

Improving spate irrigation systems: global experiences

Over the past three decades spate irrigation development has been supported under a range of national and international programs. The external support falls in three broad categories:

- Civil engineering investments
- Provision of earth moving equipment
- Support to traditional systems

This note discusses the various categories of support and then reviews a recent example of civil engineering investment in spate irrigation in Eritrea.

Civil engineering investments

In the last decades extensive civil engineering investments have been made in spate irrigation systems in Yemen and to a lesser degree in Pakistan, Eritrea and Tunisia .

In the Tihama plains in Yemen several large spate irrigation systems were 'modernized' in the eighties, i.e. Wadi Zabid, Wadi Rima and Wadi Mawr, using World Bank funding. Major investment in the Tihama continues in Wadi Siham with EU financing, implementing work that was identified in the eighties but not taken up at that time. Similarly large civil works have been undertaken in the large spate systems in South Yemen (or People's Democratic Republic of Yemen as it was called out the time) in the eighties with Soviet support. In Yemen since then the focus has shifted to smaller systems, usually as part of larger rural infrastructure projects funded by World Bank or Arab Funds. Recently under the Irrigation Improvement Project (World Bank) two of the earlier modernized systems are being rehabilitated and brought under farmer management.

In Pakistan some investments have been made on flow division and regulation structures in ephemeral rivers, but the main attention has gone to diversion structures. Under a number of national programs in Balochistan Province new spate headworks were constructed. When national budgets sources dried up, investment in spate systems continued under the World Bank funded Balochistan Community Irrigation and Agriculture Project. Moreover in Punjab Provinces a large spate system was built on the Mithawan hill torrent, using JICA funding.

Benchmarking of investment costs

When the Wadi Laba and Mai Ule engineering works in Eritrea were tendered, the costs for the headworks was USD 3,53 Million and USD 2,06 Million respectively. This works out to be USD 1420/ ha and USD 2420/ha respectively. This may be benchmarked with other recent large civil engineering investments in spate irrigation. Engineer's estimates for spate irrigation systems prepared in 1996-2001 in Balochistan (Pakistan) are USD 646/ha (Nil Dat), USD 1346/ha (Marufzai) and USD1478/ ha (Barag). The cost for Barquqa in Yemen, is USD 1507/ ha.

The cost of these systems may be put in perspective by comparing them with the costs of smaller systems in the Western Lowlands in Eritrea. Here small gated and ungated weirs and soil bunds have been built at USD 120-480/ha.

The costs of the other two approaches is considerably lower. The 2002 bulldozer program in Balochistan , as implemented by the Irrigation Departments, came down to USD 400,000 and covered 20 small systems with a total estimated command area of 6000 ha, i.e. an investment of USD 65/ha. Support to traditional systems - through the provision of gabions and earthmoving equipment in Eritrea worked out to be USD 50/ha.

The track record of all these civil engineering investments is at best patchy. Investments in flow division and regulation in Pakistan (for instance on the Gaj Nai in Sindh) have performed reasonably well, but the same cannot be said for modern flow diversion structures. One problem with the earlier investments was that they were strongly inspired by perennial systems but were not able to cope with the heavy sedimentation process or violent peak floods. An evaluation of 47 relatively minor spate systems built with national funding in Balochistan in 1960-1990 established that only 16 were still operational. Another 16 systems were abandoned, whereas 15 suffered from severe operational problems. Similarly the Mithawan system has failed because of completely inadequate sediment management arrangements. In Yemen in the Tihama plains the designs of the modernized systems became more sophisticated over time. Whereas Wadi Zabid suffered from difficult sediment handling, Wadi Mawr includes a large double sediment excluder. Serious social problems persist however in Yemen. These are related to the increased capacity of upstream landowners to control spate flows after the civil works investments. In the past the inherently weak nature of traditional diversion structures guaranteed made such full control difficult. In violation of written rules for instance local elite in Wadi Mawr to another catchment diverts water. Similarly in Wadi Siham and Wadi Zabid powerful upstream farmers have created new diversions.

Another change that has occurred with external funding is that systems often stopped being farmer-managed. The most extreme manifestation has been the Tihama Development Authority (TDA) in Yemen. TDA assumed full responsibility after the civil works on the various systems were completed, yet has had to struggle to find the funds to do so. In other cases ambiguity was created on who is responsible for what, particularly when the nature of the civil works is such that there is no local capacity to service it.

In the Sheeb system in Eritrea these problems have been countered by the support to the Sheeb Farmers Association under the Irrigation Management Transfer subcomponent. This association builds on the organization, as it existed before the ELWDP. This traditional organization has a record of relatively equitable water distribution and effective conflict resolution. Moreover, there are no extreme differences in land ownership. Monopolization of spate supplies, as has happened in several systems in Yemen, is not anticipated.

Provision of earthmoving equipment

Ambiguity on responsibilities is less of an issue in the second type of support programs, i.e. the provision of earth moving equipment. In such programs bulldozers and front loaders are made available against rates that typically cover part of the running costs but none of the capital

charges. Such earthmoving equipment was often made available in the first place from aid-in-kind programs.

With 'bulldozer' programs farmers remain in charge of the systems. They are given new means to build or restore diversion works - especially earth bunds - or do command area improvements - ranging from gully plugging to making new flood channels. In countries where bulldozer programs are in place they tend to be highly popular and often the object of considerable political favouritism. The downside of the bulldozer programs is that traditional water distribution systems are sometimes upset, because upstream farmers are able to build bigger bunds than they used to. Another point is that the programs tend to unravel when the equipment needs to be replaced. There are examples of local entrepreneurs renting out earthmoving equipment at cost, but such cases are few and far between.

Support to traditional systems

In spite of the civil investment programs, most of the spate-irrigated areas remain farmer managed. In many areas there is no civil engineering investment that can make a significant contribution. A rough estimate is that the reach of modernized systems does not extend beyond 250,000 ha. In fact, some of the larger spate irrigation systems rank among the largest farmer managed irrigation systems in the world. The structures are sometimes spectacular: earthen bunds spanning a river, or extensive spurs made of brushwood and stones. Often the traditional systems by design have fewer problems with handling peak floods and excessive sedimentation. Spurs and bunds are generally made in such a way that the main diversion structures in the river break when floods are too big. The breaking of diversion structures also serves to maintain the floodwater entitlements of downstream land users. The capacity to divert water in traditional off-takes is however is less reliable.

A number of programs have supported traditional systems - in many cases through NGOs or local government in catalyst roles. In Ethiopia for instance food-for-work programs were used to extend flood channels and build new traditional diversion structures in Konso. The same happened on a larger scale in the Rehanzai Bund (Pakistan), where farmers constructed a very large new soil bund with external financial support on the offshoots of two ephemeral rivers in order to spread floodwater over more than 15,000 ha of land. The advantages of such programs have been that they have kept local management intact. In some cases however excessive use was made of gabion structures. The experience with gabions has not always been positive. In the Wadi Beihan Project in Yemen it was found that gabions were only marginally cheaper than the local reinforced structures, but the capacity to repair the gabions was nowhere around.