

Rationale

Megaprojects are characterized by their extensive scale, investment, complexity, lead time and stakeholder involvement; as well as their potential to transform an economy, improve the environment, and contribute to the achievement of desired societal outcomes⁴. The same extensive and public nature makes megaprojects problematic to manage³, resulting in a poor megaproject management performance record of only 5% of projects completed within scope, time and budget⁹.

Research on how to reform megaproject management has, however, made great strides in better understanding the reasons why megaprojects fail and in finding solutions to avoid such failures. Listed in the top five reasons why megaprojects fail, is the lack of in-depth stakeholder engagement during the project design phase^{5 7 9}. This is also the number one reason for local community-based activism against megaprojects^{2 8}.

The next generation Very Large Array (ngVLA) is a planned megaproject with the potential to not only transform the frontiers of knowledge and understanding in radio astronomy, but also to contribute to the enhancement of the economy, environment and society of New Mexico and that of local communities surrounding ngVLA facilities in other states. The National Radio Astronomy Observatory (NRAO) recognizes the interest and influence of all potential ngVLA stakeholders; as well as the value of their unique knowledge, experience and insights and their critical role in enabling the project to realize its potential.

Objective

In light of this discussion, the authors' objective was to:

- a) investigate stakeholder engagement practices of megaprojects at the local community level, in order to identify best practices in stakeholder engagement; and
- a) investigate broader impact practices of megaprojects at the local community level, in order to identify best practices in megaproject broader impact strategy design.

The results of these investigations inform the draft ngVLA Stakeholder Engagement Strategy and Broader Impacts Strategy, respectively.

Methodology

The authors conducted a Systematic Literature Review (SLR) of 45 publications retrieved from peer reviewed journals in the knowledge areas of a) megaprojects, stakeholder analysis, and local communities; and b) megaprojects, impacts, and local communities. The methodology combined SLR guidelines suggested by various authors, but remain in line with the PRISMA method.

Results

Collaborative Design as Best Practice for Megaproject Stakeholder Engagement

Deficiencies in Current Methods

The literature reviewed and analyzed by the authors identified three deficiencies in current methods used by megaproject managers to engage / manage stakeholders:

- Traditional methods emphasize the engagement / management of high interest, high influence stakeholders and not those who have no formal contract with -, or legal authority over the project;
- Local communities are perceived as secondary stakeholders, are repeatedly excluded from in-depth stakeholder engagement / management plans, and do not have their concerns or needs addressed; and
- No clear definition of the "local community" exists in project management, and communities are treated as one group with no diverse interests.

Cooperative Design

Cooperative design⁶ (co-design) or participatory design^{1 10} was identified as the most inclusive, democratic and effective stakeholder engagement method. This approach enables a group of diverse stakeholders to make a creative contribution to the formulation and solutions of a problem in order to ensure that the product or service designed consults and serves stakeholders⁶.



Figure 1: Co-design is the process used by the NRAO for authentic and deliberate stakeholder engagement. The process consists of five phases and requires stakeholders to be involved in all phases.

The NRAO successfully implemented co-design during the project design phase of Project Radial, one of NRAO's flagship broader impact projects. The scope, process and outcomes of the implementation can be found at <https://info.nrao.edu/do/odi/RADIAL/radialproj>.

Future Work

The authors will look to further work as follows:

- Research and offer an alternative description and understanding of the local community for megaproject management; and
- Research, design and implement a stakeholder engagement / management model for megaprojects which includes primary and secondary stakeholders.

Towards an Integrated Broader Impact Strategy

The authors organized evidence and key findings related to megaproject broader impact strategy design and successful broader impact projects into the following categories:

Infrastructure: Projects that ensure local communities benefit through the sharing of ngVLA infrastructure; technical skills training programs and job creation; and the support of local and regional businesses through procurement policies.

Technology & Commercialization: Projects that drive development and commercialization of technologies / techniques that will have tangible benefits for other astronomy observatories, research facilities, the US high-tech manufacturing sector, and society.

Education & Diversity: Projects that foster a scientifically literate society and culture of citizen science; and innovate STEM education, broaden participation in STEM education by underrepresented minorities, and create opportunities for STEM research experiences.

Natural & Cultural Heritage: Projects that support research to record, study and preserve natural and cultural heritage; prevent any exploitation inconsistent with the protection of such heritage; and incorporate indigenous knowledge in ngVLA EPO materials.

Collaboration & Partnerships: Projects that formalize multi-institutional, cross-sector collaborations to advance knowledge and best-practice transfer between and by the ngVLA and its partners, thereby extending the impacts of research.

These categories now inform the draft ngVLA Broader Impact Strategy to be further developed and managed by the NRAO Office for Diversity and Inclusion.

Future Work

The authors will look to further work as follows:

- Conduct further research and analysis into the impact of megaprojects on secondary stakeholders in various phases of a project lifecycle; and
- Evaluate the impact of engaging with a broader range of stakeholders in a megaproject.

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