# IMPROVING WATER PRODUCTIVITY THROUGH BENCHMARKING AND REHABILITATION OF EXISTING SYSTEMS

# AMELIORATION DE LA PRODUCTIVITE DE L'EAU PAR LE BENCKMARKING ET LA REHABILITATION DES SYSTEMES EXISTANTS

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## ABSTRACT

*In India, irrigated agriculture consumes almost 80% of total developed fresh water resources. With increased demand of water from other sectors, the availability of water for irrigation is under stress. The water use efficiency in most irrigation systems in India at present is low due to reasons such as inadequacies in the water delivery system, inequitable water distribution to the fields and inefficient water management practices by the end users. Water use efficiency has also reduced considerably in older projects due to improper maintenance and deterioration in their infrastructure. These projects require renovation / upgradation. Further, despite the fact that productivity in irrigated areas has increased as compared to that of rain fed areas, the increase is still below world standards. Against the backdrop of such a scenario, the water resources management has to undergo a deep introspection and a paradigm shift. Benchmarking with appropriate performance indicators can help in deciding appropriate interventions and in the formulation and implementation of policies for improvement of projects.*

*The paper discusses the concept of Benchmarking, its adoption in India, various parameters, data collection requirements and application constraints. The impact of Benchmarking and renovation of old irrigation systems on water productivity is also brought out in detail in the paper.*

***Key words:*** *Water productivity, benchmarking, rehabilitation, irrigation systems*

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# *RESUME*

*En Inde, l'agriculture irriguée consomme presque 80% des ressources en eau douce. L'augmentation de la demande d'eau par d'autres secteurs cause la situation du stress hydrique en irrigation. L'efficience d'utilisation de l'eau dans la plupart des systèmes d'irrigation en Inde est au niveau bas en raison de l'insuffisance du système de distribution d'eau, de la distribution inéquitable d'eau aux champs et des pratiques inefficaces de la gestion d'eau utilisés par les usagers finaux. L'efficience d'utilisation de l'eau est également réduite de manière considérable dans les vieux projets en raison de la maintenance incorrecte et la détérioration de leur infrastructure. Ces projets exigent la rénovation. Malgré le fait que la productivité des régions irriguées a augmenté par rapport aux régions alimentées par les pluies, l'augmentation est toujours au-dessous des normes mondiales. Dans le cadre de ce scénario, il est nécessaire de subir une introspection profonde et un changement de paradigme en ce qui concerne la gestion des ressources en eau. Le benchmarking accompagné des indicateurs appropriés de la performance peut aider dans la prise de décision sur les interventions appropriées et la mise en oeuvre des politiques pour l'amélioration des projets.*

*Le rapport discute le concept de benchmarking, son adoption en Inde, les divers paramètres, les exigences de collecte de données et les contraintes d'application. Le rapport évoque en détail l'impact de benchmarking et de restauration des vieux systèmes d'irrigation sur la productivité de l'eau.*


***Mots clés:*** *Productivité de l'eau, benchmarking, réhabilitation, systèmes d'irrigation.*

# 1. INTRODUCTION

India has made significant progress in developing its water resources over the past 60 years. The expansion of irrigation system along with increased use of fertilizers; seeds of high yield varieties and modern agronomic practices have increased the production of food grains from a meager 51 million tonne in 1951 to more than 235 million tonne at present. However on account of the traditional practices being followed by the farmers, irrigated agriculture consumes almost 80% of total developed fresh water resources. With increased demand of water from other sectors, the availability of water for irrigation is under stress. On the other hand, there is considerable scope for improvement in the sector in order to get higher food grain production with use of lesser quantities of water.

The water use efficiency in irrigation systems in India at present is quite low; in the range of 35% to 40% in many old projects. The main causes for these low efficiencies are observed to be inadequacies in water delivery system, inequitable delivery of water to the fields and inefficient water management practices by the end users. Water use efficiency has reduced considerably in older projects due to improper maintenance and deterioration in their infrastructure. These projects require renovation / upgradation. Detailed diagnostic analysis for evaluating performance of the 25 years or more old schemes is carried out time to time to identify the bottlenecks and their timely corrective measures so that the potential created at a huge cost is not permanently lost.

Benchmarking has been developed as a management tool, which has proved to be invaluable in helping individual systems to be evaluated for their health status. Stated simply, Benchmarking is only "introspection" since it is a continuous process of measuring one's own performance and practices against the best competitors, and is a sequential exercise of learning from other's experience. Opportunities for improvement are identified by conducting an internal assessment and making comparative measurements with best practices to determine the performance gap between current practice and best practice. By using appropriate performance indicators of benchmarking it is possible not only to improve the water use efficiency and financial viability of the system but also ensure adoption of best management practices and the environmental sustainability in the irrigated agriculture systems. Benchmarking can help in deciding upon appropriate interventions and in formulation and implementation of policies for improvement of projects and thereby improving water productivity of the systems.

# 2. CONCEPTS OF BENCHMARKING

Literally, a benchmark is a standard or point of reference against which things can be compared or assessed. It is a continuous process. Comparing performance among organizations has been a common practice for the last more than two decades in industrial and commercial sectors as a means of achieving improved management outcomes. However, benchmarking is not yet a common practice in the irrigation sector. Moreover, definition of benchmarking for irrigation sector cannot be taken straight way from what it is in the industrial and commercial environment. No doubt, the purpose of benchmarking for both the sectors is the same that is to improve the level of performance, but the approach is slightly different or modified in case of irrigation projects.

IPTRID (2001) has defined Benchmarking as:

*"A systematic process for securing continual improvement through comparison with relevant and achievable internal or external norms and standards".*

Thus, according to IPTRID, there are two components of benchmarking. The first component suggests performance comparison of an irrigation project with relevant and achievable **internal norms** and standards. It is basically to relook / introspect on its best past performance with the aim of improving the current level of performance. It is termed as **internal or historical** benchmarking. The second component suggests performance comparison of an irrigation project with relevant and achievable **external norms** and standards. It is about adoption of practices and process of best performer among similar irrigation projects with the objective of improving present level of performance.

# 3. NEED OF BENCHMARKING IN IRRIGATION SYSTEMS

India has made rapid strides in irrigation development in the Plan era beginning from 1951 resulting in more than tenfold increase of food grain production of the country. As much as 52 percent rise in food grain production can be attributed to increase in irrigated area. Total water use in agriculture is about 80% of total present water use in the country. The National Commission on Integrated Water Resources Development Plan (NCIWRDP) has estimated that the irrigation water requirement will be of the order of 628 BCM and 807

BCM, respectively, for low demand and high demand scenario in 2050. Although, the average water availability in the country remains more or less fixed according to the natural hydrologic cycle, the per capita availability is reducing progressively owing to increasing population. In 1991, the national average per capita water availability in India was around 2200 cubic metre (cu.m.) per year which has gone down to about 1829 cu.m per year. But these figures do not give proper picture of the problem due to high regional variability: from as high as 18,400 cu.m capita$^{-1}$ year$^{-1}$ to as low as 380 cu.m capita$^{-1}$ year$^{-1}$ in some of the river basins in Tamil Nadu. With the projected future population the average annual per capita water availability may go down to around 1340 and 1140 cubic metre by the year 2025 and 2050, respectively.

India has made significant progress in developing its water resources during Plan periods. Various major, medium and minor irrigation and multipurpose projects were formulated and implemented through successive Five Year Plans to create additional irrigation potential throughout the country. Over 4000 large dams and numerous minor projects have been constructed for storage and diversion of water to meet demands of agriculture, domestic including drinking water, industries, energy etc. More than 400 dams are under various stages of construction and several other projects are under consideration all over the country. A milestone in water resources development in India is the creation of a substantial storage capability. Up to the end of X Plan (2002-07), storages of 225.14 BCM were created against the Pre-Plan storages of 15.64 BCM. Besides, storage facilities of 63.90 BCM are under construction and for another 107.54 BCM are under consideration. As a result of this development, the irrigation potential by the end of 2007 has gone up to 102.77 M.ha (contribution of major &medium projects is about 42.35 M.ha) against the 22.60 M. ha in 1951. The created storage works have enabled providing assured irrigation in the command areas, ensuring supply for hydro-power and thermal power plants and meeting requirement for various other uses.

With progressive increase in demand of water by various sectors, it is imperative that the water use efficiency has to be improved in all the sectors. This efficiency in most irrigation systems is low at present. With increase in efficiency in irrigation sector, a lot of water can be saved but water wastage in other sectors also cannot be ignored. Each litre conserved can help to meet new water demand. However, the improvement of efficiency in irrigation sector, which is a major consumer, assumes a greater significance. Efficiency improvement by 10 to 20 percent will save lot of water that can be used either to increase the irrigated area or to meet the demands of other sectors.

There is a considerable scope for rationalization and optimization of irrigation demand. To achieve this, various measures have to be taken which include; selective lining of vulnerable reaches of canals, provision of adequate funds for operation and maintenance of irrigation systems through appropriate water pricing, ensuring right and timely water supply, enhanced stakeholders' involvement in water management, proper on-farm development and management, technology upgradation through use of micro irrigation system such as drip and sprinkler, wherever feasible, etc. Various other issues that need to be addressed for efficient management of irrigation systems are; bridging the gap between irrigation potential created and utilized, conjunctive use of surface and ground water, renovation and modernization of irrigation projects, integrated use of poor quality and good quality waters,

**performance evaluation, benchmarking** and water audit of irrigation systems. Among the various measures as mentioned above, the **performance evaluation and benchmarking** are gaining popularity in recent years. The performance evaluation studies of completed irrigation projects are being carried out by Central Water Commission (CWC) and reports of the studies are provided to Water Resources/ Irrigation Departments of concerned States and other related Organisations for implementation of the recommendations.

Now, the question arises that when performance evaluation of irrigation system is in process then where is the need of benchmarking for the same purpose? The answer is that in performance evaluation, performance of an irrigation system is assessed with reference to set / planned targets and objectives of the of the project formulated / decided prior to commissioning of irrigation project whereas in case of benchmarking of irrigation systems, performance is compared with its best past performance and also with performance of other irrigation projects. In this way, benchmarking provides wider scope for performance comparison and performance improvement. Further, benchmarking is continuously moving upward with time and thus it is dynamic in nature. As, benchmarking provides a better tool for measuring performance of an irrigation system and offer better solution for improvement, therefore, the need for benchmarking of irrigation systems arises to make best use of infrastructures created by incurring huge cost to benefit the people.

# 4. PARAMETERS / INDICATORS OF BENCHMARKING IN IRRIGATION PROJECTS IN INDIA

## 4.1 Parameters / Indicators:

In general, efficiency is a measure of performance of any irrigation system. Efficiency is defined as output over input. In this, getting output from the input is through a process. The process transforms input into output and also generates impacts. The efficiency will be at its maximum when the output is maximum and input is minimum. And also adverse impacts on account of conversion process are needed to be minimum or within permissible or manageable limit. Thus broadly every system has (a) inputs; (b) processes; (c) outputs and (d) impacts. Therefore, instead of one scale, many scales are needed to measure performance of an irrigation projects. The water supplied to the system, expenditure on establishment and expenditure on operation and maintenance of system etc., may come under the category of inputs. Water delivery mechanism may be considered as process. Water delivered to fields to meet the crop water demand, annual yield from the irrigated area, revenue generated from supply of irrigation water etc., are outputs. Positive (recharge of ground water, reduction in soil salinity) and negative (waterlogging, ill effects on flora and fauna) effects on the environment will be the impacts of an irrigation system.

It is very difficult to express performance of an irrigation project with a single parameter such as efficiency. As complete benchmarking of any system encompasses all i.e., benchmarking of inputs, processes, outputs and of inputs, therefore, instead of one scale, many scales are needed to measure performance of an irrigation project. Each of such scales is termed as indicator or parameter.

## 4.2 Selection / Finalisation of Parameters / Indicators:

The following points may be helpful in selection of indicators for measures of performance of irrigation systems:

(a) Simplicity

(b) Effectiveness

(c) Universal applicability

(d) Less data intensive

(e) Derivability from routinely collected data for normal operation and management of irrigation system.

(f) Capability of showing comparative analysis of irrigation performance across irrigation systems.

## 4.3 Size of Parameters / Indicators:

A number of researchers and organisations have studied indicators to measures irrigation system performance. Many have suggested a large number of indicators. Some of these may need data that are not routinely recorded for irrigation and drainage schemes. It is therefore suggested that numbers of indictors are to be selected on the basis of specific purpose of evaluation and circumstances.

## 4.4 Parameters / Indicators suggested by INCID:

In irrigation sector, there may be a variety of irrigation domains of interest. The following four are of primary interests as suggested in the "Guidelines for Benchmarking of Irrigation Systems in India" brought out by INCID in 2002.

(a) System performance

(b) Productive performance

(c) Financial performance

(d) Environmental performance

The performance indicators that are proposed for use in the benchmarking exercise are linked to these domains of interest and their inputs, processes, outputs and impacts. There are **20 key** performance indicators that has been used for the benchmarking exercise, as given in the Table 1.

Table 1. Domain of Interest and Performance Indicators

| Domain of Interest | Performance Indicators |
|---|---|
| **I. System Performance** | 1. Water delivery capacity Index |
| | 2. Total annual volume of irrigation water supplied/delivered ($m^3$/year) |
| | 3. Field application efficiency |
| | 4. Annual Relative Irrigation Supply Index |
| | 5. Annual irrigation water supply per unit command area (Cum/ha) |
| | 6. Annual irrigation water supply per unit irrigated area (Cum/ha) |
| **II. Productive Performance** | 7. Output per unit command area (Rs/ha) |
| | 8. Output per unit irrigated area – Tons/ha crop wise, Rs/ha |
| | 9. Output per unit irrigation supply (Rs/cum) |
| | 10. Output per unit crop water demand (Rs/cum) |
| **III. Financial Performance** | 11. Cost recovery ratio |
| | 12. O&M cost per unit area (Rs/ha) |
| | 13. Cost per person employed on O&M works (Rs/person) |
| | 14. Revenue collection performance |
| | 15. Revenue per unit volume of irrigation water supplied (Rs/cum) |
| | 16. Maintenance cost to revenue ratio |
| | 17. Staff numbers for O&M per unit area (persons/ha) |
| | 18. Total O&M cost per unit of water supplied (Rs./cum) |
| **IV. Environmental Performance** | 19. (a) Average depth to water table (m) |
| | 19. (b) Land Damage Index |
| | 20. (a) Water quality: pH/Salinity/Alkalinity Index |
| | 20. (b) Salt balance (tones) |

The proposed domains of interest linked to their inputs, processes, outputs and impacts for use in the benchmarking exercise in irrigation sector, performance indicators and their definitions are given in Table 2.

Table 2: Domain of Interest, Performance Indicators and Definitions

| Domains of Interest | Performance Indicators | Definitions |
|---|---|---|
| **I. System Performance** | 1. Water delivery capacity Index | (Canal capacity to deliver water at system head) ÷ (Peak irrigation water requirement) |
| | 2. Total annual volume of irrigation water supplied/ delivered ($m^3$/year) | Total volume of water delivered to water users over the year or season. Water users in this context are the recipients of irrigation service and these may include single irrigators or groups or irrigators organized into water user groups |
| | 3. Field application efficiency | (Water used by crops by evapotrans-piration) ÷ (Water delivered at field head) |
| | 4. Annual Relative Irrigation Supply Index | (Total annual volume of irrigation water supplied) ÷ (Total annual volume of crop irrigation demand) |
| | 5. Annual irrigation water supply per unit command area (Cum/ha) | (Total annual volume of irrigation water inflow) ÷ (Total command area serviced by the system/sub-system) |
| | 6. Annual irrigation water supply per unit irrigated area (cu.m/ha) | (Total annual volume of irrigation water inflow) ÷ (Total annual irrigated crop area |
| **II. Productive Performance** | 7. Output per unit command area (Rs/ha) | (Total annual value of agricultural production) ÷ (Total command area serviced by the system/Sub-system) |
| | 8. Output per unit irrigated area – Tons/ha crop wise, Rs/ha | (Total annual value of agricultural production) ÷ (Total annual irrigated crop area) |
| | 9. Output per unit irrigation supply (Rs/cum) | (Total annual value of agricultural production) ÷ (Total annual volume of irrigation of water inflow) |
| | 10. Output per unit crop water demand (Rs/cum) | (Total annual value of agricultural production) ÷ (Total annual volume of water consumed by the crops) |
| **III. Financial Performance** | 11. Cost recovery ratio | (Gross revenue collected) ÷ (Total MOM cost) |
| | 12. Total O&M cost per unit area (Rs/ha) | (Total MOM cost) ÷ (Total command area serviced by the system by the system/sub-system |
| | 13. Total cost per person employed on O&M works (Rs/person) | (Total cost of personnel engaged in I&D service) ÷ (Total number of personnel engaged in I&D service) |
| | 14. Revenue collection performance | (Gross revenue collected) ÷ (Gross revenue invoiced) |
| | 15. Revenue per unit volume of irrigation water supplied (Rs/cum) | (Gross revenue collected) ÷ (Total annual volume of irrigation water delivery) |
| | 16. Maintenance cost to revenue ratio | (Maintenance cost) ÷ (Gross revenue collected) |
| | 17. Staff numbers for O&M per unit area (persons/ha) | (Total number of personnel engaged in I&D service) ÷ (Total command area serviced by the system/ subsystem) |
| | 18. Total O&M cost per unit of water supplied (Rs./cum) | (Total MOM Cost) ÷ (Total Water supplied) |

| | | |
|---|---|---|
| **IV. Environmental Performance** | 19. (a) Average depth to water table (m) | (Waterlogged + Saline/alkaline affected area) ÷ (Total CCA) |
| | 19. (b) Land Damage Index | Average annual depth of water table calculated from water table observations over the irrigation area |
| | 20. (a) Water quality: Ph/ Salinity/Alkalinity Index | pH/Salinity/Alkalinity of the irrigation supply and drainage water |
| | 20. (b) Salt balance (tones) | Differences in the volume of incoming salt and outgoing salt |

## 4.5 Data requirements:

Benchmarking process involves collection of primary and secondary data. Data requirement pertaining to the system / sub-system for computations of various indicators under (a) system performance, (b) productivity performance, (c) financial performance and (d) environmental performance as part of benchmarking process are given in Table 3.

Table 3. Data requirements pertaining to the system/sub-system

| Sl. No. | Data requirements pertaining to the system/sub-system |
|---|---|
| 1 | Current canal capacity of the system/sub-system at the diversion point |
| 2 | Designed Peak irrigation water demand for a month/fortnight |
| 3 | Total daily measured water at the intake of the system/sub-system |
| 4 | Total daily measured water delivery to the field head |
| 5 | Total daily measured water used by evapo-transpiration (for different crops if available) |
| 6 | Total daily measured rainfall over irrigated area |
| 7 | Total command area serviced by the irrigation system/sub-system |
| 8 | Total annual irrigated crop area |
| 9 | Total annual tonnage of each crop |
| 10 | Market price/Minimum Support Price (MSP) for the crops |
| 11 | Total volume of water consumed by the crops (Etc). For rice crop, percolation losses need to be included |
| 12 | Total revenue collected from water users |
| 13 | Total management, operation and maintenance (MOM) cost excluding capital expenditure and depreciation/renewals |
| 14 | Total cost of MOM personnel |
| 15 | Total number of MOM personnel employed |
| 16 | Total revenue due during the year |
| 17 | Periodic measurements of depth to water table |
| 18 | Waterlogged area in the command area after introduction of irrigation |
| 19 | Salinity/alkalinity affected area in the command area after introduction of irrigation |
| 20 | Electrical conductivity of periodically collected irrigation water samples in mmhos/cum |
| 21 | Electrical conductivity of periodically collected drainage water samples in mmhos/cum |
| 22 | Total daily measured drainage water outflow from the irrigation system |
| 23 | Periodic measurement of salt content of irrigation water |
| 24 | Periodic measurement of salt content of drainage water |

## 4.6 Application constraints

Correctness of the collected data is prerequisite for success of the benchmarking process. To ensure the consistency in the comparison of results, various organizations joining benchmarking process will have to adopt a set procedure for collection of data and its processing. The data for benchmarking may be categorized as (a) primary data and (b) secondary data. Data maintained by the irrigation agencies and available with them is termed as primary data.

Primary data may be needed to be observed on regular basis. For this, certain measuring instruments and devices and even undertaking some amount of minor works may be required. Further, uniformity in frequency of observation, format of data collection sheet, unit of data for a particular type etc. is necessary to be maintained for all irrigation projects taking part in benchmarking process. Maintaining of records at one place in contrast to maintaining them at State level will definitely help in maintaining uniformity, smooth sharing of data by projects, quick and easy processing of data and will also be less prone to human errors.

Data already observed and maintained by other agencies in a particular format is termed as secondary data. Rainfall, Reference crop evapotranspiration (Eto) etc., may fall under this category. Data sources in respect of secondary data may also be needed to be identified. With a view to maintaining uniformity, a data base on salient features of irrigation projects and characteristics of project area are to be created and maintained for deciding groups of peer irrigation projects.

# 5. STATUS OF BENCHMARKING OF IRRIGATION PROJECTS IN INDIA

Benchmarking in irrigation sector was introduced in India by conducting a National level workshop on benchmarking in irrigation systems in the year 2002 with the participation of officers from Central Water Commission, Ministry of Water Resources and other Central & State Governments. With the inputs from the workshop, a “Guidelines for Benchmarking of Irrigation Systems in India” was brought out by Indian National Committee on Irrigation and Drainage (INCID), New Delhi. Subsequently, numbers of state level workshop on “Benchmarking of Irrigation Projects” were conducted.

Ministry of Water Resources, Government of India in 2002 also constituted a Core Group under the Chairmanship of Member (Water Planning & Projects), Central Water Commission with members from Ministry of Water Resources, Indian National Committee on Irrigation and Drainage, International Commission of Irrigation and Drainage and Central Water Commission. The “Core Group” was constituted with the view of promoting benchmarking of irrigation projects in the states and union territories of India by way of providing guidance, developing methodology, evolving work programme, coordinating activities and extending assistance on other related aspects of benchmarking. To begin with, all states and union territories of the country were requested to initiate benchmarking of at least one irrigation system in their state/Union territories.

## 5.1 Initiatives taken by State of Maharashtra

State of Maharashtra has taken up benchmarking of irrigation systems in a big way with initiating benchmarking of 84 irrigation systems (30 major, 26 medium and 28 minor irrigation projects) in the state under eight groups of irrigation systems in the state, the total number of irrigation projects covered under performance assessment through benchmarking has gone up to 262 (48 major, 145 medium and 69 minor) in the year 2007-08. Twelve indicators were selected for the study. Water Resources Department of Maharashtra has brought out annual reports on this subject also.

The year wise indicators selected for benchmarking since 2001-02 along with their Domain are enlisted below in Table 4.

Table 4. Performance Indicators along with their Domain

| Year | Domain | Performance Indicators |
|---|---|---|
| **2001-02** | 1. System Performance | i) Annual irrigation water supply per unit irrigated area |
| | 2. Agricultural Productivity | i) Output per unit irrigated area, |
| | | ii) Output per unit irrigation supply |
| | 3. Financial Aspects | i) Cost Recovery Ratio |
| | | ii) Total O&M cost per unit area |
| | | iii) Revenue per unit volume of water supplied |
| | | iv) Maintenance cost to revenue ratio |
| | | v) Man days for O&M per unit area |
| | | vi) Total O&M cost per unit volume of water supplied |
| | 4. Environmental Aspects | i) Land damage index |
| **2002-03** | 1. Deleted Indicator | Maintenance Cost to Revenue Ratio |
| | 2. Additional Indicators | 1. Potential Created and Utilised Equity Performance |
| **2003-04** | Additional Indicator | Assessment Recovery Ratio |
| | | a. Irrigation |
| | | b. Non-irrigation |
| **2004-05** | No Change | |
| **2006-07** | 1 Deleted | Man days per unit area |
| **2007-08** | No Change | |

Water Resources Department of Maharashtra is using Benchmarking as an effective tool to evaluate the performances of irrigation projects. Project wise and Indicator-wise results along with probable causes for low performances compared to past achievement as well as state targets were made available to the field officers with the intention and directives to prepare and implement a project-wise consolidated action plan. They were stressed to submit the outcome of such action plans with its details. Project authorities are no doubt taking the cognizance of the low performances and are taking suitable action to seek the desired improvement in irrigation management.

### 5.2 Benchmarking of Water Users Associations (WUAs)

In view of the huge capital investment in construction of projects as well as in rehabilitation of canal systems, benchmarking of WUAs was felt necessary. Accordingly the issue of Benchmarking of WUAs was considered by the State of Maharashtra. To initiate the process, 9 Indicators feasible to determine the performance of individual WUA are designed and data in prescribed proforma was called from selected 11 WUA's of 7 Major projects. Benchmarking of WUAs will help to determine and bring necessary improvement in the overall functioning of each WUA. It also will help the Water Resources Department to ascertain whether the objectives of handing over the Irrigation Management to WUAs are attained or not.

## 6. REHABILITATION OF EXISTING IRRIGATION SYSTEMS

It is well established from above discussion that Benchmarking is necessary to evaluate the performance of existing irrigation systems. It helps to identify the shortcomings and also to find the remedial measures for improvement. The remedial measures could be either structural improvement or non-structural measures like management issues or even both for most of the cases. Rehabilitation of existing irrigation systems is one amongst the various structural measures. It broadly covers repair of damaged structures, desilting of canal systems, lining of vulnerable reaches, maintenance of the systems etc.. to improve system performance.

The Government of India has given due priority for Rehabilitation of existing irrigation projects to improve the efficiency / performance of the systems. As a strategy, it is stipulated that all the schemes, which are more than 25 years old should be studied in detail to bring out the status of schemes in respect of structural safety and performance and Extension, Renovation and Modernisation (ERM) schemes may be formulated and taken up based on such studies. Rehabilitation of existing irrigation projects will also bridge the part of the lag / gap of utilisation of irrigation potential created. The gap at present is about 15%. Existing schemes have been planned for use of certain quantity of water. With deterioration of system / poor management, whole of the command is not served by the available water which is then wasted generally by overuse. This reduces the water productivity. With identification of problematic areas and with proper ameliorative measures more area can be irrigated with same quantity of water thereby substantially enhancing the water productivity.

## 7. SUMMARY AND CONCLUSIONS

India has made significant progress in development of its water resources over the past 50 years. The expansion of irrigation system along with increased use of fertilizers; seeds of high yield varieties and modern agronomic practices have increased the production of food grains from a meager 51 million tonne in 1951 to more than 230 million tonne at present. However, irrigated agriculture consumes more than 80% of total developed water resources. With increased demand of water from other sectors, the availability of water for irrigation is under stress. There is considerable scope for improvement in the sector in order to get higher food grain production with use of lesser quantities of water. The water use efficiency in most irrigation systems in India at present is low and estimated to be in the range of 35%

to 40%. The main cause for these low efficiencies is observed to be inadequacies in water delivery system, inequitable delivery of water to the fields and inefficient water management practices by the end users.

Water use efficiency has also reduced considerably in older projects due to improper maintenance and deterioration in their infrastructure. These projects require renovation / upgradation. Detailed diagnostic analysis for evaluating performance of the schemes which have become 25 years or more old is carried out to identify the bottlenecks and for their timely corrective measures so that the potential created at a huge cost is not permanently lost. Benchmarking has been developed as a management tool which has proved to be invaluable in helping individual systems to be evaluated for their health status. Stated simply Benchmarking is only an "introspection" since it is a continuous process of measuring one's own performance and practices against the best competitors, and is a sequential exercise of learning from other's experience. Opportunities for improvement are identified by conducting an internal assessment and making comparative measurements with best practices to determine the performance gap between current practice and best practice. By using appropriate performance indicators of benchmarking it is possible not only to improve the water use efficiency and financial viability of the system but also ensure adoption of best management practices and the environmental sustainability in the irrigated agriculture systems. Benchmarking can help ultimately in appropriate interventions and in formulation and implementation of policies for improvement of projects.

# REFERENCES

IPTRID (2001). Guidelines for Benchmarking Performance in the Irrigation and Drainage Sector, IPTRID Secretariat, FAO of United Nations, Rome.

Guidelines for Benchmarking of Irrigation Projects in India, Indian National Committee on Irrigation and Drainage (INCID), New Delhi, June, 2002.

Report on Benchmarking of Irrigation Projects in Maharashtra State (2007-08), Water Resources Department, Government of Maharashtra, India, March, 2009.