Scale-models to bridge

The author explored communication processes between irrigation engineers and farmers in Northern Senegal to identify opportunities for joint learning aimed at improving the design process of small-scale irrigation schemes. Scale models and maps proved to be useful tools to facilitate dialogue.

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Irrigation schemes rarely function in a satisfactory way. Technical problems can be manifold and often have an important human dimension. The problems are often too complex to be easily solved by design engineers. As various actors are involved with different interests and insights, 'hard' design criteria cannot be used. The conviction grows that, to resolve these complex problems, the design of irrigation schemes should take place as a kind of 'learning process' which involves all relevant actors. For such a common learning process to take place, mutual trust and communication between the different actors is essential. Communication between irrigation engineers and farmers, however, is often very problematic. To find ways of enhancing a 'learning process', I tried, in my research in Northern Senegal, to find answers to the following questions:

- What is the difference between the technical knowledge of design engineers and that of farmers?
- To what extent can engineers and farmers learn from each other through exchange of technical knowledge?
- How can the exchange of technical knowledge be optimized?

The situation in Northern Senegal

The climate in Northern Senegal makes it difficult for the *Haalpulaar* farmers to make a living out of the natural environment. Floodplain and rainfed agriculture alone normally does not provide a secure living and therefore migration for work provides an important source of extra income. At the beginning of the seventies, farmers eagerly accepted simple village irrigation schemes (about 20 ha.) for increasing production and decreasing risks (Diemer & Huibers 1991). Although farmers depend on the government for the construction of their irrigation schemes and the repair of their pumps, they manage their own schemes and have developed their own technical knowledge.

The irrigation potential of the Senegal river and the policy of the government and donors to stimulate rice production means that there are many Senegalese and foreign irrigation engineers in the valley. From my research it became clear that irrigation engineers usually act as natural allies of the government and donors (Scheer 1996). Communication between design engineers and farmers is very limited. With regard to the few situations where communication takes place beyond a superficial level, technical issues receive little attention and the engineer remains in control of the technical information that is gathered. At best, a design engineer thinks *for* the farmers and the irrigation scheme itself often turns out to be his or her only 'message'. One explanation for this is that employers rarely stimulate and most often discourage communication with farmers. Likewise farmers are not inclined to communicate beyond a superficial level. They prefer not to ask questions because they reason that they may lose the entire project if they do. A strategic 'dependent' behaviour has often paid off for farmers in the Senegal valley. Misunderstandings between design engineers and farmers about technical subjects occurred frequently in the projects observed by me. Design engineers and farmers do not learn from each other; even worse, both draw the conclusion that the technical knowledge of the other should not be taken seriously.

Different perspectives on irrigation

My research made clear that farmers and design engineers have very different perceptions on irrigation. Design elements are given other priorities, are described differently, and are arranged in other ways. Different levels of abstraction and detail increase misunderstandings even more. The technical knowledge of design engineers is based on a scientific logic. Generally applicable rules regarding phenomena such as water flow and topography, are used to be able to design in different localities. Engineers often work with abstract maps and plans. Many technical design elements and physical characteristics are considered seperately. Consequently they may lose sight of the interrelationships between elements. The technical knowledge of farmers is focused on physical phenomena such as specific qualities of the environment, soils and topography. Farmers' knowledge is focused on their own plot, and most of them have no overview of an entire irrigation scheme. Farmers regard physical phenomena and elements as closely connected, which often permits them to respond accurately to problematic situations such as canal breaching or water scarcity. The box presents an example of the different perspectives of farmers and engineers.

Barriers to communication

Such differences in technical knowledge most often did not become explicit during the irrigation design process. As a result the sustainability of the irrigation schemes was negatively affected. The lack of learning may be largely explained by the top-down conditions of the design process. But sever-

Different perspectives

The message an irrigation engineer often gives to farmers is to maintain their canals better - in order to allow for the designed water distribution. Farmers, however, may prefer to adapt their water distribution to the changing state of the canal (cf figure 1 and 2).

The irrigation of a high plot alongside a silted canal (fig 1) only requires a small check. If the canal would be dug out (fig 2) the check would have to be higher and more solid, demanding considerably more attention from its owner. This is one of the 'technical' reasons for which farmers may prefer silted canals to maintained canals.

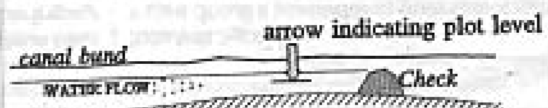

Figure 1: silted canal

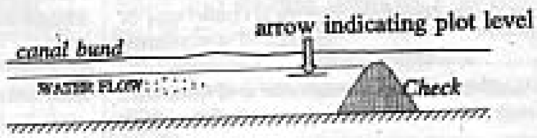

Figure 2: maintained canal

A farmer in situation 1 might reply the engineer that he does not dig out the canal, since it is 'too low', the pump is 'too powerfull' and/or the plot is too high. For the engineer this 'fuzzy' or even 'insane' remark seems to hide organizational shortcomings or is just an excuse to avoid hard work.

the communication gap

al other explanations were found at the level of communication between engineers and farmers.

A first reason was the fact that, even in situations with positive intentions and sufficient room for communication, the dialogue between irrigation engineers and farmers often remained limited to subjects that were 'just outside' the professional heartland of the irrigation engineer. Such subjects for discussion were for instance labour requirements, organizational aspects and land rights. The irrigation engineer apparently shifted his or her attention from the heart of his irrigation profession towards the area 'just outside' this domain, as if the professional heartland itself was too obvious to be discussed.

A complicating factor was that farmers' remarks that seemed to be completely insignificant to engineers, in the end proved to be the keys to important underlying notions. For the engineer, the farmer's notions on irrigation topics were often characterized by 'fuzzy concepts', which were not used 'consistently' from the 'scientific' point of view. For instance, farmers indicated that water in the open canals was pushed (even uphill) by the pump which had taken the water from the river. For design engineers, who think in terms of hydraulic gradients caused by gravity force, this was nonsense. As several technical subjects were often dealt with simultaneously, it was very difficult for farmers to unravel what happened. Moreover, engineers are inclined to give solutions to certain problems. And even when they do restrain themselves by not correcting farmers or not telling them what to do, this orientation may still make them less susceptible to 'unimportant remarks'.

Even in favourable conditions, the factors mentioned above may prevent the applied researcher or specialist from learning. The same applies to farmers, who have a more or less equal share in the misunderstandings. In Senegal, in the end, engineers and farmers blamed each other for the unsuccessful projects, which was disastrous from the perspective of learning: it made them give up the wish to communicate with the other.

Scale models for dialogue

In order to enhance communication and learning between engineers and farmers, the design engineer is allowed to live up his or her solution oriented disposition, not by telling farmers what to do, but by explicitly modelling his or her ideas about reality and desired future situations. Various models of irrigation schemes can be used. These should preferably stem from the professional knowledge domain and include those ideas that seem 'too obvious' from an engineer's point of view. In Senegal, for example, irrigation situations were modelled by making adapted plans, a series of drawings and a three-dimensional scale model of an irrigation scheme (see photo p.2) which allowed imitation of irrigation practices. Also carefully selected irrigation schemes in the region could be used as 'models'. These were suggested for *farmer-to-farmer* visits. In general, these models should not be made too complex and should certainly not suggest that everything has already been worked out, since they are meant to stimulate and structure a debate about relevant changes.

When the models are shown to farmers or categories of farmers, e.g. men or women, they should be presented as only tentative solutions. During the discussion that almost certainly follows, the engineer should now have a modest and open-minded attitude. In these circumstances farmers are triggered to show their knowledge: false assumptions of the engineer may be corrected, underlying problems may be redefined, other solutions and perspectives on reality may be put forward by farmers - for instance by actively changing the model. Equally, discussions among farmers may result, yielding perhaps even more interesting information.

Expression by action

In fact, by using the model, the engineer questions the reality of (groups of) farmers and, more indirectly, tests the validity of his or her own 'obvious' technical knowledge. In the models symbols are used which are often closer to observed phenomena than words. For this reason, 'insignificant remarks' may suddenly gain significance once farmers combine them with the language of the model. In Senegal, the scale model made me discover many aspects of the farmers' technical knowledge because they were able to express themselves by doing, thus bypassing language problems. Models also helped to single out one technical notion from another.

In accordance with what has been recorded in many other situations where diagrams, drawings, plans, aerial photographs, etc. have been used (Chambers 1992), the models also stimulated a relaxed rapport between researcher and farmers. It is equally important to note that farmers in Senegal were highly interested in directly 'meeting' the irrigation engineer, as an equal, in the area he or she knew best. This also appeared to contribute to the development of a crucial atmosphere of trust, probably because it was seen as a legitimate subject for the engineer. The latter is not always the case when specialists investigate 'relevant' socio-economic backgrounds just outside their professional domain.

Towards a system approach

Of course, by focusing on the engineer's domain, a professional bias may easily sneak into the process. Therefore, such an approach should be fitted into a broader systems' perspective, such as that offered by Checkland and Scholes (1990) in their *Soft Systems Methodology*. Yet even when it is based on a specific discipline, the model may serve as an entry point through which other relevant disciplines are approached. For instance, a model which explicits 'technical aspects' of water distribution, may well reveal aspects of social organization too.

Continuous learning cycles

After discussing the model, a phase of reflection is required. With special attention to 'fuzzy' and 'unimportant remarks', farmers' responses should be analyzed, which requires a mix of logical reasoning, intuition, and putting oneself in the farmers' situation. Normally new perspectives on farmers' technical knowledge (and their socio-economic considerations) will result. Automatically new 'desired future situations' emerge in the mind of the solution-oriented engineer. A new model may be designed, a new discussion organized, new groups approached, etc. Several of these 'learning cycles' may be built into the participatory design - action process. In a later stage, when mutual agreement has been reached about implementation, the real world irrigation scheme, slowly moulding in concrete, takes up the role of a 'model' in the learning cycle. After all, it is by trying to change the world that one learns most about it.

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References

- Chambers R. 1992. **Rural appraisal: rapid, relaxed and participatory**. IDS discussion paper 311 Brighton, Institute of Development Studies, University of Sussex, UK.
- Checkland PB. & Scholes J. 1990. **Soft Systems Methodologies in action**. Chichester, John Wiley & Sons Limited.
- Diemer G. & Huibers FP. 1991. **Farmer managed irrigation in the Senegal Valley: implications for the current design method**. Wageningen Agricultural University, Water Management Project. St. Louis, Senegal: WARDA, Water Management Project.
- Scheer SH. 1996. **Communication between irrigation engineers and farmers: the case of project design in North Senegal**. PhD thesis. Wageningen Agricultural University, The Netherlands.