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Understanding virtual scientific organizations using the Transdisciplinary Index.

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"In some ways, it is self-organizing and I think we have some real tight deadlines and we are really focused on those. ... a lot of ideas are generated from the bottom up."

"There is a lot of real relevance to the processes that DataONE is planning to build for a cyberinfrastructure that would be really useful for the kinds of research that we do here. ... "

WHY THIS STUDY IS IMPORTANT: Scientific grand challenges confronting society are being investigated by multiple domains of science. For example, the increase in human population and its impact on land-based ecosystems, oceans, ice sheets, etc. is an interdisciplinary problem. Data is scattered and not integrated.
* Empowering integrative data intensive science unlocks the potential for a more complete picture of threats and solutions but requires coordination between domains and disciplines in widely distributed locations. Complex virtual scientific research organizations (CVSROs) are emerging to address these challenges but they must be supported and nurtured in order to fulfill their goals. An examplar CSRO is DataONE, an NSF funded multi-domain, multi-institutional distributed scientific collaboration focused on data about life on earth and the environment that sustains it.
* Improving the "vision" of researchers and policy makers who often operate without seeing the big picture -which impedes effective policy making and resource allocation.
* Providing momentum to facilitate interdisciplinary science through CVSROs like DataONE which can provide the cyberinfrastructure for data science and become an attractor for coordinated.

ABOUT THIS STUDY

DataONE was identified as an exemplar CVSRO. A case study was conducted and the transdisciplinary index was used as a framework to better understand how DataONE supports interdiscplinary science.

Data for this study was generated through:
- 15 semi-structured interviews with DataONE leadership (6 face-to-face, 7 Skype, and 2 phone interviews)
- 51 responses from early members to an online survey (51% response rate)
- Participatory observation over 2 years (researchers are involved in the project).

The Transdisciplinary Index's seven elements were used to analyze the data.

ABOUT DataONE

DataONE Project Lead: Dr. William Michener, University of New Mexico

Other organizations that are partners in DataONE include USGS National Biological Information Infrastructure (NBII); National Center for Ecological Analysis and Synthesis (NCEAS), UC-Santa Barbara; National Evolutionary Synthesis Center (NESCent), Duke U; Cornell; Utah State U.; CUAHSI; U. Illinois-Chicago; U. Kansas; U. Edinburgh; UIUC-NCSA; California Digital Library (CDL), USC-ISI; U. Southampton; Ecological Society of America; U. Manchester; CSIRO, Australia; U. Michigan; The Keystone Center; and UC Davis.

Leadership/governance
*Participatory governance. Leadership team & members value the balance between tight and loose. Leadership includes leaders of wach working group. Every goal, concern and perspective represented.
Result: Creative problem solution, strong commitment to project goals, and maximization of limited resources.

*Balance between responsibilities to the funding agency and research interests of the members. If goals are met on time, members choose their own way of achieving them.
Result: Ideas and actions are generated from the bottom up creating high level of motivation and long term sustainability of effort.

"...it does not seem in the culture of DataONE to be a hierarchy of roles. ... We do not have a very hierarchical system. Although, if you look at our org charts, we have distribution of activities and personnel. In reality, the style of communication is very inclusive."

"I think it is always a balance between doing too much and trying to control too much and being too loose. ... I don't know. It is good. It is a good mix of formal project management skills and also good interpersonal skills."

"The criteria was that we wanted to have people who were good communicators who would listen and would really not want to do their own thing so that was a criteria. People who were difficult to work with or whatever, we tried to avoid that. So we built a team of people based on that. It was a real fundamental principle to start."

Context
*DataONE's emergence is a direct result of the needs identified by the data intensive scientific community and the igniting energy of its members. The resulting "organizational biography" is firmly rooted in the societal and scientific context.
Result: Developed a structure to address the need to bring together researchers, educators, representatives from non-governmental organizations, and civil servants.

"We definitely wanted to make sure the people we were bringing on board had a good reputation for, again, being able to work in a group. So, their abilities to communicate, their willingness to compromise, and their effectiveness at working virtually were all critical components in the decision making."

Communication
*Leadership selected to the project according to their reputation and ability to communicate across domains. . Communication across teams are as frequent as communicating within their own teams. *Strategies employed: email, e-meetings, online collaborative space, face-to-face meetings, and reports.*
Result: strong internal and external communication

Adaptability
*The basic unit the DataONE operates is a working group. However, membership in the working groups are not strict. People could be involved in more than one working group; interaction across working groups are highly encouraged; and even sometimes workshop model is used for some specific problems.
Result: Demonstrated ability to adapt to external (funding environment, advances in technology) and internal (personnel and organizational) changes.

"The scientific exploration, visualization, and analysis working group turned into more of a workshop and I am currently starting up a citizen science working group which is possibly also going to take on more of a workshop model."

Engagement
*Provides multiple roles for involvement including working groups, international users group, leadership team, etc.
Result: Members participate in governance and strategic planning.

"I also thought it could be very professionally productive to do this in terms of the infrastructure being developed as well as the publications and other products that could come out of the endeavor as well."

Integration
*Team members from different disciplines (earth sciences, computer science, library and information science, etc.) and different sectors (federal agency, university, national lab, library etc.) and roles are integrated for the success of the project.
Result: The DataONE system has many counteracting forces in it, but Leadership model facilitates integration to allow alignment with the goals of the project.

"We have spent a lot of time on you know, sort of what are the primary groups we are trying to serve, right? What are our primary audiences and stakeholder community?"

Purpose
*Consensus is attempted and individuals are empowered to set and achieve goals that help both them and the organization.
Result: Increase in motivated and committed members.
Pursuit of sub-projects that promotes DataONE goals.

CONCLUSIONS: Science is getting more complex and self-organizing into CVSRO. These new organizations meld different cultures of science and observations at different levels. Using the TI index as a framework we can analysis actions and results. This helps assess success of organizations and possibly help design new ones.
DataONE success comes from the leadership which allows bottom-up participation including goal setting and problem solvong. Individual goals are integrated to fit the project goals. The context provides opportunities and threats. The adaptability of DataONE utilizes the opportunities while avoiding the threats. The situation is a complex adaptive system and more can be learned through a complex adaptive system analysis.