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Options for future effective water management in Lombok: A multi-level nested framework

Taslim Sjah [a], Claudia Baldwin [b,*]

[a] Faculty of Agriculture and Postgraduate Study Program of Dryland Management, University of Mataram, Jalan Swasembada II/12C, Mataram NTB 83115, Indonesia
[b] Regional and Urban Planning, University of the Sunshine Coast, Maroochydore DC, Qld 4558, Australia

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SUMMARY

Previous research on water use in Lombok identified reduced water available in springs and limits on seasonal water availability. It foreshadowed increasing competition for water resources in critical areas of Lombok. This study examines preliminary information on local social–institutional arrangements for water allocation in the context of Ostrom's rules for self-governing institutions. We identify robust customary mechanisms for decision-making about water sharing and rules at a local level and suggest areas of further investigation for strengthening multi-level networked and nested frameworks, in collaboration with higher levels of government.

1. Introduction

To achieve its Millennium Development Goals (MDGs), Indonesia has committed to reduce by half, the proportion of the population that lacks access to clean drinking water by 2015, while ensuring that the environment is conserved (UNDP, 2000). In Indonesia, regional disparities in access to improved drinking water are significant. By 2009, in the well-known tourist destination of Bali, an average of about 60% of households had access to water piped to households, compared to an average of 45% of the urban and rural population in Nusa Tenggara Barat (NTB), a province east of Bali in the eastern Indonesian archipelago, and the focus of our paper. In addition, potable water access tends to be higher in urban areas than in rural areas, directly affected by water infrastructure development, maintenance and management issues.

A long-standing government priority to achieve self-sufficiency in food is also related to water availability. About 85% of the water on the island of Lombok in NTB is used for agricultural irrigation, with the remainder mainly used for household needs, industry, and other uses (Klock and Sjah, 2007a). Total annual rainfall varies around Lombok Island. The north of Mount Rinjani (i.e. the districts of Tanjung, Pemenang, Gangga, Kayangan, Bayan, and Sambelia) is drier than the southern parts, averaging 1515 mm/year (BPS Lombok Timur, 2011; BPS Lombok Utara, 2011). Directly south and west of the mountain is wetter (2946 mm/year), but rainfall decreases towards the south and east with some areas of East Lombok receiving 770 mm/yr (BPS Lombok Tengah, 2011; BPS Lombok Timur, 2011). Furthermore, rainfall is quite seasonal featuring high runoff in the rainy season with occasional flooding from early November through to April. This results in some farmland left unplanted around September relying on seasonal rather than perennial cropping (Klock and Sjah, 2007b; Sjah, 2007; Sjah et al., 2006).

With increasing urbanisation and tourism development to broaden the economic base, there is increasing competition for these scarce and unevenly distributed resources. Potential effects from climate change contribute additional uncertainty about future water availability. Thus a key challenge is how to equitably manage water distribution in regional areas to achieve both the MDGs and the country's goal for food self-sufficiency.

2. Lombok case study

Water use rights are granted by the central government, with priority given to water usage for daily needs and irrigation for community farming (President of RI, 2004, chapter 1). Water for urban water distribution companies is sourced mainly from good quality naturally flowing spring water from around the base of Mount Rinjani. Local people living around springs usually access the water free of charge. Where spring or tap water is not available, ground water from deep artesian wells (*sumur bor*) and dug wells (*sumur gali*) supply water for domestic use as well as agricultural irrigation. Unable to afford bottled water, many poor people rely on dug wells often with poor quality water. These dug wells can dry around September or October. When this happens, village leaders ask for and receive clean water at no cost from *Perusahaan*

* Corresponding author. Tel.: +61 7 5430 1283.
E-mail addresses: t.sjah2@gmail.com (T. Sjah), cbaldwin@usc.edu.au (C. Baldwin).

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Daerah Air Minum (PDAM), due to the extreme poverty of these communities. The uncertainty of timing of water delivery is an incentive to use water wisely.

PDAM, the semiprivate, semi-state-owned central Indonesian water provider which is regionally based, generally operates as a Public–Private Partnership to provide urban private households and tourism infrastructure with tap water for a fee (Klock and Sjah, 2007a, 2011).

Many rivers are diverted for agricultural irrigation, with various storages (large dams, *embungs* – local community dams) and irrigation channels managed by different levels of national, state, regency, and local government and the community, depending on size of dam and hectares irrigated. The predominant staple crop is rice. Water from large dams is distributed to villages or farming areas by the water gate manager (employed by the Department of Public Works) who ensures that no party breaches the agreed scheduled water distribution to the villages by locking and unlocking the water gates.

National decrees state that governments are to encourage participation of local farmers in the development and management of irrigation systems to raise their level of ownership and responsibility. For example, Regency level governments (*Kabupaten*) are to empower farmer associations through various programs and technical help (President of RI, 2006, chapters 5 and 6). In villages that have enough water, farmers collaboratively manage the irrigation water from a common source through Water User Associations (WUA, *Perkumpulan Petani Pemakai Air, PPPA, P3A*). WUAs are similar to a previous traditional community irrigation organisation called *Subak* (from days of Balinese control of Lombok) and are often still referred to as such. According to DPTPH NTB (2011), a WUA has on average about 300 members, ranging from about 50 to 1000 persons. A WUA has a locally elected leader or 'water distributor', the *Pekasih*, whose function is to distribute irrigation water to farmers' paddocks according to agreements made at meetings of the farming community (Klock and Sjah, 2007a, 2011). Community decisions are recorded as customary laws known as *awig–awig* which specify the rights and duties of all members. These may include water distribution, fee payment, and maintenance of canals. In addition to scheduling water distribution to paddocks, the *pekasih* ensures that water is appropriately delivered to paddocks by monitoring the delivery throughout day and night (Klock and Sjah, 2011). He will also organise maintenance of the irrigation system. Both formal (i.e. government employees) and informal (i.e. those appointed by community) leaders are involved in resolving water disputes.

While water distribution needs to be agreed on within villages or WUAs, agreements also need to be made with other villages that access the same general water source. For example, Klock and Sjah's (2011) research found villages to the north of the town of Praya where water is adequate, collaborate to share water amongst the villages. On the other hand, villages situated to the south of Praya do not collaborate amongst villages, but only within the village, since there is insufficient water to share beyond the village. Until recently, this system has worked fairly well.

3. The Challenge

As population density and urban communities increase and greater emphasis is put on tourism as a source of revenue for Lombok, the competition for use of water has intensified. Conflict has been reported between PDAM and local communities about fees paid to government agencies for spring water that is no longer accessible by communities who live near springs.

Lombok communities are aware of the transition that has occurred in Bali whereby development of commercial sectors with high rates of water consumption such as the regional water provider PDAM, Aqua bottled water company, and tourism infrastructure has resulted in water shortages for agriculture. In the south of Bali, farmers report reduction in the number of crop rotations a year and falling groundwater levels, also resulting in some saltwater intrusion close to the coast (Strauss, 2011). In some cases in Bali the conflict has escalated with acts of sabotage on pipelines owned by PDAM which was taking water from the same source as irrigators (Strauss, 2011). This has also occurred in Lombok (Klock and Sjah, 2007b). It is estimated that the Balinese tourism sector uses water at twice the rate of local household consumption, although increasingly, large hotels are introducing water conservation management measures.

Meanwhile Lombok is still not meeting its food security goals, has to import rice, and the transition to high value less water-intensive crops is slow. The water allocation system in Lombok is complex and expectations for it to contribute to poverty alleviation are high. There is no simplistic solution. The level of complexity demands an integrated approach at multiple scales and institutional levels. Though not without their problems, local systems of water sharing appear to exhibit positive attributes of self-governing institutions. As a result, we draw on Ostrom's theory of self-governing institutions for insight on how to support or strengthen water resource management at a local level, with the understanding that this may also point the way to action at higher institutional levels, as part of a nested framework or multi-level governance.

4. Theoretical basis – challenges of CPR management and proposed solutions

Conflict between economic and social interests in water are common around the world and not unique to traditional institutions that manage water for irrigation such as WUAs in Lombok (*subak* in Bali) and powerful economic interests of urban and industrial water users. Over the years, through analysis and testing of long-lasting self-organising resource-governing institutions, Ostrom and colleagues have developed a set of design principles that contribute to developing robust and enduring arrangements (Ostrom, 1990, 1992, 2005). Their work is based on study of institutions that depend on the flow of scarce resources for economic returns. None of the successful cases involved direct regulation by a centralised authority. They argue that individuals in many cases can cope successfully with over-exploitation of common pool resources by formulating self-governing institutions, but note that governments also have important roles to play to make self-governance work. In addition, Pretty (2003, pp. 1912–1914) suggests that communities can collaborate in sustainable management of a resource, but may need the support of specialised skills from a higher level of authority to manage the resources, especially with increased pressure on the resource and environmental change.

This paper applies Ostrom's generic principles to local water allocation processes on the island of Lombok to determine whether additional opportunities or options for improving governance, and sustainability, outcomes, could be considered by local villages, government and water authorities. It builds on the investigations by Klock and Sjah (2011) of 18 water user organisations in Central Lombok which identified physical and socio-cultural characteristics to understand how local people manage water for their needs. The villages were selected from a range of altitudes (0–450 m) above sea level to include those near springs (usually with more water) as well as those at lower elevations which receive less or inadequate water flow. All the villages investigated use water for irrigation and domestic use such as cleaning and drinking. Each of the villages has a Water User Association (WUA, *Perkumpulan Petani Pemakai Air – PPPA, P3A*). In most WUAs, somewhat arbitrary