6 CBS programme – detailed procedure for implementation

The success of a CBS programme depends significantly on implementing the steps in the right order. The organisation or the group of initiating bodies, taking the lead in launching a project should be aware of the complexity and usefulness of a comprehensive approach. Success depends on the co-ordinated implementation of a multitude of tasks and the integration of all stakeholders into the process.

6.1 First planning activities

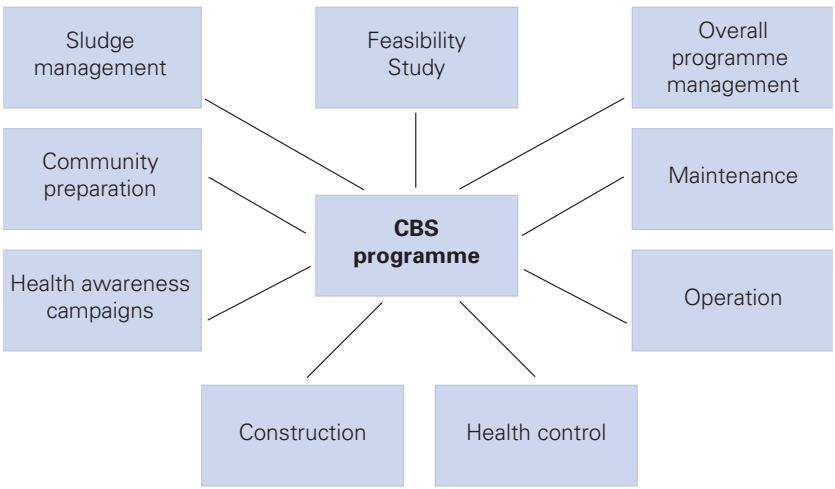
An initial workshop helps to establish a common foundation between key stakeholders. Members from the leading agency (LA), NGOs – or representatives from future beneficiary groups – should be invited to form a core team. The following issues should be addressed:

- targets of the envisaged programme
- assessment of the current situation in the relevant area, regarding sanitation and wastewater
- key existing problems in sanitation, wastewater and environmental pollution
- existing experiences with relevant projects
- awareness building concerning the tasks to be fulfilled throughout the programme
- identification of relevant stakeholders to involve in the project

Picture 6_1: Stakeholder roles and responsibilities must be clearly defined at an early stage – CBS programme steps should be understood by everyone

The key programme tasks should be identified at an early stage. With these in mind, the steps of implementation should be defined to enable smooth operation. Key tasks include:

- overall programme management, including process monitoring
- developing a feasibility study
- community preparation, including health and hygiene awareness-raising campaigns
- construction
- operation and maintenance
- monitoring sanitation and environmental standards
- final sludge management

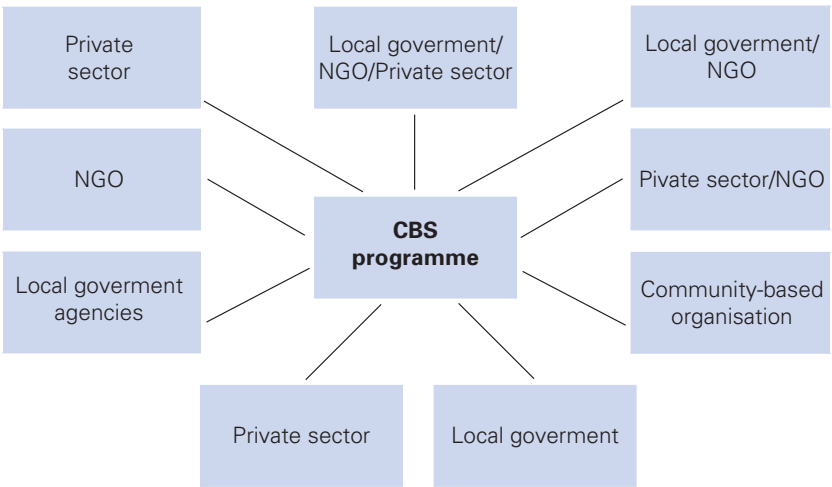


Picture 6_2: CBS programme – core tasks

Workshop participants should identify the specific competences and resources of the various stakeholders. Their roles and main responsibilities within the programme should be assigned. The collaboration and roles of partners may vary greatly from location to location.

Furthermore, the workshop should help to establish an efficient working structure. In particular, the role of the leading agency should become clear, including its core management and monitoring responsibilities. Questions to be answered include:

- What are the tasks and responsibilities of the leading agency?
- What roles and responsibilities can the communities fulfil?
- In what areas can the private sector contribute to achieve higher quality and cost effectiveness?
- What competencies can other stakeholders, such as government agencies or NGOs, contribute?
- Which tasks cannot be fulfilled by the available stakeholders? Which measures, including staff recruitment, are needed to bridge the existing gaps?



Picture 6_3: CBS programme – stakeholders

The signing of a contractual agreement or Memorandums of Understanding between the stakeholders at an early stage in the programme helps to establish a solid foundation for the following steps of co-operation.

6.2 The pilot project

Setting up a large programme is facilitated by a successful pilot project. Experience shows that it is better to implement a simple pilot, which can be extended, than to be too ambitious and create a complex programme that cannot be handled by the implementation body.

A pilot project should:

- clarify and strengthen the working structure of the implementing body
- provide all stakeholders with a firm understanding of the challenges and technical, social and financial requirements for an implementation programme
- develop and test appropriate instruments and tools for large-scale application
- integrate the relevant stakeholders into the implementation process
- equip executing bodies to be constructors for further activities
- create standardised procedures for the overall approach

The location of a pilot project should be representative of other local locations in the municipal area, with regard to quantity and quality of wastewater, socio-economic structure, settlement layout, etc. It should also allow for fairly smooth implementation and operation to set a positive example.

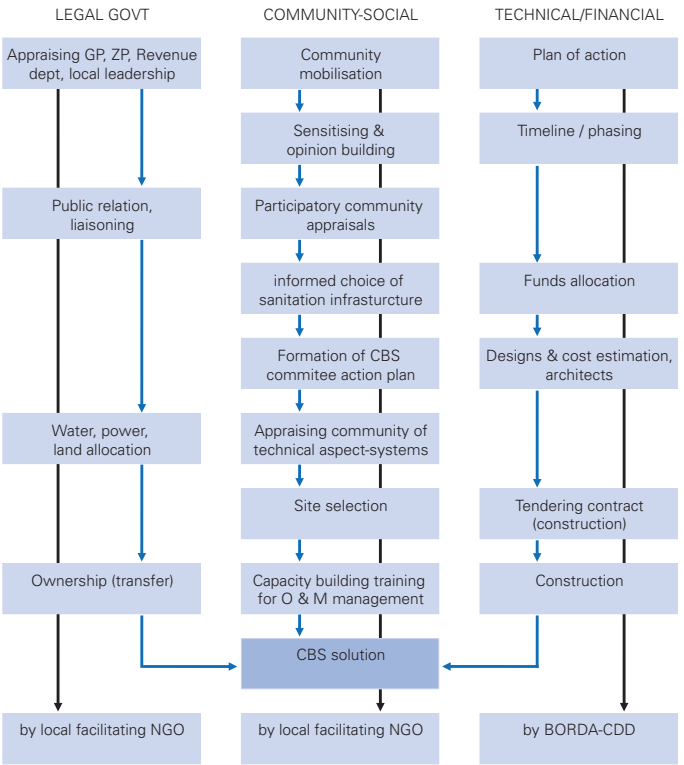
The CBS programme in Ullalu Upanagara, Bangalore, India, for example, was used to test the implementation procedure. The experience gained from the project was later used to effectively target other sites within the programme area.

A pilot project provides valuable information for future projects within the programme:

- Which feasibility-study parameters are relevant in different parts of the city?
- Which planning tools are most efficient?
- How should a demand-responsive approach look for similar target groups?
- Which DEWATS configurations would be most appropriate at similar sites?
- Which informed-choice options proved most useful?
- Which stakeholders must be involved in which implementation stages?
- Which public authorities are relevant for overall project clearance?
- Which "informal leaders" must be involved?

- How can women be targeted through special awareness-raising campaigns?
- Which problems are likely to emerge (i.e. with land-holding)?
- Which contractual arrangements with which stakeholders proved most useful?
- How can the overall implementation process be monitored?
- What financial and in-kind contribution can be expected from the users?
- How can operation and maintenance be organised?
- What can be expected from the users and which tasks must be fulfilled by a service provider?

Evaluating a pilot project helps to optimise future planning processes.



Picture 6_4:
Chart indicating the implementation process in Ullalu Upanagara
ZP = Zilla Parishad (government administration on District level, GP = Gram Panchayat (village level administration)

6.3 Preparation phase

6.3.1 Kick-off workshop

Experience shows that it is beneficial to officially launch the programme with a "kick-off" workshop to which the various stakeholders are invited:

- senior government officials at the local, regional and national levels
- relevant NGOs
- representatives of the target groups
- relevant researchers
- private-sector participants
- international agencies
- media, etc.

Picture 6_5:
The kick-off workshop introduces the scope of the programme and involves senior stakeholders on various levels

The workshop should:

- communicate the results of the pilot project
- demonstrate the scope and relevance of sanitation and wastewater-treatment programmes in relation to different fields of policy and different government levels
- clarify the importance of target driven co-operation between stakeholders

The workshop is aimed at:

- creating awareness amongst decision-makers about the legal requirements, required resources and institutional backing for the programme
- developing a supportive environment – getting different stakeholders and local authorities to offer their competencies to the programme
- launching a process for the provision of financial and human resources on different government levels
- gaining support for extending the programme into other municipalities, departments, or provinces

6.3.2 Planning workshop

The planning, implementation and monitoring activities of a programme should be launched at a planning workshop. The workshop participants analyse the results of the pilot project and draw conclusions for dissemination on a larger scale. The main out-comes of the workshop might include:

- formulation of stakeholder responsibilities, timeline and resource planning
- standardisation of procedures, such as site selection, community involvement, tendering, construction, sludge management, etc.
- drafting supporting documents, such as training kits, contract forms, monitoring sheets, etc.
- formulation of capacity-building plan for key stakeholder groups

Participants of the workshop should be:

- local authorities
- NGOs
- members of the target group
- relevant private-sector participants

Ideally, the workshop results in an approval agreement between the stakeholders involved in the implementation of the programme. Discussing and agreeing on responsibilities and the stages of the project in advance helps to avoid conflict during the later stages of implementation or operation.

Picture 6_6:
Clear agreements between project partners ease the implementation process

6.3.3 Community pre-selection and community assessment

Sanitation mapping is a powerful tool for identifying and long-listing communities eligible for sanitation and decentralised wastewater-treatment projects (see section 4.3.2, page 68). If comprehensive sanitation mapping is not possible, the long-list can be based on the experience of government authorities, NGOs or other agencies. Local authorities tend to have their own classification methodology for poor urban areas, which may be useful for the identification of potential sites.

Other criteria, which may be useful, include:
- health risks within the area
- vulnerability of the ecological system or possible environmental threats
- legal status of the settlement
- income classification.

The long-listed communities should be assessed and ranked. To enable comparison, the following information should be collected:
- current situation of sanitation and wastewater-treatment
- reports on existing sanitation programmes in comparable areas
- indicators for the community's willingness to participate in a programme
- social structure and decision-making procedures within the community
- legal status of the settlement
- land availability
- geological and topographical data

The community is provided with information about CBS and invited to a stakeholder meeting. The meeting agenda should be adapted to the specific local context. During the meeting, the CBS programme is presented and the sanitation conditions in participating communities are discussed. The contributions expected from the community must be stated clearly. Interested communities are asked to submit an expression of interest (EoI) in taking part. The EoI includes an invitation for a rapid participatory assessment (RPA).

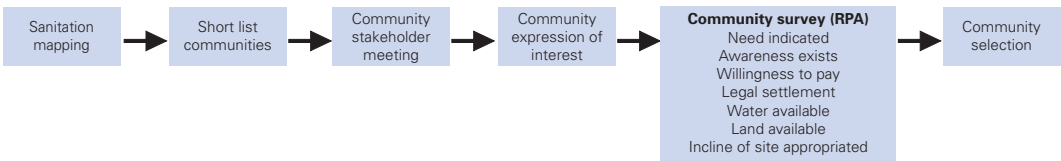
The RPA determines if the site is suitable for DEWATS applications:

- natural gravity flow should be assured – the natural slope of the land should lead the wastewater from where it is generated to the treatment plant and then to the discharge point
- availability of water and land for construction are essential for DEWATS implementation. Illegal settlements are excluded from participation. If an area is prone to flooding, community sanitation centres are usually recommended.
- community sanitation centres require vacant land for construction. Land availability and ownership must be clear
- as sanitation and wastewater systems often have a negative image, residents living close to the planned CBS or treatment unit must agree to the chosen location. Planning procedures must take account of the time necessary for obtaining community acceptance of the facilities in their immediate neighbourhood

To make sure results are objective, representatives of all community stakeholder groups should be actively involved during the RPA process. The following RPA tools can be applied:

- ladder – assessing community willingness to contribute to the new sanitation infrastructure
- transect walk – identifying and analysing the condition of existing sanitation systems in the neighbourhood through direct observation
- problem trees – identifying and analysing community sanitation problems, their cause and effect, and whether the community intends to improve its sanitation conditions
- timeline – identifying and analysing residents' experiences with previous community-participative infrastructure projects.
- venn diagram – identifying and studying existing local community institutions, their benefits and their relationship with the community. This tool is also used to assess community readiness to operate the facility

Picture 6_7:
Flow chart: from sanitation mapping to community selection



6.4 Planning phase

6.4.1 Site assessment

Successful CBS planning depends on a detailed technical survey carried out by technical experts. The relevant information can come from local government and community surveys. Government authorities and stakeholders on the ground, therfore, should be involved in the process. Some of the necessary information can also be obtained from the Rapid Participatory Assessment carried out during community selection.

Picture 6_8:
Detailed knowledge of the local situation is the basis for appropriate planning

The technical survey procedure is identical, with or without community participation. However, the process differs according to the selection of technology. Household-based sanitation systems, including simplified sewerage or off-site treatment, demand more complex surveys, planning and establishment activities than community sanitation centres with on-site treatment. The technical survey consists of four sections:

1. Assessment of general site conditions

- cartographic and topographic surveys and mapping – focused on settlement structure, topography (elevation) and site accessibility
- location and general data collection about local industries and enterprises, including home working, peripheral farming activities, restaurants and food stalls
- assessment of the number of potential users and their habits regarding water, sanitation and waste-related subjects
- survey of soil conditions at potential construction sites

2. Assessment of water and wastewater-related subjects

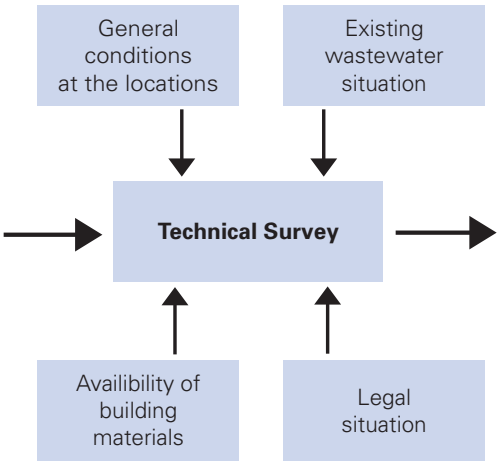
- assessment of water sources, including quantitative and qualitative security
- assessment of water-consumption levels of industries and households, and required quality for different uses
- assessment of domestic and industrial wastewater-generation processes, volumes, composition, discharge patterns and reuse options
- assessment of existing sanitation and wastewater-treatment systems – applied technologies, performance, responsibility for operation and management
- assessment of the rainwater-runoff infrastructure
- assessment of discharge options – survey of local water bodies with regard to quality, flow volume and location, including groundwater quality, use and level
- gathering of precipitation data for different times of the year

3. Legal background on wastewater

- gathering of wastewater-discharge standards and environmental-protection regulations

4. Building materials and tools

- assessment of local availability of building materials and tools



Picture 6_9: Technical survey

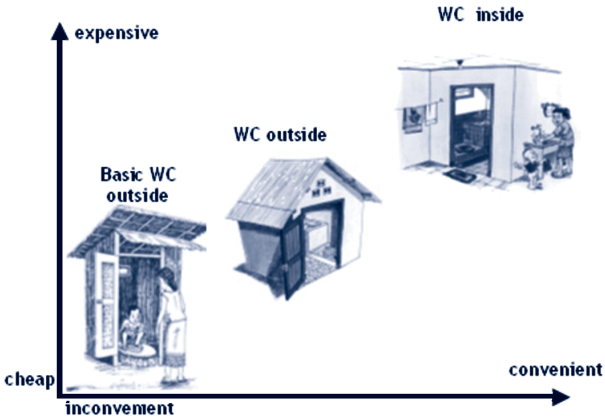
6.4.2 Informed technology choice

By providing the potential users with different options for sanitation facilities and services, the principle of "more expensive systems will cost more" is communicated. The users themselves can eliminate options that do not apply to their situation.

In the informed-choice process, users learn about many possible options:
- different toilet types and layouts of toilet facilities
- different functions and layouts of community sanitation centres
- different service levels to be expected

Informed choice is usually focused on the users' preferences concerning sanitation equipment. However, the following components can also be addressed within community meetings to assess the public acceptance of their application:

- sewer layout
- treatment components
- disposal or reuse of effluent
- disposal or reuse of effluent sludge



Picture 6_10: Toilet-facilities options

Picture 6_11: Experienced experts should facilitate assessments on willingness to pay and informed choice – substantial financial contributions by the users are crucial to the sustainability of sanitation schemes

6.4.3 Detailed engineering design

Experienced technical experts prepare the detailed engineering design applying the results obtained from the technical survey, the technology-choice discussions and the assessment of other local factors. The solutions should be discussed with local decision-makers and community leaders – to identify potential problems – at different stages of the design process.

The superstructure of CSCs *can* be constructed with standardised designs. But, public acceptance will increase significantly if the users get to have their say. The number of toilets, showers, water points and laundry places is calculated in accordance with the estimated number of users.

Picture 6_12:
The design should take into account the specific local conditions and the super preferences

Picture 6_13:
Experienced technical experts prepare the design

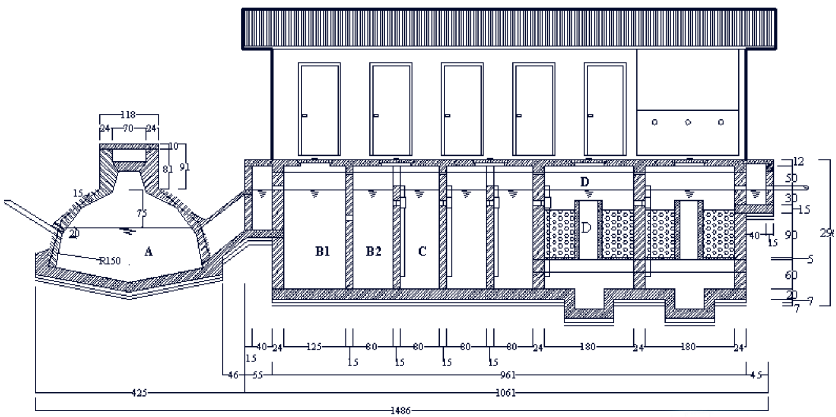
For in-house sanitation, the appropriate location for toilets, showers and wash-basins is determined together with the users. The sewerage system, including inspection chambers, must be designed according to the flow volume, peak flows and slope.

The most appropriate discharge or reuse option is selected and designed in accordance with possible applications, the local surroundings, the legal situation – and the treatment efficiency of the chosen technology.

The connection of small home-industries (e.g. tofu production), restaurants or food stalls can have a strong impact on the performance of the system. Where a simplified sewerage system with off-site treatment is constructed, special attention must be paid, therefore, to commercial wastewater. If additional inflow of such wastewater is likely in the future, this should also be considered in the plant design.

Innovative designs can reduce the cost of the facility. Examples include:

- baffled reactors and anaerobic filters located under pavements, carparks, playgrounds or streets
- positioning the facility to minimise land use and length of sewerage systems
- application of reliable standards to minimise sewer diameters



Picture 6_14:
Detailed engineering design

6.4.4 Economic planning

Economic planning includes calculating the overall project costs and developing a strategy for covering these costs.

The costs to be considered are for:

- land
- materials
- labour
- supervision – including optional planning
- operation – electricity, water, service provision etc.
- maintenance – desludging and sludge treatment.

Where Community Sanitation Centres (CSCs) and DEWATS are to be constructed, the question of land ownership must be resolved. In order to purchase real estate, negotiations must be held with the owner – a site is either private or municipal property. If the owner is not willing to sell the land, perhaps a long-term lease of 15 to 20 years can be obtained. Alternatively, a usufruct may be granted for publicly owned sites. Agreements on the land ownership or renting scheme should be finalised before more activities start.

The quantity and volume of the necessary building materials can be calculated using the detailed engineering design. The total costs for construction depend on the local context:

- if construction is carried out by employees, local wages and material costs apply;[30] in-kind community contributions should also be included in the calculation
- if there is a bidding process, estimated prices should be used – their final prices factored in after the tender is accepted
- if operation and maintenance is supplied by a service provider, a call for tenders can be launched
- if operation is carried out by the community itself, local labour and running costs should be added in

30 A local government makes a financial contribution to a project, market prices may not apply; many authorities have price codes, which must be used instead

Cost coverage can be achieved with possible financial contributions from:
- residents
- public authorities and
- international donors

The fee structure for a CSC should be based on the completed assessment of the users' willingness to pay. If full-cost coverage cannot be expected, further implementation should be postponed.

6.4.5 Agreement on implementation and landholding

In some locations it was helpful to formalise the overall process by signing a Memorandum of Understanding (MoU). The document, signed by a legal representative of the community and relevant municipal bodies, became a central part of the CBS-development plan. It is very important to ensure that the whole community supports the project, as individual disagreements can jeopardise the entire process at a later stage. A community meeting should be held, therefore, to discuss the results of the project planning and to smoothe out any remaining concerns before commencing with implementation.

The main points of the MoU included in the development plan are:
- geographical and topographical maps
- detailed engineering design
- budget plan – including the schedule for disbursements and detailed statements about the contributions from different stakeholders
- implementation schedule
- operation and maintenance plans
- ownership
- responsibilities during implementation (planning & construction)
- responsibilities after implementation (operation & maintenance)

6.5 Implementation phase

6.5.1 Task planning

The implementation schedule is developed from the tasks and respective workloads defined during the economic-planning phase. Tasks are grouped into categories and listed on a spreadsheet.

No.	Tasks	Quantity	Unit
A. Wastewater-treatment system tasks			
1	Prepare building site & levelling	1.00	–
2	Provide office space and storage	1.00	–
3	Documentation	3.00	–
1	Levelling	64.43	m³
2	Prepare sand-bed	12.00	m³
3	Refill earth	16.11	m³
1	Lay brickwork	77.93	m³
2	Prepare concrete reinforcement	40.64	m³
3	Plaster	124.27	m²
4	Prepare working subgrade	6.00	m³
5	Lay brickwork	560.32	m²
1	Pipes PVC Ø 6", l = 20 feet (~6m)	2.00	pieces
2	Pipes PVC Ø 4", l = 20 feet (~6m)	61.00	pieces
3	Pipes PVC Ø 2", l = 20 feet (~6m)	2.00	pieces
4	T-piece	80.00	pieces
5	Manhole cover	13.00	pieces
B. Sewerage system tasks			
1	Exavation	305.00	m³
2	Refill earth	101.67	m³
3	Prepare sand-bed	75.50	m³
1	Prepare concrete reinforcement	0.94	m³
2	Watertight plastering of manholes	0.00	m²
3	Open road surface	398.00	m²
1	Pipes PVC Ø 6", l = 20 feet (~6m)	152.50	pieces
2	Pipes PVC Ø 4", l = 20 feet (~6m)	48.00	pieces
3	Mount prefabricated manhole	35.00	pieces

Table 8: Example of an implementation schedule

The amount of work predicted in the detailed engineering design and economic planning is entered into the table. Task sequences are determined and the required time for each task is estimated.

Time planning requires CBS project experience and knowledge of local conditions (e.g. weather conditions during different seasons, cultural and religious events and holidays, financial allocation patterns of governments and the community). The schedule must be prepared, therefore, by experienced local staff, or by experts in co-operation with people who have local knowledge.

The average time required to construct a community sanitation centre in Indonesia ranges between 70 and 90 days. For household-based sanitation systems, including simplified sewerage and off-site treatment, 90 to 110 days can be estimated.

Picture 6_15:
Task planning should be carried out by experts

6.5.2 Quality management

The requirements for a sound planning and implementation are too often underestimated. Quality management during construction, therfore, is an essential element of the successful long-term operation of CSC/DEWATS. The systems must be constructed as high-quality products. Poor construction quality and minor faults, such as bad plastering or the use of poor-quality bricks, may result in the failure of the entire system. Construction should only be carried out, therefore, by contractors and companies who can be guaranteed to use of high-quality materials and labour. Different quality-control models have proven successful in the construction of anaerobic wastewater-treatment systems:

- In Nepal, only licensed contractors are entitled to construct biogas plants. If the qualitiy of work is unacceptable, the constructor risks losing his/her licence and will be excluded from the programme.
- In Indonesia, a network of NGOs promoting DEWATS and CBS has developed an internal certification system to assure the proper application of new quality standards. Only certified products and personnel may participate in the implementation of such facilities. High standards are ensured by certified:
  - planners
  - foremen
  - site engineers
  - supervisors
  - design engineers and
  - senior design engineers[31]

Picture 6_16: Ensuring good-quality workmanship is essential for a successful CBS programme

Efficient quality management goes hand in hand with capacity building; on-site training measures should be an integral part of any programme. Especially in programmes aimed at large-scale implementation, quality-control and standardisation procedures must become common elements to ensure effective and efficient use of the resources.

31 Requirements include:
1) education: minimum level or experience,
2) training – completion of a training programme
3) examination – training combined with tests,
4) repeated examination – every second year,
5) practical experience – adequate involvement in the different steps of DEWATS implementation.

6.5.3 Construction

The construction process and its main components are summarised in Table 9:

	Community sanitation centre	Simplified sewerage, incl. off-site treatment	Shared septic tank
Sanitation module	**Preparation work** • Survey and prepare site • Arrange materials procurement • Arrange tools and machinery • Arrange work force **Earth work** • Excavate • Levell • Fill earth and compact • Fill sand and compact **Concrete work** • Cast concrete slab • Carry out brick work • Plastering **Carpentry & roofing** • Topping-out the truss • Roofing **Assembly work** • Mount piping • Sanitary equipment • Water & electricity supply • Other interior fittings	**Preparation work** • Survey and prepare site • Arrange materials procurement • Arrange tools and machinery • Arrange work force **Install sanitary equipment at appropriate location** **Concrete work** • Cast concrete slab • Carry out brickwork • Plastering **Install and connect piping to collection system** **Assembly work** • Mount piping • Sanitary equipment • Water supply • Other interior fittings	**Preparation work** • Survey and prepare site • Arrange materials procurement • Arrange tools and machinery • Arrange workforce **Install sanitary equipment at appropriate place** **Concrete work** • Cast concrete slab • Carry out brickwork • Plastering **Install and connect piping to collection system** **Assembly work** • Mount piping • Sanitary equipment • Water supply • Other interior fittings
Collection module	Install and connect piping to treatment system (sub-soil below CSC)	**Preparation work** • Survey and prepare location line • Arrange materials procurement • Arrange tools and machinery • Arrange workforce **Earth work** • Excavate • Levell • Fill earth and compact • Fill sand and compact **Install inspection chamber** • Cast concrete slab • Carry out brickwork • Plastering **Lay sewer pipes** **Fill construction ditches and compact**	**Preparation work** • Survey and prepare location line • Arrange material procurement • Arrange tools and machinery • Arrange work force **Earth work** • Excavate • Levell • Fill earth and compact • Fill sand and compact **Install inspection chamber** • Cast concrete slab • Carry out brickwork • Plastering **Lay sewer pipes** **Fill construction ditches and compact**

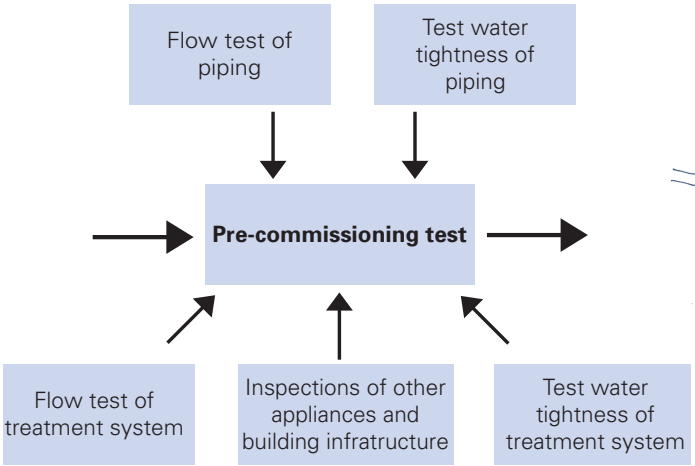
Table 9:
Detailed description of construction process

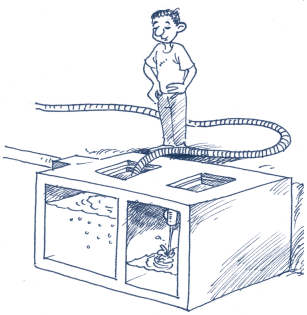
Table 9 cont.

	Community sanitation centre	Simplified sewerage, incl. off-site treatment	Shared septic tank
Treatment module	Preparation work • Survey and prepare site • Arrange materials procurement • Arrange tools and machinery • Arrange workforce Earth work • Excavate • Levell • Fill earth and compact • Fill sand and compact Concrete work • Cast concrete slab • Carry out brickwork • Plastering Assembly work • Mount piping • Fill filters	Preparation work • Survey and prepare site • Arrange materials procurement • Arrange tools and machinery • Arrange workforce Earth work • Excavate • Levell • Fill earth and compact • Fill sand and compact Concrete work • Cast concrete slab • Carry out brickwork • Plastering Assembly work • Mount piping • Fill filters	Preparation work • Survey and prepare site • Arrange materials procurement • Arrange tools and machinery • Arrange workforce Earth work • Excavate • Levell • Fill earth and compact • Fill sand and compact Concrete work • Cast concrete slab • Carry out brickwork • Plastering Assembly work • Mount piping • Fill filters
Discharge module	Preparation work • Survey and prepare location • Arrange materials procurement • Arrange tools and machinery • Arrange workforce Earth work • Excavate • Levell • Fill earth and compact • Fill sand and compact Install inspection chamber • Cast concrete slab • Carry out brickwork • Plastering Lay sewer pipes Fill construction ditches and compact	Preparation work • Survey and prepare location • Arrange materials procurement • Arrange tools and machinery • Arrange workforce Earth work • Excavate • Levell • Fill earth and compact • Fill sand and compact Install inspection chamber • Cast concrete slab • Carry out brickwork • Plastering Lay sewer pipes Fill construction ditches and compact	Preparation work • Survey and prepare location • Arrange materials procurement • Arrange tools and machinery • Arrange workforce Earth work • Excavate • Levell • Fill earth and compact • Fill sand and compact Install inspection chamber • Cast concrete slab • Carry out brickwork • Plastering Lay sewer pipes Fill construction ditches and compact

6.5.4 Pre-commissioning test

In order to ensure good construction quality, the system is tested upon completion by technical experts from the local authority. All technical modules are evaluated with regard to engineering design, quality of workmanship and functional efficiency. System flow and the water-tightness of the piping and treatment system are scrutinised closely. Technical drawings and checklists serve as tools for the pre-commissioning test.





Picture 6_17: Pre-commissioning test

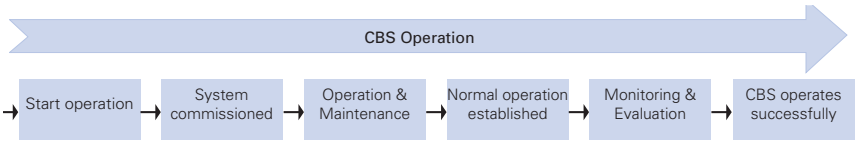
Picture 6_18: Only fully functioning systems are accepted

6.5.5 Parallel training measures

- Environmental-health training is encouraged in all CBS projects. The training is targeted at everyone in the community – all members and individuals involved in operational activities. The aim of the training is to explain the importance of sanitation facilities for personal and environmental health and to provide an understanding of the broader context of sanitation. The main subjects include personal hygiene, handling human excreta and rubbish, disease transmission and background information on particular diseases, such as diarrhoea, typhoid and dengue fever. Training is based on the guidelines of the PHAST (Participatory Hygiene and Sanitation Transformation) Initiative, jointly developed by WHO and UNDP/World Bank Water and Sanitation Programme.

- Function and application training is a basic training module for all users of the new sanitation infrastructure. The aim is to impart basic knowledge about how the system works. Correct use of the system is explained along with information about what may harm functional efficiency. The training comprises a theory and a practice module. The practical training should be carried out on site after construction is finished.
- Operation and maintenance training is only given to people directly involved in the operation and maintenance activities. Basic information on wastewater treatment and the function of the system is provided as well as an overview of all routine tasks for operation and maintenance. The various operational faults and necessary maintenance steps are also discussed.

6.6 Operation phase

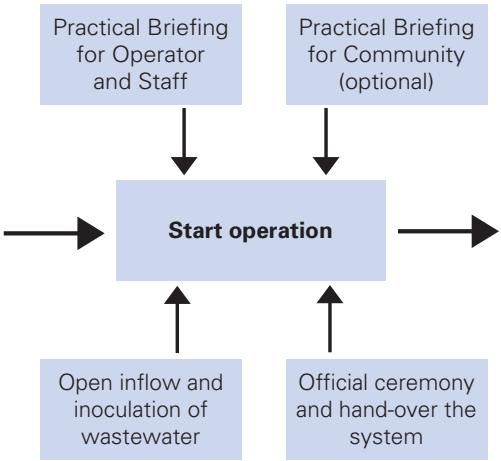


Picture 6_19: Flow chart: operation phase

6.6.1 Start operation

Operation is usually initiated by technical experts from the local authorities in collaboration with the intended operators. For fast start-up, baffled reactors and biogas plants should be inoculated with digested sludge from existing anaerobic wastewater-treatment units, such as septic tanks. After starting the system, operators are briefed on operation and maintenance.

The system formally starts operation at a hand-over ceremony with the community and/or the operating agency. Particularly in poor areas, such events should be perceived as a positive gesture towards the development of the area.

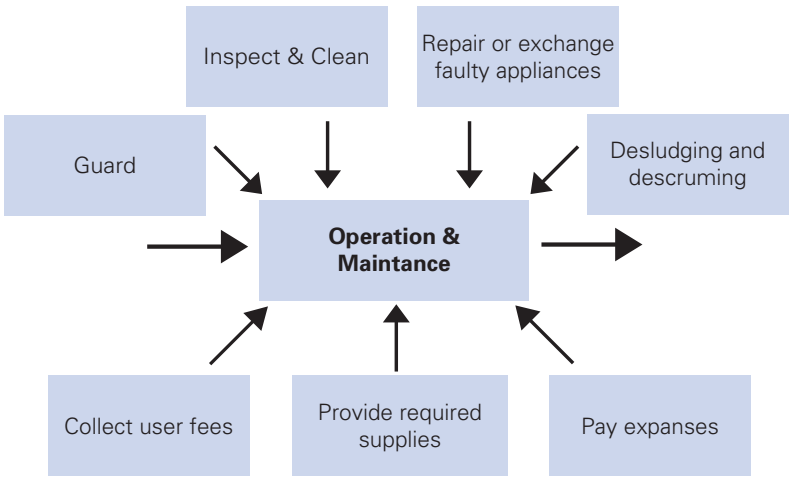


Picture 6_20:
Start operation

Picture 6_21:
The opening ceremony is welcomed by the residents

6.6.2 Operation & maintenance

Operation and maintenance should be backed by a detailed contract. Depending on the approach, the community operating body or an external operator, such as an NGO, a public entity or private company, can be responsible for the operation and maintenance. The lead agency should sign formal agreements with the relevant parties, clearly defining the terms of reference. A contract with a service provider could, for example, include the following terms:



Picture 6_22: Possible operation and maintenance tasks

- community sanitation centres have to be operated and guarded from 5:00 until 22:00
- the entrance areas (terraces) must always be maintained properly (must be cleaned at least twice a day)
- toilets, shower cells, laundry places and the rest of the plot must be inspected and cleaned daily
- faulty appliances, such as light bulbs and leaking pipes, must be replaced.
- the seal of the bio-digester has to be checked for gas tightness and water has to be re-filled on a weekly basis
- inspection chambers have to be checked and cleaned every week

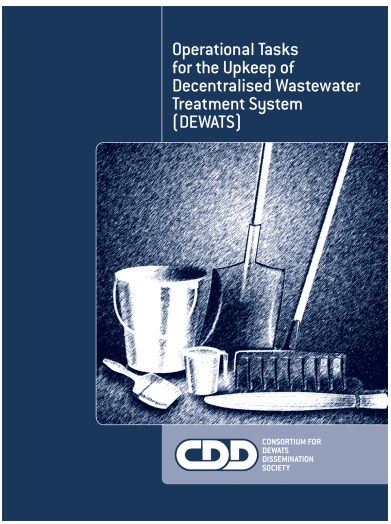
- the water tank has to be cleaned and cobwebs have to be removed every month.
- every six month, the system must be inspected by professional technical staff, who will sample wastewater, analyse of effluent water and de-scum treatment modules.
- the treatment system must be desludged every two years
- user fees must be collected
- all operation and maintenance activities must be documented

Picture 6_23: Operation & maintenance manual

As described in section 11.3,, sludge collection, treatment and disposal are an integral part of an overall wastewater-management scheme. On-site sludge treatment and disposal is usually not advisable in urban and suburban areas. In such cases, infrastructure must be provided to allow environmentally sound off-site handling.
Some municipalities have a sludge-treatment facility, which can be used. Where none is available, the responsibiling for establishing central sludge-treatment and disposal facility usually lies with the local government or municipality.

To permit the use of vacuum trucks, treatment facilities, which require regular desludging, should not be more than 50m (length of flexible desludging pipes) away from a street accessible by such a vehicle. The truck's sludge container is connected to a sludge pump with a flexible pipe. The pipe is put through the inspection shaft to the bottom of the treatment tank before the vacuum pump is switched on. During desludging only matured "black" sludge should be removed. Establishing this type of sludge-management service is one of the main challenges for public bodies. Without such services wastewater-treatment systems stop functioning. Without adequate regulations and law enforcement many housholds and public and private entities practise uncontrolled discharge of their sludge, leading to great environmental risks and health hazards.

Picture 6_24: Monitoring is required to ensure that service providers handle, treat and dispose sludge in accordance with regulations



Picture 6_25: Operation & maintenance manual for DEWATS developed by the Indian partner CDD download: www.borda-sa.org/uploads/o&m_manual-lowres.pdf)

Even if the desludging infrastructure has been established, the services must be monitored. Positive results have been achieved with a model, in which users pay the service provider with a "chip", for which the service provider gets reimbursed by the municipality after delivering the sludge to the treatment facility; users purchase the "chips" from representatives of the local government. This system prevents corruption and the service provider dumping the waste.

6.6.3 Use of biogas

Details on biogas utilisation are given in section 11.5 (page 325). This section focusses on the use of biogas with regard to the operation phase of CBS programmes.

The use of DEWATS-generated biogas is highly recommended because it:

- makes use of a renewable-energy source
- reduces greenhouse gases, which would otherwise escape from the treatment process
  Further details are given in section 4.4.2 (page 77).

The efficient and sustainable use of the biogas requires:

- sufficient production of biogas (see sections 10.2.4, page 241 and 11.5, page 325)
- maintenance of the biogas equipment (see also section 11.5, page 325)
- clear definition of who is entitled to use the biogas

Within CBS projects, biogas is normally used for applications, such as cooking, water heating or lighting. Experience shows that tensions can arise within the community if it is unclear who is entitled to use the biogas – leading to a waste of the resource in some projects. Positive results were achieved where the service providers or individuals responsible for the operation and maintenance of the overall system received the benefit. Since they handle the CBS on a daily basis, these individuals already have a deeper understanding of biogas production and can be trained to incorporate the maintenance of the biogas equipment into their other maintenance duties.

Maintenance duties for biogas appliances include:

- cleaning biogas burners and pipes to prevent clogging with water vapours
- replacing biogas lamp mantles regulary

The project leaders should make sure the decision about biogas use is made early on in the project. Once the stakeholders agree, the future users can be trained to maintain the biogas equipment, while it is being installed.

Picture 6_26: Only fully functioning systems are accepted

Picture 6_27: Biogas equipment has to be well-maintained

6.6.4 Monitoring and evaluation

The performance of the wastewater-treatment system should be checked every 6 to 12 months. The inlet and outlet quality should be analysed to verify that legal standards are being met. Results can be compared to the target performance (planning phase) to optimise the design of future plants.

Daily records should be kept by the operator and operating body so that the service can be evaluated. Records should include data on the daily number of users, specific problems and the operation and maintenance activities carried out. Where systems are badly operated, or the number of users decreases with time; the local authority should investigate the reasons and take appropriate action. This might include replacing the service providers or revising the operation and maintenance scheme.

Picture 6_28:
Monitoring of the operation and maintenance scheme contributes to sound treatment performance of CBS solutions