

Theme (iii) Improvement of irrigation and drainage efficiency through participatory irrigation development and management under small land holder conditions.

ACEH EMERGENCY SUPPORT FOR PARTICIPATORY IRRIGATION REPAIR AND WUA EMPOWERMENT

Appui d'urgence d' Aceh pour réparation participative de l'irrigation et l'autonomisation des WUA

**J D Meigh, MSc, MICE, CEng¹
Member of ICID UK**

1. Synopsis

The earthquake of 26 December 2004 off the west coast of Sumatra and resulting tsunami killed some 300,000 people and damaged farmland and irrigation systems, and had consequent effects on irrigation efficiency and livelihoods of the smallholder farmers. A further earthquake on 28 March 2005 killed 1,000 people in Nias and damaged irrigation systems throughout the island. In August 2005 Black & Veatch (B&V) were engaged by the Asian Development Bank (ADB) to assist the Indonesian Government Bureau of Rehabilitation and Reconstruction (BRR) in re-establishing the irrigation infrastructure and management as a component of the ADB grant funded Earthquake and Tsunami Emergency Support Project (ETESP)²³. A participatory approach was taken through the full development cycle with newly established WUAs rebuilding and taking over the management of secondary and tertiary systems. During the project the design engineers followed the BRR policy of “building back better” by incorporating earthquake resistant design in higher risk areas. This paper describes the participatory approach taken to restore some 93 irrigation systems over some 60,000ha.

¹ J David Meigh MSc, MICE, CEng,
Independent Consultant,
Jl Gedung Hijau VI/18, Pondok Indah, Jakarta Selatan 12310
jdavidmeigh@gmail.com
HP: +6281399117700

² The \$294.5 million ETESP, funded by ADB Grant INO-0002 to the Indonesian Government, comprises twelve components covering post-tsunami and earthquake reconstruction of Aceh and Nias. These are grouped into five principal sectors of livelihood restoration, social services, community infrastructure, physical infrastructure, and fiduciary governance; with the overall aim of systematic and participatory rehabilitation and reconstruction of infrastructure; effective restoration of livelihood, incomes; and the ability to provide the staple food to local populations; and the attainment of the Indonesian Government Millennium Development Goals (MDGs). The Irrigation Component (ETESP-IC) comprises part of the Community Infrastructure Sector.

³ David Meigh was engaged as a staff consultant to help prepare the ETESP-Irrigation Component in June 2005 to October 2005 by drafting a Project Administration Memorandum (PAM) [Ref 1] and advanced design on 6 schemes in Nias.

2. Résumé et conclusions

Le tremblement de terre du 26 décembre 2004 au large de la côte ouest de Sumatra et le tsunami tué des 300.000 habitants et endommagé des terres d'agricoles et des systèmes d'irrigation, et en conséquences sur les moyens de subsistance. Un tremblement de terre le 28 mars en outre 2005 a tué 1.000 personnes à Nias et endommagé des ouvrages d'art dans toute l'île. En août 2005, Black & Veatch (B & V) ont été engagés par la Banque Asiatique du Développement (BAD) pour aider le Gouvernement Indonésien du Bureau de réhabilitation et de reconstruction (BRR) pour la planification, la conception et la mise en œuvre des travaux de reconstruction de la composante d'irrigation de la subvention AB a financé le projet de soutien d'urgence pour le tremblement de terre et le tsunami.

Au cours du projet, les ingénieurs de conception suivent la politique de BRR de «mieux reconstruire» en intégrant conception parasismique dans les zones à risque élevé et l'intégration des bénéficiaires dans le développement du projet. Quelque 94 programmes ont été reconstruites ou a une reconstruction majeure sur une vaste zone géographique causant B & V pour ouvrir quatre bureaux régionaux, comme indiqué sur les figures 1 et 2. À l'issue de l'équipe travaillé avec les WUA et le district d'irrigation du bureau de service dans la préparation de pratiques de plan d'O & M pour chaque régime.

Ce document décrit les approches qui ont été adoptées dans la planification participative, la conception, la construction et de planification de la gestion. Conclusions et recommandations tirées du projet sont les suivants:

1. L'approche participative a montré que les associations d'eau-usagers pourraient offrir de meilleurs qualité de construction pour ce type d'œuvres compare aux petits entrepreneurs.
2. Le temps, efforts et dépenses prises pour organiser et former les communautés à gérer les contrats légaux auront le système de gestion bénéficié au futur, en particulier en améliorant le fonctionnement et l'entretien.
3. Une grande partie des efforts et le temps a été gaspillé pour convaincre le personnel de la mise en œuvre *Satker BRR*, dont les tradition préférence pour les contrats du secteur privé, à adopter cette approche. Dans le temps, ils vinrent à l'appui de cette forme d'exécution du contrat.
4. Au cours de projets de développement antérieurs à Aceh y avait eu un programme de renforcement succès bâtiment de bureaux de district et *Pengamat*. Ces agents sont généralement exclus des activités de construction, sauf en vertu d'un rôle mineur KPL. Leur expérience locale a été généralement sous-utilisés et leur grand soutien pour la participation suggère que le programme aurait eu un plus tôt et plus démarrage réussi. Par conséquent la mise en œuvre par les administrations locales plutôt que sous une administration d'urgence aurait mieux permis le renforcement des capacités, la gestion durable et la coopération avec les beneficiaries.

5. L'équipe de consultants se mit à suivre le mandat BRR à «reconstruire en mieux» en concevant des structures de remplacement permanent – tures mieux à même de supporter les futures forces de tremblement de terre. L'équipe de conception a développé une gamme de modèles d'adaptation à l'aide de béton armé et matériaux souples dans les zones sismiques à haut risque au lieu de remplacement avec la maçonnerie. Le véritable test pour ces dessins seront le prochain grand séisme.
6. Une recommandation à venir serait de permettre aux associations d'eau-usagers pour essayer les plus grandes structures et les canaux et la plus grande responsabilité de gestion de l'irrigation en particulier à l'avenir des régimes plus petits où la coordination inter-communautaire est plus facile.

3 Introduction

The earthquake of 26 December 2004 off the west coast of Sumatra and resulting tsunami killed some 300,000 people and damaged farmland and irrigation systems, and consequent effects on livelihoods. A further earthquake on 28 March 2005 killed 1,000 people in Nias and damaged structural works throughout the island. In August 2005 Black & Veatch (B&V) were engaged by the Asian Development Bank (ADB) to assist the Indonesian Government Bureau of Rehabilitation and Reconstruction (BRR) in the planning, design and implementation of reconstruction works for the irrigation component of the AB grant funded Earthquake and Tsunami Emergency Support Project.



Plate 1 Earthquake damaged canal in Nias
(Tremblement de terre endommagés des canals à Nias)

During the project the design engineers followed the BRR policy of “building back better” by incorporating earthquake resistant design in higher risk areas and incorporating the beneficiaries into the development of the project. Some 94 schemes were rebuilt or had major reconstruction across a wide geographic area causing B&V to open four regional offices as shown on Figures 1 and 2. On completion the team worked with the WUAs and District Irrigation Service Offices in preparing practical O&M plans for each scheme.

4. Unique Issues and Challenges for Irrigation Participation

The consulting services called for subproject participatory planning, preparation of engineering R&R designs and contract documents, WUA empowerment, institutional support and construction monitoring. Trying to carry this out in a disaster area created several unique issues and challenges.

1. Extent of psychological damage to beneficiaries in tsunami damaged areas making provision for emergency relief and housing a higher priority and time required before readiness for participation.
2. Before repairing infrastructure, tsunami schemes required sand, vegetation, house rubble and glass to be cleared.
3. Extent of earthquake damage to infrastructure in Nias and need for new approach to earthquake design.
4. Competition from other agencies for workers and materials drove up prices.
5. Initial reluctance of BRR Satker staff to involve farmers due to long experience with contractors and long preparation period needed for participation.
6. Many schemes in Aceh severely damaged previously due to security situation and reluctance of government staff to travel to remote areas meant O&M had been neglected in all but a few major schemes. Many included projects were not strictly earthquake or tsunami damaged.

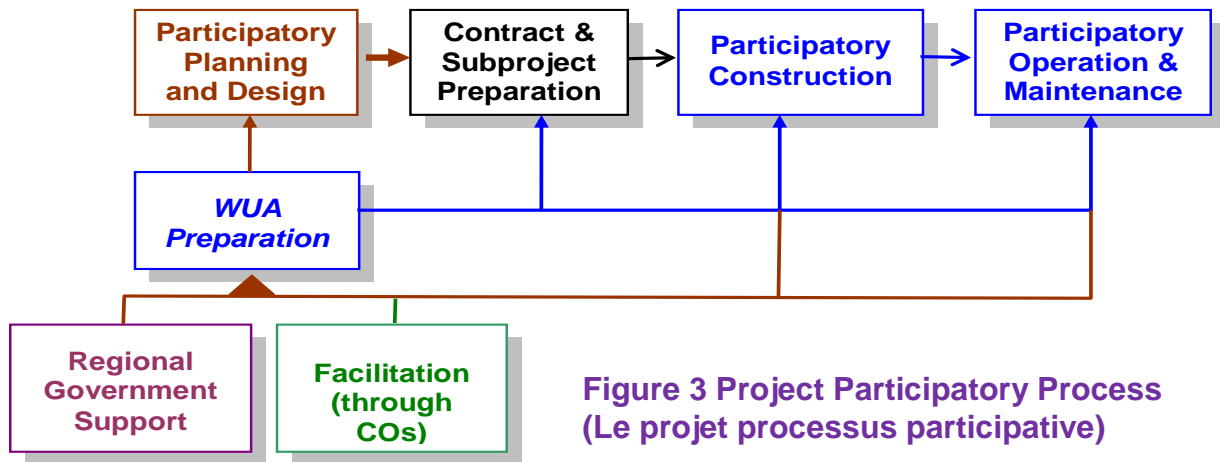
5. Planning and Organisation for Participation

Participation in the planning and design of the rehabilitation of the irrigation systems was not only a requirement of the ADB, and written into the ToR and Project Administration Memorandum (PAM)^[Ref 1] and BRR but is also a requirement of the Government of Indonesia through the New Water Law and irrigation management policy reforms. As part of the WUA support and empowerment programme the project aimed to “provide water users training and community empowerment in all project-assisted areas” through:

- development of water users associations,
- participation in walkthroughs and plenary consultation meetings during design, and
- implementation by WUA of smaller rehabilitation works under SP3 contracts

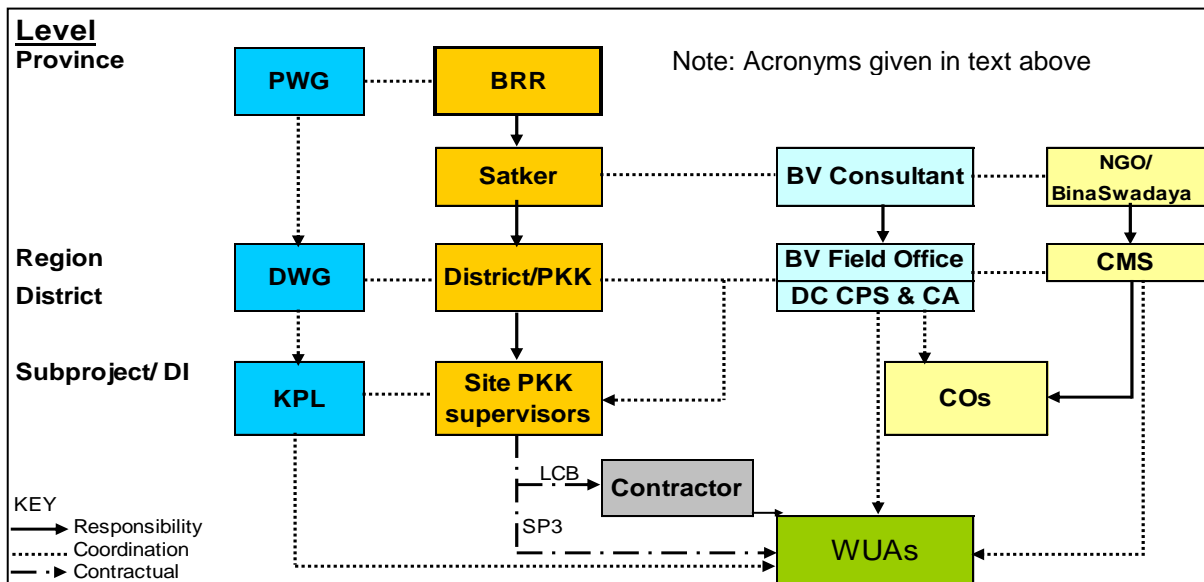
The overall participatory process is set out in **Figure 3** from initial project preparation to O&M with contribution from beneficiaries through water user associations (WUAs) and key stakeholders such as local government. The institutional support structure is shown in **Figure 4** with brief descriptions of the main organisations⁴.

⁴ In the following text many Indonesian names and translations have not been included for clarity. Those wishing greater information should refer to References 3 & 4



Organisations involved in the participatory process

1. BRR’s project implementation unit, SATKER (*Satuan Kerja*) provides project management, with authorized managers District Managers (called PPK) appointed on a regional and technical basis for implementation.
2. Provincial and District Government, including representatives of the Provincial and District Water Resource Services are key members of the Provincial and District Working Groups (PWG and DWG). They provide planning review, training through the KPL unit, conflict resolution and post construction management.
3. Irrigated rice farmers who are the primary stakeholders and beneficiaries of the project to be represented through the water user associations (WUAs) and participated in design and construction activities through community contracts called SP3 (*Surat Perjanjian Pemberian Pekerjaan*).
4. Bina Swadaya, an Indonesian NGO, provides social facilitation of WUA groups through district-based community mobilisation specialists (CMS) who train and supervise community coordinators (COs), generally one CO per subproject or per 500 hectares.



coordination between the Project, PWG, DWGs and the field teams comprising:

- Community Participation Specialists (CPS) and district coordinators (DC) to help coordinate between COs, Satker, site supervisors, the Consultant team, and Bina Swadaya.
- Construction advisors (CAs) and monitors.

The approach⁵ which has been developed and applied in ETESP involves a series of four key plenary meetings (Pleno) that are linked by integrated preparation activities between the WUA members and the consultant –government teams..

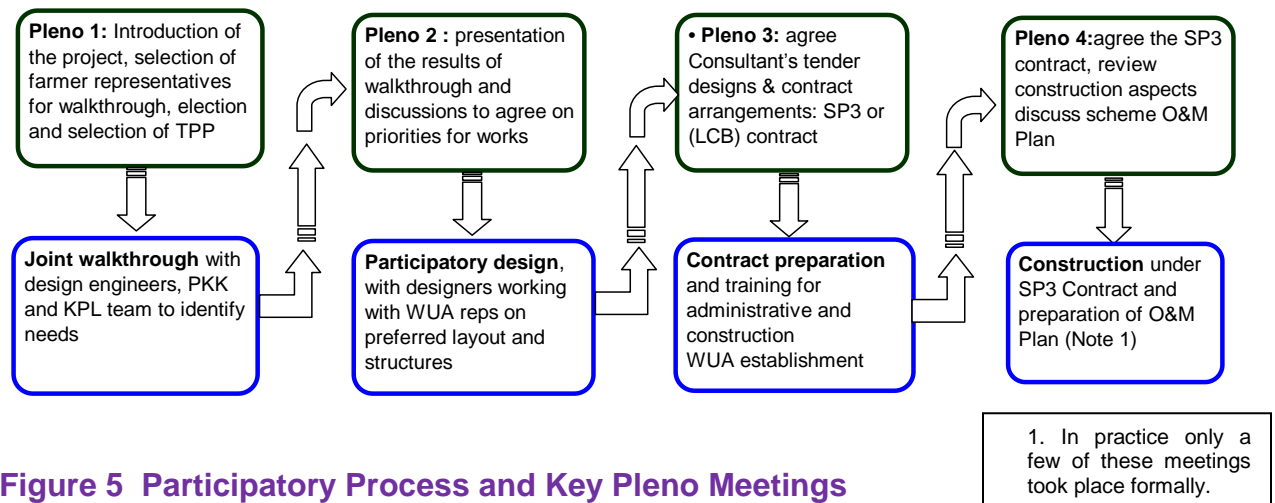


Figure 5 Participatory Process and Key Pleno Meetings (Le processus participatif et des principales réunions completes)

6. Implementation of the Participatory process

The BV WUA Empowerment and Development Unit (EDU)^[Ref 2] began work in August 2005 to facilitate walkthroughs and plenary meetings. Additional TPPs, nominated by communities, were recruited and trained by Bina Swadaya from February 2006 commensurate with the addition of design areas and activities.

Plenary meeting 1

Pleno 1 was to bring the community together to introduce the Project and to select a Community Organiser (CO) from the community and farmer representatives for initial activities before the WUA was established. One was usually the Keujruen blang.



Plate 2 Pleno meeting where women were encouraged to attend (La réunion complete où les femmes sont encouragées à participer)

⁵ For the design of the participatory process the ETESP-IC Consultants drew on the experience gained in the ADB PISP PPTA and NSIASP carried out in North Sumatra Province as well as from the World Bank JIIMWP^[Ref 3] guidelines. These projects had shown that meaningful participation requires time and considerable effort to fully engage all farmers in the process.

Throughout Aceh, irrigation schemes have an established water management organisation called the Keujruen Blang which was integrated on a scheme by scheme basis as required by the farmers into the WUAs with a constitution and bylaws to gain the status of a legal body.

System Walkthrough

As far as the ETESP-IC program for planning and design is concerned the system walkthrough is the crucial subproject integrated activity between the WUA officials, PKK, DWG and the Consultant design team. This was the first step where continuous involvement and participation of local communities was essential to ensure agreement on scheme rehabilitation and reconstruction requirements. Generally the water users know what they need but may not be aware of the full range of options for achieving it. The walkthrough, field investigations and specialized visits formed the basis for identification and selection of main rehabilitation and reconstruction options. During the walk through the group discussed and identified:



Plate 3, Walkthrough to quantify damage (Procédure pas à pas de quantifier les dommages)

- Scheme boundaries, canal and drain alignments or whether other options are preferred
- Whether the water sources are adequate or whether management of those sources needs to be improved or augmented
- Specific locations and causes of damages, malfunctions or constraints such as flooding
- Inventory of damage, including measurements of infrastructure damage and discussion of whether to be repaired or replaced
- Whether they wanted canals lined and what type of lining.
- Experiences with Operation & Maintenance and how improvements can be made

On most schemes the single most crucial structure is the headworks as this abstracts the water from the river and is subject to the harshest of environments. The walkthrough is the first step in a process of failure identification and design development to achieve a sustainable structure adapted to the river environment.

Plenary meeting 2

This was held after the system walkthrough as a beneficial to have a follow up meeting and discussion to verify the above field information, agree essential works required and to prioritize the work in case of budget constraints. Follow on topographic survey and site investigation needs were identified and preparation of tender documents commenced.

Training was an essential part of support and initially for elected community coordinators (COs) in:

- WUAs/WUAFs formation including legalization.
- participatory approaches and methods
- essential technical knowledge & skills



Plate 4 Training session for TPPs (La séance de formation pour TPPTs)

- quality control of construction works
- contract administration and accounting
- informal in-service training

This facilitates the WUA in establishment activities:

- revitalization of the existing WUAs/WUA federations or establishment of new WUAs (by integration with traditional organisations)
- preparation and development of constitution bylaws
- tax registration and legalization
- opening a WUA bank account
- capacity building in local resources mobilization, simple and applicable book-keeping, basic technical abilities, knowledge & skills and project contract administration & budget preparation and reporting.



Plate 5 Construction training at start of WUA contracts (La formation des construction au début de contrats WUA)

The consultant team prepared scheme tender designs with inputs from technical specialists that required:

- site visits accompanied by focus group members to see key structures and locations and discuss repairs or options for replacement.
- discuss current methods of, and problems with, water abstraction and management and possible technical options to satisfy the WUAs needs
- land acquisition needs on permanent or temporary basis under a Community Action Plan (CAP)

Plenary Meeting 3

This meeting was mainly for:

- deciding on the construction contract model with options of a Local Contractual Bidding (LCB) with or without a community subcontract (KSO)⁶ or by a direct WUA SP3 contract
- explanation, review of tender drawings for technical aspects and any necessary modifications
- completion of CAP requirements or any formal land acquisition
- preparation of the required budget and bid documents for SP3 contracts.

The tender and construction design approval process was iterative and to:

- meet the approval of the WUAs
- meet the requirements of consultants QA checks on engineering safety, technical competence, appropriateness and engineering value
- explain the designs to the PPKs with possible modifications or design notes to meet approvals.

Plenary Meeting 4

⁶ These were subcontracts to the LCB contracts where the appointed contractor would subcontract some of the labour related tasks to the WUA. They were generally disliked by farmers who considered the contractors exploited and often cheated them.

This meeting was intended to agree on the SP3 contract and prepare the O&M plan. In practice, owing to the crash nature of the project, no of contracts and shortage of time these items were agreed in informal meetings with the appointed WUA representatives. The completion of the SP3 contract signaled an advance payment for materials so that the contract could start. Towards the end of the project the consultant set up an O&M Planning Group to discuss O&M needs and planning. The larger schemes, over 500 ha would mainly be handed back to the District Water Resources Service for management. Generally an O&M pack was provided for each scheme giving irrigation layouts, drawings of key structures and simple O&M guidelines.

7. Aspects of Earthquake Resistant Materials and Design

Under the Project there was a tendency for larger irrigation structures such as weirs to be rebuilt or repaired using LCB Contractors whilst the WUAs tackled the smaller canal systems. Within this paper only the smaller systems are discussed here⁷.

Throughout Nias the standard masonry designed structures and canal lining fared badly during the earthquakes. Designing for normal environmental conditions are covered in the Government of Indonesia KP series of design guidelines⁸. Whilst this provides a firm basis for design in lower earthquake risk zones, there has been a tendency to follow it in a prescriptive manner without thought of the particular environment the works are located in. Standard designs using stone masonry are universally followed throughout Indonesia with reinforced concrete only used where members are normally in tension. In Nias and much of Aceh masonry and concrete had been constructed with poor materials or badly built with many voids and consequently leaked and fractured easily during earthquakes. The usual material is rounded boulder masonry with weak mortar and little curing.

Designers were recommended [Ref 6] to use materials better suited to resisting earthquakes and more likely to retain infrastructure operation after the event. When repairing or upgrading canals the WUA were told about the introduction of mesh reinforced concrete (MRC) lining with frequent joints instead of masonry lining or rectangular flumes. Initially this was in the high earthquake risk zones



Plate 6 Typical masonry construction with rounded stones, weak mortar and left uncompleted (Maçonnerie typique avec des pierres arrondies, mortier faible et les restes inachevés)

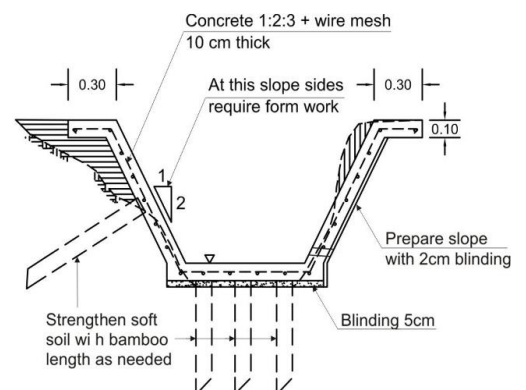


Figure 6 Standard detail of MRC canal (Le standard en détail de canal du MRC)

⁷ David Meigh has produced a more comprehensive paper on earthquake design aspects in Aceh and Nias, [Ref 4].

⁸ DGWR KP Series, Irrigation Design Guidelines, [Ref 5].

but as the news spread many WUAs in other areas requested this option^[Ref 7]. In the MRC design the mesh and trapezoidal shape is intended to give greater shear resistance whilst 2:1 side walls formed with inner wall shutters gives greater stability as a U section in soft ground or where sides cast on fill. The design restricted to channel depth of 1.5m otherwise longitudinal joints are required and support depends on the strength of the fill.

It was initially proposed to only line main and secondary conveyance canals. The tertiary distribution system is usually overlain on impermeable clay soils where earth canals are the most suitable material as they are easily repaired by the farmers following earthquakes. In practice most farmers decided at Pleno 2 that they wanted new lined canals to reduce maintenance tasks and they perceived operation would improve and hence preferred the MRC design (see Figure 6). Unfortunately a proposed design for tertiary level canals based on precast slabs some 40% cheaper was not adopted. This would have been more economic for the WUAs to use in further extending their canals.

In some high risk areas some small irrigation structures on soft ground were also designed with MRC bases instead of masonry.

8. Construction

During the construction period support on technical issues was provided by the Consultants regionally based Construction Advisers whilst institutional and administrative support was provided by the Consultants EDU. Both provided support in administering the SP3 contract as necessary.

The Project was completed in December 2008 with many of the above design initiatives constructed. Some 490 community contracts were carried out through the water-user associations with most a success, with good to reasonable

standards of construction achieved as well as community capacity and confidence building.



Plate 7 WUA building their lined canal (L'AUE construit leur ligne de canal).

The 129 local competitive bid contracts – mainly let to inexperienced local contractors – initially produced poor quality work that only marginally improved following greater scrutiny from the consultant construction advisors.

Most of the earthquake resistant designs were implemented, although some of the more conservative construction managers reverted back to masonry designs.

9. Conclusions and Recommendations

Conclusions and recommendations drawn from the Project were:

1. The participatory approach showed that water-user associations could deliver better quality construction for this type of works than small contractors.
2. The time, effort and expense taken to organise and train the communities to manage legal contracts will have future scheme management benefits, particularly in improved operation and maintenance.
3. A great deal of effort and time was wasted to convince the *BRR Satker* implementation staff, whose traditional preference was for private-sector contracts, to adopt this approach. In time they came round to supporting this form of contract implementation.
4. During previous development projects in Aceh there had been a successful capacity building program of District and Pengamat offices. These staff were generally excluded from the construction activities except under a minor KPL role. Their local experience was generally under used and their greater support for participation suggests that the program would have had an earlier and more successful start. Consequently implementation through local government rather than under an emergency administration would have better facilitated capacity building, sustainable management and cooperation with beneficiaries.
5. The consultant team set out to follow the BRR mandate to 'build back better' by designing permanent replacement structures better able to withstand future earthquake forces. The design team developed a range of adaptive designs using reinforced concrete and flexible materials in the higher-risk earthquake zones instead of replacement with masonry. The real test for these designs will be the next major earthquake.
6. A future recommendation would be to allow the water-user associations to attempt larger structures and canals and greater responsibility for future irrigation management particularly on the smaller schemes where inter-community coordination is easier.

9. Acknowledgments

Ir Totok Hartono, the team sociologist who provided much of the participation information unfortunately passed away before the project was completed. His special brand of leadership, enthusiasm and affinity with farmers will be missed. From ADB the author would like to thank Chris Morris from SERD Manila for his vision of participatory reconstruction during project planning^[Ref 8], and the two Black & Veatch team leaders, Harry King during design and David Brown during construction, for their dedication in seeing the project through.

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