



In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

Sechindra Vallury

Will defend his dissertation

Institutions for Provision of Shared Infrastructure: Insights from Irrigation Systems in India

Abstract

In many social-ecological systems, shared resources play a critical role in supporting the livelihoods of rural populations. Examples of such systems include irrigated agriculture, community forestry, and coastal fisheries. Physical infrastructure enables access to shared resources and reduces the variability of resource supply. However, in order for the infrastructure to remain functional, institutions must incentivize individuals to engage in provision and maintenance of the infrastructure. The objective of my dissertation is to understand key formal and informal institutions that affect the provision of shared infrastructure in social-ecological systems and which policy tools may improve infrastructure provision. I examine these questions in the context of irrigation systems in India because infrastructure maintenance is a persistent challenge and system function is critical for global food production.

My first study investigates how the presence of private infrastructure, such as groundwater pumps, may affect the provision of shared infrastructure, such as shared tanks or surface reservoirs. Using a stylized replicator dynamic model, I examine whether formal institutions, such as water pricing instruments, may prevent under-provision of the shared tanks. My findings suggest that in the absence of rules that coordinate tank maintenance, the presence of private pumps will be unaddressed and have a detrimental effect on system productivity and equality. On the other hand, the combination of a fixed groundwater fee and a location-based maintenance fee for tank users can improve system productivity and equality.

The second study examines the effect of power asymmetries between farmers, caused by informal institutions such as caste, on the persistence of political institutions that govern infrastructure provision. I developed a stylized

compartmental model that traces the institutional choice of individuals in a canal irrigation system. Using this mental model of elites and non-elites, I examined the effect of policy tools, such as non-farm wage employment and informational interventions, on the persistence of two types of political institutions: self-governed and nested. Results suggest that critical regime shifts in political institutions can be generated by either intervening in formal institutions, such as non-farm wage employment, or informal institutions, such as knowledge transmission or learning mechanisms.

The third study investigates how bureaucratic and political corruption affects public good provision. Using a stylized principal-agent model, I examine how institutional and environmental factors affect the likelihood of corruption and infrastructure provision. I demonstrate that cracking down on corruption is only beneficial when infrastructure provision is poor. I also show that bureaucratic wages play an important role in curbing extralegal transactions and improving infrastructure provision.

I contextualize the findings of the mathematical models using primary and case study data. My models capture the fundamental dynamics of natural resources and the provisioning challenges associated with the decisions of individuals, thus making them useful tools for informing irrigation policies beyond the specific case study contexts. These models also generate testable hypotheses for future empirical research.

Wednesday, May 15, 2019

9:00 AM

Wrigley Hall, 481

Faculty, students, and the public are invited.

Supervisory Committee:

Joshua K Abbott (Co-Chair)

John M Anderies (Co-Chair)

Bryan Leonard