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ASSESSMENT AND MONITORING OF PARTICIPATORY IRRIGATION MANAGEMENT

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SUMMARY - This paper looks into the feasibility of dealing more effectively with the problems regarding the lack of information about the local experiences on the implementation of the Participatory Irrigation Management (PIM) in the Mediterranean region. The present work (a) proposes the establishment of an information system at national level and (b) promotes the adoption of an "objective oriented" monitoring system at project level. The establishment of a national database, where all documents relevant to the development of PIM are stored and could be retrieved by users, is proposed to improve the PIM information at national level. Such database should contain periodical evaluations of the PIM programs. The objectives of establishing an evaluation and monitoring system at project level are discussed. The paper advocates that the main objective should be the improvement of the performance of the concerned system rather than the comparison of results. For this purpose the proposed monitoring and evaluation system consists of three levels of information. The first is of very general nature to feed information into the national system and to allow the comparison of results among different projects. The second level is integrated by a number of indicators that respond to general objectives that should be of interest to all managers; the third level is made of indicators that respond to the specific objectives the manager of a given system has established. The second and third levels are related to the use of benchmarking methodologies and this interrelation is discussed in some detail in the text. For the first and second levels a detailed set of indicators is proposed.

Key words: Participatory Irrigation Management, Monitoring and Evaluation, irrigation systems, performance, information systems.

INTRODUCTION

Considerable efforts have been made in many countries of the world to implement Participatory Irrigation Management (PIM) programs in the last two decades. Still little is known of the results achieved exception made of few countries (Mexico, India, Nepal) where information is relatively abundant. The general perception is that the results of these programs are positive but no easily retrievable information is available that documents the state of affairs. As not all countries are meeting the expected success it would be important to identify if the difficulties encountered are site specific or of a more general nature that will permit its early identification and the early development of strategies that will allow solving the encountered problems.

In the Mediterranean region co-exist countries where participatory irrigation management has been in place for centuries and form part of the cultural heritage of the region while in others centralized public management is still the predominant form of management. Substantial efforts have been made in the last few years in this later group of countries to promote a more decentralized type of management with mixed results. While some countries, like Turkey, have recently transferred most of its irrigated land others are still looking into the feasibility of introducing it over some few hundreds of hectares in pilot experiences.

No matter whether the number of hectares transferred are many or few the relevance of some the experiences can be high and could have a potential interest for countries that are pursuing the path to implement a PIM program. Even in the era of communications is not easy to find such information since frequently it is only available at local level.

The other related information problem is that little is known about the effectiveness obtained by the efforts made in transferring management responsibilities to farmers. Evaluation of the results achieved by the newly established Water Users Associations (WUA) are often lacking and therefore the possibility of improving the strategy selected is frequently missed. Therefore, the present paper looks into the feasibility of dealing in a more effective way with the two mentioned information problems by:

- proposing the establishment of an information system whereby the progress made in implementing PIM programs in a given country could be assessed and made available to interested stakeholders;
- promoting the adoption of a monitoring system at project level that may allow the managers of the systems to evaluate the progress made in the self management of the irrigation scheme.

Obviously, both objectives are interrelated because the results obtained at project level could be the bases for the information needed at national level.

THE NEED FOR A PIM INFORMATION AT NATIONAL LEVEL

When looking to the implementation of PIM programs at the national level we find three typical situations. Countries where PIM policies have long tradition and where the management by farmers associations are considered the normal way of managing an irrigation system. Examples of such countries are Spain, France and Italy. Another group is made of countries where substantial efforts have been made in recent years to implement a PIM policy whereby the majority of the irrigation systems have been transferred to farmers associations, for example this is the case of Turkey (Yazar, 2002) and Albania. There is a third group made of countries where governments seems to have some reservations about the rapid implementation of a PIM policy and prefer to assess the feasibility of implementing such policy in selected areas. Such countries are predominant in the southern part of the Mediterranean basin.

One may conclude from this situation that the example of countries where PIM programs work satisfactorily since many decades is not always sufficient to motivate countries to undertake a decisive step to implement a rapid PIM policy and a slow implementation is often preferred. The argument frequently used is that socio economic conditions are not the same and dismantling a system that is functioning for another one that presents uncertainties would not be advisable.

In this context, where several polices are implemented, the exchange of information appears of considerable importance particularly for countries of similar conditions. This may provide interesting opportunities to understand how some implementation problems have been resolved in the neighbouring countries. Unfortunately, such information is not easily retrievable because most of these experiences are local and they rarely find their way to international meetings or magazines or to Internet from where to find it. But even in countries like Spain, with a long tradition of PIM, it is difficult to retrieve certain type of information. For example, it is very difficult to find information regarding why some main canals and other related large structures have not been transferred to WUAs in some regions.

Another related issue is the lack of information on the impact of PIM policies when a large part of the irrigation area has been transferred. For instance, countries like Turkey and Albania have invested considerable resources in transferring most of their irrigation systems to farmers associations and other institutions but what has been the effect of such policy in the management of the irrigation systems and in the production of irrigated agriculture? Periodical evaluations of these programs are needed and dissemination of the results may be of great importance to countries that are considering to follow a similar path.

IMPROVING PIM INFORMATION AT NATIONAL LEVEL

From the previous considerations it is felt that there is a need to make an effort addressed to systematically store information related to the implementation of PIM programs in a way that can be

easily retrieved not only by members of the network but also by a wider audience. Accordingly, there are some suggestions of how this could be achieved.

The basic idea would be to establish a database where all relevant documents related to the development of PIM activities in a given country will be stored and could be retrieved by users. The question is how to organize such database and some suggestions are made below.

1. A national centrally based database

A web site should be established at central(national) level and within it a database for storing information on PIM programs and activities could be established. To enter information into the database would only be possible by authorized persons through a system of passwords and identification numbers.

2. A national coordinator

The maintenance and management of the web site should be under the general coordination of one person or Coordinator of the web site. The coordinator will assign the password and identification number to enter information and will develop the criteria for entering information into the web site. The coordinator may wish to share this responsibility with some specific organization by establishing the appropriate agreements but the coordinator remains responsible for the information entered in the database of his/her country.

3. The type of documents to be entered

Essentially 2 types of documents should be entered into the database, namely:

a. Documents related to the implementation of the PIM program at national level. One important document would be a short of “Reference PIM national document” where the main characteristics of the PIM activities are summarized. Such information could be shared with FAO, who is also interested in this type of information, and perhaps the same outline could be used. In Box 1 is included the outline used by FAO for possible consideration in preparing such document. In addition, the data base should store documents summarizing results, policy documents, national inventories of transferred systems, national legislation concerning PIM, training programmes related to PIM, etc.
b. Monitoring and evaluation (M&E) data arising from the project areas managed under a participatory approach.

It is probable that at the beginning this classification may be sufficient but if the database is provided with many documents the need for breaking it down to more specific subdivisions may be necessary. Once the data base is provided with sufficient documentation the undertaking of some comparative studies could be considered.

MONITORING AND EVALUATION OF PIM NATIONAL PROGRAMS AND ASSESSMENT OF THEIR IMPACT

The early stages of a PIM program are delicate and it is necessary for governments to assess the effectiveness and impact of the program that is under implementation or has been completed. This concern is based in that WUAs in the early stages may face financial and technical problems that may need some external aid or support from the central government. It is in nobody interest that a WUA fails in its objective since that situation may have very negative repercussions. To avoid such undesirable situations the needs for undertaking periodical evaluations of PIM national programs appear of relevance particularly in countries where the PIM policy is supported by the government even at slow pace.

Box 1 - FAO outline for the preparation of PIM country profiles

General information about the PIM program

- Year PIM began
- Target area to be transferred
- Area transferred by 2000
- PIM financed

General data on Irrigation and Agriculture

- Area irrigated
- Surface irrigation
- Lift irrigation
- Main crops irrigated
- Main types of farms
- Main types of irrigation systems

PIM Policy

- Top factors that motivated PIM (listed by priority)
- Main sources of support for PIM
- Type of policy issuance
- Irrigation systems included in PIM
- Hydraulic levels transferred
- Full responsibility and authority devolved for
- Partial responsibility and authority devolved for
- Management transferred to
- Policy/legal framework for PIM
- PIM Implementation Process

Results of PIM

- Cost of irrigation
- Efficiency of fee collection
- Quality of maintenance
- Timeliness of water delivery
- Equity of water delivery
- Area irrigated
- Crop yields
- Farm income

Key Lessons Learned

- Policy/legal framework
- Implementation process
- Support services
- Reorientation of irrigation agency

A clear differentiation should be made between the monitoring and evaluation of PIM programs and the evaluation of their impact among the farmers. In the first case, the M&E system is part of the programme and essentially tries to provide information on how efficiently the program is executed. PIM plans are like working hypotheses which need to be tested and modified in practice. Feedback, learning and flexibility in programme implementation are extremely relevant and therefore M&E are essential. On the other hand, the evaluation of impact tries to asses if the farmers are in better or worse conditions after the implementation of the PIM program and therefore the evaluation of impact is only possible when the transfer of management responsibilities have been effected.

It is complicated to provide specific guidance in *how to design a M&E system for a PIM* program since every country that decides to follow a PIM policy has a different set of objectives. Any evaluation of the programs must take into consideration such objectives in designing the corresponding M&E system. Vermillion and Sagardoy (1999) make some general recommendations on how to design such systems:

1. follow a minimalist approach - only use indicators which satisfy the following criteria:
   a. they are key aspects of implementation (i.e. performing tasks and meeting targets);
   b. they inform about essential outcomes and impacts;
   c. they do not exceed the optimal amount of information that can practically be absorbed by planners;
2. select indicators which are "information efficient";
3. distinguish between top- and bottom-directed needs for monitoring;
4. distinguish between those few indicators for which data must be collected from all sites versus those for which sampling may be sufficient.

The evaluation of impact may take place one or several years after the implementation of the PIM program and, as said before, tries to asses the farmers perception of whether the new system of management has resulted in an improved situation. The Colegio of Postgraduados (1994) of Mexico carried out an evaluation of impact and the results are summarized in Table1.

Table 1 . Farmers positive opinion expressed in percentage (%) about the services received after transfer (Source: Colegio de Postgraduados, 1994)

Topic	*Mayo* *	*Delicias*	*Grullo*	*Culiacan*	*Total* **
1. Water management					
Water distribution improved	72	88	81	91	84
Volume of water satisfactory	60	90	93	82	79
Water received timely	66	89	92	77	79
Water measured satisfactorily	52	75	89	57	64
2. Water tariff					
Tariff considered expensive	66	44	43	30	45
3. Maintenance					
Maintenance improved	72	90	81	86	82
Rehabilitation needed	81	81	65	91	83
Users willing to contribute to rehabilitation	82	86	71	83	82
4. Farm level					
Evidence of salinity	30	38	30	36	34
Desires to improve irrigation system	85	87	85	85	85
5. Farmers income					
Annual income negative	19	12	5	8	12
Annual income greater than >10 000 M$ ***	31	59	61	82	60

* Mayo, Delicias, Grullo y Culiacan are four large irrigation schemes totalling more than 400,000 ha.
** The total refers to the average of all the irrigation systems where the survey was carried out
*** At the present exchange of 1 US$ = 3.10 Mexican pesos it represents 3225 US$/year

In addition to the topics indicated in the table, the assessment considered many other aspects such as organization of the users, agricultural production and the financial situation of the associations. The results are not reflected here because the intention is not so much to analyse the case of Mexico but to emphasize the point that these evaluations should cover a wide range of topics to be able to identify where the system is not working as desired and take corrective measures. The development of such information would be of interest to researchers and practitioners of PIM programs in other countries and, therefore, would be relevant to incorporate it into the suggested database.

PAST EXPERIENCES IN EVALUATING THE PERFORMANCE AT PROJECT LEVEL

For many years, the performance of irrigation systems has been under scrutiny and the need for developing tools that would permit to evaluate their performance in an objective manner has attracted researchers. In the course of the last 20 years, the research institutions like IIMI (1996) and IFPRI, (1996) and other international organizations (ILRI, FAO) have contributed considerably to this area of

knowledge by developing performance indicators that should permit a comparison of the performance among projects. More recently, FAO, IWMI and IPTRID (2001) have taken a renewed interest in the application of "benchmarking performance" to the irrigation sector and several efforts are being made for its application in some countries.

Although the theory for the application of performance indicators has been fully developed their practical application remains limited and few irrigation schemes use them as an standard practice even in industrialized countries. One may wonder about this state of affairs given the fact that in principle their use should contribute to improve performance but some of the possible reasons are:

- Most of the performance evaluation systems were developed for comparative purposes with the idea that the comparison will provide some orientations regarding the values obtained from some of the indicators. No doubt that such comparisons have provided useful orientations to all the irrigation community but they were of little practical use to the systems from where the information was collected.
- Any monitoring system requires the compilation of considerable information and this always has a cost. The management of irrigation system is made of farmers or officials of public administration and both are very conservative in the use of funds if no clear benefits are perceived.
- Managers often see monitoring systems as a tool aimed at evaluating their own performance and most people are not happy about this idea. The objectives of an evaluation and monitoring system are often not well understood by managers and leaders of irrigation systems.
- The diversity of irrigation systems is large and it is difficult that any monitoring system may be satisfactory for all of them. It would more appropriate to develop evaluation systems for each main type of irrigations system. For example, Sagardoy (1985) proposed an evaluation system specifically addressed to small systems.

APPLYING BENCHMARKING TOOLS TO IRRIGATION SYSTEMS

In 2000, the need for approaching the problem of performance evaluation in a different way was felt and a meeting on the use of the "benchmarking tools" in the irrigation sector was held at FAO and attended by a selected group of professionals.

Benchmarking is a highly respected practice in the business world. It is an activity that looks outward to find best practices and high performance and then measures actual business operations against those goals. Gonzalez (2000) identifies at least 3 types of benchmarking. The first concentrates in the processes, the second in the performance and the third in the strategies. *Process benchmarking* concentrates in how a specific process is carried out and can be improved, for example the billing system, the recruitment process the production of a specific piece of equipment. *Performance benchmarking* tries to evaluate its own performance and compare it with others. Analysis of operating statistics is the primary technique applied. *Strategic benchmarking* essentially examines how companies compete and rarely focuses in one industry but looks how high performing companies operate and tries to learn the successful strategies and apply them elsewhere.

The application of benchmarking to irrigation offers certain potential but has also limitations. The advantages derive from the need to be specific about the targets (benchmarks) to be reached. The limitations arise form the fact that the management of irrigation systems is not a real business activity as no benefit is involved and therefore competition and other related motivations of the business world do not fully apply. Therefore, the undertaking of M&E systems which primary purposes is the comparison of results between irrigation schemes is often of limited interest to managers because there is no real competition and second because the physical differences among systems made interpretation of results difficult to say the least. On the other hand, the establishment of targets to be achieved in a short time is a benchmarking technique that should be of interest to managers that are really motivated to provide the best possible services to the farmers and here benchmarking techniques offer interesting possibilities.

The application of benchmarking techniques to irrigation are still at an early stage and several efforts are being made to test different approaches and ideas. The Australian National Committee of ICID has undertaken several activities in the field of benchmarking and produced an interesting report in 2000 (ANCID, 2000). IPTRID produced the Guidelines for benchmarking (IPTRID, 2001) and WB is

financing some initiatives in Mexico and other countries. ICID held a session at the Montpellier meeting in 2003 on benchmarking and evaluation of performance and other efforts are being made but results are not yet widely available

SETTING PERFORMANCE OBJECTIVES AND A RELATED MONITORING SYSTEM AT PROJECT LEVEL

The success of benchmarking in the industry derives mainly from the fact that it establishes clear objectives and monitors how the objectives are being achieved. The comparison with competitors is only a factor in the determination of the targets to be reached. If we put the accent in the achievement of objectives the application of this technique to irrigation system can help managers to achieve them.

For establishing the targets the irrigation systems do not need to look into other systems, although it may be useful in some cases, but rather analyse the information that they themselves generate The interpretation of repetitive results from the indicators may provide an excellent reference of the values that can be achieved easily and permit managers to take better informed decisions.

Let us try to illustrate this by an example. Any irrigation system must collect the money arising from the water tariff so that the total approved budget is collected. Let us assume that the tariff is collected monthly. Every monthly invoice is therefore 1/12 of the total to be paid annually. In theory at the end of every month 100 % of the emitted invoices should be collected but in practice the collection may vary and rarely coincide with the 100%. Let us also assume that the manager of such irrigation system has established a monitoring system that reports monthly the percentage between actually paid and total to be paid. If the indicator provides a value of 80% for January is this value something that requires correcting action from the manager or is it normal for that month? To answer this question he/she needs to have enough historical information to understand the relevance of these data. Once enough historical information is available setting the best practices targets becomes a simple matter.

The above example rises several important issues:

1. The indicator is related to the objective which is reaching the 100% of the emitted invoices.
2. Only one indicator has been mentioned but there could be others related to the same objective, for example the cumulative percentage of paid bills with regard to the total emitted (for each month) or the number of farmers that have paid every month. It is up to the manager to decide how many indicators he needs to diagnostic the situation. If it is a simple process one indicator may be sufficient for more complex or important processes several indicators may be required.
3. For each indicator the manager should establish a target or “best practice”, and this is a complex matter because, as illustrated in the example, the best practice can only be settled when enough statistical information has been developed so that it allows the establishment of an achievable target. The more statistic information is available for an indicator the easier the task of defining the best practice. In absence of statistical data the values from other systems with similar characteristics may provide a useful reference. Here the value of comparatives benchmarking studies can provide a useful information particularly when the irrigation systems have similar conditions.

Therefore, if we want that benchmarking becomes a tools that is appreciated by the managers of irrigation systems, it is necessary to develop a benchmarking system that responds to his/her objectives as manager of the system. However, it is impossible to develop a system that may consider all the possible objectives of managers but some objectives are certainly of interest to most of them and some proposals in terms of objectives and indicators can be developed. For the rest each manager will have to complete the benchmarking system with those objectives and indicators that are specific to his/her irrigation scheme.

In summary, a flexible benchmarking system is proposed with three levels of information. One of a descriptive nature to feed information into the national system and that will permit to identify projects of similar characteristics and eventually compare some values. A second level integrated by a number of indicators that respond to general objectives that should be of interest to all managers and a third level made of indicators that respond to the specific desire of the manager of a given system and respond to objectives that he/she has established.

As far as the general level of information the intention is to describe the main characteristics of the irrigation system. For this purpose the *System Descriptors* proposed in the IPTRID Guidelines (2001) are found quite appropriate and could be used for this purpose.

For the second level an attempt is made in the following paragraphs to identify objectives that would be of common interest to managers of irrigation systems and the related indicators.

As for the third level each manager should make specific proposals to reflect objectives that are not sufficiently represented by those proposed here.

System operation objectives (Table 2)

Defining objectives for the system operation is not an easy task because there is a certain degree of interrelation among common objectives indicating that they belong to objectives of higher ranking. Some of the most obvious ones are: reducing the losses of the irrigation system, satisfy crop irrigation requirements, distribute the water timely, measure the water accurately, distribute the water equitably and others. Let us examine them with some detail.

1. *Reducing the losses of the irrigation system*. The losses of an irrigations system are of physical or operational nature. The physical losses are due to the physical characteristics of the system and are mainly due to infiltration and evaporation. The operational losses result from improper operation of the system that leads to waste water into the drainage systems or open fields. However operational losses are uncontrollable because they are due to human errors which are difficult to prevent. The total losses can be evaluated by the difference between the water received at the head of the system and the one delivered at the farms.

2. *Satisfying crop irrigation requirements.* No doubt that the main purpose of irrigation is to satisfy the crop water requirements. The first indicator proposed, also known as relative irrigation supply, indicates the proportion in which the irrigation requirements are satisfied. The limitation of this indicator is that farm irrigation efficiency has to be estimated and this value is rarely based in field determinations. The second indicator tells us if the canal capacity is a constraint to provide the irrigation requirements.

3. *Distribute the water timely.* Satisfying crop water needs means not only providing the required amount of water but also do it at the right time. The suggested indicator provides an orientation if the number of irrigations given was close enough to those required. Other indicators could be used related to the time intervals between to consecutive irrigations but this requires detail calculations that would be justified only if the manager wants to investigate this issue in greater detail.

4. *Measure the water delivered accurately.* This is a legitimate objective for all systems although some may not have the minimum of equipment (calibrated farm intakes) that permit to measure flow and time. Although many irrigation systems do not measure the water delivered it is necessary to promote a change of attitude. Therefore it is felt that including this objective is relevant even if some systems will just respond to the indicators negatively indicating that water is not measured.

There are other objectives that are like “distributing the water equitably”[1] which are perfectly legitimate in some cases but not common to all irrigation systems and following the proposed criteria are not included here. Examples of such objectives are: reduce (or increase) the amount of water delivered per hectare, provide irrigation on–demand, reduce the time between irrigation requests and deliveries and others. If they are relevant to some specific systems the corresponding objectives and related indicators should be added to those indicated in Table 2 by the concerned managers.

[1] Distributing water as equitable as possible is a logical objective in irrigation systems where monoculture prevails (sugarcane, rice. etc. areas.) but not in irrigation systems where several crops are grown because every crop has different irrigation requirements

Table 2. System operation objectives and related indicators

Objective	Indicators related to the objective	Time period for application of indicator	Remarks
1. Reducing the losses of the irrigation system.	*Total losses = Total volume of water supply at the head of the system - Total volume of water delivered at farms*	decade monthly peak demand, annually	Total losses include operational losses
	Efficiency of the distribution system[*] $= 1 - \frac{Water\ losses}{Total\ volume\ of\ water\ \ supplied}$	Decades monthly peak demand, annually	Time evolution of efficiency provides relevant information
2. Satisfying 100 % of crop irrigation requirements	*Relative irrigation supply*[**] $= \frac{Irrigation\ water\ delivered\ at\ farm \times farm\ efficiency}{net\ irrigation\ requirements}$	decades peak demand, annually	The critical period is peak demand
	$\frac{Canal\ capacity}{Peak\ Irrigation\ demand}$	Peak period	It should be determined for all canals
3. Distribute the water timely	$\frac{Number\ of\ irrigations\ given\ per\ main\ crops}{Number\ of\ irrigations\ required\ per\ main\ crops}$	End of irrigation season	It should be determined for main crops
4. Measure the water delivered accurately	$\frac{\text{Total volume of water delivered at farm level}}{\text{Total number of hectares irrigated}}$	Monthly, seasonally, annually	The total volume should be the sum of the volumes delivered at every farm
	$\frac{Number\ of\ offtakes\ \ calibrated}{Total\ number\ of\ offtakes}$	Annually	It provides an indication of the capacity of the system to measure water

[*] In addition to the efficiency of the system it will be useful to determine the efficiencies of the delivery canals using the same type of equation

[**] This indicator is sometime expressed in somewhat different forms

Financial objectives (Table 3)

1. *Achieving 100 % of fee collection.* This is certainly an objective that most of the managers of irrigation systems strive to achieve. However rarely the 100% is achieved and part of the arrears are passed to following year or months.

2. *Obtaining full acceptance of proposed budgets*. Often managers propose a budget to the farmers representatives that is not accepted due to several reasons. In such cases a lower budget is generally approved and this represents a serious limitation for the proper operation of the system.

3. *Reducing the impact of O&M costs in the farmers benefit*. This means in practice that the O&M cost per cubic meter should be as low as possible.

Certainly there are other possible objectives but they may not be applicable to all places. For instance the reduction of O&M costs could be an objective but it is not applicable everywhere since

some systems may need in coming years strong programs of maintenance that will result in higher costs and the manager will not be able to achieve such objective. Those three listed above are certainly desirable in all systems.

Table 3. Financial objectives and related indicators

Objective	Indicators related to the objective	Time period for application of indicator	Remarks
1. Achieving 100% of fee collection.	$\frac{Gross\ \ revenue\ \ \ collected}{Gross\ revenue\ \ \ invoiced}$	Monthly, quarterly, biannually, yearly	Values around 90% are acceptable
	Percentage of farmers that have not paid the invoices	Monthly, quarterly, biannually, yearly	They should not exceed 15%
2. Obtaining full acceptance of proposed budgets	$\frac{Total\ budget\ approved}{Total\ budget\ proposed}$	yearly	
	$\frac{Total\ O\&M}{Total\ Irrigated\ Area}$	yearly	
3. Reducing the impact of O&M costs in the farmers benefit	$\frac{Total\ O\&M\ costs}{Total\ annual\ volume\ of\ water\ delivered}$	yearly, seasonally	Values range from 0.002 € to 0,6 €/m
	$\frac{Total\ O\&M\ costs\ per\ hectare}{Estimated\ net\ benefit\ per\ hectare}$	yearly, seasonally	Estimating net benefits should be done on sample bases

Maintenance objectives (Table 4)

The main objective of a manager of an irrigation system in terms of maintenance is *to ensure that repairs that were identified before the start of the financial year are executed*. Repairs arising from emergency situations are out of his/her control. We are not going to enter into the area of how the manager identifies the needed repairs and assume that this is done in a responsible and professional manner. The indicator proposed tries to measure how effectively the maintenance plan was carried out.

Management objectives (Table 5)

Desirable management objectives are many and it is not easy to isolate those that could be more relevant. Furthermore the subject becomes more complex because the objectives of the manager of the system may not be the same as those of the Management Board. As not all the irrigations systems are managed by a Management Board it has been considered more appropriate to limit the management objectives to those of the manager of the irrigation system no matter whether he is a public official or an employee of the Management Board of a WUA.

Table 4. Maintenance objectives and related indicators

Objective	Indicators related to the objective	Time period for application of indicator	Remarks
To ensure that planned repairs are executed.	$\frac{Number\ of\ activities\ planned}{Number\ of\ activities\ executed}$	Monthly, End of financial year	
	$\frac{Budget\ approved\ for\ maintenanace}{Budget\ actually\ spent\ on\ mainteance}$	Monthly, End of financial year	
	$\frac{Number\ of\ emergency\ activities\ carried\ out}{Total\ number\ of\ maintenance\ activities\ undertaken}$	Monthly, End of financial year	It is intended to evaluate how often emergencies occur

In our view managers of irrigation systems should strive to achieve one essential objective which is *having staff well prepared and motivated to undertake their job responsibilities*. Let us examine in some detail this objective which in reality embraces other objectives of lower level. The connotation of "technically well prepared" denotes a good selection of staff and some periodical training to upgrade their knowledge. The notion of "well motivated" implies that the manager is using management techniques that make staff feel part of a worthwhile organization and motivated to do their jobs effectively. For the selection process some qualitative indicators can be suggested but we have preferred to summarize them into a single one that tries to reflect if the selection process was done according to the best technical criteria given some financial restraints. As far as the training is concerned the proposed indicator gives an idea of how often they receive training. For the motivation of the use of coordination and information meeting with the staff is one of the possible techniques but there are others which are difficult to reflect in indicators.

As in previous cases there are other objectives like: developing good relations with the next superior management levels, having a good communication channel with the users, enforcing discipline among staff and many others, which are difficult to assess with simple indicators and that are not essential to perform his/her job in a satisfactory manner and are therefore not included here.

Table 5. Management objectives and related indicators

Objective	Indicators related to the objective	Time period for application of indicator	Remarks
Having staff technically well prepared and motivated to undertake their job responsibilities.	*Selection of staff done according to adequate[2] selection process* *(rank from 1 to 5)*	Yearly or whenever new staff recruited	
	$\frac{Total\ number\ of\ training\ days\ per\ year}{Total\ number\ of\ staff}$	Yearly	Considers only permanent staff
	Number of coordination and information meetings held	Monthly. Annually	

[2] Adequate means: suitable TORs, advertising of position, independent evaluation process and interviewing the candidates by a panel

Environmental Objectives

Environmental concern is growing and more and more is asked to irrigation systems to reduce the possible negative impacts. Here again are many possible objectives to be considered but most of them are specific of some locations. Not even the salinization process is a common denominator to all irrigation systems. Therefore, according to the suggested approach we have not included an objective common to all systems.

FINAL CONSIDERATIONS REGARDING THE IMPLEMENTATION OF PROPOSED BENCHMARKING SYSTEM

An attempt has been made to develop a benchmarking system that may appeal to managers of irrigation systems because the suggested indicators will help them to achieve reasonable objectives. A minimalist approach has been followed trying to reduce the number of objectives and the corresponding indicators to the bare minimum. Managers can always add other that they consider relevant to their objectives. It is important that managers start to visualize their jobs as objectives to be achieved.

The value of many indicators is related to their variation in time and therefore they should not be limited to few values per year. In this respect, it is important that when the routine data of an irrigation system are entered into a computer they should be entered into a format that later on permits an easy application of the indicators. Retrieving the data necessary for the indicators once that data have been entered in a arbitrary manner may take considerable time and work.

Once the system is in place the managers will have an important work in developing for each indicator the so-called “best practices” or the values for which some type of action is required. In some cases it may require to accumulate information for at least a year before attempting to define such values.

The adoption of the proposed system should be limited to few irrigation systems given the fact that is a new system and needs to be tested. After one year of use it will be relevant to evaluate if the system has been able to contribute in some way to achieve higher levels of performance. If this objective is achieved there would be a justification for encouraging a wider adoption of the proposed system.

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