



UNITED NATIONS ENVIRONMENT PROGRAMME

Final Report

Terminal Evaluation of the UNEP project “Demonstrating Application of Environmentally Sound Technologies (ESTs) for Building Waste Reduction in Indonesia (DEBRI)”

by Adrian Coad (Lead Consultant)
and Julia Niggebrugge (Desk Researcher)

Evaluation Office

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LIST OF ACRONYMS

BAPPENAS	State Ministry of National Development Planning
BRR	Badan Rehabilitasi dan Rekonstruksi (ministerial-level agency created to coordinate relief efforts)
BSP	Bali Strategic Plan
C&D Waste	Construction and Demolition Waste
DEBRI	Demonstrating Environmentally Sound Technologies for Building Waste Reduction in Indonesia
DTIE	Division of Technology, Industry and Economics
DPP	Department of Urban Planning and Housing (Dinas Perkotaan dan Permukiman)
DKP	Department of Cleansing and Beautification (Dinas Kebersihan dan Pertamanan)
EST	Environmentally Sound Technology
EU	European Union
GTZ	German Society for Technical Cooperation
IETC	International Environmental Technology Centre
ISWA	International Solid Waste Association
MoE	Ministry of Environment (in Indonesia “KLH”)
NAD	Bandah Aceh Province
RfP	Request for Proposals
ROtI	Review of Outcomes to Impacts
SLGSR	Support for Local Governance for Sustainable Reconstruction (GTZ project)
TE	Terminal Evaluation
ToR	Terms of Reference
TRMWP	Tsunami Recovery Waste Management Programme (UNDP programme)
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
UNON	United Nations Office in Nairobi

1. EXECUTIVE SUMMARY

1. This report presents an evaluation of the UNEP project entitled “Demonstrating Application of Environmentally Sound Technologies (ESTs) for Building Waste Reduction in Indonesia”; generally referred to by its abbreviation “DEBRI”. The project was funded by the European Union (EU). The report is structured according to the requirements of the United Nations Environment Programme (UNEP) Evaluation Office in Nairobi.
2. The project was set up to assist with the recycling and disposal of the wide variety of waste that resulted from the destruction of buildings and infrastructure by the tsunami that struck Banda Aceh in December 2004. The project took a three-pronged approach, looking at technology support, capacity building and economic instruments. The project purchased – with much delay – a mobile waste shredding machine for vegetative wastes and tyres. The shredding machine represents one of the “Environmentally Sound Technologies” (ESTs) for the treatment, reuse and recycle of post-disaster waste” that the project aimed to demonstrate. The machine was handed over to the Department of Cleansing and Beautification (DKP) and thereby built capacity of local government officials in debris handling and processing.
3. The project also developed a package of economic instruments to ensure long-term viability of ESTs, and disseminated, to a small degree, knowledge and experiences gained to other affected countries in Asia.
4. When the project was ready to begin in April 2007, most of the debris had been cleared, and disposed in the Gampung Jawa landfill site of Bandah Aceh or in temporary/ ad hoc dumpsites. As the shredding machine is now installed at a landfill site (and can be moved to others) the project’s objective to subsequently use the EST for general day-to-day waste (though not for concrete, masonry and stones) has been taken into consideration. In fact, the green waste that is being shredded now – almost five years after the tsunami – is unlikely to be from remaining tsunami debris. The amount of post-disaster waste in the landfill sites compared with the utilisation of the machine (184 running hours in almost nine months) and the machine’s average life time of five years¹, lead to the conclusion that the project’s physical impact on Bandah Aceh’s waste management is minimal.
5. The experience of dealing with disaster waste was recorded for providing assistance in other disaster situations and for assisting in the development of contingency plans that would guide the response to future disasters. The impacts of the project outside the formal objectives and results are also discussed in this report.
6. The project was executed by the Indonesian Ministry of Environment (MoE), in partnership with other national and local agencies. Technical inputs were provided by specialists within UNEP and by consultants, some of them provided by the International Solid Waste Association (ISWA), based in Copenhagen, Denmark.
7. The achievements of the project are assessed against the objectives and results that were foreseen before the start of the implementation of the project. The information materials relate well to the management of post-disaster debris as foreseen in the design of the project, but some weaknesses are identified in the proposed methodology for selecting technologies. The report on economic instruments does not result in any concrete recommendations regarding economic instruments that can promote the sustainability of recycling machinery. The fact that the reports have been released only in English limits their application in Indonesia.

¹ Information on average life time provided by the DEBRI Senior Programme Coordinator.

8. Concerns are expressed regarding the “Effectiveness” and “Efficiency” of the project. These relate to the employment of three national full-time staff and the purchase of a large shredding machine which has a capacity far in excess of its utilisation, and that cannot be used for all but a very small proportion of C&D waste. Hence part (b) of the overall objective, the subsequent use of ESTs on “C&D waste generated on a day-to-day basis” in Banda Aceh has not been accomplished.
9. Further concerns are expressed in regard to “Financial Planning” and “Preparation and Readiness”. The procurement process of the shredding machine took much longer than planned. The tendering had to be done three times. Mistakes were made in specifications and budget allocations. The inspection prior to shipment was not conducted. Demurrage charges and port penalties of Euro 22,537 were incurred as a result of the delay in obtaining the necessary permits to clear the shipment in Indonesia from the Ministry of Finance.
10. The shredding machine is not suitable for crushing concrete, masonry or stone, so it is not appropriate for processing most C&D waste. Furthermore it was not delivered until the end of the project, and it was the only machine that was provided, so the demonstration period of EST (in singular, as the project identified several technologies but demonstrated only one) for processing tsunami debris (excluding C&D waste) has been very short. Hence, one of the major aims, that was enshrined in the title of the project (“demonstration of ESTs”), was only partly achieved. However, the project did achieve some of its intended outputs.
11. Reports on estimating the quantities of different types of debris generated by disasters such as earthquakes and tsunamis were produced. A report on economic instruments and financial mechanisms was written. Considerable documentation was prepared on the subject of the selection of waste processing equipment. An extensive (127 page) report on disaster waste management mechanisms was prepared and published. All these documents were uploaded onto the project website (www.unep.or.jp/ietc/DEBRI/). It is reported that the documents and expertise developed through this project have been used in post-disaster situations and in preparing for disasters not only elsewhere in Asia, but also in Africa and Latin America.
12. The effectiveness of the project is assessed according to the UNEP *Review of Outcomes to Impacts* (ROtI) methodology, and the assessments for project results are shown in matrix form in the main body of the report and presented in more detail in Annex 8.5.
13. Banda Aceh has made considerable progress in implementing recycling of wastes and in landfill disposal and it is one of the cleanest cities in Indonesia. It is a very suitable location for demonstrating ESTs, since the city’s waste management already attracts national attention. It is intended that the shredding machine will also be the first stage in a composting operation that will convert shredded green waste into organic soil improver. However, more investment is needed before this goal can be achieved. Funding has been promised by the provincial Public Works Department for the construction of a shelter to cover the shredding machine, but other equipment will be needed before compost can be produced in an efficient way. Although there are clear ecological benefits in composting, there are concerns about the financial sustainability of composting at this scale.
14. There are serious concerns about the management and supervision arrangements of the project which are at the root of the project’s efficiency and financial planning problems. On the one hand, project management and decision making was mostly done from Japan with very little control over the execution of project activities and the utilisation of project resources on the ground. On the other hand, the line between project management and supervision responsibilities was blurred, with the Programme Coordinator often in a position with conflicting interests.

15. The report follows the list of criteria that has been developed by UNEP for project evaluation. Some of these criteria are discussed in great detail – particularly the achievements of the outputs for each activity - while more information is needed to adequately explore and rate others.

2. INTRODUCTION AND BACKGROUND

2.1 BACKGROUND INFORMATION

2.1.1 Project identification

Project Title:	Demonstrating ESTs for Building Waste Reduction in Indonesia – DEBRI
Project Location:	Bandah Aceh
Funding Agency:	European Union
Contract reference #:	ASIE/2006/125-929
Asia-wide Programme:	EU – ASIA PRO ECO II B [Post-Tsunami Programme]
Name of Beneficiary:	United Nations Environment Programme (UNEP)
UNEP Project Number:	UNF Project Number: UNE-INT-01-207
Implementation:	UNEP Division for Technology, Industry and Economics (DTIE) in the International Environmental Technology Centre (IETC), Japan Ministry of Environment, Government of Indonesia International Solid Waste Association (ISWA)
Date Financing Agreement signed:	4 September 2006
Duration of project (planned):	24 months
Project Starting Date:	1 November 2006
Project Completion Date:	December 2009
EC Budgetary Allocation:	Euro 750,000

2.1.2 Background to the Project

1. The project was set up with EU funding in response to the disastrous destruction of houses, businesses and infrastructure caused by the tsunami in December 2004. This destruction generated huge amounts of building debris – stones, bricks, concrete, timber, roofing materials and road surfacing, that was mixed together with other materials, some of them valuable resource materials and some of them hazardous. This material needed to be cleared before infrastructure and housing could be re-established. DEBRI was meant to demonstrate a waste management mechanism, which would first be applied to Tsunami-generated debris and then subsequently be used for day-to-day construction and demolition waste in rehabilitation and reconstruction efforts of the affected communities in Banda Aceh, Indonesia.
2. According to a DEBRI publication² the Department of Urban Planning and Housing (DPP) estimated that 17,286 new houses were required to be built to replace the destroyed houses. This means that more than 40 percent of the buildings (85% housing, 15% commercial buildings) in Bandah Aceh were destroyed by the Indian Ocean Tsunami.

² “Guidelines for Collection of Data on Debris Resulting from the 2004 Indian Ocean Tsunami in Banda Aceh, Indonesia” (http://www.unep.or.jp/ietc/Publications/DEBRI/DEBRI_1_Guidelines_for_collection_of_data_on_debries.pdf)

3. The estimated waste volume left after the tsunami was 603,495 m³ of which 461,614 m³ had been cleared and disposed to landfill sites by July 2007. Of the remaining 141,881 m³ an estimated 58,622 m³ is C&D waste (equivalent to about 800 residential buildings) left in temporary dumpsites or in the form of un-demolished buildings³.
4. When the project started in early 2007 most of the debris had been collected and disposed of or recycled. Concerning disaster debris management this was an appropriate time to draw together the threads of experience and reflect on the lessons learned with regard to:
 - the assessment of the scale of the problem,
 - methods of collection, recycling and disposal of the debris, and
 - the issues of co-ordination and planning.
5. It was expected that the new equipment would reduce the volume of landfill required for disposal. The intention to increase the recycling of waste was in harmony with the new waste management law which came into force in late 2009. The law emphasises the need for reducing, re-using and recycling all kinds of waste, and the principle that polluters should pay the costs associated with managing the waste that they generate.

2.1.3 Main objectives:

6. The main objectives of the project have been presented as follows:
 - To support the reconstruction/ rehabilitation in Banda Aceh Indonesia through development of partnerships for the application of Environmentally Sound Technologies (ESTs) to the treatment/ reuse/ recycle of debris waste generated by the Indian Ocean Tsunami.
 - To support subsequent application of Environmentally Sound Technologies ESTs to the treatment/ reuse/ recycle of the construction/ demolition waste generated on a day-to-day basis.

2.1.4 Relevance to UNEP Programmes

7. The project, a response to the Indian Ocean Earthquake and Tsunami disaster, is relevant to UNEP's approach of "building better and green". The project was intended to specifically address the constraints at the local level in Banda Aceh in identifying technologies and techniques that are environmentally sound, in ensuring longer term competence to handle waste as well as disaster debris and in building capacity to take economic decisions related to disaster recovery.

2.1.5 Executing Arrangements

8. Under the "Contribution Agreement with an International Organisation" between the European Commission (EC) and UNEP, UNEP was responsible for the overall coordination and due execution of the EC contribution to the DEBRI project. The overall management and administration of the project was performed by the UNEP Division for Technology, Industry and Economics (DTIE), by staff located in the International Environmental Technology Centre (IETC) in Japan.
9. The actual project execution was done by three agencies: the IETC belonging to UNEP/DTIE, the Indonesian State Ministry of Environment (MoE) and the International Solid Waste Association (ISWA). In addition, although not acting as executing agencies, the Department of Cleansing and Beautification (DKP) and the local municipalities of Banda Aceh were to play an important role in the project.

³ "Disaster Waste Management Mechanism: A Practical Guide for Construction and Demolition Waste in Indonesia" (http://www.unep.or.jp/ietc/Publications/DEBRI/DEBRI_8_Disaster_Waste_Management_Mechanism.pdf)

2.2 THE EVALUATION MISSION

10. The evaluation mission was undertaken by Adrian Coad, who was engaged as a consultant for a total period of 6 weeks in March and April 2010. A condensed CV describing the consultant's experience can be found in Section 8.6 in the Annexes. The Terms of Reference (ToR) for this consultancy are reproduced in Annex 8.1. After an initial period for studying documents obtained from the internet, the consultant spent ten days in Banda Aceh (as required by the ToR) before returning to his home station in UK to write the report.
11. Because of the delays in the procurement of the equipment, the project had been extended to December 2009. All project activities had been completed at the time of the evaluation mission.
12. There was no UNEP staff in Banda Aceh at the time of the consultant's visit, and the co-ordinating agency responsible for relief work and reconstruction – Badan Rehabilitasi dan Rekonstruksi (BRR) – had been disbanded. Therefore the head of the waste recycling and processing section, Mr Mirzayanto and the Head of the DKP, Ir. T. Iwan Kesuma, were the main local sources of information about the project. The operation of the waste shredding machine that had been acquired by the project was observed and discussed. The investigations that were undertaken during the visit to Banda Aceh are listed in Annex 8.2.
13. Unfortunately, it proved difficult to obtain all the necessary information for the evaluation. The outputs associated with the main activities of the project were available on the project website, and were subsequently provided by the Senior Programme Co-ordinator. The grant application and the initial summary agreement with ISWA were provided together with the quarterly reports and two interim reports. Other information e.g. on workshops, human resources, training and the procurement process was not provided,. The final financial report of the project was made available very late in the evaluation process, after the evaluation report had already been through several rounds of comments.

3. SCOPE, OBJECTIVE AND METHODS

3.1 OBJECTIVE AND SCOPE OF THE EVALUATION

14. The objective of this terminal evaluation is to examine the extent and magnitude of any project impacts up to the time of the evaluation exercise and to determine the likelihood of subsequent impacts. The evaluation also should assess project performance and the implementation of planned project activities and planned outputs in the light of actual results. The evaluation was expected to focus on the following main questions:
- 1) *To what extent has the project supported reconstruction and rehabilitation in Banda Aceh, through the development of partnerships for the application of Environmentally Sound Technologies (ESTs) to the treat, reuse and recycle debris waste generated by the Indian Ocean Tsunami?*
 - 2) *Did the project develop a waste management mechanism for handling treatment, reuse, and recycling of tsunami-generated debris which could subsequently be applied to day-to-day construction/ demolition wastes?*
 - 3) *To what extent has the project built capacity of the stakeholders for the management of tsunami-generated wastes and subsequently day-to-day wastes in an environmentally sustainable manner?*

3.2 QUESTIONS TO BE ADDRESSED

15. Bearing in mind the issues raised in Section 3.1, the consultant sought answers to the following, more specific questions:
- 5) *Who were the stakeholders and potential partners for the project, and were effective partnerships with them developed?*
 - 6) *How did the project gather together the experience gained in dealing with disaster debris, and how effectively has this knowledge and experience been recorded and transmitted to officials and experts who can benefit from this information in their preparations for future disasters?*
 - 7) *How can the quality of the technical inputs be assessed?*
 - 8) *Were project resources used efficiently?*
 - 9) *What lessons can be learned from this project?*

4. PROJECT PERFORMANCE AND IMPACT

4.1 INTRODUCTION

16. This section is the main substantive section of the report, and factual evidence is provided, whenever possible, to support the conclusions of the consultant.

4.2 ATTAINMENT OF OBJECTIVES AND PLANNED RESULTS

17. As mentioned, the situation “on the ground” in April 2007 regarding the collection, recycling and disposal of the solid wastes generated by the 2004 tsunami was such that some of the project objectives set out in the project document⁴ were no longer relevant. However, since the consultant was not provided with any revised project description, the attainment of the initial objectives must be assessed.

4.2.1 Objective

18. The overall objective of the project, as stated in the Logical Framework of the Grant Application Form reads:

To support the (a) reconstruction/ rehabilitation in Banda Aceh through developing partnerships for the application of Environmentally Sound Technologies (ESTs) to the treatment/ reuse/ recycle of debris waste generated by the Indian Ocean Tsunami, and (b) subsequently the construction/ demolition waste generated on a day-to-day basis.

19. The attainment of this objective will be discussed in general terms, and later, together with the planned results, the effectiveness, relevance and efficiency of the project activities will be considered in more detail.
20. No evidence was available that the project has supported the “reconstruction/ rehabilitation of Banda Aceh”. The processing of green waste is of advantage for the beneficiary and the information material that was developed is good for disaster preparedness, but both outputs do not link to the actual reconstruction or rehabilitation of Banda Aceh.
21. Formal partnerships were established with the MoE – which holds responsibility for waste management at the national level – and its provincial arm (BAPEDALDA NAD), and with the International Solid Waste Association (ISWA) for the provision of technical expertise and advice. There was a close informal partnership with the local Department for Cleansing and Beautification (DKP) which is responsible for providing solid waste management services, as well as other duties. Close links were also developed with the agency that was established by the Indonesian government to co-ordinate relief efforts – the Badan Rehabilitasi dan Rekonstruksi (BRR). The State Ministry of National Development Planning (BAPPENAS) was also involved in discussions. Project staff also maintained contact with multilateral and bilateral development agencies – particularly the United Nations Development Programme (UNDP) and the German Agency for Technical Cooperation (GTZ). A number of NGOs have been involved in training events.
22. It cannot be said, however, that these partnerships were involved in the “application of Environmentally Sound Technologies (ESTs) to the treatment/ reuse/ recycle of debris waste generated by the Indian Ocean tsunami”, because the only item of equipment that was supplied by the project is used for green waste most likely generated after the tsunami. Specifications of waste processing equipment were developed for the Request for Proposal (RfP) – and these could theo-

⁴ In this case the EU Grant Application Form replaces the standard UNEP project document.

retically be used by Indonesian authorities in the future to procure these machines – but this information cannot be considered as application of technology.

23. The shredding machine supplied by the project and commissioned in September 2009 is not intended to process most kinds of C&D debris. The machine's manual states that it is not suitable for crushing stone, masonry or concrete and the manufacturer's non-liability for damage resulting from disregarding this restriction. It is a shredder which is designed to break foliage and tyres into small pieces as a first stage of a composting process or for preparing fuel material, or to reduce the volumes occupied by such materials in a landfill.
24. Additionally, it is not appropriate to use this machine to process timber from demolition wastes because such wood may have been painted or treated with fungicides, and these chemicals would make the wood unsuitable for composting. Furthermore, in accordance with the waste management hierarchy⁵, it is better to reuse construction timber than to recycle it. In fact, construction timber is being reused by the UNDP-led Tsunami Waste Management Project, and a workshop was established for the purpose near Gampung Jawa to produce furniture and other construction items such as doors and windows. Therefore there is little reason to believe that the machine has made a contribution towards the treatment of day-to-day C&D wastes.
25. Since the purchased machine should not process construction timber, it should be used to process only trees, branches, and vegetative waste. It is questionable whether a machine of this size is needed for this portion of the waste. The total running time of 184 hours between September 2009 and end of May 2010 indicates that it was under-utilized. A further contribution to rehabilitation could be the supply of shredded green waste as fuel, either unprocessed or processed (in form of briquettes) to affected communities, but this has not been formulated as an activity of the project, and this application would require a second shredder to reduce the particle size to the range required for making briquettes.
26. It follows that the project has not made a significant impact within the scope of the stated objective. However, the project has generated useful outputs in other ways.

4.2.2 Results

27. Consideration will now move to the five intended project results, as listed in the Logical Framework of the Grant Application Form:

Expected result #1: Waste management mechanisms established for treatment, re-use and recycling of tsunami generated debris.

28. The extent to which this result was achieved depends on the understanding of the word "established". No mechanisms for managing tsunami-generated waste were set up in a physical sense. If "mechanisms established" is understood to include the preparation of plans, this result was achieved to some extent because reports were prepared to provide guidance on assessing quantities and types of disaster-related debris, on the selection of waste processing machinery and on preparations of plans for responding to future disasters⁶. The project did not develop these general approaches and principles into specific plans, but the reports that were written do

⁵ The waste management hierarchy is a guide for prioritising waste management practices with the objective of achieving the optimal environmental outcome. It sets out the preferred order of waste management practices (avoid, reduce, reuse, recycle, recover, treat, dispose) from the most preferred to least preferred.

⁶ "Disaster Waste Management Mechanism: A Practical Guide for Construction and Demolition Waste in Indonesia" (http://www.unep.or.jp/ietc/Publications/DEBRI/DEBRI_8_Disaster_Waste_Management_Mechanism.pdf);

"Guidelines for Collection of Data on Debris Resulting from the 2004 Indian Ocean Tsunami in Banda Aceh, Indonesia" (http://www.unep.or.jp/ietc/Publications/DEBRI/DEBRI_1_Guidelines_for_collection_of_data_on_debries.pdf);

"Technology Identification and Selection" (http://www.unep.or.jp/ietc/Publications/DEBRI/DEBRI_5_Technology_Identification&Selection.pdf)

provide a foundation of information for the preparation of such emergency plans. Indeed, lessons learnt during the project were used by the MoE to formulate the disaster debris section of the Waste Management Law (2009).

Expected result #2: New ESTs for debris management, particularly reuse/ recycle technologies, successfully applied and utilized in Banda Aceh in handling tsunami generated debris.

29. The mobile shredding machine is in use, though the letter provided by DKP referring to 5,500 tons of processed debris does not indicate whether this debris was tsunami-generated or municipal waste.

Expected result #3: Capacity of local and national government officials enhanced in debris handling and processing, technology assessment methodologies, reuse/ recycling and related issues, so as to ensure sustained application of ESTs in waste management not only in the post-tsunami programmes, but for everyday municipal wastes and future disasters as well.

30. Very little evidence was supplied to the consultant regarding capacity building. A summary of the workshops that were conducted and the existing information about them is in Section 4.7.6. The second interim report refers to the development of training materials. Two PowerPoint presentations were received but it is unclear for which occasion they were made. No information was provided concerning the content of these training materials and the numbers and levels of the trainees. It is mostly not known who participated in these events and what subjects were covered, and no evidence of increased capacity resulting from these events was seen.

31. Reports were produced on selection of technology for processing solid wastes, and these reports were posted on the project website. Information is still needed on the number of copies printed and distributed. They were produced only in English, but the overwhelming majority of officials in the Banda Aceh DKP do not speak English, so it is not clear how the target readership for these reports was defined. According to the Senior Programme Coordinator most of the publications had a summary prepared in Bahasa but those were not posted on the website or presented to the evaluator. Furthermore the Senior Programme Coordinator stated that the officials who were involved have a sufficient command of English. The website and the reports posted on it, however, would reach a broader audience if they were not in English only.

Expected result #4: Economic instruments for long-term viability of ESTs are developed, which includes the development of appropriate tax structures and subsidies to promote the use of aggregates generated from the waste processing.

32. A useful review of the range of economic instruments and financial measures has been prepared. One version of this report is on the project website. This covers issues related to revenue collection and financial incentives, but it provides no specific or concrete recommendations. It would benefit from an executive summary or some concise conclusions. In Annex 2 of the report "Contextualizing Economic Instruments of Waste Management in Indonesia Policy Options and Transition of Institution" there are some more concrete recommendations about promoting composting by means of links with the Ministry of Agriculture and with manufacturers of chemical fertilisers (neither of which is an economic instrument), and though these links already exist, it is appropriate to mention them as important in the promotion of composting. However, there are no clear recommendations regarding "economic instruments for long-term viability of ESTs" and so it appears that this result has been only partially addressed:

Expected result #5: Improved knowledge and technical competence in applying ESTs by other affected countries in Asia

33. Among the reports on the web site are two that are concerned with the selection of technology for processing solid waste. The technologies are compared according to a long list of criteria; the length of this list indicates a holistic approach to technology selection. The method of selection is based on a decision-making tool developed by IETC, called the Sustainability Assessment of Technologies (SAT). However, the actual selection process that is followed is not sufficiently practical, particularly because it assigns similar weighting to each criterion (when some – such as the factors that would lead to a complete end to operations – are clearly of far greater significance than others) and it is purely subjective and qualitative, not considering actual values of costs, capacities and times (such as downtime and delivery times) in actual situations. Comparisons of capital and operating costs can be very misleading unless expressed in terms of unit costs – typically costs per ton.
34. Some of the comparisons are misleading – for example waste minimisation (included because the project directive was to also to cover day-to-day waste) is not an alternative to sanitary land filling because they are complementary – and waste minimisation (as distinct from reuse and recycling) is not an option for disaster waste (unless it involves building houses with less material or improving their resistance to earthquakes and tsunamis).
35. The consideration of anaerobic digestion appears to be based on shallow textbook information rather than practical operating experience. In the case of composting only one method (windrow composting) is selected for consideration, whereas there are many ways in which biodegradable wastes can be composted. According to the DEBRI Senior Programme Coordinator windrow composting was included as the only method because the DPK decided this to be the only viable and useable method under local conditions. In summary, the list of equipment and the range of criteria are positive aspects of this output, but the method of selection is inadequate.
36. The availability of these reports on the web site provides the opportunity for English-speakers in other countries (not only in Asia) to benefit from them when they are planning their response to a disaster that destroys houses and infrastructure or when they are faced with the challenge of large quantities of disaster debris. The fact that the reports base the selection process on subjective qualitative – and often theoretical – assessments limits their usefulness.
37. An important aspect in selecting technology is to estimate the throughput that is required. Three reports concerned with estimating the quantities of the various types of waste generated by the tsunami are available on the web site. The guidelines and methodologies presented in these reports could be of great assistance in the task of assessing the required throughputs for waste processing equipment in similar situations.

4.2.3 Effectiveness

38. The expected impacts on the target groups as defined in the Grant Application Form were defined as follows:

(a) Situation of target groups	(b) Technical and management capacities
Impact on house owners and other building owners/occupiers: Rehabilitation and reconstruction facilitated by removal of potential physical hazards (access restrictions, possibility of collapse) posed by the presence of destroyed buildings and construction waste	Impact on local government: <ul style="list-style-type: none"> - Local capacity built on developing and implementing waste management mechanisms capable of handling disaster waste and subsequently day-to-day wastes - Capacity built in formulating and implementing appropriate economic instruments for promoting recycle/reuse of construction/demolition waste;
Impact on local public <ul style="list-style-type: none"> - Reduction of public health risks through the sound and environmentally safe handling, removal and disposal of disaster wastes; - Additional remunerative opportunities created from waste management 	Impact on local public <ul style="list-style-type: none"> - Development of facilities and management capacities to handle day-to-day construction/demolition waste - Additional market created for waste processing and using technologies/equipments
Impact on Construction and road building agencies: Increased local availability of construction materials	Impact on Republic of Indonesia: Increased awareness on the scope and potential of recycling waste materials
Impact on Republic of Indonesia: Reduced demand on extracting natural resources due to availability of recycled raw materials	Impact on communities in general: Capacity built on managing and reusing demolition debris in case of future disasters

39. The impacts related to “removal” might have been appropriate for the situation when the grant application was produced but obsolete when the project activities began in April 2007. As no new or revised project document had been produced this must be considered unaccomplished and an incorrect assumption of the project. However, the overall and the specific objectives were and are still valid and impacts can be deduced from the outputs and the expected results/outcomes of the logical framework.
40. The following project outputs are used for the ROTI:
- A mechanism is available to guide the management of both post-disaster waste and day-to-day construction and demolition wastes;
 - Environmentally-Sound Technologies (ESTs) for municipal waste management are identified and demonstrated. (Here the focus is shifted from the management of disaster waste to the treatment of municipal waste)⁷;
 - Training for local government officials in the handling and processing of debris;
 - A package of economic instruments that ensures long-term viability of ESTs is available;
 - Experience-based knowledge regarding the management of post-disaster waste is made available to other affected countries of Asia.
41. The matrix for the ROTI is on the next page. As mentioned in the section on “Rating justification” it is considered that the potential impact of the information materials is reduced by the fact that they have been mostly produced in English⁸. Very little information about the capacity building aspects of the project was provided, and so the rating is based on the evidence that was available. The shredding machine already has environmental benefits because it reduces the volume of the landfill that is taken up with vegetation (or green) waste, and it also has the potential to reduce the volume occupied by discarded tyres, by allowing the waste to be packed more densely within the landfill. A further benefit is that the amount of oxygen retained in the landfill is

⁷ At the workshop on technology selection, in the presence of the Vice Mayor of Banda Aceh in the meeting, there was a plea that the technologies procured under the project be suitable for handling not only C&D wastes, but also municipal wastes. (Second Interim Report).

⁸ According to the Senior Programme Coordinator 25 PowerPoint presentations were prepared in Bahasa. Only two were received (one on waste threats and one on temporary waste storage).

reduced so that the risk of fire is less. Additional environmental benefits would result from the use of a screening machine, preferably with another shredder that would further reduce the size of the green waste, so that mulch and compost could be produced to improve the soil and increase agricultural yields. The shredding machine cannot be used for C&D waste – apart from any trees and shrubs that are mixed with it. Similarly, it can only be used for component of disaster waste that is vegetation. If the technology demonstration component of the project is restricted to C&D waste, the shredding machine makes an almost insignificant contribution.

42. **ROtI Matrix** (See also Annex 8.5)

Results rating of project entitled:		Demonstrating ESTs for Building waste Reduction in Indonesia – DEBRI					
Outputs	Outcomes	Rating (D-A)	Intermediary	Rating (D-A)	Impact (GEBs)	Rating (+)	Overall
A mechanism is available to guide the management of both post-disaster waste and day-to-day construction and demolition (C&D) wastes.	The measures proposed in the mechanism are incorporated into disaster response plans – and implemented for day-to-day waste management	B	Widespread dissemination of these waste management mechanisms.	C	Improved management of post-disaster debris and day-to-day construction waste		BC
Environmentally-sound technologies (ESTs) for municipal waste management are identified and demonstrated	An EST is set up and operated on a regular basis and achieves environmental benefits.	A	The necessary additional equipment is purchased so that a marketable product or environmental benefit is obtained from the processed waste	C	Harmful environmental impacts caused by municipal solid waste are minimised.	+	AC+
Local government officials are trained in the handling and processing of debris.	Local government officials are capable of handling and processing debris.	C	The training materials are made available in appropriate situations, and trained staff are available	D	Economical and environmentally -friendly waste processing		CD
A package of economic instruments that ensures long-term viability of ESTs is available	National and municipal decision-makers are convinced of the value and effectiveness of these instruments	D	The recommended economic instruments are implemented and achieve their intended purpose.	D	Economic instruments are used effectively to ensure that ESTs continue to operate for their full design life		DD
Experience-based knowledge regarding the management of post-disaster waste is made available to other affected countries of Asia	Officials and experts with responsibility for the management of post-disaster are familiar with this knowledge	B	The knowledge thus made available is valued and used by officials in making plans for disasters	C	This knowledge is used elsewhere to solve problems caused by post-disaster waste		BC
	Rating justification: No information provided about training. The project provided no experience of processing debris. Information materials mostly provided in English only.		Rating justification: Method of promotion and dissemination of information materials is not specified.		Rating justification: No information provided about evidence of impacts apart from operation of shredder.		

43. The UNEP expected accomplishments (for disasters and conflicts) are:
- (a) *That States' environmental management contributes to disaster risk reduction and conflict prevention;*
 - (b) *That acute environmental risks caused by conflicts and disasters are mitigated;*
 - (c) *That the post-crisis assessment and recovery process contributes to improved environmental management and the sustainable use of natural resources.*
44. The project has the potential to contribute to a reduction in environmental risks arising from disasters if the guidance materials – particular the Waste Management Mechanism, and also, to some extent, the information on waste processing machinery – are incorporated into disaster preparedness plans and local guidance documents. Effective processing of post-disaster debris, as recommended in these documents, reduces the area of land that is required for waste disposal and also reduces the requirements for raw materials and the energy required to extract them.
45. No particular gender aspects have been identified. Women and children clearly have a major impact on the generation of waste in the home and in schools, but green waste and C&D waste are of less concern to women and children. The processing of green waste is not expected to generate much employment, and it is likely that women will not be interested in the work that is involved.

4.2.4 Relevance

46. The information materials that have been produced are relevant to the cross-cutting issue of *Disasters and Conflicts* that is included in the UNEP Medium Term Strategy 2010-2013. The technology that was demonstrated is of little relevance to disasters and conflicts, but a useful means of improving waste disposal and recycling green waste. The project is more relevant for municipal waste than for Tsunami waste and the machine would therefore have been just as relevant to any other Indonesian city that has a waste management problem (and maybe less attention from international donors). Visibility of the machine, however, is higher in Banda Aceh.
47. The technology that was provided by the project is closely relevant to Target 9 of the seventh Millennium Development Goal – “Integrate the principles of sustainable development into country policies and programmes and reverse the losses of environmental resources”. By taking the first step towards the preparation of mulch and compost from green waste, the project is not only supporting the recycling of waste but is also helping to conserve soil resources and promote organic agriculture. The siting of the shredding machine in Banda Aceh is significant because the city has an active programme for promoting composting and recycling (having a plastic processing facility, a schools recycling programme and a household composting scheme) and also has a sanitary landfill that offers a considerable degree of environmental protection. Furthermore, Banda Aceh has won competitions for the cleanest city and maintains its streets in a very clean state. The city can therefore be described as a “centre of excellence” in waste management, and it offers useful demonstrations of good environmental practice. It is therefore a strategic location for the shredding machine and the composting operation that could be associated with it. The provincial Public Works Department has agreed to fund the construction of a shelter for the shredding machine, but additional funding will be needed to provide at least a screening machine to separate the fine material from the coarse, and a paved area for building the wind-rows of compost.
48. A letter from the Officer-in-Charge in UNEP DTIE IETC to the EU from 23 April 2008 justifies the purchase of the machine as it addresses “the major/ larger volume of inorganic construction and

demolition wastes resulting from the tsunami” as “70% of the wastes are inert/ inorganic in nature, including stones, bricks, concrete etc.” As the machine turns out to be unsuitable for these inorganic materials which usually account for more than 70 percent of the waste, the project loses relevance considerably.

4.2.5 Efficiency

49. There are three aspects of the project which appear not to have provided good value for money, but with regard to the other aspects of the project there is no reason to question the efficiency.
50. The first of these aspects is the organisation of the project. Three staff members were appointed to work in the MoE, and it is not clear what part they played in the management of the project apart from arranging meetings and taking part in discussions. The ToRs for their appointments were not provided to the evaluation consultant. In all appearances, most important decisions regarding the project were taken in Japan, by the Programme Coordinator assisted by a part-time Project Manager. Lack of efficiency is also reflected by the fact that the on-site UNEP national staff member in Bandah Aceh could not speed up the clearance of the machine which spent 6 months in customs. It appears that the appointment of these three was not cost-efficient, and one full-time staff outside MoE in Bandah Aceh could have achieved the same if not more.
51. Furthermore, there was a large number of meetings, apparently involving quite a small group of people, to discuss the development of the project at the early stages. The second interim report records that there were 11 meetings concerned with organisational management planning and nine in connection with the operational setup, all during the initial stages of the project. No minutes of these meetings were provided so it has not been possible to assess more definitively whether it would have been possible to save time and money by organising these meetings in a better way. In the second Interim Report it is noted that the involvement of the MoE was considered essential but the weakness was their lack of support or understanding of the reporting requirements. This comment adds to the concern about the need for three full-time project experts in the MoE.
52. The second aspect is timeliness of the project implementation. The financial agreement with the EU was signed on 4 September 2006 and the project started on 1 November 2006. The first activity related expenditure is recorded in April 2007. Clarification on this was requested from the project but was not provided. The project document scheduled “technology demonstration” eleven months after project start which would have been October 2007. The RfP was only finalized in April 2008 and the machine was handed over to the DKP in September 2009, thus the procurement process started with 15 months delay. Effectively, it took the Procurement Office in the United Nations Office in Nairobi (UNON) 18 months to procure one big, relatively common machine that shreds mostly organic waste while the RfP asked for four smaller machines that can a) crush solid waste b) sort solid waste, c) shred organic waste, and d) turn organic wastes to aerate and compost it,
53. The third aspect is whether the shredding machine represents good value for money. First, the equipment purchased by the project for EST demonstration purposes was expected to demonstrate at least four key tasks related to building waste reduction: size-reduction and crushing, sorting, aggregation and material handling. The shredding machine procured by the project is only capable of crushing organic waste and rubber tires. The conveyer belt used to discharge the crushed waste coming out of the shredder can hardly qualify as a demonstration of building waste sorting. Aggregation and material handling are also not demonstrated by the purchased equipment. Second, the machine has a capacity of 60 tons per hour, which is very high in comparison with the amount of green waste that needs processing. The machine was commissioned

in September 2009, and an email from the DKP states that the machine had been operational for 184 hours⁹. This indicates that the machine has been operated for less than four hours a week. This is a very low rate of utilisation and is clearly uneconomical in terms of the cost of processing a ton of waste, especially if the capital cost is taken into account. Even if the capital cost is ignored, the cost is high in terms of maintenance. The maintenance schedule specifies several levels of maintenance, each to be carried out at different frequencies. For example, the maintenance manual for the engine specifies the criteria shown in Table 1 for deciding when particular maintenance tasks are to be carried out. The manual clearly states that the criterion that applies is the one that comes first.

Table 1. The triggers for maintenance at two frequency levels

Maintenance level	Frequency based on -		
	fuel consumed	service hours	calendar period
1	10,400 litres	250 hours	6 months
2	83,250 litres	2,000 hours	12 months

54. For example, if the machine is working two hours a week, in six months it operates about 50 hours, and then the servicing tasks for maintenance level 1 must be carried out, because of the six month frequency. The servicing will involve changing some of the fluids and replacing some of the components. These fluids and parts must be imported from Germany at considerable cost. If the machine has worked only 50 hours (instead of the permissible 250) the cost of maintenance per ton of waste processed is five times what it would be if the machine were more intensively utilised. If the machine is not maintained according to the service schedule in the operating manual, it is likely that the machine will prove unreliable and the eventual costs of breakdown repairs will be high.
55. The Managing Director of VM-TEC GmbH (the machinery supplier) stated in a telephone interview that the choice of machine was a compromise because of the proximity of the project closure date. He also confirmed that the delivered machine, despite the project reports and the confirmation letter issued by VM-TEC cannot handle "concrete (including concrete blocks), stone (marble, granite, rock etc.), brick and other such solid wastes" as defined in the RfP. This is further documented in the machine's manual and in the procurement documentation. The UNEP Senior Programme Coordinator, however, communicated that he has personally witnessed the machine being used for crushing stones.
56. Much smaller shredding machines are available. Smaller machines could be utilised in a more efficient way, and the reduced expenditure on a smaller shredding machine would have allowed the purchase of other items that are necessary for composting the waste – at least a screening machine to separate the fine material that is suitable for composting from the larger pieces of wood, and preferably also a small shredder to reduce the size of the pieces of vegetation, and an additional fine screen for final screening of the product compost. A chainsaw could also have been purchased for cutting up large tree trunks, rather than requiring a large shredding machine to handle them.

⁹ The evaluation consultant was told during his site visit that the operational time of the machine was only 35 hours.



Shredder in action, with input hopper raised



Green waste being loaded into shredder

The shredder rotors which rotate in opposite directions to drag in and break up the green waste



4.3 SUSTAINABILITY

4.3.1 Financial sustainability

57. On-going financial commitments are in connection with the shredder and the concern to compost the green waste. The cost of the spare parts for the first service of the motor, including

freight costs, was in the region of € 1,500. Later servicing is likely to involve greater expenditure. In addition, the other components of the machine require servicing, particular the rotors that cut and break up the waste. A letter from the Head of DPP to UNEP dated August 2008 confirms a budget provision for the period 2009-2010 for the operation and maintenance of the machine. The letter does not specify the amount allocated. The Managing Director of VM-TEC observed during the first inspection of the machine, six months after installation, that one reason the machine was under-utilized was partly the lack of diesel and oil. This hints at an insufficient budget allocation or disbursement of the same.

58. The financial sustainability of composting also raises questions. Though all agree that composting is appropriate and necessary from an ecological perspective, municipal composting operations have usually proved financially unsustainable without significant subsidies, often because the market is not willing to pay a price that covers the cost of production, or the demand for compost is insufficient. The consultant is not aware of any study that was done to investigate the financial feasibility of composting before shredding was identified as the technology to be supported by the project. Contacts have been made with a local manufacturer of chemical fertiliser in the hope that the compost produced by DKP can be marketed by that manufacturer, thereby improving the chances that a financially sustainable way can be found to produce and sell compost.
59. Investment will be needed – probably coming from municipal and provincial sources – to provide the infrastructure and machinery that are still required for the establishing of a composting operation. It is also likely that a recurrent subsidy will be needed to help to cover the operational costs of the composting operation.

4.3.2 Socio-political sustainability

60. The main concern in this context is whether the shredder will be effectively used in the future to make compost. Effort will be needed to promote the use of compost, involving demonstration schemes, publicity and advisory services. Allocation of this funding will require political support.
61. Current practice is that green waste is collected at the same time as household waste, and it is separated from the household waste at the disposal site. This involves extra work for the collection crews on the trucks. It is likely that the collection labourers will need to be closely supervised to ensure that they separate the green waste for shredding, rather than taking it all directly to the landfill tipping face for rapid discharge with the household waste. This will require continuing co-operation between the collection, disposal and recycling sections of the DKP, particularly because this separation of green waste reduces the time that the trucks can spend picking up waste.
62. The impact of the information materials, particularly the manual on the Disaster Waste Management Mechanism, will depend on the extent to which local administrations are motivated to plan for possible future disasters.

4.3.3 Institutional framework and governance

63. One of the aspects of the project was the development of economic instruments that can promote good waste management practice. Whilst some economic instruments replace the need for enforcement mechanisms, others require effective enforcement. (An example of this latter case is the need to prevent illegal dumping of waste if households or businesses are charged according to the amount of waste that they discard, rather than being charged a standard, fixed fee.) The UNEP publications on waste management and economic instruments show compliance with the new Indonesian Waste Management Law).

64. Links between the collection, disposal and recycling arms of the DKP are needed to ensure a good supply of green waste, as discussed above. Links are also needed between the municipal and agricultural sectors to promote the use of compost.

4.3.4 Environmental aspects

65. No environmental threats to the sustainability of the project outputs have been identified. The environmental benefits relate to the shredding machine that reduces the volume of the landfill that has been taken up with vegetation (or green) waste and tyres. By allowing the waste to be packed more densely within the landfill, the amount of oxygen retained in the landfill and the risk of fire is reduced. The shredded remains can be used for compost or for fuel if additional processing is provided.

4.4 CATALYTIC ROLE AND REPLICATION

66. No changes in policy, priorities or regulatory frameworks that were linked to the project and that could have a catalytic effect were identified in the information that was provided. However the shredding machine is expected to have a catalytic effect in two ways:
- The presence of the shredding machine can catalyse investment from provincial and municipal authorities to build a composting plant around the machine. This investment can include the purchase of a screening machine and the construction of a shelter for the machine and paving for the composting operation.
 - Banda Aceh has a number of features in its waste and resource management system which attract visitors on study visits. The demonstration of the shredder (and later, it is hoped, a composting operation) can be expected to encourage replication elsewhere.
 - A letter from the Mayor of Banda Aceh to the MoE states that the MoE regards DEBRI “as one of four model projects to showcase the national waste management law (No.18/ 2008)”. The mayor believes that DEBRI will further “Banda Aceh’s own waste management plans and strategies for the future (...) and will also help implement elements of the broader 3R strategy (Reduce, Reuse, Recycle) that is being pursued by the city of Banda Aceh”.
67. The reports that were provided do not identify any incentives, institutional changes, policy changes, or catalytic financing derived from the project that are expected to lead to or oppose replication or scaling up.
68. The technology demonstration component is suitable for replication in broad terms, though the inappropriate sizing of the machine should not be copied.
69. The head of the recycling section of the DKP is enthusiastic and committed to his work and can be regarded as a champion for the recycling of green waste.
70. The second Interim Report refers to the use that was made of documents prepared by the project in the context of disasters elsewhere:
- *A number of disaster recovery efforts, following major disasters in the region, particularly the Myanmar cyclone and Chinese earthquake, benefited from advice provided by UNEP on debris management. This was done through the UNDAC mechanism as well as through training and on-site advice provided by UNEP.*
 - *Training for local officials and government staff members from Asia, Africa and Latin America, have also used DEBRI materials.*
 - *Within the planned implementation of the law, DEBRI is being used as a showcase model for disaster debris management, and is encouraging other cities and local authorities to undertake ‘waste preparedness’ within their disaster management plans.*

- *Lessons learnt from the DEBRI project are to be used by UNEP to develop similar programmes and projects in the biennium Work Programme of UNEP for 2010-2011.*
 - *UNDAC-trained staff members of UNEP, including those involved in the DEBRI Project, have used, and continue to use, project materials in field assessments and in UNDAC Preparedness Missions.*
 - *A global agreement between UNEP and ISWA envisages the development of projects on waste management, including those related to construction and demolition wastes, and disaster wastes.*
71. In the sixth quarterly report it was reported that:
- Documents prepared by the project so far had been packaged in a CD-Rom and disseminated widely to a range of stakeholders in the region working on disaster wastes.
72. The question sent to IETC regarding how many CD-ROMS were disseminated and to whom was never answered. It has not been possible for the consultant to independently substantiate any of the above claims, but there is no reason to doubt that they reflect the usefulness of the documents in other situations.

4.5 STAKEHOLDER PARTICIPATION AND PUBLIC AWARENESS

73. The stakeholders for the components of the project that were associated with the planning of waste management following a disaster are the Ministry of Environment (MoE/KLH), the Ministry of Planning (BAPPENAS), the agency responsible for reconstruction (BRR) and the City Administration of Bandar Aceh. Although records of the meetings and training events were not provided, it is clear that these organisations were involved in the preparation of the output documents of the project.
74. It is not clear to what extent these organisations were involved in the selection and specification of the shredding machine. There were two workshops dedicated to the selection of the equipment, but it is not clear how the priorities and concerns of all stakeholders were incorporated into the final selection. According to a letter from the Officer-in Charge of UNEP DTIE IETC to the EU the Indonesian MoE, DKP and the EU office in charge for DEBRI were consulted before the order was placed with VM-TEC. However, the stakeholders' agreement was given based on the assumption that the machine could handle stone, bricks and concrete.
75. Stakeholders for the proposed composting operation include the Ministry of Agriculture, the Agriculture Department at the local university and potentially a local producer of chemical fertiliser. All three have been involved in the preparations for composting at the Banda Aceh landfill site. (A sample of the composted output from the shredder was sent to the local producer of artificial fertiliser in the hope that the industry would promote the distribution of compost. No reply had been received at the time of the evaluation mission.)
76. ISWA has provided advice and input to the technical components of the project. Nothing has been reported about the quality of the collaboration between UNEP and ISWA.
77. Three target groups were identified in the project document: Local government, local public and local house and building owners/ occupiers. The overall relevance for the target groups, according to the project document is the "reconstruction and rehabilitation of Bandah Aceh", a definition that should have been updated when the project started. Specific relevance for the target groups was defined as follows:

Target groups	Relevance
Local government	They have the responsibility of getting the debris cleared as quickly as possible and in an environmentally sound manner and also provide resources for the reconstruction process. The project will help to develop a waste management mechanism, which will not only help in environmentally sound handling of debris but can also be used for handling day-to-day waste.
Local public	The local community need alternative business/ employment opportunities after the devastating effects of the Tsunami. The project will create additional business opportunities (debris collection, debris processing facilities, aggregate/filling material/fuel/compost marketing) and thus provide additional jobs. It is highly desirable that normal waste planning mechanisms at local and at national level address the issue of high-volume wastes from disaster events as well. The project will build capacity in relevant agencies on this aspect thus providing the cities with a replicable model of a comprehensive and environmentally sound mechanism to handle post disaster debris waste.
House owners and other building owners/occupiers	They need to dispose off the debris from damaged house and also require cheap and locally available construction materials for reconstruction.

78. While those aspects concerning the clearing and disposing of tsunami waste have been no longer relevant from the beginning of the project, the local government has been participating in the knowledge sharing and technology application part of the project. It continues to do so since the DPK has taken over the shredding machine. Participation of the local public, including the private sector, is limited as the operation of the shredding machine has not created any new jobs so far. Neither has or will the project provide house and buildings owners/ occupiers with construction material for reconstruction.
79. A public awareness rally was held in a public park on 2 August 2008 to promote recycling and other aspects of good waste management practice, and to inform the public about the new waste management law and the DEBRI project as one of four pilot projects that showcases as model for the new law. It was attended by 1000 people, including 400 schoolchildren, the Mayor of Bandah Aceh and two Vice mayors. The events also included an exhibition where various different ways of using and processing waste materials, including composting and making handi-crafts were put on display by community groups and NGOs operating in Banda Aceh. A brief report on this event was prepared, but it is not clear what role the project played in the staging of this event.

4.6 COUNTRY OWNERSHIP AND DRIVEN-NESS

80. The evaluation consultant was not able to arrange a meeting with the experts who had been supporting the project within the MoE.
81. The EU Monitoring Mission report from April 2008 states that “the only counting result as yet is that the project management succeeded in organizing all the beneficiaries to accept the project, after initial reluctance and ignorance from both officials in the capital as well as in the field.” Proof of that acceptance is found in a request for project extension to the EC from 11 August 2008, where the MoE states that the capacity building efforts of the DEBRI project have been integrated into existing work of the MoE and DKP and can be used for “further expansion of their programmes and projects in other parts of the country, or other disasters”.
82. On the local level, ownership has been demonstrated by the indication of the provincial Public Works Department to allocate funding for erecting a shelter for the shredding machine during the next financial year, and the DKP of Banda Aceh has provided funds for the purchase of spare parts and lubricants for the machine.

83. The latest legislation on solid waste management (Law 18 of 2008) seeks to promote recycling and the “Polluter pays” principle, so it is expected that the guidance on recycling and on economic instruments provided in the project reports will be of value in the process of implementing this legislation. The new legislation shows the commitment of the Indonesian authorities to improving solid waste management and to reduction, reuse and recycling of waste streams.

4.7 ACHIEVEMENT OF OUTPUTS AND ACTIVITIES

4.7.1 Introduction

84. The numbering and description of the Activities and Outputs in the initial project document/ Grant Application Form and the Sub-project Document are different from the details presented in the later quarterly reports. The numbering and descriptions used towards the end of the project will be used here.

4.7.2 Activity 1 – Baseline data creation

85. The baseline data concerned the quantities of the various types of debris generated by the tsunami that had already been collected and disposed of, and the amount that was still awaiting collection. The data were largely based on figures that were available in reports prepared by other UN agencies and donor organisations, but field checks were also made by the consultant who was engaged to write the reports. This information was an essential starting point for a project concerned with post-disaster waste, because it is necessary to know the quantities and types of debris that need to be collected and disposed of so that the appropriate measures and equipment (considering both the types and capacities of the equipment) can be determined. The studies indicated that there was a considerable amount of debris that had been cleared but was not properly disposed of so that the project should initially concentrate on tsunami waste in the landfill sites and then shift to municipal and day-to-day waste.
86. Three reports were prepared on the topic of waste quantities. Some information about them is provided in the boxes below

Title & date	DEBRI 1 Guidelines for collection of data on debris resulting from the 2004 Indian Ocean Tsunami in Banda Aceh, Indonesia (10 pages, undated).
Brief abstract	These guidelines were developed in order to lead activities related to firstly, collecting all existing information on Tsunami-generated waste, including the organizational and operational processes to clear it; secondly, creating baseline data that will help in developing a waste management mechanism to handle day-to-day construction and demolition waste, but quickly up-scaled to handle debris during a disaster.
Consultant's comments	This report is useful first step in that it describes the situation regarding waste management after a disaster, presents the data needs for taking remedial action, and offers guidance on how the data should be collected and presented.

Title & date	DEBRI 2 Preliminary Data Report on Tsunami-generated Debris (11 pages, undated)
Brief abstract	This preliminary report on the tsunami-generated debris was intended to collate existing basic data to provide the basis for a full consultant-generated report. The data presented in this document was substantiated and added to/confirmed by the consultant as per the agreed terms of reference and the Data Collection Guidelines.
Consultant's comments	This report contains information about percentages of houses in various conditions, generation rates and volumes of various types of waste, and a list of documents. It is not clear why this report is available on the website, given that the next report (DEBRI 3) gives the same information, in addition to other material. It seems that this report is therefore redundant.

Title & date	DEBRI 3 Report on Tsunami-generated Debris September 2007; Prepared by Dr. Suprihanto Notodarmojo (33 pages).
Brief abstract	This is the report prepared by DEBRI Consultant, Prof. Suprihanto, outlining the key findings regarding the quality and quantity of disaster debris.
Consultant's comments	<p>This report states, on page 6: Current tsunamis debris remaining in the city is approximately 58,622 m³ in the form of undemolished buildings, solids and mud in low lying area, or wastes remaining in temporary dumpsites. It is not clear why, if so much debris remained to be moved, there was no scope for the project to be involved in debris management in a practical way.</p> <p>Contradictory data on municipal solid waste are presented without any comment being made. On pages 6 and 7 the generation rate is quoted in weight terms as 0.6 kg/cap.day and in volume terms as 1.2 litres/ cap.day, suggesting a density of 500 kg/m³. Total quantities collected each day in 2006 are quoted as 96 tons/day and 600-700 m³/day, suggesting a density of only 150 kg/m³. Such inconsistencies may not be the fault of the writer, but they should be highlighted and, if possible, explained.</p> <p>This report provides information which could be very useful in other disaster situations, and provides a useful starting point for other project outputs. The report was presented during the Technology Selection Workshop in Jakarta, 27 September 2007.</p>

4.7.3 Activities 2 and 3

87. Activity 2 was concerned with organizational management planning, and a total of 11 meetings were held to develop consensus on the planning of the project. The Quarterly Update for the period February to April 2007 stated that a report was under preparation, but no such report was provided to the evaluation consultant.
88. Activity 3 was concerned with the operational setup of the project and eight meetings with this theme were reported during the quarter May to July 2007. Some of the meeting minutes are available.

4.7.4 Activity 4 – Technology Identification and Management

89. The consultant engaged for this Activity was Dr. Agamuthu Periatamby, from University Malaya. Four reports were produced on this topic, two of which were uploaded onto the project website. A draft report was presented at the *Technology Selection Workshops* in September 2007. There was also a stakeholder consultation on *Technology Identification and Selection* which was held in Jakarta from 25 to 27 November 2007. This consultation brought together 14 participants from the MoE, the BAPEDALDA office of Banda Aceh, and the DKP of Banda Aceh City. At this workshop it was requested that selected technology should also be able to handle municipal solid waste as well and disaster debris and C&D waste.
90. The documents concerning the selection and specification of technology that were provided to the evaluation consultant are described briefly in the tables below. Activities 4 and 5 have been grouped together because the selection of technology (Activity 4) leads to the specification of the technology (Activity 5), and the changes of the descriptions of the desired equipment raise some serious questions about the technical competence of the experts involved or the quality of the editing of the documents. Therefore the documents of Activities 4 and 5 are listed together and followed by a discussion of some of the points raised by the comparison of these documents.

4.7.5 Activity 5 – Technology Demonstration

91. The tasks involved in Activity 5 (together with the responsibilities) have been listed in the Sub-project Document as follows:

- *Identify and assess appropriate, locally-suited and environmentally sound technology needs (ESTs) for managing and utilizing post disaster wastes - particularly reuse/ recycle technologies. (UNEP/MoE)*
 - *Carry out a detailed assessment of the technologies/equipment (types, capacities, list of reputed suppliers) and select appropriate technologies/equipment (up to five technology systems/equipment) for the project. (UNEP/MoE)*
 - *Develop specifications for the selected waste processing equipment to be procured under the project. (UNEP)*
 - *Prepare publications and dissemination materials (MoE/UNEP)*
 - *Organize seminar to disseminate technologies selected for demonstration. (UNEP/MoE)*
 - *Local support for installation and commissioning of selected technologies. (MoE)*
92. The Procurement Unit of the UNON was responsible for launching the tender, evaluating the bids and concluding the contract(s) for the supply of the equipment.
93. The following list provides summary information about the outputs of Activities 4 and 5. In the interests of convenience and clarity the outputs are referred to by the code letter (a to g) that is assigned to them in the following list. The list is followed by discussion of some of the points of concern regarding these outputs.

Title & date	a) DEBRI 4 Key Factors in Technology Identification and Selection (86 pages, undated, pdf).
Brief abstract	This report was prepared by UNEP and used by DEBRI Consultant, Prof. Agamuthu (University of Malaya) to prepare and assess a list of appropriate C&D technologies. It lists the key sustainability factors that need to be taken into account in identifying and selecting technologies.
Consultant's comments	This report is available on the project website. For comments see below.

Title & date	b) C&D Technology Catalogue (23 pages).
Brief abstract	This report was prepared by Prof. Agamuthu (University of Malaya) as an introductory document to the actual technology assessment/selection. It provides a basic explanation on the key technology categories/systems and descriptions. It reviews the range of machines considered for the four applications (size reduction, sorting, waste handling and treatment of organic waste) and describes their attributes according to a list of criteria. It also provides information about how various materials can be recycled.
Consultant's comments	This report is not available on the project website. It provides similar information to the other reports, except that it does not include any scoring of the alternatives or selection. For detailed comments see below.

Title & date	c) DEBRI 5 Technology identification and selection Revised Nov 2007 (99 pages pdf).
Brief abstract	This report was prepared by Prof. Agamuthu (University of Malaya). It is the key document that actually does the technology assessment based on the sustainability factors and ranking/scoring system given to him by UNEP.
Consultant's comments	This report is available on the project website. For comments see below.

Title & date	d) Technology Components (12 pages).
Brief abstract	This document contains the final list of actual technologies that need to be procured under the DEBRI Project for debris waste management. It also includes the agreed recommendations of the technology selection workshop.

Title and date	e) Guidelines for Specifications Waste Management Equipment for the DEBRI Project
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	(10 pages).
Brief abstract	These guidelines were prepared by UNEP with ISWA support. There is a separate list of 250 suppliers. This document is only about the selection of the machinery.

Title & date	f) Technology Specifications: Waste Management Equipment for the DEBRI Project (9 pages).
Brief abstract	This document contains detailed descriptions and specifications of the equipments to be procured under the project. It was developed using the documents, "Technology Components" and "C&D Technology Catalogue" (produced as a part of Activity 4: Technology Identification and Selection) by the MoE, Banda Aceh's Cleansing Department (DKP) and UNEP, in close consultation with ISWA experts.

Title & date	g) Request for Proposals (RFP/08/0024/ss) dated 4 April 2008.
Brief abstract	This is the RfP for supplying the selected machinery. Annex C gives the specifications for the equipment.

94. Before discussing more general points some specific observations will be mentioned:
- It is unexpected that shredding is listed as a *waste handling technology* because normally both shredding and crushing would be considered as *size reduction technologies*, even though they are used for different materials.
 - Compaction is not suitable for the usual types of debris and C&D waste. Compaction is used for low-density packaging waste, such as plastic and cardboard, and is not suitable for concrete, soil, rubble and wood. Compacting machinery is not able to break concrete and brick. It is not understood why it is mentioned in this context – there is no need to consider it using the list of criteria.
 - As has already been mentioned, biogasification (or anaerobic digestion) has not been proven to be successful on a large scale for mixed municipal waste, and it is not appropriate for C&D waste, which contains very little organic matter. Even wood is resistant to microbiological decomposition, requiring fungi rather than bacteria to break it down, and taking more time than is allowed for anaerobic digestion. Already mentioned also was the fact that waste reduction is not an alternative to sanitary land filling. As waste reduction, reuse and recycling are developed, the amount of waste going to landfill will reduce, but in the short- and medium-term there will always be waste material that needs to be landfilled.
95. There are two more general aspects that need to be considered:
- The actual selection process – the method that was used and the selection that was made. Some of the concerns regarding the selection process have already been mentioned in Section 4.2.2. The method that has been used in the reports is subjective and does not use any numerical data. For comparisons of different processes it is important to use unit costs – the costs of treating one ton or one cubic metre. Costs are a very important factor because, if machine A is cheaper than machine B, it may be possible to buy additional equipment with machine A so that the result with this combination is better than could be obtained by machine B, even though machine B is better than A alone. Maintenance is also a much more important factor than many other considerations, not only in terms of cost, but also because of delays while waiting for spare parts to arrive, and the risk that maintenance work will not be done so that the machine soon becomes unserviceable. In this connection an important consideration is whether there is an agent within the country who stocks the necessary spare parts and provides the expertise needed for maintenance and prompt repairs. Costs of operation and maintenance should also be considered in situations in which recurrent funding is not guaranteed. Actual operating experience in similar conditions is also a very important factor, because if the process is described in text books but has not been proved to be practical and

reliable in comparable situations, it is usually wise to reject that option. It is commendable to consider a wide range of factors, as has been done in the reports, but the outcome of this analysis is not an adequate method for selection.

- The second point regarding the specification of the equipment is linked to the values of the parameters that determine the size and performance of the machine. There are two aspects of interest regarding these numbers. One is the inherent “reasonableness” or validity of the values – whether they are appropriate or even feasible, because if these numbers are quite unrealistic this undermines the credibility of the documents containing them, suggesting to bidders and to other readers that there is no clear understanding of what is required. The second aspect is the actual magnitude of the values of the parameters, because if there are significant variations as the process develops, there should be explanations of the reasons for these differences. In order to compare some of the values that have been quoted for key variables that describe the equipment, Table 2 has been prepared, taken data from reports prepared within Activities 4 and 5.
96. A quick review of the table shows some wide variations in the data, in particular between the earlier reports. Some of the differences suggest possible errors in the data. For example in report (b) a motor developing 150-250 HP is said to be enough to process up to 800 tons per hour, whereas the same power is needed to process only 15 to 20 tons per hour in reports (f) and (g). In the case of the sorting belt, the width of the belt is limited to 75 cm in report (d), whereas documents (f) and (g) state that it should be 200cm. (In the consultant’s opinion, 200 cm is too wide for the belt, even if it is picked from both sides.) The recommended speed for the belt varies from 0.5 to 1.0 report (b) to less than 0.06 metres per second in documents (f) and (g). However, the most remarkable value is for the speed of the output conveyor belt for the shredder, which documents (f) and (g) both suggest should be 200 m/s (or 720 km/h); this is comparable to the cruising speed of a commercial jet, and it is fortunate that this requirement was ignored by the successful bidder because such a speed may have thrown pieces of wood a distance of perhaps 50 metres from the machine.
97. Other questions that this information raises include whether a sorting belt of the type described is the best way of sorting C&D waste – if the waste is sorted before crushing, the large, sharp pieces would quickly damage the belt, and if it is sorted after crushing the task of removing small pieces of wanted material would be very costly in terms of time and labour. Another question relates to the compatibility of the sorting belt throughput with the capacity of the compost plant, but it is assumed that much of the sorted waste would be landfilled rather than composted. One further remarkable numerical value was the proposal in report (e) that plastic perforators “in the 1,000 to 2,500 tons per hour range will be well-suited to the needs of the DEBRI.” Assuming that these machines work 6 hours a day, it is hard to see how Banda Aceh could discard 6,000 to 15,000 tons of plastic bottles each day.

Table 2. Comparison of variables used to describe machines in the reports of Activities 4 and 5

	b	d	e (ISWA)	f	g (RfP)	Actual
Crusher						
throughput (tons/hour)	150-800	15-20	25-65	15-20	15-20	-
power (horsepower)	150-250	-	-	150-250	150-250	-
size of output (cm)	-	0.5-7.5	-	0.5-6	0.5-6	-
estimated cost (thousands US\$)	-	93	350-600	-	-	-
Sorting belt						
throughput (tons/hour)	-	5-8	25-50	5-8	5-8	-
speed of belt (m/s)	0.2-2	-	0.5-1	<0.06	<0.06	-
width of belt (cm)	-	50-75	150	200	200	-
estimated cost (thousands US\$)	-	140	-	-	-	-
Shredder						
throughput (tons per hour)	10-35	3-5	-	10-15 [3]	10-15 [3]	60
throughput (m ³ per hour)	-	-	-	100-150	100-150	-
power (horsepower)	150-350	-	80-120	80-100	80-100	350
speed of output belt (m/second)	-	-	-	200	200	-
speed of shredding shafts (rpm)	-	-	-	-	50-800	0-34
size range of output (cm)	-	-	-	1.2-12	1.2-12 [4]	15-30
estimated cost (thousands US\$)	-	93	-	-	-	390
Compost windrow turner						
throughput (thousands m ³ /hour)		0.5 - 1	[1]	0.2-0.4	0.2-0.4	-
power (horsepower)		50-80	-	80-100	80-100	-
estimated cost (thousands US\$)		70 [2]	-	-	-	-

Notes [1] In the ISWA guidelines for specifications there is no information about the machinery required; instead, parameters of the composting process are provided

[2] Includes windrow turner and other small items necessary for composting.

[3] Estimated assuming the bulk density of the incoming waste is 100 kg/m³.

[4] It should be possible to vary the particle size of the output material.

98. Another observation from these documents cast some doubt on the technical understanding of those who prepared them or the quality of the editing. The issue this time is the power to drive the shredder. In document (g) – the RfP – the section on “Components of the equipment” for the mobile waste shredding machine includes “diesel operated cutters”, and yet under “Energy requirements” it asks for electric power. In addition to this apparent contradiction, the machine is required to be mobile so that it can be used in various locations, but there must be few suitable places around the city – particularly after a disaster – where an electricity supply of at least 60 kW is readily available.
99. A more serious concern is raised by comparing the values for parameters given in the RfP and those of the machine that was actually purchased by the project. The recommended throughput was in the region of 10 to 15 tons per hour (this value is based on the consultant’s guesstimate of the density of the incoming waste) – and this is already much more than the actual quantities of waste would require. However, the actual capacity of the machine is 60 tons per hour. The required size of the pieces in the output was 1.2 to 12 cm, whereas the machine that was purchased is claimed to reduce the material to sizes in the range 15 to 30 cm. The purchase of a smaller machine would have released funds for the purchase of a rotating screen for separating

course material, and perhaps a much smaller shredder for cutting up the larger pieces or reducing the product compost to a fine particle size.

100. An additional output of this activity was supposed to be a “performance evaluation of installed technologies”. Apart from one email sent by the DPK about the running hours of the machine since installation, no evaluation on the machine’s performance has been produced.

4.7.6 Activity 6 – Local Capacity Building

101. In the Grant Application Activity 6 was described as “Capacity building of local stakeholders viz. local government officials, civil society, technology users, by identifying target groups, developing training packages, and delivering training”. Outputs were to comprise training materials, a training workshop and multiple meetings. A listing of the workshops reported on in the final DEBRI project report follows below.
102. A workshop on *Technology Selection* was conducted on 27 September 2007 in Jakarta. The objectives of the workshop were to present the analysis of waste management issues in Banda Aceh and identification of technology components and specifications based on baseline data assessment and international knowledge of state of the art waste management technology. Sixteen participants from UNEP, the MoE and IWSA attended. A summary of the discussion was provided.
103. A workshop on *Technology Selection* was conducted on 28 September 2007 in Banda Aceh. A summary of the discussion that took place was provided but no information about the agenda or the participants.
104. Training on *General Capacity Building* was conducted on 28-29 August 2008 in Bandung and Jakarta. This training was on existing and future debris and general waste management system in Banda Aceh. The training targeted local government agencies and representatives of national government agencies located in the Banda Aceh area; the NGO sector, comprising of both local NGOs and local representative offices of international NGOs; political and local leaders and associations. No agenda, minutes or list participants has been provided.
105. Two workshops on potential *Economic Instruments* were held in Jakarta, on 31 July 2008 and in Banda Aceh, on 1 August 2008. The schedule of the workshop in Jakarta shows a presentation on economic instruments followed by a discussion. The Economic Instrument workshop in Banda Aceh was intended to present and explain the definition of economic instruments, various types of economic instrument for waste management, and to compile inputs from waste management stakeholders in Banda Aceh to define the appropriate economic instruments for Banda Aceh. Discussion points on both events include some information about participants but no comprehensive lists.
106. According to VM-TEC an *Equipment Training* workshop for DKP staff that is operating the machine was conducted in Banda Aceh in September 2009. VM-TEC trained 8 staff over 3 days on site in operating and maintaining the machine.
107. The first Interim Report states that “*Training materials (were) prepared and delivered for meetings organized in Jakarta and Banda Aceh*” during the period covered by the report, that is up to September 2007. The consultant was not able to see these training materials, but it is believed that PowerPoint presentations were prepared in the Indonesian language and that they were presented at a workshop held in September 2007. No information was available to the consultant regarding intended target groups and participants at the workshop in Banda Aceh.
108. The development of the 127 page document “Disaster Waste Management Mechanism” was cited as work done within Activity 6 and delivered to the MoE by the end of September 2008,

according to the Quarterly update for that period. The basis of this document is said to have been a conceptual report entitled “*Construction and Demolition Waste Management Practices*” that was prepared by a team from ISWA. The preparation of this document was said to have been assisted by four brainstorming meetings and discussions with other organisations involved in waste management in Banda Aceh, including UNDP and GTZ. The feedback from a workshop attended by 45 officials was also included in the finalisation of that report.

109. It is understood from the Head of the Recycling Section at Banda Aceh that the training on the topic of *economic instruments* was conducted in the Indonesian language with inputs from Indonesian consultants. He also mentioned a study visit tour to Bandung and Jakarta. No reference to these events was found in the Quarterly Updates or Interim Reports, so it is not known whether the project played a part in funding or planning the tour and training.

4.7.7 Activity 7 – Developing Economic Instruments

110. The following tasks are included within the scope of this Activity:

- Identifying the economic potential of waste management activities and economic instruments for addressing barriers to cooperation with local and national authorities.
- Organising workshops in Jakarta and Banda Aceh to discuss potential economic strategies and policy options.

111. A consultant [Dr. Virza Sasmitawidjaja] was hired for this activity. A preliminary report entitled, “*Background Document on Economic Instruments with special reference to Debris and C&D Waste Management*” and dated February 2008 was prepared in consultation with UNEP Economics and Trade Branch (UNEP-ETB) and uploaded onto the project website. It was further developed by Indonesian stakeholders. Dr. Sasmitawidjaja carried out a policy analysis in order to identify economic barriers and develop potential economic instruments for addressing barriers in cooperation with MoE and local authorities. Two meetings, one in Jakarta and the other in Banda Aceh, were organized to discuss economic strategies and policy options. MoE’s own policy dialogue on economic instruments, carried out as a part of the new National Waste Management Law was also used as inputs to the process. The final report: “*Contextualizing Economic Instruments of Waste Management in Indonesia: Policy Options and Transition of Institution*” – was completed by September 2008.

112. These reports use a very broad definition of the term *economic instruments* that even includes public awareness. They provide a useful background on financial aspects of solid waste management. Problems in collecting revenue are discussed. Links are made between some methods of charging for waste collection and the effectiveness of enforcement of legislation. The second report makes the important point that many recycling programmes “*are turning out be economically unfeasible since most of the activities mainly depended on subsidy.*” (p.50). Annex 2 of the second report looks for concrete recommendations for promoting recycling but the only recommendations that are made are in connection with institutional links. The value of this Activity is chiefly in its assembly of general information about economic instruments and financial mechanisms, and if this material is not already available in the Indonesian language it is recommended that the second report be translated and distributed.

4.7.8 Activity 8 – Knowledge Sharing and Information Management

113. The tasks initially envisaged for this Activity were to:

- *plan a campaign and a publication for the community by identifying target groups, and developing training and publication packages;*
- *deliver a campaign event and publication to present the overall results of the project;*

- *establish a regional communications and knowledge sharing system – using the ‘Environmentally Sound Technologies Information System (ESTIS)’ – with associates and other stakeholders in the region.*
114. This activity was completed by the end of September 2008. Using UNEP’s ‘Environmentally Sound Technologies Information System (ESTIS)’, a knowledge sharing system was developed in order to share the background and experience-based information that had been assembled by the project. The output of this exercise was a website that is linked to a common search engine that indexes websites created by ESTIS. Most of the documents prepared under this project have been made available on the website.
115. Although there is some material in common between some of the reports on the website, they represent a useful source of information on the topic of disaster waste management for readers who are competent in English. It is hoped that abridged versions can be translated into other languages.

4.8 PREPARATION AND READINESS

116. The project’s objectives and components were described at the start of the project in a way that appears to have been clear and feasible considering the time frame of the project. However, the project experienced a serious delay. The need for the extensions of the project arose from complications in the tendering process. According to the UNON Procurement Office this was due to three reasons:
- 1) Unclear specifications led to unsuitable bids. According to the project the first tender round needed to be repeated because not enough proposals were submitted. It is not clear whether this happened because of poor or faulty specifications or because more advertising should have been done beforehand.
 - 2) Incorrect financial assumption on the cost of the desired machines led to a compromise in purchase. This means that the initial market research as well as the recommendations collected were inadequate.
 - 3) Internal changes in personnel within the Procurement Office. Over the 18 months the case was handed over to new Case Officers at least four times. Having different case officers working on one procurement project often causes delay. The fact that the last Case Officer (upon request of the evaluation consultant) is unable to find the main file prepared for the case, including the three tenders, the contract and the documentation on the Contract Approval Committee session, indicates a degree of disorganization within the Procurement Office and a poor hand-over of the case.
117. From email correspondence between the cargo company, the UNON Travel Unit, UNON procurement Office, the supplier and DTIE, it becomes evident that neither the UNON Procurement Office nor DTIE in Paris or Japan were aware of the necessary things to do when it came to the shipment of the machine and the customs clearance in the port of Belawan. The DEBRI project was not sufficiently prepared for the clearing of the machine upon arrival. This was partly due to the closure of the BRR which normally managed the customs formalities for the importing of equipment purchased by projects. It is not clear what measures the DEBRI team undertook to get the necessary permits to clear the shipment. The time the machine spent in customs (April to September 2009) caused the project an additional Euro 22,537 in demurrage costs. This far exceeded the shipping costs from Germany to Indonesia of Euro 12,152.
118. Not enough is known about the inputs that were expected from the MoE to make an assessment of the adequacy of their capacity. The only information that was provided indicated that there

were some problems in motivating the MoE to provide reports on time. The other partner organisation, ISWA, has a large pool of experts to call on and so potentially has the capacity to provide the information required, though the lack of institutional structure seems to have caused difficulties in communication, and some details of the reports provided are not up to the standard that would be expected. There appear to have been some delays in finalising the arrangements with ISWA, but these delays do not seem to have a serious impact on the project. It is not known whether a representative of ISWA was involved in delivering any training sessions, as was envisaged in the Memorandum of Understanding.

119. It is not known to what extent the planning of the project drew on the experience of other relevant projects, but it is clear that the DEBRI project took steps to ensure that lessons from other projects were incorporated into project outputs. UNEP has carried out a number of environmental assessments and recorded lessons learnt from previous disasters in the region (Japan, Philippines, et al.), the most recent being the Tokyo Typhoon of 2004. The Grant Application Form states that these assessments and reports shall form a key set of background resources for the project. In addition the *Rapid Environmental Assessment Report* of Tsunami affected countries produced by the 'UNEP Tsunami Task Force' provided lessons for the DEBRI project.
120. No counterpart facilities or resources were mentioned in the documentation that was received, and it appears that the staff who were most active within the MoE were paid by the project. No obvious problems were caused by the legislative framework, although customs procedures appear to have caused a significant delay in the arrival of the shredding machine. The new solid waste management law is in harmony with the objectives of the project.

4.9 ASSESSMENT OF MONITORING AND EVALUATION SYSTEMS

121. Monitoring of progress was documented through the various reports. Progress towards the completion of activities was not reported according to milestones but by describing tasks that had been completed.
122. Risk management cannot be assessed as risks had not been identified in the Grant Application or in the Sub-Project Document. The assumptions listed do not correspond with the actual problems the project faced during implementation.
123. Indicators and Means of Verification (MoVs) for expected results #1 and #4 were adequate. Expected result #2 was supposed to be verified by a field survey on the application of ESTs which has not been done. Indicators for the knowledge sharing events and capacity building were quantitative (numbers of officials, number of participants) which would have required baseline data and setting of benchmarks to be meaningful. MoVs for these results were determined as meeting and workshop reports and minutes which were only partly obtained in form of discussion point summaries in the final DEBRI report on activities.

M&E during project implementation

124. The project monitoring was carried out by the Programme Coordinator at UNEP-DTIE-IETC. Quarterly and annual reports on technical and financial aspects of the project implementation were sent by UNEP to the EU Office in Jakarta. UNEP was responsible for consolidating all the information to draw up the reports for the EU, though according to the Sub-project Document it was the joint responsibility of the MoE and UNEP. The reports listed all ongoing and completed project activities but insufficient information was provided on the start and conclusion of activities to know how closely the implementation plan was followed.

125. EU Monitoring requirements were covered by two EU-appointed Monitoring Missions in May 2007 and April 2008 and through the quarterly and interim reports submitted by UNEP, though the second EU Mission Report states: “A number of general studies and reports have been delivered, while others are not” and complains that the EC has not been timely and correctly informed about the project delay.

126. The two Monitoring Mission Reports (2007 top, 2008 below) rated the project as follows:

1. Relevance and quality of design	c
2. Efficiency of implementation to date	c
3. Effectiveness to date	c
4. Impact to date	c
5. Potential sustainability	c

Note: a = very good; b = good; c = problems; d = serious deficiencies

1. Quality of Project Design	c
2. Efficiency of implementation to date	d
3. Effectiveness to date	d
4. Impact prospects	d
5. Potential sustainability	c

Note: a = very good; b = good; c = problems; d = serious deficiencies

4.10 IMPLEMENTATION APPROACH

127. The project was implemented around three components – technology, capacity building, and economic instruments – which provided for a clear and logical approach. Implementation responsibility was with IETC (UNEP/DTIE) in Japan. Project execution was carried out partly directly by IETC and partly by ISWA and MoE in collaboration with DKP and the City of Banda Aceh.

128. UNEP hired three national staff within the MoE (two in Jakarta, one in Banda Aceh) in order to create country presence. The highest level local staff (the “Local Manager”) was responsible for the local administrative management and logistical arrangements of the project in Jakarta. The local staff in Banda Aceh (the “Administrative Manager”) was responsible for the local administrative management and logistical arrangements of the project in Banda Aceh. In reality, project staff in Indonesia had very limited management responsibilities considering that all important decisions were taken in Japan, by the Programme Coordinator. As explained in Paragraph 51, these local staff were most likely too numerous for the few responsibilities and small work load they carried.

129. A part-time “Project Manager” was hired in Japan, in line with the Project Application Document, who was expected to be in overall charge of the project and responsible for the day to day functioning of the project. The TORs for this position indicate, however, that the Project Manager’s role was to assist the Programme Coordinator with the management of the project. In any case, *de facto* project management was located in IETC Japan, and had as such very little control over the execution of project activities and the utilisation of project resources.

130. A multi-stakeholder consultative process, with inputs from appropriate experts drawn from partner institutions and UNEP was used to ensure consensus and to design and develop the waste management system. It is clear that consultation with key stakeholders was an important feature of the implementation approach and that the documents that were to be the main project outputs usually began with the writing of general background reports which were then developed and linked to local conditions by consultants with local knowledge.

131. The Sub-project Document referred to a “*Project Implementation Committee (PIC)* consisting of key staff members from UNEP-DITE-IETC and MoE to advise and guide the project’s implementation”, but no information about the scope of this committee, its membership or its decisions has been provided.

4.11 FINANCIAL PLANNING AND MANAGEMENT

132. All financing for the project came from the European Union’s EU-ASIA PRO ECO II-B Post-Tsunami Programme. As a regular UNEP project, DEBRI has used the UNEP headquarters’ Integrated Management Information System (IMIS) system for financial management. UNEP/DTIE has collected financial reports from the other two executing agencies (ISWA and MoE), consolidating these into one report on a quarterly basis. For this project, UNEP maintained two sub-accounts, one covering UNEP and ISWA expenditures on an “obligations” basis and one covering expenditures by MoE on the basis of internally certified expenditure reports prepared by MoE. UNEP did not carry out any review of the expenditures by ISWA and MoE, accepting “at face value” the amounts claimed by these partners on the basis that they are properly vetted, trusted partners of long standing.
133. The Contribution Agreement signed between UNEP and the EC, however, specified that costs incurred by project partners contracted by UNEP are eligible under the same conditions as those incurred by the organisation and that contractors’ costs therefore needed to be “identifiable, backed by originals of supporting evidence and verifiable”.
134. Even though the Sub-project document signed between UNEP and the MoE specified the reporting schedules and formats to be used for financial reporting and required that all financial reports were certified and signed by a competent authority in the Ministry, it did not require that supporting documentary evidence of expenditures was kept by the MoE for possible inspection by UNEP or the EC. As a result, neither the MoE nor UNEP have been able to provide supporting documentation to an EC verification mission in the last quarter of 2009. The MoE has also not provided UNEP with a final financial statement audited by government auditors by 31 July 2010. As a result, the EC has deemed the reported MoE expenditures ineligible. UNEP/DTIE has meanwhile obtained a signed final financial statement from the MoE and claims that all supporting documentation can now be found in Jakarta. It remains to be seen if the EC will come back on its previous decision and agree to cover the Euro 88,557 (i.e. US\$112,582 at the exchange rate of the Contribution Agreement) advanced by UNEP to the MoE of Indonesia.
135. In a similar fashion, the MoU with ISWA required the final financial reports from ISWA to UNEP to be certified by a competent authority of ISWA, but did not refer to nor repeat the Contribution Agreement requirements. In fact, ISWA claims it was not even aware of these requirements. As a result, neither ISWA nor UNEP were able to provide evidence of expenditures to the EC verification mission and several reported expenses by ISWA have been considered ineligible. ISWA has agreed to bear the losses in this case which are unquantifiable as ISWA only reported on the budgeted amount (US\$34,700) and not on effective expenses which, according to ISWA, were in fact higher.
136. Financial statements were provided to the evaluation team with the two Interim Reports. A final financial statement was not ready at the time of the data collection and analysis phase of the evaluation, but was provided to the Evaluation Office, after several requests, when the draft evaluation report had already gone through several rounds of comments and revisions. Table 3 below presents a summary of project expenditures reported to the EC against the original project budget.

Table 3. Project expenditures reported to the EC versus budgeted project cost in the Contribution Agreement,

Budget codes	Budget headings	Total project cost (as budgeted)	Total expenditure	Balance at project completion
1	Human Resources	236,550.00	239,572.39	-3,022.39
2	Travel	45,800.00	30,969.40	14,830.60
3	Equipment and supplies	340,244.00	318,425.88	21,818.12
4	Local office / Action costs	34,200.00	16,627.05	17,572.95
5	Other costs, services	44,200.00	31,989.88	12,210.12
7	<i>Subtotal direct project of the action</i>	<i>700,994.00</i>	<i>637,584.59</i>	<i>63,409.41</i>
8	Adm. costs (max. 7% of '7')	49,006.00	44,630.92	4,375.08
12	Total eligible costs (7 + 8)	750,000.00	682,215.52	67,784.48

Source: DEBRI Project – Final Report to the EC, Annex 05B – 13 September 2010.

137. As can be derived from Table 3, the EU contribution was disbursed for 91 per cent. This summary table evidently hides the details provided in the Final Report to the EC. It should be noted that there was only one case of significant cost overrun, namely on the cost of the Project Manager which was 26 per cent higher than expected. As mentioned before, it is not clear whether the EC will now agree to cover the Euro 88,557 expenses reported by the MoE – these expenses are included in the expenditures in the table above. However, costs incurred by ISWA are not included, as ISWA has agreed to self-finance its non quantified contributions to the project. The demurrage and storage costs incurred for the shredding machine (Euro 22,537) are included in the expenditures and the EC has emitted no objection to cover this expense.

138. For most of the technology selection process the intention was to buy several machines, but in the end only one was purchased. The DEBRI Senior Programme Coordinator as well as the UNON Chief of Procurement in Nairobi confirmed a problem in financial planning and that the prices obtained for the machines previous to the tender process were not at all accurate.

4.12 UNEP SUPERVISION AND BACKSTOPPING

139. The project's supervision was carried out by the Programme Coordinator of the DEBRI project, along with the Director of IETC in Japan, and further by the Director and Deputy Director of DTIE in Paris, under whose office IETC falls. The DEBRI project is a regular project under IETC's umbrella.

140. The Programme Coordinator also supervised the tasks and duties of the Project Manager and three project staff members embedded in the MoE through meetings, review of project reports and cross-checking with agreed deliverables under the agreement between the MoE and UNEP. The MoE, along with DKP and UNEP, was essentially responsible for the local implementation activities in Jakarta and Banda Aceh, UNEP was responsible for activities jointly carried out with ISWA. All reporting to the EU was carried out by UNEP.

141. There is ground to believe that this project, as often seems to be the case with UNEP projects, did not have a clear separation of management and supervision responsibilities. Both the part-time Project Manager and the Programme Coordinator were stationed in the same office at IETC Japan, with one reporting directly to the other as opposed to having separate reporting lines to ensure a firewall between management and supervision. Furthermore, the TORs for the

Project Manager indicate that his role was one of assisting the Programme Coordinator, who appears to have, to a very large extent, both managed and supervised the project. The Programme Coordinator was therefore frequently in a position with conflicting interest.

142. To this, one needs to add that poor financial management by UNEP/DTIE led to the likely rejection by the EC of close to US\$150,000 in reported expenses incurred by the two other executing agencies (MoE and ISWA). The fact that the requirements were not set out in the cooperation agreements (Sub-project document and MoU, respectively) in the first place, and that UNEP and its partners were taken by surprise when the EC requested supporting documentation for expenses reported by the MoE and ISWA, other than the internally certified financial reports, indicates a lack of attention to the terms and conditions set out in the Contribution Agreement signed between UNEP and the EC, and likely a systemic lack of knowledge of EU/EC financing rules and regulations in UNEP.

4.13 COMPLEMENTARITY WITH THE UNEP MEDIUM TERM STRATEGY AND PROGRAMME OF WORK

4.13.1 Linkage to UNEP's Expected Accomplishments

143. The project was initiated before the UNEP Medium Term Strategy (MTS) was in place so it cannot be attributed to one specific expected accomplishment. However, its results are complementary with the following cross-cutting thematic areas of the MTS:
144. "Disasters and conflicts" – by preparing and disseminating experience-based information materials on the management of solid wastes generated by natural disasters. The processing of C&D wastes and their use as in-fill for reconstructing damaged sites and building embankments of the rivers and canals in the city could have been a clear benefit for disaster prevention, if a machine that can crush concrete, masonry and stones had been purchased.
145. "Resource Efficiency" and "Ecosystem management" – by processing and recycling of waste. Promoting the recycling of green waste to form soil improver through the provision of the shredding machine is the first step in a composting operation – returning organic matter to the soil from which it came to maintain the fertility of the soil.

4.13.2 Project contributions that are in-line with the Bali Strategic Plan, including South-South co-operation

146. The Bali Strategic Plan (BSP) is concerned with capacity building and technology support. The project has invested in capacity building by means of training workshops and information which has been distributed in printed form and electronically by means of the project database. Technology support has been provided by means of reports that provide information useful in the selection of waste processing equipment, and through the purchase of a large shredding machine to upgrade the disposal of tree waste and tyres and to promote composting.
147. South-South co-operation has been facilitated by the involvement of consultants from Malaysia and Indonesia and intensive consultations with officials in Jakarta and Banda Aceh in the preparation of documents which have been made available to officials and experts internationally. Reports generated by the project have been put on the project website so that they are available to authorities concerned with waste management and disaster preparedness in the region as well as elsewhere in the world. It was reported in the second Interim Report that responses to disasters in the region, particularly the Myanmar cyclone and the earthquake in China, had benefited from advice provided by UNEP on debris management.

148. Opportunities for both South-South and North-South co-operation have been opened up by the involvement of the International Solid Waste Association in the activities of this project and by means of a global agreement between UNEP and ISWA, which envisages the joint development of projects on waste management, including those related to construction and demolition wastes, and disaster wastes.

5. CONCLUSIONS AND RATING

5.1 Achievements

149. The project succeeded in providing useful general guidance documents on the following topics:
- Methods of assessing the quantities and types of waste generated by disasters such as tsunamis and earthquakes.
 - Types of machinery that can be used to process various types of solid waste, and criteria that can be used in the selection of the most suitable types, taking into account social and environmental factors.
 - Economic instruments and financial mechanisms that can be used within solid waste management.
 - Comprehensive guidance on dealing with post-disaster debris and on planning for the eventuality of future disasters.
150. The project provided a shredding machine that can be used to process green waste (vegetation) so that some of it can be used for composting. Alternatively, if the processed waste is land filled, it occupies less space in the landfill and is less likely to allow fires within the waste. The machine can also be used to assist in the land filling of scrapped tyres. Banda Aceh has a number of strengths in the field of solid waste management which make it a good place for practitioners to visit in order to develop their competence in waste management. The presence of the shredding machine adds to the benefits of technical visits to Banda Aceh. The municipal and provincial authorities are prepared to contribute financially to the development of a composting operation, so that some of the processed green waste can be converted into useful soil improver.

5.2 Possible limitations of these outputs

151. The scoring system recommended for the selection of technologies for treating wastes does not give sufficient weight to considerations that have caused the failure of waste treatment systems. This shortcoming results from its not giving sufficient emphasis to financial aspects, maintenance, institutional considerations and factors related to the nature of the waste itself.
152. The reports appear to have been written for an Indonesian readership, but they have not been translated into the Indonesian language. It is likely that many of the officials who could benefit from such reports will not be able to use them because they are not sufficiently fluent readers of English.
153. The shredding machine was originally intended for processing C&D waste, but in fact it can only be used to treat a very small part of such waste. It is more suited to processing garden or green waste, particularly tree branches. The quantities of such waste, though high compared to less fertile areas, are very small in comparison with the capacity of the machine, so that the machine is used for no more than four hours a week. This low rate of utilisation is inefficient. The purchase of a smaller machine would have released funds for the purchase of other machinery that is needed to complement shredding in order to compost the waste.
154. Composting is excellent in terms of ecology, but most municipal composting operations that do not receive a subsidy have failed for financial reasons. No feasibility or marketing study in connection with composting was undertaken before the decision was made to buy the shredder.

5.3 The planning and management of the project

155. The observations of the evaluation consultant regarding the planning and management of the project have been limited by the lack of information on the conduct of the project. The list of missing information includes notes of meetings and other events, terms of reference for consultants and others engaged by the project, information about the changes to the planning of the project, and the decisions that led to the purchase of the shredding machine. There are serious concerns about the management and supervision arrangements of the project which are at the root of the project's efficiency and financial planning problems. On the one hand, project management and decision making was mostly done from Japan with very little control over the execution of project activities and the utilisation of project resources on the ground. On the other hand, the line between project management and supervision responsibilities was blurred, with the Programme Coordinator often in a position with conflicting interests.

5.4 Overall ratings table

Criterion	Evaluator's Summary Comments	Evaluator's Rating
A. Attainment of project objectives and results (overall rating) Sub criteria (below)		MS
A. 1. Effectiveness – overall likely-hood of impact achievement (ROtl rating)	Information materials appear to have been used elsewhere, but are only in English. Shredder performs a useful task and may lead to a composting operation.	MS
A. 2. Relevance	The information materials relate to disaster management and the shredder can generate some environmental benefits.	S
A. 3. Efficiency	The need for three full-time staff in the MoE was not justified. The project started and ended with delay. The shredding machine does not match the defined needs on the ground and spent too much time in customs.	MU
B. Sustainability of Project outcomes (overall rating) Sub criteria (below)		ML
B. 1. Financial	Operating and maintenance costs for this machine are high compared to its actual output. It is likely that any composting operation or briquette fabrication would need an on-going subsidy.	ML
B. 2. Socio Political	Impact of information materials reduced if in English only. Composting operation will need political support.	ML
B. 3. Institutional framework and governance	No concrete recommendations for economic instruments. Good links within DKP and with agricultural sector are needed to make use of shredder. Project is in line with the national waste management law.	ML
B. 4. Environmental	No environmental threats are anticipated. Environmental advantages dominate.	L
C. Catalytic Role	The shredder may encourage investment in composting. Banda Aceh has many features to encourage study visits by officials from other cities. The information materials have been used in other cities and countries	HS

Criterion	Evaluator's Summary Comments	Evaluator's Rating
D. Stakeholders involvement	Efforts were made to involve officials in decision-making and the preparation of documents.	S
E. Country ownership/ drivenness	The new waste management law is in harmony with the objectives of the project. Provincial and municipal authorities expressed willingness to contribute to the composting operation.	S
F. Achievement of outputs and activities	There are shortcomings in the reports and the selection of the type and size of the shredder is a mismatch.	MU
G. Preparation and readiness	Project's objectives and components were clear in the beginning but not feasible within its timeframe due to shortcomings in project management.	MU
H. Implementation approach	The initially intended approach was good but the project was not executed according to the plan. There were administrative, operational and technical problems. Decision making was concentrated in Japan with limited control over the execution of project activities and the utilisation of project resources.	MU
I. Financial planning and management	The budget was provided, but no other information was provided regarding financial planning. UNEP was unable to provide timely supporting documentation requested by the EC for expenditures reported by the two other executing agencies (MoE and ISWA) as per the conditions set out in the Contribution Agreement. As a result, MoE and ISWA expenses have been deemed ineligible by the EC. Coverage of MoE expenses by the EC is still under discussion but unlikely. The expectation during most of the project period was that several machines would be supplied, but only one appeared. Incorrect financial planning led to the procurement of an inadequate shredding machine.	U
J. Monitoring and Evaluation (overall rating) Sub criteria (below)		MU
J. 1. M&E Design	Indicators were not SMART and insufficient. Some outcomes had no baseline data. No risks had been identified.	MU
J. 2. M&E Plan Implementation (use for adaptive management)	Monitoring reports were submitted but did not assess progress against indicators. Information from the monitoring system was not sufficiently used to improve project performance. Feedback on the terminal evaluation came with much delay.	MU
J. 3. Budgeting and Funding for M&E activities	Budget allocation was made for a terminal evaluation.	MS
K. UNEP Supervision and backstopping	Very little information on supervision and backstopping was provided. Management and supervision responsibilities were blurred. UNEP did not pay proper attention to terms and conditions set out in the Contribution Agreement with the EU regarding its financial management responsibilities.	U

6. LESSONS (TO BE) LEARNED

6.1 Speed of response

156. The tsunami occurred in December 2004 but this project did not start until April 2007, and when it did start, it appeared that some of the intended results of the project were not appropriate for the conditions that existed at that time. Decisions on projects that are concerned with rehabilitation after disasters must be given a “fast track” approach in order to prevent similar mismatches or contradictions between the intentions of the project and the realities on the ground.

6.2 Count the cost

157. One of the outputs of the project was a document that was intended to show how machinery – termed “Environmentally-Sound Technologies (ESTs)” – should be selected. One criticism of the methodology that was presented was that it was based on subjective assessments and no quantitative data. The sequel to this exercise showed the importance of the most obvious items of quantitative data – the purchase cost and the capacity. Throughout the process of type selection and right up to the tendering stage, it was, apparently, the intention to buy four machines. The request for proposals described four machines. However, the outcome was that only one machine was purchased, it was far larger than had been recommended and did not meet the required technical specifications. This unfortunate result might have been avoided if more precise information had been collected regarding the prices and the specifications of the machinery. The specification handed over to the UNON Procurement Office should have been double checked. Research should have been done up front on options for shipping to Bandah Aceh and customs procedures for a more realistic timeframe.

6.3 Who is accountable?

158. The institutional arrangements of the project lacked a clear distribution of responsibilities between the local staff, the Project Manager and the Programme Coordinator. There were no TORs for the local staff in Indonesia and the Project Manager’s TORs indicate that he was mostly assisting the Programme Coordinator, and had no decision making responsibilities. Therefore, the line between the management of project (called “execution” in UNEP terminology) and project supervision and back-stopping (called “implementation”) was clearly blurred and, as a result, insufficient checks and balances were built in the project set-up. This was certainly the case for the fiduciary aspects of the project: finances, human resources and procurement.
159. However, the DEBRI project set-up is certainly not a unique case for UNEP. The Quality of Project Supervision Review 2009 by the UNEP Evaluation Office indicates that project supervision / management requirements and expectations for non-GEF funded projects are not clearly defined at the corporate level. The Review recommends that UNEP should develop clear guidelines and standard roles and responsibilities for Project Managers and project supervisors, indicating their specific responsibilities vis-à-vis project supervision / management. The DEBRI project is a show-case for how a poor definition of responsibilities has led to inefficient management and inadequate supervision.

7. RECOMMENDATIONS

7.1 Audit of procurement of goods under the project

160. It is recommended that UNEP conducts an independent audit of the procurement process of the shredding machine, from the preparation of specifications up to the delivery of the machine in Banda Aceh. This audit should ideally be conducted jointly with OIOS. Much has gone wrong during this process, leading to an extreme delay in delivery, an inappropriate choice of the very costly machine, an evident waste of project resources due to demurrage charges and port penalties, and increased project management and administration costs to UNEP. The audit would provide valuable insights in what went wrong and why, and could provide recommendations on how to avoid such serious costly mishaps in the future.

7.2 EU financing rules and regulations

161. The financial reporting requirements in the cooperation agreements between UNEP and the two other executing agencies of the project did not adequately reflect the EU requirements set out in the General Terms and Conditions of the Contribution Agreement between EC and UNEP. In addition, the UNEP/DTIE project team did not properly inform partners about these requirements. This led to the most likely rejection by the EC of close to US\$150,000 in expenses reported by the executing agencies. The EC requires a higher level of financial control than UNEP usually applies to its “trusted” partners and UNEP needs to ensure that cooperation agreements with partners (Sub-project documents, MoUs etc.) duly reflect EC requirements. UNEP also needs to ensure that staff involved in EU financed projects and programmes is more aware and has a better knowledge of EC/EU financing rules and regulations.

7.3 User-friendly documents

162. The project produced some reports which have already been used elsewhere in training or in the development of plans. It is recommended that these documents are developed further so that they are more attractive to the casual reader and more suitable for use in capacity building programmes. The reports could be developed in a number of ways:

- The information content could be condensed in order to provide the general guidance (as opposed to information that is specific to Banda Aceh in 2007) in as concise a way as possible, so that the reader is not discouraged by the size of the document.
- Each report could be divided into portions that would suit a training programme – each portion covering the material that might be taught in one session.
- Calculations or decision-making processes that refer to the specific conditions found in Banda Aceh in 2007 could be reworked into case studies by providing the additional information about the context which would enable a full understanding of the reasons for decisions and assumptions that were made. These case studies could be developed as instructive examples or as exercises for individual or group work.
- Condensed reports could be translated into other languages so that they would be accessible to much larger numbers of local and national government officials who have difficulties in reading English.
- The website should be updated. It currently looks outdated which discourages visitors from reading.

7.4 On-going demonstration of ESTs

163. The project has invested heavily in the shredding machine, and it is important that this investment is used as intensively as possible. Although the shredder serves a useful purpose in breaking up foliage and vehicle tyres so that they occupy less volume in a landfill, it can also be used as the first stage of a composting operation. Some municipal officials in Banda Aceh have shown interest in such a development, but it may take some time before funds are found to buy the other equipment that is needed – particularly a rotating screen – and to set up the paved area and infrastructure on which the compost windrows could be built. Banda Aceh also has the advantage that it already has a number of interesting waste recycling initiatives and so attracts officials and others who wish to see recycling in action. Communication needs to be continued with those officials that showed interest so that the current visibility of the machine does not fade away.
164. A study on the use of the machine (as envisioned in the project document) should be conducted to gain baseline data for future projects on e.g. composting or briquette manufacturing. The machine should be maintained properly and used as intended. UNEP should request periodical updates on the machine to ensure the project's sustainability.
165. The quantity of green waste that is of a size that is small enough for composting after being shredded is relatively small, but this type of composting operation would be useful not only for demonstrating a technology, but also for investigating the demand for compost. The product could be sold directly to farmers and gardeners and also to factories producing chemical fertiliser (which are now being encouraged or obliged to market organic compost). The head of the recycling section of the DPK estimates that the cost of a rotating screen that could process up to 500 kg/h would be in the region of € 1,500. Another machine, known as a granulator, that would improve the market value of the compost would cost around € 2,800. There remains the problem of aerating the compost; this could be done on a small scale by manual turning, by a blower and a pipe network or by means of a windrow turning machine towed behind a tractor. UNEP should promote the idea of taking the project further within the MoE and the DPK. Especially the three UNEP staff member embedded in the MoE should be able to draw on their expertise from working with UNEP to help the DPK in writing project proposals, giving technical advice and in showing how to apply for funding from financial institutions.

Annexes

Annex 1. Terms Of Reference For Evaluation Mission

Terminal Evaluation of the UNEP project Demonstrating Application of Environmentally Sound Technologies (ESTs) for Building Waste Reduction in Banda Aceh Indonesia (DEBRI)

1. PROJECT BACKGROUND AND OVERVIEW

Project rationale

The aim of the Project Demonstrating Environmentally Sound Technologies for Building Waste Reduction in Indonesia (DEBRI) is meant to demonstrate a waste management mechanism, which will first be applied to Tsunami-generated debris and would subsequently be used for day-to-day construction/demolition waste in rehabilitation/reconstruction efforts of the affected communities in Banda Aceh, Indonesia.

The Indian Ocean Earthquake and Tsunami had a devastating impact on a number of countries in the region, with Indonesia being the hardest hit. Over 200,000 people were killed, with more than three million people's livelihoods destroyed.

The Indian Ocean Tsunami caused the demolition of almost all the buildings situated up to two kilometres from the seashore resulting in a huge amount of demolition waste. Disaster waste comprises valuable resource materials including scrap metals, timber, demolition waste from buildings /structures, and soil/sediment. The Project was designed to support the removal of these resources to be processed including recycling and reuse where appropriate in an environmentally sound manner.

The main objectives of the project were:

1. To support the reconstruction/rehabilitation in Banda Aceh Indonesia through development of partnerships for the application of Environmentally Sound Technologies (ESTs) to the treatment /reuse/recycle of debris waste generated by the Indian Ocean Tsunami
2. To support subsequent application of Environmentally Sound Technologies (ESTs) to the treatment/reuse/recycle of the construction/demolition waste generated on a day-to-day basis.

Relevance to UNEP Programmes

The Project directly addresses two relevant themes as elaborated in the document namely

- a) Waste management/sanitation
- b) Cleaning up of the Indian Ocean Tsunami generated waste and debris in Banda, Aceh, Indonesia

The project as a response to the Indian Ocean Earthquake and Tsunami disaster is relevant to UNEP's approach of "building better and green". The project was supposed to specifically address the constraints at the local level in Banda Aceh in identifying technologies and techniques that are environmentally sound, in ensuring longer term competence to handle waste as well as disaster debris and in building capacity to take economic decisions related to disaster recovery.

Executing Arrangements

The project was executed by the UNEP Regional Office for Asia Region and was coordinating and managing the implementation with the technical support of the Economics and Trade Branch of UNEP/DTIE. UNEP worked with other national and regional organisations that had experience and background in solid waste management.

The project was implemented through partnership approach by building partnerships with the Indonesian Ministry of Environment, the International Solid Waste Association (ISWA), and the local governmental agencies including national and local authorities.

Project Activities

The main activities in the project were:

Activity 1: Baseline Data Creation

Under this component the project action was to conduct a study on the initiatives already undertaken/ongoing /proposed in Banda Aceh on management of Tsunami-generated debris, including those that were in place for the management of day-to-day construction/demolition wastes in pre-tsunami periods.

Activity 2

This activity comprised of identification and securing concurrence (consensus building) on responsibilities of different partners in formulating and implementing the integrated waste management mechanism.

Activity 3

This component entailed the formulation of a waste management mechanism, addressing the tsunami-generated debris, and subsequently applicable to day-to-day construction/demolition waste. The mechanism specifically elaborates the elements related to waste collection, treatment, reuse/recycle, covering aspects of policy, technology and financing. This was to be done through:

Series of meetings and discussions among the project partners

Development of a local strategy for Banda Aceh on waste issues, bringing together knowledge and experience on existing and ongoing work on waste and debris clean-up by the project partners.

Activity 4: Technology Identification and Management

This component comprised of the identification of appropriate and locally suited Environmentally Sound Technologies for managing and utilizing debris-particularly reuse/recycle technologies –and including identification of potential technology suppliers.

The activity was meant to identify the key factors that would have to be considered for technology selection, subsidiary decisions that should be taken and the necessary capacity for partners to in order for them to be able to make informed decisions on waste management.

Activity 5: Technology Demonstration

This activity was composed of onsite demonstration of vital components of ESTs for reuse/recycle of debris. This activity was supposed to begin with the implementation of a detailed assessment of the technology needs for debris management.

Activity 6: Local Capacity Building

This component was designed to provide capacity building for local stakeholders viz. local government officials, civil society, technology users, by identifying target groups, developing training packages and delivering training. Training sessions targeting the stakeholder groups were supposed to be held at various locations in Banda Aceh.

Activity 7: Economic Instruments

Activity number seven was to identify economic barriers and develop potential economic instruments, including microfinance for addressing those barriers in cooperation with local and national authorities.

Activity 8: Knowledge Sharing and Information Management

This activity was aimed at establishing a regional communication and knowledge sharing system, using Environmentally Sound Technologies Information System (ESTIS) with associates and other stakeholders in the region.

Budget

The project had the following budgetary allocation:

EC Contribution-EUR 750,000= 100%

Total cost of Project-EUR 750,000

TERMS OF REFERENCE FOR THE EVALUATION

1. Objective and Scope of the Evaluation

The objective of this terminal evaluation is to examine the extent and magnitude of any project impacts to date and determine the likelihood of future impacts. The evaluation will also assess project performance and the implementation of planned project activities and planned outputs against actual results. The evaluation will focus on the following main questions:

1. To what extent has the project supported reconstruction and rehabilitation in Banda Aceh, through the development of partnerships for the application of Environmentally Sound Technologies (ESTs) to the treat, reuse and recycle debris waste generated by the Indian Ocean Tsunami?
2. Did the project develop a waste management mechanism for handling treatment, reuse, and recycling of tsunami-generated debris which can subsequently be applied to day-to-day construction/demolition wastes?
3. To what extent has the project built capacity of the stakeholders for the management of tsunami-generated wastes and subsequently day-to-day wastes in an environmentally sustainable manner?

2. Methods

This terminal evaluation will be conducted as an in-depth evaluation using a participatory mixed-methods approach, during which the UNEP Project Task Manager, key representatives of the executing agencies and other relevant staff are kept informed and consulted throughout the evaluation. The consultant will liaise with the UNEP Evaluation Office and the UNEP Project Task Manager on any logistic and/or methodological issues to properly conduct the review in as independent way as possible, given the circumstances and resources offered. The draft report will be delivered to the Evaluation Office and circulated to UNEP Project Task Manager and key representatives of the executing agencies. Any comments or responses to the draft report will be sent to the UNEP Evaluation Office for collation and the consultant will be advised of any necessary or suggested revisions.

The findings of the evaluation will be based on multiple approaches:

1. A desk review of project documents including, but not limited to:
 - a) The project documents, outputs, monitoring reports (such as progress and financial reports to UNEP and UNEP annual Project Implementation Review reports) and relevant correspondence.
 - b) Notes from the Project Task Manager's office.
 - c) Other project-related material produced by the project staff or partners.
 - d) Relevant material published on the project web-site.
2. Interviews with project management and technical support staff.
3. Face-to-Face and telephone interviews with intended users for the project outputs and other stakeholders involved with this project, including in the participating countries and international bodies. The Consultant shall determine whether to seek additional information and opinions from representatives of donor agencies and other organisations. As appropriate, these interviews could be combined with an email questionnaire, online survey, or other electronic communication.
4. Interviews with the UNEP Project Task Manager and Fund Management Officer, and other relevant staff in UNEP dealing with Demonstration of ESTs for Building Waste Reduction in Indonesia (DEBRI) Project. The Consultant shall also gain broader perspectives from discussions with relevant UNEP Programme staff.
5. Field visits¹⁰ to project staff and target audiences. The evaluator will make field visits to Banda Aceh to meet key beneficiaries of the project to get their opinions on the project performance.

¹⁰ Evaluators should make a brief courtesy call to UNEP Focal points during field visits if at all possible.

Key Evaluation principles

In attempting to evaluate any outcomes and impacts that the project may have achieved, evaluators should remember that the project's performance should be assessed by considering the difference between the answers to two simple questions "*what happened?*" and "*what would have happened anyway?*". These questions imply that there should be consideration of the baseline conditions and trends in relation to the intended project outcomes and impacts. In addition it implies that there should be plausible evidence to **attribute** such outcomes and impacts **to the actions of the project**.

Sometimes, adequate information on baseline conditions and trends is lacking. In such cases this should be clearly stated by the evaluator, along with any simplifying assumptions that enabled the evaluator to make informed judgements about project performance.

3. Project Evaluation Parameters and Ratings

The success of project implementation will be rated on a scale from 'highly unsatisfactory' to 'highly satisfactory'. In particular the evaluation shall **assess and rate** the project with respect to the eleven categories defined below¹¹.

It should be noted that many of the evaluation parameters are interrelated. For example, the 'achievement of objectives and planned results' is closely linked to the issue of 'sustainability'. Sustainability is understood as the probability of continued long-term project-derived outcomes and impacts and is, in turn, linked to the issues of 'catalytic effects / replication' and, often, 'country ownership' and 'stakeholder participation'.

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A. Attainment of objectives and planned results:

The evaluation should assess the extent to which the project's major relevant objectives were effectively and efficiently achieved or are expected to be achieved and their relevance. Any project contributions to the achievement of UNEP Expected Accomplishments¹³ should be clearly highlighted.

- *Effectiveness*: Evaluate the overall likelihood of impact achievement, taking into account the "achievement indicators", the achievement of outcomes and the progress made towards impacts. UNEP's Evaluation Office advocates the use of the Review of Outcomes to Impacts (ROtI) method (described in Annex 5) to establish this rating. The analysis should specify whether the project has plausible causal pathways that link project activities to the achievement of Expected Accomplishments. It should also specify whether the intervention is likely to have any lasting differential impacts in relation to gender.

¹¹ However, the views and comments expressed by the evaluator need not be restricted to these items.

¹² However, the views and comments expressed by the evaluator need not be restricted to these items.

¹³ UNEP Expected accomplishments are specified in the 2010- 2011 Programme of Work and the 2010-2013 Medium Term Strategy. <http://www.unep.org/PDF/FinalMTSGCSS-X-8.pdf>

- *Relevance*: Establish whether the project's outcomes were consistent with those of the programme frameworks and thematic sub programmes. Ascertain the nature and significance of the contribution of the project outcomes to other UNEP thematic sub programmes. To what extent does the project intervention link to the achievement of the MDGs (in particular Goal 7)?
- *Efficiency*: Was the project cost effective? Was the project the least cost option? Was the project implementation delayed and if it was, then did that affect cost-effectiveness? Assess the contribution of cash and in-kind co-financing, and any additional resources leveraged by the project, to the project's achievements. Did the project build on earlier initiatives; did it make effective use of available scientific and/or technical information? Wherever possible, the evaluator should also compare the cost-time vs. outcomes relationship of the project with that of other similar projects.

B. Sustainability:

Sustainability is understood as the probability of continued long-term project-derived outcomes and impacts after the project funding ends. The evaluation will identify and assess the key conditions or factors that are likely to contribute or undermine the persistence of benefits after the project ends. Some of these factors might be outcomes of the project, e.g. stronger institutional capacities or better informed decision-making. Other factors will include contextual circumstances or developments that are not outcomes of the project but that are relevant to the sustainability of outcomes. The evaluation should ascertain to what extent follow-up work has been initiated and how project outcomes will be sustained and enhanced over time. **Application of the ROTl method** described in Annex 5 will also assist in the evaluation of sustainability.

Four aspects of sustainability should be addressed: financial, socio-political, institutional frameworks and governance, environmental (if applicable). The following questions provide guidance on the assessment of these aspects:

- *Financial resources*. Are there any financial risks that may jeopardize sustenance of project outcomes and onward progress towards impact? What is the likelihood that financial and economic resources will not be available once the project funding ends (resources can be from multiple sources, such as the public and private sectors, income generating activities, and trends that may indicate that it is likely that in future there will be adequate financial resources for sustaining project's outcomes)? To what extent are the outcomes and eventual impact of the project dependent on continued financial support?
- *Socio-political*: Are there any social or political risks that may jeopardize sustenance of project outcomes and onward progress towards impacts? What is the risk that the level of stakeholder ownership will be insufficient to allow for the project outcomes to be sustained? Do the various key stakeholders see that it is in their interest that the project benefits continue to flow? Is there sufficient public / stakeholder awareness in support of the long term objectives of the project?
- *Institutional framework and governance*. To what extent is the sustenance of the outcomes and onward progress towards impacts dependent on issues relating to institutional frameworks and governance? What is the likelihood that institutional and technical achievements, legal frameworks, policies and governance structures and processes will allow for, the project outcomes/benefits to be sustained? While responding to these questions consider if the required systems for accountability and transparency and the required technical know-how are in place.
- *Environmental*. Are there any environmental risks that can undermine the future flow of project environmental benefits? The TE should assess whether certain activities in the project area will pose a threat to the sustainability of the project outcomes. For example; construction of dam in a protected area could inundate a sizable area and thereby neutralize the biodiversity-related gains made by the project; or, a newly established pulp mill might jeopardise the viability of nearby protected forest areas by increasing logging pressures; or a vector control intervention may be made less effective by changes in climate and consequent alterations to the

incidence and distribution of malarial mosquitoes. Would these risks apply in other contexts where the project may be replicated?

C. Catalytic Role and Replication

The catalytic role of UNEP is embodied in its approach of supporting the creation of an enabling environment, investing in activities which are innovative and show how new approaches and market changes can work, and supporting activities that can help upscale new approaches to a national (or regional) level to sustainably achieve global environmental benefits.

In general this catalytic approach can be separated into three broad categories of activities: (1) “**foundational**” and enabling activities, focusing on policy, regulatory frameworks, and national priority setting and relevant capacity (2) **demonstration** activities, which focus on demonstration, capacity development, innovation, and market barrier removal; and (3) **investment** activities (rarely if ever undertaken exclusively by UNEP) with high rates of cofunding, catalyzing investments or implementing a new strategic approach at the national level.

26. The three categories approach combines all the elements that have been shown to catalyze results in international cooperation. Evaluations in the bilateral and multilateral aid community have shown time and again that activities at the micro level of skills transfer—piloting new technologies and demonstrating new approaches—will fail if these activities are not supported at the institutional or market level as well. Evaluations have also consistently shown that institutional capacity development or market interventions on a larger scale will

In this context the evaluation should assess the catalytic role played by this project by consideration of the following questions:

- INCENTIVES: To what extent have the project activities provided incentives (socio-economic / market based) to contribute to catalyzing changes in stakeholder behaviours?
- INSTITUTIONAL CHANGE: To what extent have the project activities contributed to changing institutional behaviors?
- POLICY CHANGE: To what extent have project activities contributed to policy changes (and implementation of policy)?
- CATALYTIC FINANCING: To what extent did the project contribute to sustained follow-on financing from Government and / or other donors? (this is different from co-financing)
- PROJECT CHAMPIONS: To what extent have changes (listed above) been catalyzed by particular individuals or institutions (without which the project would not have achieved results)?
- (Note: the ROtI analysis should contribute useful information to address these questions)

Replication approach, in the context of UNEP projects, is defined as lessons and experiences coming out of the project that are replicated or scaled up in the design and implementation of other projects. Replication can have two aspects, replication proper (lessons and experiences are replicated in different geographic area) or scaling up (lessons and experiences are replicated within the same geographic area but funded by other sources).

Is the project suitable for replication? If so, has the project approach been replicated? If no effects are identified, the evaluation will describe the strategy / approach adopted by the project to promote replication effects.

D. Stakeholder participation/public awareness:

This consists of three related and often overlapping processes: information dissemination, consultation, and “stakeholder” participation. Stakeholders are the individuals, groups, institutions, or other bodies that have an interest or stake in the outcome of the UNEP project. The term also applies to those potentially adversely affected by a project. The evaluation will specifically:

- Assess the mechanisms put in place by the project for identification and engagement of stakeholders in each participating country and establish, in consultation with the stakeholders, whether this mechanism was successful, and identify its strengths and weaknesses.
- Assess the degree and effectiveness of collaboration/interactions between the various project partners and institutions during the course of implementation of the project.
- Assess the degree and effectiveness of any various public awareness activities that were undertaken during the course of implementation of the project.

E. Country ownership/driven-ness

This is the relevance of the project to national development and environmental agendas, recipient country commitment, and regional and international agreements. The evaluation will:

- Assess the level of country ownership. Specifically, the evaluator should assess whether the project was effective in providing and communicating information on Demonstrating ESTs for Building Waste Reduction in Indonesia and other affected countries in the Asia Region for handling Tsunami generated debris and subsequently be used for day-to-day construction/demolition waste and support policy formulation and informed decision making processes in waste management at local, national and regional levels.
- Assess the level of country commitment to Demonstrating waste management mechanism using ESTs for Building Waste Reduction in post tsunami construction/demolition and subsequent application on the day-to-day construction/demolition wastes by the affected communities at the local, national and regional levels.

F. Achievement of outputs and activities

- Delivered outputs: Assessment of the project’s success in producing each of the programmed outputs, both in quantity and quality as well as usefulness and timeliness.
- Assess the soundness and effectiveness of the methodologies used for developing the technical documents and related management options in the participating countries
- Assess the extent to which the project outputs have the credibility, necessary to influence policy and decision-makers at the national and regional levels.

G. Preparation and Readiness

Were the project’s objectives and components clear, practicable and feasible within its timeframe? Were the capacities of executing institution and counterparts properly considered when the project was designed? Were lessons from other relevant projects properly incorporated in the project design? Were the partnership arrangements properly identified and the roles and responsibilities negotiated prior to project implementation? Were counterpart resources (funding, staff, and facilities), enabling legislation, and adequate project management arrangements in place?

H. Assessment of monitoring and evaluation systems

The evaluation shall include an assessment of the quality, application and effectiveness of project monitoring and evaluation plans and tools, including an assessment of risk management based on the assumptions and risks identified in the project document. The Terminal Evaluation will assess whether the project met the minimum requirements for 'project design of M&E' and 'the application of the Project M&E plan' (see minimum requirements 1&2 in Annex 6). UNEP projects must budget adequately for execution of the M&E plan, and provide adequate resources during implementation of the M&E plan. Project task managers are also expected to use the information generated by the M&E system during project implementation to adapt and improve the project.

I. Implementation approach

This includes an analysis of the project's management framework, adaptation to changing conditions (adaptive management), partnerships in implementation arrangements, changes in project design, and overall project management. The evaluation will:

- Ascertain to what extent the project implementation mechanisms outlined in the project document have been closely followed. In particular, assess the role of the various committees established and whether the project document was clear and realistic to enable effective and efficient implementation, whether the project was executed according to the plan and how well the management was able to adapt to changes during the life of the project to enable the implementation of the project.
- Assess the extent to which the project responded to the mid term review / evaluation (if any).
- Evaluate the effectiveness and efficiency and adaptability of project management and the supervision of project activities / project execution arrangements at all levels (1) policy decisions: Steering Group; (2) day to day project management in each of the country executing agencies.
- Identify administrative, operational and/or technical problems and constraints that influenced the effective implementation of the project.

M&E during project implementation

- *M&E design.* Projects should have sound M&E plans to monitor results and track progress towards achieving project objectives. An M&E plan should include a baseline (including data, methodology, etc.), SMART indicators (see Annex 4) [**Note from consultant:** *Annex 4 does not refer to SMART indicators, but Annex 6 does.*] and data analysis systems, and evaluation studies at specific times to assess results. The time frame for various M&E activities and standards for outputs should have been specified.

The evaluator should use the following questions to help assess the M&E design aspects:

SMART-ness of Indicators

- Are there specific indicators in the log frame for each of the project objectives and outcomes?
- Are the indicators relevant to the objectives and outcomes?
- Are the indicators for the objectives and outcomes sufficient?
- Are the indicators quantifiable?

Adequacy of Baseline Information

- Is there baseline information?
- Has the methodology for the baseline data collection been explained?
- Is desired level of achievement for indicators based on a reasoned estimate of baseline?

Arrangements for Monitoring of Implementation

- Has a budget been allocated for M&E activities?
- Have the responsibility centers for M&E activities been clearly defined?
- Has the time frame for M&E activities been specified?

Arrangements for Evaluation

- Have specific targets been specified for project outputs?
- Has the desired level of achievement been specified for all Indicators of Objectives and Outcomes?

M&E plan implementation. A Terminal Evaluation should verify that:

- an M&E system was in place and facilitated timely tracking of results and progress towards projects objectives throughout the project implementation period (perhaps through use of a logframe or similar); annual project reports and Progress Implementation Review (PIR) reports were complete, accurate and with well justified ratings;
- that the information provided by the M&E system was used during the project to improve project performance and to adapt to changing needs;
- and that project had an M&E system in place with proper training for parties responsible for M&E activities.

Budgeting and Funding for M&E activities. The terminal evaluation should determine whether support for M&E was budgeted adequately and was funded in a timely fashion during implementation.

J. Financial Planning

Evaluation of financial planning requires assessment of the quality and effectiveness of financial planning and control of financial resources throughout the project's lifetime. Evaluation includes actual project costs by activities compared to budget (variances), financial management (including disbursement issues), and co-financing. The evaluation should:

- Assess the strength and utility of financial controls, including reporting, and planning to allow the project management to make informed decisions regarding the budget and allow for a proper and timely flow of funds for the payment of satisfactory project deliverables.
- Present the major findings from the financial audit if one has been conducted.
- Identify and verify the sources of co-financing as well as leveraged and associated financing (in co-operation with the IA and EA)
- Assess whether the project has applied appropriate standards of due diligence in the management of funds and financial audits.

The evaluation should also include a breakdown of final actual costs and co-financing for the project prepared in consultation with the relevant UNEP Fund Management Officer of the project (table attached in Annex 1 Co-financing and leveraged resources) [**Note from consultant:** Annex 1 does not contain such a table but Annex 2 does.]

K. UNEP Supervision and Backstopping

The purpose of supervision is to work with the executing agency in identifying and dealing with problems which arise during implementation of the project itself. Such problems may be related to project

management but may also involve technical/substantive issues in which UNEP has a major contribution to make. The evaluator should assess the effectiveness of supervision and administrative and financial support provided by UNEP including:

- the adequacy of project supervision plans, inputs and processes;
- the emphasis given to outcome monitoring (results-based project management);
- the realism / candor of project reporting and rating (i.e. are PIR ratings an accurate reflection of the project realities and risks);
- the quality of documentation of project supervision activities; and
- financial, administrative and other fiduciary aspects of project implementation supervision.

In summary, accountability and implementation support through technical assistance and problem solving are the main elements of project supervision (Annex 6) [**Note from consultant:** *It appears that Annex 4 is the appropriate reference, not Annex 6.*].

L. Complementarity with UNEP Medium Term Strategy and Programme of Work

Linkage to UNEP's Expected Accomplishments. The UNEP Medium Term Strategy specifies desired results in six thematic focal areas. The desired results are termed Expected Accomplishments. Using the completed ROtI analysis, the evaluation should comment on whether the project makes a tangible contribution to any of the Expected Accomplishments specified in the UNEP MTS. The magnitude and extent any contributions and the causal linkages should be fully described.

*Project contributions that are in-line with the Bali Strategic Plan (BSP).*¹⁴ The outcomes and achievements of the project should be briefly discussed in relation to the objectives of the UNEP BSP.

South-South Cooperation is regarded as the exchange of resources, technology, and knowledge between developing countries. Briefly describe any aspects of the project that could be considered as examples of South-South Cooperation.

The **ratings for the parameters A - K will be presented in the form of a table**. Each of the eleven categories should be rated separately with **brief justifications** based on the findings of the main analysis. An overall rating for the project should also be given. The following rating system is to be applied:

HS	= Highly Satisfactory
S	= Satisfactory
MS	= Moderately Satisfactory
MU	= Moderately Unsatisfactory
U	= Unsatisfactory
HU	= Highly Unsatisfactory

¹⁴ <http://www.unep.org/GC/GC23/documents/GC23-6-add-1.pdf>

5. Evaluation Report Format and Review Procedures

The report should be brief, to the point and easy to understand. It must explain; the purpose of the evaluation, exactly what was evaluated and the methods used. The report must highlight any methodological limitations, identify key concerns and present evidence-based findings, consequent conclusions, recommendations and lessons. The report should be presented in a way that makes the information accessible and comprehensible and include an executive summary that encapsulates the essence of the information contained in the report to facilitate dissemination and distillation of lessons.

The evaluation will rate the overall implementation success of the project and provide individual ratings of the eleven implementation aspects as described in Section 1 of this TOR. ***The ratings will be presented in the format of a table*** with brief justifications based on the findings of the main analysis.

Evidence, findings, conclusions and recommendations should be presented in a complete and balanced manner. Any dissident views in response to evaluation findings will be appended in an annex. The evaluation report shall be written in English, be of no more than 50 pages (excluding annexes), use numbered paragraphs and include:

- i) An **executive summary** (no more than 3 pages) providing a brief overview of the main conclusions and recommendations of the evaluation;
- ii) **Introduction and background** giving a brief overview of the evaluated project, for example, the objective and status of activities. The report should provide summary information on when the evaluation took place; places visited; who was involved; the key questions; and, the methodology.
- iii) **Scope, objective and methods** presenting the evaluation's purpose, the evaluation criteria used and questions to be addressed;
- iv) **Project Performance and Impact** providing *factual evidence* relevant to the questions asked by the evaluator and interpretations of such evidence. This is the main substantive section of the report. The evaluator should provide a commentary and analysis on all eleven evaluation aspects (A – K above).
- v) **Conclusions and rating** of project implementation success giving the evaluator's concluding assessments and ratings of the project against given evaluation criteria and standards of performance. The conclusions should provide answers to questions about whether the project is considered good or bad, and whether the results are considered positive or negative. The ratings should be provided with a brief narrative comment in a table (see Annex 1);
- vi) **Lessons (to be) learned** presenting general conclusions from the standpoint of the design and implementation of the project, based on good practices and successes or problems and mistakes. Lessons should have the potential for wider application and use. All lessons should 'stand alone' and should:
 - Briefly describe the context from which they are derived
 - State or imply some prescriptive action;
 - Specify the contexts in which they may be applied (if possible, who when and where)
- vii) **Recommendations** suggesting *actionable* proposals for improvement of the current project. In general, Terminal Evaluations are likely to have very few (perhaps two or three) actionable recommendations.

Prior to each recommendation, the issue(s) or problem(s) to be addressed by the recommendation should be clearly stated.

A high quality recommendation is an actionable proposal that is:

1. Feasible to implement within the timeframe and resources available
2. Commensurate with the available capacities of project team and partners
3. Specific in terms of who would do what and when

4. Contains results-based language (i.e. a measurable performance target)
5. Includes a trade-off analysis, when its implementation may require utilizing significant resources that would otherwise be used for other project purposes.

viii) **Annexes** may include additional material deemed relevant by the evaluator but must include:

1. The Evaluation Terms of Reference,
2. A list of interviewees, and evaluation timeline
3. A list of documents reviewed / consulted
4. Summary co-finance information and a statement of project expenditure by activity
5. Details of the project's 'impact pathways' and the 'ROtI' analysis
6. The expertise of the evaluation team. (Brief CV).

TE reports will also include any formal response / comments from the project management team and/or the country focal point regarding the evaluation findings or conclusions as an annex to the report, however, such will be appended to the report by UNEP Evaluation Office.

Examples of UNEP Terminal Evaluation Reports are available at [www.unep.org/Evaluation Office](http://www.unep.org/EvaluationOffice)

Review of the Draft Evaluation Report

Draft reports submitted to UNEP Evaluation Office are shared with the corresponding Programme or Project Task Manager and his or her supervisor for initial review and consultation. The UNEP staff and the Executing Agency staff are allowed to comment on the draft evaluation report. They may provide feedback on any errors of fact and may highlight the significance of such errors in any conclusions. Where, possible, a consultation is held between the evaluator, Evaluation Office Staff, the Task Manager and key members of the project execution team. The consultation seeks feedback on the proposed recommendations and lessons. UNEP Evaluation Office collates all review comments and provides them to the evaluator(s) for their consideration in preparing the final version of the report.

6. Submission of Final Terminal Evaluation Reports.

The final report shall be submitted in electronic form in MS Word format and should be sent directly to:

Segbedzi Norgbey, Chief,
UNEP Evaluation Office
P.O. Box 30552-00100
Nairobi, Kenya
Tel.: (254-20) 7624181
Fax: (254-20) 7623158
Email: segbedzi.norgbey@unep.org

The Chief Evaluation will share the report with the following individual :

UNEP Project Task Manager
Dr. Hari Srinivas
Urban Programme Officer
International Environmental Programme
2-110.Ryokuchi Koen,
Tsurumi-Ku,
Osaka, 538-0036, Japan
Tel: + (81-6) 6915-4594
Fax: + (81-6) 6915-0304
Email: hari.srinivas@unep.org.jp

The Final evaluation will also be copied to the UNEP Programme Operational Focal Points.

The final evaluation report will be published on the Evaluation Office's web-site www.unep.org/Evaluation_Office and may be printed in hard copy. Subsequently, the report will be sent to the UNEP/GEO Programme office for their review, appraisal and inclusion on their website.

7. Resources and Schedule of the Evaluation

This final evaluation will be undertaken by an international evaluator contracted by the Evaluation Office, UNEP. The contract for the evaluator will begin on 1 March 2010 to 07 May, 2010 for 6 weeks spread over 10 weeks (6 days Desk Review, 10 Days of Field Work, 4 Travel Days, and 10 days for report writing). The evaluator will submit a draft report on 09 April 2010 to UNEP Evaluation Office. The Chief of the Evaluation Office will share the draft report with the UNEP Project Task, the UNEP Project Task Manager, and key representatives of the executing agencies. Any comments or responses to the draft report will be sent to UNEP / EO for collation and the consultant will be advised of any necessary revisions. Comments to the final draft report will be sent to the consultant by 23 April 2010 after which, the consultant will submit the final report no later than 7 May 2010.

The evaluator will, after an initial telephone briefing with Evaluation Office and the UNEP Project Task Manager, conduct initial desk review work and later travel to selected project Banda Aceh Indonesia to meet with project staff at the beginning of the evaluation Mid-March 2010.

In accordance with UNEP Evaluation Policy, all UNEP projects are evaluated by independent evaluators contracted as consultants by the Evaluation Office. The evaluator should have the following qualifications:

The evaluator should not have been associated with the design and implementation of the project in a paid capacity. The evaluator will work under the overall supervision of the Chief, Evaluation Office. The evaluator should be an international expert in environmental management. S(he) should have the following minimum qualifications; (i) Knowledge and experience in solid waste management; (ii) Knowledge and experience in integrated environmental assessment; (iii) Experience in internation-

al/regional project evaluation; (iv) Knowledge of UNEP Programmes is desirable; (v) Knowledge of the local language of the beneficiaries is an advantage; (vi) Fluency in oral and written English is a must.

8. Schedule Of Payment

The evaluator will a lump sum fee payable in three instalments of 30% upon signature of the contract, 30% of the SSA fee will be paid upon submission of the draft report and a final payment of 40% of the SSA fee will be made upon satisfactory completion of work. The fee is payable under the individual Special Service Agreement (SSA) of the evaluator and **is inclusive** of all expenses such as travel, accommodation and incidental expenses.

In case, the evaluator cannot provide the products in accordance with the TORs, the timeframe agreed, or his products are substandard, the payment to the evaluator could be withheld, until such a time the products are modified to meet UNEP's standard. In case the evaluator fails to submit a satisfactory final product to UNEP, the product prepared by the evaluator may not constitute the evaluation report.

Annexes included in the TORs

(can be obtained from the Evaluation Office on request)

Annex 1	Overall Ratings Table
Annex 2	Co-financing and Leveraged Resources
Annex 3	Review of the Draft Report
Annex 4	Expectations regarding the role of Task Managers in UNEP Project Supervision and a list of Documentation relevant for the evaluation of Project Supervision (provided to Evaluator by responsible officer)
Annex 5	Introduction to Theory of Change / impact pathways, the ROTi Method and the ROTl Results Score sheet
Annex 6	Minimum requirements for M&E

Annex 2. Evaluation timeline including names of interviewees

Date, 2010	Activity, persons interviewed
28 February	Contract signed
1 March	Start of contract period
1 – 12 March	Desk review
13 March	Departure for Banda Aceh
15 March	Arrival in Banda Aceh
16 March	Briefing phone call from Dr Srinivas. Preparing list of information to be requested from Dr Srinivas.
17 March	Meeting with Mr Mirzayanto, Head of section responsible for recycling and waste processing of Department of Cleansing and Beautification (DKP) to discuss the project and plans for the visit. Visit to landfill to observe shredding machine in action.
18 March	Studying maintenance manual of shredding machine
19 March	Continuing to study documentation
20 March	Information received from Dr Srinivas. (See Annex 8.3) Meeting with Mr Mirzayanto.
21 March	Review of documents received
22 March	Review of documents received. Meeting with Mr Mirzayanto and with the Head of the Department of Cleansing and Beautification, Ir. T. Iwan Kesuma.
23 March	Further request for information submitted to Dr Srinivas (Annex 8.3). Final meeting with Mr Mirzayanto. Review of documentation.
24 March	Review of documentation. Departure for Jakarta
25 March	Requested meeting with Ministry of Environment Focal Points but they were not available. Departure for UK
26 March	Arrival in UK
27 March to 13 April	Writing draft report
13 April	Submission of draft report

Annex 3 List of documents reviewed

Documents reviewed from the internet

- DEBRI 1 Guidelines for Collection of data on debris resulting from the 2004 Indian Ocean Tsunami in Banda Aceh, Indonesia; (10 pages, undated)
- DEBRI 2 Preliminary Data Report on Tsunami-generated Debris (11 pages, undated)
- DEBRI 3 Report on Tsunami-generated Debris September 2007; Prepared by Dr. Suprihanto Notodarmojo (33 pages)
- DEBRI 4 Key Factors in Technology Identification and Selection (86 pages, undated)
- DEBRI 5 Technology Identification and Selection (99 pages, revised November 2007)
- DEBRI 6 Background Document on Economic Instruments with special reference to Debris and C&D Waste Management Prepared by UNEP-DTIE Economics and Trade Branch and UNEP-DTIE International Environmental Technology Centre; (20 pages, February 2008).
- DEBRI 8 Disaster Waste Management Mechanism - A Practical Guide for Construction and Demolition Wastes in Indonesia (127 pages, 2008)
- UNEP Bali Strategic Plan for Technology Support and Capacity-building (9 pages, December 2004)
- UNEP Medium-term Strategy 2010–2013 Environment for Development (30 pages, undated)
- UNDP/BRR Tsunami Recovery Waste Management Programme (TRWMP) NAD-Nias (21 pages)

Documents and information received from IETC

a) Project documents

Grant Application Form – 2005

Sub-Project summary: Project identification, Project background, Project proposal, Logical framework matrix, Work plan etc.

Memorandum of Understanding with ISWA

TORS for an L2 Project Manager based in Japan

b) Project progress reports

Quarterly updates: - Numbers 1 to 11

Interim reports: - Numbers 1 and 2, together with financial reports

c) Technical reports

Guidelines for Collection of data on debris resulting from the 2004 Indian Ocean Tsunami in Banda Aceh, Indonesia. (10 pages)

Preliminary Data Report on Tsunami-generated Debris (18 July 2007, 11 pages)

Report on Tsunami-generated Debris September 2007, prepared by Dr. Suprihanto Notodarmojo (33 pages)

Construction and Demolition Waste Management Practices (31 pages)

Key Factors in Technology Identification and Selection (19 pages)

C&D Technology Catalogue (24 pages)

Key Factors in Technology Identification and Selection (84 pages)

Technology Components (12 pages)

Guidelines for Specifications Waste Management Equipment for the DEBRI Project (10 pages)

Technology Specifications: Waste Management Equipment for the DEBRI Project (7 pages)

Request for Proposals (RFP 08/0024/ss) (24 pages)

Waste Management Mechanism (38 pages)

Contextualizing Economic Instruments of Waste Management in Indonesia: Policy Options and Transition of Institution (72 pages)

Annex 4. Summary co-finance information and statement of project expenditure by activity

No reference was made to co-financing, so the sole source of funding is taken to be the grant of EURO 750,000 from the European Union [Asia-wide programme: EU-ASIA PRO ECO II-B Post-Tsunami PROGRAMME; Project Contract N°: ASIE/2006/125-929]

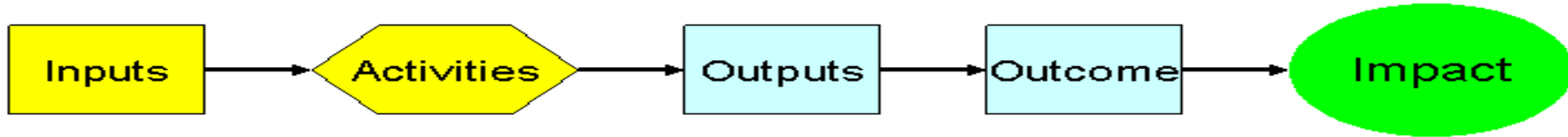
Summary of financial reports

Item	Amounts in Euros		
	Budget	First Interim Report October 2007	Second Interim Report October 2008
Human Resources	236,550.00	99,729.85	130,803.77
Travel	45,800.00	10,983.60	27,752.54
Equipment & supplies	340,244.00	3,925.43	0
Local office / Action costs	34,200	6137.51	15,695.97
Other costs and services	44,200	5,079.05	14,885.49
Subtotal	700,994.00	125,855.44	189,137.77
Administration costs	49,006.00	8,809.88	13,239.64
TOTAL	750,000.00	134,665.32	202,377.42

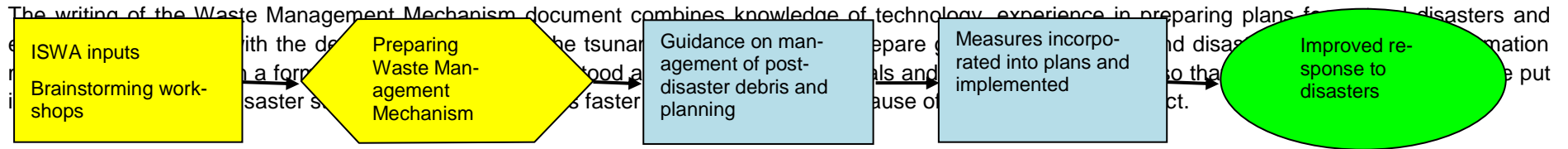
Some of the expenditures reported in the first interim report were not shown in the second interim report. Some examples are given here. No explanations were found for why expenditures in the first report were not shown in the second.

Item	Budget	First Interim Report October 2007	Second Interim Report October 2008
1.3.1 (new) Kick off meeting	250	1,351.86	0
1.3.1.(b/c) Organisational mgmt plng	750	1,642.94	0
1.3.2 (a) Baseline data creation	750	2,819.73	738.42
2.2(a) Baseline data creation	1,000	2,828.60	0
3,2 (a) Laptop computer - field work	5,000	3,791.01	0
3.2 (b) Printer	1,000	134.43	0

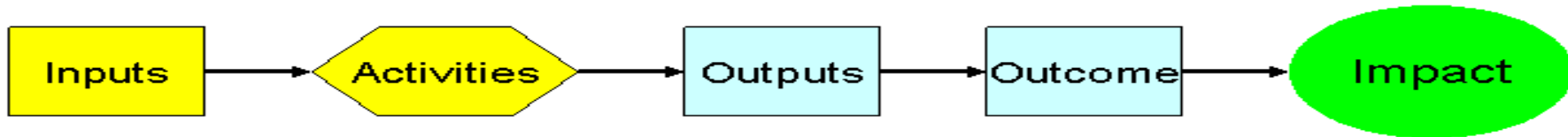
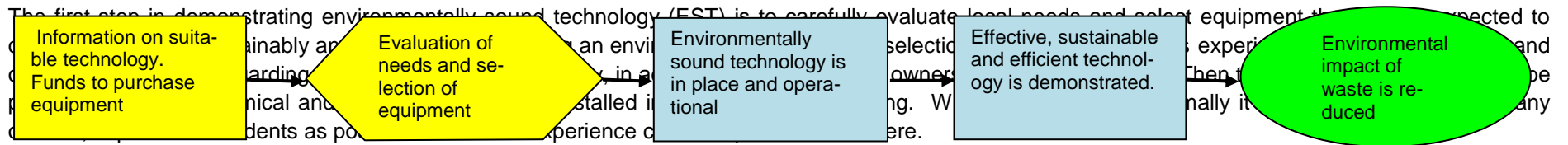
Annex 5. Details of the project's 'impact pathways' and the 'ROtl' analysis



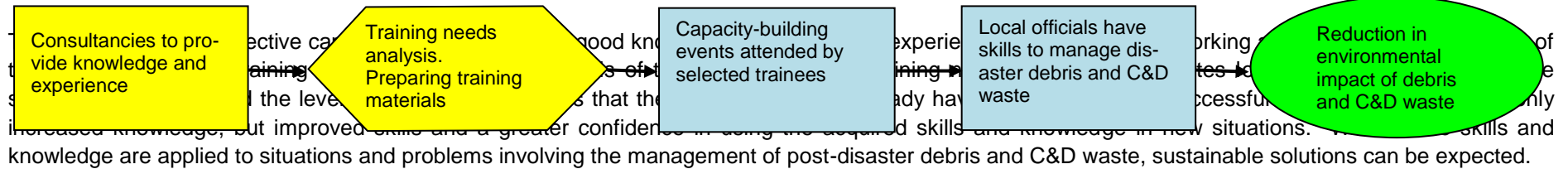
Disaster Waste Management Mechanism



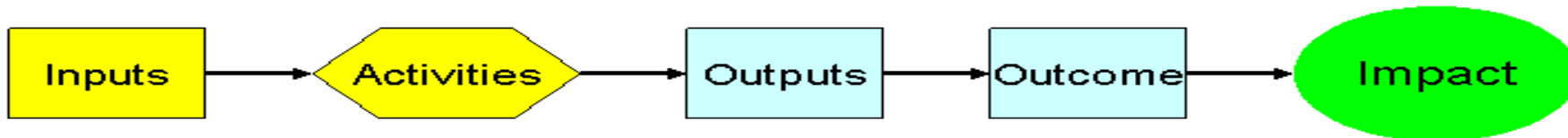
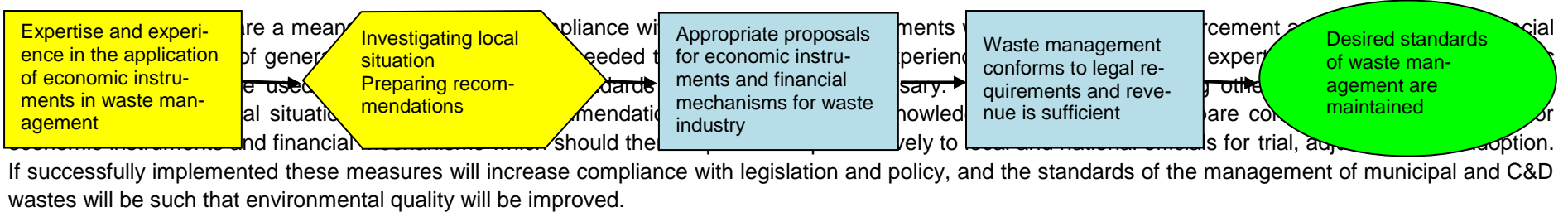
Demonstration of Environmentally-sound Technologies



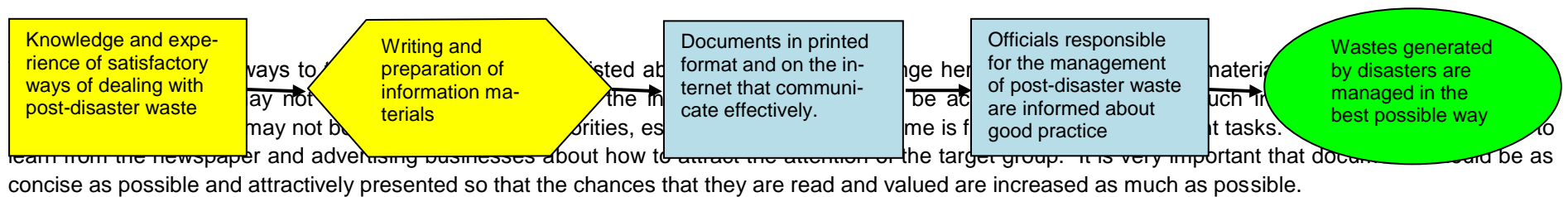
Local Capacity Building



Development of Economic Instruments



Knowledge Sharing and Information Management



Annex 6. Expertise of the Evaluator (brief CV)

Summary

Over 30 years' experience in **solid waste management** and public health engineering, mainly for economically less-developed countries, with particular experience in institutional and technical aspects, and capacity building.

Key skills include

- a broad and practical knowledge of solid waste management practices in a large number of developing countries,
 - particular experience relating to private sector participation in solid waste management,
 - experience with other institutional aspects including strategy development
 - specific expertise in healthcare waste management
 - expertise in developing, organising and conducting training courses and international workshops in waste management and other related topics
 - writing, reporting and editing technical publications.
-

Posts held

2009 – Team leader for EU-funded healthcare waste management project, Romania
2007 – 2008 Freelance consultant
2006 – Solid waste management advisor to the Governorate of Sharkia, Egypt
2005 – Freelance consultant
2003 – 2005 Technical Advisor, GTZ; Senior Advisor for Private Sector Participation in Solid Waste Management, Egypt
1997 – 2003 Waste management specialist, SKAT (Swiss Centre for Development Cooperation in Technology and Management), St Gallen, Switzerland
1995 – 1997 Technical Advisor, GTZ (German Agency for Technical Cooperation); Advisor in waste management to the Palestinian Authority
1980 – 1995 Lecturer and Programme Manager, Water, Engineering and Development Centre (WEDC), Loughborough University, UK
1978 – 1980 Assistant Engineer, Binnie & Partners, Consulting Engineers, London
1973 – 1975 Instructor, Department of Civil Engineering, Pahlavi University, Shiraz, Iran
1966 – 1967 Teacher, St Paul's Secondary School, Beaufort, Sabah, Malaysia

Work experience in low- and middle-income countries

Iran (2 years), Egypt (3.5 years), Palestinian Territories (21 months), Romania (1 year); Malaysia (1 year), India (5 months), Sri Lanka (6 months), Vietnam (5 months), China (6 weeks), Kenya (5 weeks), Indonesia (7 weeks), Bangladesh (4 weeks), Also short assignments in Botswana, Brazil, Burkina Faso, Cambodia, the Caribbean, Chad, Ghana, Jordan, Kosovo, Lebanon, Lesotho, Madagascar, Morocco, Mauritius, Nigeria, Oman, Senegal, Swaziland, Syria, Tanzania, Yemen, Zambia, Zimbabwe.

Education

1975-1978	PhD by research in Public Health Engineering at University College London (awarded 1983) into mechanisms of rapid sand filtration. (Thesis title: "Conductimetric measurement of deposits in deep bed filters")
1970-1973	MS, Pahlavi (now Shiraz) University, Shiraz, Iran. Environmental and Hydraulic Engineering: research into the relationship between socio-economic indicators and the characteristics and quantities of solid waste. (Thesis title: "The Dynamics of Solid Waste Generation in an Industrialising Economy".)
1967-1970	BA, Trinity College, Cambridge: Mechanical Sciences

Professional qualifications

2002	Chartered Waste Manager, Chartered Institution of Wastes Management, UK
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Evaluation and appraisal assignments undertaken

Year	Location	Project	Funding agency
2003	Vietnam	Appraisal of augmented proposal for wastewater and solid waste projects	GTZ
2001	Vietnam	Appraisal of wastewater and solid waste project proposal	GTZ
2001	Egypt	Appraisal of waste management project proposal	GTZ
2001	Kenya	Evaluation of impact of training programme	SDC/NETWAS
2001	Egypt	Review of waste management project	GTZ
2001	Tanzania	Review of waste collection and recycling project supporting microenterprises	ILO
2001	Palestinian Territories	Review of solid waste management project	GTZ
2000	Beijing, China	"In depth" evaluation of waste management project	UNIDO/SECO
1999	Mauritius	Review of waste management in small island states	UNEP
1999	Madagascar	Review of healthcare waste management	VOARISOA
1997	Vietnam	Review of urban development projects	SDC

Publications

<ol style="list-style-type: none"> 1) <i>Collection of Municipal Solid Waste in Developing Countries</i>; co-authored with Manus Coffey; (200 pages) to be published by UN-Habitat in 2010. 2) <i>Solid waste management and the Millennium Development Goals – Links that inspire action</i>, co-authored with Barbara Gonzenbach; Booklet in CWG series, published by Skat, Switzerland 2007. 3) <i>Solid waste, health and the Millennium Development Goals</i>; CWG, Skat, St Gallen, Switzerland;

- 2006.
- 4) *Private sector involvement in solid waste management – avoiding problems and building on successes*; Full report of 250 pages published by GTZ; July 2005. Summary brochure published by the Skat Foundation on behalf of the CWG, July 2005.
 - 5) *Solid waste collection that benefits the urban poor* Skat Foundation, St Gallen, Switzerland, 2003
 - 6) *This shit drama – are there ways out?* Report on the 19th AGUASAN Workshop, Switzerland, 2003
 - 7) *Profits for All - Service for All - innovative approaches and management options for equitable and sustainable drinking water and sanitation services*; Report of the 18th AGUASAN Workshop, June 24 - 28, 2002, Skat Foundation, St Gallen, Switzerland.
 - 8) *Better solutions through new ways of thinking*; Skat Foundation, St Gallen, Switzerland 2002; ISBN 3-908156-04-1
 - 9) *From Sector Reform to Sector Revolution - a new (and revolutionary) approach is needed to ensure sustainable operation and maintenance of installed systems*; Report of the 17th AGUASAN Workshop, June 25 - 29, 2001; SKAT, St Gallen Switzerland.
 - 10) *Partnerships for better solid waste management for the poor*; Paper presented at ADB Forum– “Beyond Boundaries: Urban Services for the Poor”; Manila 20-22 June 2001
 - 11) *Establishing Links with National Initiatives for SWM Privatisation in Aswan Governorate*; SWM Report 13, Aswan City Council and GTZ, June 2001
 - 12) *Planning for Sustainable and Integrated Solid Waste Management*; Report of CWG International Workshop, Manila 18 to 21 September 2000
 - 13) *HCA – The Household-centred Approach*; report of 16th AGUASAN Workshop (Water supply and environmental sanitation), June 26 to 30, 2000
 - 14) *Guidance Pack Private Sector Participation in Municipal Solid Waste Management* by Sandra Cointreau-Levine, ISBN 3-908001-90-0, SDC and SKAT, 2000 (Editor and contributor)
 - 15) *How are we managing our healthcare wastes?*; co-author with Jürg Christen; A4, 92 pages, ISBN 3-908001-86-2; SDC and SKAT, 1999
 - 16) *Sitting in the hot seat: The role of the sanitation manager: Waterlines*, Vol 17, No.3 1999, pp6-8
 - 17) *Aid going to waste – and worse*; SKAT Waste Management *Infopage*, No. 5; March 2000.
 - 18) *Directory of English language publications and organisations for solid waste management in low-income countries* (editor), SDC/SKAT 1998
 - 19) *Municipal Solid Waste Management: Involving Micro- and Small Enterprises: Guidelines for Municipal Managers*; (contributor and chief editor); 16 x 24cm, 154 pages, ISBN 92-9049-365-8; SDC, WASTE, GTZ, ILO, SKAT, 1998 Also available in French and Spanish versions.
 - 20) *Lessons from India in Solid Waste Management*; (editor and contributor); A4, 250 pages; WEDC, UK, 1997, ISBN 0 906055 49 0.
 - 21) *Education in Municipal and Informal Systems of Solid Waste Management* (with Mansoor Ali and Andrew Cotton) in *Educating for Real: the training of professionals for development practice*; edited by Nabil Hamdi; Intermediate Technology Publications; 1996; ISBN 1 85339-333-9, 1996
 - 22) *Informal Recycling and Municipal Attitudes* (with A P Cotton and S M Ali), presented at *Whose Environment? New Directions in Solid Waste Management*; University of Birmingham, May 1994, section 11 pp 1-10
 - 23) *Managing Medical Wastes in Developing Countries*, World Health Organisation; WHO/PEP/RUD/94.1 1994
 - 24) *Observations of Solid Waste Management in Bombay 1992* (with Manfred Scheu), WEDC, 1994,

ISBN 0 906055 40 7

25) *Water Treatment – Design for Reliability*; in *Developing World Water*, Grosvenor Press International, 1989

26) *A Case Study in Solid Waste Generation and Characteristics in Iran*; in Holmes John R; *Managing Solid Wastes in Developing Countries*, pp91-102, Wiley 1984, ISBN 0 471 90234 9