

D17.1 Procedure for the Pre-Selection of Sanitation Systems

The following presents a simple Multi-Criteria Analysis (MCA) procedure for the pre-selection of sanitation systems during the expert consultation workshop (CLUES step 5.1). It is based on weighted summation and the concept of sanitation system templates introduced in the Compendium of Sanitation Systems and Technologies (tool T15). The purpose of this procedure is to systematically, objectively and transparently determine possible sanitation solutions in a common agreement between stakeholders by stimulating the discussion about different options. The procedure also aims to predict to what extent relevant aspects are fulfilled by each option.

The MCA is not only a tool for decision support; it also helps to prepare further planning steps by highlighting which criteria are important for a good solution. For example, uncertain data on less important criteria is not a problem, whereas for the important ones it might be worth collecting more data.

The following pages describe the MCA procedure only. For details on how the expert consultation workshop should be organised and facilitated, please study also the corresponding chapter of the CLUES guidelines (Step 5: Identification of Service Options; pp. 33-38).

Unless otherwise stated, the following steps can be carried out in the plenary with all workshop participants. Different stakeholders have different priorities, therefore it is important that the process is moderated by a skilled facilitator.

1. IDENTIFY THE OBJECTIVES THAT YOUR SANITATION SYSTEM SHOULD ACHIEVE

1.1 Define the main *objectives* of the sanitation system, based on the outputs of the previous steps of the planning process (particularly Steps 3 and 4). The objectives can be derived from a problem tree (see tool T8) describing the cause-effect relationships around the existing situation. It might be useful to distinguish between primary objectives (need to have) and secondary objectives (nice to have). The following guiding questions should help you identify the main objectives:

- Which priority problems emphasized by the community in Step 4 are addressed by the project?
- Which technical, economic, socio-cultural, health and ecological objectives does the new system have to fulfil?
- What are key aspects that might affect the applicability of sanitation systems and technologies? Examples of such strong aspects are household water availability, settlement pattern, interest in reuse or existing laws, rules and standards.

1.2 Determine measurable (but not necessarily quantifiable) *attributes* or *criteria* for each objective. With these attributes, the performance of an option regarding each objective can be evaluated later on.

Example: Identification of objectives and attributes

| Primary objectives: | Attributes: |
|---|---|
| Stop the pollution of the river by wastewater | Expected flow of nutrients and pathogens to river |
| Reduce risk for diarrhoea | Expected exposure of user to pathogens |
| Provide an odour-free environment | Expected odour nuisance |
| Affordability for majority of households | Cost per household |
| Reliable technology | Risk of failure |
| Secondary objectives: | |
| Produce fertiliser for urban agriculture | Reusability of products |
| Short realisation time | Realisation time |
| Easy to maintain for user | Maintenance frequency at household level |

2. IDENTIFY THE SANITATION OPTIONS

The identification of feasible sanitation *options* for your project site can be done based on tool T15, the Compendium of Sanitation Systems and Technologies. The suggested procedure for this is the following:

2.1 Identify the products that are generated/used locally

2.2 Identify the system template(s)¹ that process the defined products

2.3 Identify the basic applicability of the system template(s) to the project site based on background knowledge from previous steps. The system should:

- not conflict with the primary objectives determined under 1.
- respect cultural habits and user priorities
- not interfere with the existing legislation
- be capable of being integrated into current services

¹ A system template defines a suite of compatible technology combinations from which a system can be designed.

2.4 For each applicable template, select feasible technologies from each functional group where there is technology choice presented; the series of technologies makes up a system (in the following referred to as option).

Tip: In order to save time during the expert consultation workshop, the process leader could already prepare steps 2.1-2.3 in advance. For example in a dry area, where no water for toilet flushing is available, the discussion in the workshop can be based on the systems without waterborne sewerage from the beginning.

3. SCORING: ASSESS THE VALUE ASSOCIATED WITH THE CONSEQUENCES OF EACH OPTION FOR EACH ATTRIBUTE

Create a matrix with the *attributes* from 1. as columns and the *options* identified in 2. as rows (see the example below). Characterize (if possible quantify) all the attributes for each option and fill in the matrix. Thereby, the attributes will be specified in different units (e.g. high/medium/low; good/bad; \$; years).

Example: *Characterisation of attributes*

| | Expected flow of nutrients and pathogens to river | Expected exposure of user to pathogens | Expected odour nuisance | Cost per household | Risk of failure | Reusability of products | Realisation time | Maintenance frequency at household level |
|----------|---|--|-------------------------|--------------------|-----------------|-------------------------|------------------|--|
| Option 1 | Very low | Low | low | 400\$ | low | Very difficult | 2a | Weekly |
| Option 2 | Medium | High | medium | 50\$ | medium | Medium | 30d | 2x per week |
| Option 3 | High | Medium | high | 30\$ | high | Easy | 5d | Daily |
| Option 4 | Very high | Very low | medium | 120\$ | medium | Difficult | 1/2a | Weekly |

The resulting table pulls together the critical pieces of information and provides a good overview of the pros and cons of different systems. In some cases, this table might already be sufficient to discuss the available alternatives, or to dismiss certain options. For the latter, define so called “killer criteria” – criteria which absolutely must be fulfilled by each option (e.g. the cost must be below a certain value).

By continuing with *scoring*, the different specifications are brought into a comparable form and can easily and rapidly be interpreted: for each attribute, the relative strength

of preference is estimated in a scale ranging from most preferred (e.g. 5 points, 100 points) to least preferred (0 points)².

Example: Scoring

| | Expected flow of nutrients and pathogens to river | Expected exposure of user to pathogens | Expected odour nuisance | Cost per household | Risk of failure | Reusability of products | Realisation time | Maintenance frequency at household level |
|----------|---|--|-------------------------|--------------------|-----------------|-------------------------|------------------|--|
| Option 1 | 5 | 4 | 4 | 1 | 4 | 1 | 1 | 4 |
| Option 2 | 3 | 2 | 3 | 4 | 3 | 3 | 4 | 2 |
| Option 3 | 2 | 3 | 1 | 5 | 2 | 4 | 5 | 1 |
| Option 4 | 1 | 5 | 3 | 2 | 3 | 2 | 3 | 4 |

Scoring requires a good understanding of the implications of the options and should therefore be done by experts knowing the relevant sanitation systems. With good facilitation the scoring process should be feasible in the plenary. If different stakeholders have too different opinions you might decide to let each participant do the scoring individually.

Alternative: The specifications of the different criteria can also be brought into a comparable form by using qualitative measures instead of scores, like ++ (strong advantage), + (advantage), 0 (neutral), - (disadvantage), -- (strong disadvantage) and X (not applicable). Such a descriptive assessment is simple and can easily be understood also by non-experts like community members. However, weighting the different criteria (4.) and calculating an overall score (5.) will not be possible. If you want to calculate an overall weighted score for each option and eventually come up with different rankings by different stakeholders, you should rather opt for scoring. Otherwise, you can also proceed in a simpler way as follows: based on the qualitative assessment, let the workshop participants discuss and vote on the available alternatives (if appropriate also through pocket voting, see tool T2). The

² For easy transformation, the scale of the scoring should have a gradation which is compatible with the one of the characterisations. What 'most preferred' and 'least preferred' means should be discussed for every criterion before the scoring in order to clearly define minimum and maximum values of the scale. Consider also that the so-called marginal utility does sometimes not follow a linear function, but can be exponential (e.g. the same price difference between options that cost 30\$ and 50\$ can be more important than between options that cost 380\$ and 400\$).

ranking can then be done by the number of votes that each option obtains. Such a voting on the pre-selected options can even be done later on in the community consultation workshop.

If you choose this alternative, qualitative method, the steps described in the following are not relevant.

4. WEIGHTING: ASSIGN WEIGHTS FOR EACH ATTRIBUTE TO REFLECT THEIR RELATIVE IMPORTANCE TO THE DECISION

Now, each stakeholder³ classifies the *attributes* according to their importance between 0 and 100 points. The attribute considered most important is assigned the weight 100. Then, the stakeholders decide which attribute they think is the least important one and judge how much less important it is to the decision compared to the most important one. For the other attributes the weighting is chosen in between, according to their relative importance. In the end, the weights are scaled down so that their sum equals to 100%.

Example: Weighting

| | Expected flow of nutrients and pathogens to river | Expected exposure of user to pathogens | Expected odour nuisance | Cost per household | Risk of failure | Reusability of products | Realisation time | Maintenance frequency at household level | Sum |
|------------------------------|---|--|-------------------------|--------------------|-----------------|-------------------------|------------------|--|-----|
| Weighting Stakeholder A [Pt] | 100 | 100 | 50 | 80 | 70 | 30 | 10 | 40 | 480 |
| Weighting [%] | 20.8 | 20.8 | 10.4 | 16.7 | 14.6 | 6.3 | 2.1 | 8.3 | 100 |

³ While the previous steps should ideally be carried out in an objective plenary discussion, this step is done by each stakeholder separately to reflect individual perspectives, preferences and opinions. Workshop participants representing the same stakeholder can work together. In some cases it might even be possible to do the weighting in the plenary.

5. CALCULATE THE WEIGHTED TOTAL SCORE

Combine the weights and scores to derive the overall value of each option. This can be done by multiplying scores by weights for each attribute and summing the products up for each option. Each stakeholder generates different total values according to their weighting.

Example: Weighted total score

| | Expected flow of nutrients and pathogens to river | Expected exposure of user to pathogens | Expected odour nuisance | Cost per household | Risk of failure | Reusability of products | Realisation time | Maintenance frequency at household level | Weighted score |
|------------------------------|---|--|-------------------------|--------------------|-----------------|-------------------------|------------------|--|----------------|
| Weighting Stakeholder A [Pt] | 100 | 100 | 50 | 80 | 70 | 30 | 10 | 40 | |
| Weighting [%] | 20.8 | 20.8 | 10.4 | 16.7 | 14.6 | 6.3 | 2.1 | 8.3 | |
| Option 1 | 5 | 4 | 4 | 1 | 4 | 1 | 1 | 4 | 3.5 |
| Option 2 | 3 | 2 | 3 | 4 | 3 | 3 | 4 | 2 | 2.9 |
| Option 3 | 2 | 3 | 1 | 5 | 2 | 4 | 5 | 1 | 2.7 |
| Option 4 | 1 | 5 | 3 | 2 | 3 | 2 | 3 | 4 | 2.9 |

6. COMPARE THE RESULTS AND EVALUATE THE ALTERNATIVES

Rank the options according to their total values (the highest value corresponds to the best option). Different stakeholders may generate different rankings. Compare and discuss the ranking of options by stakeholders and their different weightings. Allow people to voice doubts and explore these. Analyse how sensitive the rankings are to scores and weights assigned to each of the attributes and options. Examine the extent to which vagueness about the outcomes or disagreements between people/stakeholders make any difference to the final overall results.

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