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# Modernizing irrigation management – the MASSCOTE approach

## Mapping System and Services for Canal Operation Techniques

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## Mapping System and Services for Canal Operation Techniques

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by

**Daniel Renault**
FAO Land and Water Development Division

**Thierry Facon**
Land and Water Management
FAO Regional Office for Asia and the Pacific

**Robina Wahaj**
FAO Consultant

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- Modernizing irrigation management – the MASSCOTE approach. Mapping System and Services for Canal Operation Techniques
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- MASSCOTE – *draft version* (Arabic and Chinese).
- MASSCOTE Training presentations (Introduction plus the 11 steps)
- MASSCOTE – a methodology to modernize irrigation services and operation in canal systems Application to two systems in Nepal Terai: Sunsari Morang Irrigation System and Naryani Irrigation System.
- Modernization lectures: a set of presentations
- Rapid appraisal procedure –Text and spreadsheet file.
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- Irrigation training manuals for technicians
- Strategic planning training modules

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- Adobe Acrobat® Reader (not included on CD-ROM)

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# Preface

The MASSCOTE methodology has been developed to assist technical experts, irrigation managers and irrigation professionals engaged in the difficult task of modernizing or re-engineering the irrigation management of medium-to-large irrigation canal systems.

While most irrigation experts, policy-makers, donor agencies and practitioners recognize the pressing need to bring about drastic changes in irrigation management, few know how to do so in practice. Despite considerable commitments in terms of effort and resources, many modernization projects have failed and irrigation institutional reforms have not yielded expected results because of a lack of attention to detail. In Asia, an FAO regional irrigation modernization programme concerning more than 30 irrigation systems highlighted inadequate attention to canal operation as a major reason for disappointing results and underperformance.

Irrigation has been and will remain instrumental in combating food insecurity in rural areas. However, a significant shift towards more productive agriculture and wealthier farming systems is underway. At the same time, there is a growing focus on the multiple uses of water for improved livelihoods, on the need for conserving the environment for sustainable development and on the use of water resources. With increasing water scarcity and growing competition from different sectors for the water resources available, irrigated agriculture is expected to do "more with less" in terms of both water and funding, thus freeing up resources (water and money) for other uses.

In spite of the increased challenges and changing context in which irrigation takes place, irrigation engineers are still trained in the same traditional manner that only prepares them to design and construct the canals and not to manage irrigation systems. There are very few training centres and universities (and these mostly in the developed countries) that provide training in service-oriented irrigation management and modern canal operation techniques. Usually, irrigation professionals are expected to learn by themselves in the field how to handle issues related to performance improvement, multiple uses of water, environmental needs, low farm-gate prices, conjunctive use, etc. Generally, they are left with limited capacity and resources to deal with the increasing complexity of management.

Irrigation modernization is often misunderstood and associated exclusively with high technology or costly automation. However, modern irrigation management is essentially concerned with responding to the needs of current users with the best use of the available resources and technologies as well as a sense of anticipating the future needs of the scheme. How to convert this into very practical, effective technical solutions is a critical question. As they say, "the devil is in the details", but the paradox is that driving out the devil is not attractive to many. The more water is debated globally, the less managers are provided with practical solutions and tools to address complex situations and requirements.

The MASSCOTE approach is an attempt to overcome this paradox and to help managers address modern needs, issues and challenges in a serious way. The entry point is canal operation, but the scope is modernization and the goal is to promote service-oriented management, with specific identified targets in terms of effectiveness in relation to money, to water and with regard to the environment.

The methodology capitalizes on many modernization programmes in which FAO has been involved in recent years, in particular through associated training (RAP and MASSCOTE training courses). In the last decade, FAO has trained more than 500 engineers in Asia. Therefore, it is fair to say that the approach presented here has

largely been developed in close collaboration with irrigation managers in the field, who are envisaged to be the main users of this product.

MASSCOTE seeks to stimulate the critical sense of engineers in diagnosing and evaluating obstacles, constraints and opportunities, and in developing a consistent modernization strategy. The methodology is developed in a step-by-step approach in order to convert the overall complexity into simple and straightforward elements. These are then explored in a recursive process leading progressively to a new management setup and improvements in canal operation in order to facilitate the move towards more effective water management and improved water delivery service

The English word mascot means an object, person or animal believed to bring good luck, especially one kept as the symbol of an organization such as a sports team, and it comes from the French word *mascotte*. The authors believe that achieving success in bringing about modernization in irrigation through service-oriented management requires good organization, a good team and also some good luck – this is why MASSCOTE is needed.

This publication is accompanied by two CD–ROMs containing training material and technical documents on key topics in water and irrigation management, including some versions of MASSCOTE in Arabic, Chinese and French.

# List of acronyms and symbols

| | |
|---|---|
| BFSL | Below full supply level |
| CA | Command area |
| CI | Confidence interval |
| CMC | Chatra Main Canal |
| COT | Canal operation technique |
| CR | Cross-regulator |
| CV | Coefficient of variation |
| DBW | Duck-bill weir |
| DOI | Department of Irrigation |
| ET | Evapotranspiration |
| ETc | Crop evapotranspiration |
| ETo | Reference evapotranspiration |
| F | Froude number |
| *F* | Hydraulic flexibility |
| FF | Fixed frequency |
| FSD | Full supply depth |
| FSL | Full supply level |
| *g* | Gravity acceleration |
| GLBC | Ghataprabha Left Bank Canal |
| *H* | Head |
| *h* | Water level |
| IPTRID | International Programme for Technology and Research in Irrigation and Drainage |
| ITRC | Irrigation Training and Research Center (California Polytechnic University) |
| IWMI | International Water Management Institute |
| IWRM | Integrated water resources management |
| *Kc* | Crop coefficient |
| KOISP | Kirindi Oya Irrigation System Project |
| *Ks* | Water stress coefficient |
| LBO | Left Bank Old |
| LCW | Long-crested weir |
| M&E | Monitoring and evaluation |
| MASSCOTE | Mapping System and Services for Canal Operation Techniques |
| MOM | Management, operation and maintenance |
| NIS | Narayani Irrigation System |
| O&M | Operation and maintenance |

| | |
|---|---|
| PRA | Participatory rural appraisal |
| PTL | Proportional to time lag |
| $Q$ | Discharge |
| $q$ | Discharge through offtake |
| RAP | Rapid Appraisal Process |
| RBMC | Right Bank Main Canal |
| RBN | Right Bank New |
| $S$ | Sensitivity indicator |
| SBU | Sequential bottom-up |
| SCADA | Supervisory control and data acquisition |
| SMIS | Sunsari Morang Irrigation System |
| SO | Simultaneous operation |
| SOA | Service-oriented architecture |
| SOM | Service-oriented management |
| TLO | Time-lag operation |
| $V$ | Velocity |
| WDP | Water distribution plan |
| WUA | Water users association |
| WUC | Water Users Committee |
| WUCC | Water Users Coordination Committee |
| WUCCC | Water Users Central Coordination Committee |
| WUG | Water users group |

# Summary

The performance of many canal irrigation delivery systems is unsatisfactory in terms of: (i) water resources management; (ii) service to irrigated agriculture; and (iii) cost-effectiveness of infrastructure management.

In recent years, participatory approaches and management transfer reforms have been promoted as part of the solution for more cost-effective and sustainable irrigation services. Large agency-managed systems have been turned over partially or completely to various types of management bodies. However, the results have usually been disappointing. Common findings have been: (i) the new management bodies are not up to the task; and (ii) these bodies have inherited dilapidated systems and severe financial constraints.

This FAO Irrigation and Drainage Paper presents a step-by-step methodology for water engineering professionals, managers and practitioners involved in the modernization of medium-scale to large-scale canal irrigation systems from the perspective of improving performance of conjunctive water supplies for multiple stakeholders. While the focus is on canal operation, the scope concerns the modernization of management. The approach consists of a series of steps for diagnosing performance and mapping the way forward in order to improve the service to users and the cost-effectiveness of canal operation techniques.

This paper presents a proposed comprehensive methodology for analysing canal operation modernization, which is based on Mapping System and Services for Canal Operation Techniques (MASSCOTE). It discusses the main elements of canal operation and organization before describing the steps of the MASSCOTE approach in detail. These steps are grouped into two main parts: (i) baseline information; and (ii) a vision of water services and modernization plan for canal operation.

The part relating to baseline information focuses on: the Rapid Appraisal Procedure (RAP); system capacity and behaviour (sensitivity); perturbations; water networks and water balances and the cost of operating the system.

The part relating to the vision of water services and modernization plan focuses on: service to users; re-engineering of management; and options for modernization improvements. The analysis leads on to a consolidated vision of the future of the irrigation system management and a plan for a progressive modernization of irrigation management and canal operation.