

Zanjera Danum indigenous irrigation system Dingras municipality, Ilocos Norte, Philippines

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1 Static Analysis - Collective action

The indigenous irrigation system of Zanjera Danum is located in the Ilocos Coast in the northwest extreme of the Luzon island in the Phillipines. Along the coastal lowlands, the irrigation system of Zanjera Danum is part of the municipality of Dingras and it is comprised by an area of agricultural lands that has been irrigated for centuries by traditional system of membership and low technology.

The irrigation system affects approximately 1500 ha, specially fields with crops of rice paddy. The systems is organized by different territories, for example the baryo (village or neighborhood) and its subdivision named as *sitio* which, are the closes arrangements to hamlets. There exist 32 hamlets or *sitio* covering the space of the Zanjera Danum system. There exist minor crops for tobacco and garlic and most of the rice cropping depends on the weather patterns. There are commonly three cropping seasons between May-August, September-December and January-April and, are highly depend on water availability.

The key resource, referred as the natural infrastructure, is river water for irrigation. Another key element to understand the system is land which, is privately owned, not necessarily by the people who work in the land who have the category of tenants.

This case study belongs to the Common-Pool Resource (CPR) database. One major source for the case study on indigenous irrigation systems and social organization was written originally by [Coward Jr1979].

1.1 The Commons Dilemma

Appropriation problem. The community faces a potential problem of appropriation of the resource natural water given that the farmers need to extract water to irrigate their pieces of land (*sitio*). Every *sitio* is divided by blocks with a stream of water passing laterally to the parcels which is one of the arrangements to preserve distribution at levels of acceptable fairness. Another dilemma or challenge for the community is the of maintenance of the physical infrastructure man-made, basically canals and finally, another collective challenge is the management of conflicts among the resource users.

There exist several community rules that have been established in order to maintain the system running and the resource users as well as, the leaders and land owners do tend to respect these rules. In the case of conflicts, the community activates simple but effective norms to overcome the problems based on proximity of their members. The system of irrigation of Zanjera Danum is relatively small: the population of this municipality is approximately 30 thousand inhabitants in 1990s according to the Census of Population and Housing.

The existing combination of landholdings and engineering structures allowed to have a relatively equitable system for the distribution of the natural resource. Water is extracted through a system of bamboo and rock creations to divert water from the river such that water runs parallel to the river. Then, a constructed canal subdivided into three branches directs the water to different *sitios*. As for the landholdings, 564 shares are distributed across the *sitio*, under the local names of atars. This share provides the owner the right to a proportion of the system's water and a right to vote within the community and other privileges. The existence of these shares help mitigating any over-appropriation dilemma. Further and more important, as shares offer rights over the extraction of the resource, it gives the shares owner responsibilities as well, in the form of responsibility to provide labor for maintenance purposes, operate the system, construction if needed, etc.

The rules are enforceable within the community. The Zanjera system is independent of any government agency. According to the source description, users of the common resource perceive the rules as equitable and fair. Conflicts arise in the group but there are solved based on membership and most important, using the sense of community which arises from the collaborative work in groups toward the maintenance of the system.

The dilemma of under provisioning of public infrastructure might arise in the form of maintenance of the system but the community approached a solution to this issue with the use of two mechanisms to combine work groups to fit different maintenance and operation tasks, particularly during the wet season when river increases its water levels and there is a higher risk of flooding and canals are subject to clearing and repair. Work is needed to clean roads, culvert, bridges and to re divert water flow, among other tasks. The first format is *dagup* labor in which, total manpower has to be mobilized to major repairs of the system. This is required only during special occasions, not routinely. The second format is *sarungkar* labor, used in a more frequent manner with three and a half days of assigned activities for every group.

The potential problems of free riding behavior or cheating on appropriation rules are also overcome with another principle of the organization, referred to the leadership roles. Leadership occurs at multiple levels and starts with the *sitio* arrangement. Every *sitio* is operated approximately by 15 to 30 farmers and the *panglakayen*, leader, coordinates the activities of the *sitio*, commonly assisted by 2 more members. Additionally, every canal diverted from the river is led by a *cabecilla* selected by the irrigation association. The top component of this hierarchy is comprised by the president, vice president and secretary of the association who are elected annually. They represent the community and serve as the link with government officials. Even though the work by [Coward Jr1979] does not mention the effectiveness of the leadership, it offers a broad sense that the community is very involved in decisions and control of overappropriation or underprovision problems.

1.2 Biophysical Context (IAD)

Natural infrastructure (NI): Water for irrigation is used all year long for the three crops seasons and water scarcity increases the commons dilemma during the dry season. Land, another natural resource is privately owned, commonly by people who do not live in the proximity of the community. There might exist problems of parcels at the lower portions of *sitios* but they offer these additional sites to farm for irrigation leaders as a form of payment for their work.

Hard human-made infrastructure: Infrastructure in the case of Zanjera Danum system is not very complicated since it comprises mostly a system of canals build from bamboo to divert water from the river. Most of the hard human-made infrastructure requires maintenance specially during the wet season when flooding affects *sitios*. The system lacks water storage capacity such as tanks or reservoirs.

1.3 Attributes of the Community (IAD)

Social Infrastructure

Social infrastructure refers to the grid of relationships among agents that allow them to connect to one another to exchange material and information. [Anderies2015]. Zanjera Danum is comprised by 34 *sitios* which are the work units of the system. It is a community with an ordered arrangement of engineering structures and landholdings, independent from any form of governmental control. It has a multi level organization pattern with different levels of leadership going from the localized leaders or *panglakayen* up to the president of the association. The social infrastructure offers a proportional rights and responsibilities. Different formats for work in the maintenance activities help to establish a sound organization to provide the public infrastructure used in the system.

Resource users and public infrastructure providers: The resource users are the community members of the Zanjera Danum irrigation system, typically identified as farmers conducting agricultural activities. Public infrastructure providers are the same community that is responsible for the canal construction and maintenance under specific responsibilities.

Trust and sense of community: According to the author of the main source document, this system is managed with success due to the institutional organization of members, the well defined layers of leadership, the engineered arrangement for water distribution and the active participation of members in maintenance activities.

Human Infrastructure

Human infrastructure accounts for the capacities of individual agents process information and make effort allocation decisions [Anderies2015]. The source document does not detail attributes from the community but one can identify it as a small community, commonly tenants, dedicated mostly to agricultural activities. There exist a slight identification of a town-based elites who own land and generally occupy the positions of president, vice president and secretary of the association.

There is no explicit statement about the levels of skills and experience needed to manage

the system but the organization seems to work appropriately and it can be mentioned as a successful case study due to the fairness and equitable distribution of water for irrigation as well as, the distribution of responsibilities among the members.

1.4 Rules in Use (IAD)

Position Rules: There exist two different types of position rules in the system and some subdivisions within each of them. The first group refers to leadership positions

- *Panglakayen*, known as the headman or leader at the *sitio* level. Every *sitio* is operated approximately by 15 to 30 farmers. He/she coordinates the activities of the *sitio*, commonly assisted by 2 more members.
- Cabecilla, every canal diverted from the river is led by a cabecilla who, is selected by the irrigation association.
- The top component of this hierarchy: president, vice president and secretary of the association. They are elected annually. They represent the community and serve as the link with government officials.

The second group of position rules are related to work related activities:

- *Dagup* labor needed to major repairs of the system. This is require only during special occasions, not routinely.
- *Sarungkar* labor, used in a more routinely manner with three and a half days of assigned activities for every group.

Boundary Rules: Members of the system have boundary rules in order to distribute the water for irrigation in a potentially efficient and equitable manner. The 34 *sitios* are entitled to atars (membership shares) and it provides rights as well as, responsibilities, especially for maintenance work. Atars give rights to several parcels of land which are not contiguous but they are located in different blocks. The different blocks and parcels are perpendicular to the canal system so then they all have access to the water stream. The user of the first parcel of the first block will have his next parcel in the same parcel of the following block, etc.

Choice Rules: *Panglakayen* coordinates the activities of the *sitio*, and he can obtain assistance from 2 other members. Cabecilla is the headman for the canal and coordinates irrigation activities. President, vice president and secretary of the association represent the community and serve as the link with government officials.

Aggregation Rules: Members of every *sitio* select their *panglakayen* and he can request for a replacement or based on the wishes of other members. The mechanism for his election is not well defined. Cabecillas are selected by the whole irrigation association. President, vice president and secretary are elected by the total membership of the system.

Scope rules: It is possible that scope rules are not well defined in the source document. For example, it is not clear up to which point a *panglakayen* can influence with his/her decisions, as well as cabecilla or president of the association.

Information Rules: It seems that information rules are not well defined within the original source document. The system is independent of any governmental agency but it does not express the mechanism for information rules.

Payoff Rules: Costs and benefits are not explicitly mentioned in the source document. There is not any mention about fines, sanctioning, or, on the other hand, gains or recognition from activities in the system, except for the quasi-payment that irrigation leaders obtain from the parcels that lays at the tail of the water canal of every *sitio*.

1.5 Summary

The Zanjera Danum system comprises a community in the northern extreme of the Philippines which, uses an irrigation system, particularly for rice paddy fields. Water for irrigation is the key common use resource and there exist mechanism to control over appropriation of the resource as well as, under provision of public infrastructure in the form of maintenance of basic canals as the human-made hard infrastructure. The system offers proportional right and responsibilities through a system of community shares. It is also organized by a multi-level organization with three different leadership tiers: *panglakayen* at the *sitio* level, cabecilla for irrigation canals and president, vice president and secretary. The system organizes also a combination of labor to provide maintenance along the year and conflict resolution is managed by water allocation mechanisms through shares, land arrangements and by creating membership in the community. Zanjera Danum can be considered as a successful irrigation system due to its well defined leadership patterns, the engineered arrangement for water distribution and the mechanisms for active participation of members in maintenance activities which overall, offer a sense of fairness and equitable distribution of the resource, as well as, it gives proportional and legitimate responsibilities to users.

2 Case Contributors

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References

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