

WORKING GROUP ON MODERNIZATION AND REVITALIZATION OF IRRIGATION AND DRAINAGE SYSTEMS (WG-M&R) Closure Report – JULY 2024

1. Background

The Working Group Modernization and Revitalization of Irrigation and Drainage Systems (WG_M&R) was established in recognition that the modernization of irrigation schemes would be a very important topic due to the role of I&D in support of global food production. The Working Group was established at the ICID IEC meeting in 2014, for initial term of six years with effect from 2015. The mandate of the WG-M&R was extended by the ICID IEC in 2020 for a further two years in response to the disruption of ICID activities resulting from the COVID 2019 pandemic.

The mandate of the WG_M&R was summarized in the adopted scoping document as:

- (a) exchange of information, knowledge and experience,
- (b) review and prepare a condensed overview of existing key books, manuals, guidelines, and other relevant publications on the topic;
- (c) prepare and present reports and/or case studies on recent development in the countries that are represented in the WG;
- (d) to collect and review manuals, guidelines, codes of practice and standards on modernization and revitalisation of irrigation schemes;
- (e) to organise international workshops, seminars or symposia on the topic;
- (f) to prepare an overview paper on the state of the art on the topic for publication in *Irrigation and Drainage (IRD)*.

2. Activities Undertaken

The WG_M&R has met at each ICID annual conference/congress/World Irrigation Forum held since formation in 2015; and, in addition to the working group meeting, the WG_M&R organized Workshops or International Workshop at each annual meeting of ICID as summarized below. In addition to the physical meetings of the WG members, virtual meetings were held to maintain the work program during the disruption resulting from the COVID pandemic and following the recommendation to all WGs to increase communications among members between physical meetings.

Year	Venue	WG, Workshop, Seminar	Outputs
2014	Gwangju		IEC approved formation of WG_M&R
2015	Montpellier	1 st WG meeting	Presentations on (i) FAO work with respect to modernization and revitalisation of irrigation schemes (Thierry Facon); (ii) Definition of modernization (Ian Makin), (iii) Brief overview of modernization aspects (Harish K Varma).
2016	Chiang Mai	2 nd WG meeting & Symposium on irrigation modernization (ISIM)	Fifty participants at ISIM discussed five papers on approaches to modernization. An initial draft definition of modernization was presented as a basis for further discussion and development. An outline template for case studies was developed and circulated to ICID national committees.
2017	Mexico	3 rd WG meeting.	Case studies from China (Dr. Dong Bin), Korea (Dr. Kwang-Sik Yoon), and Nigeria (Engr. Muhammad

Year	Venue	WG, Workshop, Seminar	Outputs
			Sani Bala) were presented by the authors.
2018	Saskatoon	4 th WG meeting	Five more case studies were presented during the WG meeting on Malaysia (MANCID), USA (Burt & Wahlin), Canal Automation (Wahlin), Taiwan (Dr. Chih-Hung Tan, Japan (JNC).
2019	Bali	5 th WG meeting and International Workshop	A further nine case studies were presented to the 70 participants at the International Workshop.
2020	None	6 th WG meeting (video meeting)	Virtual meeting – physical meeting postponed COVID. The planned International Symposium on M&R had received eighteen abstracts for presentation at the symposium. However, the symposium was postponed due to the virtual nature of the meetings.
2021	Marrakesh	7 th WG meeting (Video meeting)	The postponed International Symposium on M&R was further postponed due to limited attendance at the mixed mode conference.
2022	Adelaide	8 th WG meeting and International Workshop	Ten papers presented in Adelaide and uploaded to WG web pages. The draft Guidelines on Modernization were discussed, and lead authors confirmed inputs during WG meeting.
2023	Visakhapatnam	9 th WG meeting and International Symposium on “Pathways and Technologies for Modern Irrigation Services”	13 papers presented at the Symposium, in addition to keynote addresses by (i) President Ragab Ragab and (ii) Ms Yasmin Siddique of ADB. The final WG meeting discussed the output of the Symposium, progress towards the Guidelines on Modernization, and the Survey of Norms and Processes for Maintenance of Irrigation and Drainage Systems. The members of the WG were polled about the proposed revision of ICID working groups and most confirmed their interest to continue work on Modernization within the mandates of the revised WG structure.

The mandate and objectives of the WG_M&R were to investigate, analyse, disseminate information on new developments and to formulate recommendations with respect to:

- (a) Planning and preparation for modernization and revitalization of irrigation schemes;
- (b) Interaction between modernization, revitalization and required operation and maintenance;
- (c) Cost sharing for modernization, revitalization and required operation and maintenance;
- (d) Institutional and organizational framework required for modernization, revitalization and operation and maintenance;
- (e) Methods and techniques of lining of conveyance and distribution canals;
- (f) Canal control systems with respect to their automation, using internet, mobile communication, and remote monitoring in canal operations;
- (g) Modification to improve communication, operational capacities and flexibility in operation and maintenance of systems; and
- (h) Standardization and codes of practice in irrigation systems.

To address these objectives, the WG adopted a working definition of modernization (**Annex 1**). The initial draft of the definition was based on work by ADB and its consultants on modernization in South Asia). Key concepts in the definition are the recognition that modernization is (i) better implemented as

a process rather than a “one-shot” event and (ii) successful modernization should focus on service provision to water users rather than, the more traditional approach of a focus on technology and infrastructure upgrades and will often involve institutional changes to foster a service focus.

The WG developed a template for case studies (**Annex 2**) and called on national committees and the research community to provide examples of modernization for wider dissemination and to provide a foundation for preparation of ICID guides on modernization. Case studies and reports on modernization research and practical applications of new technology were presented during the various workshop, symposia and working group meetings organized by the WG_M&R. Papers and presentations, listed in **Annex 3**, are available on the WG_M&R web pages within the ICID web site.

A questionnaire on current norms and practices for maintenance of irrigation and drainage systems was also developed and circulated, through Central Office, to the National Committees of ICID. The response to the questionnaire was less than hoped for with only about 20 partially completed questionnaires being received. Some respondents provided a national level overview of current practices, other focussed on sub-regions and/or individual schemes. The data received did not allow for a conclusive analysis. Therefore, the WG_M&R recommend one of the reformulated WG consider developing a revised questionnaire and follow-up studies.

In addition, members of the WG_M&R contributed over 400 terms related to irrigation modernization and automation for inclusion in the ICID Multilingual Dictionary.

Members of the WG_M&R that have contributed to the work and meeting of the group are listed in **Annex 4**.

3. Conclusion and recommendations

The members of the WG_M&R support the rationalization of the ICID working groups to: (i) avoid overlapping mandates (to the extent possible); (ii) increase the participation in WG meetings and events while minimizing the total duration of the annual ICID meetings to reduce cost of participation and disruption of work schedules; and most importantly (iii) enable a continued focus by ICID on the issues of, and experiences with, modernization of irrigation and drainage services.

Three of the newly reformulated WG have been identified to include modernization of irrigation and drainage services in the developing mandates. Several of the members of the erstwhile WG_M&R have indicated they will be willing to continue to contribute to the ICID efforts on this topic. Interested members will, through their relevant national committees, confirm their interest to join the relevant WG as the revised mandates become clear.

4. Way Forward

As noted above two major planned outputs of the WG_M&R remain to be completed. The Guidelines on Modernization of Irrigation and Drainage Services will be completed by the existing writing team for publication by ICID as quickly as possible. The Survey of Norms and Processes for Maintenance is proposed to be passed on to one of the revised WG to continue work on the topic given the limited response from national committees to the original survey and follow-up correspondence.

Modernization of I&D services should remain a key area of focus for the ICID. ICID should (i) continue to develop collaborative work on the modernization topic with the major development funding institutions, including World Bank, Asian Development Bank, African Development Bank, and Islamic Development Bank; (ii) further strengthen cooperation with FAO and IWMI; and (iii) encourage members of ICID to examine the role of the profession in the modernization of irrigation and drainage development and operations in line with the concepts laid out by the proposed definition of modernization developed by the WG_M&R in collaboration with ADB and IWMI. The ICID Guidelines on Modernization are intended to become a ‘living on-line document’ that can be updated by other working groups as new information and practices become available, noting that technology and management practices are changing rapidly in response to changing rural demographics, climate change, and increasing availability of technological solutions to irrigation and drainage challenges.



WORKING ICID DEFINITION OF MODERNIZATION

Modernization is the process of upgrading infrastructure, operations, maintenance, and management of irrigation systems to sustain water delivery services required by farmers to optimize production and water productivity.

This definition distinguishes modernization and revitalization investments from the, historically more prevalent, investments in rehabilitation of irrigation schemes which tended to give a higher emphasis on reconstruction and upgrading of infrastructure and lesser focus on improving services to farmers. The definition encapsulates concepts that distinguish “modernization” of irrigation services from “rehabilitation” of irrigation systems. The important concepts are expanded as:

- (a) “**process**” reflecting the need that modernization of systems should be a continuous exercise to enable incorporation of future changes in the irrigation system and service requirements of the farmers. Ideally the process will align with existing government development and budgetary timeframes and systems;
- (b) “**upgrading**” means improving beyond what is existing; not replacing or rehabilitating. It means applying design best practices to infrastructure to optimize operation requirements and maximize system performance and efficiencies;
- (c) “**infrastructure**” means all physical assets related to the irrigation system, including headworks, conveyance systems, drainage systems, monitoring systems, communication systems, farm and access road networks, operation buildings etc.;
- (d) “**operations, maintenance and management**” means all human resources and management processes responsible for managing, operating and maintaining the irrigation system including ground and surface water management, and the associated physical infrastructure;
- (e) “**irrigation system**” encapsulates all physical and non-physical components that contribute to convert water and nutrients into food and fibre. This includes the infrastructure, water resources, agency staff, farmers, services providers, supply and market chains required to enable farmers conduct a viable enterprise, whether for subsistence or in active engagement with external markets;
- (f) “**sustain**” means that the irrigation system will continue to deliver a defined level of performance after upgrading. This includes managing the water resources to: (i) account for reallocations to other users, (ii) prevent adverse depletion of land and water resources, and (iii) enhance resilience to climate variability and adverse impacts anticipated from climate change. It also means ensuring that all costs relating to management, operation, maintenance, and asset depreciation of the system are affordable and are fully covered through either government, user (farmer), or private sector financing;
- (g) “**water delivery service requirements of the farmers**” means ensuring reliable, adequate and flexible supply of water as agreed with farmers allowing them to maximize water and agricultural productivity. This requires farmers to be involved in planning, design and operation of the irrigation system, and in routine water management decisions;
- (h) “**optimize production and water productivity**” means farmers must endeavour, and be supported through technology transfer and extension services, to optimize the productivity of their land with the available water.

In this definition, modernization is not limited to the introduction of modern hardware and/or software techniques but involves fundamental transformation of the way in which the business of irrigated agriculture is done. In most cases, modernization of irrigation infrastructure and services will be a more relevant and cost-effective investment than rehabilitation, or restoration, of the original infrastructure – although a more complex undertaking often involving multiple stakeholders and agencies than previous approaches.



**MODERNIZATION AND REVITALIZATION OF IRRIGATION
(Broad Outline for Case Study / Country Paper)
(Guide – ideally about 9-10 pages – max length 14 pages)**

1. **Introduction** – Very brief overview (**max 1.5 pages**)
 - (a) general country information such as topography, climate, agriculture, and water resources development, and
 - (b) Irrigation and drainage development and achievements in the past
2. **Policy** – This section should briefly describe the (**max 1.5 pages**)
 - (a) challenges of food security,
 - (b) challenges of water scarcity,
 - (c) how irrigation water allocations are being effected,
 - (d) what are the shortcomings in irrigation systems,
 - (e) what strategies are being adopted, and
 - (f) how increasing more crop per drop challenge is being/ proposed to be met.
3. **Approach to modernization** – This section may include (**guide 1-2 pages**)
 - (a) details of the approach/ methodology adopted for modernization including
 - (b) stakeholders' consultation,
 - (c) tools used for identification of components for modernization such as rapid appraisal, MASSCOTE, remote sensing and GIS etc.,
 - (d) components of modernization including cost estimates, benefits etc. and
 - (e) Funding mechanism
4. **Project information** – This section may include (**guide – up to 3 pages**)
 - (a) general information on project(s),
 - (b) its (their) performance in the past,
 - (c) identification of issues/concerns,
 - (d) need for modernization of the project(s);
 - (e) components of modernization of projects taken up, and
 - (f) component details etc.
5. **Implementation of modernization proposal** – This section may include (**Max 1.5 pages**)
 - (a) how modernization proposal was implemented,
 - (b) monitoring of project implementation,
 - (c) contribution from beneficiaries,
 - (d) how the need for new technology (if deployed) is being addressed.

6. **Lessons learnt including benefits from modernization** – This section may summarize (**Max 2 pages**)

- (a) bottlenecks/issues/concerns faced during implementation,
- (b) how these were overcome,
- (c) lessons learnt from modernization process,
- (d) impact and outcome of modernization of project etc.

7. **Way forward** – This section may provide (**Max 3 pages**)

- (a) summary and conclusions,
- (b) recommendations for future modernization plans,
- (c) roadmap for modernization of irrigation development in the country etc.
- (d) Funding required
- (e) Possible funding mechanism

References, maps, tables (as needed)



**CASE STUDIES AND PRESENTATIONS
WORKING GROUP MODERNIZATION AND REVITALIZATION**

Thailand 2016

- Modernization and Rehabilitation of Irrigation in Indonesia. (Soekrasno S, Adang Saf Ahmad, Bistok Simanjuntak, Eko Subekti, M. Adrie Azhari)

Mexico 2017

- Irrigation Modernization and Revitalization in Korea (Kwang Sik Yoon) -ppt
- A case study of Jiamakou Yellow River Diversion Project Shanxi Province, China (Dr. Dong Bin) - ppt
- Modernization and Revitalization of Irrigation in Pakistan- A case study of Sindh (Fateh Muhammad Marri) docx
- Rehabilitation and Revitalization of Irrigation Schemes in Nigeria: Lessons from Bakolori Irrigation Scheme (Engr. Muhammad Sani Bala) docs and ppt
- Case study of irrigation modernization in Northern Victoria, (Hugh Turrall and Mark Wood) docx

Canada – 2018

- Modernization & Revitalization a case study of Japan (Shinji?) ppt
- Irrigation modernization with IoT and cloud-top computing: case study in Taiwan (Chih-Hung Tan, Ph.D.) ppt
- Canal Automation for Irrigation Delivery Systems (Dr Brian Wahlin) - ppt
- Modernization of the San Luis Canal Company in Central California (Charles M. Burt. P.E., Ph.D., D.WRE. Presented by Brian Wahlin, P.E., Ph.D., D.WRE) ppt
- Tertiary Infrastructure Development in the Muda Area (National Key Economic Area [NKEA] – Entry Point Project [EPP]10) (Malaysia – ned to confirm author) ppt

2019 Bali, Indonesia

- International Workshop on Modernizing Irrigation Services for Water, Food, and Nutrition Security
- Process of Irrigation Modernization of Indonesia, Case: Serayu and Wadaslintang Irrigation Schemes, Indonesia
- Using smart water operation center for better water management in Thailand
- ICT, IoT, and Big DATA Application for Irrigation facilities management
- Practical evaluation of ICT smart automated sluice gate for paddy fields from the aspect of an additional function of ponding water temperature control
- Innovative Initiatives in Water Stressed Area by Effective Monitoring of Canal Operations
- Re-Visiting the Rap Evaluation for Irrigation Modernization - Concept and Application for Small-Scale Irrigation
- Automatic Subsurface Irrigation and Drainage using Sheet-pipe typed Mole Drain
- A Case Study on Conversion of Canal Based Irrigation Network System to Pressurized Pipe Based Network System Integrated with Solar Plant in The State of Uttar Pradesh, India
- Subsurface water level control system “FOEAS” and its diffusion

2020 & 2021 – No Case Studies Presented – COVID pandemic caused cancellation of events.

2022 Australia – International Workshop

- A readiness assessment of Indonesian pilot project modernization. Case study Kedungputri, a premium irrigation area, Central Java. – (Vicky Ariyanti , Corri Eriza, and Kuji Murtiningrum)
- Assessment of modernization needs for the Philippine National Irrigation Systems to Support High Value Crop Production – (Mona Liza F. Delos Reyes)

- Not presented => Modernization of East Fork Irrigation District – A Case Study Hood River, Oregon, USA – (Brett Golden, Julie Oshea, Preston Brown, Kristen Allgood = contact Brian Wahlin)
- Not presented => Establishment of Digital Terrain Model of an Impounding Reservoir with Echo-Sounder and Drone (Joongu Lee , Moonsuk Lee , Kangwon Choi and Hyunsu Kim)
- Not Presented → Innovative Lift Irrigation Scheme for Food Security and Agricultural Sustainability (Dr. Shivaji Sangle, Ms. Shivani Sangle)
- Modernizing a pressurised pipeline supply system for high value agriculture in Asia. (Rob Rendell)
- Bernam River Water Balance Management System, Malaysia. A Case Study on Paddy Irrigation Efficiency at the Pasir Panjang Irrigation Block of the Barat Laut Selangor Irrigation Scheme (BLSIS), Bernam River Basin, Malaysia (Dato' Ir Hanapi Mohamad Noor, Ir Yong Siew Fang)
- Towards enhanced capacity of farmers and institutions in irrigation and drainage as key contributors to sustainable food production and poverty alleviation in the Philippines (Mona Liza F. Delos Reyes and Bart Schultz)
- Not presented – Monitoring and detection of soil elements for the sustainable management of irrigation of agricultural resistance by an intelligent system (Loubna BOUHACHLAF, Jamal MABROUKI, Ahmed Elshaikh, and Souad EL HAJJAJI)
- Curse Or Blessing! Are Smallholder Irrigation Schemes Doomed To Succeed? (Eng Bezzel Chitsungo) – presented but no paper received
- Developing effective institutions for irrigation services, including capacity building of different stakeholders, a case of Zimbabwe (Eng Bezzel Chitsungo) – presented but no paper received
- Modernization of Irrigation through Piped Irrigation Systems in India. Alok Sikka, Kuhelika Ghosh, Faiz Alam (IWMI, India)
- Presentation by Rubicon on Canal Automation by Ravi Varun.

2023 India – International Symposium

- ASRWG Technical Report on Irrigation and Drainage for Asian Food Security (Australia)
- Pathways and Technologies for Modern Irrigation Services Country Paper Burkina Faso – West Africa
- Pathways and Technologies for Modern Irrigation Service (China)
- Irrigation Modernisation in Indonesia 2023
- Pathways And Technologies for Modern Irrigation Services; Iran Country Paper
- Pathways And Technologies for Modern Irrigation Services – Japan's Country Report (Japan)
- Country Paper on Current State and Future Pathways for Modern Irrigation Service in Nepal (Nepal)
- Country Report on Pathways and Technologies for Modern Irrigation Services in Nigeria (Nigeria)
- International Symposium on Theme: Pathways and Technologies for Modern Irrigation Services – “Irrigation Solution” Approach Promoted by The Sahel Irrigation Initiative Regional Support Project (SIIP): One of The Keys to Improve Investments in Irrigation in The Sahel and West Africa
- Rehabilitation and Modernization of Irrigation Infrastructures in Somalia
- Country Paper - National Irrigation and Drainage Services- Sri Lanka
- Country Papers – Zimbabwe on the Theme: Pathways and Technologies for Modern Irrigation Services



MEMBERS OF THE ICID WORKING GROUP ON MODERNIZATION AND REVITALIZATION OF IRRIGATION AND DRAINAGE SERVICES

Members	Member from (Year)
VPH Ian Makin, Chairman (UK)	2015
Dr. Dong Bin, Vice Chairman (China)	2015
Engr. Muhammad Sani Bala, Secretary (Nigeria)	2015
Mr. Mehrzad Ehsani (Iran)	2015
Ir. Eko Subekti (Indonesia)	2015
Dr. Kwang-Sik Yoon (South Korea)	2015
Mr. Mohd Yazid bin Abdullah (Malaysia)	2015
Dr. Brian T. Wahlin (USA)	2015
Mr. Usman-e-Ghani (Pakistan)	2016
Dr. Ali Omran Ali (Iraq)	2016
Dr. Sanjay Belsare (India)	2017
Mr. Jan Potgieter (South Africa)	2018
Prof. Dr. Tarek Ahmed El-Samman (Egypt)	2018
Dr. Chih-Hung Tan (Chinese Taipei Committee)	2018
Dr. Shinji Fukuda (Japan)	2018
Omid Moridnejad – Young Professional (Iran)	2018
Ms. Mona Liza Delos Reyes (Philippines)	2019
Engr. Reyne B. Ugay (Philippines)	2019
Dr. Toshihiko Kuno (Japan)	2020
Mrs. Zaineb Mohammed Akram (Iraq)	2020
Dr. Mohsen Barahimi (Iran)	2020
Mr. Dinesh Bhatt (Nepal)	2020
Prof. Sunil D. Gorantiwar (India)	2021
Dr. Neelam Patel (India)	2021
Dr. YaLong Li (China)	2021
Dr. SHI Yuan (China)	2021
Dr. Di Wu (China)	2021
Dr. Usman Khalid Awan (Pakistan)	2022
Dr. Macdex Mutema (South Africa)	2022
Dr. Hwa-Lung Yu (Chinese Taipei Committee)	2022
Secretary General, ICID	
Permanent observers	
Mr. Alan Kendall Clark (UK)	2015
FAO Representative	2015
World Bank representative (Dr. Petra Schmitter)	2021
IWMI representative (Dr. Alok Sikka)	2021

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