Working with farmers

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Working with farmers

Towards a service approach in irrigation

Training

The socio-economic base line survey

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ABSTRACT

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Water management in rural areas is becoming more complex, increasing the need to communicate more intensely with water users. The trend to decentralize decision making in water management and to make those who render water management services answerable to the clients of their services, only enforces this. The intention of this report is to acquaint the community with a technical training in the methods and techniques that social scientists apply when working with farmers. They can be either managers responsible for all operations of a project or water management organization, staff charged with the task to supervise social scientists, or staff working together with social scientists and applying their results. The report may also be appreciated by social scientists who wish to refresh their knowledge.

Keywords: accountability, capacity building, drainage and Irrigation, gender, performance assessment, water management, working with farmers

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Contents

Preface

With water management in rural areas becoming more complex, the need to communicate more intensely with water users is apparent. The trend to decentralise decision making in water management and to make those who render water management services answerable to the clients of their services, only enforces this. For the better part staff of drainage and irrigation projects are experts with a technical training. Generally they have not been trained in the methods that social science experts, like rural sociologists, agro-economists, agricultural extension workers, or community organisers, apply when working with farmers. The objective of this report is to inform people with a technical training in the methods and techniques that social scientists apply when working with farmers. They can be either managers responsible for all operations of a project or water management organisation, staff charged with the task to supervise social scientists, or staff working together with social scientists and applying their results. The report may also be appreciated by social scientists who wish to refresh their knowledge.

The report contains three chapters; one on service agreements, one on training, and another on the socio-economic base line survey. The perspective from which the information is presented is that of the manager or (senior) staff member of a project. The text of the chapters is set up to allow readers to train themselves. The chapters start with identifying learning goals and include questions for self evaluation. Together the three chapters cover only a part of the many different aspects of working with water users. Other issues would include the sociology of farmers' communities, women and water, farming systems and farm economics, Participatory Rural Appraisals and other assessment techniques, and sustainable Water Users' Associations. Together the subjects would constitute a handbook on working with farmers. The realisation of such a handbook is planned in the future.

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Wageningen, November 2004

Chapter 1 Towards a service approach in irrigation

Bart Snellen

1. Introduction

The world irrigated area expanded in the last century from 40 to 274 million hectare, of which 207 million in the developing countries. The vast majority of the irrigation systems were financed from public funds. This indicates that construction of irrigation systems does not usually produce a return on the invested capital that is sufficient to attract private investors. Most irrigation systems also require government assistance for obtaining their operational expenditures. This dual dependence on public funds explains why the service-approach is not yet common among irrigation system managers.

With a service-approach, managers of irrigation and drainage systems:
- make every effort to ensure that the services they provide are well adapted to the needs of their customers (the farmers);
- make sure that they provide these services at the lowest possible cost;
- are accountable to users on the above issues (service provision and cost-efficiency).

The service-approach is not limited to the operational phase of an irrigation or drainage system; it is equally important during planning and design. With a service-approach, the primary objective of the planners and designers is to provide the kind of services that the farmers most needs to increase productivity. This puts the farmer, with the water-related constraints that limit his productivity and the various options that allow him to overcome these constraints, at the very centre of the planning and design process. The farmer does not get all this attention for his needs for free: the service-concept requires the farmer to pay at least the full recurrent cost of service provision. This obligation cannot be imposed unilaterally upon the farmer; it must be agreed upon after negotiation. By taking part in the negotiations leading to a service-agreement, the farmer largely determines the outcome of the decision-making process about investments in irrigation and drainage.

The service-approach is a powerful instrument for overcoming many of the obstacles that presently limit – and even threaten – the potential contribution of irrigation and drainage to farmers as well as to society. Its application requires major changes in the planning, design and operation of irrigation and drainage systems, the role of the various players and the legal and institutional environment. This chapter aims to provide both the motivation and an outline for accomplishing these changes.

2. Early lessons

The Transactions of the International Engineering Congress held in San Francisco in 1915 contain contributions about irrigation development in the U.S.A., Italy, Spain, Australia, Libya, India, and Argentina. The text reproduced below (Box 1) leaves no doubt about the benefits of irrigation, for the farmer as well as for society.

Box 1. Benefits of irrigation. Reproduced from: Luiggi, L.* *Italian Irrigation*. Paper no. 40 in: *Transactions of the International Engineering Congress, 1915*. Waterways and Irrigation. San Francisco, California, September 20-25, 1915. p530-582.

"It is the firm opinion of all Italians that irrigation gives most beneficial results, not only from the private view of the proprietor but also from the public point of view; as the most prosperous agricultural districts of Italy are those where irrigation has been practiced for centuries. In regions formerly suffering from great emigration the evil was cured as soon as irrigation was introduced; emigration soon diminished and then ceased almost completely, and this owing to the larger crops raised and to the increased prosperity of these districts."

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In the same paper, however, the author states*: " …it is sad to ascertain that all large irrigation canals are never a great financial success; even under the very best circumstances they pay only the working expenses and leave only a very small margin, 1 to 2%, for the capital invested unless hydro-electric power can also be combined with irrigation."* The author also explains the reason for this low return on investment:

" The reason is that it is not alone sufficient to build a canal carrying a large volume of water in order to make it a success; it is necessary to be able to sell this water, that is, find the farmers ready to use it. But before the water can be disposed of, the distributing ditches must be prepared and the land properly leveled; then the farmers must learn how to apply water to the land, at the precise moment and in quantities best suited for the growth of plants in each kind of soil; they must decide which crops are the most profitable in each district; and furthermore, where the land is not very permeable, it is necessary to prepare drainage ditches in order to get rid of the surplus water, which otherwise by stagnating, might damage the vegetation or produce an excess of parasitic plants or cause water-logging of the land. All of this requires experience, time, and capital, and so the Canal Administration is not able to sell all its water until many years after the canal is completed. In the best cases, it takes from 20 to 30 years – but generally much longer – to dispose of all the water of a very large canal."

In spite of the low return on investment, the Italian State encouraged irrigation development by granting a substantial subsidy: 3% per year on construction cost of the main system for the first 10 years, 2% per year for the next 10 years and thereafter 1% for another 10 years.

For similar reasons, the Government of Spain imposed water charges that covered the cost of operation maintenance and operation only. *"The Government is apparently satisfied with the returns from increased value of the irrigated district to compensate it for the original appropriations made for construction of the works."* (Stevens, 1915)[1]

[1] Stevens, J.C. *Irrigation in Spain*. Paper no. 45 in: *Transactions of the International Engineering Congress, 1915*. Waterways and Irrigation. San Francisco, California, September 20-25, 1915. p657-671

In India, a distinction was made between Productive Works – *"which when projected were expected to pay their working expenses as well as to clear all interest charges on their capital cost within ten years of completion"* – and Protective Works – *"designed primarily to afford protection against famine. They are not as a rule expected to return a direct profit, although indirect returns are anticipated from reductions in famine relief charges and in remissions of land revenue, as well as from the general support they afford to the agricultural status of the tracts they serve."* Construction of *Protective Works* was fully subsidized by the Government. (Nethersole 1915).[2]

In another paper submitted to the 1915 International Engineering Congress, F.H. Newell deals with the question *"Does irrigation pay?"* Newell considers the question from different viewpoints: the State, the Promoter, the Investor, the Landowner, and the Farmer or Irrigator. Under this last heading, Newell provides the arguments for the service-orientation:
"On the back of the farmer rests the entire superstructure of irrigation development. Unless he succeeds, not only in making a living, but in showing a reasonable gain at the end of the year, the works and the investment in them cannot be called a success. In other words, the landowner, the investor, the promoter, the state and the nation, all look to the farmer to justify the effort made in irrigation development. The engineer who plans and builds the works sometimes forgets this fact, or, at least, considers it none of his business; but with wider view of his opportunities and his responsibilities, he is beginning to appreciate more and more the fact that he has a duty in seeing to it that, so far as lies within his power, the works are planned and built with primary consideration of the farmer's need and personality."

Newell wrote a book on 'Irrigation Management' in 1916, to share his experience with other men in charge of operation and maintenance of newly completed irrigation systems in the western part of the United States. Three years earlier, he had published a book on 'Principles of Irrigation Engineering'. In the preface to 'Irrigation Management' he wrote: *"Planning and building is only the beginning; the really difficult and at times discouraging work is that of properly utilizing the irrigation systems after they are built and of getting fair returns from the irrigated lands.*"

Newell's book of 300 pages and 15 chapters advises irrigation managers how to assist the farming community in overcoming these difficulties and prepare for *Transfer of Control*:
"The irrigation project built by a corporation or by the Government is destined ultimately to go into the hands of the water users. The sooner this transfer is made, the better for all concerned if the water users will accept the full responsibility and employ men of large experience. The manager who is thus acting as agent of the original builders must look forward to the time when the water users themselves will exercise more direct control and make such provisions as may be necessary towards aiding the water users in appreciating the responsibilities which they should assume."
Box 2 contains excerpts from Newell's book that demonstrate his concerns and insights about sustainability of irrigated agriculture.

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[2] Nethersole, M. Recent Developments of Irrigation in India. Paper no. 42 in: : *Transactions of the International Engineering Congress, 1915*. Waterways and Irrigation. San Francisco, California, September 20-25, 1915. p591-610

Box 2: Early lessons on sustainability of irrigated agriculture. Excerpts from: Newell, F.H. 1916. *Irrigation Management*. D. Appleton and Co. New York-London.

Social sustainability
Under earlier pioneer conditions in irrigation development, there was a spirit of cooperation in the community. The irrigation canals were built by cooperative effort and where thus operated, success depending on mutual support and assistance. There also grew up the development of community methods of handling products and cooperation in marketing them. Where irrigation canals are built by the government, the same degree of community life is not possible at the outset. Settlers do not have the same interest in each other's success and it has rarely been possible for them to join together in distributing water fairly among themselves. In the large irrigation systems built by the Government, the water must be taken to each man's farm, because if left to be distributed among a small group, there is always complaint that the man at the end of the lateral, or the weaker member of the community, does not get his share. (p.38, Chapter 3: The Human Element).

Environmental sustainability
The fact that there are certain soluble salts in the soil is not only a source of profit, but also of danger in that, by careless handling of the water, these salts may be washed out from one portion of the field and concentrated in another, producing what is commonly known as alkali, destructive to valuable plant life. With indifferent handling of water, therefore, not only is the soil greatly reduced, but large areas of otherwise fertile soil are more or less permanently injured and can be relieved only by an effective system of drains. (p.25, Chapter 2: The Physical Conditions)

Institutional sustainability
There is a saying in the irrigated West that "water is worse than whisky in making trouble". There is also another phrase, that of "winter friendship", implying that during the crop season every man is at warfare with his neighbor, and it is only after the crop season is over that friendship is re-established. This condition arises from the fact that the water laws in some of the states are quite imperfect, being unsuited to the needs of the people. (p.46, Chapter 4: The Legal Aspect).
Effective cooperation is essential to the success of a community of irrigators. One of the first duties of a manger in a new project is to see to it that organizations of the irrigators are formed for the promotion of mutual interests. In such matters, however, it is wise for him to keep in the background, while at the same time doing everything possible to stimulate others to take an active part and to work for the common good.(p.215, Chapter 12: The Irrigator and his Associations).

Financial sustainability
The normal condition of all large irrigation projects, during early years at least, is that of extreme financial distress bordering upon bankruptcy. Each year the payments become relatively easier as more land is brought under cultivation and as greater success is attained with the crops; but with an occasional bad year or failure to secure markets, the progress while upward is necessarily slow. (p.286, Chapter 15: Conclusions).

Technical sustainability
In the hundreds of miles of canals and laterals and scores of structures.... there are so many points of structural weakness or possible danger, that the man who designed and built these portions can alone be trusted to get them into active operation. One of the greatest dangers to the new piece of work is the attempt of new men, unaware of many of the conditions, to handle it. (p.10, Chapiter 1: The Problems).

Newell explained that it took many years of hard work and perseverance to achieve a situation where additional farm income from irrigated agriculture would be able to cover interest charges and recurrent costs for operating and maintaining the scheme:

'Ultimately these will be met, but in the first few years, perhaps during ten years, the outgo so far exceeds the income that bankruptcy threatens.' (p.289; also see Box 2 under Financial sustainability).

The situation described by Newell relates to irrigation development early this century in the Western part of the USA. As we have seen above, authors in other parts of the world also arrived at the conclusion that investing in irrigation development is not particularly rewarding from a financial perspective. The preface of a manual on irrigation design in Indonesia (van Maanen, 1931)[3] states that '*capital invested in irrigation development cannot be expected to be totally remunerative*'. Yet the author advocates investment in rice-irrigation schemes because '*an alternative labour-market for millions of people cannot readily be created.*' A similar statement is made in the proceedings of what is probably one of the first international symposiums on irrigation in Africa: '....*I myself firmly believe that irrigation projects normally should be based on sound economic foundations, but I also hold the view that in under developed countries, human, sociological and political reasons may argue strongly in favour of schemes that for a long time cannot be economic. But I stress the fundamental necessity of the public authority being aware, from the outset, that such schemes are not basically economic, and this will require particular financial support of the kind now dispersed by the International Development Association (IDA).*' (Phillips, 1961)[4]

When international irrigation lending started in the 1950's, the early lessons apparently had been forgotten. It took the international irrigation development industry several decades to relearn them.

3. Early lessons forgotten

3.1 Emphasis on construction

International irrigation lending started in the 1950's, in response to rising agricultural prices and pessimism about food supplies. Lending was aimed at expanding irrigation infrastructure, wherever technically and economically feasible. Feasibility studies for internationally assisted irrigation development were aimed at estimating the investment cost of the irrigation infrastructure and the potential yield increase due to irrigation. Both estimates were based almost entirely on physical characteristics alone (topography, soils, climate, and hydrology). Farmers' aspirations and capabilities to engage in irrigated agriculture did not enter into the picture, nor the availability and competence of the future managers and operators of the scheme. Irrigation agencies derived their budgets, their power and their social prestige from their mandate to

[3] Maanen, D. Van. Irrigatie in Nederlandsch-Indie. Een handleiding bij het ontwerpen van irrigatie-werken. Batavia, 1931.

[4] Phillips, J. Irrigation in Trans-Saharan Africa: The Basis and the Challenge. p 9-24 in Wright, C.S. Africa and Irrigation. Proceedings of an International Symposium held at Salisbury, Southern Rhodesia, August 1961.

build new infrastructure, not from their capacity to develop sustainable irrigated agriculture (de Graaf & van der Toorn, 1995)[5].

3.2 Unrealistic planning

The use of the Internal Rate of Return (IRR) as the major investment criterion implies a bias against durability. Since costs and benefits occurring in the more distant future are discounted highly, little account is taken of the project sustainability after the first 10 to 15 years of the project's life (Tiffen 1987)[6]. Choosing projects on the basis of a high IRR introduces a bias against those with a higher initial cost even if they have low maintenance costs, because it assumes initial capital is the scarce factor (ibid.).

Perhaps even more important is the following: We have seen in section 2 that irrigation projects hardly ever produce an adequate IRR. In most cases, therefore, in order to meet the IRR required by the development banks *the estimates of project costs and benefits have to be manipulated!*

This means no less than starting the complex enterprise, which irrigated agriculture undoubtedly is, *on the basis of a deceptive business plan*! In an environment of internationally assisted irrigation development there are few accountability mechanisms to confront those involved with the preparations of a project with the actual results. In fact, there are good reasons for those directly involved not to draw attention to the inconsistencies between the assumptions made in the planning phase and the results obtained in practice:

- The irrigation managers, because it might make them unpopular with their superiors and reduce their chances of promotion or getting transferred to a construction job where more money can be made;
- The consultants and contractors, because it might make them unpopular with the financing agencies and spoil their chances of winning another contract;
- The development bank staff, because their promotion depends on the amount of money they disburse in their assigned region and sector;
- The policy-makers, who had discovered irrigation investment as a way to respond to concerns of the general public about hunger and poverty in developing countries.

[5] de Graaf, M. and W. Van den Toorn. *Institutional context of irrigation management transfer.* p. 69-86 in: Johnson, S.H. et al. *Irrigation Management Transfer. Selected papers from the International Conference on IMT, Wuhan, China, 20-24 September 1994*. IIMI/FAO, 1995.

[6] Tiffen, M. *The dominance of the internal rate of return as a planning criterion.* ODI/IIMI Irrigation management Network Paper 87/1b. April 1987.

3.3 Irrigation as a "privileged solution"

After the disastrous droughts in the Sahel region in 1972-73, irrigation seemed self-evidently suited for dealing with the problem of African drought. There was so much international support for irrigation that Moris (1987)[7] termed it a 'privileged solution'. The term is derived from the concept of a 'privileged problem' that is used to describe problematic situations which may have been present for a long time, but which seem to require an organized solution by means of public intervention. According to Moris '*A privileged solution is not thought to require testing and modification. The answer will seem to lie at hand, and what matters is simply to find the resources and will to act. In Africa, irrigation projects have often enjoyed a privileged status among some policy-makers. They seem the obvious solution for modernizing production, minimizing food imports, removing food deficits, and ameliorating the impact of drought.*'
This would explain, why African governments continued to invest in modern irrigation despite its high costs and poor performance. Moris perhaps was not quite right about continued investments; expansion of irrigated area in Africa was only marginal after 1980. The important point made by Moris, however, is that privileged solutions do not stimulate testing and modification; they do not promote a 'process learning' strategy.

3.4 Consequences of unbalanced irrigation development

In the mid-1960's irrigation enjoyed a favored status among investors, with irrigation investments representing more than 75% of total World Bank disbursements in the agricultural sector. Total lending for irrigation by the four main financial donors (World Bank, Asian Development Bank, United States Agency for International Development, and the Japanese Overseas Economic Cooperation Fund) reached its peak in 1977-79 and has been declining since. By 1986-87 it was just over 50% of the 1977-79 level (Rosegrant & Svendsen, 1993).[8] A World Bank Operations Evaluation Study explains this trend as follows:

'*The Bank, like other parts of the development assistance community, has responded to price trends and development perceptions in making loans for irrigation. When agricultural prices started to rise and there was pessimism about food supplies, the Bank began to invest heavily in irrigation, a trend that intensified during the Green Revolution period. The continuous and substantial fall in world staple food prices since then has prompted the Bank to lessen its emphasis on irrigation.*' (Jones, 1995).[9] Other authors, however, cite disillusionment of financing agencies with the economic performance of previous investments as a major cause. (E.g. Turral,

[7] Moris, J. *Irrigation as a Priviliged Solution in African Development*. Development Policy Review Vol.5 (1987), p.99-123
[8] Rosegrant, M.W. and M.Svendsen.1993. Irrigation investment and food policy. *Food Policy*, February 1993: 13-32.
[9] Jones, W.I. 1995. *The World Bank and Irrigation.* A World Bank operations evaluation study.

1995).[10] In the irrigation literature, the view that performance of public irrigation systems has been generally poor is hardly contested. In a keynote address to an international conference on sustainable irrigation, Mr. Khalid Mohtadullah (at that time Director of Research at the International Irrigation Management Institute, thereafter in charge of the water section of the Water and Power Development Authority in Pakistan which is responsible for the world's largest irrigation system and later Executive Secretary of the Global Water Partnership, until 2002) stated: '*The expansion in irrigation development has undoubtedly made significant contributions towards expanding world food output, alleviating hunger and improving diets. Yet, dissatisfaction with the performance of irrigation systems in developing countries is widespread. Despite their promise as engines of agricultural growth most irrigation systems are performing below their potential. This is true whether performance is measured in terms of achieving planned targets, or in terms of the production potential created by the physical works. In other words, most of the benefits have stemmed from the magnitude of the investment, and not from efficient and productive systems.*
The poor performance of irrigation systems can be attributed to a number of factors. These include design and construction factors, poorly-managed operations and inadequate supplies in the lower-end of the command area. Canals and gates are allowed to fall into disrepair. Water deliveries are often untimely and unreliable. In general, only about 25-30 percent of the water delivered into large canal systems in developing countries actually becomes available to the crop leading to worldwide irrigation efficiencies less than 40%. All factors add up to much of the world's existing irrigation being under-used, crop yields in irrigation systems far below their potential with low cropping intensities and, in some cases failing to enhance incomes and food security for those who most need it - the rural poor.
Lack of maintenance has caused many systems to fall into disrepair, further inhibiting performance. Over time, distribution channels fill with silt, increasing the likelihood of breaching, outlets break, and salts build up in the soil. ..... It has been estimated that 150 million ha - 60% of the world's total irrigated area - need some form of upgrading to remain in good working order. There may be controversy about the accuracy of the quantitative estimates made by various sources. Nonetheless, it does illustrate the magnitude of the problem.*' (Mohtadullah, 1992)[11] .

* The extent of damage by salinisation is illustrated by Table 1, which is reproduced from the proceedings of the same conference (Rydzewski 1992).[12]

[10] Turral, H. 1995. *Recent trends in irrigation management: Changing directions for the public sector.* Natural Resource Perspectives No.5. ODI, London, U.K.

[11] Mohtadullah, K. 1992. *Research and training needs for stimulating irrigation development.* p.3-13 in: Feyen, J. Et al (Eds.). *Advances in planning, design and management of irrigation systems as related to sustainable land use*. Proceedings of an International Conference. Leeuven, Belgium. September 14-17, 1992.

[12] Rydzewski, J.R. 1992. Irrigation development planning for sustainability. p.17-33 in:Feyen, J. Et al (Eds.). *Advances in planning, design and management of irrigation systems as related to sustainable land use.* Proceedings of an International Conference. Leeuven, Belgium. September 14-17, 1992.

Table 1 Irrigated land damaged by salinisation; top five irrigators in the world; estimate, mid-1980's.

Country	Area Damaged (million hectares)	Area Damaged (% of Total Irrigated Land)
India	20.0	36
China	7.0	15
USA	5.2	27
Pakistan	3.2	20
Soviet Union	2.5	12
Total (5 countries)	37.9	25
World	60.2	24

De Graaf & van den Toorn (1995) comment on the institutional aspects of poor irrigation performance: '*What promised to be one of mankind's major steps towards intensification and expansion of agriculture has become an often disappointing investment, a burden on national governments and the focus of rent-seeking and tortuous communication between the farmers and agencies.* They offer the following explanation: '*The single, possibly most important factor responsible for the disappointing returns on irrigation investment in the larger systems, is the failure of proper, reliable and responsive management of the main system. Most systems are built or under control of the same agencies which are subsequently in charge of their operation. In many of the larger systems in countries such as India, Bangladesh and Indonesia, there is not really any management of the system in terms of deliberate water allocation in response to actual circumstances. There is only administration.*'

The before last sentence of this quotation implies that system managers do not make any effort whatsoever to provide adequate services to farmers.

3.5 Responses of the 1970's and 1980's aimed at improving irrigation performance

De Graaf & van den Toorn (1995)[13] summarizes the efforts of the irrigation development community aimed at improving irrigation performance. These efforts have in common that they focused on a particular group of actors involved in irrigated agriculture, or on a particular aspect of the irrigation system. Another common feature is that each of the prescribed remedies at one time enjoyed the status of a "priviliged solution". As pointed out earlier, this does not stimulate testing and modification and does not promote a 'process learning' strategy.

On-Farm Development. These efforts included construction of infrastructure and land-leveling at the tertiary level, as well as inducing farmers to adopt the practices recommended by the extension agencies. These programmes have absorbed substantive funds and accomplished relatively little. The main reason is that farmers

[13] de Graaf, M. and W. Van den Toorn. *Institutional context of rrigation management transfer.* p. 69-86 in: Johnson, S.H. et al. *Irrigation Management Transfer. Selected papers from the International Conference on IMT, Wuhan, China, 20-24 September 1994*. IIMI/FAO, 1995.

remained dependent on the quality of main system management, which was not addressed by these programmes.
Participation. These efforts were aimed at involving planners in design, planning, operation and maintenance of irrigation schemes. This has resulted in few systems not having their water users' association or scheme committee, at least on paper. In actual practice, the influence of these organisations is constrained by the unwillingness of middle and higher level officials in irrigation agencies to share power with lower levels and with farmers.
Strengthening of Irrigation Agencies. Many training programmes have been conducted, but the actual transition from training individuals to actually changing structural aspects of the agency is often not made. The political clout that irrigation agencies derived from construction of infrastructure has proved to be a major obstacle towards change.

3.6 Responses of the 1990's

The favoured response of the early 90's confronted the power-base of the irrigation agencies head-on:
Irrigation Management Transfer (IMT). Prompted by the need to restrict continued government subsidy to irrigation, more than 25 developing countries engaged in programmes of "irrigation management transfer" (IMT) that were strongly promoted by the World Bank. IMT involves transfer of responsibility and authority for irrigation management from the government to non-governmental entities. Most experience with IMT comes from countries with well-functioning systems which were handed over to well-capitalised, market-oriented farmers in an environment of clear policies and legislation. *Mexico has followed this model, and much has been claimed for the rapid and comprehensive reform that has ensued, although little hard evidence has yet emerged to substantiate these claims and allow meaningful inferences for other developing countries, especially ones with relatively much larger numbers of subsistence farmers* (Turral, 1995).

Transfer of the responsibility for managing, operating and maintaining (parts of) the irrigation system from the government to the farmers requires the following (after Vermillion, 1994)[14]:
1. Clear and sustainable water rights are accorded to users, at an individual or group level;
2. The irrigation infrastructure is compatible with the water rights allocated and local management capacity and is in good working order;
3. Clear and recognized responsibilities and authority are vested in the managing organisations;
4. Adequate financial and human resources exist to operate and maintain the infrastructure and the managing organisations;

[14] Vermillion, D.L. 1995. Irrigation management transfer: towards an integrated management revolution. p.17-20 in: Johnson, S.H. et al. *Irrigation Management Transfer. Selected papers from the International Conference on IMT, Wuhan, China, 20-24 September 1994*. IIMI/FAO, 1995.

5. Transparent accountability of, and supporting incentives for, the managing entities.

From the previous paragraphs, it may be clear that in most irrigation systems several of these preconditions are not met. In addition, as Newell already explained in 1916, even with proper guidance of competent and dedicated irrigation system managers, it takes many years of hard work and perseverance to achieve a situation where additional farm income from irrigated agriculture would be able to cover interest charges and recurrent costs for operating and maintaining the scheme. Moreover, Newell insisted that the irrigation managers should prepare the farming community for the transfer of control from the very beginning. It seems unlikely, therefore, that the 'priviliged solution' of IMT will result in sustainable irrigation systems without such preparation and without considerable reforms of the agencies involved.

Integrated Water Resources Management (IWRM)

The above overview on responses to poor irrigation performance is based mainly on criticism originating from within the irrigation (sub)sector itself. The main concern was the low return on capital investment. Over the last decade, the irrigation (sub)sector worldwide has received serious criticism from other professionals in the water sector for making wasteful and environmentally damaging use of water resources. For example, Bhatia&Falkenmark, in a paper prepared for the International Conference on Water and the Environment in Dublin, 1992 wrote:

"*The water resources sector in developing countries is characterized by misallocation among alternative uses and wastage in each use. Large quantities of water (over 80%) have been allocated to irrigation where benefits are low. This excessive use in irrigated agriculture has continued even though quantities of both surface and groundwater available for urban areas has declined. Further, water use in agriculture has been characterized by large subsidies where revenues cover only around 10 percent of the total operation, maintenance and capital costs.*"

The Dublin Conference led to four guiding principles for the water sector (Box 3). At the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992, these principles were endorsed and taken up in the action programme for the 21st century, Agenda 21.

Box 3. Guiding Principles formulated at the International Conference on Water and the Environment in Dublin, 1992.

Principle No.1: Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment. *Since water sustains life, effective management of water resources demands a holistic approach, linking social and economic development with protection of natural ecosystems. Effective management links land and water uses across the whole of a catchment area or groundwater aquifer.*

Principle No.2: Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels. *The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in the planning and implementation of water projects.*

Principle No.3: Women play a central part in the provision, management and safeguarding of water. *The pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and*

implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them.

Principle No.4: Water has an economic value in all its competing uses and should be recognized as an economic good. *Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to a wasteful and environmentally damaging use of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.*

Many international and national agencies for development assistance adapted their policies to reflect the above principles. An example is the World Bank policy paper *Water Resources Management* of 1993, which was followed by *A Guide to the Formulation of Water Resources Strategy* in 1994 (World Bank Technical Paper No.263). With the new policy, planners of irrigation development needed to demonstrate that:

- Water resources for the scheme are not required for (drinking) water supply elsewhere;
- Irrigation represents the best economic use of the water resources;
- Stakeholders (including women) participate in the planning process;
- The scheme is financially and environmentally sustainable.

In order to meet the above conditions, irrigation agencies need to co-operate with other water agencies, as well as with stakeholders. These are not only the farmers, but all parties directly or indirectly affected by irrigation and drainage activities. For a given river basin, the group of stakeholders increases with increasing water scarcity and increasing share of irrigation of total water use. In addition to the need of balancing the interests of various water users for productive purposes, there is the need to ensure that an adequate supply of water remains in the aquatic ecosystems, as these provide the life support system on which the welfare of the entire community within the basin depends (Box 4).

Box 4: Integrated Water Resources Management

IWRM is a process that promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. (GWP TAC Background paper no.4, Global Water Partnership, Stockholm, Sweden, March 2000)

Two issues are at the core of IWRM:
1. Acknowledging that ecologically sound water-systems are essential for the sustainable use of water resources by humans, animals and plants.
2. Acknowledging that the management requires a careful process of balancing the interests of all users and uses, as well as a regulatory framework to guarantee the sustainable use of water resources.

The requirements for adequately dealing with water resources were imposed on an irrigation sector that already faced great difficulties in achieving an adequate return on investment in the period when water scarcity was not yet an issue of international

concern. The result was that international financial assistance for irrigation, which was already declining since 1980, dried up almost completely during the 1990's.
A decade after the publication of its 1993 policy paper *Water Resources Management*, the World Bank produced a new *Water Resources Sector Strategy: Strategic Directions for World Bank Engagement* (February 2003). Looking back on the experience with implementing the Dublin Principles (Box 4), it is observed that while " *the Principles remain powerful, appropriate and relevant" ….. "progress in implementation has been difficult, slow and uneven and that even the most advanced countries are very far from full compliance with the Dublin Principles."*
From the main messages in the new strategy, it may be concluded that the World Bank intends to increase its activities in the water sector, including irrigation and drainage. To prevent that the Dublin Principles remain an obstacle for new investments, message no.4 reads: "*The main management challenge is not a vision of integrated water resources management but a "pragmatic but principled approach.*"
In an attempt to remove the poor image of internationally supported irrigation development in terms of low returns on investment, the strategy paper emphasizes the indirect benefits:
"Major water resources projects often form the basis for broad regional development, with significant direct and indirect benefits for the poor (and others). Major water development projects in Brazil, India, Malaysia and the United States show large direct benefits (from irrigation and hydropower) and indirect benefits that are typically twice as large……Recent analyses in India have shown that irrigation infrastructure has a major impact on the returns to investments in education."

Remarks:

1. Section 2 (Early lessons) of this chapter shows that appreciation of the indirect benefits of irrigation is not new. As indicated in the same chapter, due to this appreciation, national governments were willing to subsidize irrigation development. It was the World Bank that required irrigation projects to yield an internal rate of return on the basis of the direct benefits. This requirement led to manipulation of feasibility studies becoming common practice among irrigation planners, with detrimental results on the performance of the systems so (ill) prepared.
2. When looking up some of the references given in the World Bank 2003 Water Resources Sector Strategy, the central message of the paper that was supposed to demonstrate the large indirect benefits of irrigation in the USA appeared to be that: " … *the distribution of benefits has been tilted in favour of irrigation interests and hydroelectric power users and that the project's major cost bearers have been riparian-based indigenous tribes of the Upper Columbia River."* (Ortolano & Cushing, 2002)[15]

Similarly, the word " irrigation" does not appear in the paper that supposedly shows major impacts of irrigation infrastructure on the returns of investments in education in India (Pritchett 2001)[16]

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[15] Ortolano, L. and K. Cushing. Grand Coulee Dam 70 Years Later: What Can We Learn? *Water Resources Development*, Vol. 18, No. 3, 373-390, 2002. (Listed under no. 14 in Endnotes and Bibliography of Water Resources Sector Strategy, World Bank, February 2003)

[16] Pritchett, L. 2001. Where Has All the Education Gone? *World Bank Economic Review*, Vol.15, No.3, 367-391 (Listed under no.14 in Endnotes and Bibliography of Water Resources Sector Strategy, World Bank, February 2003)

One of the conclusions that I expect readers to draw from the previous sections of this chapter, is that there is every reason to be cautious when dealing with institutions that derive power from their role in the decision-making process about large investments in the irrigation sector, especially when they are not accountable for the results. The two remarks made here confirm this need for caution.

A final quote from the World Bank's new Water Resources Strategy paper provides an adequate conclusion of this section as well as preparing the way for the next section on the service-approach:
"…..while the irrigation philosophy of the 1960s, 70s and 80s (of continuous publicly-financed expansion) has run its course, a new one yet has to take its place. The irrigation community is still a long way from:

- *Making a transition from the era of expansion and construction to an era of intensification and management;*
- *Articulating and operationalizing a modern institutional model that unbundles the bulk infrastructure from the distribution infrastructure; separates the public and private aspects of the systems; clarifies the public roles (legal framework and regulation) and private (profit and non-profit) roles for service delivery; and*
- *Articulating sound, achievable, sequenced approaches to cost recovery for different components of irrigation and drainage systems."*

4. Towards a service-approach

4.1 Service level

The return on the investment of irrigation and drainage systems is generated at the farm level, through an increase of the value of crop production. Irrigation water, however, is only one of the inputs in the crop production process. In market-oriented production, irrigation costs are generally between 2 and 10 percent of total crop production costs. From the farm production perspective, irrigation water deliveries should therefore be made to fit into the overall production process. For the farmer, the preferred option is to have access to irrigation water in the same way as most of us use the taps in our home. That means, being allowed to open and close a valve or sluice gate at the farm entrance at any time and varying the discharge according to need. In other words, freedom in timing, duration and rate of irrigation supply.

Many irrigation systems, however, have been designed and are managed from the perspective of the irrigation agency only. In order to reduce costs, most irrigation schemes in developing countries deliver water to a group of users. For ease of operation for the system managers, deliveries are often made according to a time schedule. There is a large variety in the ways irrigation schedules are prepared: each of the three elements of (timing, duration and rate of supply) can either be fixed or varied and can either be decided by the irrigation agency or based on requests by the users groups. For an overview of the various scheduling methods, refer to any irrigation textbook.

The greater the flexibility in terms of timing, duration and rate of supply, the higher the level of service. In most service-industries (hotels, restaurants, airlines, etc.), provision of a higher service level leads to higher investment and operational costs. By introducing the service-concept in irrigation and drainage, however, there is much scope for cost reduction. With the conventional approach, many of the actors that take part in the preparation, design, construction and operation of the irrigation or drainage system have little reason to reduce costs. With the service-approach, these actors depend on farmers' decisions about the level of service that will be provided and the infrastructure that will be built. They are also accountable to farmers, both in terms of the service provided as well as the costs involved. Moreover, farmers have the option of building and operating (part of) the system by themselves or contractor(s) of their choice.

4.2 Service agreement

Ansoff (1979)[17] stated that from the viewpoint of society, the effectiveness of any organization's activities (profit and non-profit) is determined by two criteria:

1. The degree to which the organization=s products or services respond to the needs of its customers;
2. The efficiency with which the organization uses resources in supplying these needs.

Helfert (1987) defines the fundamental theme of management of a commercial organization as: *Planned commitment of resources for the purpose of creating, over time, economic value sufficient to recover the resources employed and to earn a margin of profit.*

For commercial organizations, Ansoff's definition can be readily translated into a single performance indicator, which combines the two criteria:

Return on Investment (ROI) = (Revenue - Costs) / Investment

with *Revenue* being an objective measure for customers appreciation of the product, and all of the resources used being expressed in money terms, either as *Costs* or as *Investment.*

In order to achieve and improve ROI, business managers try to:

- Increase *Revenue* by observing and responding to (changes in) needs of customers;
- Reduce *Costs* through efficient use of resources;
- Maintain (improve) profitability of current *Investment*;
- Improve future profitability by investing in product or service improvements and cost-reducing innovations.

Presented with the ROI of a number of commercial enterprises for a given year, any interested person is capable of comparing the performance of these companies in

[17] Ansoff, H.I. 1979. Strategic management. Macmillan Press Ltd., London, U.K. 236 pp.

that year, without needing to know where these companies are located, the type of business, or their internal accounting procedures[18]. Also, on the basis of the ROI of a company for a number of years, an interested outsider can easily see whether the company's performance is improving or decreasing over the years. In short, ROI is convenient for *reporting* performance, it provides an *accountability mechanism*, and also an *incentive to perform*.

Murray-Rust & Snellen (1993)[19] presented a definition that is based on Ansoff's definition of organizational effectiveness:
The overall performance of main system managers [of an irrigation scheme] *depends on two complimentary criteria:*

1. *The degree to which the services offered by the main system managers respond to farmers' needs, within the limitations imposed by national policies and objectives and by overall resource availability; and*
2. *The efficiency with which the irrigation system uses resources in providing these services.*

In the above definition, several items cannot be readily expressed in monetary terms. For example:

- Farmers' appreciation for irrigation services often cannot be expressed as *sales* when farmers do not pay the full cost of irrigation service; also farmers in most cases do not have the option of obtaining irrigation services from another supplier;
- Water, although a key resource in irrigation management, is usually not priced like an economic commodity.

It is less easy, therefore to express the performance of irrigation system managers in a simple ratio such as ROI.
Because ROI cannot be readily applied to irrigation systems, Murray-Rust & Snellen presented a substitute performance incentive and accountability mechanism for main system managers of public irrigation system managers: the Service-Agreement, which specifies (1) the services that will be provided, (2) the payments or other resources that will be contributed by the users in return for these services, (3) the procedures that will be used to check whether services are provided and payments are made as agreed, (4) the consequences for each party of not fulfilling the agreement, (5) the authority that will be addressed to settle conflicts, and (6) the procedures that will be used for updating and improving the agreement.[20]

[18] N.B. This does not mean that these companies do not have internal accounting; in fact their ROI cannot be calculated without internal accounting data.
[19] Murray-Rust, D.H. and W.B. Snellen. 1993. Irrigation System Performance Assessment and Diagnosis. International Irrigation Management Institute/IIMI, Colombo, Sri Lanka. 148 pp.
[20] An updated version of the contents of the Service-Agreement is presented in Box 8

4.3 Potential and limitations of the Service-Agreement

The main potential of the service agreement is that it provides performance incentives to system managers, and an operational accountability & control mechanism.

If the agreement is only between system managers and users, meeting the conditions of the contract does not necessarily mean that:
- The arrangement as specified in the agreement represents the optimum situation for the two parties involved;
- The arrangement as specified in the agreement represents the optimum from a broader perspective (rural development; river basin managers, national economy, society-at-large).

The first issue can be resolved by renegotiation and adjustment of the agreement. Over the years, the two parties may be expected to gradually improve the situation towards what they perceive as optimum. The second issue may be considered as an *allocation* problem: Society, through a government agency or department *allocates* public funds for development of an irrigation system; it also *allocates* water resources to the system for the purpose of irrigated agriculture. This calls for a mechanism for checking and adjustment of these allocations, from a broader perspective than that of the farmers and managers of the irrigation system.

4.4 Performance assessment

Performance assessment is concerned with the *allocative* and *productive efficiency* of *resources* employed for achieving *results*.

In the context of public irrigation systems, *resources* include natural resources (such as land, water), investments (such as irrigation infrastructure, farm equipment), and operational inputs (such as salaries, farm inputs). If performance of a public irrigation system is assessed from the perspective of society, then the assessment should consider all resources that are valued by society, including resources that do not represent a cost to the producers and operators of the system.
The main *result* or objective of an irrigation system is always agricultural production. There may be other objectives that are valued by society, such as creation of rural employment, poverty alleviation, reducing reliance on food imports etc. In order to achieve those objectives, however, the irrigation system must improve agricultural productivity.

Resources are *used effectively*, or *allocated efficiently* if the same resources could not have been used to produce other *results* that are valued more by society. To describe the effectiveness of resource use, economists use the term *allocative efficiency* [21]. This term

[21] "*Allocative efficiency is achieved when it is impossible to change the allocation of resources in such a way as to make someone better off without making someone else worse off.*" Quoted from p.248 in: Lipsey, R.G., P.O. Steiner and D.D. Purvis. 1987. Economics. 8th edition. Harper & Row, New York.

refers to decisions on the *allocation* of resources to produce a specific result. A performance assessment requires an evaluation of the effectiveness of these allocative decisions.

Box 5 (In)efficient allocation or (in)effective use of resources

Some examples where an irrigation system represents *inefficient allocation* of resources:
- It produces crops for which there is no demand, or crops that could have been produced at lower cost by rainfed agriculture, or could have been imported at lower cost;
- It deprives an industry of water, while producing less value per m^3 than that industry;
- It deprives a city of drinking water, thereby reducing the quality of life of more people than the number of those who benefit from the irrigation system.

The examples in Box 5 demonstrate that performance assessment of an irrigation system cannot be based on information from the irrigation system alone; information on results of resource use by the irrigation system must be compared with results of using the same resources in other sectors. Because an irrigation system in addition to the resources land and water also uses capital resources, such comparisons are not restricted to the agricultural sector or the water sector, but extend to all other sectors of the economy. The first example mentions crop imports; this shows that comparisons may extend beyond national borders. On the other hand, a country may choose to reduce its reliance on crop imports and stimulate national irrigated agriculture even if production costs are above world-market prices. In such cases, the effectiveness or allocative efficiency of the irrigation system should be evaluated against the national objective of reducing crop imports.

Box 6 Efficient and effective use of resources

Resources are used *efficiently*, if the *results* could not have been produced with fewer resources. System A is more *efficient* than system B, in all of following cases:
1. System A's production is higher than B, investment and operational costs are the same;
2. System A's investment costs are lower than for B, production volume and operational costs are the same;
3. System A's operational costs are lower than for B, production volume and investment cost are the same;
4. System A uses less irrigation water than B, all other items are the same.

If system A is more efficient than system B, this does not necessarily mean that system A performs better. Reconsider the first three of the above examples for the following situations:
- System A cannot sell all of its produce; system B sells all;
- In a country where unemployed is a major problem, system B provides jobs to many small farmers, whereas system A consists of large mechanized farms.

Reconsider the fourth example, given that:
- There is no other user (agriculture, water supply, industry) interested in using the surplus water diverted by system B;
- The surplus water diverted by system B drains back into the river basin, without adverse effect on water quality.

The examples in Boxes 5 and 6 show that performance assessment of an irrigation system cannot be solely based on information on efficiency of resource use for agricultural production. The effectiveness and efficiency of resources used for achieving results other than agricultural production (e.g. creating rural employment)

must also be taken into consideration. Information on water use efficiency must be considered in the context of overall river-basin management.
Another implication of the above is that a performance assessment that is based on a number of productivity indicators alone, without knowing the value that society places on the agricultural and non-agricultural results of the system and without information of the river-basin, may convey a distorted picture of system performance.

4.5 Allocative efficiency in a commercial environment

As allocation of public resources appears to be a problematic issue, it seems worthwhile to explore how the issue of allocative efficiency is dealt with in a commercial environment.
In order to maximize its profit, a commercial firm will try to produce whatever it produces at the lowest possible cost. In a market-economy, the objective of profit-maximization therefore ensures productive efficiency.
Productive efficiency by itself is not sufficient to generate profit: the good or service that is so efficiently produced must be sold. In order to maximize profit, therefore, commercial firms must only produce goods or services for which there are customers that are willing to buy. In a free market economy, with many individual firms all trying to maximize their profit, this assures both productive and allocative efficiency at the macro-level:
- *Productive efficiency*, because whatever is produced is produced at the lowest possible cost;
- *Allocative efficiency*, because no resources are allocated for the production of goods or services that nobody wants to buy.

In a commercial environment, therefore, allocative efficiency is not a problem issue at all; it is automatically achieved, provided two conditions are met:
1. Profit-maximization is the main objective;
2. Productive resources and outputs are obtained from and sold at prices that are established in a free market economy.

The discovery of the price system as a social control mechanism was made in the eighteenth century by Adam Smith, who in his book *The Wealth of Nations* (1776) spoke of the price system as "The Invisible Hand".

4.6 Market-imperfections in irrigated agriculture

Irrigated agriculture, especially when developed with public funds, does not often fulfil the two conditions listed in the previous section:
- Many irrigation systems have social objectives, such as generation of employment, alleviation of rural poverty, reducing migration to urban areas, reducing dependence on food imports;

- Investments as well as operational resources are often subsidized; the price of the major productive factor in irrigated agriculture - water - is hardly ever established through the market; part of the production is often consumed by farmers themselves; the production that is marketed is often subsidized or taxed.

As a consequence, performance assessment in irrigated agriculture is in two main aspects more difficult than in a commercial environment:

1. Adequate performance at the level of the individual firm implies adequate performance from the perspective of society; whereas irrigation system performance that is perceived as adequate by the farmers and system managers concerned may not be adequate when considered from a broader perspective;
2. Comparative performance of firms is relatively easy because all firms have the same objective of profit-maximization; they pursue this objective by obtaining inputs from and selling outputs to the market; whereas irrigation systems are developed for a variety of objectives that are system specific and obtain inputs and produce outputs at prices that are also often system specific.

4.7 How to deal with the responsibility void in public irrigation system management?

Development and operation of a public irrigation system represents a use of public funds and of public water resources. The investment decision is usually made on the basis of a feasibility study, which includes a comparison of the expected benefits generated by the system and its costs. The benefits are commonly based on the estimated increase in crop production value due to irrigation; not on the revenues from selling irrigation services to farmers. The organization that delivers irrigation water to farms cannot be held responsible for agricultural production if these farms are operated as independent businesses. Nor can the farm managers be held responsible if actual increase in crop production value falls short of what was assumed in the feasibility study, for several reasons:

- Estimates are usually based on yield potential as determined by soil and climatic conditions in the system, rather than on managerial skills of farmers;
- Farm managers are not usually involved in preparing the estimate; even when they are consulted they are hardly ever required to commit themselves to achieving specific production targets;
- Productivity of an irrigated farm within a public irrigation system not only depends on managerial skills of the farmer, but also on the quality of the irrigation services received from the public system.

The above implies a *responsibility void* in the operation of a public irrigation system: resources are invested in a water delivery system without a mechanism for securing an adequate return on that investment.

In order to get a grip on the performance of a public irrigation system, it will be necessary to develop an accountability mechanism and performance incentives for the water delivery system and for the agricultural productivity of the system. To

prevent the responsibility void, the design of such mechanisms should have been considered during the feasibility study of an irrigation system. Ideally the institutional design should even be a step ahead of the technical design throughout the preparation phase, so that the technical design follows from the requirements of the institutional design. For existing public irrigation systems, repairing the responsibility void requires a major re-organization, which may be described as a restructuring toward a performance-orientation.

4.8 How to achieve a performance-orientation?

The purpose of restructuring a public irrigation system toward a performance-orientation is to gain control over the allocative and productive efficiency of the resources employed for achieving results. Instead of trying to provide general guidelines for the restructuring process of public irrigation systems, we will briefly compare the accountability mechanisms and performance incentives required for two very different types of systems. One system is designed to enable farmers to maximize their income from irrigated agriculture; the other is designed primarily for the purpose of famine relief.

Table 2 Objective, performance incentives and accountability mechanism in a public irrigation system aimed at enabling farmers to maximize income from irrigated agriculture

Primary system objective	Maximum value of agricultural production from system
Performance incentive (crop production)	Maximum farm income
Performance mechanism	Farmers act as entrepreneurs who aim at maximizing their profit from irrigated farming; farmers obtain their inputs from and sell their outputs to the free market
Requirements	1. Free market that is capable of providing inputs and absorbing produce at prices which enable competent farmers to obtain an income that they perceive as adequate; 2. Main irrigation system managers who are capable and willing to adapt irrigation services to farmers' requirements.
Accountability mechanism (irrigation services)	Service-contract between main system managers and farmers, which specifies services and fees
Performance incentive (main system managers)	Revenues from service fees

Example 1: Market-incentives and service-orientation

Agricultural performance of the system in the first example (Table 2) is based on profit-maximizing behaviour of individual farmers. Farmers will commit resources to the production of those crops that will earn them the highest margin of profit. Farmers obtain all of the inputs - with the exception of irrigation water - and sell all of the produce at free-market prices. These two conditions, profit-maximization by farmers and free-market mechanism, provide the performance mechanism for allocative and productive efficiency of resource use at the farm level. This

performance mechanism assumes perfect competition among participants: providers of inputs, buyers of produce, as well as among the producers. This implies non-uniform distribution of the income derived from irrigated agriculture among the producers within the system.
The water delivery services provided by the main system managers in a public irrigation system do not fit the condition of free competition:
- The resources operated by the managers (irrigation infrastructure, water resources) are not obtained at free-market prices;
- The services they offer cannot be obtained from the free market;
- The price of these services is not established by the free-market;
- Customers who are not satisfied with the services provided or the price charged for those services cannot obtain similar services from another supplier.

The free-market mechanism, therefore, cannot be readily applied to induce a performance-orientation among main system managers. The mechanism described below is aimed at making maximum use of free-market type of arrangements and incentives among participants. A key element is a service-agreement between the providers and users of irrigation services.

The service-agreements specifies:
1. The irrigation services that will be provided and the procedure for checking that services are delivered as agreed upon;
2. The procedure for calculating the cost of these services to the users and the procedure for checking that services are delivered at the lowest possible cost to the users;
3. The consequences for each party of not fulfilling (parts of) the agreement;
4. The authority that will be addressed in case of conflicts;
5. The procedure for renewal, updating and improvement of the agreement.

The service-agreement is the outcome of a *negotiation* process, which substitutes the free-market mechanism. If successfully used it contributes to allocative efficiency: resources are allocated to produce services that are well adapted to farmers' needs. It also promotes productive efficiency: whatever service is provided must be produced at the lowest possible cost to the users.

The above performance mechanism makes heavy demands on the main system managers. In order to be able to respond to the market, individual farmers may request changes in irrigation services that cannot be accommodated by the system, for one or more of the following reasons:
- The requested change is not compatible with requests from other users; and/or
- Not compatible with current service-agreement; and/or
- Not compatible with present infrastructure; and/or
- The water supply is limited.

Main system managers have to be able and willing to respond quickly and adequately to the demands made by their users. In addition, they have to accept that they are primarily accountable to farmers, both in terms of the service provision and in terms

of the cost of these services. This means they have to subscribe to a *service-orientation* (see Box 8), which is totally different from the top-down approach that is common in many irrigation agencies (Box 7). Main system managers are likely to be more responsive if their salary depends on the revenues from irrigation fees paid by their users.

Box 7 : Top-down management is unworkable

"*Unlike industrial systems, irrigation systems are managed not only from the top toward the bottom, but also from the bottom up. This is because the very act of irrigation requires farmers to be entrepreneurs and take risks. Farmers are not on the payroll but must gamble their time, capital, and talents in the real present, in hopes of accruing future benefits. Because of this, a top-down management is unworkable, since the bureaucracy and its employees do not take the risks.*"

From: Keller, J. 1986. Irrigation System Management. p.329-352 in*: Irrigation Management in Developing Countries* by Nobe, K.C. and R.K. Sampath (Eds.), Westview Press.

As water is becoming more scarce, there is a need to coordinate (not just allocate!) all water management activities that affect water quantity and quality in a river basin. This means that in addition to providing water services that are well adjusted to needs of their direct customers, system managers must also respond to demands made by other users. These other users are not interested in service delivery to farmers, they are interested in the effects of the irrigation system on water availability and quality. In order to deal with the interests of various groups, Service-Agreements may also be drawn up between river-basin managers and the major water users within their river basin.

Box 8: Key elements of the service-oriented approach for the restructuring of irrigation & drainage organizations

1. An irrigation & drainage organization is **service-oriented** when it (1) makes every effort to provide services that are well adapted to farmers' needs, (2) aims to provide these services at the lowest possible cost to its users, and (3) is accountable to farmers on the above issues 1 and 2.
2. A **Service-Agreement** between a service-oriented irrigation & drainage organization and its users specifies (1) The irrigation services that will be provided and the method used for checking that services are delivered as agreed upon, (2) The procedure for calculating the cost of these services to the users and the procedure for checking that services are delivered at the lowest possible cost to the users, (3) The consequences for each party of not fulfilling (parts of) the Service-Agreement, (4) The authority that will be addressed in case of conflicts, (5) The procedure for renewal, updating and improvement of the Service-Agreement.
3. For **large-scale systems**, irrigation and/or drainage water within the system is sometimes handled by several organizations. Such systems require a Service-Agreement for each level in the system where water is transferred from one organisation to the next. The set of Service-Agreements regulates the transactions between the organizations that provide irrigation and drainage services.
4. Organizations need to be **authorized** to make a Service-Agreement. For public-funded organizations, the manager or representative of the organization needs authorization from the ministry or department. In this authorization, restrictions or conditions may be imposed to ensure consistency with higher-level policies and especially with overall river-basin management policies. For Farmer Organizations or Water Users' Associations, the procedures for preparing, negotiating and signing the Service-Agreement must be described

in an Organizational Charter.

5. The **Organizational Charter** specifies rules for behaviour within an organization. In addition to specifying procedures related to the Service-Agreement, it describes the purpose of the organization, the organizational structure, the procedures for electing council members and appointing functionaries, the rights and duties of council members, functionaries and regular members.
6. **Service-oriented restructuring of irrigation and drainage organizations** is a process of identifying, designing and implementing the technical and institutional modifications needed for sustained operation of the system on the basis of an appropriate set of Service-Agreements and Organizational Charters.

Example 2: Protective-irrigation and equity The **Organizational Charter** specifies rules for behaviour within an organization. In addition to specifying procedures related to the Service-Agreement, it describes the purpose of the organization, the organizational structure, the procedures for electing council members and appointing functionaries, the rights and duties of council members, functionaries and regular members.

Service-oriented restructuring of irrigation and drainage organizations is a process of identifying, designing and implementing the technical and institutional modifications needed for sustained operation of the system on the basis of an appropriate set of Service-Agreements and Organizational Charters.

Table 3 Objective, performance incentives and accountability mechanism in a public irrigation system designed for the purpose of famine relief

Primary system objective	Protection against famine in drought years
Performance incentive (crop production)	Means of subsistence in drought years
Performance mechanism	Farmers receive only enough water to irrigate about one-third of their land; this ensures a subsistence level of production
Requirements	Equity of water distribution
Accountability mechanism (irrigation services)	1. Main system managers must be able and ready to demonstrate that the system achieves equitable distribution; 2. Users must have a right to file complaints with an independent third party
Performance incentive (main system managers)	Adequate salary

In a system designed for protective-irrigation (Table 3), the objective is not to maximize the value of agricultural production in the system, but to provide as many farmers as possible with a small amount of irrigation water that will enable them to produce enough to survive droughts. The most important performance characteristic of such a system is equity of water distribution. Main system managers here must *not* be responsive to requests from individuals or groups of farmers. This means that these systems are *not* service-oriented; it does not mean that they cannot be performance-oriented. For a performance-orientation and accountability, a *service-declaration* is required which specifies:

1. The working principle and procedures for achieving equity in water distribution, indicating the responsibilities and rights of main system managers and users;

2. The procedures for checking and demonstrating to the users that the system achieves equitable water distribution;
3. The authority where users can deposit complaints about inequity of water distribution;
4. The authority and procedures for dealing with offenders of the rights and responsibilities specified in the declaration;
5. The procedure for renewal, updating and improvement of the declaration.

It is unrealistic to insist that the cost of operating a protective irrigation system be recovered from the users. For that reason, the procedures for calculating and controlling operational costs have been omitted from the service-declaration. On this issue, main system managers should be accountable to their agency, rather than to the users of the system. They should also receive a salary from the agency that is adequate to prevent them from accepting bribes for special favours that violate the principle of equitable water distribution.

Performance-orientation of other types of public irrigation systems

The two examples presented above represent two extremes in terms of the extent to which actions of main system managers are determined by their users or by higher administrative levels. Most public irrigation systems will be somewhere in between these two extremes. The examples are intended to make clear that performance of any public irrigation system is enhanced by a clear statement of the services that will be provided and the accountability and incentive mechanism that will be used to achieve effective and efficient service delivery.
Performance-oriented management of public irrigation systems requires that the issues specified in these statements and mechanisms are also quantified. The next section presents tools for giving performance-oriented management a quantitative base.

4.9 How to give performance-oriented management a quantitative base?

Figure 1 presents the lay-out of a pump irrigation scheme with three different types of indicators that are used to regulate delivery of irrigation services:
1. Internal process indicators, that are used by the operators of the scheme;
2. On-farm process indicators, that are used by the water users groups and farmers;
3. Service-provision indicators, that are used by both operators and users.

For the same pump irrigation system, Figure 2 shows the flow of information concerning irrigation requirements and irrigation deliveries between canal system operators, water users groups and farmers. Figure 2 does not specify the type of information. Let us assume that in this system the water users group in each tertiary canal weekly makes a request indicating the flow size to be delivered at the head of the tertiary and the number of hours per day that they want to receive that flow. The requests from each tertiary canal are processed into a water delivery schedule by the

canal operators. With such an arrangement, canal operators only monitor the process indicators indicated with an asterisk (*) on the left side in Figure 1, and all of the on-farm process indicators on the right are used by the farmers and the water users groups. At the interface of these two domains, we find the service-provision indicators that must be readily accessible for monitoring by either group. In the example, these are gauges, which indicate the flow size at the head of the tertiary canals. For easy observation by any interested party, these gauges are provided with a scale in liters per second.

The above arrangement must be described in detail in the service-agreement for this pump irrigation scheme, including the function and use of the service-indicator. The other indicators in Figure 1 do not need to be included in the part of the agreement that describes the delivery of irrigation services. The electricity consumption (KWh) and the flow totalizer (m^3) readings, however, are likely to be used in calculating the cost of irrigation services. The procedure for calculating these costs and apportioning them to the various users groups must also be specified in the agreement. Representatives of the users groups must be granted access to the pump station to verify these readings.
The pump irrigation scheme in Figure 1 uses a fairly high number of indicators. Figure 3 is an example of an irrigation scheme that is based on proportional distribution on whatever flow is available in the river. Such a scheme does not require any of the indicators shown in Figure 1, nor the information flows shown in Figure 2. This shows that the number and type of indicators required for an irrigation scheme depends on the design and operational rules of that scheme.
Figure 4 presents the indicators required for *river-basin management*. It shows a number of irrigation systems, including the pump-irrigation scheme presented in Figure 1, and a number of other major water uses (power plant, sugar cane factory, city water supply company). River-basin managers in this example require information on the water extraction by each major user and on the quantity and quality of effluent from these users. Information on water extraction by the pump-irrigation scheme can be readily supplied by the scheme operators. Providing information on the effluent from the scheme requires an additional effort. River-basin managers may include the provision of this information by the system operators as a condition in the service-agreement between their organization and the pump scheme operators.

Figure 5 is an example of *an external indicator* showing the intensity of use of several irrigation systems in the same river basin. This type of indicator allows any interested party to compare the effectiveness of various irrigation systems. The *intensity of use indicator* shown in Figure 5 does not require information from the system operators; the information is obtained *externally*. Information from the system may be combined with external information for the purpose of *comparative performance* of irrigation systems.

Figure 5 reveals that only 69 % of the pump-irrigation system is cultivated, against 100 % for the system based on proportional distribution. This is meant to draw attention to the fact that information intensive systems are not necessarily the most effective systems. Figure 6 conveys a similar message for monitoring water quality.

Questions for self evaluation

Question 1: Explain how the problems facing the irrigation sector today are mainly the result of past irrigation development policies.

Question 2: Explain why lack of accountability of system managers to farmers leads to poor performance of irrigation systems.

Question 3: Why is a service-orientation is essential for improving overall system performance?

Question 4: Explain the key elements of a service-agreement.

Question 5: What actions are needed to draw up a negotiated service-agreement between farmers and system managers?

Question 6: What actions are needed for re-orientation of an irrigation organization towards a service approach?

Definition of terms

Allocative efficiency: Allocative efficiency is achieved when it is impossible to change the allocation of resources in such a way as to make someone better off without making someone else worse off.
Internal Rate of Return (IRR): the discount rate at which the net present value of the cash inflows over the duration of the economic life of an investments is equal to the net present value of the cash outflows.
Integrated Water Resources Management (IWRM): IWRM is a process that promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.
Irrigation Management Transfer (IMT): IMT is the process of handing over responsibility for the management of (part of) an irrigation system to a users' organization.
Market-imperfections: externalities that cause market outcomes to be inefficient because they lead to the wrong allocation of resources from society's point of view.
Organizational charter: a document that specifies rules for behaviour within an organization. It describes the purpose of the organization, the organizational structure, the procedures for electing council members and appointing functionaries, the rights and duties of council members, functionaries and regular members.
Performance: the effectiveness of an organization's activities; both for profit and non-profit organizations, overall performance depends on two criteria: (1) The degree to which the organization's products or services respond to the needs of its customers, and (2) The efficiency with which the organization uses resources in supplying these needs.
Productive efficiency: output produced per unit of resource input.

Return on Investment (ROI): Net profit (= Revenues less costs) obtained by a commercial company over a specified period as a percentage of the total sum invested in the company.
Service agreement: A negotiated contract between systems managers and farmers which specifies (1) the services that will be provided, (2) the payments or other resources that will be contributed by the users in return for these services, (3) the procedures that will be used to check whether services are provided and payments are made as agreed, (4) the consequences for each party of not fulfilling the agreement, (5) the authority that will be addressed to settle conflicts, and (6) the procedures that will be used for updating and improving the agreement.
Service approach: An irrigation & drainage organization follows a service-approach when it (1) makes every effort to provide services that are well adapted to farmers' needs, (2) aims to provide these services at the lowest possible cost to its users, and (3) is accountable to farmers on the above issues 1 and 2.
Service-oriented restructuring of irrigation and drainage organizations: The process of identifying, designing and implementing the technical and institutional modifications needed for sustained operation of the system on the basis of an appropriate set of Service-Agreements and Organizational Charters.

Recommendations for further reading

Malano, H.M. and P.J.M. van Hofwegen. 1999. *Management of irrigation and drainage systems – a service approach*. IHE Monograph 3. A.A. Balkema, Rotterdam, the Netherlands. ISBN 90 5410 483 X . The book further elaborates the concepts presented in this chapter. It provides an overview of the principles necessary to develop a service-orientation.

Plusquellec, H. 2002. *How design, management and policy affect the performance of irrigation projects: emerging modernization procedures and design standards*. FAO, Bangkok, Thailand. ISBN 974-680-215-1. This book is written from the perspective that the first step in modernization is to adopt a service-orientation. It emphasizes the linkages between physical improvements and institutional reforms. The author has recently retired from a senior irrigation position at the the World Bank. It is published by the FAO Regional Office for Asia and the Pacific (FAO/RAP) in Bangkok. The preface is by Mr. Thierry Facon, Water Management Officer at the FAO/RAP, who maintains a website on modernization of irrigation systems www.watercontrol.org. which defines modernization as *the transition from supply-oriented to service-oriented irrigation water delivery*.

FAO, 1996. *Irrigation scheme operation and maintenance*. Irrigation Water Management Training Manual No. 10., by W. Bart Snellen. FAO, Rome, Italy. ISBN 92-5-103876-7. This training manual describes some of the difficulties involved in irrigation management and recommends the service-approach for overcoming them. The manual gives examples of various design alternatives for a given situation and how the implications for system managers and users are reflected in the service-agreement.

Dolfing, B. and W.B. Snellen (1999). *Sustainability of Dutch Water Boards: appropriate design characteristics for self-governing water management organizations*. ILRI, Wageningen, the Netherlands. 45 pp. This book uses the 1000 years of experience of Dutch Water Boards to define the factors that are essential for sustainability of water management institutions.

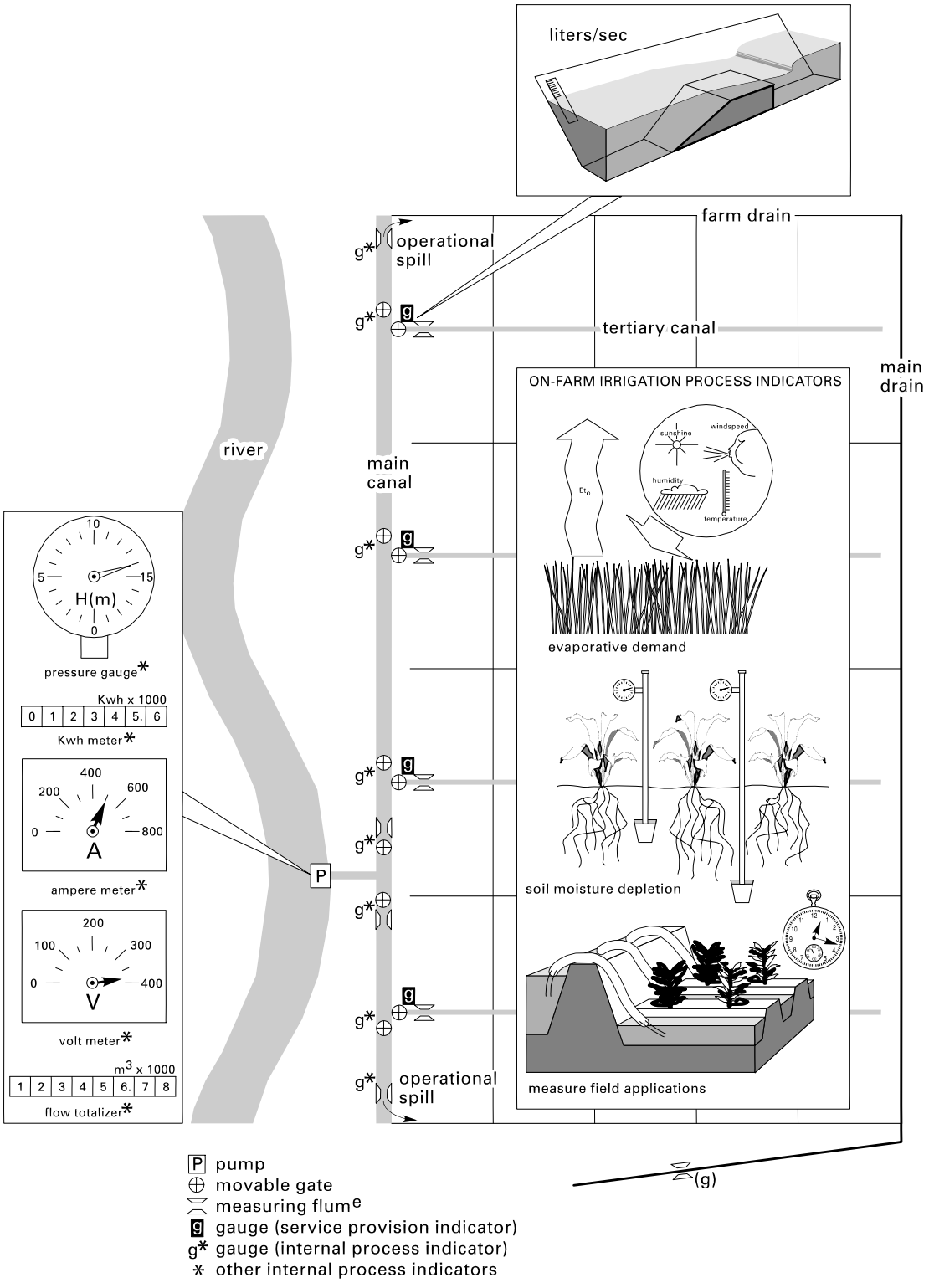

Figure 1 Pump irrigation scheme with internal process indicators, service provision indicators, and on-farm process indicators.

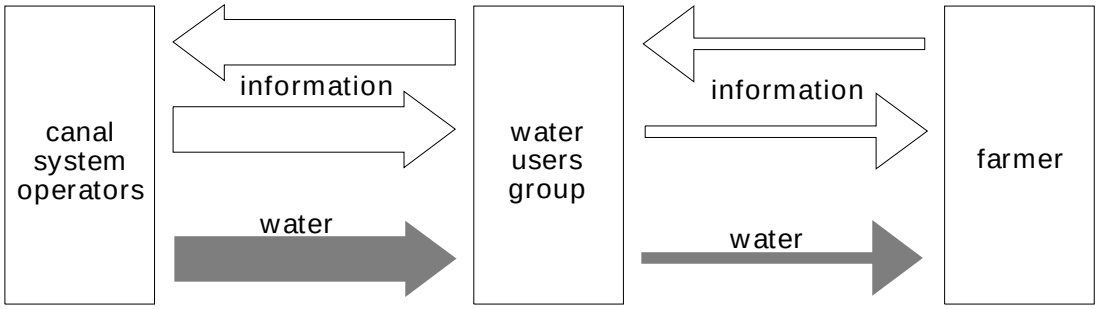

Figure 2 Flows of information that need to precede the flows of water in systems such as shown in Figure 1.

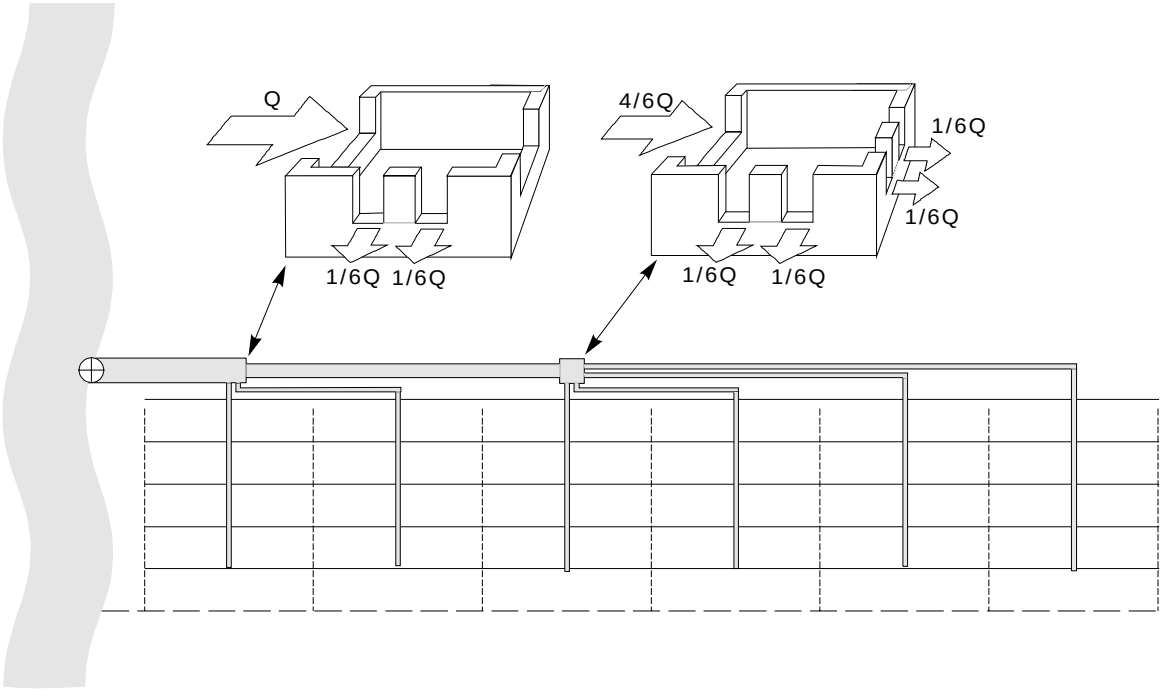

Figure 3 Irrigation scheme with proportional distribution that for its normal operation does not require the type of indicators shown in Figure 1, nor the information flows shown in Figure 2.

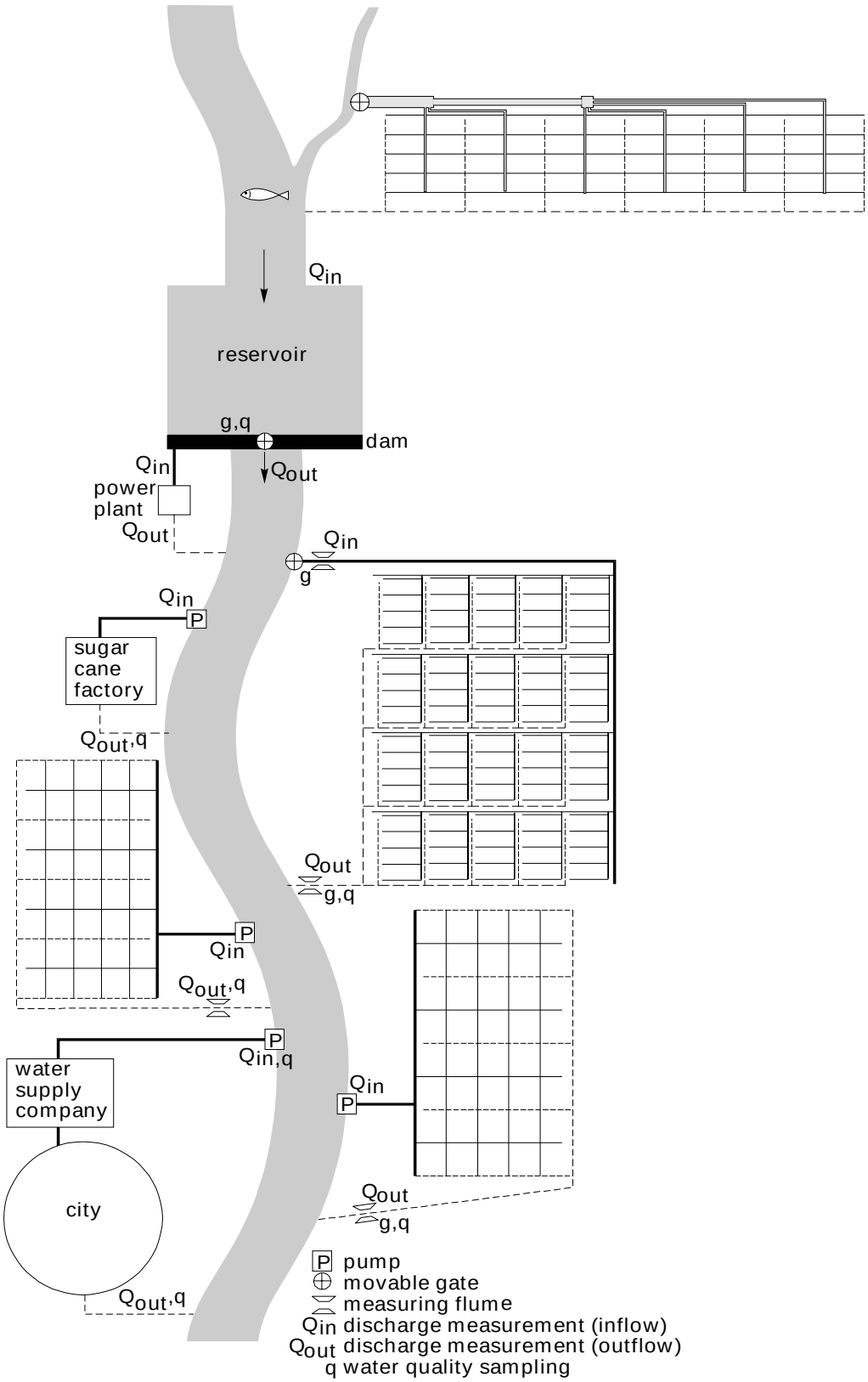

Figure 4 Indicators for managing water quantity and water quality in a river basin.

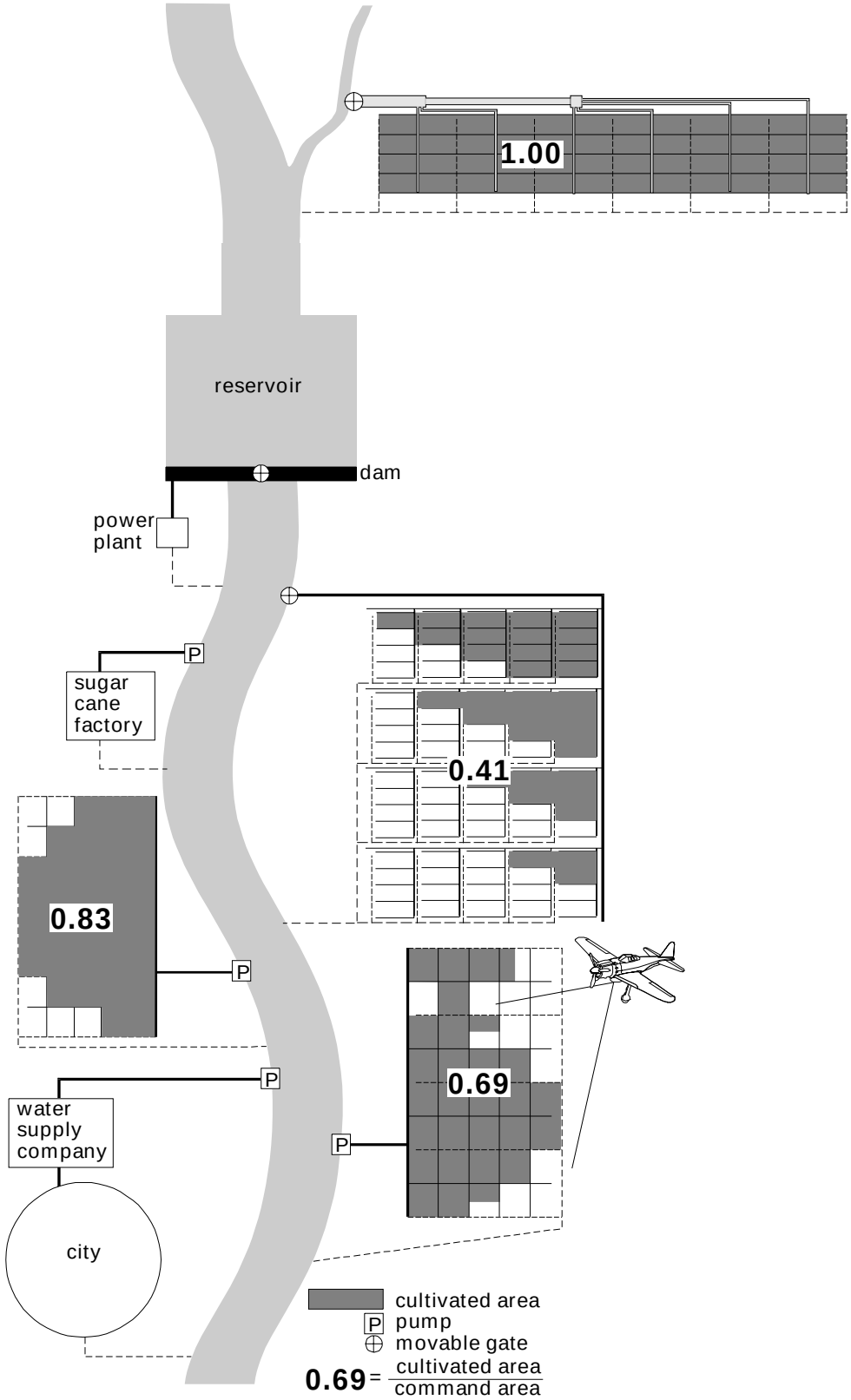

Figure 5 Example of an external indicator showing intensity of use of several irrigation systems in the same river basin.

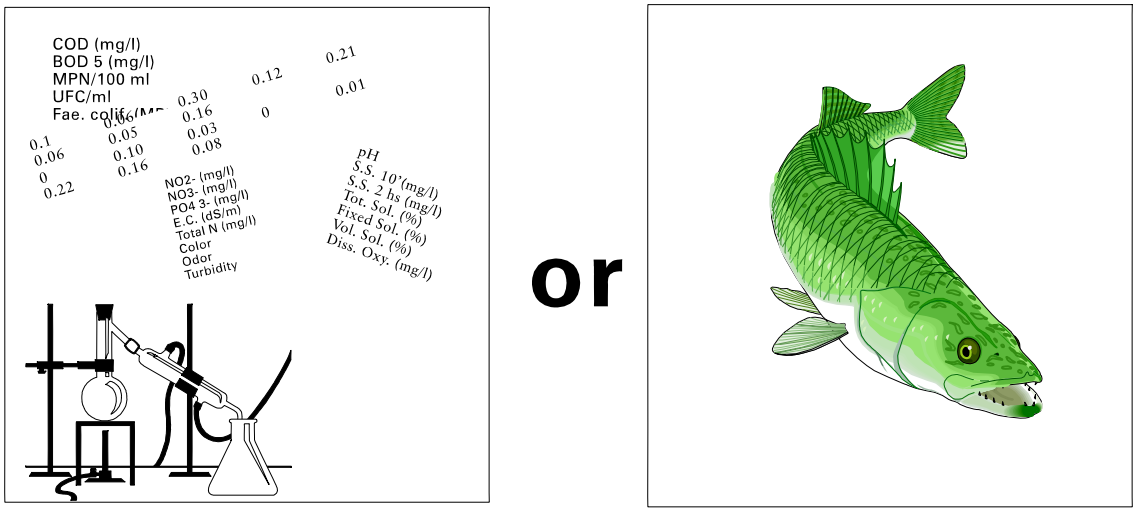

Figure 6 Comparing two approaches for monitoring water quality: cost intensive laboratory analyses versus observing presence of fish.

Chapter 2 Training

Catharien Terwisscha van Scheltinga

Summary

Summary of this chapter

This chapter consists of two parts. Part 1 presents briefly the major changes in thinking about water management and learning. It describes which implications these changes have for training in water management. It is an overview of the developments with the objective to inform a wider audience of water managers.

The starting point is the assumption that water managers aren't necessarily specialists in training. Therefore training-terminology like 'curriculum development', 'learning objectives', 'course outline', 'session plan' etc. have been explained.

An important message of this chapter is that in all cases training has a link to its context, and therefore should not be seen as an isolated event, but rather as a part of a capacity building strategy.

Part 2 consists of a mini-toolkit on training in water management. It provides hands-on guidance and examples, illustrating the different steps in the training process that a manager of irrigation and drainage projects could get involved in: the training needs assessment, curriculum development, implementation, and evaluation.

It elaborates on each step in a practical way, showing how to analyse training needs; how to put together a training course on a water related topic; how to choose the type of training, forms of instruction and gives points of attention when implementing training; and how to evaluate training.

Links from Part 1 to Part 2 and vice versa have been included in the text.

Learning goals

Learning goals **At the end of this chapter, you should be able to**

Part 1

- Describe changes in water management and changes in learning
- Indicate what the implications of these changes are for training
- Be familiar with the different steps in the training process: needs assessment, planning, implementation, and evaluation
- Be aware that for a particular situation a choice needs to be made which types of training and forms of instruction would have preference

Part 2

- Explain how training should be seen in its context, rather than as an isolated event.
- Indicate how to create a positive learning environment for adult learners
- Roughly formulate the basic elements of a training needs assessment
- Roughly put together a training proposal based on the basic elements of curriculum development
- Be informed about some types of training and forms of instruction, and be able to indicate for a particular situation which types of training and forms of instruction would have preference
- Be informed where to find training materials
- Point out some issues for evaluation of training
- Describe roughly how to develop a training approach in its context
- Be informed about databases on training courses for staff

PART 1 Developments in training in water management

1. Introduction

Why this manual?

In general, training is used to overcome a problem between existing and required knowledge and skills. It is an element in the majority of irrigation and drainage projects. The topics of training can range from very technical to more organization-oriented. The form of the training can range, for instance from classroom teaching to field based training.

At present, there are two major changes that bring about an urgent need to reconsider the approach to training.

First, there is a shift from looking at irrigation and drainage in isolation towards seeing them in the context of integrated water resources management (IWRM). Efficient food production is no longer the only aspect to consider in irrigation and drainage. The environmental sustainability and the implications for society as a whole are to be addressed as well.

Second, there is a change in the approach to learning. In learning, the emphasis is changing from 'one-time learning' with a focus on learning facts towards problem solving and 'life long learning'.

As a result of both these developments, new knowledge and skills are needed as well as new ways in which these knowledge and skills are brought to people.

Typical questions

In the context of a project, it is often the manager who is to decide on training.
Usually managers are not trained as trainers. However, managers or senior project staff of irrigation and drainage projects can be expected to organize training activities, select training courses or even develop overall training programmes for their staff and/or beneficiaries. They may find this a difficult task, especially when the subject of training others was never part of their own education. How should the manager approach the matter? How to do it effectively?

In order to make the project a success the manager asks him/herself the question: who needs to be trained? What type of training should be used? Which costs will this entail? Whom to approach for the training, inside and outside the project? What results can be expected from training? And how to measure these?

For whom is this chapter?

This chapter has been written for managers in irrigation and drainage projects, or water related projects in a wider sense, who have to address the above questions on training in one way or the other. It could be that (s)he needs to select training or an organisation to do so, prepare or even implement training him/herself, judge how much resources should be spent on training etc.

Managers work at different levels. Some are involved with delivery of water to farmers, while others are working on catchment level. This results in different interests both with regard to knowledge and skills on water management, as well as towards learning.

The questions mentioned above regarding training, can therefore be elaborated with even more questions. For all these questions there is no easy answer. This chapter is proposed as a guide on training for managers in irrigation and drainage projects at different levels. It does not pretend to have an answer to all questions, but it hopes to give insight in the matter of training. In part 1 it provides a description of the developments in training in water management, while in part 2 it provides practical guidance how to deal with aspects of training using examples. The chapter tries to be short and concise, with practical examples, but it is not a cookbook with clear-cut recipes.

Is training the answer?

As indicated above, training comes in the picture when addressing the gap between 'what is' and 'what should be'. However, there are several possible causes to this problem, for instance:

1. People don't know how and when
2. People are not motivated
3. The organisation needs to change in order to address the problem
4. The right policy and legislation are not in place

Etc.

Training is just one solution. It mainly addresses the first cause mentioned, in which there is a situation where people don't know how and when. Training is not a solution for instance when policy or organizational changes are required. That would entail a different process, of which training could be a part, but never the only part. One should look then for other, and better, solutions, in order to deal with the problem.

In the remainder of this chapter we will focus mainly on situations where training can be the answer. Where people have to acquire new knowledge and/or skills, and by getting skills and knowledge, the problem can be solved.

Overview of this chapter

The chapter is divided into two parts. The first part is aiming to inform about the developments in training in water management, while the second part focusses on doing. Both parts can be read independently from each other. References (with hyperlinks) have been included from Part 1 to Part 2 and vice versa. Part 2 is organized in such a way, that the question of the reader, guides the reader with hyperlinks to the relevant part of the text, without that one has to read through the text as a whole.

In part 1 first an introduction to training and the role of training in projects is given (paragraph 2). Then the changes in water management and learning are described, including the shifts towards IWRM and 'life long learning' (paragraphs 3 and 4 respectively). Then the consequences of the changes in IWRM and learning for the four steps in the training process will be dealt with systematically: needs assessment (par. 5.1), planning (par. 5.2), implementation (par. 5.3) and evaluation (par. 5.4). In a final paragraph (6) something more will be said about training in its context.

2. Introduction on training and its role in projects

In this paragraph training is described as a process, and different ways in which training is part of a project (and of a manager's job) are discussed

Training as a process

Training is not a product in itself where the knowledge and skills are handed out in sizeble packages. It can better be described as a process. In the planning phase it is determined what you want to achieve and how you will achieve it. For this, first a training needs analysis is done (step 1), and then the design for the training is further elaborated, in which objectives of the training are formulated and materials prepared. This step is called curriculum development (step 2). After the planning has been completed, the training can be implemented (step 3). Finally, evaluation (step 4) is done in order to check that you have succeeded in achieving the objectives (see Figure 1).

In summary: Four steps can be distinguished in the training process :

1. Training needs assessment
2. Curriculum development
3. Implementation
4. Training evaluation

Figure 1: phases and steps in the training process

Phase	**Steps**	Detailed steps
Planning phase	**1. Needs Assessment**	Determine training needs
	2. Curriculum Development	Specify training objectives
		Organise training content
		Select training methods and techniques
		Identify needed training resources
		Assemble and package lesson plans
		Develop training support materials
		Develop tests for measuring trainee learning
		Try-out and revise training curriculum
Imple-mentation phase	**3. Implement and manage training**	
Training evaluation phase	**4. Evaluate the training**	

Based on: Planning for Effective Training, a guide to curriculum development, FAO, 1993

Note that training is a circular process. After all four steps from needs analysis to evaluation have been carried out, the evaluation phase should involve a return to the planning phase, to identify further training needs, adjust the developed training materials, etc.

In paragraph 5 and in Part 2 we come back to the steps in this process and how to implement these.

Role of the manager

The manager can have different roles in the training process (see the examples below). (S)he can be involved in the training needs analysis, the preparation and implementation of a training plan or a particilar training, the evaluation, or any combination of these. The manager is the one who is to decide how many resources need to be spent and what training courses are to be organised. (S)he might do training him/herself or have the supervision over other people involved in training. What should be the points to look at? Note that training is practically never the main focus for the manager!

Example

How does a manager get in touch with training?

- **The manager of an irrigation project is to develop a training plan.**

In an irrigation project there is a large training component. The manager of the project, an irrigation engineer, is expected to develop and implement all the training required, including the follow up and institutional development related to it. Training is not the main focus of the project. **The main focus is to improve the irrigation performance.**

- **The manager of a construction project initiates the formation of Water Users Associations (WUAs).**

  During the implementation of a drainage project, Water Users Associations are formed. In future, these WUAs will be responsible for the maintenance. A local NGO is involved for the training of the farmers. The manager approves the budget for the training. Training is not the main focus of the project. **The main focus of the project is effective implementation.**

- **The manager of a research project organizes a training course on presentation skills.**

  In a research project it is important that the research results are communicated. The manager of the project plans a training for the scientific staff, in order to improve their presentation skills. **Main focus of the project is the scientific quality of the research results.**

- **The manager of the irrigation division of a training centre organises training courses on Integrated Water Resources Management for technical staff from the Ministry of Water.**

  The manager has an engineering background and is involved as a subject matter specialist in the development and implementation of training courses on Integrated Water Resources Management, but also for technical training e.g. on sprinkler and drip-irrigation. **The main focus of the project is the training content.**

3. The need for training: Changes in water management

In this paragraph the changes in water magement are discussed, and some of the consequences with regard to training are pointed out.

Integrated Water Resources Management (IWRM)

Over the last 30 years there have been significant changes in water management. This altogether resulted in a shift from a mono-disciplinary approach in irrigation and drainage development towards an integrated water resources management (IWRM) approach. While projects in the past were very specifically about one field, e.g. 'irrigation' or 'drainage' or 'drinking water', nowadays projects deal with different aspects of integrated water resources management (IWRM) or rural development in a larger sense.

The focus on the relationship between the different functions and uses of water within a catchment, is one of the main characteristics of Integrated Water Resources Management (IWRM). It goes too far to deal with all aspects of IWRM in this paragraph, and reference is made to other literature on this topic (GWP, 2000). In summary, IWRM describes water management within a total setting in which social equity, economic efficiency and environmental sustainability are the overriding criteria. The important elements to look at are the enabling environment (i.e. national policies, legislation and regulations), the institutional framework (administrative levels and stakeholders), and the management instruments (operational instruments for effective regulation, monitoring and enforcement that enable decision-makers to make informed choices between alternative actions). Further it is stressed to take into account that stakeholders have different interests, should come together at the lowest appropriate level (subsidiarity), and that users should be involved in management (participation).

Irrigation Management Transfer (IMT)

Besides, there is an important shift from irrigation management by the government to irrigation management by farmers. Water Users Associations (WUAs) are created, in order to take over (part of) the operation and maintenance of the irrigation or drainage system. See also the example below.

Example

Irrigation Management Transfer
Putting farmers in charge of water development and management has proved effective to achieve efficient and sustainable water management systems and to increase water productivity. This is evident in the transfer of management of irrigation systems to the immediate beneficiaries and through the formation of water users associations, where users assume direct responsibilities in operation and maintenance of the system. (FAO, 2001)

For managers, this means that (s)he should also be accountable to farmers and no longer (only) to the government. Working with farmers to understand and, where possible, solve the problems that prevent them from producing more food is crucial. The manager becomes a service provider to the farmer and in certain cases it may even mean that the manager is no longer employed by the government, but by the farmers. The increased productivity of the farmers becomes an important measurement of success for the manager.

A wider field of knowledge & skills required

In practice this entails that a manager in a project is dealing with different water resources (groundwater, surface water etc), different users or user groups (farmers, fishermen, nature conservationists) and is involved in different tasks with regard to water management (policy, use, etc). The majority of managers sofar has an engineering background. In order to meet the demands related to these developments, the manager need to be able to cover **a wider field** of knowledge and skills, like the capacity to think and work with different disciplines together (interdisciplinary skills), accountability, multiple functions of water, stakeholder platforms etc.

Demand oriented activities

Overall, the activities undertaken should be addressing the problems of the users of the system: **demand oriented activities**. For instance in research it means that the research should be addressing the problems of the farmers. However, sofar the usefulness of research was mainly measured by the scientific value of the research papers. For this change towards demand oriented activities additional knowledge and skills are required, like communication, negotiation and presentation skills.

Technical skills

It also means, that in certain cases the manager should have the **technical knowledge and skills** to design creatively for water allocation, application, distribution and evacuation in an IWRM context. Or for instance the skills that the irrigation and drainage infrastructure is constructed in such a way that this addresses the needs of the farmers. Especially when the organisational set-up changes, e.g. by the creation of water user organisations and the related management transfer, the water infrastructure might need to be (re)designed too. Viable solutions for WUAs and farmers and their implementation have in this process a considerable importance besides the technical design standards.

Altogether these changes in water management demand for capacity that needs to be developed. This can be done in different ways of which training is one. Staff working in irrigation and drainage has generally been trained along disciplinary lines. Additional training to introduce interdisciplinarity and to increase the skills and knowledge to work with and for farmers are essential.

Summary

In summary, in order to be able to improve water management with and for farmers, training is needed to create

1. Knowledge and skills to communicate with farmers
2. Knowledge and skills on non-technical issues
3. Knowledge and skills to design with and for farmers

Further reading

Literature for further reading

- GWP, 2000 - Integrated Water Resources Mangament, Global Water Partnership, Technical Advisory Committee (TAC), document no.4, isbn 91-630-9229-8 www.gwpforum.org (select 'publications')
- FAO, 2001 - Participatory Training and Extension, FAO-Digital Media Series No.14

4. The need for training: Changes in learning

In the following pages changes in the field of learning will be described in brief. Key points in this are 'adult education', 'problem solving approach', and 'facilitating learning'. The changes in water management related training that these entail are discussed and the term 'life long learning' is introduced.

Changes in education

Most people have started their education in a classroom with a teacher. The teacher knew everything and controlled the learning process. (S)he had a blackboard and chalk as the main means of teaching aid. Over time the role of the teacher, the teaching materials, and more importantly the view on learning have changed tremendously.

Adult education

In water management, the learners are adults. One of the changes in the field of learning, is how adult education is approached. No longer in the way described above, with a school situation characterised by the blackboard, and forcefully learning facts by heart, but rather in a way that closely relates to what people want to learn, and applicable to a practical situation in which they are going to use that knowledge.

Characteristics of adult learners

How do adults learn, then? And how could we design the training accordingly? There are five characteristics of adult learners:

1. Adults learn more effectively if the wish to learn comes from inside, rather than being pushed from outside. They are **voluntary learners** and perform best when they have decided to attend the training for a particular reason. They have a right to know why a topic or session is important to them.
2. Adults have usually come with an **intention to learn**. If this motivation is not supported, they will switch off or stop coming.
3. Adults have **experience** and can help each other to learn. Encourage the sharing of that experience and your sessions will

become more effective.

4. Adults learn best in an atmosphere of **active involvement** and participation.
5. Adults learn best when it is clear that the context of the training is close to their own tasks or jobs. Adults are best taught with a **real-world approach**.
   (Sources: Robert Smith (1983), Alan Rogers (1986), Jenny Rogers (1989) In: Pretty et al, 1995)

Learning cycle (Kolb)

David Kolb has described how adults learn. This became known as the 'learning cycle of Kolb'. In brief, he describes that people perceiving a problem, find out about possible solutions, test these, and choose one to use. In this way they learn. These four steps are:

1. Concrete experience
2. Observation and reflection
3. The formation of abstract concepts, and
4. Testing in new situations

The four steps can be represented schematically in a cycle (see Figure 2). After completion of the test, one can always encounter new problems of course, where we need to think and reflect on new solutions again.

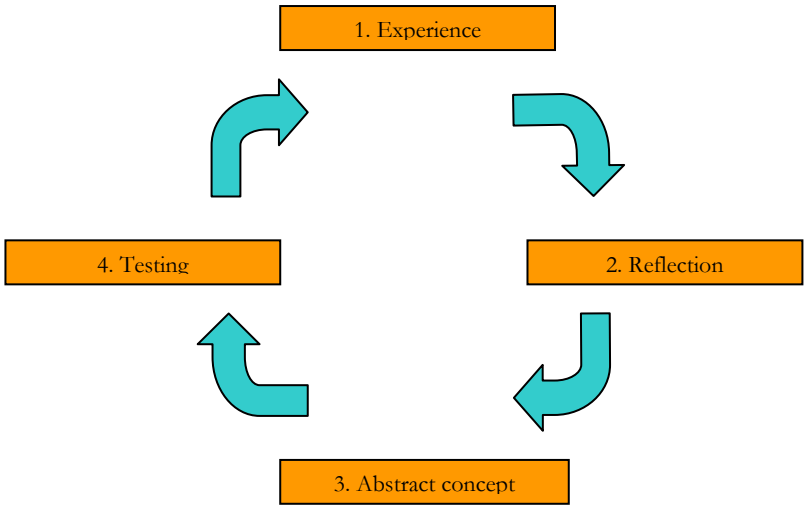

Figure 2: The learning cycle of Kolb

Kolb and Fry (1975) argue that the learning cycle can begin at any one of the four points, and that the cycle actually should be seen as a continuous spiral. However, the learning process often begins with a concrete experience. Let's take the example of starting to build a latrine, using an air-pipe for odor control (see Figure 3 'The different kind of abilities that learners need to be effective').

Example

The experience is that normally a latrine brings a certain smell with it. People could wish to improve the situation, and might have seen others using a pipe to do so. Having a pipe triggers the thought on this (step 1). The person thinks how to fix the pipe, in order to achieve a posive effect (step 2). In the third step the understanding of the general principle is central, and abstract thinking is adding to it: one can think to use one pipe for two latrines at a time (step 3). In the fourth step this understanding is tested. With this active experiment is is seen whether the general principle assumed, can be implemented and work in the practical circumstances. The action of testing and the experience it brings are bringing us back to step one.

Another starting point for learning, can also be the theoretical concept (step 3). If one knows based on theoretical knowledge about odor control in a latrine, one could wish to test this knowledge with an experiment (step 4), and discover whether it works or not (step 1), reflect on it (step 2), and adjust the concept (step 3).

Continuous

Both ways shows us, that the cycle can actually be understood as a continuous spiral: a new experiment is based on the knowledge and skills acquired during earlier learning.

Problem solving approach

Altogether, in the learning cycle adults follow what we call a problem solving approach. This is what we should strive for in training on water management as well. It means that we should wish to focus on real, everyday life of staff and/or farmers and their tasks in this. And that this is then taken as a basis for training. The training addresses the every-day-problems of the learners and provides the opportunity to analyse these and to work out solutions.

In this way people do not only learn a specific solution to a specific problem, they also learn a way how to address problems in general, i.e. by thinking themselves about solutions (rather than to wait for somebody to bring the solution).

Figure 3: The different kind of abilities that learners need to be effective (Pretty, 1995)

Facilitating learning

This brings us to the second point in changes in learning: the facilitation of the learning process. In the example mentioned above, the learner does not only need a teacher who knows everything and tells the learner what to do. The learner also needs somebody, who can facilitate his/her learning process. This has major consequences for the role of the trainer in trainings on water management.

Role of the trainer

The trainer in his/her role of a facilitator is quite different from the role as an instructor. An instructor imparts knowledge to farmers or staff who adopt a passive role or merely receiving information. In contrast, a facilitator creates conditions for farmers or staff to learn, by arranging opportunities for the farmers/staff for instance to observe and interpret differences in conditions and crop or system performances, to carry out tests and exercises, and through discussions. The facilitator encourages farmers/staff to adopt an active role in the learning process (FAO, 2001).

This does not mean that it is no longer important for a trainer to have (technical) knowledge. It is. However, it is not the only capacity a trainer needs to have. The need to be able to facilitate the learning process of the staff and/or farmers will require new skills and

knowledge for trainers in water management. One can think of the knowledge and skill to prepare practical assignments, to create a positive learning environment for adult learners, to encourage the participants to reflect on their learning, to listen to learners while reflecting on their problem, and to guide the learners in their thinking towards solutions, etc.

Adult learners - even though wishing to decide for themselves when and what and how to learn - may not be used to a trainer that is facilitating their learning process rather than instructing them what to do. It may need some time in the training, to establish the roles and expectations for both learners and trainers.

Learning environment

Especially it is important, that both learners and trainers understand that the creation of the learning environment, is a joint task of the trainer and the participants. In Part 2, practical suggestions are given in this regard (See Part 2, how do I…). (bookmark here 'positive1', bookmark there 'positive2')

Figure 4: Appropriate irrigation (Pretty, 1995)

All learners are different

As the learners are no longer seen as a passive listener only, it should also be acknowledged that **all learners are different**. Not all learners go through the learning cycle in the same way, either because their entry point is different, or because their speed of learning is different. As learners are different, this means for instance, that not everybody automatically hears the same, when the trainer is explaining something. In Figure 4 'Appropriate irrigation' this has been illustrated: the term 'appropriate irrigation clearly bring different thoughts to the minds of the people involved. In order to deal with this, the trainer needs to be alert and cross check from time to time, whether what (s)he is trying to explain, is understood by the learners.

Consequences for training in water management

The changes in the approach to learning from instruction and knowledge transfer to a combinatino with self-directed learning and facilitation of learning means for water managers that training should be **problem oriented**. Farmers and (extension) staff will learn best by a combination of approaches. For instance not only a setting with a blackboard, but also including an analysis of their problems in an every day setting in the field. The training should therefore also include a **focus on learning by doing** in a water management context. For existing courses, the content and the form of the courses needs to be considered, and redesigned in order to address these changes in learning.

Examples

An example could be that the training is not held in a classroom environment, but located in the field. The trainer can analyse the problems in the field for which training might be required much better together with the farmers in the field - in stead of in the office (see Part 2 for details). (Bookmark here 'field1', bookmark there 'field 2')

Another example is that the training content of a training for mid-career professionals in drainage is organized in such a way, that assign-ments are increasingly less structured, encouraging the participants to analyse a situation by themselves, start looking for information and solutions that they find appropriate, rather than predescribing every step in the process of finding a solution (see Part 2 for details). (Bookmark here 'curriculum1', bookmark there 'curriculum 2')

A third example is in an irrigation project, where there is a large training component. The training approach followed by the project of practical courses and follow up, relating the training to the every-day-life situations of the staff of the Ministry of Agriculture, proved successful in two ways. It improved the capacity of the irrigation staff to design and plan irrigation schemes, in communication with the farmers. Second, it exposed the irrigation staff to a different type of training, in which their active participation was required, their learning stood central stage, the training had a practical focus, and they were encouraged to find their own solutions. As a result, they incorporated this approach in their training to farmers, which significantly improved the training they provided to farmers (see Part 2 for details). (Bookmark here 'curriculum3', bookmark there 'curriculum 4')

Life long learning

In this changed approach to learning, it no longer holds that 'the expert' knows, and the other people are to listen to him/her. In a problem-solving approach, the learner is the expert for his/her own situation. An 'outsider' can bring new knowledge, which can definitely be very important, but the learner cannot only 'record' this knowledge. (S)he needs to do something him/herself with it, in order to bring it to use.

And following the learning cycle as described by Kolb, while solving problems always new problems may be formulated, so there is always a new need for knowledge, and a need to learn something new. Therefore, the learning never stops. The term 'life long learning' is used in this regard.

Life long learning is a continuous engagement in acquiring and applying knowledge and skills in the context of authentic, self-directed problems (Fischer, 1996).

Summary

In summary, the key-words for training should be:

- A focus for learning by doing; problem solving approach
- The participants are approached as active learners
- The learning process has a central point in the training
- The participants are encouraged to think for themselves
- A good learning environment is created
- The trainer acts as a facilitator of the learning process rather than a lecturer/instructor (only).

In the following paragraphs we will elaborate on methods of training that can be used during the needs assessment, planning, implementation and evaluation of the training (paragraphs 4, 5, 6 and 7 respectively).

Further reading

Literature for further reading

- Boyatzis, R.E., Cowen, S.S., Kolb, D.A. and associates (1995) *Innovation in Professional Education, steps on a journed from teaching to learning*, Jossey-Bass Publishers, San Francisco
- FAO (2001) *Guidelines and Manual on the Participatory Training and Extension in Farmers' Water management (PT&E-FWM).* FAO Digital Media Series, No. 14
- Fischer (1996) *"Making learning a part of life. Beyond the gift wrapping approach to technology"* http://www.cs.colorado.edu/~l3d/philosophy.html
- Pretty et al. (1995) "*Participatory Learning and Action, A Trainer's Guide"*, Jules N. Pretty, Irene Guijt, John Thompson, Ian Scones, IIED Participatory Methodology Series, International Institute for Environment and Development /IIED, London, 1995, ISBN 1 899825 00 2

5. The training process

5.1 Training needs assessment

A training needs assessment is an inventory of the gap that is addressed by the training. It gives a clear picture of the knowledge and skills available versus the knowledge and skills required. The outcome of the training needs assessment is an answer to the question 'what needs to be taught and how can people learn?'

***Why** do a training needs assessment?*

The training needs assessment is the starting point of the training process. One can refer to the output of this step, usually a report, as a basic document at a later stage, for instance to measure the impact of the training. It also serves to get an overview of the perceived problems, and to get an impression which ones can be addressed by training. Another important use of the training needs assessment is, that it is an input for decision-making about funds for training.

***When** to do a training needs assessment?*

A training needs assessment is done before starting a training, and even before planning for a training. It allows to get a better picture of the gap between the knowledge and skills available and the knowledge and skills required and to know what impact is to be achieved.

> *Needs assessments gather information to assist professionals in making data-driven and responsive recommendations about how to solve the problem (…). The important role that needs assessment plays is to give us information, at the beginning of the effort, about what is needed to improve performance. (Rossett, 1991)*

***Who** does the training needs assessment?*

The training needs assessment can be done by the manager, by an outsider hired by the manager for this purpose, or the people to be trained themselves. It will depend on the situation and the complexity of the problems, for instance how many institutions are involved, how many people may need to be trained, the resources level available, the time-frame etc., who is involved, but in general the manager has an important role in the training needs assessment.

***What** to do for a training needs assessment?*

The training needs assessment consists of six elements:

1. A review of the ***present capacity***. This review includes an overview of the different groups and organizations involved, their tasks and the performance of these tasks. The framework of Bolger, as used in Kay and Terwisscha van Scheltinga (2003) can be used to distinguish levels like individual, organisation, sector and enabling environment (see Figure 5).
2. Formulation of the ***desired situation***. In this formulation, the gap

between the actual and the desired situation is indicated.

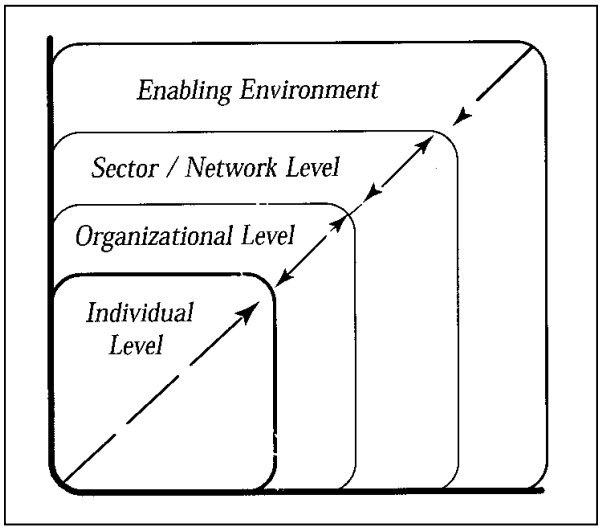

Figure 5, Levels of Capacity Building, Bolger (2000) in: Kay & Terwisscha van Scheltinga (2003)

3. Formulate the ***goals*** of a training programme. Based on the review of the present capacity and the formulation of the desired situation, the goals of a training programme can be indicated. Attention should be paid to the difference in focus possible for the training needs assessment. The focus can be the present situation in which there is an immediate problem, which needs to be dealt with. The focus can also be that there is a foreseen need in the future, for which training is a way to deal with it (see the example below).
4. An outline of the ***delivery methods*** to support the goals of a training programme
5. An indication of ***costs*** of the training programme
6. Recommendations on ***strategies for implementation*** of a training programme.

(Based on FAO, 1993; Underwood, 1998)

Example

Addressing an immediate problem (focus 'now'): *To a staff member of the irrigation department who should be able to do a land-survey it is proposed to do a course on land-surveying in order to be able to survey plots and make maps.*
Addressing an foreseen need (focus 'future'): *In the same irrigation department, a staff member is provided the opportunity to do an MSc in irrigation. An MSc-degree is a prerequisite for the position of head of the department. After one year the staff member will be back, and work together with the head of the department. After three years, when the head of the department will be transferred, the staff member can take over. The management of the department is taken care for without disruption.*

***How** to do a training needs assessment?*

The main activity for a training needs assessment is information collection. Through observation, interviews, survey through questionaires, and study of available documents, data can be gathered.

The needs assessment is conducted in stages. Plan beforehand what is done when, and what the intermediate result will be, as well as how the findings of the needs assessment will be used for decision making (Rossett, 1991).

Keep in mind that the result of the training needs assessment needs to give an answer to the question 'what needs to be taught?'

The Farmers Seasonal Plan is an example of a training needs assessment for improved water management, with active involvement of the farmers. The method has been developed by FAO, as part of a Farmers' Training Programme (See Part 2 for details) (bookmark here 'needs1', bookmark there 'needs2').

Further reading

Literature for further reading:

- FAO (1993) *Planning for effective training, a guide to curriculum development,* prepared by Tim Wentling, FAO, Rome
- FAO (2001) *Guidelines for participatory training and extension in farmers' water management (PT&E-FWM),* In: Participatory Training and Extension in Farmers' Water Management, FAO Land and Water Digital Media Series No. 14, FAO, Rome, 2001
- Rossett, A. (1991). *Needs assessment.* In G.J. Anglin (Ed.), Instructional Technology (pp. 156-169), Libraries Unlimited, Englewood, Colorado.
- Swist, Jeannette, *Conducting a Training Needs Assessment*, CMC, SPHR at: http://www.amxi.com/amx_mi30.htm
- Underwood (1998) Baseline training needs assessment for community forestry in South Africa, Rural Development for Network - paper 24d, ODI, London

5.2 Curriculum development

In this part, first a definition of curriculum development will be given, followed by an overview of the basic elements. The output of this step is the course rationale and outline.

Whether as a manager you are involved in the organisation of a field day to demonstrate irrigation to farmers or a six month course in methodologies for drainage research for researchers, the phases in planning the training activity are basically the same. The content will be different.

Definition curriculum development

The content, together with the design of training are indicated with the term curriculum development. **Curriculum** can be defined as *'all the activities which the students do, especially those which they need to pursue if they are to finish the course and to achieve the goal' (FAO, 1998).* In other words: curriculum development is developing the master plan for selecting content and organizing learning experiences for the purpose of changing and developing learners' behaviors and insights (after Walker). It is answering the question 'about what' people should be trained and 'how' it roughly will take place. It is the overall design for a training activity.

Overall design

The question how the training will be done in detail, the instruction, is not necessarily part of the curriculum development. In this manual it is seen as part of the next step, implementation and dealt with separately (see 'session plans' in paragraph 6).

Basic elements of curriculum development

The basic elements of curriculum development are a description of the learning objectives, specified for the target group, together with an overview of the training content and an indication of how and where the training will be dealt with. The learning objectives should state what the student is to learn, in terms of knowledge and understanding and skills. Learning objectives on knowledge and understanding can be formulated in sentences starting with 'after the course the participants will **know that**…', while the skills to be learned can be described as 'after the course the participants will **know how**…' . In the overview below the basic elements of curriculum development are summarized in the five questions: why, for whom, what, how, and when.

Basic elements of curriculum development	
Why?	Specify learning objectives
For whom?	Indicate target group
What?	Formulate and organise the training content (in a general manner)
How?	Prepare an outline of the sessions / choose training methods / forms of training
Where?	Indicate where the training will take place, and under which circumstances

For each of the basic elements of curriculum development, a reference to the part 'changes in learning' (paragraph 3) applies. There it has been discussed that learning will be most effective, if the target group wants to learn. As a manager, it is important to ensure the involvement of the target group or stakeholders. They should own the objectives formulated for the training course. The content should be related to their practical situation, and be organized in such a way that it gives a possibility to discover new knowledge, apply this knowledge, and test it for the own situation.

Output: course rationale and course outline

With the answer of the five questions why-who-what-how-when, the curriculum of a course is determined. The answers result in a description of the background of the course, the **course rationale**, and a rough indication what the course will deal with and when, the **course outline**. An example of both a course rationale as well as the course outline is given in Part 2 (See Part 2). The rationale and outline are the basis for the further development of the training activity, as well as a reference point when evaluating.

Further reading

Literature for further reading:

- FAO, 1998 - Participatory Curriculum Development in Agricultural Education, A Training Guide

5.3 Teaching methods and implementation

In this paragraph a number of teaching methods and the implementation of training are discussed.

Based on the key-words for training, as stated in paragraph 3, and the rationale/outline of the course as prepared in paragraph 5, the methods for training are to be chosen. These key-words for training were a focus for learning by doing; problem solving approach; participants are approached as active learners; all learners are different; the learning process has a central point in the training; people are encouraged to think for themselves; a good learning environment is created and the trainer also acts as a facilitator of the learning process rather than a lecturer/instructor only.

Methods that can be used for this during the implementation are plenary introduction, brainstorming, small group discussions, plenary discussion/presentation, practical (field) activities, field walk/field observations, role play, and demonstrations (field trials and field tours). Other methods are case studies, reflection on learning, formulation of problems and solutions by participants, and practical assignments related to the actual work situation. All these methods will encourage people to think for themselves, and give the learning process of the participants a central position in the training (see also part 2 for examples).

Methods to avoid are lecturing (only), prescribing people what to think, transferring knowledge (only) or in other words a focus on learning facts (only).

Combination of methods

The methods to be selected depend on the objective of the training. Preferably a combination of methods is used. For example: when

training farmers about improved water management this will mean to focus on methods where water management is directly part of the training, and examples of good and less good water management are central. If possible this kind of training is organised in the field, where people can see the problems and solutions (see example).

Example

In a project farmers training was organized. 'During the meetings and training sessions, technical matters were explained as far as possible through scale models, maps and drawings. When the agreement between the farmers and the Project was discussed, posters were used visualising the tasks that farmers had to fulfill.' (NRAP report, 2001, pp 44)

Session plan

In all situations of training, it is advised to prepare a **session plan**, stating what will be done, how it will be done, how much time is required, what materials are required etc. It is a detailed description of what was stated in the course outline (paragraph 5). Use of session plans make it possible to be well prepared for a training activity, and to replicate a training later in the similar way. It enables somebody who has not designed the training, to implement it. In Part 2 a practical approach to develop a session plan has been included, as well as an example (See Part 2) (bookmark here 'session1' bookmark there 'session2')

Not all training courses need to be prepared from scratch. There are courses organized on a variety of topics related to irrigation and drainage and IWRM. Two overviews of databases available on the internet have been included (Annex 1 and Annex 2). There are also materials available on the internet (see overview in Annex 3) It is extremely important to formulate the objectives of the course etc. along the lines as pointed out in the paragraph on curriculum development (5.2) before selecting a course and/or materials. For instance the content of the concept Integrated Water Resources Management (IWRM) is not the same in the courses listed.

Further reading

Literature for further reading

- FAO (2001) Farmers' Training Manual, Participatory Training and Extension for Farmers' Water Management, FAO Digital Media Series, No. 14

5.4 Evaluation

In this paragraph reasons for and moments of evaluation are discussed.

Why evaluation ?

With an evaluation the effectiveness of the training can be measured. There are different reasons why one could wish to do an evaluation. This translates in different ways to look at evaluation and the

effectiveness of the training to be measured with evaluation. Therefore, determine first, why you want to do the evaluation.

Reasons why one could wish to do an evaluation could be (and note the different ways to look at effectiveness!):
- To get feedback about the effectiveness of a training activity and to adjust immediately during the continuation of the training,
- To improve the effectiveness of the training as a whole, in the next training,
- To stimulate the (self) learning process of the learners
- To give the learners an opportunity to reflect on what is learned.
- To measure the result of the training,
- To justify the investment in the training.

In practice, often an combination of reasons is present.

Methods for evaluation

Different methods that can be used for evaluation are:
- oral evaluation
- written evaluation

There is a variety of ways possible to shape the evaluation according to the requirements of the manager.

Moments of evaluation

Evaluation can be done during or after the training. If in a training course a daily evaluation is held, if facilitates to let the participants reflect on their learning. At the same time it can give the opportunity for the organisers of the course to get feed back on how the participants value the course - and immediate adjustments can be made where necessary and possible.

For instance in a training course (See Part 2), on day 2 there is an evaluation by cards, with the questions 'I learned' , 'I like', and 'Least interesting'. The question 'I learned' stimulates the reflection of the participants on their own learning process, while the questions 'I liked' and 'least interesting' give feedback to the course coordinator and the possibility to adjust the programme, if necessary. Another example (same box) is that the questions provide feedback, which on day 6 shows that the same action is valued positively as well as negatively by different participants.

For a training course, the overall evaluation of the course which is held immediately after the course can provide information about the increase in the knowledge and skills of the participants.

An evaluation measuring the impact of the training on the day-to-day work situation of the participants needs to be done several months after the training course has been given and the participants are back at work. For this purpose, it is advisable to include the formulation of an action plan in the training, so that participants can reflect on

application of the new knowledge and skills in the work environment, already at the time of the training.

Results of evaluation

While planning the evaluation, consider how the results of the evaluation will be used, and how they will be presented. For instance when a total course is evaluated with a written evaluation, appoint the person who is to do something with the results as the person to compile the overall evaluation result. (see also the example below).

Example

Use of the results of an evaluation
The Ministry of Agriculture and FAO organised a series of training courses. The courses were organised in close collaboration with the Botswana College of Agriculture, which included (part of) the training courses in her regular course programme (BSc-level). The courses were evaluated immediately after the course, in a written and an oral evaluation. The results of the evaluation were presented to the Botswana College of Agriculture (BCA), which could therefore benefit from the experiences of the training courses.

Further reference is made to the chapter on evaluation of this handbook (in preparation).

Further reading

Literature for further reading:
- FAO (2001), Participatory Training and Extension for Farmers' Water Management, FAO Digital Media Series, No. 14

6. Training in the context of capacity development

In this paragraph, the embedding of training and the position of training in its context is discussed.

Link to practice

Training is not something that takes place in isolation. It addresses a gap between the required and available knowledge and skills of staff. The better the relationship between the reality and the training, the better the effectiveness of the training. In order to realise this linkage, is important to include an element of follow up to the training (see example below and details in part 2).

Example

In an irrigation development project in Botswana, the knowledge and skills of the staff of the Irrigation Section of the Ministry of Agriculture significantly increased through a range of training courses. The courses followed an interactive learning approach (as mentioned in 'implementation') and was linked closely to the work practice of the staff. An active follow up to the courses was provided: for instance two months after a training on design of sprinkler systems, a staff member of the project visited the field offices, to review newly designed sprinkler projects.

Link to training needs assessment

The effectivety of training will also depend on other factors, like the institutional set-up, the policy context etc. Some of these issues, could already have been analysed as part of the needs assessment. As mentioned in paragraph 4 on this issue, four levels can be

distinguished: the individual, the institutional, the sectoral and the enabling environment level (see Figure 5, Levels of capacity building, Bolger (2000) in Kay & Terwisscha van Scheltinga (2003) and the analysis of the context in part 2, on training needs assessment).

Link between the different elements of a project

The training should have a close link to the other parts of the project, of which it forms a part. It should be clear how the expenditure on training contributes to the overall goals of the programme. The project mentioned below might be an example in this regard.

Example

The specific budget for training in the Netherlands Research Assistance Project (NRAP) in Pakistan was about 15% of the total budget. Activities in the field of trainng included on-the-job training, attachment training, formal training courses organised and formal courses attended (national and international). As a result, the staff of the International Waterlogging and Salinity Research Institute (IWASRI) in Lahore improved their capacities to write proposals, to undertake research, and to report on findings. IWASRI staff also acquired skills to work with farmers. The results of the research have had a far-reaching impact on the planning and design of projects in water infrastructure and the project proved itself to be value for money. Source: NRAP, Final report (2001)

In summary: The manager should have a clear picture of how the training is related to the needs assessment, and how the follow up is organized. Further it should be clear to the manager how the training links to the different elements of the project in order to avoid that training takes place in isolation.

Further reading

Literature for further reading
- Kay, M. and Terwisscha van Scheltinga, C. (2003)

PART 2 Mini-toolkit for training in water management

1. How do I create a positive learning environment

Creating a positive learning environment

- Is the atmosphere of your sessions friendly and encouraging?
- Have you made plans to relieve any anxieties your trainees might feel?
- Will your teaching methods allow learners' previous experiences to be acknowledged or used?
- Will learners be 'rewarded' for their contributions?
- Does the work allow participants to measure their own progress?
- Do you make it clear that you are available for additional help if individuals have difficulties?
- Are the first few minutes of your sessions always attention-grabbing?
- Do you build in frequent opportunities for reinforcement and practice?
- Are you avoiding lectures, or at least limiting them to 10-20 minutes?
- Have you built in regular feedback sessions?

Source: Pretty, 1995

Link to Part 1 'Developments in training in IWRM'

2. How do I assess the need for training

Example

The Farmers Seasonal Plan is an example of a training needs assessment for improved water management, with active involvement of the farmers. The method has been developed by FAO, as part of a Farmers' Training Programme. The Farmers' Seasonal Planning forms together with the Farmers' Seasonal Training, the Farmers' Training. The objective of the Farmers Training is, to put farmers in charge of the analysis and definition of the constraints, development opportunities and technologies through a particpatory appraisal of priorities and their potential.

The Farmers Seasonal Planning focuses on problem identification, selection of techniques and technologies to be tested and preparation of a seasonal work plan. This plan will be implemented during the Farmers' Seasonal Training. The training sessions will be according to farmers' needs and requirements and follow closely the various agricultural seasons.

The farmers' seasonal plan might include:

- a cropping plan for the crops that have been selected to be studied during the agricultural season;

Link to Part 1 'Developments

Link to Part 1 'Developments in training in IWRM'

- a crop water management plan, including experiments for field irrigation techniques and irrigation scheduling; and
- the structural improvements to be carried out on the irrigation, drainage or flood system.

The farmers' seasonal plan will further include an assessment of the inputs and support required to strengthen the water users association. In general, five sessions, scheduled over a five-week period, prior to the agricultural season, will be sufficient to formulate and agree on the plan (FAO, 2001).

Care should be taken to address all six steps of the training needs assessment as mentioned in part 1:

1. Review the present capacity.
2. Formulate the desired situation.
3. Formulate the goals of the training.
4. Outline the delivery methods
5. Indicate the costs
6. Recommend a strategy for implementation of a training programme.

(Based on FAO, 1993; Underwood, 1998)

3. How do I analyse problems in the field and link these to training for farmers

Example

Participatory assessment of irrigation and drainage system - review of field conditions

Before starting to discuss possible improvements in farmers' water management it is important to review with the farmers the conditions of the current situation regarding the water management. Further it is important to assess in the field the specific problems and difficulties and to define constraints farmers experience, to identify technologies and practices to improve water supply or to increase irrigated areas. During the transect walk the assessment focuses on the farmers' knowledge in relation to the irrigation and drainage situation and their ideas for improvements.

Link to Part 1 'Developments in training in IWRM'

The objectives are to review the conditions of the irrigation system, and to review the farmers' knowledge in relation to the irrigation and drainage systems in the area and identify common constraints and potentials for improvements.

The expected outputs are an assessment of farmers' knowledge, ideas and priorities in relation to farmers' water management, and a list of identified potential improvements in relation to identified farmers water management problems.

Source: Participatory assessment of irrigation and drainage system - review of field

conditions, Exercise 1B, Farmers' Training Manual, Participatory Training and Extension in Farmers' Water Management (PT&E-FWM), FAO, 2001

4. How do I develop curriculum emphasizing 'learning by doing'

The basic elements of curriculum development are a description of the learning objectives, specified for the target group, together with an overview of the training content and an indication of how and where the training will be dealt with. The learning objectives should state what the student is to learn, in terms of knowledge and understanding and skills. Learning objectives on knowledge and understanding can be formulated in sentences starting with 'after the course the participants will **know that**…', while the skills to be learned can be described as 'after the course the participants will **know how**…' . In the overview below the basic elements of curriculum development are summarized in the five questions: why, for whom, what, how, and when.

Basic elements of curriculum development

Why?	Specify learning objectives
For whom?	Indicate target group
What?	Formulate and organise the training content (in a general manner)
How?	Prepare an outline of the sessions / choose training methods / forms of training
Where?	Indicate where the training will take place, and under which circumstances

For each of the basic elements of curriculum development, a reference to the part 'changes in learning' (paragraph 3) applies. There it has been discussed that learning will be most effective, if the target group wants to learn. As a manager, it is important to ensure the involvement of the target group or stakeholders. They should own the objectives formulated for the training course. The content should be related to their practical situation, and be organized in such a way that it gives a possibility to discover new knowledge, apply this knowledge, and test it for the own situation.

With the answer of the five questions why-who-what-how-when, the curriculum of a course is determined. The answers result in a description of the background of the course, the **course rationale**, and a rough indication what the course will deal with and when, the **course outline**. An example of both a course rationale as well as the course outline is given below. The rationale and outline are the basis for the further development of the training activity, as well as a reference point when evaluating.

Example **4.1 Example of a course rationale**

Link to Part 1 'Developments in training in IWRM'

TRAIN THE TRAINERS COURSE

Duration 2 weeks
Period 3 – 14 December
Location At Institute A

Background
To obtain Project Result no. 5 *"Operational Training Centre at Institute A"* the following activities have been initiated:

5.1 Construct and furnish training centre and hostel
5.2 Prepare a programme for National Training Courses
5.3 Develop training modules on
- Land Drainage
- Management of Problem Soils
- Use of Poor Quality Water for Agriculture

5.4 Conduct National Training Courses

The Train the Trainers (TTT) course will present tools and methods for enhanced learning and to facilitate change. The course is especially aiming at the transfer of knowledge at a post-graduate level and thus improving the sustainability of the project results. The tailor made course will be built up around the curriculum development for the National Training Courses and therefore contributes to Project Result no. 5 as mentioned above.

Participants
Ten participants are foreseen for this course, of which six staff members from Institute A, lecturing in the National Courses and 4 University staff members participating in regular teaching programmes.

Language
The working language of the course will be English.

Objectives
To increase the participants' ability to prepare training and make presentations specifically related to land and water management.

Expected output
On completion of the Course, the participants will feel that their ability to interact with other education curriculum developers has improved. Their capacity to develop and use curriculum using research results and other

specific knowledge in the field of land and water management, has improved. Furthermore, their capacity to prepare and give presentations will have been improved. Back at their Centre they will be able to use their improved skills in their educational duties, thus enhancing their capacity to apply and use the research results obtained in the educational programme.
The course is a first step in the development and implementation of new ways for curriculum development and interactive teaching.

Methodology
Subjects will be treated in the form of lectures, guided do-it-yourself study and hands-on assignments. In the assignments, participants can work based on the educational work from their own duty station. Further presentations and group discussions will be included to provide additional background information and to integrate the subjects. Time will also be allocated for exchange of knowledge by participants and for Indian lecturers on the topics of curriculum development and presentation skills.

Input of participants
Participants have to bring data from their duty station on curriculum and presentations which they developed and/or use. An active participation in the case studies, exercises and discussion is a prerequisite. Ample time will be allocated for self-study.

Course materials
During the course, black board, flip-over-charts, etc. A video camera and possibilities to view recorded video material will be required. Computers will be required for Word and Power Point Presentations.
Assignments and lecture notes will be prepared by Institute B. Printing will be done at Institute A.

Time schedule
2 weeks, 6 days per week, 6 hours per day for classroom sessions and 2 hours per day for self study.

Organisation
The course will be jointly organised by:
- Institute A; and
- Institute B.

The tasks expected from the two organisations are:
Institute A:
- Will approach and select the participants
- Organise the course, i.e. arrange the course facilities, including training materials (flip-chart, etc)
- Ascertain the availability of board and lodging.

Institute B:

- Assist the counterpart organisation with the preparation of the course.
- Provide two lecturers for the subjects (i) Presentation skills, and (ii) Curriculum Development in Land and Water Development.
- Provide Lecture Notes, and assignments
- Assist with the implementation.
- Be responsible for the budget and reporting

Course Management

Course Director:	to be appointed by Institute A
Course Leader:	to be appointed by Institute A
Course Advisor & Lecturer:	to be appointed by Institute B
Lecturer:	to be appointed by Institute B

Source: Training for Trainers. Course on Curriculum Development, Learning Theory and Presentation Skills, 3 - 14 December 2001, Central Soil Salinity Research Institute - Karnal - India; International Institute for Land Reclamation and Improvement - Wageningen - The Netherlands

Example **4.2 Example of a course outline**

Link to Part 1 'Developments in training in IWRM'

Day	Date	Topic	Preparation
1	3 Dec	- Opening - Introduction of lecturers and participants - Introduction to objective and working methods of course - Principles of learning (building trust, respect) - Goal of the training (participants formulate goal of the training) - Expectations - Sharing experiences (inventory of experiences with curriculum development, interactive teaching and presentation skills) - Learning points of the day (explanation) - Evaluation day 1 / learning points of the day	Institute A Institute A Institute B Institute B Institute B Institute B Institute B Institute B
2	4 Dec	- Learning process : adult education learning based on experience (Kolb) trainer self assessment - Theory: Curriculum development (formulation of target group, objective, materials, methods) - Evaluation day 2 / learning points of the day	Institute B Institute A will arrange input from extension staff Institute B
3	5 Dec	- Assignment: Analysis lecture curriculum development - Theory: Presentation skills - Assignment Presentation skills: develop lecture using ppt - Evaluation day 3 / learning points of the day NB: Institute A will request participants to bring existing material and information for new	Inst. A+B Institute B Inst. A+B Institute B

		material (to be developed in the course) Institute B - also including basics of Powerpoint	
4	6 Dec	- Assignment Presentation skills: develop lecture using ppt - Feedback (listening, asking questions, positive feedback) - Presentation of lectures (2)(15 min + 30 min feedback p.p.) - Evaluation day 4 / learning points of the day	Institute B Institute B Institute B Institute B
5	7 Dec	- Presentation of lectures (8)(15 min + 30 min feedback p.p.) - Conclusion of the first week - Evaluation day 5 / learning points of the day	Institute B Institute B Institute B
Weekend 8 + 9 Dec		Saturday is the second saturday of the month: off day Sunday: excursion	 Institute A
6	10 Dec	- Summary of first week / opening second week - Role of training (training needs analysis) (changing role of trainers) - Assignment: analyse training methods used. - Use of other methods (interactive teaching) - Evaluation day 6 / learning points of the day	Institute B Institute B Institute B Institute B Institute B
7	Dec	- Assignment : Use of other methods (interactive teaching) - Evaluation day 7 / learning points of the day	Institute B Institute B
8	12 Dec	- Presentation of lecture (using other methods) and feedback (10) (15 min + 30 min feedback p.p.) - Evaluation day 8 / learning points of the day	Institute B Institute B
9	13 Dec	- Use of evaluation - Making an individual action plan - Presentation of the action plan - Evaluation day 9 / learning points of the day NB: Institute B prepares follow up; actual follow up will be done by Institute A	Institute B Institute A+B Institute B Institute B
10	14 Dec	- Time available - Course evaluation (written)	Institute A+B
11	15 Dec	- Course evaluation (oral) - Official Closure (certificates/ follow up) - (half day) NB: Oral evaluation will be done, based on that 2/3 participants speak during official closure; Institute A will arrange for certificates and follow up	Institute A Institute A

Link to Part 1 'Developments in training in IWRM'

Daily time schedule at Institute A:
Morning: 9.30 start, 11.00-11.30 tea break; 1-2 lunch break
Afternoon: start 2 (or 2.30), 3.30-4 tea break; 5 end
Source: Training for Trainers. Course on Curriculum Development, Learning Theory and Presentation Skills, 3 - 14 December 2001, Central Soil Salinity Research Institute - Karnal - India; International Institute for Land Reclamation and Improvement - Wageningen - The Netherlands

5. How do I make a session plan

Link to Part 1 'Developments in training in IWRM'

A **session plan** is an overview of a part of the training activity stating what will be done, how it will be done, how much time is required, what materials are required etc. It is a detailed description of what was braodly described in the course outline (paragraph 5). Use of session plans make it possible to be well prepared for a training activity, and to replicate a training later in the similar way. It enables somebody who has not designed the training, to implement it.

To prepare a session plan, you can use the following procedure:

- Select the subject, the target group and the learning situation
- Define the learning objective(s) of the session
- Define what the participants must know to be able to achieve the objective, should know (information that reinforces learning), or could know (background information). Concentrate on the must know items. Formulate the expected output of the session.
- Develop the session plan. Describe the steps in the learning process that you want to develop with the participants. Indicate the activities of both the trainer and the participants and the duration of the activities. Write the content outline, list the requirements and indicate the work-method.
- Review the session plan
- Prepare the implementation.

An example of a session plan, that can be used when planning drainage improvements with farmers has been included (see below)

Format of a session plan

Title of the session
Date

Introduction

Objectives
♦ ...

Material required
♦ ..

Expected outputs
♦

Time required
♦

Preparations required
♦

Timing
♦

Procedure (steps)

Guidelines for (technical) preparations

Questions for discussion

Example **Example of a session plan**

Link to Part 1 'Developments in training in IWRM'

EXERCISE 4C: PLANNING OF DRAINAGE IMPROVEMENTS

Introduction
Before the farmers can make a start with the planning and preparations for the Drainage improvements the following points need to be covered: cause(s) of drainage
Problems; benefits of drainage; required drainage intervention; and functioning of the
different components of the drainage system. The outcome of this exercise is a drainage plan which including a step-by-step plan, which lists the activities that have
to be undertaken from planning/design to operation and maintenance. In this plan
farmers should also define which activities can be done by themselves and for what
activities support from an external (governmental) organization has to be requested.

Objectives
- To plan and prepare for drainage improvements.

Expected outputs
- Layout and plan for the improvements of the drainage situation.
- Step-by-step activities plan.
- Identified tasks and responsibilities that can not be implemented solely by the farmers.

Preparations required
- None.

Materials required
- Copies of the map prepared in Exercise 4A.
- Sheets and markers.

Time required
- Three hours and 30 minutes.

Timing
- When the drainage problem is visible.
- After Exercise 4A (Assessment of drainage, flood and salinity problems) and 4B (Selection of drainage improvements).

Procedure (Steps)

Plenary Introduction (15 min)
1. Review of the previous training session (Exc. 1, Part C).
2. Explain the specific objectives and expected output.

Plenary discussions (10 min)
3. Decide with the farmers which area with a drainage problem will be selected to plan and prepare drainage improvements for.
4. Discuss drainage planning and design considerations.

Field visit/small group activities (1 hour and 30 min)

5. Visit with the farmers the selected area and ask the farmers to split up in small groups of 4-5 persons.
6. Give each group a copy of the map prepared in Exercise 4A.
7. If it is required, ask the groups to prepare a more detailed layout map of the drainage problem area, on the basis of the map preparedduring Exercise 4A, indicating slopes, drainage flows, agricultural fields, roads, rivers, drainage obstructions, etc.
8. Ask each group to draw the layout of the selected drainage measures (Exercise 4B) and to discuss what needs to be done further to improve the drainage situation.
9. Ask each group to present their layout map and drainage improvement plan.

Plenary discussions (40 min)

10. Discuss the different proposals. Pay special attention to: the layout of proposed field drainage systems; length of and distance between the field drains; outlet and land form between the field drains; alignment of the collector drains; drainage outlet; field and collector drain alignment versus existing infrastructure; drainage boundaries versus other existing social/organizational boundaries; size of independent controllable drainage units; implications for drainage management; possibilities for reuse of drainage water; additional requirements to improve the drainage situation.
11. Try to decide on the best and most realistic proposal that the farmers will be able to Construct, manage, operate and maintain.

Plenary exercise (1 hour)

12. On the basis of the selected proposal ask the farmers to list down all the steps (activities) that have to be taken from planning/design until operation and maintenance. The purpose is not to go in great detail but to get an overview (feeling) of the activities that can be done by the farmers themselves and for which external help/support is required.
13. Write the steps down in a chronological order grouping them under the headings planning & design, implementation, and operation & maintenance (see example in Guidelines for (technical) preparation).
14. Discuss which activities can be solely done by the farmers and for which activities external help is required or which activities have to be completely done by an external organization.

Summary and Closure (Exc. 2, Part C).

Link to Part 1 'Developments in training in IWRM'

Guidelines for (technical) preparations / questions for discussion

Considerations for planning drainage improvements

- Planning of measures to improve the drainage situation in an area normally depend on the expected benefits compared to the costs. As discussed in Exercise 4B, the benefits do not only comprise improved crop yields but other agricultural and social benefits as well.
- Drainage is not the only factor determining the increase in farm returns. Only when drainage is a major constraints significant increase in farm returns can be expected. Therefore when low input farming is predominant in an area it might not be profitable to implement high cost drainage measures such as pipe drainage. The level of drainage investment should suit the level of agricultural development.
- Unless the area under consideration is located in the vicinity of a natural drainage outlet, a main drainage infrastructure needs to be planned and implemented. Normally planning and implementation of the main drainage infrastructure is beyond the capacity of a single group of farmers.

For more technical information, see also Irrigation water management training manual No. 9, Drainage of irrigated lands, 1996, FAO/ILRI, Chapter 4-7.

Questions for discussion on considerations of drainage planning

1. What are the expected financial benefits of drainage compared to the expected costs for installation, operation and maintenance?
2. Can this group of farmers manage the implementation, operation and maintenance of the planned drainage system themselves or is co-operation with other farmers necessary?
3. Is it necessary to involve the irrigation and drainage department in design and implementation?

Questions for discussion on design considerations for surface drainage /subsurface drainage

Questions for discussion on general design considerations for drainage

(….)

Questions for the preparation of the step-by-step plan

1. What activities have to be initiated and completed before the actual implementation of the drainage plans can start?
2. What activities have to be done to finalize the implementation works?
3. What are the maintenance activities have to be undertaken on a regular or ad hoc basis?
4. What has to be done to operate the system?
5. Can the farmers do the activities that have been identified themselves?
6. In case an activity can not be done solely by the farmers, what part can be done by the farmers and what part can not?
7. Why can farmers not do certain (parts of) activities themselves?
8. Which external organization(s) might be able to assist the farmers in the implementation of the activities?
9. What will be the tasks and responsibilities of the selected external organizations in relation to these activities?

Source: FAO, Farmers' Training Manual, Participatory Training and Extension for Farmers' Water Management, 2001a; Exercise 4C

6. How do I select teaching methods

Link to Part 1 'Developments in training in IWRM'

The following aspects need to be considered when selecting teaching methods:

- Goal of the course
- All learners are different (and therefore a combination of teaching methods is advisable)
- Logistical opportunities and limitations
- Experience of the trainer and the learners with different methods

Below an overview of different methods is given, also indicating for which purpose the method is relevant in particular.

Teaching methods

1. **Plenary introduction**
   A Plenary Introduction is normally the first activity to start a new training session. Its' main objective is to introduce the subject and to familiarize the participants to some basic concepts by referring to familiar and related topics. Pay attention to: time management
2. **Brainstorming**
   The main objective of a brainstorming session is to introduce new topics and to discover new ideas and responses very quickly by having the group describing the topic or idea by listing an exhaustive list of related characteristics and conditions.
3. **Small group discusssion**
   Instead of discussing one subject with the whole group, more subjects can be discussed by using small groups. The main objective is to give every participant a way to actively participate in the discussion.
4. **Plenary discussion/presentation**
   The plenary discussion can follow directly after small group discussions, but does not need to do so. The objective of the plenary discussion/presentation is to synthesize the ideas of the participants about a (new) topic or information that is discussed within the group. A training session using the method of plenary discussion may split up in small groups for small group discussions and continue with a plenary discussion for the formulation of the conclusion.

Training Methods (continued)

5. **Practical (field) activities**
   To give participants the opportunity to go to the field and experience a new technology by watching and doing. The objective is to learn through practicing new practices.
6. **Field walk/field observations**
   The objective of a field walk or field observation is to give participants the opportunity to learn through observations in the

field. The areas to be visited are their own fields within their irrigation scheme.

7. **Role play**
   In role-plays, participants use their own experiences to play a real life situation. The objective of the role-play is to face the participants with (a problem in) their real life situation, from different points of view and to let them find a solution in a creative way.
8. **Demonstrations**
   The objective of demonstrations is to introduce and demonstrate new or alternative farming practices or technologies. Through demonstrations farmers may be convinced of improving or selecting a technology. There are several types of demonstrations in the field.
   - **8 A. Demonstrations: field trials**
     A field trial is the introduction of a technology by the farmers themselves on a test area.
   - **8 B. Demonstrations: field tour**
     A Field Tour is an exchange visit to another area where new or alternative farming practices or technologies are used by other farmer(s) and demonstrated to the participants.

Source:Farmers' Training Manual for Participatory Training and Extension for Farmers' Water Management, FAO, 2001a.

7. Where do I find training materials on IWRM

Link to Part 1 'Developments in training in IWRM'

In Annex 3 an overview is given of a database on training materials as prepared by Cap-Net (www.cap-net.org)

It is extremely important to formulate the objectives of the course etc. along the lines as pointed out in the paragraph on curriculum development (5.2) before selecting a course and/or materials. For instance the content of the concept Integrated Water Resources Management (IWRM) is not the same in the courses listed.

8. How do I evaluate a day in a training course together with the course participants

Link to Part 1 'Developments in training in IWRM'

EXAMPLES OF EVALUATION METHODS DURING A TRAINING

The topic 'evaluation / personal learning points of the day' was an element of every day, and mentioned in the session plan. During half an hour (0.5 hr) the day was evaluated in different forms. As evaluation was a part of the content of the course, there were different methods for evaluation on different days, and there was a theoretic part on evaluation on day 9.

Day 2: Evaluation with cards

The evaluation of day 2 is done with cards, grouped as 'I learned', 'I liked', 'Least interesting was'. Yellow post-its were used to answer the three questions. The post-its were stuck together, and the total result was discussed.

As a result of the evaluation of day 2, the following answers were given:

I learned:
- Practice on PPT
- Basics of PPT
- Skills for good Communication
- Skills needed for trainers
- Conditions for good learning
- Learning process (3x)
- Learning experience and learning cycle
- Principles of learning
- Characteristics of Training
- Making action plans
- Curriculum Development
- Good and Effective Training Programme

Least interesting was:
- Course co-ordinator's question about learning and teaching
- Disturbance of interventions to questions
- Nothing (2x)
- All software programme
- Some remarks of audience

I liked:
- Use/Practice of/on PPT 4x
- PPT + Presentation (4x) by using PPT
- Motivation to learn
- Interactions between lecturer & trainees
- Interactive discussion on learning process (2x)
- Learning skills (2x)
- Discussions + Personal examples
- Group discussions
- PPT presentation individually
- Curriculum Development of a Programme with different participants (2x)
- Learning outcomes
- Questional methods
- Evaluation

Day 5: Evaluation by vote.

Participants can give their opinion on two questions, with each 4 pre-set options: 1. I feel a. happy; b. energised; c. tired; d.other (specify); 2. I have learned a. something (as per my expectation); b. more than I expected; c. less than I expected; d. other (specify).

As a result of the evaluation of day 5, the voting outcome was as follows:

- I feel happy 8x
- I feel energised 2x
- I feel tired 0x
- I feel other, specify... 0x
- I have learned something (as per my expectation) 8x
- I have learned more than I expected 1x
- I have learned less than I expected 1x
- I have learned other, specify ... 0x

Day 6: Evaluation by open questions

Post-it cards were handed out to answer four open questions, 'at the beginning of today, there was'; 'the best part of today was', 'the less interesting part of today was', 'my opinion on today's achievement is'. Day 6 was the first day of the second week of the course.

As a result of the evaluation of day 6, the questions were answered as follows:

At the beginning of today there was: ...

- Evaluation of activity last week undertaken
- Drawing on how I feel
- A start by asking the week-end experience (3)
- "Eagerness" on the beginning of a new week
- The drawing of pictures
- Cool weather
- The expectation that a new lecture (would start) but first we made a drawing on our feeling about the last week
- My expectation to do more on PPT
- The analysis of last week's training by making a drawing

2. The best part of today was ...

- The analysis of the training methods (2x)
- The video film for learning the methods for solution (2x)
- The comprehensive recollection of the last week's training (2x)
- The explanations on communication barriers
- The understanding of the trainer/researcher interaction
- The role play
- The finding of the block diagram (Dr Tripathi's guess game: we had to make a drawing based on the explanation he was giving to us)
- The video presentation / role play

3. The less interesting part of today was ...

- The revision of last week's topics (4)
- Nil 2x
- The analysis of training methods
- The self perception of line
- The analysis of training methods 2x

4. My opinion on today's achievement is ...

- good (4)
- excellent
- B+/ so-so (2)
- role –play, learning from video
- role of agriculture and teaching method
- analysis of the activities and finding out method material, style etc.

Day 8: Evaluation by drawing

Participants were requested to make a drawing to express their impressions of the action plans they are making.

Result evaluation day 8. The drawing was included to encourage creative expressions for the Action Plans, and to provide an opportunity to express oneself in an other way than with words. Normally the participants are hesitant about drawing: we are used to writing or talking to express ourselves, and therefore to not often consider this as a good alternative. The remark about the total collection of drawings made was that together we can make something impressive.

Source : Trainer Notes, Training Course 'Training for Trainers Course on Curriculum Development, Learning Theory and Presentation Skills', held 3 - 14 December 2001 at the Central Soil Salinity Research Institute - Karnal - India, and jointly organised by CSSRI and International Institute for Land Reclamation and Improvement - Wageningen - The Netherlands

9. How do I develop a training approach while taking the context into account

Example

The Training approach of the project 'Assistance to Irrigation Development in Botswana'

In the initial stage, the project focussed on technical training in the field of irrigated horticulture for irrigation staff. For that purpose, training in irrigation design and planning, crop water requirements, surveying, irrigation scheduling and construction was foreseen and organized. During the project, the training focus shifted from improving only the technical capacity of the staff to improving communication skills as well. It became clear that better communication with farmers was needed. This created the space to move from a discussion about 'right' or 'wrong' with regard to a technical design towards a discussion of 'technically correct design options with different implications for the user.'

Link to Part 1 'Developments in training in IWRM'

And instead of assuming that technical knowledge would filter down automatically, there was a need to train irrigation staff to become better trainers of farmers and extension staff. Finally, there appeared to be the need for feasilbity studies in order to establish technically feasible and economically viable irrigation schemes, in which farmers participated from the onset of the development of the scheme, as it would be their scheme. *Source: Catharien Terwisscha van Scheltinga, pers.med.*

10. Where do I find information on training courses for staff

Link to Part 1 'Developments in training in IWRM'

In Annex 1 and Annex 2 overviews are given of databases on training courses as maintained by FAO (http://www.fao.org/ag/agl/aglw/watertraining/index.stm) and Cap-Net (www.cap-net.org).

It is extremely important to formulate the objectives of the course etc. along the lines as pointed out in the paragraph on curriculum development (5.2) before selecting a course and/or materials. For instance the content of the concept Integrated Water Resources Management (IWRM) is not the same in the courses listed.

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- FAO (2001) *Guidelines and Manual on the Participatory Training and Extension in Farmers' Water management (PT&E-FWM).* FAO Digital Media Series, No. 14
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- FAO (2001) *Guidelines for participatory training and extension in farmers' water management (PT&E-FWM),* In: Participatory Training and Extension in Farmers' Water Management, FAO Land and Water Digital Media Series No. 14, FAO, Rome, 2001
- Kay, M. and Terwisscha van Scheltinga, C. (2003) *Towards sustainable irrigation and drainage through capacity building.* Paper No 128. Presented at the 9th International Drainage Workshop, September 10 – 13, 2003, Utrecht, The Netherlands
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- Underwood (1998) Baseline training needs assessment for community forestry in South Africa, Rural Development for Network - paper 24d, ODI, London

Curriculum development

- *Planning for Effective Training, a guide to curriculum development, FAO, Rome, 1993 (isbn 92-5-103413-3)*
- Innovation in Professional Education, steps on a journey from teaching to learning, Richard E. Boyatzis, Scott S. Cowen, David A. Kolb, and associates, Jossey-Bass Publishers, San Francisco, 1995 (isbn 0-7879-0032-X)
- Curriculum Development; theory into practice, Daniel Tanner, Laurel Tanner, Merrill/Prentice-Hall, New Jersey/Ohio, 1995 (isbn 0-02-418931-6), third edition
- Course Design, a guide to curriculum development for teachers, George J. Posner, Alan N. Rudnitsky, Longman, New York/London, 2001 (isbn 0-8013-32508), sixth edition
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Implementation

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Series, No. 14
- Training Skills for Supervisors, Donna Flanagan, IRC International Water and Sanitation Centre, The Hague, The Netherlands, Training Series No. 4, 1987

Evaluation
- FAO (2001) Farmers' Training Manual, Participatory Training and Extension for Farmers' Water Management, FAO Digital Media Series, No. 14

Context
- Kay, M. and Terwisscha van Scheltinga, C. (2003) *Towards sustainable irrigation and drainage through capacity building.* Paper No 128. Presented at the 9th International Drainage Workshop, September 10 – 13, 2003, Utrecht, The Netherlands

Databases on training

By FAO: http://www.fao.org/ag/agl/aglw/watertraining/default.stm *(see the overview attached in Annex 1)*
By Cap-Net: http://www.cap-net.org/CapTrainingEducationCourseBrowse.php *(see the overview attached in Annex 2)*

Training materials

FAO/ILRI Irrigation Water Management Training Manuals:
- No.1, Introduction to Irrigation, FAO/ILRI, 1985
  Also available on-line:
  http://www.fao.org/docrep/R4082E/R4082E00.htm
- No.2, Elements of topographic surveying, FAO/ILRI, 1985
  Also available on-line:
  http://www.fao.org/docrep/R7021E/R7021E00.htm
- No.3, Irrigation water needs, FAO/ILRI, 1986
  Also available on-line:
  http://www.fao.org/docrep/S2022E/S2022E00.htm
- No.4, Irrigation scheduling, FAO/ILRI, 1989
  Also available on-line at
  http://www.fao.org/docrep/T7202E/T7202E00.htm
- No.5, Introduction to Irrigation, FAO/ILRI, 1990
  Also available on-line at
  http://www.fao.org/docrep/S8684E/S8684E00.htm
- No.6, Scheme Irrigation Water Needs and Supply, FAO/ILRI, 1992
  also available on-line:
  http://www.fao.org/docrep/U5835E/U5835E00.htm
- No.7, Canals, FAO/ILRI, 1993
  also available on-line:
  ftp://ftp.fao.org/agl/aglw/docs/iwmtm7.pdf
- No.8, Structures for Water Control and Distribution, FAO/ILRI, 1993
  also available on-line:

ftp://ftp.fao.org/agl/aglw/docs/iwmtm8.pdf

- No.9, Drainage of irrigated lands, FAO/ILRI, 1996
  also available on-line:
  ftp://ftp.fao.org/agl/aglw/docs/iwmtm9.pdf
- No.10, Irrigation Scheme operation and maintenance, FAO/ILRI, 1996
  Also available on-line at:
  ftp://ftp.fao.org/agl/aglw/docs/iwmtm10.pdf
- Small scale pumped irrigation: energy & cost, FAO/Silsoe College, 1992
  also available on-line:
  ftp://ftp.fao.org/agl/aglw/docs/iwmtm8.pdf

NB The Irrigation Water Management Training Manuals are also available in the CD-Rom

Database on training materials

By Cap-Net : http://www.cap-net.org/TrainingMaterialBrowse.php *(see the overview as attached in Annex 3)*

Acknowledgements

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- All participants of courses in which I participated as a trainer or participant, for the knowledge and experience they shared with me.

ANNEX 1 Overview of the FAO Database on Education and Training Courses in Irrigation and Flood Control

Link to Part 1 'Developments in training in IWRM'

The database provides a description of the course, the topics, the target group, fee, duration, accomodation, indicates the training institution which organizes the course and whom to contact (email).

In the overview below, only the titles of the courses and the s are mentioned. For the detailed information, reference is made to the website (http://www.fao.org/ag/agl/aglw/watertraining/index.stm) or to the database in the CD-Rom (version of 27.10.04).Contact at FAO: water-training@fao.org.

Overview of courses of the FAO Database on Education and Training Courses in Irrigation and Flood Control

	Course	Country, Training Institution
1	Advanced Drainage Water Quality Course	Canada, Brace Centre for Water Resources Management
2	Advanced Use of Remote Sensing in Water Res. Mgt., Irr.& Dr.	Netherlands, Int'l Inst. for Geo-Information Science & Earth Observation ITC
3	Advances in Irrigation Engineering	Canada, Brace Centre for Water Resources Management
4	Advances in drainage and water management	Canada, Brace Centre for Water Resources Management
5	Agricultural and Environmental Engineering	Portugal, Instituto Superior de Agronomia
6	Applied microcomputer use in irrigation and drainage	United States of America, International Irrigation Center
7	Awareness training course on part. irr. management for famers of WUA's	India, Irrigation Management & Training Institute (IMTI)
8	Bachelor for Applied Science (Irrigation)	Australia, Charles Stuart University
9	Capacity building for Participatory Irrigation Management (PIM)	Italy, Mediterranean Agronomic Institute of Bari (CIHEAM)
10	Capacity building training course for members of managing committee of WUA's and Agriculture extension service persons	India, Irrigation Management & Training Institute (IMTI)
11	Dam Safety, Operation and Maintenance Int'l Seminar and Study Tour	United States of America, U.S. Department of the Interior
12	Design of sprinkler and trickle irrigation	United States of America, International Irrigation Center
13	Design of wells and pumps	United States of America, New Mexico State University

14	Designer/Manager School of Irrigation	United States of America, Irrigation Training and Research Center (ITRC)
15	Discharge measurement	Netherlands, IPC Groene Ruimte, International Vocational Training Centre
16	Drainage of Irrigated land	Netherlands, IPC Groene Ruimte, International Vocational Training Centre
17	Drinking Water Supply	Netherlands, IPC Groene Ruimte, International Vocational Training Centre
18	Drip Irrigation Design	United States of America, Irrigation Training and Research Center (ITRC)
19	Environmental Issues and European Policies on Water Management	Netherlands, International Agricultural Centre (IAC)
20	Environmental management and sustainable development	United Kingdom, Bradford Centre for International Development (BCID)
21	Environmental sanitation: Solutions & Management	Netherlands, International Water and Sanitation Centre (IRC)
22	Farmers workshop on related topics of irrigation and agriculture	India, Irrigation Management & Training Institute (IMTI)
23	Field analysis of irrigation systems	United States of America, International Irrigation Center
24	Gender and Equity in Water Supply and Sanitation	Netherlands, International Water and Sanitation Centre (IRC)
25	Ground water management	United States of America, New Mexico State University
26	Hydraulique Agricole (in French)	Burkina Faso, Ecole Inter-Etats d'Ingénieurs de l'Equipement Rural (EIER)
27	Hydrologic systems and modelling	Canada, Brace Centre for Water Resources Management
28	Hygiene ed.& promotion: Planning & Management for Behavioural Change	Netherlands, International Water and Sanitation Centre (IRC)
29	I: Economics of Water Resources and II: Water Resource Management	United Kingdom, Imperial College at Wye
30	Integrated Water Resource Management International Workshop	United States of America, U.S. Department of the Interior
31	Integrated Water Resource Management	United Kingdom, Water, Engineering and Development Centre (WEDC)
32	International Course on Drainage Execution and Maintenance (ICDEM)	Netherlands, Int'l Institute for Land reclamation and Improvement (ILRI)
33	International Course on Institutions in Water Management (ICIW)	Netherlands, Int'l Institute for Land reclamation and Improvement (ILRI)
34	International Course on Land Drainage (ICLD)	Netherlands, Int'l Institute for Land reclamation and Improvement (ILRI)

35	Int'l Master Programme I Environmental & Urban Hydroinformatics	Netherlands, Int'l Inst. for Infrastructural, Hydraulic & Environmental Eng.(IHE)
36	Int'l Master Programme in Coastal Eng. & Port Development (CE&PD)	Netherlands, Int'l Inst. for Infrastructural, Hydraulic & Environmental Eng.(IHE)
37	Int'l Master Programme in Land & Water Development (LWD)	Netherlands, Int'l Inst. for Infrastructural, Hydraulic & Environmental Eng.(IHE)
38	Int'l Master Programme in River Eng.& River Basin Dev. (RERBD)	Netherlands, Int'l Inst. for Infrastructural, Hydraulic & Environmental Eng.(IHE)
39	Int'l Master Programme in Sanitary & Environmental Engineering (SEE)	Netherlands, Int'l Inst. for Infrastructural, Hydraulic & Environmental Eng.(IHE)
40	Int'l Master Programme in Water & Environmental Res. Management	Netherlands, Int'l Inst. for Infrastructural, Hydraulic & Environmental Eng.(IHE)
41	International Post-Graduate course on Water Management	Turkey, International Agrohydrology Research and Training Center (IARTC)
42	Int'l short course in Integrated Coastal Zone Management (ICZM)	Netherlands, Int'l Inst. for Infrastructural, Hydraulic & Environmental Eng.(IHE)
43	Int'l short course in Service Oriented Management of Irr.Schemes	Netherlands, Int'l Inst. for Infrastructural, Hydraulic & Environmental Eng.(IHE)
44	Introduction to the Economics of Irrigation and Drainage	United Kingdom, Stephen Merrett
45		Irrigation District School of Irrigation United States of America, Irrigation Training and Research Center (ITRC)
46	Irrigation Equipment (in English and French)	Morocco, Agromomical and Veterinary Institute Hassan II
47	Irrigation Methods	Netherlands, IPC Groene Ruimte, International Vocational Training Centre
48	Irrigation Scheduling	United States of America, New Mexico State University
49	Irrigation System Evaluation Class I + II	United States of America, Irrigation Training and Research Center (ITRC)
50	Irrigation System management transfer and water user organization	United States of America, International Irrigation Center
51	Irrig.Water Management. Post Graduate Dipl. & Master of Eng. Degree	India, Water Resources Development Training Centre (WRDTC)
52	Irrigation and drainage under ecological constraints (in Russian)	Israel, Centre for International Agricultural Development Cooperation (CINADCO)
53	Irrigation and water management study tour of western USA	United States of America, International Irrigation Center

54	M.S. in Agriculture, speciality in Irrigation	United States of America, Irrigation Training and Research Center (ITRC)
55	MSc programme in Water Resources Engineering and Management	Zimbabwe, Dept. of Civil Engineering, University of Zimbabwe
56	Management of Irrigation Projects (MIP)	Swaziland, Mananga Centre for Regional Integration and Management Dev.
57	Management of Water Resources for Urban and Agriucultural Use	Israel, Centre for International Agricultural Development Cooperation (CINADCO)
58	Master on Irrigation and Agricultural Resources Engineering	Portugal, Instituto Superior de Agronomia
59	Methodes modernes d'irrigation et vulgarisation agricole (in French)	Israel, Centre for International Agricultural Development Cooperation (CINADCO)
60	Modern Techniques in Groundwater Exploration Management	Netherlands, Int'l Inst for Geo-Information Science and Earth Observation ITC
61	Modernization, Rehabilitation & transfer of irrigation delivery systems	United States of America, International Irrigation Center
62	Monitoring for Effectiveness in Community-Based Water Supply & San	Netherlands, International Water and Sanitation Centre (IRC)
63	National training course on " On Farm Water Management"	India, Water Technology Centre (WTC)
64	Natural Resources Management	Netherlands, Int'l Inst for Geo-Information Science and Earth Observation ITC
65	Natural Resources Management	Netherlands, Int'l Inst for Geo-Information Science and Earth Observation ITC
66	On-farm irrigation: desing, evaluation and scheduling	United States of America, International Irrigation Center
67	On-farm water management, extension, transfer of managament to users, and the role of women in irrigated agriculture	United States of America, International Irrigation Center
68	Operation and Maintenance of Irrigation Pumping Station	Slovakia, Research Institute of Irrigation, Drainage and Landscape Engineering
69	Operation, maintenance and management of irrigation delivery systems and the transfer of management to users	United States of America, International Irrigation Center
70	Orientation course for field level officers & members of managing committee of WUA's	India, Irrigation Management & Training Institute (IMTI)
71	Participatory training methodologies for the empowerment of rural women in the Medeterranean area for sustainable irrigated crop production	Italy, ICID-Italy
72	Planification de Redes de Riego a Presion (in Spanish)	Israel, Centre for International Agricultural Development Cooperation (CINADCO)

73	Postgraduate study on Hydrogeology & groundwater resources (in E&F)	Switzerland, Inst of Soil&Water Management, Ecole Polyt. Fédérale de Lausanne
74	Postgraduate study on Hydrology & Water Resources Management (E&F)	Switzerland, Inst of Soil&Water Management, Ecole Polyt. Fédérale de Lausanne
75	Practical simulation/optimization models for optimal groundw. man.	United States of America, International Irrigation Center
76	Pressurized irrigation systems	Israel, Centre for International Agricultural Development Cooperation (CINADCO)
77	R&D in Irrigation and Fertigation in Controlled Environment	Israel, Centre for International Agricultural Development Cooperation (CINADCO)
78	Remote Sensing and GIS Applications for Integrated Catchment & Water Management (ICWM)	Netherlands, Int'l Inst for Geo-Information Science and Earth Observation ITC
79	River Basin Management: Application of the EU Water Framework Directive	Netherlands, International Agricultural Centre (IAC)
80	Small scale irrigation design and maintenance	United States of America, New Mexico State University
81	Structures for Water Control and Distribution	Netherlands, IPC Groene Ruimte, International Vocational Training Centre
82	Supervisory Control and Data Acquisition (SCADA) for Irrigation	United States of America, ITRC
83	Technical Training tailored to the needs of the requesting organization	United States of America, U.S. Department of the Interior
84	Technical training course for assistant engineers and junior engineers	India, Irrigation Management & Training Institute (IMTI)
85	Technology and Sustainable Development (TSD)	India, Madras
86	Topographic Surveying, level I and II	Netherlands, IPC Groene Ruimte, International Vocational Training Centre
87	Training Course on Ground Water & its Management	India, Irrigation Management & Training Institute (IMTI)
88	Training Course on Irrigation management for Operating Level	India, Irrigation Management & Training Institute (IMTI)
89	Training Course on Waterlogging and Drainage	India, Irrigation Management & Training Institute (IMTI)
90	Training Course on Watershed Management	India, Irrigation Management & Training Institute (IMTI)
91	Training course for office bearers of distributary and project committee	India, Irrigation Management & Training Institute (IMTI)
92	Training course on Drip and Sprinkler Irrigation Systems	India, Irrigation Management & Training Institute (IMTI)
93	Training course on Network planning	India, Irrigation Management & Training Institute (IMTI)
94	Training course on Operation and Maintenance of irrigation systems	India, Irrigation Management & Training Institute (IMTI)
95	Training course on Part.irrigation management for middle level officers	India, Irrigation Management & Training Institute (IMTI)
96	Training course on Participatory irr. management for senior level officers	India, Irrigation Management & Training Institute (IMTI)
97	Training course on Rajasthan irrigation and drainage act	India, Irrigation Management & Training Institute (IMTI)

98	Training course on Socio-economic aspects of irrigation projects	India, Irrigation Management & Training Institute (IMTI)
99	Training course on computer applications (module I-XI)	India, Irrigation Management & Training Institute (IMTI)
100	Training course on conjunctive use of water	India, Irrigation Management & Training Institute (IMTI)
101	Training course on conveyance efficiency and flow measurement	India, Irrigation Management & Training Institute (IMTI)
102	Training course on diagnostic analysis of irrigation systems	India, Irrigation Management & Training Institute (IMTI)
103	Training course on forest and environmental clearance of irr. projects	India, Irrigation Management & Training Institute (IMTI)
104	Training course on foundation cum induction course	India, Irrigation Management & Training Institute (IMTI)
105	Training course on irrigation management for junior level	India, Irrigation Management & Training Institute (IMTI)
106	Training course on irrigation management for middle level	India, Irrigation Management & Training Institute (IMTI)
107	Training course on irrigation management for senior level	India, Irrigation Management & Training Institute (IMTI)
108	Training course on irrigation scheduling	India, Irrigation Management & Training Institute (IMTI)
109	Training course on land acquisition act	India, Irrigation Management & Training Institute (IMTI)
110	Training course on quality assurance and quality control	India, Irrigation Management & Training Institute (IMTI)
111	Training course on waribandi	India, Irrigation Management & Training Institute (IMTI)
112	Training course on water application methods	India, Irrigation Management & Training Institute (IMTI)
113	Training course for trainer core groups	India, Irrigation Management & Training Institute (IMTI)
114	Training/orientation course for admininistrative level officers of irrigation & agriculture department on PIM	India, Irrigation Management & Training Institute (IMTI)
115	Training/orientation course for senior level officers of irrigation & agriculture department	India, Irrigation Management & Training Institute (IMTI)
116	Urban Infrastructure, Engineering and Management	Netherlands, Int'l Inst for Infrastr., Hydraulic and Environmental Engineering (IHE)
117	Water Resources Development (civil). Post Graduate Diploma and Master of Engineering Degree	India, Water Resources Development Training Centre (WRDTC)
118	Water Resources Management	United Kingdom, Overseas Development Group (ODG)
119	Water Resources Management	Australia, International Technologies Centre
120	Water Resources Management and Development	Swaziland, Mananga Centre for Regional Integration & Management Development
121	Water Resources and Environmental Management	Netherlands, Int'l Inst. for Geo-Information Science and Earth Observation ITC
122	Water Resources and Environmental Management	Netherlands, Int'l Inst. for Geo-Information Science and Earth Observation ITC
123	Water course rehabilitation and maintenance	United States of America, New Mexico State University

124	Workshop on Account procedure for officials & members of Water Users' Associations of Gudha project	India, Irrigation Management & Training Institute (IMTI)
125	Workshop on Community Water Supply Management	Netherlands, International Water and Sanitation Centre (IRC)
126	Workshop on Farmer's Participation in Irrigation Management	India, Irrigation Management & Training Institute (IMTI)

ANNEX 2 Overview of the Cap-Net Database on Training and Education in IWRM

Link to Part 1 'Developments in training in IWRM'

Source: http://www.cap-net.org/CapTrainingEducationCourseBrowse.php (as on 22.10.2003)

The enabling environment

Legislation, National and International Water Law.

1. Water Law; Institute :Institute of Water and Environment/Cranfield University
2. LL.M. in International Water Resources Law; Institute :McGeorge School of Law/University of The Pacific
3. Ocean Governance: Policy, Law, and Management; Institute :the International Ocean Institute (IOI), Dalhousie University
4. LL.M in International & Comparative Water Law & Policy; Institute :University of Dundee, Water Law and Policy Programme
5. MSc in Water Studies; Institute :University of Dundee, Water Law and Policy Programme
6. Water Law and Institutions; Institute :UNESCO-IHE Institute for Water Education

Financing Management and Investment.

7. Financing water development; Institute :Institute of Water and Environment/Cranfield University
8. Marketing and Financial Management; Institute :UNESCO-IHE Institute for Water Education

Policies on Management and Use of Water Resources.

9. Water Law; Institute :Institute of Water and Environment/Cranfield University
10. Economics of Environment and Resource Management; Institute :Institute of Water and Environment/Cranfield University
11. Water Politics and Globalisation; Institute :Institute of Water and Environment/Cranfield University
12. Society and Water Policy Evaluation; Institute :Institute of Water and Environment/Cranfield University
13. Ocean Governance: Policy, Law, and Management; Institute :the International Ocean Institute (IOI), Dalhousie University
14. Diploma in Water Supply and Sanitation; Institute :Institute of Water and Sanitation Development
15. International Water Management; Institute :Swiss Federal Institute for Environmental Science and Technology, Switzerland.
16. Water and International Development; Institute :The University of

British Columbia

17. LL.M in International & Comparative Water Law & Policy; Institute :University of Dundee, Water Law and Policy Programme
18. MSc in Water Studies; Institute :University of Dundee, Water Law and Policy Programme
19. Knowledge Management for Decision Makers in the Water Sector; Institute :UNESCO-IHE Institute for Water Education

Institutions

Organisational Framework.

20. Integrating Water Quality Goals Through Total Maximum Daily Loadings (TMDL); Institute :University of Wisconsin Madison
21. Community Management of Water Supplies and Sanitation; Institute :Institute of Water and Sanitation Development
22. COMMUNITY MANAGEMENT OF WATER SUPPLY AND ENVIRONMENTAL SANITATION PROGRAMMES; Institute :NETWAS Network for Water and Sanitation
23. International Course on Institutions in Water Management (ICIW); Institute :Alterra-ILRI
24. Water Law and Institutions; Institute :UNESCO-IHE Institute for Water Education

Institutional Capacity Building, Including Human Resources.

25. International Course on Institutions in Water Management (ICIW); Institute :Alterra-ILRI
26. Strategic Management and Public Private Partnerships; Institute :UNESCO-IHE Institute for Water Education
27. Change Management; Institute :UNESCO-IHE Institute for Water Education
28. Water Law and Institutions; Institute :UNESCO-IHE Institute for Water Education

Management instrument

Water Resource Assessment.

29. Planning, Implementation, Management and Maintenance of Water Resources Projects; Institute :National Water Resources Institute, Kaduna, NIGERIA
30. Remote Sensing and GIS applications for Integrated Catchment and Water Management (ICWM); Institute :International Institute for Geo-Information Science and Earth Observation
31. Groundwater Resources Monitoring, Evaluation and Modelling; Institute :ITC - International Institute for Geo-Information Science and Earth Observation
32. Advanced Use of Remote Sensing in Water Resource Management, Irrigation and Drainage; Institute :ITC - International Institute for Geo-Information Science and Earth Observation
33. Geo-information and Earth Observation for Integrated Catchment and Water Management; Institute :ITC- International

Planning Water Resource Management and Development.

34. Ocean Governance: Policy, Law, and Management; Institute :the International Ocean Institute (IOI), Dalhousie University
35. Diploma in Water Supply and Sanitation; Institute :Institute of Water and Sanitation Development
36. International Water Management; Institute :Swiss Federal Institute for Environmental Science and Technology, Switzerland.
37. Planning, Implementation, Management and Maintenance of Water Resources Projects; Institute :National Water Resources Institute, Kaduna, NIGERIA
38. Change Management; Institute :UNESCO-IHE Institute for Water Education
39. Water Resources Planning; Institute :UNESCO-IHE Institute for Water Education Water Allocation and Demand Management.

Social Change and Stakeholder Participation.

40. Society and Water Policy Evaluation; Institute :Institute of Water and Environment/Cranfield University
41. Community Management of Water Supplies and Sanitation; Institute :Institute of Water and Sanitation Development
42. Diploma in Water Supply and Sanitation; Institute :Institute of Water and Sanitation Development
43. Measurement of Impact and Practical Implication of Human Activity on Water Quality; Institute :National Water Resources Institute, Kaduna, NIGERIA
44. PARTICIPATORY METHODS IN PLANNING AND MANAGEMENT OF WATER AND ENVIRONMENTAL PROJECTS/PROGRAMMES; Institute :NETWAS Network for Water and Sanitation
45. COMMUNITY MANAGEMENT OF WATER SUPPLY AND ENVIRONMENTAL SANITATION PROGRAMMES; Institute :NETWAS Network for Water and Sanitation

Regulatory Instruments and their Application.

46. Catchment Management of Water Quality; Institute :Institute of Water and Environment/Cranfield University
47. Water Law; Institute :Institute of Water and Environment/Cranfield University

Negotiation Skills, Conflict Resolution.

48. Water Politics and Globalisation; Institute :Institute of Water and Environment/Cranfield University
49. Conflict Prevention and Cooperation in International Water Resources; Institute :WaterNet
50. PARTICIPATORY METHODS IN PLANNING AND

MANAGEMENT OF WATER AND ENVIRONMENTAL PROJECTS/PROGRAMMES; Institute :NETWAS Network for Water and Sanitation

Economic Management Instruments.

51. Financing water development;Institute :Institute of Water and Environment/Cranfield University
52. Economics of Environment and Resource Management; Institute :Institute of Water and Environment/Cranfield University
53. Operations Management; Institute :UNESCO-IHE Institute for Water Education
54. Marketing and Financial Management; Institute :UNESCO-IHE Institute for Water Education

Information Management, Monitoring.

55. Change Management; Institute :UNESCO-IHE Institute for Water Education
56. Knowledge Management for Decision Makers in the Water Sector; Institute :UNESCO-IHE Institute for Water Education
57. Remote Sensing and GIS applications for Integrated Catchment and Water Management (ICWM); Institute :International Institute for Geo-Information Science and Earth Observation
58. Groundwater Resources Monitoring, Evaluation and Modelling; Institute :ITC - International Institute for Geo-Information Science and Earth Observation
59. Advanced Use of Remote Sensing in Water Resource Management, Irrigation and Drainage; Institute :ITC - International Institute for Geo-Information Science and Earth Observation

Water Quality Management

60. Catchment Management of Water Quality; Institute :Institute of Water and Environment/Cranfield University
61. Integrating Water Quality Goals Through Total Maximum Daily Loadings (TMDL); Institute :University of Wisconsin Madison
62. MSc Water and Wastewater Engineering; Institute :School of Water Sciences, Cranfield University
63. Measurement of Impact and Practical Implication of Human Activity on Water Quality; Institute :National Water Resources Institute, Kaduna, NIGERIA
64. Water Quality Assessment; Institute :UNESCO-IHE Institute for Water Education
65. Water Quality Control in Water Supply; Institute :UNESCO-IHE Institute for Water Education

Others

66. Community Management of Water Supplies and Sanitation; Institute :Institute of Water and Sanitation Development

IWRM in general

Most IWRM Subjects

67. Water Management in Tropical and Subtropical Regions; Institute :University of Applied Sciences
68. Integrated Watershed Management; Institute :Institute for Resources and Environment
69. Water Resources Engineering and Management (WERM); Institute :University of Zimbabwe
70. Water Resources; Institute :University of Wales
71. Integrated Water Resources Management; Institute :DHI Water & Environment
72. MSc in Water Management; Institute :Institute of Water and Environment, Cranfield University
73. IEWM Integrated Environment and Water Management; Institute :DHI Water & Environment
74. International Post-graduate Course on Hydrology with special regard to IWRM; Institute :Water Resources Research Centre
75. Water Resources Engineering Management; Institute :Department of Water Resources Engineering, University of Dar es Salaam
76. INTEGRATED WATER RESOURCES MANAGEMENT; Institute :School of Civil Engineering, Asian Institute of Technology
77. Integrated Tropical Coastal Zone Management; Institute :Asian institute of technology
78. Building Capacity in Integrated Water Resources Management; Institute :Network for Water and Sanitation International
79. Integrated Watershed Management; Institute :The University of British Columbia
80. MSc Water Resources Technology and Management; Institute :Department of Civil Engineering, School of Engineering, University of Birmingham
81. Masters in Integrated Water Resources Management; Institute :University of the Western Cape
82. MA in Environment and Development & MSc in Development Studies: Water and Water Policy; Institute :School of Oriental and African Studies, University of London
83. MBA in Water Resources Management; Institute :University of Dundee, Water Law and Policy Programme
84. Applied IWRM - Level 1; Institute :Hydrogeology Center, University of Neuchatel
85. Integrated Coastal Zone Management; Institute :UNESCO-IHE Institute for Water Education
86. Watershed Management; Institute :UNESCO-IHE Institute for Water Education

87. IWRM; Institute :Regional Center For Training and Water Studies (RCTWS-Egypt)
88. Integrated Water Resources Management; Institute :Center for Environmental and Geographic Information Services (CEGIS)

Sector interactions

Water management and drinking water supply

89. Water and International Development; Institute :The University of British Columbia
90. Planning and Design of Low Cost Water Supply for Rural Areas; Institute :National Water Resources Institute, Kaduna, NIGERIA
91. M.Sc. in Water Supply and Environmental Sanitation; Institute :Department of Civil Enginering, Kwame Nkrumah University of Science and Technology
92. MANAGEMENT FOR SUSTAINABILITY OF WATER SUPPLY AND SANITATION PROGRAMMES; Institute :NETWAS Network for Water and Sanitation
93. Operations Management; Institute :UNESCO-IHE Institute for Water Education
94. Water Quality Control in Water Supply; Institute :UNESCO-IHE Institute for Water Education
95. Strategic Management and Public Private Partnerships; Institute :UNESCO-IHE Institute for Water Education
96. Integrated Water Resources Management; Institute :Center for Environmental and Geographic Information Services (CEGIS)

Water management and environment

97. International Water Management; Institute :Swiss Federal Institute for Environmental Science and Technology, Switzerland.
98. MSc Water Resources Technology and Management; Institute :Department of Civil Engineering, School of Engineering, University of Birmingham
99. M.Sc. in Water Supply and Environmental Sanitation; Institute :Department of Civil Enginering, Kwame Nkrumah University of Science and Technology
100. Integrated Water Resources Management; Institute :Center for Environmental and Geographic Information Services (CEGIS)

Water management and agriculture

101. Water and International Development; Institute :The University of British Columbia
102. MSc Water Resources Technology and Management; Institute :Department of Civil Engineering, School of Engineering, University of Birmingham
103. Integrated Water Resources Management; Institute :Center for Environmental and Geographic Information Services (CEGIS)

ANNEX 3 Overview of the Cap-Net Database on Training Material in IWRM

Link to Part 1 'Developments in training in IWRM'

Source: http://www.cap-net.org/TrainingMaterialBrowse.php (as on 22.10.2003)

The enabling environment

Legislation, National and International Water Law.

1. Water and Public Health; Material owner:WHO Documentation Centre
2. Institutional Frameworks, WHO Guidelines for Drinking Water Quality Training Pack; Material owner:WHO Documentation Centre
3. Legislative Frameworks, WHO Guidelines for Dinking Water Quality Training Pack; Material owner:WHO Documentation Centre
4. Enabling Environment and Institutions for Integrated Water Resources Management; Material owner:World Bank Institute
5. Legal and Regulatory Setting for Integrated Water Resources Management; Material owner:UNESCO-IHE
6. Water Law and Institutions; Material owner:UNESCO-IHE

Financing Management and Investment.

Policies on Management and Use of Water Resources.

7. WHO Guidelines for Drinking Water Quality Training Pack; Material owner:WHO
8. Enabling Environment and Institutions for Integrated Water Resources Management; Material owner:World Bank Institute

Others

9. Cost Recovery, WHO Guidelines for Drinking Water Quality Training Pack; Material owner :WHO Documentation Centre

Organisational Framework.

10. Toolkits for Private Participation in Water and Sanitation; Material owner:The World Bank
11. Institutional Frameworks, WHO Guidelines for Drinking Water Quality Training Pack; Material owner:WHO Documentation Centre
12. Enabling Environment and Institutions for Integrated Water Resources Management; Material owner:World Bank Institute
13. Water Law and Institutions; Material owner:UNESCO-IHE

Institutional Capacity Building, Including Human Resources.

14. Farmers' Training Manual for Participatory Training and Extension; Material owner:The Water Resources, Development and Management Service, FAO
15. Training of Trainers in Marine Protected Areas Management; Material owner:UNEP - CEPNET
16. Human Resources, WHO Guidelines for Drinking Water Quality Training Pack; Material owner:WHO Documentation Centre
17. Water Law and Institutions; Material owner:UNESCO-IHE

Management instrument

Water Resource Assessment.

18. Water in the Mediterranean; Material owner:MIO-ECSDE
19. Understanding the Water Cycle; Material owner:Swiss Centre of Hydrogeology

Planning Water Resource Management and Development.

20. Farmers' Training Manual for Participatory Training and Extension; Material owner:The Water Resources, Development and Management Service, FAO
21. Guide to Monitoring and Evaluation of Irrigation Management Transfer.; Material owner:Japanese Institute for Irrigation and Drainage & INPIM
22. Electronic learning guidebook on Participatory Irrigation Management; Material owner:World Bank Institute (WBI)
23. Toolkits for Private Participation in Water and Sanitation; Material owner:The World Bank
24. Disaster mitigation in water and sanitation systems; Material owner:CEPIS - PAHO
25. Training of Trainers in Marine Protected Areas Management; Material owner:UNEP - CEPNET

Water Allocation and Demand Management.

26. Water in the Mediterranean; Material owner:MIO-ECSDE
27. Guide to Monitoring and Evaluation of Irrigation Management Transfer.; Material owner:Japanese Institute for Irrigation and Drainage & INPIM
28. Electronic learning guidebook on Participatory Irrigation Management; Material owner:World Bank Institute (WBI) Social Change and Stakeholder Participation.
29. Toolkits for Private Participation in Water and Sanitation; Material owner:The World Bank
30. Advocacy manual for Gender and Water Ambassadors; Material owner:Gender & Water Alliance

Regulatory Instruments and their Application.

31. Institutional Frameworks, WHO Guidelines for Drinking Water Quali Training Pack; Material owner:WHO Documentation Centre

Negotiation Skills, Conflict Resolution.

Economic Management Instruments.

32. Electronic learning guidebook on Participatory Irrigation Management; Material owner:World Bank Institute (WBI)
33. Economic Dimensions of Water Resources Management; Material owner:World Bank Institute

Information Management, Monitoring.

34. Water in the Mediterranean; Material owner:MIO-ECSDE
35. Guide to Monitoring and Evaluation of Irrigation Management Transfer.; Material owner:Japanese Institute for Irrigation and Drainage & INPIM

Water Quality Management

36. WHO Guidelines for Drinking Water Quality Training Pack; Material owner:WHO
37. Sewage Treatment Operators Manual for the Caribbean Region; Material owner:UNEP - CEPNET
38. Water and Public Health; Material owner:WHO Documentation Centre

Others

39. Disaster mitigation in water and sanitation systems; Material owner :CEPIS - PAHO
40. Cost Recovery, WHO Guidelines for Drinking Water Quality Training Pack; Material owner :WHO Documentation Centre

IWRM in general

Most IWRM Subjects

41. Education materials on monitoring and protection of watersheds; Material owner:Earth Force
42. Introduction to Integrated Water Resources Management; Material owner:World Bank Institute
43. Understanding the Water Cycle; Material owner:Swiss Centre of Hydrogeology

Sector interactions

Water management and drinking water supply

44. Water and Public Health; Material owner:WHO Documentation Centre
45. Water Supply, Sanitation and Health with IWRM Considerations.; Material owner:World Health Organisation

Water management and environment

46. Education materials on monitoring and protection of watersheds; Material owner:Earth Force
47. Disaster mitigation in water and sanitation systems; Material owner:CEPIS - PAHO

48. Ecosystems and Water; Material owner:Swiss Centre of Hydrogeology

Water management and agriculture

49. IWRM and Agriculture; Material owner:UNESCO-IHE

Chapter 3 The socio-economic base line survey

Aart Schrevel

Learning goals

After having studied the contents of the chapter and having done the exercises, the reader will be able to:

- explain the purposes of a socio-economic Base Line Survey
- understand the functions of the socio-economic base line data in a project
- list the main categories of data to be collected
- list the phases of the Base Line Survey
- understand the basics of socio-economic survey methodology (sampling, the questionnaire, reporting)
- understand the work relation between the project management and the research team

1. Introduction

At some point in their career, managers and other senior staff of rural development projects – irrigation and drainage projects – find themselves in the situation that they have to commission a socio-economic Base Line Survey. They will have to instruct one of their staff members, or more likely, recruit a researcher from outside, to make a proposal, which they then will have to evaluate. Subsequently they will have to supervise the execution of the Base Line Survey, direct it, and accept and use its results. This chapter is instrumental in preparing them for these tasks. It describes the socio-economic Base Line Survey itself, how it is to be conducted, and the kind of information that it generates. It explains the minimal requirements for a proper Base Line Survey, and introduces such subjects as sampling, the questionnaire, and criteria for assessing the quality of a final report.

project manager'

'researcher'

'intervention'

In the following the term 'project manager' will be used as short for project managers and other – senior – staff of irrigation and drainage projects. Most likely they have a training as irrigation or drainage engineer. The term 'researcher' applies to the expert or the institute which is given the task to 'undertake a Base Line Survey. With 'intervention' is meant the project activities in the field (e.g. construction or rehabilitation of irrigation and drainage infrastructure). In all cases the word 'he' is used, rather than 'he/she', although that would have been more appropriate..

2. Purpose and definition of the Base Line Survey

Today, irrigation, drainage, and other rural development projects invariably have at least one socio-economic objective as one out of several objectives. Thus, projects are to 'improve the living conditions of the rural population', 'to increase the income of the rural poor', or 'to enhance the position of rural women'. The Base Line Survey can be used by project managers to help them to achieve such an objective, or more accurately, to help a manager to ascertain that he has achieved the social objective of his project. The definition of the Base Line Survey is:

definition

a project management instrument to assess the socio-economic conditions of the population of the project area prior to changes in these conditions due to an intervention.

The definition is straightforward and simple. It says that project managers, by applying the Base Line Survey instrument, obtain information about the actual socio-economic situation in their project area, and that this information should be collected before the project will start its activities, thus before conditions in the field are changed by a project. Box 1 is an example of the questions that were asked during a socio-economic Base Line Survey that was implemented within the framework of an irrigation construction project in Rajahstan, India.

example

Box 1

The Project Management Unit of a large scale irrigation implementation project in Northwest India decided to organise a base line survey. The survey covered such diverse subjects as demographic composition of households, cropping patterns and yields, distribution of land and land transactions, main occupations of household members, labour input in agriculture, livestock ownership, income sources and levels, literacy rates, borrowings, migration, and willingness to participate in project implementation activities

functions

The Base Line Survey serves two functions. These are:

- to assess socio-economic conditions as they prevail in a survey area prior to an intervention, and,
- to provide project managers with the information that they need during project implementation about prevailing socio-economic conditions

The first function is the most important one. Every project in a rural setting has an effect on the socio-economic conditions of the population. If all goes well, projects generate benefits and these benefits are available to the inhabitants of the area where the project takes place. It is not certain that all inhabitants benefit to the same extent and in fact some may even see their position deteriorate

because of a project. By executing a Base Line Survey the socio-economic conditions that exist before the project are measured and recorded.

Different categories of households

Typically the socio-economic Base Line Survey distinguishes between different categories of households, like poor and rich farmers, upstream and downstream farmers, or farmers with land to be drained by the project and without.

At a later moment, after the project has been completed, the socio-economic conditions can be measured again. By comparing the socio-economic conditions before and after the intervention conclusions can be drawn with regard to the success of the project in realising its socio-economic objectives.

before and after

More in particular a comparison allows conclusions to be drawn with regard to the question which households benefited most, and which less or not at all from the project. The Base Line Survey serves to appraise conditions before the project intervention. The survey that is taking place after the intervention is completed is called an Impact Assessment Survey. Basically the Impact Assessment Survey is a repetition of the Base Line Survey, although it is usually possible to shorten the numbers of issues addressed.

Impact Assessment Survey

Socio-economic surveys generate a wealth of data on the actual living conditions of the population of the project area. They inform project managers about the composition of households, about their sources of income, and hence, their relative dependence on agriculture, about differences in wealth, about the livelihoods of the project area population, etc. Base Line Surveys also inform project managers about the aspirations of households with regard to the project and its management. Intelligent project managers know how to use this data to improve the outcome of their projects.

source of data

Indeed the socio-economic Base Line Survey is a great opportunity to learn to understand better the population of a project area. Usually not much information about this is available at the start of a project. Thus it may happen that the researcher responsible for undertaking the socio-economic Base Line Survey is being asked to collect all kind of information, 'now that he is in the field anyway'. This could easily lead to the situation that the survey becomes overloaded with questions and becomes too time consuming and expensive to carry out, both for the project as well as for the respondents.

avoid overload

3. Managing the survey

Management situations

Managing a Base Line Survey means that at least two situations have to be *ment*dealt with:

- commissioning the survey, and
- supervising the execution of the survey.

To this can be added that the manager will have the opportunity to:

- apply the results of the survey

One of the first questions that a project manager will have to answer is who he should instruct or ask to implement the survey. Obviously the project manager will insist on the best possible candidate. The project manager can either instruct one of his staff to undertake the survey, but in case the required expertise is not available at the project, he will have to hire expertise from outside. The latter condition is more likely. Usually the work is commissioned by direct assignment or is tendered. In both cases the project manager needs to have a good understanding of the work to be done.

Research institutions

The most likely place to find the required expertise is a local university. Thiscan be a general university which covers the full range of academic disciplines, or an agricultural university. Technical universities usually do not have the required expertise under their roof. Within a general university, the Department of Rural Development, Department of Sociology/Social Development, Department of Geography, Department of Socio-Economics, or the Department of Agriculture are most likely to have staff members trained to do this kind of work. Moreover, junior staff members and recently graduated students can be expected to be available as survey assistants.

Box 2.

country	*project focus*	*commissioned to*
Indonesia	*rural development and forestry*	*free lance consultants*
Indonesia	*irrigation rehabilitation*	*NGO*
India	*irrigation construction*	*development research institute*
Pakistan	*drainage pilot*	*free lance consultant*
China	*land reclamation*	*own staff*
Malaysia	*swamp protection*	*local university*

In a country like India, development research institutions exist that can do the job. In Indonesia several NGO's (Non-Governmental Organisations) qualify. In other countries, NGO's seem to have a far more applied-work attitude and do have the kind of academic

orientation that is required to do a Base Line Survey. Also rarely NGO's focus on water management development at field level. If they work in villages, they are more likely to focus on community development aspects. Finally, consultancy firms may qualify. Box 2 contains details regarding the author's experience with commissioning Base Line Surveys in different countries.

selection criteria

How can a project manager ascertain whether or not a candidate institution is suitable to do the work? Basically, by finding the answers to the following questions:

- does the candidate institute have experience in doing this kind of work (track record)?
- can it produce an acceptable survey plan?
- can it make the required staff (expertise) available?
- is the price acceptable?

These questions must be asked, either orally or in written. Prove of experience can be provided in much the same way as consultancy firms apply to prove their track record with regard to particular assignments. A list can be asked of all the surveys that the candidate institution has undertaken in the past, including details to clarify the nature of the survey. A survey plan should minimally describe the work to be done, the staff assigned to do the survey, when and over which period the survey is to take place, and the compensation that is required.

supervision

The supervision task preferably remains in the hands of the most senior project manager with a specialisation in the socio-economics of rural development. Day-to-day tasks can be delegated to a project staff member who is well informed about the requirements of the Base Line Survey (as described in this chapter). Preferably this person has a training as a socio-economist or rural sociologist. If not available, a person with a background in one of the engineering sciences can be given the task, provided that he has followed a training in basic socio-economic survey techniques.

4. Phases and the research plan

Four phases

In essence, the phases of the socio-economic Base Line Survey entail:

- preparation
- data collection
- data processing
- reporting

Each of the four phases needs to be broken down into sub-phases, or tasks. The tasks are implemented in their proper order. Some of the tasks are the responsibility of the project manager, others of the researcher. It is important to make a strict distinction between responsibilities. The tasks, the order in which they are implemented, and the first responsible for each task, are shown in Table 1. In the table it is assumed that the Base Line Survey is being tendered.

Before the selected researcher will write the research plan, he will first read secondary data as available. Secondary data are all reports and studies, as well as publications from government offices, etc., that contain relevant information about the survey area, or the survey population, or both. By doing so, the researcher will get a good idea of the situation in the field. And he avoids collecting data that are already available.

The research plan

Having done that the researcher is ready to write a research plan.
Research plans should minimally contain:

- a description of the situation and background to the study, culminating in a central research question and – usually several – research questions
- a discussion on what exactly needs to be looked at in order to answer the research questions
- a description of the research methodology (survey instruments) that will be applied
- a staffing plan
- a time schedule, and finally,
- a description of the equipment, etc. that is required

About 6 months pass from the moment at which actual data collection starts until the final report is submitted. Before that the process of selecting a researcher takes another 2 months. These periods are indications. Depending on such factors as the complexity of the survey, the distance to the survey area, the availability of staff, etc. the period can be shorter or longer.

Table 1. Time frame of a standard Base Line Survey (months)

tasks	responsibility		preparation		data collecting			data processing		report-ing
	pm	re	-2	-1	1	2	3	4	5	6
preparing tender/tendering	x		-							
writing/issuing proposal		x	-	-						
issuing contract	x			-						
reading secondary data		x			-					
writing detailed research plan		x			-					
forming the research team		x			-					
designing questionnaire		x			-					
instructing interviewers		x				-				
testing questionnaire		x				-				
running questionnaires		x				-	-			
designing structured interview sheets		x			-					
interviewing key informants		x			-	-	-			
progress meeting I	x						-			
data recording		x						-		
analysing data		x						-		
writing draft report		x							-	
presenting findings to population		x							-	
progress meeting II	x								-	
submitting final report		x								-

pm = project manager
re = researcher

The project managers and the researcher should agree on a work schedule like the one presented in the table above as part of the overall contract in which the work is commissioned. Important is also to agree on progress meetings. These serve to verify whether the work is still on track or whether adjustments in the schedule are required. Obviously the progress meetings are also suitable discuss provisional results. Although preferably the original plan should not be altered, as this has can have scientific consequences or can lead to extra work and costs, changes may have to be necessary. The progress meetings can be the moment to decide on changes in the original plan. In the schedule above, two progress meetings are foreseen. If required the number of progress meetings can be increased.

5. Staffing

Research co-ordinator

The composition of the research team depends on such factors as the complexity and the size of the survey that is to be carried out. Minimally a research team consists of a research co-ordinator and a number of surveyors. The research co-ordinator has the lead and ensures that the research is carried out according to the research plan. Preferably he has written the research plan himself. Among the tasks of the research co-ordinator is to instruct the interviewers and to supervise their work. This implies that he is present in the field during the time that the interviewers meet with the respondents. If required he can be assisted by one or more research assistants.

> ***Box 3***.
> *In 2000 a survey was organised in villages in Punjab, Pakistan. Pairs of female surveyors were talking to female respondents, whereas mixed teams could address male respondents. The collected information appeared to be more complete than it would been if only men were interviewed.*

Surveyors

The number of surveyors that is required can be anything from 4 – 10 or more. It is usually a good idea to form pairs of surveyors, who will team up together. As a general rule both male and female surveyors should be recruited. In certain cultural settings the involvement of

Female surveyors

female surveyors is the only way to obtain information from female respondents (Box 3). In other situations female surveyors are preferred because women are less comfortable speaking to men who do not belong to their family.

Young graduates

Often, respondents are from different ethnic or religious backgrounds, or speak different languages. In a survey area where the population is of mixed background, the survey team should mirror the situation in the field as much as possible. Preferably interviewers are selected who

understand the respondents' condition. Especially good results can be obtained if the interviewers are young graduates from a local university waiting for their first paid job as a professional and originating from the area in which the research is to take place. This latter condition is not absolutely necessary, though. The students should be selected from a suitable university department and should have had training in research methodology. Sometimes it is suggested to work with high school students as interviewers. This is not recommended, for the reason that high school students usually do not have any experience with survey methodology. Also acceptable is to form pairs of interviewers consisting of a graduated university student and a high school student. High school students do have the advantage that they can be normally be recruited from the survey area population.

Data processors

After the data are collected they need to be processed. For this purpose one or more data processors are required. They are typists with an understanding of the computer programme that is used to analyse the data (see below). Data analyses is the task of the research co-ordinator again. He will also write the survey report. Again research assistants can help him doing the work.

6. The questionnaire

Definition

One of the two instruments that is used to collect data in the field is the questionnaire. The other is the structured interview sheet. The questionnaire is actually *an ordered list of questions with space to write down the answers.*
Although the questionnaire is almost always prepared on paper and also a hard copy is used to fill in the answers, it is quite possible to use a laptop computer. The advantage of the laptop computer is that the data are immediately available in digital form and can be processed much easier. If managed well, using a laptop computer to support data collection can lead to substantial time saving.

Unique

A standard questionnaire for socio-economic Base Line Surveys does not exist. The subjects that are being addressed through the questionnaire depend on the conditions in the field, which of course differ from one place to the another. And they depend on the purpose of the Base Line Survey itself, as expressed in the survey objectives and research questions. It follows that each questionnaire is unique and that each Base Line Survey requires designing a new questionnaire. It is much like designing an irrigation or drainage canal. What needs to be done is standard practice, but how it will eventually look much depends on project criteria and local conditions, both of which are particular for a situation.

6.1 Standard topics

Standaard topics

Having said that, it is also true that a number of topics feature in every socio-economic Base Line Survey. Table 2 presents these topics. The second column in the table gives details about the information that is actually analysed later during the survey and presented in the survey conclusions. The third column in the table shows the use of the data during project implementation (in line with the second purpose of the Base Line Survey to provide managers with insight in socio-economic conditions of the project area population).

Table 2: Typical socio-economic Base Line Survey topics

TOPICS	DETAILS	FUNCTION
composition of household	household members gender age of household members main occupations origin	- to understand demographic conditions and background of the project area population - to link occupations to categories of persons
occupations	per household member: kind of income generating activity, where, time spend	insight in which households members are working for an income, kind of income raising activities undertaken (also off-farm)
incomes	per household member: incomes earned, costs to make incomes	insight in relative wealth of household categories, relative dependence on (irrigated and drained field) agriculture
access to land, water, irrigation and drainage infrastructure	per household: area of (dry, irrigated, drained) land controlled, location of this land relative to water sources and collectors, fragmentation of landed property, relative fertility of the land, control over water supply or disposal systems, etc.	to understand the relative importance of and access to irrigation, drainage for different categories of households
role in management of land, water, irrigation and drainage infrastructure	respondents role, if any, in the management of the land assets of the community, or of water control infrastructure	to gain insight in ways in which the project area population manages land, and irrigation and drainage infrastructure
perceptions about the project and willingness to participate	respondent's understanding about the project and its goals, expressed willingness to co-operate	learn about success of project's earlier attempts to communicate intentions, about attitudes towards the project, and whether households can be approached to participate

note: list is not necessarily complete

Main topics

Usually in a questionnaire the different main topics are dealt with in blocks of their own. Thus a standard questionnaire contains a block 'household demography', 'incomes from agriculture', 'incomes from off-farm activities', 'access to land', 'irrigation', 'household perceptions of the project', etc. However, it can be beneficial to apply an order of questions which is more logical to the mind of the respondent. In that case questions belonging to different main topics are mixed. For example, it is usually advisable to immediately ask for the main activities and occupations of each household member when discussing the composition of the household at the beginning of a questionnaire. The advantage of this way of working is that later during the survey further details of the different occupations can be systematically addressed simply by going back to the list of activities that is already produced. This way of doing reduces the risk that one or more income raising activities are missed. This risk would be higher if at some point in the questionnaire the question would be asked what the sources of income of the household are. In the same way it is also possible to ask for each field the crops that were grown the last harvest and the harvest before that, the income that the farmer earned for each crop, as well as the irrigation and drainage conditions. The other, less accurate way would be to make a list of all fields first, then of all crops of the fore last season, then of the crops of the last season, then of the prices he received, and finally to ask the question of the irrigation and drainage situation on the farm.

Three topics which are always present in socio-economic Base Line Survey designed for rural development projects will be discussed in more detail here. These are 'household demography', 'sources of income and relative wealth', and 'opinions and expectations'.

6.2 Standard topics

Demografic data

Every Base Line Survey starts with questions regarding the household that is being surveyed and its structure. (Note that at the top of the first page space is reserved to register the name of the interviewer, the date of the interview, etc.) Standard questions include the number of household members, their age, gender, education levels, occupations, and the households' religion and ethnicity (if relevant). The names of the households or respondents must not be recorded. This in order to avoid every possibility that results of the survey are later traced back to individual households or persons, with possible negative consequences for them.

In most rural areas the nucleus type of household is the most common type. A nucleus households consist of parents with their children. In this type of household one may see that the parents' parents live with their children, either in the older generations' house or in the

children's house. Extended households, the type of household where families consisting of grandparents, children, grandchildren, cousins, uncles, etc. live are less frequent. The definition of household is *a group of related persons living together under one* roof or eating their meals together.

Definition

Another important question concerns a household's place of origin and when it came to live in the survey area, even when this is more than one generation ago. Often a relation exists between access to resources, place of origin, and date of moving to an area. Insight in these differences and their background is usually helpful in understanding the project area population and the different groups in which it must be subdivided.

6.3 Sources of income and relative wealth

At the core of the socio-economic Base Line Surveys are questions to assess household income. The number of questions involved is usually high, as a household's income situation is often complex. There can be different sources of income and more than one household member earning one or more incomes. Further complicating the issue is that incomes can be seasonal. A sound approach is take a reference year and to ask for all incomes that were earned in that year. It is recommended to take as the start of the reference year the first month of the cultivation cycle of the main crop. The last month of the reference year is 12 months later. This allows for all seasonal crops to be covered. For multi-annual crops, the harvest during the reference year is asked. Over this twelve month period all incomes by all household members are measured. The economic data will provide detailed insight in:

Measuring incomes

- the sources of income of the households of the survey area, as well as of categories of households, e.g. the poor, middle class households, and the rich, and/or per ethnic group, and/or for upstream versus downstream farmers
- the relative importance of each of the sources of income, again for each group
- the relative wealth of each group in relation to other groups and to an established poverty level

Conditions with regard to these issues as existing prior to the project intervention can change because of the intervention. Or even stronger, are likely to change because of the intervention.

The socio-economic Base Line Survey draws conclusions about the incomes of the households of a population. The incomes can be incomes from agricultural activities or from off-farm work. Incomes

Incomes from agriculture

from agricultural fields concern all incomes earned from all fields and crops cultivated by a household during a reference year. The incomes are calculated by subtracting total costs from the value of the harvest. Especially in irrigation and drainage projects, it makes sense to differentiate between land with or without irrigation and drainage. Even further detailing can be required. It may be necessary to relate incomes to conditions of over-irrigated land (waterlogged!), well-irrigated land, less well-irrigated land, and not irrigated land. Other categories are of course possible, depending on local conditions. Similar categories can be made to indicate drainage conditions. Obviously the exact details require the input of experts of different disciplines. In addition to incomes from fields incomes from livestock are to be assessed.

Off-farm work

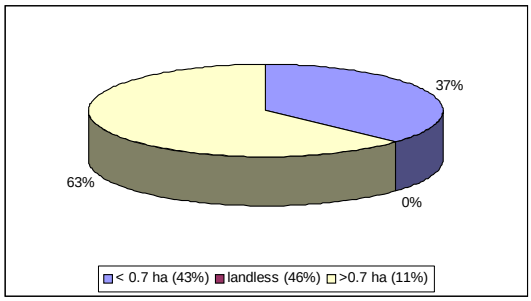
Examples of off-farm incomes are incomes from services (school teacher, government official, watchman, etc.), from skilled work (driver, cook, needle work, etc.), or from selling one's labour (agricultural labourer or industrial labourer). It should be noted that incomes from off-farm work are often higher than incomes from agricultural activities. For this reason care must be taken to also include all sources of off-farm income. Even if they were earned during only part of the year, have already stopped but did exist in the reference year, or where earned by children or elder household members. Incomes in kind are converted into incomes in money.

Household categories

The relative wealth of a household can be expressed by comparing it to the income of other households. For this purpose all households that aresurveyed are divided into categories. The categories are usually based on the area of agricultural land cultivated by households. In irrigation schemes this usually means the area of irrigated land. In most rural societies, and especially in irrigation and drainage areas, a household's wealth is a function of the area of land it owns or controls.

Figure 1 shows a typical land distribution situation in Java, Indonesia, The distribution is highly skewed: a relatively large number of households with farms just enough to live from (43%) has a relatively small proportion of the total land area (37%), whereas a small number of households with large holdings (11%) has a relatively large proportion of all land (63%). The proportion of landless households is considerable (46%). By definition, landless households do not own land themselves. In other rural areas, the picture may be different. In Haryana, India, for example, farms are much larger and land ownership, at least according to official statistics, is less skewed. Relative income levels in both areas are roughly the same: in both areas about 20-30% of the population appeared to have incomes at lower than poverty level.

Figure 1. Land distribution in an irrigation system in Java, Indonesia



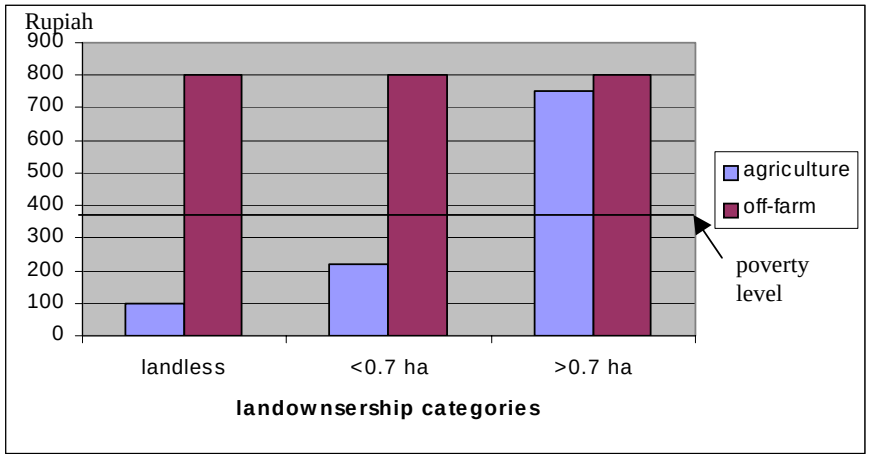
Distinguishing between three landownership categories, as is done in the example above, appears to be a practical way to differentiate between households. If necessary four or five classes can be made instead of three. This, however, will have consequences for the required number of households in the survey sample (see below). In stead of distinguishing between landownership categories, it may be useful to construct categories on the basis ethnicity, or location of land in relation to the source of water (in irrigation projects), or area of land drained (in drainage projects).

Poverty level

The relative wealth of a household can also be expressed in relation to a poverty level, or minimum income level. Almost all countries work with a poverty level of some sort for statistical and political purposes. The poverty level is the income that an average household or person is considered to need in order to survive or to live a 'decent' life. The poverty level is often calculated as the sum of a number of essentials, like rice, other food products, cloths, school fees, etc. By comparing the incomes earned by the households in a Base Line Survey with the poverty level valid for that area conclusions can be drawn regarding the number of households or persons living below the poverty level before the project intervention. After the project is finished and the Impact Assessment Survey is completed, the incomes at that time can again be compared to the poverty line and conclusions can be drawn as to the effect of the project on poverty.

Figure 2 is an example of the use of a poverty level. The data concern the same irrigation area on Java, Indonesia, as in Figure 1a. In the figure the incomes from agriculture and off-farm activities are separated and are compared to a poverty level.

Figure 2.



It is clear that in this situation only households with farms larger than 0.7 ha earn an income from agriculture above the poverty level. All the other households, a majority, require incomes from off-farm work to reach income levels higher than the poverty line. The average income of each of the three categories distinguished in the figure was always above the poverty level. Still about 20% of all households did not reach this level. They were found among the landless and households with less than 0.7 ha of land.

6.4 Opinions and expectations

The last block of questions in a Base Line Survey deals with the opinions and aspirations of respondents vis-à-vis the project. Usually the questions are open questions and the respondent's exact words are written at their appropriate place in the questionnaire. To hear the opinions at an early moment is important. With this knowledge a manager can formulate more accurately a policy to involve the project area population in the project. And the more accurate a policy is, the higher are the chances on success. Also, on the basis of information about a population's opinions and aspirations, a manager can more or less predict the reactions to a decision he wants to take. If he had not known the opinions he would be more uncertain. It follows that this block of questions serves the second objective of the questionnaire, namely to provide the project manager with relevant information during project implementation.

expectations

Respondents can have all kind of expectations about a project,of which some may be realistic, others less unrealistic. Project managers need to understand these expectations. This knowledge is indispensable when dealing with individual inhabitants of the project area as well as with groups of people during village meetings. Expectations expressed by the project area population can even

change project plans or policies, as is clear from an example of Indonesia (see Box 4).

> ***Box 4.***
> *In a land reclamation project in South Sulawesi, Indonesia, contractors had started clearing land. The Base Line Survey which just had become available showed that local inhabitants strongly felt that certain trees and distinct land marks would be left undisturbed, as this would facilitate land distribution later. The opinion was respected and the contract with the land clearing company was reviewed. The higher costs were seen as justifiable in view of the demands of the population.*

6.5 Testing of the questionnaire

10 questionaires

It is essential that a questionnaire is first tested before it is used to collect data on a larger scale. The test should include about 10 households. The questionnaires are filled in with households from the survey population as if the survey would already have commenced. After the 10 questionnaires have been filled in, the questionnaire as a data collection instrument is evaluated. This must be done together with the surveyors, as they have the relevant experience. If required the questionnaire is adjusted. Usually the required changes concern reformulation of questions and additional space for answers that were not foreseen. It is not unusual that quite a few adjustments are necessary. Of course the research co-ordinated is to be directly involved in the testing. It is usually possible to use the data collected during the test in the survey proper.

6.6 Structured interviews

definition

Just a few words are required to explain the survey instrument 'structured interview'. A structured interview is *a list of questions that is used during in-depth interviews with key persons*. Key persons are persons who are known or expected to have a good understanding of one or all of the survey subjects. They are asked to be available for an interview. An important difference between respondents and key persons is that the former are selected at random, whereas the latter are always hand-picked.

7. The survey area and the survey area population

7.1 The survey area

Definition

The survey area is *the area where people live who are either affected by or who may affect the outcome of the project*. The survey area is not congruent to the

Definition

project area. The project area is *the area where the intervention of the project takes place*. In case of an irrigation or drainage area, it is the area where the irrigation or drainage system is constructed or rehabilitated. The survey area is larger and includes this area and the surrounding area of which the population experiences either positive or negative effects of the project.

Spill-over effects

It is not unusual for the people living outside the boundaries of a project area to experience the – positive or negative – effects of a project. The effects are referred to as positive or negative spill-over effects. For example, in the area downstream of an area where an irrigation system is rehabilitated water levels in drains may increase and if the water levels are not too low it may be used for irrigation. This can be considered a positive spill-over effect. However, if water levels rise to the level that flooding occurs, a negative spill-over effect occurs.

Boundaries

The positive and negative spill-over effects must be taken into consideration when the success of a project is assessed and therefore should be measured. The question is of course where the boundaries of the survey area should be situated. After all, the effects can be felt at long distances from a project area. It is impossible to be precise about this. The boundaries of the survey area are best determined by the manager and the researcher together. One criterion could be whether a 'substantial' impact, either positive or negative, on the incomes of people not living in the project area proper must be expected. What exactly is meant with 'substantial' should be assessed as best as possible, using information as available.

Direct effects only

It is usually correct to address only those inhabitants in the survey area – project area plus surrounding areas – who are directly affected by an intervention. Whether this can indeed be done depends on the formulation of the research questions. Households directly affected by an irrigation project are those who will have more less or irrigation water on their fields after project completion. In a drainage project they are the people whose land will be directly drained by the project or who will experience lower groundwater levels. Inhabitants who do not have a direct interest in the land themselves can safely be excluded from the survey. For instance this is the case with school teachers,

government officials, shop keepers, families working in the industrial sector, etc. To make matters complicated, if these people have land themselves or are members of households with land, they cannot be excluded.

Landless households

An important question is always whether landless households should beincluded in the survey. They should in all those cases that one or more of the household members derives an income by working as an agricultural labourer on another person's land. In that case their incomes are directly affected by the intervention. If land becomes more productive because of irrigation or drainage becoming available, the demand for agricultural labourers may increase. Or with production levels and incomes of land owners increasing, more machines are introduced. In that case the demand for the services of agricultural labourers decreases. This example also shows the importance of taking stock of also the conditions of those who do not have land themselves, but working in agriculture. Irrigation and drainage projects can have important effects on their income situation too.

claims

In addition to the reasons already mentioned project managers may have another reason why they wish to understand the extent of spill-over effects on households outside the project area proper. This is because it allows them to react with more certainty on claims for compensation because of negative spill-over effects coming from people from outside the project area.

7.2 Ensuring co-operation

Private or sensitive questions

The co-operation of the population of the survey area is required in order to be able to execute the survey. People have to make available at least one hour of their time and have to be willing to give all kind of data regarding their personal lives. Some of this data may be private or sensitive. Data on the actual composition of a household may be sensitive information, for example in those cases that a men or a women is living with another partner. Typically data on income sources and levels are sensitive also, as people may not wish to share that information with strangers, perhaps because they fear that this information is passed to the tax authorities.

A first step to be taken to obtain the co-operation of the population is to approach the (administration) leaders and ask them the question whether they agree and support the initiative. An immediate answer can usually not be given, as the leader will have to consult with others, like for instance the members of the village council, or the heads of villages or other administrative units, and ask their opinion.

Once permission from the local authorities has been obtained the respondents can be approached. Their permission to ask them questions must be obtained and this is done by asking each of them individually whether they are willing to co-operate. This is best done prior to actually starting to ask them the questions on the questionnaire. To ask whether they are willing to co-operate must be preceded by an explanation of the purpose of the survey, the context in which the survey is taking place, and the kind of questions that will be asked. It will usually be necessary to explain for which purposes the survey data are used. Surveyors should explain that the survey data are only used for the purposeof the project and will not be available for any other purpose or organisation. Of course they can say this only if they know it to be true, which means if the project follows a deliberate strategy with regard to privacy protection. Surveyors must be carefully instructed with regard to the way that they introduce themselves and the purpose of their visit.

Privacy protection

7.3 Feed back

At the end of the survey, after all data have been collected, processed, analysed, and used to write the concept of the final report, the conclusions of the survey should be explained to the respondents. This should not only be done as a courtesy, but also to solicit their feed-back. Hearings can be organised during which the survey results are presented. Given the fact that the population of irrigation and drainage areas is usually not used to work with this kind of aggregated data special efforts must be made to present the information in a way that it can be understood. Comments and reactions can be ploughed back into the report.

8. The sample

The population of project areas is often large. On the island of Java, Indonesia, the average farm has an area of 0,25 ha and an irrigation scheme may have an area of 10-20,000 ha. Even on relatively small irrigation areas like these the number of farms is 40-80,000. In the Punjab (north-west India and north-east Pakistan) it is not unusual for irrigation schemes to have a size of 300,000 ha and more. Systems of twice of even three times of that size are also not an exception. An average farm in the Punjab would be in the order of 2 ha. A quick calculation shows that the number of farms in those regions can be 150,000 or a multitude of that number. In cases like these it is quite impossible to survey entire survey area populations. It simply would be too time consuming and too costly. Fortunately acceptable results can be achieved if a sample of the population is surveyed in stead of the entire population.

definition

A sample is *a selection of households from a population to be surveyed and reflecting its characteristics*. It can be compared with the cross cut that engineers take from an area to be irrigated. The cross cut shows all the characteristics of the larger area it represents. Sampling and interpreting sampling data requires knowledge of complex techniques.

Random selection

For the Base Line Survey it is necessary to draw a random or a-select sample. This means that every household belonging to the survey population has the same chance of being selected in the sample. Random sampling is achieved relatively easily. It does not matter how a household is selected in the sample, as long as it did not have a higher chance than any other household to be selected. Chance and chance only dictates which households enter the sample. Never should households be hand-picked. Examples of methods for random sampling are shown in Box 5.

Box 5.
Examples of ways to randomly select households:
- *pick every 25th or so house in each street of each village in the survey area,*
- *use a table with random figures (from a PC or calculator) and apply the figures to the list of persons living in each village*
- *draw squares of equal size on the map of the project area and pick in every square the same number of farms*
- *any other method based on the principle that chance only directs selection of households*

Note that it is usually not a good idea to use the land ownership register or a land ownership map. In many rural areas part of the rural households do not have land of their own. However, their lives and incomes are depending on the agricultural sector, either because they are land labourers or because they are traders in agricultural products, or because they are indirectly dependent of the agricultural sector. If we would use land ownership data, we would fail to include these categories in the sample. The conclusions would not be valid for the entire population (but only for the group of landowners).

Another reason why land registration files are unusable is that they are almost never up to date. Often people prefer not to have all changes in land ownership registered either because of the costs involved or because of tax consequences. In countries where a maximum is put to the area of land that a household may possess land is often registered in another persons name. Using the land registration files to draw a sample under such conditions would produce unacceptable biases in the sample.

8.1 Minimum sample size

The size of a sample depends on two factors: the level of accuracy that one wishes to achieve, and the level of differentiation that one expects in the answers. Higher levels of accuracy require larger samples, or more accurately, samples that constitute a larger proportion of the population from which the sample is drawn. The highest level of accuracy is 100%, which is achieved if the size of the sample is equal to the size of the population. In the kind of socio-economic Base Line Survey that is discussed here, much lower levels of accuracy are usually considered acceptable (90%).
A more important consideration than the level of accuracy is the level of differentiation that one expects in the sample and that is to be shown in the results. If the sample population is broken down into a high number of categories, the sample must be larger than in case a small number of categories is required. This has to do with the fact that a minimum number of cases is required in each category. The minimum number is put at 20. Categories are for example land ownership categories, income categories, or distance to a source or irrigation water categories. A highly differentiated sample produces cross tables of, for example, 5 columns and 5 rows The sample in that case would require a size of (5x5x20=) 500 cases. A simpler sample would have 3x3 cross tables and consequently a size of (3x3x20=) 180 cases.

The actual sample that is taken should be 5-10 households more than the minimally required number. The extra households are the reserve. These households are also interviewed. If for some reason a household is the sample produces unreliable results it can be left out and replaced by one of the reserves.

8.2 The stratified random sample

Stratified sample

Above it was explained how a sample is drawn from a survey population. The survey population was looked at as one whole. Sometimes it is necessary to divide the survey population into two or more main categories, or strata, and to draw an equal, pre-determined, number of respondents from each of the strata. In that case a stratified sample is drawn. Each of the strata is treated as if it were a sample of its own. It follows that a stratified sample must be twice or more times as large as a straight sample, depending on the number of strata that are required. A stratified sample is drawn when the researcher wants to make sure that households which share one characteristic can be compared with households that share another, usual opposite characteristic. An example is a stratified sample with two strata, of which one contains exclusively households with upstream land and the other households with downstream land.

Drawing a stratified sample works as follows. Before the sample is drawn the survey population is subdivided on the basis of the strata. Thus, the names of all upstream farmers are written on one list and those of downstream farmers on another. Subsequently within each of the strata a sample is drawn as if the strata population were a survey population by itself.

Disadvantages

Working with strata has two distinct disadvantages. Households are pre-selected on the basis of one characteristic, the differentiating factor, and an equal numbers of households are entered into each stratum. This method of working usually implies that the distribution of the households in the survey population over the differentiating factor remains unknown. This can be a problem. The other disadvantage is that the stratified sample is much larger than the normal sample, and consequently more expensive.

8.3 Control group needed?

Control group

Text books on methodology mention the possibility of working with a control group. The advantage of a control group is that the impact of an intervention –on the survey population can be established with more confidence. The idea is that exactly the same data are collected on the survey population as on a control group. The survey population experiences the impact of the intervention, but the control group does not. After the intervention, both populations are surveyed again. By comparing the differences between the populations the impact of the intervention is established. Thus if after a project the average income of the population of the project area is twice as high as in the control population it can be concluded that this is the effect of the project (all things being equal).

From a purely methodological perspective working with a control group is good practice. Yet there is a problem that renders the method not appropriate in case of the socio-economic Base Line Survey for irrigation and drainage projects. This is that it is almost always difficult, if not impossible, to find a control group that shares exactly the same characteristics as the survey area population. There is also a practical problem that makes it difficult to work with control groups: the survey costs will be twice as high. All in all, working with a control group in case of a socio-economic Base Line Survey is not recommended.

9. Data processing and analysing

Definition

Data processing is *the task of preparing the rough data for analysing*. It is done after all questionnaires have been filled in. Processing of the data is preferably done electronically. A popular data processing program

SPSS

that can be run on an average PC is SPSS/pc+ (SPSS is short for Super Performing Software System; it used to stand for Statistical Package for Social Sciences). Other programmes designed to analyse data are SAS, CSS Statistica.

Dependent and independent variables

Data processing essentially means to relate the answers that respondents gave to one question to the answers given to one or more other questions. Depending on which factor is believed to influence the other, we speak of 'dependent variables' and 'independent variables'. One step further is to assess the strength of the relation between two variables. For example, the answers to the question about the total annual income of the households in a sample is related to the answers regarding the area of well-drained agricultural land that households cultivate. This is done in order to establish whether or not households with more well-drained land have higher total annual incomes. Expressed differently, it is established whether a positive relation exists between total annual income and area of well-drained land cultivated. Obviously, 'well-drained land' is the 'independent variable' and 'total annual incomes from agriculture' is the 'dependent' variable.

9.1 Preparation

Processing of the data collected by way of a questionnaire is preceded by three steps. The first two steps take place during the design stage of the questionnaire. Step one is to give each and every possible answer

Code book

to each of the questions in the questionnaire an unique code. The second step is the construction of a code book. The code book is *a list*

Definition

of all questions in a questionnaire and all the answers and the code of each answer. The list also shows in which column of the data matrix (see below) the codes are found. The codes only have a meaning in combination with the column in which they occur.

Table 3 shows an example of a code book. Usually question 1 in the table concerns the sex of the head of household. There can be only two possible answers; these are given code 1 and code 2. Thus code 1 in column 5 means 'male' and code 2 in the same column means 'female'. Note that the same codes have an entirely different meaning in another column. In case the cell in which a code can be recorded is left open, it means that the information regarding the gender of the

respondent is not available. In the example the codes related to the following question are recorded in columns 5 to 7. Three columns are required, because the actual age of the respondent is to be recorded. Sometimes the number of possible answers, and hence the number of codes required, can be high. This is the case for example with the question on the composition of the household. Many combinations are possible, as can be seen in the table. .

Table 3. Example of a the first 4 questions of a questionnaire recorded in a code book

question number	description	variable number	column number	code
	identification		1-3	
1	gender of respondent	1	5	1 – male 2 – female open – no data
2	respondent's age	2	6-7	actual age open – no data
3	household members	3	8-9	01 – 1 02 – 2 03 – 3 --- 11 - >10 persons
4	households composition	4	10 – 11	01 – single, male 02 – single, female 03 – husband and wife 03a – husband, wife, male grandparent 03b – husband, wife, female grandparent 04 – husband, wife, son <16 04a – husband, wife, son <16, male grandparent 04b – husband, wife, son <16, female grandparent --- 15 – husband, wife, >3 sons <16, >3 sons >16, >3 daughters <16, >3 daughters >16

Data matrix

The third step takes place after the data have been collected, thus after all questionnaires have been filled in. The actual answers that respondents gave to the questions are transferred from the questionnaires to a data matrix. In the data matrix each cell provides space for a code. The columns represent questions and each row represents a respondent (identified by a number). Table 4 shows the data matrix that relates to the data of Table 3, above. The data from 5 imaginary respondents are recorded.

Table 4. Structure of the data matrix

codes from Table 3									*space for more codes*													
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4
0	0	1		1	2	2	1	1	1	5													
0	0	2		1	4	5	0	9	1	1													
0	0	3		2	3	2	0	5	0	7													
0	0	4		2	6	7	0	2	0	3													
0	0	5			5	5	0	1	0	1													

The data matrix has as many columns as the total number of digits required by the codes. The length of the data matrix is equal to the number of respondents. Now the advantage of working with codes becomes clear. Codes are short for answers. Sometimes an answer can be very long. If the full answers were to be recorded in a matrix, it would be inconveniently wide.

accuracy

The main problem with transferring the data from the questionnaires to the data matrix is accuracy. In the process mistakes can be made. These will have a bearing on the end results of the survey. In order to minimise the risks involved, data processing has to be given proper attention. Sufficient time should be taken to allow for the job to be carried out, and above all, dedicated people should be set to the task. Comfortable work stations should be provided. It is good practice to ask a colleague to check the codes entered by the data processor into the data matrix.

9.2 Actual data processing

Now that all answers to each of the questions are written in the data matrix actual data processing can take a start. SPSS and the other software programme to analyse statistical data can be given many instructions, including to:

- calculate frequencies: count the number of times that a variable is recorded; e.g. the number of men and women, or the number of households classified as poor, middle class, or rich, or the number of times that respondents said to agree with the project plans
- calculate a measure to express a series of data (average, mean, median, variance, standard deviation, etc.)
- calculate the strength of the relation between two variables; using the example above, to calculate whether rich households tend to have more irrigated land than middle class and poor households (the programme calculates Kendall order correlation, Spearman order correlation, and similar measures)
- produce cross tables, histograms, section diagrams, graphs, column and bar diagrams, etc

Understandable interpretation

SPSS and similar programmes produce the outcome of complicated statistical tests with pressing just a few keys on the keyboard. This allows researchers wishing to impress their readers to produce the values of different statistical values in their reports. Applying statistical tests is only acceptable if the testsare adequately applied and correctly interpreted. The conclusions must beexplained in words that are understandable. Project managers must insist onthis. Producing only the value that is obtained after doing a test is useless.

Two tests that are frequently applied in socio-economic Base Line Surveys are Kendall order correlation, and the Spearman correlation. Both indicate the strength of the relation between sets of data, for example, income and percentage of total land holding under irrigation. In both cases a perfect possible correlation is +1 and a perfect negative relation is expressed as –1. A score of 0 indicates no relation at all. In the example it means that as many households have much irrigated land and low incomes as there are households that have high incomes and not much irrigated land. The researcher is still left with the task to explain how this is possible.

9.3 Data analysing

Data interpretation

Data interpretation means deciding which characteristics should be counted, which relations between variables should be appraised, and the actual interpretation of the results. It is the responsibility of the research co-ordinator together with his assistants. The decisions are guided by the objectives of the survey, and more specifically, by the research questions. Data analysing is another critical step is the Base Line Survey.

Data processing essentially means going back to the research questions and using those collected data that can help in answering the questions. Thus, if one of the research questions was to establish the number of households living below the poverty level, the data on the incomes of all households are looked at in relation to a poverty level. If a research question was to establish whether households with farms further away from a main drain would be less dependent on incomes from well-drained fields than households living closer to the village, data on the distance of fields from main drains would be analysed and related to data on household income structure. Most probably the research co-ordinator will prepare a cross table showing ‘distance to main drain’ in the columns and ‘highly dependent’, ‘moderately dependent’, and ’not dependent’ in the rows. In the text the figures in the table would be explained.

10. Reporting and report use

Reporting includes the process of writing the socio-economic Base Line Survey report and submitting it for approval. As is the case with report writing in general, the task of producing the report is time consuming. At least one month must be allowed for the writing itself and another for discussing the first draft and producing the final version of the report. Usually the report itself is written by the research co-ordinator. He can be assisted by research assistants.

Basic raporting questions

It is good practice to agree at the moment of signing the contract that a meeting will take place to discuss the draft concept of the survey report. This can be seen as a Progress Meeting. The project manager receives the draftreport prior to the meeting. He prepares himself for the meeting by asking himself three basic questions:

- does the report give answers to the research questions that were agreed earlier?,
- is the information presented in such a way that it is possible to compare it with the results of the Impact Assessment Survey later?, and,
- is the information logical and can it be understood?

Satisfactory results?

A survey report starts with an explanation of the survey itself, the objectives, and the research questions. It continues with presenting and explaining the data that were collected, and finalises with the conclusions. The project manager should convince himself that the report addresses indeed each of the research questions in a satisfactory way. In other words, he should make sure that the researcher is delivering what was agreed earlier.

Transparent information?

Equally important is the check on the way in which the information is presented. Of course the information should be easily accessible or transparent. Still another condition must be fulfilled also. All information should be presented in such a way that the researchers responsible for the Impact Assessment Survey can compare their results with those presented in the Base Line Survey. Basically this means that as much as possible information is expressed in figures and presented in tables. It is also necessary to include in the report a detailed account of the research methodology that was applied. The questionnaire that was applied and the structured interview should be added as annexes to the report. For reasons of privacy, all questionnaires with data are to be destroyed after the final report is accepted.

It is good practice to invite staff members of the project to participate

in the meeting during which the draft report is discussed. Usually all kind of detailed information concerning the project area population is discussed during the meeting and this information is of importance to all project staff. They should have the opportunity to read the report before the meeting is actually taking place. In order to start the discussion the researcher can be asked to present the main conclusions of the report to the meeting. For this purpose he can use an overhead projector or a computer.

Corrections, supplementary information required?

The meeting during which the draft report is discussed should be concluded with an agreement on the corrections and supplementary information that are required. The final report will reflect the agreements. With submitting the final report the researcher has fulfilled his contractual obligations.

Questions for self-evaluation

Question 1. Give two reasons why a socio-economic Base Line Survey is necessary in every irrigation and drainage project.

Question 2. The socio-economic Base Line Survey and the Impact Assessment Survey are two surveys that take place before and after a project intervention. Explain the relation between the two surveys. Do the questionnaires in the surveys have to be identical?

Question 3. Describe the phases of a Base Line Survey . How much time is required to complete a Base Line Survey from the moment of tendering onwards?

Question 4. Mention four tasks of the research co-ordinator.

Question 5. Which categories of households are usually distinguished in Base Line Surveys designed for irrigation and drainage projects? Do landless households have to be included in the survey?

Question 6. Explain what is meant with structured interviews. What are key informants?

Question 7. What is meant with random sampling? How can random sampling been achieved?

Question 8. What is a code book and how does it look like?

Question 9. What is a data matrix and how does it look like?

Question 10. What tasks can be performed by a computer programme like SPSS?

Definition of terms

average	-	value obtained after dividing the sum of all values by the number of values (μ) (interval or ratio level)
Base Line Survey (socio-economic)	-	survey to assess (socio-economic) conditions (of a population) prior to an intervention
code book	-	list showing for each question all possible answers, the codes to the answers, and the column numbers of each code
commissioning (a survey)	-	instructing (the implementation of a survey)
control group	-	population of equal size and further characteristics subjected to the same survey
data (socio-economic)	-	collected and recorded information regarding the (socio-economic) conditions of a survey population
data analysing	-	act of drawing logical conclusion from data
data collecting	-	act of gathering data using standard data collection methodology
data matrix	-	table showing the coded answers of each respondent
data processing	-	act of transferring collected data to data matrixes
data processor	-	person processing data (see data processing)
direct assignment	-	giving a project to a person or institution against an agreed price without organising other bids
household	-	group of people living under the same roof or cooking together
Impact Assessment Survey (socio-economic)	-	survey to draw conclusions regarding the (socio-economic) effects of a project after an intervention
intervention	-	activities of a project in the project area (this text)
key informant	-	person selected for interviewing because of expected knowledge about a subject
livelihood	-	means of living, making a living
median	-	value exactly in the middle of a list of all values ranked from low to high (ordinal level)
modus	-	value most frequently available in a list showing all values (nominal level)
negative relation (between variables)	-	relation whereby a high value on one variable goes together with a low value on the other
NGO	-	Non Governmental Organisation
percentage	-	proportion per hundred (%) (ratio or interval level)

positive relation (between variables)	-	relation whereby a high (low) value on one variable goes together with a high (low) value on the other
progress meeting	-	meeting between partners in a project to discuss progress of the work
project area	-	geographical area where intervention takes place (compare survey area)
project manager	-	manager of an irrigation, drainage, or other type of rural development project (this text)
questionnaire	-	ordered list of questions with space to write down the answers
random sample	-	sample of a population generated in such a way that all members (households) have an equal chance of being selected
range	-	the highest and lowest value to a variable (ratio or interval level)
reporting	-	act of presenting preliminary or final findings or conclusions
research assistant	-	(junior) expert helping the research co-ordinator in doing the research tasks
research co-ordinator	-	person responsible for the implementation of a research of survey
research methodology	-	ways to conduct a research
research plan	-	detailed steps to do a research
research question	-	question that give direction to data collection and analyses
researcher	-	person or institute responsible for implementation of a research (this text)
respondent	-	person asked to answer the questions in a questionnaire
sample	-	selection of households from a population to be surveyed and reflecting its characteristics
secondary data	-	data relevant to the subject and already available before a survey
socio-economic Base Line Survey	-	survey to assess socio-economic conditions of a population prior to an intervention
sources of income	-	place from which income is got
Spearman order correlation	-	measure to express relation between two variables (rs) (minimally ordinal level)
spill-over effects (negative or positive)	-	(positive or negative) effects of an activity or intervention in a distinct area felt outside that area
SPSS	-	Super Performing Software System (formally Statistical Package for Social Sciences), software programme for data analyses
standard deviation	-	measure to express the spread or dispersal of values around the average (σ) (root of variance; compare variance) (ratio or interval level)

stratum	-	layer in a population singled out because of one or more exclusive characteristics
stratified random sample	-	random sample based on strata
structured interview sheet	-	questionnaire
structured interview	-	interview (with key persons) using pre-determined questions set in a logical order
survey area	-	geographical area from which data are collected, area where people live who are either affected by or who may affect the outcome of a project (compare project area)
survey population	-	population subjected to a survey
surveyors	-	person asking the questions of a questionnaire to respondents
tender	-	act of asking bids from one or more pre-selected persons or institutions to implement a project
variables	-	possible answers to a question
variance	-	measure to express the spread or dispersal of values around the average (σ^2) (compare standard deviation) (ratio or interval level)