EMPOWERS Working Paper No. 4

(Version 2)

Using Visions, Scenarios and Strategies within the EMPOWERS Planning Cycle for IWRM

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March 2005

Abstract

The Euro-Med Participatory Water Resources Scenarios project (now known as the EMPOWERS Partnership), funded by the European Commission's Euro-Mediterranean Regional Programme for Local Water Management[1], is working in Egypt, Jordan and the West Bank/Gaza to develop tools and approaches that will lead to improved water governance[2], with a focus on practical applications at the local level. The principle long-term goal of the project is to improve development and management of water resources at the intermediate and local level by promoting increased participation and representation of stakeholders in planning and decision-making processes. EMPOWERS has also adopted the regional role of disseminating information that relates to local water governance via a web site and regional events such as workshops, conferences and exchange visits.

To this end, the project is developing a planning cycle for Integrated Water Resource Management (IWRM). This cycle starts with the identification of water-related problems and the development of area specific long-term visions for water resource development that determine the strategies and plans to attain that vision. This strategizing process is supported by the collection and analysis of relevant information on water resources, infrastructure, actors, demand and access, to be used in semi-quantitative Bayesian Networks (computer software) that help to validate and substantiate visions and strategies. The aim of this planning cycle is to support stakeholders at local and intermediate levels in making the essential technical and political decisions to develop and manage their water resources. The overall EMPOWERS planning cycle is described in more detail in *Working Paper 3* (see references section).

This working paper describes the approach to developing future *visions* of water resource management, and of using *scenarios* as a tool to analyse key factors affecting the vision. The scenarios developed are in turn used as a basis for identifying potential *strategies* and *plans* to achieve the vision that are feasible and desirable in terms of equity, economic efficiency and environmental sustainability.

One of the core assumptions of the EMPOWERS programme is that stakeholder involvement - particularly at the intermediate and local level - in a process of visioning and development of scenarios leads to improved use and management of water governance. Improved management implies taking better account of users needs and engenders collective responsibility for interventions in the water sector. It is this larger process of participatory analysis and visioning, scenario building and strategic planning that is the real heart of EMPOWERS.

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[1] This publication has been produced with the assistance of the EC MEDA Water Programme. The content of this publication is the sole responsibility of the EMPOWERS Partnership and in no way may be taken to represent the views of the EC

[2] *Water governance* relates to the range of political, social, economic and administrative systems that are in place to develop and manage water resources and the delivery of water services at different levels of society. EMPOWERS focuses particularly on local water governance – that is governance at levels ranging from the community to district/governorate.

EMPOWERS Working Paper Series

The working paper series[3] of the EMPOWERS programme is an important part of the wider mission of information dissemination and structuring of lessons learned in the project. One of the principal outputs of EMPOWERS will be guidelines for participatory, pro-poor, and stakeholder-led development and management of water resources. Working papers are intended to systematise and make public the development of these tools. The working papers will be maintained and continuously updated on the project web-site, and will then be used as the basis for developing guidelines and training materials.

Other titles in the working paper series

WP 1.	Overall Vision and Approach of EMPOWERS
WP 2.	Country Background Papers (Egypt, Jordan and Palestine)
WP 3.	The EMPOWERS Planning Cycle for IWRD&M
WP 4.	Visions, Scenarios and Strategies for IWRD&M
WP 5.	Water Resource Assessments
WP 6.	Stakeholder Dialogue and Concerted Action
WP 7.	Participatory Project Identification, Design and Planning
WP 8.	Process Documentation and Monitoring
WP 9.	GIS and Bayesian Networks

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[3] These papers are work-in-progress. While they reflect a broad consensus among the EMPOWERS partners they do not necessarily reflect the views of every single partner on every single point.

Background and Introduction to Scenario Building -
What it is, and why use it?

Scenario building (or scenario planning) is a tool whose aim is to help support good decision making. It is based on a systematic and consistent examination of possible future trends, and the impact these trends are likely to have on the possibility of achieving a shared vision. Scenario building is not about 'knowing the future', or always being right; it is about trying to minimize the chances of being seriously wrong. Scenario building is also about recognising that there are often many routes to achieving a shared vision, but that these routes will have different attributes (e.g. level of risk, economic, social or environmental cost, level of potential benefit etc).
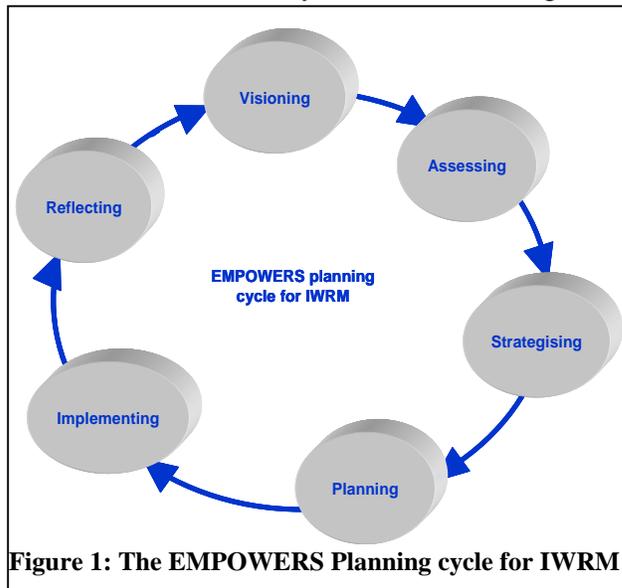

Figure 1: The EMPOWERS Planning cycle for IWRM

different attributes (e.g. level of risk, economic, social or environmental cost, level of potential benefit etc).

Participatory vision and scenario building occupy an important place within the EMPOWERS integrated water resource management (IWRM) cycle (see Figure 1)

The preparation of local and intermediate level narrative scenarios for different planning periods (5 to 25 years), is part of a larger process of visioning, strategy development and planning (see Box 1 for an explanation of these terms) to achieve improved IWRM.

Using this process the project is encouraging and guiding stakeholders in looking beyond the normal limits of their day to day work, encouraging them to take a more holistic view of water supply and demand – be it at the basin, governorate or community levels. The aim is to address frequently ignored questions such as: how do my actions relate to those of others – both actual and planned; or, what assumptions do I make about the role and behaviours of others – and are these assumptions shared. Our aim in using the approach is to improve how water resources are developed and managed, by helping stakeholders to look into the future and consider the long term implications of their management decisions.

EMPOWERS is using visioning and scenario building to encourage stakeholders to see how their water related problems and potential solutions can have positive or negative effects at different scales: how to look for solutions that are not necessarily within the village reach; how to factor the behaviour of villagers into governorate level plans; how to understand the implications of one use of water on other uses and on different users.

Different approaches to using scenarios – future narratives and mathematical models

Before looking in more detail about how scenarios will be used in EMPOWERS, it is worth briefly establishing a conceptual framework for scenarios themselves. When people talk about using scenarios, they typically have one of two rather different concepts in mind.

The first of these, used widely in the scientific (and water resource) communities, sees the term scenario used to describe, frequently within a mathematical modelling framework, a complete and coherent set of parameters or variables. So, for example, in a water resource management model a 'scenario' might refer to a complete set of parameters describing the impacts of the development of a cascade of dams on downstream water availability. This might be compared to a 'baseline scenario' in which the water course was in a pristine state (i.e. no dams).

The second concept, used in the business community, is one that provides opportunities for **dialogue** between specialists and non-specialists. In this context, qualitative and quantitative information, some of which may come from modelling studies, is combined in **narrative scenarios** which in turn act as a sort of future baseline against which

possible management decisions can be assessed. This approach focuses on development of complex narratives (stories) describing different possible futures. The narrative scenarios are not the same as strategies, plans, or visions, but are an intermediate step that normally comes after agreement has been reached on a shared vision and before strategies and plans are made.
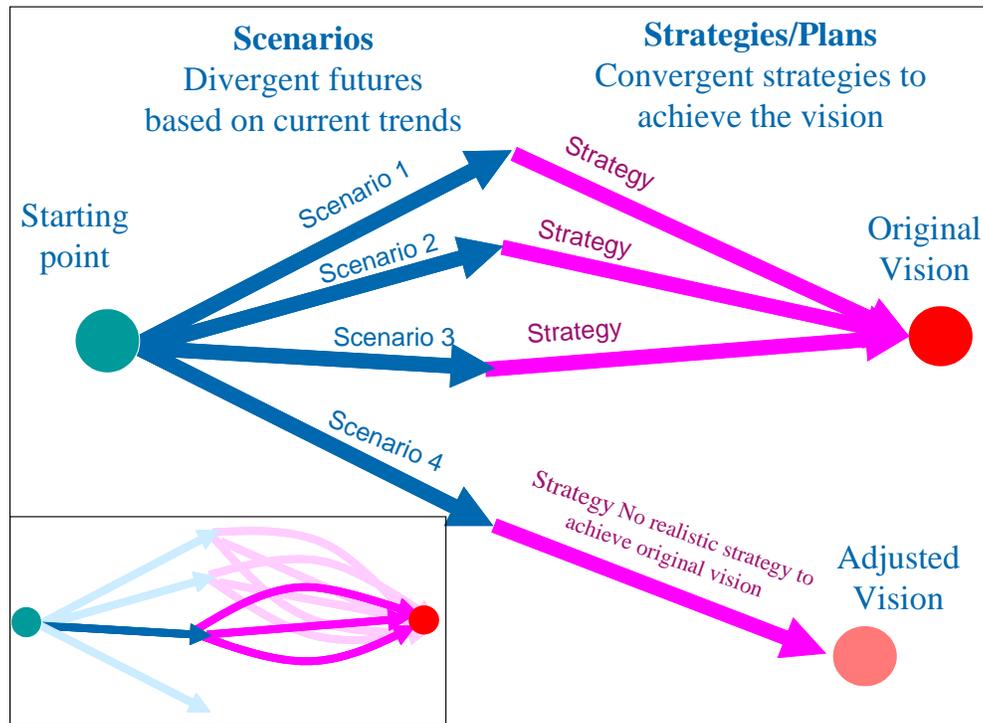

Figure 2.   Visions, scenarios, strategies and plans

Figure 2 illustrates how EMPOWERS is using scenario development in the sense of the second concept. It shows how narrative scenarios represent multiple divergent versions of the future. To achieve some shared future vision, it is therefore necessary to look at the implications of each scenario, and develop strategies or plans based on **each** of these. Only in the case where an acceptable strategy (or strategies – see inset) can be developed that meets the vision under **each** possible scenario can it be said with certainty that the achieving of a vision is largely risk free. In the case of some individual narrative scenarios, it may not be possible to produce a strategy that will enable the vision to be achieved, in which case a new vision (or adjusted vision) may have to be developed.

In much of the scenario literature from the business world it is emphasised strongly that scenarios must be understood as being equally valid (see for example Van der Heijden, 2005). That is, that all the descriptions of possible futures are equally valid (although not necessarily equally likely to occur) and that therefore a truly robust strategy must allow the vision to be achieved under all of them. In EMPOWERS, and particularly for use at the village level, this methodology (which can be highly complex and time consuming) has been simplified to one in which all scenarios are initially identified in their broad outlines, and broad strategies identified to deal with them, while the

discussion is then quickly brought to focus on a 'most likely' scenarios and more detailed strategies related to it (see inset). This modification of the approach often leads, implicitly or explicitly, to a re-definition of the original vision – as under less favourable scenarios this is often impossible to achieve. For an example of this see the Qabatya town example in Annex 1.

Scenario development can only be a useful tool within the context of a clearly defined future vision or other choice. Clarifying the overall vision or, in some cases, the components of the overall vision, as well as the stakeholder group (or groups) who own the vision, is key to making clear decisions. It is also critically important to recognise that a scenario is quite different to a strategy or plan in that it does not yet identify the actions and activities needed to achieve a shared vision.

The rest of this working paper will deal in more practical terms with the five main steps in the process of developing and using scenarios and strategies as part of a process of visioning, strategising and planning. These steps are:

1. Developing a shared vision
2. Developing short narrative scenarios
3. On the basis of one or more scenarios, developing the strategies that achieve the vision
4. Testing visions, narrative scenarios and strategies
5. Feedback to stakeholders on results of scenario and strategy development.

Using scenarios in a water resource planning cycle

The steps of the scenario building process are fully integrated into the EMPOWERS planning cycle (see Figure 3, and *Working Paper 3* for a fuller overview).

Figure 3. Visioning step nested within EMPOWERS Cycle
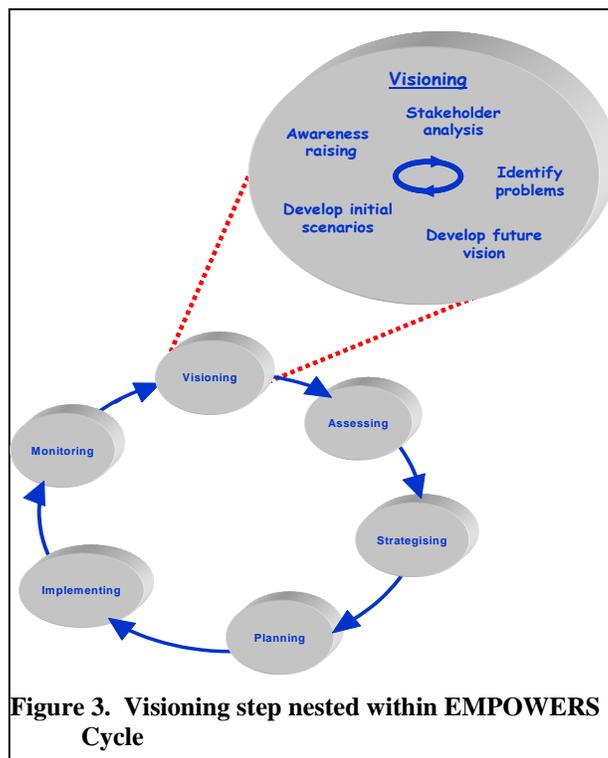
While set out in a logical sequence, it is important to bear in mind that all the steps of the scenario building process occur iteratively throughout the larger planning cycle. For example, once scenarios and strategies have developed and tested, it may be that the original vision is found to be unrealistic (i.e. there are no realistic strategies to achieve it). Previously overlooked trends may themselves call for new scenarios and additional information to be collected and analysed.

Equally, feedback from project stakeholders may put in doubt the credibility of information that is being used, or developing strategies and plans in more detail may detect new issues that have to

be taken into account in the scenarios. In all these cases either vision, scenarios or strategies (and sometimes all three) will need to be revised.

EMPOWERS works at multiple spatial, temporal and societal scales from governorate and district to end-users; villages, towns, but also farmer groups, households and water user associations. The framework binding these different levels and groups together is two nested levels of planning and project management cycles. The most important of these are the governorate/district and village/town level planning cycles, in addition to which there are individual project cycles.

The diagram in Figure 4 shows how different project and planning cycles at different organisational levels link together within the EMPOWERS project. The first two 'light' cycles are more general and have to do with looking in broad terms and with a longer view at the broad outlines of water resource and service development and management in selected districts and communities. They represent an exploratory or 'light' implementation of the planning cycle implemented in the first year. The light planning cycles serve to introduce both project teams and stakeholders to the key concepts involved. The output of these light cycles will be a shared but provisional future vision for both governorate/district and selected village/towns. These visions then form the basis for a longer term process to develop water use and management strategies at district and or governorate level. It is likely that, at least, the broad outlines of a village level strategy and possible interventions will be identified by the end of this first planning cycle.
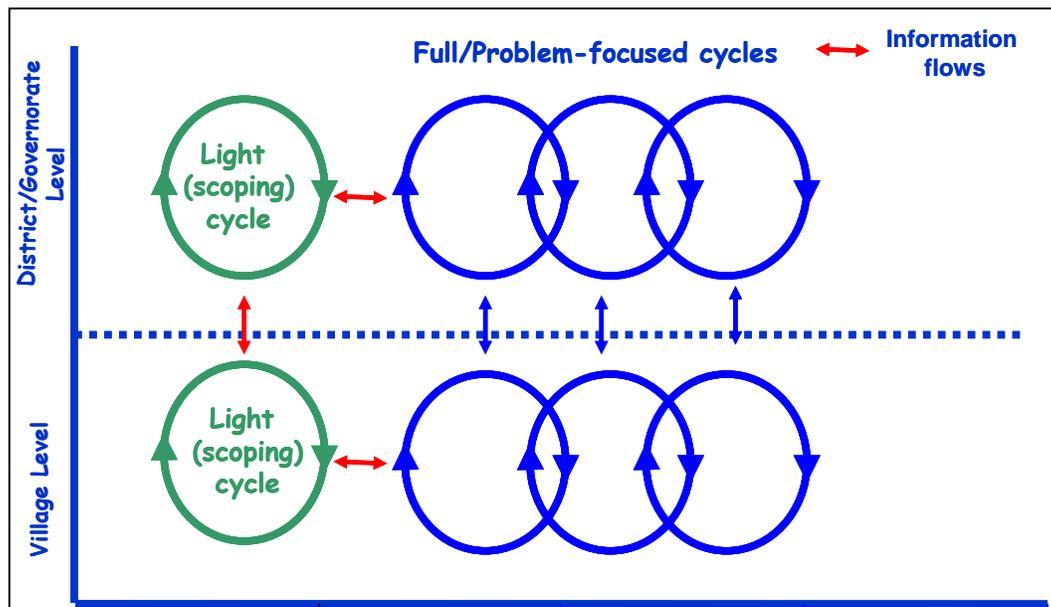
Figure 4: Implementation of the EMOWERS planning cycle at different levels and intensities

The planning cycles in year two and three are more pragmatic and will address key issues that need further attention within the context of the agreed vision (both at the community and district/governorate level). They are more focused on specific problems detected in the light planning cycle and include individual planning cycles for specific projects. The key idea here is that individual projects should arise and contribute to a

larger and holistic strategy to achieve the visions on water resource management at community and district/governorate level.

As mentioned, the totality of the EMPOWERS water resource planning cycles, and how different phases of the planning cycle link together within it, is discussed in more detail in *Working Paper 3*. How this is embedded in a broader stakeholder approach is outlined in *Working Paper 6*. Below, the five main steps of scenario building are further explained.

Step 1: Developing a shared future vision

At both institutional levels a future and shared vision needs to be the starting point for planning (for project cycles vision will be replaced by objectives). For each level however, different time scales are likely to apply. The longest time scale will apply to the governorate level where larger scale decisions about broad policy development and links to national and river basin level planning will be made (Note: 2025 is the EMPOWERS target). Village level visions should also look well into the future, however a shorter (around ten year) time horizon is probably more realistic. Finally within either village or district/governorate level cycles, individual project related planning cycles should have a time horizon at least as long as the expected lifetime of the planned actions.

What should a future vision look like?

A vision should be a short and succinct statement of a desirable future; this vision needs to be shared and agreed upon by all relevant stakeholders. Visions should be SMART, that is Specific, Measurable, Acceptable, Realistic and Time bound. At a village level a vision could be formulated as in the box below:

Box 2 Example of a village vision

That all community members will have access to a domestic water supply meeting national norms by 2010'; that 'irrigated land will have stabilised at 200 hectares, and sustainable water sources will have been identified and developed' by 2015; and that by 2006 the capacity of a sewage treatment plant will be increased so that there are no downstream pollution impacts.

The village vision should encompass the interests of all water users and uses (domestic, sanitation, irrigation) and should consist of an agreed (and achievable) description of what the different water supplies will be like by the target date.

A governorate (or district) level vision will be similar, dealing with meeting the needs of different users at the governorate level, but also looking at the larger picture in terms of meeting the needs and obligations of the governorate to other users outside its boundaries – for example, large scale transfers to other governorates etc. Project level visions are something of a special case and will, in essence, be the same as the goals and immediate objectives of the project.

Visions are, by definition, forward looking and should involve thinking about possible futures that take account of how things may have changed at the end of the targeted

period. The key point is that the vision should limit itself to a clear description of the desired future state for all water resources and services within the focus area (village, town, governorate). Based on the clear articulation of a vision, and analysis and extrapolation of key trends (scenarios), strategies can then be developed to achieve the vision. It is crucial that the visions (village and governorate) be agreed by all stakeholders, only then will it be possible to begin to negotiate meaningfully over strategies for achieving the vision.

Step 2: Developing narrative scenarios

As mentioned, the five steps of developing and using scenarios and strategies are closely interlinked. Visioning and scenario development draws heavily on the earlier steps in the EMPOWERS planning cycle – notably initial problem identification and water resource assessments. Problem identification helps to define the initial vision or visions; water resource assessments both better define the problems/opportunities, and provide the agreed data-set upon which scenarios will be based.

The scenario development step involves using the insights and information gained to identify key trends, local but also national or international, and to extrapolate these into the future. At the same time this step involves identifying possible opportunities and constraints to achieving the vision. The period of extrapolation, and the time frame of the scenarios, needs to be at least as long as the horizon of the vision. Scenarios being defined based on these factors will form a basis for bringing together coherent developmental strategies to achieve the vision.

As discussed earlier, scenario building provides an excellent opportunity for stakeholder dialogue. This can be promoted and systematised by using a number of techniques that include brainstorming and ranking those factors that might critically affect achievement of a vision. Figure 5 is a diagram that can be useful in this process, by helping to identify those factors that are at the same time both most important and most uncertain. These are the factors upon which the different future situations described by the narrative scenarios are based.

Figure 5: Ranking factors for narrative scenarios (Schwartz, 1991)
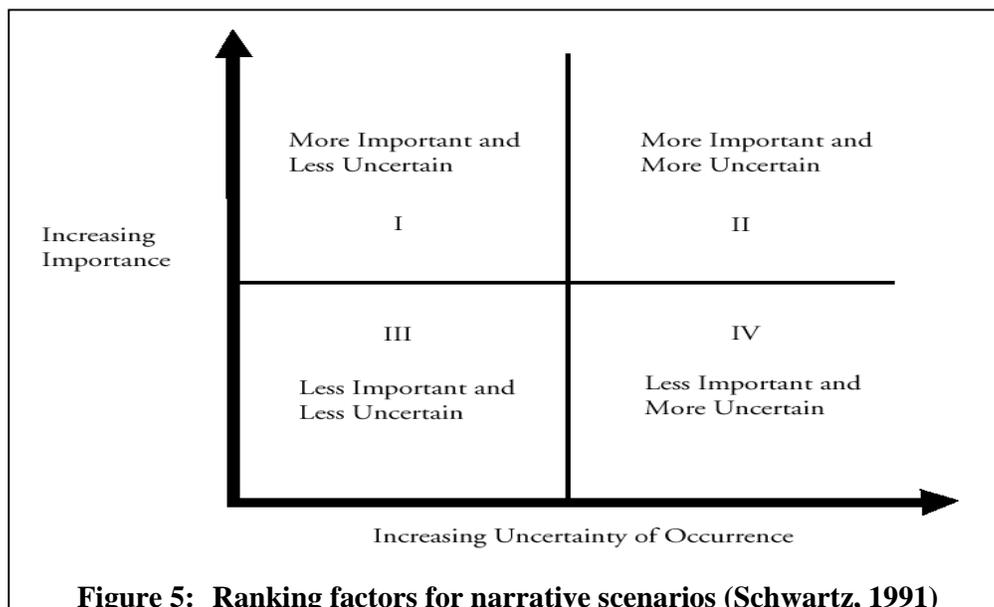
The steps below can be followed to develop narrative scenarios related to the shared vision discussed above; a card exercise will often be useful to structure ideas:

1. Brainstorm to identify all factors that will affect achieving the vision (local factors that may be open to change as well as external factors that are beyond direct control)
2. Classify factors according to the diagram in Figure 5 (which can take the form of a wall chart to which cards are attached).
3. The factors in the upper-right quadrant are those to be used for the narrative scenarios; they are the factors that are key for achieving the vision. It is preferable to limit these key factors to two or three, as this reduces the number of possible combinations and hence scenarios)
4. Define two extreme states for these key factors (e.g. low/high population growth; external funding is/isn't available) and write narrative scenarios according to each possible combination of the different states of the key-factors (if two key factors then there will usually be four scenarios - see Box 3).
5. Use the factors listed in the other three quadrants to develop a "background story" for each of the four scenarios.
6. Sub-step 4 and 5 will provide the essential information to write-up the four scenario narratives. They can be backed up by any factual information/data as available from earlier data collection.

These narrative scenarios are descriptions of a possible future situation (in 5, 10 or 20 years time) and do not include the activities to come to that situation. This is handled in the next step when developing the strategies that will achieve the vision under the assumption of one selected narrative scenario.

Box 3: Scenarios:

Two factors are identified as being most important and uncertain with regard to achieving the vision for domestic water supply, set out in Box 2. These are a) **population**, which depending on migration may vary from 1.5 to 2 times present rates; and b) **the main water supply network**, which may or may not be extended to the village.

Based on these two factors, four scenarios outlines can be developed based on:

    a) Population at 1.5 times current and no extension of the network
    b) Population at 1.5 times current with extension of the network
    c) Population at 2 times current with extension of the network
    d) Population at 2 times current and no extension of the network

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Step 3: On the basis of one or more scenarios, developing the strategies that achieve the vision

This step will normally be carried out in two iterations. In the first, broad strategies will be developed for each scenario, where a strategy is a broad group of actions by which, working from the situation described in a scenario, the vision can be achieved. This first step is particularly important as it helps to identify whether the vision may need adjustment for one or more scenarios. It may also be necessary to carry out step 4 (testing of scenarios and strategies) for this iteration before moving onto the second iteration.

In the second iteration a 'most likely' scenario is identified and used as the basis for developing more detailed strategies. In Box 4 strategies are understood as being a collection of broad groups of activities. In this second iteration one or more such collections may be developed. In the box below strategies for a 'private sector', and 'community' approach are developed. The grouping of activities to make strategies is an important exercise in its own right, and the logic of the grouping needs to be tested against achieving the vision in the next step.

Box 4 Broad but focussed strategies

Broad strategies related to the above scenarios are:
- **Scenario (a):** Population at 1.5 times current and no extension of the network. *Strategy:* Invest in water harvesting and well development along with associated institutional capacity building to ensure sustainability
- **Scenario (b)** Population at 1.5 times current with extension of the network
  Scenario (c) Population at 2 times current with extension of the network
  Strategy: For both these scenarios, establish institutions for management of the new network, identify tariff structures, ensure capacity of institutions to maintain and sustain the new network – the assumption being that the extended network will be able to cope with the full range of population increase.
- **Scenario (d)**: Population at 2 times current with no extension of the network
  Strategy: Revisit vision as hydrological data suggests there are no options to expand the water supply to meet the projected demand.

Having selected scenario (b) as the most likely, **more focussed strategies** are developed for this scenario:

Strategy a (community management approach)
- Establish community network management association
- Carry out studies to set tariffs
- Set up training programme for association
- ……

Strategy b (service provider approach)
- Identify service provider
- Establish tariffs and payment modalities
- Implement customer relations management system
- ……..

Box 4: shows examples of broad and more detailed strategies.

Even though a "most likely" scenario is selected, it is important to recognize that other scenarios may also be important when formulating strategies and plans. By taking these "less likely" scenarios into account and, as much as possible, integrating them into strategy and plan development, the certainty of achieving the vision is increased.

In practical terms, this could, for example, mean that pumping infrastructure is designed on the basis of one scenario but pump houses are oversized so that extra pumps could be installed, or extra land is purchased on the off-chance that an extra treatment plant might have to be constructed, or headworks are oversized etc. The idea being that a small amount of additional expenditure reduces the risk of large capital outlays, time delays etc at a later date.

Step 4: Testing visions, narrative scenarios and strategies

The heart of the EMPOWERS approach revolves around information; collecting, managing, sharing and most of all using it to come to better plans and activities. SMART Visions, Scenarios, and Strategies are all part of the framework to use the information collected in other parts of the EMPOWRES cycle effectively. To allow this to happen, the scenarios and strategies developed in narrative form by stakeholders must have as much information as is available incorporated in them, and they must then be tested for internal consistency. That is, they must be tested to see;

a) whether the information collected from different sources makes sense when compared and collated, and

b) whether the strategies developed are sufficient to achieve the vision.

This testing can mean nothing more than detailed scrutiny of the assumptions and data used. However, in many cases it will call for some element of mathematical testing or modelling.

Bayesian Networks

EMPOWERS is piloting the use of Bayesian Networks (BNs) to support this aspect of the work. Bayesian Networks are a graphical computer based modelling and analysis tool, based on Bayesian probability theory. They provide a relatively simple framework for analysing both quantitative and qualitative information, and have the important attribute of allowing uncertainty and its effects to be explicitly accounted for. For more information on the theory and application of Bayesian Networks see Jensen (1996).

Bayesian networks can be structured based upon (and closely reflecting) the initial problem trees of the stakeholders, and can then incorporate the information collected and analysed in the water resource assessment (see *Working Paper 5*). The objective of testing scenarios and strategies using Bayesian Networks is:

     i)   to verify the internal consistency of the scenarios and strategies. This means to check whether taken together they will allow the vision to be achieved, and with what probability;

     ii) to identify what additional data and information needs to be collected. This may involve an iteration back to the previous step in the cycle - or even an entire new cycle.

Because of the nature of Bayesian Networks, a single model will contain both 'problem tree' and 'solution tree' because of the ability to switch between different values for each node. At the same time the BN allows the combined testing of both scenarios and strategies. The degree of detail reflected in the Bayesian Networks depends largely on

the available data and the need for clarity (certainty) in outputs. The network (and the tree) should contain nodes describing all the key factors necessary to describe both scenarios and strategies.

The level of detail will also depend on the use of the network. If it is for simple illustration of the broad outline of a strategy in view of a specific scenario it can be largely qualitative. If it is for more detailed evaluation of a proposed set of actions (as part of a project planning cycle) then it should be more detailed and contain numerical data.

For example, if a BN is being developed to look at the strategy of developing rainwater harvesting to reduce demand on domestic water supplies for irrigation, then minimal numerical (hard) data would include daily rainfall, expected recharge rates, volume of water to be stored, current use of domestic water for irrigation, crop irrigation requirements. Key internal factors (those that can be affected by project level interventions) for example awareness, people's capacity, etc., and external factors (beyond the scope of project level interventions) such as rainfall should be identified. The model should then be used to test for the probability that a strategy will meet the objectives/vision under different combinations of these critical factors (scenarios).

While BNs allow the testing within a single framework of scenarios and strategies, for the sake of clarity and communication with outsiders it is useful to make a clear separation between them.
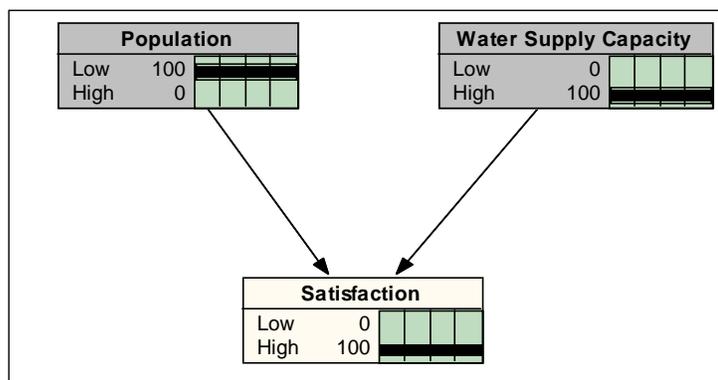

Figure 6: **Bayesian Network example**

Figure 6 illustrates how scenarios and strategies can be illustrated in a single simple BN model. In this the underlying trend affecting user satisfaction is population growth. It is currently low, and based upon it there are two possible scenarios – low population and high population. There are also two possible strategies to follow – to maintain water supply capacity at its current low level, or to expand it to a high level. The model shows (not illustrated), that under a high population scenario only a high water supply capacity strategy will achieve the vision of high satisfaction. This is of course a very simple example. True scenarios will consist of groups of factors (for example population, water resource availability and demand) with a range of states. Equally strategies are likely to contain a range of actions (supply capacity, institutional capacity etc).

As with the entire EMPOWERS cycle, the testing of strategies, scenarios and visions is an iterative process that involves periods of working with and away from stakeholders. The crucial point is that the final networks (and key scenarios and strategies) be discussed with and agreed by all primary stakeholders. The testing of initial scenarios

and strategies by the BNs will most probably lead to necessary modifications in the scenarios and strategies selected, and possibly also in the initially agreed vision, as more information and insights become available in the process.

Step 5: Feedback to stakeholders on results of scenario and strategy development

Feedback to stakeholders will take different forms depending on the different stakeholders involved and their level of understanding and need for information. All stakeholders need to be involved in the dialogue necessary to develop vision, scenarios and strategies, be this at the district/governorate or at the village level. Numerically minded key stakeholders may be involved directly in work on the Bayesian Networks, while villagers will probably not. In all cases, the final visions, strategies and associated plans should be clearly and simply written up, and more importantly signed up to by all stakeholders.

Output of scenario and strategy development:
The outputs of the scenario and strategy development and testing will consist of a properly documented list of (not more than four) scenarios complete with a brief narrative summary setting out in words the main trends/factors being addressed and their likely future state. The outputs of strategy development, taking into account one of the four scenarios, will be an initial list of possible interventions – which may or may not be grouped together into a true strategy – but which taken together are likely to have a good chance of achieving the vision under the assumption of the selected scenario. An example of such a document is attached in **Annex 1**

Summary

The objective of EMPOWERS is to help communities and local governments to better plan, develop and manage their water resources. Key to this is facilitating them to take a longer term view that encompasses the rights and needs of others and the likely impacts of proposed developments.

Scenario building within the larger EMPOWERS planning cycle is a key tool in facilitating this. Within EMPOWERS a difference is made between
visions – a desired future state;
scenarios – the trends underlying achievement of the vision;
strategies – the broad outline of how to achieve the vision; and
plans – detailed stepwise implementation guides (including stakeholder tasks, timeframe, budget, etc).

Developing scenarios and strategies is an iterative process of identifying, with stakeholders, the factors most important to achieving a vision, and the main possible future situations described by different possible developments within the factors. Similarly the process of strategy development consists of identifying a range of possible interventions which, based on the different scenarios will allow the vision to be met.

Identifying how long each of these steps should take – and what is the minimum requirement in terms of people and resources to do them adequately is an important part of the EMPOWERS project and will be a major subject of the process documenting activity.

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