a dynamic objective that serves as a driving force for the vision of the project. While some of these findings seem apparent, organizations oftentimes overlook these key interactions and lose sight of the project vision, as stated by interview participants. Beyond collaborations in big data science, these findings are applicable to companies and projects that rely on virtual organizing as a form of collaboration. Thus, these findings serve as a framework for managers, consultants, and organizational development specialists create and maintain productive and thriving virtual organizations in the 21st century.

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