

# Institutional Analysis of the Tanowong Irrigation System in Philippine

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## 1 Part I: Static Analysis - Collective action

This case covers the traditional terraced irrigation system of Tanowong people who live in the western portion of the Mountain Province in the Northern Luzon highlands of the Philippines.

Due to the insufficient water supply to the existing Tanowong irrigation network, they started a major canal expansion project (hard human-made public infrastructure) that could bring water from a new source (Bwasao Stream). This project was initiated by Tanowong people in 1954 and took two years to complete. The newly built canal is 25 kilometers long because the source of water is distant from where the terraced rice fields are located. Tanowong people organized collective action to provide the labor for the expansion project, and were partially supported by the government. Tanowong people also faced the challenge of defending their newly acquired water source from the neighboring Agwa people who demanded that they should be given some share of the Bwasao water. In face of this challenge they made an alliance with a neighbor community (Pedlisan), but up until the date of the research, the threat was still present.

The key resources (natural infrastructure) in the system are private land (which is culturally relevant), and shared water streams and rivers (in the paper they emphasize the Bwasao Stream, but it is not necessarily the main water source).

The original CPR report, developed in the 1980s by Edella Schlager and Shui Yan Tang at Indiana University, may be found at <https://seslibrary.asu.edu/seslibrary/case/34/cpr>. Coupled Infrastructure Systems framework is explained in more detail in Anderies (2014) <http://link.springer.com/article/10.1007/s11538-014-0030-z>.

### 1.1 The Commons Dilemma

- **The potential appropriation problem / poor coordination of appropriation**  
The potential appropriation problem (in this case, poor coordination of appropriation) was overcome among the Tanowong community. They have water distributors whose interests were very well aligned with resource users (farmers) because they got 5 percent of the total gains of the community. However, when water got scarce, and the Tanowong community decided to use a new water source (Bwasao Stream), they have

appropriation conflicts with a different community. The neighboring Agawa people who is claiming right on the Bwasao Stream happened to live closer to the Bwasao Stream than Tanowong people. Because there are not clear property rights rules of the Bwasao Stream, they have not found a solution yet on how to share it or not with the other community (Agawa) that is claiming shared rights of the Bwasao Stream.

- **The potential under provision of public infrastructure**

The potential under provision of public infrastructure was also overcome among the Tanowong community. The villagers faced the daunting challenge of constructing a 25 kilometer canal in order to tap into Bwasao Stream. Because of the high cost of providing this large-scale public infrastructure, the villagers had to contribute a significant amount of voluntary labor work, which worked very well because of the dap-ay system (head of villages) and of some governmental support. However, because Agawa was claiming water rights of the stream after the new canal was built, the threat was still present. Also, among the Tanowong community, potential under provision of soft public infrastructure was also overcome. To defend their water, Tanowong people faced the challenge of (1) making lobbies to the central government so that they would be given the exclusive formal use right of the Bwasao stream and (2) eliminating the threat from the Agawa people by helping them build another physical infrastructure that tap into a different water source. Tackling these challenges required a significant amount of voluntary labor work and fees were collected from the villagers.

## 1.2 Biophysical Context (IAD)

- **Natural infrastructure**

The irrigation system feeds terraced rice fields (private) located on a mountainous sloped terrain. The villagers also cultivate sweet potatoes for food, which required much less water. By 1950s, the terraces in the original site expanded in number and size. The old water source (it is not mentioned in the research) could not meet the increased demand for water, thus now they are using a new water source (Bwasao Stream). The location of the later stream is not too close to the community and that is the reason why other community (Agawa) which is closer to the source is claiming shared rights to it. No other Natural Infrastructure characteristic is mentioned in the research.

- **Hard human-made infrastructure**

The water from the old two streams is conveyed to the fields by a ditch approximately four kilometers long and on the average about two and one-half feet wide and three feet deep. This ditch is repaired annually in late December after the planting season by all the villagers (Bacdayan 1980, 175). In addition, new dam and 25-kilometer ditches from Bwasao to Tanowong were built by the Tanowong people. In the research, how this type of infrastructure affects the commons dilemma is not mentioned, and it cannot be inferred either.

## 1.3 Attributes of the Community (IAD)

Tanowong people occupy four villages: Tanowong (mother village), Kadatayan, Nadatngan, and Madongo. About 1,000 thousand people live in these villages. These four villages are homogenous in terms of culture and sociopolitical regime. Although living in discrete

villages, the people see themselves as one sociopolitical group separate and distinct from their neighbors. There is much coordination in the social, religious, and political life of the entire group (Bacdayan 1980, 173).

- **Social Infrastructure**

- Identifying resource users and public infrastructure providers: Water resource users are the Tanowong people. There are some types of public infrastructure providers in Tanowong: (1) The Tanowong people not only resource users but also public infrastructure providers who have belonged to locally institutionalized groups (dap-ay); (2) Government bureaucracy has a variety of authorities to offer financial supports and permissions to the villagers and their natural resources in Tanowong; and (3) Congressman (local representative) also played a role in providing public infrastructure in both forms of material support for constructing dam/ditch and of political effort for making policy agenda.
- Description of dap-ay: The Tanowong are organized into different dap-ay groups. A dap-ay group consists of the families belonging to a particular dap-ay which in Tanowong would number up to thirty. There are four different groups of dap-ay in Tanowong (Bacdayan 1980, 173). Multiple instances of a social unit called dap-ay exist in each village and these organizations function as social, political, and religious centers of village life. Through dap-ay, various decisions regarding irrigation systems (e.g., labor allocation, fee collection, building a new physical infrastructure, etc.) are made and carried out. Also, the irrigation system is proved to be helpful for the manner in which it provides the entire political community with a central issue with which all members identify very strongly at a time when other serious socially disruptive forces are at work.
- Trust: While there is explicit competition among dap-ay, they always coordinate their efforts for the welfare of the community as a whole. The competition between the dap-ay is always within the framework of a loyal opposition, with the welfare of the village remaining uppermost in everyones thinking (Bacdayan 1980, 174). There is no known case of anyone being fined or punished for outright refusal to cooperate on the Bwasao project (building dam and ditch) (Bacdayan 1980, 184). Moreover, after the new project to bring water from the Bwasao Stream, because they received support from the government, a new consciousness and favorable attitude toward the normally remote national government arose.
- Enthusiasm/solidarity: As enormous as the Bwasao project (building dam and ditch) was realized to be, the Tanowong people took to it with great enthusiasm. The meetings in the dap-ay must have strengthened their resolve, for there is no known case of anyone being fined or punished for outright refusal to cooperate on the project. Instead, there was eager support, and the work crews, composed of both sexes and all ages, led by the old men, toiled hard and long. The strong feeling of common purpose and solidarity generated among the Tanowong people by the Bwasao project still prevailed in 1972 (Bacdayan 1980, 184).

- **Human Infrastructure**

- Experience/skills: Because of the new project to bring water from the Bwasao Stream, villagers gain a new dimension of experience and education in leadership, particularly in the skills of negotiation with other villages and in dealing with modern government bureaucracy (Bacdayan 1980, 184). All of the formal and informal negotiations which the Tanowong undertook with the opposing village of Agawa, with her close neighbor of Pedlisan, and with the various government officials and agencies of the national government have been fertile fields of social and political experience for the villagers. This was especially true for the community leaders, who learned to deal with a much wider universe than the village and who progressively built skills and confidence in coping with internal and external challenges (Bacdayan 1980, 185).
- Knowledge: Often each dap-ay is assigned responsibility for specific segments of regular projects like trail and irrigation repair. In such a case, year in and year out, the members of each dap-ay know exactly where to go at the appointed day or days of work (Bacdayan 1980, 174). The Tanowong people were able to construct the dam in Bwasao and a ditch from it to their village even with no sophisticated surveying equipment. This remarkable engineering feat was made possible only through their indigenous knowledge from their detailed familiarity with the territory from years of hunting and foraging (Bacdayan 1980, 179). In the spring of 1972 the people of Tanowong and Pedlisan united strongly in opposition to the owners of a paint manufacturing firm in Manila who wanted to gain concessions to tap for oleoresin in the pine forests. This opposition to the exploitation of the pine forest resources is due to the realization of the correlation between the density of trees and the amount of available water (Bacdayan 1980, 183).

## 1.4 Rules in Use (IAD)

### Position Rules

There are three types of positions in this study: resource users, dap-ay, and water distributor.

- Resource users: From the start of rainy season until the next season, irrigation is individualistic and not communal. Those who need water, perhaps for the repair or expansion of their fields, must go alone to clean the ditches for the water to flow from the streams without obstruction (Bacdayan 1980, 176).
- Dap-ay: The dap-ay is not only a group of resource users, but one of public infrastructure providers in Tanowong. Through the dap-ay, the villages are mobilized and grouped for communal action. The dap-ay serve as focal points of mobilization and accountability where decisions require implementation, such as the collection of material or money, the procurement of labor for community trail and irrigation repairs, and the dissemination of information about other villages or municipal government (Bacdayan 1980, 174). A dap-ay divides the assessment of goods, money, or labor among its families and enforces their delivery (Bacdayan 1980, 175). The repair crew is composed of men and women of all ages and sometimes includes young boys and girls, depending upon the available labor in each family (Bacdayan 1980, 175). And they organized themselves to negotiate with other communities and the government, but the author does not mention who was in charge of this.

- Water distributors: The water distributors are informally selected by the people on the basis of dependability, diligence, and fairness. Men who are thought to be good as water distributors are urged to take the office, or else are mentioned to the leading men of the village as able candidates. Sometimes men themselves apply for the job by indicating to the people their desire; if they are thought fit for the job, eventually they are told to give it a try. Once the water flowing, there are eight to twelve water distributors who take over the task of systematically distributing the water as fairly as they can to the different fields. This practice of having water distributors is convenient and efficient in that it saves the individual owner from having constantly to check his fields. And it prevents conflict among the different owners, since they cannot accuse one another of stealing or of taking more than their share of water (Bacdayan 1980, 176).

### **Boundary Rules**

- It seems that there are not clear rules of who can appropriate water in the system, neither what are the physical boundaries of the system. The fact that the Tanowong community started appropriating water from a new stream at Bwasao that is now under dispute with another community is a clear sign of this. Also, the author mentions that the Tanowong community shares much territory with the neighbor community Pedlisan as a result of intermarriage, then the rule of who can participate in the Tanowong systems is not very clear.

### **Choice Rules**

- Every user must contribute to the public infrastructure provisioning, they may withdraw water from the system but must not withdraw more of what it is assigned to them (water allocation was probably based on the proportional to land-holding rule).
- Water distributors must work on the fair distribution of water to the terraces privately owned by resource users.

### **Aggregation Rules**

- Community problems are discussed in individual dap-ay gatherings as well as village-wide meetings. There is much consultation between dap-ay prior to any decision being made for the entire community at one of the meetings, While each dap-ay theoretically has an informal council of old men who make the decision, in actual fact, especially at present, every mature man participates in the deliberation of the council (Bacdayan 1980, 174).

### **Scope rules**

- It seems that the rules-in-use in Tanowong only apply to the Tanowongs people and that they negotiate with other communities when necessary. They are subject to governmental rules too (e.g property rights).
- While there is no discrimination regarding sex and age of the participant in repairing ditches, if the job requires hard labor, as when typhoons have been especially destructive and ditches and stone retaining walls must be rebuilt, then men if possible should represent their families (Bacdayan 1980, 175).

- Unusually heavy damage to a segment, however, such as massive landslide, calls for labor from all the people (Bacdayan 1980, 179).
- In case of emergencies the water distributors also stand on call all day instead of their routinized work (Bacdayan 1980, 176).

### Information Rules

- The water distributors have to go to the top of the mountain to overlook the terraces and exchange information of which part of the area will need water the most that evening (Bacdayan 1980, 176).

### Payoff Rules

- The working group, particularly the men involved, split into smaller groups and go to the different Tanowong villages to collect fines from those who failed to participate in repairing ditches. The fines take several forms: money (one peso), rice (fine bundles), or a good drink and meal for the group (Bacdayan 1980, 175-6). Distributors are paid at the end of the harvest in kind at 5 percent of the harvest: five bundles of rice for every 100 bundles harvested (Bacdayan 1980, 176).

## 1.5 Summary

Tanowong people successfully coped with the three commons dilemmas outlined in Subsection 1.1. The existing social organization *dap-ay* was instrumental for the success. The labor required for the provision of public infrastructure was all mobilized through these social organizations. Also, the high provision threshold of the 25-kilometer canal and high user dependence on the irrigated rice cultivation probably motivated strong commitment and united collective action from the villagers. However, there is still an unresolved dispute between Tanowong villagers and Agawa villagers in regard to the rights of the Bwasao Stream, its allocation, and how to use and maintain the hard human made infrastructure (canal and ditches) in place.

## 2 Part II. Dynamic Analysis - Robustness

### 2.1 Update on the Commons Dilemma

Irrigation was not considered critical due to the adequacy of the water supply. This complacent situation changed radically in 1954, when the growing insufficiency of the water supply led the Tanowong people urgently to seek out hitherto untapped and remote water sources to expand their irrigation (Bacdayan 1980, 176). In-text parenthesis indicate corresponding links in the system representation (Robustness diagram) on the SES library.

### 2.2 Shocks, Capacities, Vulnerabilities

**...to and of the Resource (link 7 to R):**

- Link 7 to R (shock): There is no explicit information about external shock. But it is obvious that internal shock to water resource occurred in response to the Tanowong peoples increasing demands for the terraces needed for water. Over the years the

inadequacy of the original irrigation sources became more and more of a problem for three reasons: (1) the expansion and increase in the number of terraces on the original site, (2) the construction of new terraces along and below the irrigation ditch which necessarily diverted water permanently, and (3) the denuding through careless cutting and frequent fires of the pine forest of the mountains in the environs of the streams which served as the source of irrigation water. Therefore, rice terraces were not adequately watered and thus became increasingly unproductive, leading to their conversion to the growing of sweet potatoes. At first the water distributors were blamed for the shortage so that they became more strict with the water. They looked with extreme disfavor at those people close to the source. But these moves were all no avail, since there simply was not enough water (Bacdayan 1980, 177).

- Link 1 between R and RU (cultural significance of rice): Rice does not grow very well in this mountain area and its cultivation so time consuming. So sweet potatoes not only constitute a major portion of the diet as well, but also are a more economical crop. Nevertheless, rice is considered to be the best food by the Tanowong people because of its cultural significance: their religious ceremonies are keyed to the rice cultivation; and the ownership of a rice terrace is like a badge of citizenship and of continuity, rootage, or identity in the group. This cultural significance of the rice terrace is the background for the intense concern shown over the dwindling water supply (Bacdayan 1980, 178).

**...to and of the Public Infrastructure (link 7 to PI):**

- Link 5 between PI and Resource dynamics: Tanowong and Pedlisan are very similar culturally, closely situated, and traditionally friendly due to both intermarriages and shared territory. These two factors stimulate the development of their cooperation system as social capital (PI) to lead them to share water resource. Their established social capital played a critical role in preventing a paint manufacturing firm (RU) from gaining concessions to tap for oleoresin in the pine forests (R) whose function is to keep available water (R) (Bacdayan 1980, 183).
- Link 2 between PI (water rights) and PIP (government) : In the course of treating the water conflict with Agawa, the Tanowong people became convinced of the necessity of obtaining government (PIP) sanction for their irrigation system as a means of ensuring permanent control of the water source. An application to the government for a water right, accompanied by a petition from the community, was filed early in 1956 to initiate the proceedings. Finally, in April 1972 Tanowong was notified that they had been granted a temporary water right (PI) certificate by the secretary of the Department of Agriculture and Natural Resources (Bacdayan 1980, 182).

**...to and of the Resource Users (link 8 to RU):**

- Link 1 between R and RU (capacities): The Tanowong people (RU) recognized the water shortage for rice terraces and struck on the bold idea of tapping Bwasao (R) as a new source of water. They knew that water there is steady, that there is no great variations in its flow between the rainy and dry seasons, and that it therefore is a dependable year-round source. The reason the Tanowong people (RU) was familiar with Bwasao (R) is that it lies within their hunting, mushrooming, and bamboo-gathering range, and directly on their path to where they go for trade and employment (Bacdayan 1980, 178).

- Link 6 between RU and PI (vulnerabilities): Control of water has been a sore point between a number of villages. No sooner had the Tanowong (RU) begun work on their expanded irrigation works than another village, Agawa of Besao municipality, made claim to the water source. After much negotiation between the leaders of Tanowong and Agawa, the Agawa people reluctantly agreed not to interfere further with the Tanowong project from 1954 to 1955. However, in 1970 the Agawa people tried to tap one of the springs above the Tanowong dam at Bwasao, relying on their previous claim that if at any time in the future Agawa should need water, the Tanowong were to share some with them. The Tanowong people were so upset that they let their determination be known to fight any incursion of their water resources. But their new negotiation was achieved with the help of the increasing number of intermarriages and the resulting joint ownership of rice fields: 1) The Tanowong people proposed that the Agawa tap another stream in the vicinity but one not flowing to their dam; 2) The Agawa argued that they would accept the Tanowong proposal if the Tanowong people would carry and install the pipes from the proposed water source toward the Besao municipal center; and 3) the Tanowong people finally agreed to them in order to eliminate the threat to their water source. Tanowong immediately mobilized to carry out the agreement, and they now hope that there will be no further irritants arising from the Bwasao irrigation system (PI) to disrupt the relationship between Tanowong (RU) and Agawa (RU) (Bacdayan 1980, 180-1).

**...to and of the Public Infrastructure Providers (link 8 to PIP):**

- Link 3 between PIP and PI (dap-ay): The traditional Tanowong social organization of irrigation focusing on the dap-ay (PIP) proved adequate for the construction and continuing maintenance and distribution of water from the Bwasao water works, a tribute to the vitality and capability of this traditional framework of communal action (Bacdayan 1980, 183). The Tanowong people organized in the form of the dap-ay were to build the dam (PI) at Bwasao and then construct a ditch (PI) leading from the dam to Tanowong. (Bacdayan 1980, 178-9). As in the original irrigation system, the Bwasao ditch is repaired every year in January. Because the Bwasao ditch is nearly 25 kilometers long, different dap-ay are assigned specific segments of the ditch as their charge (Bacdayan 1980, 179). As soon as the water is safely flowing through the ditch beginning from the Bwasao dam, the water distributors take over as in the pre-existing irrigation system (Bacdayan 1980, 179). The traditional social organization (PIP) and pattern of maintenance established for the pre-existing irrigated terrace system (PI) proved adequate (Bacdayan 1980, 180).
- Link 3 between PIP (congressman) and PI : After the serious self-help effort of the Tanowong people, the newly elected Congressman (PIP) included the Tanowong irrigation expansion project among those to be supported his pork barrel funds. This compensation became available from the government for the additional labor needed to complete the irrigation work. After these government funds were expended, subsequent grants were obtained from the government for further work on the irrigation system (PI) for widening and straightening its course (Bacdayan 1980, 179).
- Link 2 between PIP (government) and RU : The Bwasao irrigation expansion heightened the awareness of the Tanowong people (RU) of the national government (PIP) system as a source of financial, material, and technical aid. Earlier experience with



the government was often negative, in that the government demanded taxes and free labor for roads and other kinds of construction, and demonstrated its power through incarceration of individuals in prisons. For a relatively isolated minority group, this positive development is of critical importance in furthering Tanowongs identification with and integration into the national political system (Bacdayan 1980, 184-5).

- Link 3 between PIP (government) and PI (communal forest): Close cooperations between Tanowong and Pedlisan succeeded in protecting their pine forests from a paint manufacturing firm. As a result there is a strong movement to have the surrounding forest areas declared a watershed or communal forest (PI) by the government (PIP), which would make them immune to outside exploitation for lumber or oleoresin (Bacdayan 1980, 183).

### 2.3 Robustness Summary

Internal shock to water resource occurred in response to the Tanowong peoples increasing demands for the terraces needed for water (link 7 to R). The cultural significance of the rice terrace is the background for the intense concern shown over the dwindling water supply (link 1 between R and RU). Close cooperation between Tanowong and Pedlisan is social capital that played a critical role in preventing a paint manufacturing firm from gaining concessions to tap for oleoresin in the pine forests (link 5 between PI and Resource dynamics). Tanowongs people have abundant indigenous knowledge of the new water source at Bwasao (link 1 between R and RU). The traditional social organization and pattern of maintenance established for the pre-existing irrigated terrace system proved adequate for managing the dam and ditches from Bwasao to Tanowong (link 3 between PIP and PI). After the serious self-help effort of the Tanowong people, the newly elected Congressman included the Tanowong irrigation expansion project among those to be supported his pork barrel funds (link 3 between PIP and PI). But on the other hand, water resource users in Tanowong were concerned that further irritants from the Bwasao irrigation system to disrupt the relationship between Tanowong and Agawa (link 6 between RU and PI). In the course of treating the water conflict with Agawa, the Tanowong people became convinced of the necessity of obtaining government sanction for their irrigation system. In April 1972 Tanowong was notified that they had been granted a temporary water right certificate by the secretary of the Department of Agriculture and Natural Resources (link 2 between PIP and RU). Also, close cooperations between Tanowong and Pedlisan succeeded in protecting their pine forests from a paint manufacturing firm. As a result there is a strong movement to have the surrounding forest areas declared a watershed or communal forest by the government, which would make them immune to outside exploitation for lumber or oleoresin (link 3 between PIP and PI). The Bwasao irrigation expansion heightened the awareness of the Tanowong people of the national government system as a source of financial, material, and technical aid. This positive development is of critical importance in furthering Tanowongs identification with and integration into the national political system (link 2 between PIP and RU).

## 3 Part III. Case Contributors

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