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Abstract

The project concerned the planning and implementation of action research on alternative strategies for environmental sanitation and waste management in six peri-urban coastal communities in south Asia. Five universities and five NGOs from India, Bangladesh, Sri Lanka, The Netherlands and Finland cooperated with local Governments. Its objectives were to measure the cost-effectiveness of innovative and replicable approaches to excreta and solid waste management in low income peri-urban settlements; to measurably improve sanitation conditions and practices; to scale up the tested approaches; and to strengthen interdisciplinary cooperation and implementation skills of the participating research and civic society institutions. The project used participatory methods to promote the adoption of improved sanitation and hygiene. Local women were trained to produce and install sanitation facilities, generate work and income and improve their status. Innovations were toilets and rainwater harvesting tanks built by local women masons, including lower cost toilets, water tanks and eco-latrines, home composting and vermi composting. The research used a quasi-experimental design of three study and three control communities.

The project was able to meet virtually all project objectives. Ownership of sanitary toilets grew from 79% to 100% in the site in Bangladesh and to 91% and 89% in the sites in Kerala and Sri Lanka. There were no or minimal changes in the control areas, except for Kerala where a national sanitation campaign is going on. For those without latrines, sharing has increased. Quality of construction and hygiene were significantly better in the pilot communities than in the control communities. Differences found were 47%, 30% and 20%. Composting of solid waste grew from 0% to 29% in Morrelganj (Bangladesh), from 10% to 69% in Thumbolly (Kerala) against 6% in the control site and 12,5% against 0% in the sites in Sri Lanka. School science experiments on measuring the impact of urine fertilization on plant production are going on in two sites and have been expanded to five sites.

Water supply improvement was undertaken on request in all areas. This resulted in the construction of a new sand filter by the Government and 125 rainwater harvesting household reservoirs by the women masons in Morrelganj, the upgrading of eight ponds in the Kerala pilot areas and the construction of four RWH tanks in the pilot site in Sri Lanka. Solar disinfection (SODIS) was introduced to promote the safe use of drinking water. First measurements showed that at 60 degrees Celsius, no contamination was present. E-coli were absent from 37 degrees Celsius onward. Self-tests using H₂S strips showed e-coli in stored untreated water in 97% of the households in the Sri Lankan pilot. More testing is still needed.

Costs were 31%, 20% and 86% lower than in comparable government programmes. All facilities were built without outside subsidies. A full-fledge cost-effectiveness study could not be done because there were no government programmes in the control areas.

The knowledge generated was laid down in case studies, articles in refereed journals and the national press, a DVD, and websites in each country. An Occasional Paper will yet be produced. Interdisciplinary knowledge and skills were enhanced in five international workshops, two inter-country workshops and one university course.

The project proved that women can successfully undertake water and sanitation masonry and solid waste recycling, but in Sri Lanka a shift was needed to other vocational training. Upscaling of approaches is taking place in all three countries. In Morrelganj, the approach was scaled up to three wards. Lessons on composting are taken up to the national level through the partners' roles as advisors to the national sanitation policy. In Kerala, expansion is under way to 12 of 21 Local Self Governments and two municipalities. One proposal has already been sanctioned. The solid waste component has become part of the State policy. In Sri Lanka, expansion is taking place to the work of Plan International and the Red Cross.

Summary

The project concerned the planning and implementation of action research on alternative strategies for environmental sanitation and waste management in six peri-urban coastal communities in south Asia. It was a three year project, carried out from January 2003 to July 2006. A half year budget neutral extension was obtained to cope with delays due to the tsunami disaster. Five universities and five NGOs from India, Bangladesh, Sri Lanka, The Netherlands and Finland cooperated with local Governments in three low-income urban sites in Bangladesh, Kerala and Sri Lanka.

Objectives

The project's objectives were:

- to measure the cost-effectiveness of innovative and replicable approaches to excreta and solid waste management in low income peri-urban settlements;
- to measurably improve sanitation conditions and practices;
- to scale up the tested approaches ;
- to strengthen interdisciplinary cooperation and implementation skills of the participating research and civic society institutions.

The project used participatory methods to promote the adoption of improved sanitation and hygiene. Local women were trained to produce and install sanitation facilities, generate work and income and improve their status. Innovations were toilets and rainwater harvesting tanks built by local women masons, including lower cost toilets, water tanks and eco-latrines, home composting and vermi composting. The research used a quasi-experimental design of three study and three control communities.

Activities

The project started with an inception workshop of all the partners in February 2003 in Delft, the Netherlands. This provided an opportunity to learn about general conditions in the southern countries and plan the project in detail, including the selection of sites, the review of technologies, the cooperation with the authorities and the design of the case studies and surveys.

Thereafter, baseline studies were carried out in six project communities, three pilots and three controls. They were matched for comparability yet located sufficiently far to avoid influences from inter-community contacts. At the same time, case studies were carried out in all communities for qualitative data and to get information on any ongoing programmes. All six communities are poor, with low sanitation and hygiene and located in environmentally fragile coastal areas.

Planning of the fieldwork began in August 2003, with a workshop in Kandy, Sri Lanka. A visit was paid to the project area and to an area with an ongoing eco-sanitation programme, with 100% subsidized household toilets. Three international workshops took place to review project progress and plan in depth, in Trivandrum (February 2004), Dhaka and Morrelganj (September 2004) and Cochin (July 2005).

Training of trainers took place in Allepey, Kerala, in October 2003. Five women and five men were trained on the construction of low-cost toilets and (vermi) composting. In their turn they trained four women masons in Morrelganj, the pilot community in Bangladesh. In Allepey, Kerala, five women latrine masons were trained and 3 women masons for rainwater harvesting tanks. In addition, training was started on vermi-composting for in total 400 women. In Sri Lanka, no further sanitation training took place as those trained were the intended implementers

Community organization started with the establishment of a Project Management Committee (PMC) and a Project Advisory Committee (PAC) and the formation of a Young Voluntary Group in Morrelganj (Bangladesh). The latter were the promoters and wrote and performed a play on sanitation and social problems (“Death trap”). In Thumpolly, Kerala, the NGO also set up a Programme Management Committee, an Advisory Committee and a team of ten Volunteers. In Karrukapone in Sri Lanka, no committees were set up, but the work was implemented with a local youth club that had been organized by the church.

A new gender element in Morrelganj was that here for the first time, three of the six members of the PAC were women, including the chairperson. The PMC had also a woman member. There was further some hesitancy if Muslim women could be trained as mason. Hence, training was given to mixed teams. This led to an initial situation where the women functioned as helpers to the men. Through discussions and with increased experience the women developed into full-fledged masons. They now run a Village Sanitation Centre that supplies not only the project ward but the whole Municipality. In Kerala and Sri Lanka the problem was more to involve the men. Hence in Thumpolly special hygiene education sessions were organized for men, while in Sri Lanka three sessions were held with the local fishermen.

New technologies and designs were developed in all project sites. They comprised: a lower cost rainwater tank consisting of five latrine rings with a cover, piping and a householder designed “looking glass” to note when the diverted first flush of rainwater is clear enough to connect the pipe to the tank; various designs of composting bins; a drip irrigation system for urine used in a natural science experiment to measure the impact of urine fertilization on plant production at the local schools; urine fertilization of ornamental plants at home and in a women-established plant nursery, lower cost latrine lining using old car tyres, two types of eco-latrines, and vermi-composting at household and community level. The water supply component was originally not a part of the project but was added on request of the communities. All innovation hardware was introduced without subsidy; the project only covered the promotion and training costs and the costs of the research.

Results

The project could virtually meet all its objectives. Both toilet provision and solid waste segregation and reuse by women proved to be socially and economically viable in Bangladesh and Kerala. In Sri Lanka, alternative types of work were found for 60 young women, as women’s work as masons did not work out. Contrary to project planning, only young unmarried women had come forward to be trained. They did not continue after marriage.

The 4WS project was 31% cheaper than a comparable government project in Bangladesh, and 20% cheaper in Kerala. In Sri Lanka, the 4WS project costed 14% of a comparable government project. Women masons make an income of US\$ 18/RHT in Bangladesh (125 constructed so far) and earn the equivalent of US\$ 15-17/month at the solid waste recycling units (3 so far) in Kerala. Women latrine masons in Thumpolly are earning Rs. 250 (US\$ 5.4) per installed/repaired toilet. Other women obtain incomes from solid waste recycling (Rs. 3/kg) and paper and fibre bag making (Rs.2/bag).

Presence of latrines grew from 79% to 100% in Morrelganj and grew to 91% and 89% in Thumpolly and Karrukapone. None were directly subsidized. External funds went to promotion, training and research, not construction. All overhung latrines and latrines draining directly onto surface waters were replaced by more sanitary models. There were no or minimal changes in the control areas, except for Kerala where a state-wide sanitation campaign had been going on at the same time as the project. The use of the latrines grew to 100% for women and men Morrelganj. In Thumpolly and Karrukapone, some open defecation continues, but its presence has been reduced significantly. The safe disposal of children’s faeces also improved, by 46% to 90%. Sixty six percent of the households now use potties; none did this earlier. In Sri Lanka, training children on safe defecation methods increased by 32% to a total of 83%. Latrine sharing by those without a toilet of their own

increased. Measurement should however have been more standardized. Now, the Kerala team did for example not study children's defecation.

Quality of construction and operation of latrines showed good results. In Morelganj, there was a difference of 47% between the pilot and control community in having a clean latrine with the water seal intact. In Kerala, the percentage of poor latrines was 6% less in the pilot area than in the control area. The greatest improvement was for toilet hygiene, net gains of 31% and 1% respectively. In the Sri Lankan project, all hygiene indicators were better for the pilot community, except the presence of faecal parts in the water: 58% vs. 50%.

In the pilot area in Bangladesh handwashing with soap before handling food and after visiting the toilet improved from 24% and 80% to 66% and 97% respectively. In the control area, handwashing before eating actually fell from 25% to 9% and remained the same (34%) after defecation. Washing hands after cleaning babies improved from 44% to 95% in the pilot area and dropped from 52% to 34% in the control area. Reported handwashing behaviour also improved substantially in the pilot community in Kerala. Improvements concerned especially the washing of hands before eating (by 26%, an increase of 24%) and after defecation (from 1,5% to 27%). Washing hands after handling children's excreta grew from 0.5% to 6.2%. There is however no significant difference with handwashing practices in the control area. In the Sri Lankan site there were also significant improvements : 85% of the pilot households washed hands after defecation against 45% in the control community. For washing before eating results were better in the control community : 37% and 44% respectively.

Segregation of solid waste grew from 0% to 68% in the Bangladesh pilot site, with 29% making compost. In the control area this was 14%. In the Kerala site, segregation grew from 10% to 69% against 6% in the control area. In Sri Lanka, progress was least, with a growth in composting to 12,5% against 0% in the control area. The introduction of pot vegetation is expected to increase this percentage.

The improvement of the domestic water supply was added by the community members in all three sites. In Bangladesh, safe water use increased from 44% to 85%, of which 41% thanks to the RWH tanks. In the site in Sri Lanka, the people abandoned the use of the sand dune well after testing positive for e-coli. In Kerala, use of wells also increased. Introduction of SODIS (Solar Disinfection) was started to reduce these risks. A start was made to test the effects, but more time and efforts are needed to measure the impact on water quality and water use.

Measurement of environmental impacts through scale observations showed much more progress in the pilot communities than in the control communities. As to soundness of technology, due to the high water table, it would be advisable to introduce more eco-toilets, preferably above ground. A start was made with such toilets in Kerala and Sri Lanka. They need more time and cost reduction to become widely accepted and used.

Gender impacts are the increased participation of women in decision-making, the training of women for new tasks in solid waste management in the Kerala site and in water supply and sanitation technology and production in the Bangladesh pilot project, the generation of work and income for poor women in all three sites, the increased attention to the roles of men in hygienic conditions and practices, the achieved redistribution of work between women and men, benefiting women and adolescent girls in the Kerala project. Four women staff obtained a certificate in Health-related Environmental Biology at the University of Kuopio.

The women's masonry component was least successful in Karrukapone, as contrary to planning, only adolescent girls came forward for training, who did not continue after marriage. Instead, vocational training was given to 60 young women, leading to income from dressmaking, wedding cake making etc. Besides the originally planned masonry and composting work, including the use of compost and urine fertilizer in a plant nursery,

diversification of jobs occurred also in Kerala, where women could take up paper and fibre bag making.

Continuity of the approaches in the pilot areas has been ensured with the continuation of the community-level organizations and follow up with the local administrations.

Expansion from one to three wards is under way in the Bangladesh site. Lessons on composting are taken up to the national level through the partners' roles as advisors to the national sanitation policy. In Kerala, expansion is under way to 12 of 21 Local Self Governments and two municipalities, following a one day dissemination workshop on 4WS. One proposal has already been sanctioned. The solid waste component has become part of the policy of the State Sanitation Mission. In Sri Lanka, expansion is taking place to the work of Plan International and the Red Cross.

The project has been documented in six case studies, annual progress reports, four websites and a number of conference paper and articles in refereed journals, including:

- M.Snel. Women, Wellbeing, work, waste and sanitation (4Ws) - Action research on alternative strategies of environmental sanitation and waste management for improved health and socio-economic development in peri-urban coastal communities in south Asia. Paper presented at the first Dry Toilet Conference, 20-23 August 2003, Tampere University, Finland. <http://www.irc.nl/page/8297>
- Heinonen-Tanski, H., Snel, M., van Wijk-Sijbesma, C. Quazi, A.R., Mathew, K, Werellagama, I., Rahman, M., Rashid, S. M. A., Jayaweera, P. & Judith, H. 2006 Assessing of Environmental Quality in Six Areas in India, Sri Lanka and Bangladesh, *Environm. Develop. Sustainability*. Accepted. [http://www.springerlink.com/\(fsur4bydikwopb45kpmc1145\)/app/home/contribution.asp?referrer=parent&backto=issue,22,49;journal,1,27;browsepublicationsresults,394,1585](http://www.springerlink.com/(fsur4bydikwopb45kpmc1145)/app/home/contribution.asp?referrer=parent&backto=issue,22,49;journal,1,27;browsepublicationsresults,394,1585);
- Helvi Heinonen-Tanski and Christine van Wijk-Sijbesma (2004) Human excreta for plant production. *Bioresource Technology*, Vol. 96, Issue 4 , PP. 403-411
- Heinonen-Tanski, H., Sjöblom, A., Fabritius, H. & Karinen, P.200x. Pure human urine is a good fertiliser for cucumbers, *Bioresource Technology* available online at www.sciencedirect.com
- Heinonen-Tanski, Helvi, Eilia Torvinen, Päivi Holopainen, Deepashika S.K. Gunasekara, Palitha Jayaweera.2005. *Micro-biological water quality after SODIS-treatment and rainwater harvesting*. Presented at the 5th International Planning and Review Workshop, Cochin, Kerala, July 12-14, 2005.
- Heinonen-Tanski, H. Human excreta for fertilisation of non-edible tropical plants. Paper submitted to *Bioresource Technology*.
- Saji, Jessy. Integrated Water Resource and Solid Waste Management : Alappuzha, Kerala, S.India. Paper presented at the 32nd WEDC International Conference « Sustainable Development of Water Resources, Water Supply and Environmental Sanitation », Colombo, Sri Lanka, 13th - 17th November 2006

The Occasional Paper is yet to be prepared, as this was only possible after the analysis of the post study.

On the initiative of the southern partners, a new proposal has been formulated to transfer and adjust the approach to the low-income areas of major cities to work further on eco-sanitation and see whether a similar innovative approach can work in urban slums, where the environmental risks are even greater. This project will benefit from the experiences gained in the development and use of participatory methods, gender approaches, and the need for greater standardization of data collection instruments between the countries.

Consolidated scientific report

Context

The need for the action research derives from the problems faced by municipalities in densely populated and ecologically fragile coastal areas to improve environmental conditions by the reduction of soil and water pollution, to cut off health risks to sanitation and water related diseases (still the second cause of death of children under five in developing countries) and to stimulate social and economic development. In this, the municipalities do not stand alone. Expectations of the WHO are that by 2015 there will still be over two billion people who have no improved sanitation. (WHO, 2004). The achievement of the Millenium Development goal for sanitation will thereby greatly lag behind that of water¹.

The absence of sanitation contributes significantly to the poor quality of life and the costs of living of poor households. In the areas where the action research was carried out, sanitation coverage for the poor is between 30 –50%. In India, half of the domestic waste is left uncollected and health expenditures range from RS 100 to 400 per person per year. An average IRS100 per person per year is used for the treatment of water and sanitation related diseases².

The poor sanitary conditions also pose serious social problems. Gender norms prescribe that while men are free to urinate and defecate in any place during the day, women and adolescent girls must find private places which they may only use under the cover of darkness. This means that they must often walk long distances and help themselves in highly unhygienic places full of the excreta from other women and girls. The conditions are not only unhygienic and distasteful, but also affect their safety and force them to limit their intake of food and fluids during the day with serious negative consequences for their health (kidney disorders). Health risks and social problems are the greatest in densely populated areas with limited vegetation and periods of high rainfall, such as coastal zones.

At the same time, the conditions provide opportunities for social and economic development in low income areas of coastal zones. Low-cost solutions for excreta disposal and solid waste collection and recycling which are implemented by local women generate employment within the women's own areas. This is important because gender constraints of a practical and strategic nature (looking after young children and protection of safety and modesty) make it hard for young women to travel to and from work in areas away from home. The low-cost solutions are also profitable for the authorities responsible for infrastructure and environmental health. While the average unit costs of sewerage range from USD 175 to USD 300 per person, those for on-site double vault pour-flush latrines cost on average USD 70³. Better environmental and personal hygiene is also crucial to meet international standards of for shrimp processing and fish export and for the development of tourism.

Objectives

The above considerations have led to the formulation of an action research project with the following general objectives :

¹ The MDG Target 10: halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation.

² The MDG Target 8: have halter by 2015 and begun to reverse the incidences of malaria and other major diseases

³ Lenton, Roberto and Albert Wright, 2004. Interim report of Task Force 7 on water and sanitation. New York, USA: United Nations. <http://www.unmillenniumproject.org/documents/tf7interim.pdf>

1. Measurably improve sanitation conditions and practices in three pilot areas
2. Measure the cost-effectiveness of technically, socio-economically and environmentally innovative and replicable approaches to excreta and solid waste management in low income peri-urban settlements in a part of Asia that has lagged behind in sanitation
3. Scale up the tested approaches through integration of lessons learned in sanitation policies and implementation programmes of Local and State Governments
4. Strengthen interdisciplinary cooperation and implementation skills of the participating research and civic society institutions through knowledge exchange, cross-regional training and joint documentation of studies, interventions and results.

The specific scientific and technical measurable objectives are:

A. *Cost-effectiveness*

- Number and percentage of households that effectively adopted sanitary facilities and practices in comparison with control areas
- Socio- economic viability of solid waste collection, recycling and marketing
- Cost of interventions in the pilot areas as compared with the control areas

B. *Improved conditions and practices*

- Measurably improved conditions and practices in the sample households in the pilot areas
- Investigation of the technical and environmental soundness of the adopted technologies

C. *Use of the generated knowledge*

- Three case studies on existing approaches
- Reports to and meetings with municipal authorities
- Information on the websites of eight partners with links to at least ten major international websites on sanitation and development
- One joint Occasional Paper published in hard copies and on the internet
- Published articles in national and international journals, popular periodicals and the local press
- Plans of six local municipalities for application of relevant findings

D. *Interdisciplinary knowledge and skills*

- Four faculties in four universities have shared knowledge and skills in interdisciplinary evaluation of low-cost sanitation approaches
- Four NGOs have shared knowledge and skills in low-cost excreta disposal and waste recycling
- Eight partners have shared knowledge and skills in integrated low-cost sanitation programme development, implementation, monitoring, evaluation and documentation
- Replicable interdisciplinary and participatory programme approaches developed, tested and documented

The project used action research with a quasi-experimental design of three pilot communities and three matched control communities. The baseline study was done through social surveys using closed questionnaires on attitudes, practices and conditions regarding environmental sanitation, water and hygiene. The survey was either done in a random sample or in all households (as was the case in the Bangladesh area). It was replicated at the end of the project. Two environmental surveys were carried out which scored the main factors (general overview, water supply, sanitation and solid waste treatment) from 0 (very poor or totally lacking) to 5 (excellent). They were done in November-December 2003 and

November-December 2005. Both visits were made during the first months of the dry season, so that the nature and vegetation effects caused by the annual cycle would be as similar as possible. The methodology used has been described in Heinonen-Tanski, H., Snel, M., van Wijk-Sijbesma, C. Quazi, A. R., Mathew, K., Werellagama, I., Rahman, M., Rashid, S. M. A., Jayaweera, P. & Judith, H. 2006. *Assessing of Environmental Quality in Six Areas in India, Sri Lanka and Bangladesh*, accepted in the refereed international and multidisciplinary journal *Environmental Development Sustainability*

Activities

Inception workshop

The project started with an inception workshop of the seven core members of the 4WS project from 17 to 21 February 2003 in Delft, the Netherlands. At the workshop, the partners presented the situation in their country/state and their experiences with safe excreta disposal and the management of solid waste. After discussing the project in general, detailed planning started on its design and implementation. This involved the establishment of selection criteria for the study and control communities, the review of safer human excreta disposal and waste management models, the design of a format for the case studies, the design of the questionnaires for the baseline studies, and the planning of the contacts with the authorities in charge of water and sanitation infrastructure and environmental management, especially the local governments. Work was also done on the development of webpages and various types of information materials, the creation of reporting formats, planning of training for women workers and support staff and preparation of a detailed time and workplan for the first phase of the project. Each partner received a CR ROM with relevant information on project related topics. Yearly updates were sent and partners also provided literature.

Baseline studies

After the inception workshop, the partners choose the pilot and control villages, established a working relationship with the local authorities (municipalities in Bangladesh, the *Panchayat Raj*¹ and municipality in Kerala and the *Pradeshiya Sabha* in Sri Lanka). In each community, a baseline study was carried out. In Bangladesh and Sri Lanka, all households were interviewed. In Kerala, household samples covered 25% of the pilot community and 3.4% of the control community. The results have been written up in the first Annual Report of the project. Highlights are in Table 1.

Table 1 Summary of baseline conditions in the project communities

Bangladesh – Pilot community Morelganj	Control community Paikgacha
<ul style="list-style-type: none"> • 79% of adult householders have and use sanitary toilets; the others use a latrine draining on a canal or pond. • 43% of the children <5 practice open defecation • 50% dispose solid waste in open spaces <ul style="list-style-type: none"> 33% dispose in ponds 16% in drains 1% at roadsites • 53% of households use ponds and shallow tubewells for drinking water • 26% think this drinking water is unsafe 	<ul style="list-style-type: none"> • 42 % of adult householders have and use sanitary toilets; the others use a latrine draining on a canal or pond. • 67% of the children <5 practice open defecation • 71% solid waste disposed in open spaces <ul style="list-style-type: none"> 14% dispose in ponds 8% in drains 2% at roadsites 5% in dustbins from neighbouring ward • 93% of households use ponds and shallow tubewells for drinking water • 22% think this drinking water is unsafe

¹ A panchayati Raji is a political and administrative unit below the district such as a cluster of households at the neighborhood level.

<p>Kerala – Pilot community Thumbolly, Allepuzha</p> <ul style="list-style-type: none"> • 75% have sanitary latrines • 15% soiled by excreta • 33% of men practice open defecation • 90% depend on a combination of tap and well water • 50% dispose solid waste in yard and occasionally burn it. In 50% of households waste is collected 33% sells to informal sector collectors 10% segregate 	<p>Control community Shanghumugham, Trivandrum</p> <ul style="list-style-type: none"> • 66% have sanitary latrines • 36% soiled by excreta • 51% of men practice open defecation • 70% depend on a combination of tap and well water • 70% dumps solid waste on the beach The remainder deposits in yard, burn or throw in public places 16% segregates waste before selling or disposing it.
<p>Sri Lanka – Pilot community Karrukkupane</p> <ul style="list-style-type: none"> • 44% of the households own a latrine Men and children practice open defecation • 42% dispose solid waste in yard 6% segregate • 71% buy piped water from vendors 	<p>Control community Udappuwa</p> <ul style="list-style-type: none"> • 35% of the households have a latrine 12% uses a public latrine Men and children practice open defecation • 45% dispose solid waste in yard 3% segregate 21% use municipal collection service 99% buys water from vendors

Case studies

Case studies on the pilot and control areas provided an overview of the situation regarding water supply, excreta disposal, drainage and solid waste management. The studies also gave an overview of public and private sector actors and their activities in the areas and the prevailing sector policies¹.

Planning workshop

To prepare the pilot projects, COSI and IRC organized a planning workshop in Kandy, Sri Lanka, from 11 to 14 August, 2003. All eight partners participated in the workshop. The participants visited the project area for structure observations and discussions. They also visited an eco-sanitation project in Matale, to orient themselves about the local experiences with dry latrines. Dry latrines have been included in the latrine options from which the participating households choose their models. A poster session was held at which each team presented their progress. A copy of the directives can be found in Annual Report – Synthesis of work in 2003. The remainder of the workshop was dedicated to the planning of the mason training and the review and fine-tuning of the action plans. At the workshop, the following selection criteria were agreed on for the selection of the women masons:

- Gender: balance of women and men (3 women, 2 men)
- Age: 25-45 years
- Marital status: widowed, single mother, married
- Education: minimum of primary school
- Previous experience: healthy and physically strong individuals willing to work as masons. No previous experience in masonry necessary
- Area: Persons from the pilot area

Training

From 14 to 25 October, a training of trainers' workshop for solid waste recycling and for the promotion, construction and follow up of sanitary latrines took place in Alleppey, Kerala, India. Six trainees (4 women, 2 men) joined from Sri Lanka, one woman from the pilot community in Kerala and three (all male) from Bangladesh). In the pilot area in Allepuzha, Kerala, five women had expressed an interest in training if their husbands agreed. One of them then joined the training.

¹ All the case studies developed by the partners will be integrated in an occasional paper which shall be produced in the coming months.

Three women from Sri Lanka were also from the pilot community itself. The other participants were from the supporting local NGOs and one University staff member. The trained NGO workers will train in their turn local community members as waste recyclers and latrine promoters and builders in the project. In Sri Lanka and Kerala, these were all women; in Bangladesh, training of five women and five men was planned. The reason for also training men was the local reluctance that women take up masonry work on their own. The ultimate number of women and men with training on the technologies used is given in Table 2.

Table 2 Persons trained for technical tasks, by sex and task, for the three pilot sites

Country	Bangladesh		Kerala		Sri Lanka	
	women	men	women	men	women	men
Household compost bins	10	10	38 + 400 on vermi-composting	1	4 (of whom 3 from the pilot c'ty)	2
RWH tanks						
Household latrines						

Implementation

The intervention took place in three pilot communities, while three matched communities served as control. All are poor communities located in fragile coastal areas. The main characteristics are as follows :

- Morelganj and Paikgacha in south-west Bangladesh are areas of comparable size and density. Both are located in coastal zones with high water tables, saline water and water contamination by arsenic and iron. This has made water supply a priority need in the area, reason why this component was added to the 4WS project. Both communities are newly established municipalities with low income populations who mainly work in small enterprises such as shrimp cultivation and services, with women working as domestic servants (39% and 29%). The communities are typical for many such communities in Bangladesh. The people of Paikgacha are more homogeneously poor than those in Morelganj, and have lower literacy levels. However, the unemployed rate in Morelganj (11%) is higher than in Paikgacha (3%).
- Thumbolly and Shanghumugham in Kerala, India are environmentally and socio-economically comparable low-income peri urban settlements. Shanghumugham is somewhat poorer than Thumbolly. In Shangumugam there is very poor latrine coverage by the Corporation and only very few programs have been implemented. The main occupation of the men folk is fishing. Both areas have a piped water supply with public standposts. The water is treated and chlorinated, but residual chlorine is not monitored. The supply is irregular and many people depend therefore on a combination of tap and well water.
- Karukkupane on the west coast of Sri Lanka is a rapidly growing fishing village ten km outside the main town of Chilaw. The population is ethnically Sinhalese but use Tamil as their mother tongue. The community consists of two villages : Karukapane and Korayapura. Karukapane has two sections: larger and smaller Karukapane. Education is maximally primary school. Almost all households (97%) are Roman Catholics. Udappana, the control community is 30 km away from Chilaw. Its population is Tamil, of which 86% is Hindu, 10% Muslim and 5% Roman Catholic. Both are fishing communities with similar environments, but Karukkupane has an economically more mixed population (poor and middle class). Women work in the fish production process, taking the fish out of the nets and sorting fish. Some women go also to the fish auction place (*Lellama*) to sell fish. They also work in mat weaving and raise animals such as poultry and pigs. Yet neither men nor women consider these to be jobs.

Community organization. In two pilot communities the national NGOs worked with local NGOs – in Bangladesh the Community Development Centre (CDC) and in Sri Lanka the Integrated Health and Environmental Organization (IHO) and later SEPA (Social Service

Participatory Development Foundation Their staff mobilized and organized the communities to review their situations and identify, plan and implement improvements in sanitation and waste management, as well as improved hygiene practices. In the pilots of Morelganj and Karukapane, also improvements of water supply were started as this was a great problem of the population and their first priority. In Morelganj there was only one Pond Sand Filter, insufficient to meet all water needs. In Karukapane, women and girls from families that could not afford to buy water were patiently sifting sandy water from a sandwell outside the village (Fig. 1).

Community participation and management. In Morrelganj, Bangladesh, Project Management and Advisory Committees were set up and a Young Voluntary Group was formed. The latter was active in promotion work and wrote and performed a play “Death trap” on sanitation and social problems. The play was staged during a sanitation fair, at which community members could see the different types of sanitation hardware available on the market. Thumbolly saw the establishment of a Programme Management Committee, an Advisory Committee (13 members) and a team of ten Volunteers.

In Kerala a strong focus was placed on regular meetings were arranged with local community and administration to improve the water and sanitation situation of the area. Local press have published several writings on the objectives and activities of the 4 WS project. Since no public land was available in this area some private property was found which was turned into a vermi-composting unit. The 4Ws programme in Kerala specifically facilitated the municipality to start a decentralized community solid waste management programme in other 5 wards. Booklets on community participation in solid waste management were prepared and distributed. A committee constituted by municipality chaired by district collector for planning solid waste management programme for the municipality authorized SEUF to prepare a leaflet regarding solid waste management system to be introduced in the municipality.

In the context of Sri Lanka, a strong focus was placed on strengthening self-confidence, motivation, leadership skills, and implementation skills necessary for the participating research and knowledge exchange in the community. Community participation was also clearly reflected in the “Green House” label part of the project. This entailed strong community participation so that each and every household in the pilot areas would eventually have a latrine, compost bin, safe drinking water : SODIS or rain water tank, and bins for the segregation of its household waste (organic and inorganic) A total of 150 households out of 320 have so far received the green label.

Gender strategies. Gender and gender approaches were a structural feature of the project. In the Bangladesh project, it was found that by forming mixed teams of masons helped to get women accepted in a technical job. This enabled them to grow from mason helper to full-fledged masons which set up their own shop (see below). The project in Kerala had already a high participation of women. Here the focus was laid on involving more men through a special men’s meeting. In Karrukapone, three orientations were held with the male fishing societies. In the case of Sri Lanka, despite its difficulties, some useful results have been achieved, especially in the areas of education which have allowed women to improve their socio-economic status through vocational and business management training.

Technologies. New technologies and designs were developed in all pilot sites. In Morrelganj, a new type of rainwater harvesting tank (RWH) was developed. This consisted of five latrine rings with a cover and piping. This is easy to construct and takes up less space than a large tank. Its costs are Th 3,500 for 1,000 litre storage. Large tanks are harder to pay as they ask for a larger up front investment (Th 7,5000 for a reservoir of 3,200 litres). An innovation contributed by the first householder to install the tank was a pet bottle inserted in the pipe just before it enters the tank. This makes it possible to see when the diverted first flush becomes clear and the water can be guided into the tank for storage and

use (Figure 2). In Sri Lanka, sand from the beach was used in the construction of RWH tanks which reduced the cost.



Fig. 1 Drinkwater source Sri Lanka pilot



Fig. 2 Innovative RWH tank

In the pilots in Bangladesh and Sri Lanka, also new designs of composting bins were developed. In Bangladesh they have two compartments and when the first is full, the mobile top can be turned to open the second compartment, while the contents of the first one compost (Fig. 3). In the pilot in Sri Lanka, the compost bin is cast in parts at the mason's house and it then put together at the user's house (Fig. 4). In Kerala, households get a choice of composting models ranging from plastic bags, pots and buckets to ferro-cement barrels, boxes and drums.

Innovations in latrines were introduced in the pilots in Kerala and Sri Lanka. In Thumbolly, Kerala a design was made for an eco-latrines and the first family was identified that would try this model. As it is still expensive (Rs. 12,000 or US\$ 257) work goes on to reduce the costs. The household was very satisfied as for the first time they had no flooded latrine during the monsoon.

In Karrukapone, the first eco-latrines was constructed after promotion of about one month. Its attraction is no need for flushing water. It is built by a fisherman (manual labourer) at a very low cost. The pit is reinforced by a lining of sand-filled old car tires at a total cost of Rs. 20. The household contributed the idea of filling the tires with sand for stability and hygiene.



Fig. 3 Compost bin Morrelganj



Fig. 4 Girl mason with bin components

To familiarize households with eco-sanitation and see the effects from urine fertilization, urine diversion urinals were installed in a school in Morrelganj and Karrukapane. The children's urine served to fertilize Neem trees and coconut plants and Pihinbiyas (a local tree used for firewood, chosen with the help of the Forestry Department) respectively. The children measure growth of fertilized and control trees.

<http://www.irc.nl/content/download/24617/275809/file/Photo%20Story%20Girls%20Urinal%20used%20for%20Drip%20irrigation.pdf>

In the Kerala site, vermi-composting was taken up as a means for making compost. This has now expanded to 2000 households. A seminar on organic farming familiarized the households with recycling and productive use of organic waste. Five hundred families received seeds to stimulate vegetable gardening. Two households experiment with fertilizing of vegetables (lettuce, green chillies and ladyfingers) with a mixture of children's urine and water, leading to earlier flowering. Impact measurement and extension are going on.

Participatory tools. Participatory methods and tools have been used to raise demand of community members for improved sanitation technologies, inform them about options and make informed choices of the type of facility they want and can afford. The two tools developed, field tested and used are the sanitation ladder (Fig. 5) and the solid waste management ladder (Fig. 6). In addition, SEUF used the Evaluation Wheel to measure perceived changes in the Kerala project site.



Fig. 5 Building the sanitation ladder



Fig. 6 Developing a SWM ladder

Review workshops. After the inception and planning workshops, the 3rd international workshop for planning and review of the 4Ws project took place from February 10th-13th 2004 in Trivandrum, Kerala (India). The workshop focused on reviewing the objectives in relation to the 4Ws project in relation to where the project stood at that point and the planning of activities specifically for the pilot schemes that would be implemented in 2004.

The next international workshop took place in Dhaka from 22 to 26 September 2004. It was hosted by NGO Forum. Prior to the meeting, the participants participated in two important national events: the official launching of Bangladesh' National WASH-STREAM Campaign and the National Convention of NGOs and Civil Societies of Bangladesh on Water Supply, Sanitation and Hygiene. The participants could also participate in some sessions of a national workshop on knowledge management organized by Streams of Knowledge, an international alliance of cooperating sector support centres. At the project workshop each team presented the progress made. A two day field visit was paid to the project area. Meetings took place with the Project Advisory Committee, the school and the elected representative. The team also attended the sanitation fair and met with householders that had installed latrines and RWH tanks. The latter part of the workshop was devoted to

planning and development of a solid waste ladder, a format for cost analysis, a strategy note for project outreach and follow up and a workplan for the remaining project months.

The last international review meeting took place in Cochin, Kerala, from 12 to 14 July 2005. The workshop was held in the context of the wrapping up of the project. The work done so far was reviewed and data from the water quality testing discussed. A visit was paid to the project area with special attention to cost issues. Further issues addressed were the development of the post study, the environmental backstopping missions, and the dissemination and documentation of results. Furthermore, some time was spent on the formulation of a follow-up proposal which would take up the developed approach with the local government authorities in other areas.

Literature supply. At each meeting and occasionally through email contact, new literature was supplied by IRC. The other partners also shared their documents at the meetings.

Communication. A Yahoo group was set up at the start of the programme to facilitate communication between the partners in five countries.

Websites

The following websites were established:

In the Netherlands:

<http://www.irc.nl/page/227>

In Finland

http://www.uku.fi/ympti/julkaisuja/Backstopping_2006.pdf

In Kerala, India:

<http://www.seuf.org/html/4wsachiv.html>

In Bangladesh

http://203.91.155.211/nrc/alt_sanitation.html

In Sri Lanka

<http://www.cosi.org.lk/page/302>

Results achieved

Women's work

In Morrelganj ward no. 5, four women masons have been trained by those trained in Kerala to construct sanitary latrines, rainwater harvesting tanks and composting bins. This has brought the total of ten women masons. Two of them have started their own business of a Village Sanitation Centre. They have expanded construction to include also animal watering troughs and garden pots. From the construction yard they also ship these items to other parts of the town.

In Sri Lanka the project has had more mixed results in providing paid work in sanitation to women. Two of the trained young women left the community after their marriage. A third woman stopped after marriage and childbirth. This left one adolescent girl, Dishani, who made composting bins at her parent's house (Fig. 5). However, the community shifted to stick barrels for composting as these can be made from available materials without further costs. This meant a loss of work, as her parents would not let her do construction work on her own in the yards of other people. Two young men have now taken on the constructing water seal latrines and dry pit latrines. Dishani is helping in constructing dry pit latrines. At the initial stage a trained male mason was hired to fix the stoves but later one woman was trained and she started to fix the stoves as a self employment. A man who as an unskilled labourer helped put up the rainwatertanks is now fully skilled to construct tanks himself.

Although this part of the 4WS project was less successful, it did call attention to the need for on-site employment for adolescent girls and women. Hence vocational training was organized through a government programme and village girls got trained on many vocations so that they could select and work on whatever they feel comfortable with (while the 4Ws programme was taking place- clarification is needed here between the two sentences). This resulted in the establishment of a Rural Ladies Development Society. The RLDS conducts training courses on bridal dress making, regular dress making, knitting and

cookery. The machines were supplied by the Government. Sixty young women are employed.

The project has also led to a greater diversification of women's employment opportunities in Kerala, where SEUF introduced paper bag making. This resulted in the establishment of a paper bag making centre at a cost of Rs. 200,000 (US\$ 4270), which was paid from a prize rewarded to SEUF by the State Sanitation Mission « Clean Kerala ». Two more centres have started since.

In the Kerala project, 275 women of the 400 trained have started to separate waste and compost it using vermi-composting. Income for women comes from selling worms and compost, growing and selling vegetables and flowering plants and doing masonry work (Table 3). The income that an average family has earned during the project period is Rs.2000-2500 (US\$43-53). Five women have been trained in community level vermin composting. One community based vermin unit has been constructed (Fig. 7). Two women were trained in running a nursery plantation. They use compost from latrines and fertilize with urine and earn about Rs.700-800/- (US\$15-17) per month.



Fig. 7 Women at the community compost plant Fig. 8 Women trained as 'masonmen'

Socio-economic impacts

In Bangladesh, the greatest impact has been that the project provided an income and improved the status of ten women, who work as RWH and latrine masons not only in the project ward but also the municipality. In total they have already built 125 RWH tanks, of which 113 in other parts of the town. All are fully paid by the owners. The women masons earn an equivalent of US\$ 18 for each RWH tank that they build. As mentioned earlier, there is also a great difference in decision-making, with women and men jointly managing the participation.

Table 3 Training and income for Kerala women resulting from the 4WS Project

Activity	# women trained	# women working	# items produced	Unit cost	Income
Latrine building and repairs	5	5	28	Rs 2250-4000	Rs 250
			22	Rs 750	Rs 250
Rainwater tanks	3	0	0	N.A.	N.A.
Waste barrels	3	3	100	Rs. 750	Rs 350
Paper & fibre bags	5	5	500	Rs 4	Rs 2
Paper bags	30	15	1300	Rs 4	Rs 2
Vermi-Composting	400	275	5 ton	Rs 4/kg	Rs 3
Community VC plant	5	5	0,25 ton	Rs 4/kg	Rs 3
Plant nursery	2	2	120 plants	Rs.3	Rs.2.50
TOTAL	453	310			

An impact of the project in Sri Lanka is that it led to the lessening of a caste conflict between the two sections of Karrukapone. In the lower section of the community, the women also started a savings and loan club to finance for the construction of RWH tanks. After a PRA analysis had shown that the poorest families did not participate, the women decided to invite these poor Tamil women to become a member. After the invitation these women joined. The project further led to two intercaste marriages in the community.

In the pilot area in Kerala, SEUF organized a participatory impact assessment activity using an evaluation wheel (see Progress Report no.5 : January-June 2005, Annex 3). All perceived changes were positive (Table 4). The greatest changes (63-93%) were in health consciousness, self-initiative, social relations, relationship with Local Self Government (SLG), income generation and commitment. Intermediate level changes (50-60%) concerned hygiene practices, plastic segregation, new self-initiatives, data collection, waste composting, capacity building, status raised as facilitator, awareness of new technologies, sharing and management of knowledge and proposed new projects. Least, but still substantial (26-49%) were participation, self-confidence, waste management, gender sensitiveness, water quality, time keeping and leadership.

Table 4 Perceived impacts of the 4WS project in Thumbolly, Kerala in %

Aspect		Before	After	Change
Psycho-logical	Commitment	5	98	93
	Status raised as a facilitator	15	75	60
	Gender sensitiveness	25	70	45
	Confidence level	18	52	34
	Self-initiative	25	88	63
Skills	Time keeping	6	55	49
	Leadership	40	89	49
	Knowledge sharing & management	18	77	59
	Social relations	15	80	65
	Relationship with LSG	20	85	65
	Data collection	14	70	56
Content-related	Awareness of new technologies	20	80	60
	Participation	22	48	26
	New self-initiatives	35	87	52
	Proposed projects	40	90	50
	Capacity building	10	70	60
	Health consciousness	10	73	63
	Hygiene practice	10	40	50
	Waste management	20	60	40
	Plastic Segregation	20	72	52
	Waste composting	3	60	57
	Water quality	20	65	45
	Income generation	4	80	76

Environmental impacts

The environment was greatly improved in all the pilot areas during this project. General conditions, water supply, sanitation and solid waste treatment were all better at the end of the project than at the beginning. In India there was also a development in control area, though less than in the pilot area. In Sri Lanka and Bangladesh there was no progress in the control areas. Table 5 gives a summary of the environmental impacts.

Table 5 Environments at the start and end of the project

Project sites	General conditions		Water supply		Sanitation and wastewater		Solid waste	
	First survey	Second survey	First survey	Second survey	First survey	Second survey	First survey	Second survey
Indian control area	2	3	3	3	1	2.5	2	2.5
Indian pilot area	3	4	3	4	2	4	2	4
Sri Lankan control area	3 ⁺	2.5	2	2	2	2	2	2
Sri Lankan pilot area	3	3.5	2	3	2	3.5	2	2.5
Bangladesh control area	3	3	1	1	2	2	3 ⁺	3 ⁻
Bangladesh pilot area	3	4	4* (1)	4.5	2	4	3	3.5
TOTAL	17 ⁺	20	15* (12)	17.5	11 ⁻	18 ⁻	14 ⁺	17 ⁺

* In Bangladesh the first improvement happened before the first survey. The figures marked *show the post situation, while the figures in parenthesis shows the situation if this improvement would not have been carried out.

Impacts on water supply

In Morrelganj, the 4WS project brought a significant improvement in the local water conditions. By the time of the post study, 12 households had a RWH tank constructed by the project masons. Six are shared by two households, so 18 households now have rainwater as a source. All tanks were constructed with 100% household financing. A new pond sand filter for communal use was constructed in the ward by the Bangladesh government. In contrast, the control community continues to have not a single safe water source (Table 6).

Table 6 Safe and unsafe water sources in the pilot and control area in Bangladesh

Watersource		Morrelganj				Paikgachha			
		Baseline		Post study		Baseline		Post study	
		No	%	No	%	No	%	No	%
STW* /pump	Safe	0	0	0	0	0	0	1	0.3
	unsafe	0	0	266	62	0	0	97	26
PSF**		0	0	1	0.2	0	0	0	0
RWHS***		0	0	18	4.2	0	0	0	0
Well		0	0	1	0.2	0	0	0	0
No safe source of DW		417	100	143	33.3	370	100	275	73.7
Total		417	100	429	99.9	370	100	373	100

*Shallow Tube Well **Pond sand filter ***Rainwater harvesting system

In the pilot community safe use of drinking water grew from 44% before the project to 85% afterwards. Forty one percent of this improvement was due to the rainwater tanks and PSF which the women masons built after the community people had stressed that the project should include also water supply. Sources of water for cooking were the same as for drinking at the start, but at the post study the number of households that used ponds for cooking water had increased. It is however considered that this is not a problem when cooking implies the boiling of the food. In the control community drinking water remained unsafe.

Table 7 shows that in the pilot village the use of the riskier wells increased at the expense of the public taps, indicating a deterioration of the public service. In the control area, the use

of improved water supply remained virtually the same. The main shift was here from neighbour's wells to own wells.

Table 7 Domestic water sources in the project and control community in Kerala

Sources of domestic water supply	PILOT				CONTROL			
	Baseline		Post study		Baseline		Post study	
	No	%	No	%	No	%	No	%
Own well	40	9.2	82	17.5	5	3.5	31	24.3
Neighbour's well	4	0.9	26	5.5	61	43.3	11	8.6
Public well	4	0.9	26	5.5	0	0	16	12.5
Pond		0	5	1.0	0	0	0	0
Private tap	27	6.2	64	13.6	4	2.8	3	2.3
Public tap	358	82.7	267	56.8	71	50.4	67	52.3
TOTAL	433	99.9	470	99.9	141	100.0	128	100.0

Contrary to expectations, the training of women in building RWH tanks did not result in their construction. Community members have, however, upgraded eight rainwater ponds and planted medical herbs, vegetables and flowering plants on the banks. They also cleaned 400 m. of canal banks. Two households planted flowers along the roadsites. This has now been extended to a stretch of 200 m.

In Sri Lanka, the main change in drinking water supply are the introduction of RWH tanks (6 build with cost sharing between users and a disaster mitigation fund) and the great reduction in the use of the *paliya* after tests under the project had shown it to be contaminated. Most people now buy drinking water from a private sector water truck (Table 8). Water remains a primary need in the pilot as well as the control community.

Table 8 Water sources for drinking in the project and control community in Sri Lanka

	PILOT				CONTROL			
	Baseline		Impact		Baseline		Impact	
	No.	%	No.	%	No.	%	No.	%
Own well	206	32	206	29	2	0.7	2	0.6
Purchase from browser	255	41	324	45	296	98	325	98
Neighbour's well	74	11	117	16	2	0,7	1	0,3
Public well	0	0	63	9	0	0	1	0,3
Tubewell	0	0	7	1	0	0	3	1
Sea and other			5	0,7				
Paliya (sand dune well)	108	17	6	0,8	0	0	0	0
Rain water tank	3	0,4	6	0,8	0	0	0	0
TOTAL	654	100	726	100	300	100	332	100

The project has introduced solar disinfection (SODIS) in the sites in Kerala and Sri Lanka. Water quality tests have been carried out through cooperation of the national NGOs with Kuopio University. The water was analysed for total heterotrophic bacteria, bacilli, faecal clostridia, mycobacteria and algae, to check on risks caused by a dense population, too high organic matter contents from vegetation, or contamination from animals and/or construction materials. The local laboratories have analysed the water for faecal coliforms.

A first test of the sources at Karrukapone, Sri Lanka showed zero e-coli in the school well and rainwater, and 40 e-coli per 100 ml in the traditionally dug sandwell. The SODIS sample showed a total of 5000 bacteria before treatment and 4400 afterwards at a temperature of 37 degrees Celsius, 900 before and 500 after at 50° C and zero at a temperature of 60° C. No e-coli were found. Self-testing with H2S strips in 100 households showed 97% had an E-coli problem. This led to an awareness campaign with the ward, municipality and the media.

There are still too few analyses ready, but preliminary it seems that those micro-organisms analysed are present. It seems also that there is a great variation between the different water sources, so that some tanks should be better protected. Only a part of this activity is paid by this EU-project.

Water quality tests of the Pond Filter in the Bangladesh site have been carried out regularly. They showed a negligible number of Total Coliforms/Fecal Coliforms.

Human excreta disposal.

At the time of the baseline survey, 79% of the households (330 households among 417) in the pilot community in Bangladesh had a hygienic type of latrine. The post study showed that at present 100% of the households have such a latrine. They include several types of pour flash latrine such as septic tank (35.9%), off set toilet with single pit (10.5%) and off set toilet with twin pits (5.1%). The remainder (48.5%) have a direct pit pour flash latrine. The situation in the control area is a stark contrast. Initially, 42.4% (157 households out of 370) had a hygienic type of latrine. This has dropped to 33.8%.

Table 9 Types of household latrines in project and control area in Bangladesh, in %

Type of latrine	Baseline		Post study	
	Morrelganj	Paikgachha	Morrelganj	Paikgachha
Septic tank	79	42	36	5
Offset single pit			11	4
Offset twin pit			5	1
Ring slab			49	29
Pit covered	0	0	0	0
Pit uncovered	0	0	0	1
Open/ Hanging	21	53	0	43
No latrine in hh		5	0	23
TOTAL	100	100	101	100.0%

In Kerala, ownership of latrines in the pilot area increased from 78% to 91%, an increase of 13%. In the control area the increase was almost the same : from 68% to 80%, or 12%. This is in a way not surprising as a state campaign, « Clean Kerala » is taking place across the state. Husbands generally gave social reasons (privacy for women and girls) for building a toilet. For women or couples, hygiene and health were important arguments. For those who have no latrine of their own, sharing increased in both the pilot en the control community. Contrary to expectations, sharing remained much more common in the control site (an increase from 66% to 85%) than in the pilot site (a growth from 28% to 49%). In both areas, the main reasons for not having a latrine are expense and lack of space.

In the Sri Lankan project, the percentage of households with toilets in the intervention village rose from 69% to 89%. Those who shared a toilet doubled from one quarter to half of the households without a toilet of their own. Reporting of excreta disposal being a problem fell from 31% to 16%. In contrast, latrine ownership in the control village rose with only 4% to 39%. Sharing rose from one fourth to one third and there was no reduction in perceived problems with sanitation. The project also led to a greater health awareness

among women in the pilot community. They gave health as the main reason for constructing the toilet – for their husbands and the families in the control community, privacy for women was the main motivating factor.

Having a latrine makes no impact if it is not used by the majority of the household members. At the start 79% of the men in the pilot area and 42% in the control area in Bangladesh were defecating in hygienic latrines. In the post study these figures became 100% for the pilot area, and had remained 42% in the control area. For the women, these figures were the same as for the men. Half of those without latrine practice a form of open defecation. This is worse than in the control community where one third of those without latrines use open spaces or the beach. In the Sri Lankan project, open defecation was practised by 46% of those without a latrine, as compared to 69% in the control area.

Children are usually less good at using toilets. In 42% of the households in the pilot area and 55% of those in the control area in Bangladesh, children did not use a latrine or potty. In the post study, this had changed for the better for 87% of the households in the pilot area and 40% in the control area. A potty was used in 61% of the households in the pilot area and 90% of the stools were deposited in the latrine. These figures are 0% and 54% in the control area. In the pilot in Sri Lanka, especially mothers had increased their training of the children on latrine use, from 51% to 83%. This reflects that the female local NGO worker had worked especially with the women, as further detailed under gender impacts. Defecation practices by children was not investigated in Kerala.

The percentage of households with a clean latrine and proper water seal grew from 73% to 97% in the pilot area in Bangladesh and dropped from 43% to 20% in the control area. In Sri Lanka it is clear that keeping the latrine clean is a problem in communities with water supply problems. Apart from the water seal, the pilot community did much better than the control on upkeep of hygiene (Table 10). Households in the Sri Lankan pilot which have a sanitary latrine, compost bin, safe water and smokeless stoves are rewarded with a green house label. 150 households out of 320 (47%) now have a plaque which announces them to be a « green » house.

Table 10 Observations on toilet hygiene in the Sri Lankan communities

Observation questions on cleanliness	Pilot	Control	Difference
Does the water seal area contain faecal parts?	57.8%	49.6%	- 8.2%
Do the toilet walls contain urine and faecal patches?	60.8%	63.6%	+ 2.8%
Are there faecal parts around the house?	68.6%	82.9%	+ 14.3%
Are there flies in the toilet?	7.3%	33.3%	+ 26.0%
Is water source inside or close to latrine?	52.7%	37.2%	+ 15.5%
Is cleaning reagent used for cleaning?	72.0%	24.8%	+ 47.2%
Availability of hand washing facility near the toilet?	52.0%	35.0%	+ 17.0%
Availability of soap/ash at the washing place?	69.9%	21.7%	+ 48.2%
Average better score for pilot community	20.35%		

In the Kerala pilot community, the quality of latrine conditions improved. Earlier, 17% of the latrines in the pilot community were in a bad state. This dropped to 13%. In the control area, poor latrines increased from 13% to 19%, 6% more than in the pilot area. Upkeep of hygiene also increased more in the pilot community than in the control site (Table 11).

Table 11 Hygiene of latrines in the Kerala pilot and control areas in %

Observed hygiene	Pilot community			Control community		
	Baseline	Poststudy	Difference	Baseline	Poststudy	Difference
Good	37	55	+18	25	38	+13
Satisfactory	48	37	+11	39	44	+5
Poor	15	9	-6	36	19	-17
TOTAL	100	101	+23	100	101	+1

Handwashing. In the pilot area in Bangladesh handwashing with soap before handling food and after visiting the toilet improved from 24% and 80% to 66% and 97% respectively. In the control area, percentages dropped from 25% to 9% for washing before handling food. For washing after defecation, the figure remained the same with 34%. Washing hands after cleaning babies improved from 44% to 95% in the pilot area and dropped from 52% to 34% in the control area. Reported handwashing behaviour improved substantially in the pilot community in Kerala. Improvements concerned especially the washing of hands before eating (by 26%, an increase of 24%) and after defecation (from 1,5% to 27%). Washing hands after handling children's excreta grew from 0.5% to 6.2%. There is however no significant difference with handwashing practices in the control area. In the Sri Lankan site there were significant improvements : 85% of the pilot households washed hands after defecation against 44% in the control community.

Solid waste management. Waste management has improved considerably under the project. In Bangladesh, nobody initially segregated waste and made compost, although 87% in the pilot area and over 90% in the control area knew about composting. Now, 68% of the households in the pilot area segregate waste and 7% make compost. In the control area segregation now happens in 14% of the households, but no-one yet makes compost.

In the project area in Kerala, out of 500 women trained, 275 or 69% have taken up waste segregation and barrel compost making, against an initial 10% of segregation. In the control community this is only 6%. One plant nursery has been established which uses the compost produced with vermi-composting. In the community of Karrukapone, the demand for cemented compost bins dropped, as people considered them too expensive. The project then switched to the promotion of stick barrels (a circle of sticks surrounded by old fishnets). These have been adopted by 90% of the population. The compost is used for home gardening or is sold to a nearby plant nursery. The project has promoted the use of palm shrubs to protect the plants from the strong marine winds. The use of compost is very evident and provides strong motivation for others to take up solid waste composting.

A problem typical for the Sri Lankan pilot was stray pigs. Eighty percent of the households have now penned their pigs. Segregating waste for selling increased from 6.3% to 9.3%, while in the control area it dropped from 2.7% to 0%. Compost making which was unknown before is now practiced by 12,5% in the pilot area. In the control area, 0,3% makes compost.

Gender impacts. In Bangladesh, the Project Advisory Committee which manages the project at ward level in Morrelganj has three women and three men. There is a female chairperson. This was the first time that women in the community have been represented on a development committee. The higher level Project Management Committee has also a female member. She is the elected women representative of the area. Initially there was some doubt in Bangladesh on whether women in a Muslim community can become masons. Hence, also men were trained and men and women worked as a team. In practice, this meant that the women masons were assistants to the men. This was discussed with the NGO. It was agreed that women should get support when they want to become masons in their own right. This has now resulted in women trained and working as full fledged masons (Fig. 8) and in a first women masonry enterprise in the area.

In the project in Sri Lanka, results have been less satisfactory. As mentioned above women did not really continue in the masonry work. The positive impact has been that at least other work opportunities have been created for young women who were earlier restricted to selection and cutting of fish and similar unrecognized support work for the fishermen.

In the beginning only the women groups took part in the activities, the major reason being that the local NGO catalyst was a woman and all her contacts in the village were with

women. Also as men are fishermen, mostly only women had free time for the project. But eventually, as the village became more aware of the project, and also due to the influence of the church, the males also got involved in the work including public cleaning campaigns at youth club level and small group level. Cleaning beach areas, abandoned land and public places happens at least once every two months.

Women in the project area in Kerala increased their status due to their new knowledge and skills. The greater attention to gender including to the training of men in hygiene has resulted in an increase in male participation in cleaning work from 2% to over 10%. This change has benefited mostly the women and adolescent girls, with respectively 13,5% and 10% reduction in their share in domestic cleaning. A similar trend could be noted for the cleaning of the latrine. Although women still are the primary cleaners, their share dropped from 93% to 81% and the percentage of households where latrine cleaning is shared by women and men increased from 5% to 16%.

Capacity development. From 13 to 26 October, 2004, four women staff from three partners (COSI, NGOF and SEUF) participated in the course on Health related environmental microbiology at the University of Kuopio, Finland. It was an advanced level course aimed at MSC and Doctoral students. All four women passed the certificate course. Details are given in the end-of-project report of Kuopio University.

Continuity. The 4WS project is now firmly embedded in Morrelganj Municipality. The first municipal elections took place in mid 2005 and the elected Municipal Chairman took the chair of the Project Management Committee. The Committee issued a work order for 4 km. drains and the construction of a community latrine with four units. A site was allocated to construct a community-based composting plant for solid waste. To enable households to build RWH tanks, a small municipal credit fund was established. In Kerala, the 4WS approach has been adopted by the Municipality for all its wards. In Sri Lanka, a young man has taken up RWH and toilet construction; for women, continuity of training and work is facilitated by the formal establishment of the Women Development Society under the rural development programme. The Public Health Inspector has increased his number of visits after the dissemination seminar mainly to maintain the healthy practices introduced for raising pigs and dogs. Project staff handed over a list of people who still do not have latrines to the public health authorities. This is being followed up by the PHI.

Cost-effectiveness.

Table 12 gives the total hardware and software costs per capita in the project in Bangladesh. The table shows that both inputs are lower in the community project in the pilot area than what is usually spent on comparable items in a government programme. In total, the 4WS project was over 30% cheaper than a comparable government programme. Moreover, neither RWH tanks nor latrines have been subsidized in the 4 WS project. In Government projects, a subsidy of 80% is the norm.

Table 12 Per capita cost of hard- and software in the 4WS project and Government projects

Item	Cost (Tk.)	
	4WS Project	Government
Software	188.36	327
Hardware	543	725

The costs of the hardware developed in the Kerala project are given in Table 13. As these are all new components, there is no comparison with the costs for a similar project under the government. However, savings are at least 20%, as construction in government schemes is through hired labour, while the project innovations were installed with labour by the owners.

Table 13 Cost of hardware components in the Kerala project

Item	Quantity	Cost (IRS)
Community level vermi composting unit	1	17,500.00
latrine construction - pit lining with tires	1	3,500.00
latrine construction- pit lining with ferro cement	3	6,000.00
Ferro cement barrels (composting)	10	7,500.00
Eco-san toilet	1	20,000.00
Total		54,500.00

Using the cost of a typical government project in Sri Lanka¹, the total costs would be 11,316,000 Sri Lankan Rupees, or 86,400 Euros when carried out in Karrukapone (SL RS 866 (per person cost per year) x 3 (total project duration) x 2,000 (the total population in Karukkupane) + 6,000,000 (the initial costs). The total cost of the 4WS project were SL RS 1,353,360 or Euro 12,322.00. They are comprised of SL RS 1,053,360.00 or Euro 10,032 for local mobilization, participation and education and SL RS 300,000 or Euro 2,290 for materials and supervision from headquarters.

The greatest local cost-effectiveness comes from the RWH tanks. Daily each household spends 50-60 rupees for buying drinking water. Using rainwater for drinking purposes saves them approximately 1,500 rupees or US\$ 31 per month. This is equal to US \$ 150. Savings are spent mainly by women for other household expenses in an ad hoc manner. They earn small amounts ('pin money') by selling recyclable goods. The compost made is mainly used for pot cultivation.

Problems encountered

In general, the expected results have been achieved as is set out under Conclusions. The first and fourth general objectives, measurably improve sanitation conditions and practices and strengthening of interdisciplinary and institutional cooperation have been largely achieved. Excreta disposal and hygiene conditions have greatly improved in all project areas.

An area where further improvement is needed is in consistency and comparability of survey research. In the project harmonization was strived for through exchange of questionnaires and review by e-mail. In hindsight, a group review would have been better as this would have increased peer support.

Measuring the cost-effectiveness of the innovative approaches vis-à-vis government programmes (the second objective) turned out to be harder than expected as there were no government programmes in the areas concerned. The project did however show that with adequate promotion through participatory methods it is possible to achieve sanitary innovations without outside subsidies.

Scaling up the strategy was achieved least in Sri Lanka, where the tsunami disaster affected the project. The people of Karrukapone faced a serious economic crisis as they could not go fishing for months. There was also uncertainty about resettlement. This factor plus the fact that it is the custom to migrate to another fishing area for four months each year made it harder to achieve result and left less time for upgrading. Another reason was that the Government water and sanitation programme financed with an ADB loan had already been completed, so that there was no opportunity to share the latrine, solid waste and RWH approaches. However, toward the end of the project scaling up has also started in Sri Lanka as shown in the section below on post project implementation.

¹ JICA, 2003. The study on improvement of solid waste management in Secondary cities in Sri Lanka.

Furthermore, in both the Bangladesh and Kerala project area, the Municipal Health staff initially felt threatened by the project as they fear that the recycling of waste would make them redundant. This is slowly changing, but more time for discussion is planned as the Municipalities and Health Department's roles are still required for the end solution.

Implementation plans after the project

In Kerala, dissemination of the 4WS project began at the municipal level on December 2, 2005 with a one day municipal seminar. The meeting was presided by the municipality's Chairman and attended by the political representatives and health staff of the town. Already during the project scaling up was achieved from one to six wards.

At the national level, discussions on scaling up were held with the Kerala Sanitation Mission, the Department of Health and Municipal authorities and Councillors. Clean Kerala Mission is a Government agency which is providing funds for solid waste management projects. As a result, of this meeting, SEUF was chosen as a service provider (capacity building and development) on solid waste management at state level. The Kerala Sanitation Mission has provided funds for solid waste management to 32 municipalities in Kerala. A workshop has been organized for five of these municipalities (see below). Municipal staff have been trained and taken part in exposure visits.

Dissemination to local government bodies started with a two day workshop for representatives from 11 Local Self Governments including Panchayat presidents and the municipal chairmen from Kollam, Pathanamthitta, Kottayam and Alappuzha districts. It was held on 12th and 13th December 2005 at the Capacity Building Centre of SEUF and Alappuzha Municipality. SEUF's Director shared the experience of replicable models of low cost technology in solid waste management, new technology in sanitation and new initiatives in income generating activities with the intervention of the 4WS project. The methodology used in the 4WS programme was appreciated by the participants. They also impressed by the low cost technologies used for solid waste management and income generation from waste under the motto 'From waste to wealth'. The participants stressed the need of gender participation for the effective implementation of solid waste management programmes.

Representatives from 21 Local Self governments from Ernakulam, Kottayam, Pathanamthitta, Kollam and Alappuzha districts took part in a one day dissemination workshop on 17th February 2006. After the introduction of the 4WS project and its achievements in the field the participants identified their problems in solid waste management and discussed the need of new projects in their areas. Twelve Panchayats and two municipalities prepared project proposals on solid waste management with the help of SEUF and submitted them to the national Clean Kerala Mission. The mission can provide up to Rs.1 million in each Panchayat and three million Rupees to each Municipality on the basis of submitted project proposals. The Mission has already sanctioned 1 million Rs. to Chunakkara Grama Panchayat.

On the basis of the acceptance of the decentralized solid waste management programme in six wards of Alappuzha, the Municipality prepared a new proposal for solid waste management in the other 25 wards of the municipality and submitted the proposal to the Clean Kerala Mission. The costs of this project cost comes to Rs. 69, 00,000/-.

In Morrelganj, Bangladesh, the municipality and wards have scaled up the approach from one to three wards. Already 125 new rainwater harvesting tanks have been built in the municipality. The work is done with 100% household financing, which is very remarkable in the sector. The school ecosan project will be replicated in five secondary schools. Household waste segregation and composting has been adopted for the two new wards. They have already allocated land for the composting. NGO Forum has contacts with three NGOs which already have established a good market for compost.

In Sri Lanka, scaling up to the ADB third water and sanitation project was not possible as they had just completed their regional programme in Chilaw district. Efforts to scale up the approach with other bilateral donors did not succeed. During the last dissemination seminar the political authorities stated that they are interested to continue with the project in other areas if COSI & SEPA can fulfil the same role. As no reservations have been made for this, replication within the district is not yet possible. However, scaling up is happening in the programme of the non-governmental Plan International in three Provinces. In addition, the Local Government in the district of Batticaloe learned about 4WS and have invited COSI to give inputs in their new programme, Community-Led Total Sanitation. UNICEF has also invited an agreement for this programme.

Publications and papers

The following conference papers, articles and more informal publications were produced:

- Snel, M. Women, Wellbeing, work, waste and sanitation (4Ws) - Action research on alternative strategies of environmental sanitation and waste management for improved health and socio-economic development in peri-urban coastal communities in south Asia. Paper presented at the first Dry Toilet Conference, 20-23 August 2003, Tampere University, Finland. <http://www.irc.nl/page/8297>
The conference was held in the context of the EU's policy for Sustainable Development, as presented by Ms Heidi Hautala, MP <http://www.drytoilet.org/>
- Wijk, Christine van, Kumala R. Sari, Said Allaoui and Kocharani Mathew. Raising and meeting demands for on-site toilets. Paper presented at the first Dry Toilet Conference, 20-23 August 2003, Tampere University, Finland.
- Heinonen-Tanski, H., Snel, M., van Wijk-Sijbesma, C. Quazi, A.R., Mathew, K, Werellagama, I., Rahman, M., Rashid, S. M. A., Jayaweera, P. & Judith, H. 2006 Assessing of Environmental Quality in Six Areas in India, Sri Lanka and Bangladesh, Environm.Develop. Sustainability. Accepted.
[http://www.springerlink.com/\(fsur4bydikwopb45kpmc1145\)/app/home/contribution.asp?referrer=parent&backto=issue,22,49;journal,1,27;browsepublicationsresults,394,1585;](http://www.springerlink.com/(fsur4bydikwopb45kpmc1145)/app/home/contribution.asp?referrer=parent&backto=issue,22,49;journal,1,27;browsepublicationsresults,394,1585)
- Helvi Heinonen-Tanski and Christine van Wijk-Sijbesma (2004) Human excreta for plant production. Bioresource Technology, Vol. 96, Issue 4 , PP. 403-411
- Heinonen-Tanski, H., Sjöblom, A., Fabritius, H. & Karinen, P.200x. Pure human urine is a good fertiliser for cucumbers, Bioresource Technology available online at www.sciencedirect.com
- Heinonen-Tanski, H. 2006. Backstopping review for environmental assessment in three pilot areas and three control areas.
http://www.uku.fi/ympti/julkaisuja/Backstopping_2006.pdf.
- Heinonen-Tanski, Helvi, Eilia Torvinen, Päivi Holopainen, Deepashika S.K. Gunasekara, Palitha Jayaweera.2005. *Micro-biological water quality after SODIS-treatment and rainwater harvesting*. Presented at the 5th International Planning and Review Workshop, Cochin, Kerala, July 12-14, 2005.

- Heinonen-Tanski, H. Human excreta for fertilisation of non-edible tropical plants. Paper submitted to Bioresource Technology.
- Saji, Jessy. Integrated Water Resource and Solid Waste Management : Alappuzha, Kerala, S.India. Paper presented at the 32nd WEDC International Conference « Sustainable Development of Water Resources, Water Supply and Environmental Sanitation », Colombo, Sri Lanka, 13th - 17th November 2006

The following project materials were developed, produced and used in the project and have become available for project upgrading:

In Bangladesh:

- A construction manual for a fertilizing school urinal
- A brochure on the *Jali Chaka* composting bin
- A poster on solid waste management

In Kerala:

- Booklet on Solid Waste Management
- Project brochure
- An article. « Wealth from waste » in Loyola Journal
- A video/CD on experiences and results of the 4WS project

In Sri Lanka

- A project brochure
- A set of posters
- Design of a school urinal which the urine is used for plants
- Set of flash cards
- Green house label
- Reproduced information material on rain water tanks and Smokeless stoves
- Paintings
- Bags for separate solid waste
- Village map

Presentations were given on the project at :

- a meeting organised by the Kuopio UNICEF group in 2003
- a meeting dealing with challenges for (Finnish) environmental microbiologists organised by the Finnish Club for Microbiologist at the University of Helsinki in December 2005
- a scientific meeting of Department of Environmental Sciences, University of Kuopio in May 2006.
- The Senter/EG Liaison Conference on the Sixth EU Framework programme, at Rotterdam, 10 December 2002
- Dr. Tanski also used the project material to update her lecture materials

Other publications/PR outputs

- A study on the Reuse of Human Excreta in Bangladesh, February-August 2005.
- An article in a major Bangladesh newspaper
- An interview on Radio Kantti (in Finnish).
- An article in a state-level daily newspaper
- A paper presented in a workshop conducted by Malayalam Manorama, a leading daily newspaper in Kerala
- A prize rewarded for sanitation work by the State Director of the Clean Kerala Mission at a public function attended by state health officers and 500 other persons
- A prize of Rs. 2000 (US\$ 43) to Thumpoly ward (the project area) for the best wall poster

Conclusions

The project was able to meet most project objectives through its innovative approaches to technology, promotion, gender and environment:

A. Cost-effectiveness

- Both toilet provision and solid waste segregation and reuse by women proved to be socially and economically viable in Bangladesh and Kerala. In Sri Lanka, alternative types of work have been found for young women, as their employment as masons did not work out, mainly due to selecting unmarried women.
- The 4WS project was 31% cheaper than a comparable government project in Bangladesh and 20% cheaper in Kerala. In Sri Lanka, the 4WS project needed 11,6% of the cost of a comparable government project with Japanese support.
- Women masons make an income of US\$ 18/RHT in Bangladesh (125 constructed so far) and the equivalent of US\$ 15-17/month at the solid waste recycling units (3 so far) in Kerala. Women latrine masons in Kerala earn Rs. 250 (US\$ 5.4) per toilet. installed/repaired. Women in the Kerala site obtain money from solid waste recycling and paper and fibre bag making.

B. Measurably improved conditions and practices:

- Ownership of latrines grew from 79% to 100% in the Bangladesh project. In Kerala and Sri Lanka ownership increased to 91% and 89% respectively. There were no or minimal changes in the control areas, except for Kerala where a state-wide sanitation campaign is going on.
- The actual use of the latrines grew to 100% for women and men in the Bangladesh site. This is quite an achievement as men are known to use latrines less than women. The safe disposal of children's faeces also improved, by 46% to 90%. Sixty six percent of the households now use potties; none did this earlier. In Sri Lanka, training children on safe defecation increased by 32% to a total of 83%. Measurement should have been more standardized. Now, the Kerala team did for example not study children's defecation.
- Latrine sharing by those without a toilet of their own increased.
- Quality of construction and operation of latrines showed good results. In Bangladesh, there was a difference of 47% between the pilot and control community in having a clean latrine with the water seal intact. In Kerala, the percentage of poor latrines was 6% less in the pilot area than in the control area. The greatest improvement was for toilet hygiene, net gains of 31% and 1% respectively. In the Sri Lankan project, all hygiene indicators were better for the pilot community, except the presence of faecal parts in the water: 58% vs. 50%.
- Segregation and composting of solid waste was taken up well. Segregation grew from 0% to 68% in the Bangladesh pilot site, with 29% making compost. In the control area this was 14%. In Kerala, segregation grew from 10% to 69% against 6% in the control area. In Sri Lanka, progress was the least, with a growth in composting to 12,5% against 0% in the control area. The introduction of pot vegetation is expected to increase this percentage.
- Water nearby is indispensable. The improvement of the domestic water supply was added by the community members in all three sites. In Bangladesh, safe water use increased from 44% to 85%, of which 41% thanks to the RWH tanks. In the site in Sri Lanka, the people abandoned the use of the sand dune well after testing positive for e-coli. In Kerala, use of wells also increased. Introduction of SODIS (Solar Disinfection) was started to reduce these risks. A start was made to test the effects, but more time and efforts are needed to measure the impact on water quality and water use.
- Measurement of environmental impacts through scale observations showed much more progress in the pilot communities than in the control communities. As to

soundness of technology, due to the high water table, it would be advisable to introduce more eco-toilets, preferably above ground. A start was made with such toilets in Kerala and Sri Lanka. However, more time is needed to introduce eco-toilets in the communities. Also a focus needs to be placed on reducing the overall costs so as to become widely accepted and used.

- Experiments for school children to measure and demonstrate the impact of the use of urine as natural fertilizer are going on in schools in Morrelganj, Bangladesh and Karrukapone in Sri Lanka.
- Gender impacts include the generation of work and income for poor women in all three sites. More specifically, the training of women for new tasks in solid waste management in the Kerala site and in water supply and sanitation technology and production in the Bangladesh pilot project, the increased participation of women in decision-making, the increased attention to the roles of men in hygienic conditions and practices, the achieved redistribution of work between women and men, benefiting women and adolescent girls in the Kerala project, and the capacity building of women staff in environmental science.

C. Use of the generated knowledge

- Case studies were prepared as well as articles in refereed journals and the national press. In each country, a website was established.
- The Occasional Paper is yet to be prepared, as this was only possible after the write up of the final annual report which includes the analysis of the post study.
- Continuity of the approaches in the pilot areas has been ensured with the continuation of the community-level organizations and follow up with the local administrations.
- Expansion from one to three wards is under way in the Bangladesh site. Lessons on composting are taken up to the national level through the partners' roles as advisors to the national sanitation policy. In Kerala, expansion is under way to 12 of 21 Local Self Governments and two municipalities, following a one day dissemination workshop on 4WS. One proposal has already been sanctioned. The solid waste component has become part of the policy of the State Sanitation Mission. In Sri Lanka, expansion is taking place via links with Plan International and the Red Cross.
- In Morrelganj, Bangladesh, the school experiment for natural science on the use of urine as fertilizer has been upgraded to three secondary schools.
- On the initiative of the southern partners, a new proposal entitled "Women, Work, Water, Wastewater, Waste, Wellbeing and Sanitation (6Ws)" was submitted under the Asia Pro Eco Programme- Phase II has been formulated to transfer and adjust the approach to the low-income areas of major cities to work further on eco-sanitation and see whether a similar innovative approach can work in urban slums, where the environmental risks are even greater.
- The project will benefit from the experiences gained in the development and use of participatory methods, gender approaches, and the need for greater standardization of data collection instruments between the countries.

D. Interdisciplinary knowledge and skills

- A total of five international workshops have taken place during the period of the project. Each international workshop was held in one of the three southern countries, with the exception of the inception workshop held in Delft, the Netherlands.
- A total of two inter-country training workshops took place especially for the lady mason training in Kerala and Bangladesh.
- A total of four women staff from three partners (COSI, NGOF and SEUF) participated in the course on Health-related Environmental Biology at the University of Kuopio, Finland. This was an advanced level course aimed at MSC and Doctoral students. All four women obtained the certificate.

Management report

● Organisation of the collaboration

Overall the collaboration with all partners has gone very well. Over the past years the workshops which taken place been around every half year have been critical in terms of keeping the group on-track regarding the work that needed to be undertaken. The collaboration between the university and NGO within each country has worked well including interaction between the country teams.

In terms of work relations between the university and NGO, our only concern has been with the Sri Lankan team, namely the University of Peradeniya and COSI Foundation for Technical Co-operation who could have worked more efficiently together.

Inevitably, due to the Tsunami at the end of December 2004, some of the 4Ws project sites have been affected by this devastating natural phenomenon mainly in India and Sri Lanka. In India, the tsunami caught one of the lady masons from Alappadu Panchayat. In Sri Lanka, as a result of the Tsunami, none of fisherman went fishing for this first half year. There were jelly fish which tangled the nets making it impossible to fish. Right after the tsunami all the families lived on dry rations supplied by the government and NGOs. There have been some discussions at the government level as to whether or not the village of the 4Ws project should have been relocated due to its vulnerability to Tsunami attacks. This however did not take place due to lack of funds.

● Meetings

During the project the following workshops have taken place:

- 1st Inception workshop- Delft, The Netherlands- February 2003
- 2nd Review and planning workshop- Kandy, Sri Lanka- August 2003
- 3rd Review and planning workshop- Kerala, India- January 2004
- 4th Review and planning workshop- Dhaka, Bangladesh, September 2004
- 5th Review and planning workshop- Kerala, India- July 2005

All partners attended each of the workshops. The workshop reports can be found in the annual report from 2003 and 2004.

● Exchanges

Various exchanges have taken place over the past three year. Sharing has taking place (1) between senior and junior staff (2) technical and social staff (3) NGOs and Universities (4) between country teams (5) South-South, North-South and South-North. More specifically some of the important exchanges have included:

- The Training of Trainers for latrine masonry and waste recycling which has taken place in October 2003 in Alaphuzha, Kerala. Six trainees (4 women, 2 men) joined from Sri Lanka, one woman from the pilot community in Kerala and three (all male) from Bangladesh. In the pilot area in Allepuzha, Kerala, five women had expressed an interest in training if their husbands agreed. One of them then joined the training.
- A review mission for environmental aspects in Kerala, Sri Lanka and Bangladesh, between November and December, 2003.
- From 13 to 26 October, 2004, four women staff from three partners (COSI, NGOF and SEUF) participated in the course on Health related environmental microbiology at the University of Kuopio, Finland. It was an advanced level course aimed at MSC and Doctoral students. All four women passed the certificate course.

- **Management problems**

- No major management problems have occurred during the period of the project. Sometimes receiving outputs on time required some extra pressure from IRC's side but all outputs were eventually delivered.
- A second proposal entitled "Women, Work, Water, Wastewater, Waste, Wellbeing and Sanitation (6Ws)" was submitted under the Asia Pro Eco Programme- Phase II in June of this year. The 4WS project demonstrated that poor urban women can become entrepreneurs in safe and environmentally sound waste disposal and water supply. The 6WS project proposed to add waste water disposal and the treatment of sludge. Another difference in this second proposal is that municipalities or other local government bodies (water boards) in the North and South would be partners from the start and not, as in 4WS, brought in during implementation. Through a learning alliance knowledge generated in pilot projects on productive use of faeces - especially urine segregation in schools- in the North and the South would be a core element of the project. Unfortunately we missed the next round by two points (passing score was 34 and we received 32). However we have been in contact with the Committee Chairman Dr. Michel Marc to see if there may be any upcoming proposal calls which we can react to in the near future. We hope to submit the 6Ws proposal again before the end of the year.