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**INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE
FOURTH WORLD IRRIGATION FORUM (WIF4)
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Theme: Modernization of Irrigation Systems

Concept Note

For decades, pursuing and achieving water security has become one of the topmost agendas of global development. Increasing population and subsequent development demand an increasing amount of fresh water for consumption. Historically, irrigated agriculture has been the biggest freshwater consumer, but its share is reducing due to its limited availability as well as competition from other sectors. However, in the current scenario of increasing water scarcity, agriculture and subsequently food security will bear the brunt of this reduced supply. Thus, improving the irrigation water management and propagating modernization of irrigation systems is of utmost importance in current times.

Modernization is the “Process of upgrading infrastructure, operations and management of irrigation systems to sustain the water delivery service requirements of farmers and optimize production and water productivity (ICID, 2016)”. Modernization seeks to give more attention to the needs of farmers as a core objective of irrigation operations and modernization efforts. Irrigation modernization undertakes technical and managerial upgrading (as opposed to mere rehabilitation) of irrigation systems combined with institutional reforms, with the objective to improve resource utilization (labour, water, economic, social and environmental) and water delivery service to farms. Irrigation systems not only include the physical infrastructure for agricultural development, but also include stakeholders’ participation as well to holistically improve the irrigation systems for all the beneficiaries. To improve the management of these irrigation systems, all aspects of the farm from reservoir and canal operation to farm management need to be considered while planning. Thus, modernization of irrigation systems entails holistic improvement of resource mobilization, delivery to the farm gates, water saving techniques, management practices, policies, institutional and financing mechanisms that ultimately result in agricultural, social, environmental, and economic benefits not just for the farmers as well as water users.

With respect to modernization and revitalization of irrigation systems, some of the significant aspects to be considered are understanding modernization and revitalization of the schemes as well as its concerned operation, maintenance and management, financial instruments available, handling political, economic, social and environmental facets, institutional and organizational arrangements, stakeholders’ involvement and prevalent codes of practice and standards. For certain schemes, revitalization may be required before modernization activities can be undertaken. This concerns the technical, operations and management, social, institutional, financial and environmental aspects. The revitalization concerns reforming the broader policy and strategy aspects. Ensuring that irrigation systems are designed, installed, managed, and maintained well is

essential if production gains and subsequent direct, indirect and induced economic benefits are to be realized, all whilst managing direct and indirect environmental impacts. Modernization and revitalization of irrigation systems play a crucial part in ensuring the sustainability of the irrigation in the beneficiary areas as the schemes often span over generations, and maintaining their relevance in evolving contexts of agricultural water management require appropriate response from the scheme concerned.

The topic of modernization and revitalization of irrigation systems is relevant to the vision and mission of ICID and of interest to its members. Members view the activity in contexts relevant to their economic and developmental stages. While the advanced countries would like to propagate the experiences, skills and materials developed, the countries with a medium and low Human Development Index would like to be aware about the solutions available and means to deploy them. Thus, the flagship event of ICID, World Irrigation Forum 4, WIF4 aims to highlight the importance of modernization of irrigation systems and discuss, in detail, different aspects of it, outlined in the sub-themes (ST):

- Sub-theme 1: Policy and strategy for modernization of irrigation systems
- Sub-theme 2: Technology for modernization of irrigation systems
- Sub-theme 3: Financing for modernization of irrigation systems
- Sub-theme 4: Performance Assessment of Irrigation systems

Sub-Theme 1: Policy and Strategy for Modernization of Irrigation Systems

The ST-1 focuses on the relevant policies and strategies required to modernise irrigation systems. Factors such as climate change, increased food and energy demands, depleting water resources and ecosystems services, international markets, financial mechanisms, economic and other social aspects influence the requirements of the modernization process of irrigation systems. Thus, robust policies and strategies need to be set up for the modernization process to ensure its effectiveness.

For this pursuit, carrying out the modernization process in the irrigation systems would entail strategic planning and developmental stratagems in terms of laying down the vision, setting up plans and technical requirements, implementing safeguarding measures, building capacity of the personnel etc. Additionally, supporting legal instruments need to be available to carry out the modernization along with institutional reforms and conducive policies regarding investment, construction material, facilities and equipment, operation and maintenance, management system and mechanisms. Another aspect needs to be taken into account during modernization is the WEF (Water-Energy-Food-Ecosystems) nexus. Considering its significance, while devising policies, the WEF nexus approach should be considered for managing the trade-offs and enhancing synergies amongst the different sectors.

The papers submitted in this sub-theme (ST1) will focus on the following topics:

- Development planning for modernization including the overall vision, development lay-out, roadmap of implementation, safeguard measures, etc.
- Supporting policies for modernization adopted by all levels of government on matters such as investment, construction material, facilities and equipment, operation and maintenance, management system and mechanisms

- Laws and regulations supporting and safeguarding modernization and preparing conducive social and economic environment for ensuring longevity of the measures
- WEFE (Water-Energy-Food-Ecosystems) nexus approaches for managing trade-offs and enhancing synergies

Sub-Theme 2: Technology for Modernization of Irrigation Systems

The ST-2 focuses on the state-of-the-art technologies available for the modernization of irrigation systems. Technology is advancing day-by-day; however, the instruments required for implementing the upgraded technology in the irrigation systems must be adequately employed to improve resource utilization, water delivery service, and productivity.

Modernization of irrigation system through technology deploys engineering and management solutions including hardware and software upgrades, in addition to the technical standards system as well as other innovative approaches such as landscape-based approaches for irrigation performance appraisal. In several cases, implementing dynamic modern approaches such as use of renewable energies and non-conventional water resources need to be integrated with the irrigation systems to ensure regular water supply and reduced costs to the farmers as well as the environment.

The papers submitted in this sub-theme (ST2) will focus on the following topics:

- Engineering technologies for modernization: water consumption monitoring technologies, coordinated multi-water-source allocation technologies, handling of ageing infrastructure for water resources storage and conveyance, responsive canal network/pipeline water delivery and distribution technologies, scheduling and control technologies of water use, on-farm irrigation technologies, etc.
- Management technologies for modernization: Smart-water management technologies including information sensing and transmission technologies, data governance and integration, establishment of a knowledge base, decision support system, drone applications in improving precision irrigation management and scheduling, etc.
- Technical standards system for modernization: the scale and dimensions of modernization efforts, the expected results of modernization, comparative studies of technical standards of different countries, etc.
- Innovative approaches for irrigation performance appraisal including landscape-based approaches

Sub-Theme 3: Financing for Modernization of Irrigation Systems

The ST-3 focuses on employing proper financial mechanisms to carry out the modernization of irrigation systems. Investments from several avenues, such as private or public sector, multilateral development banks, beneficiary stakeholders, is fundamental to the success of projects. The loans and other forms of investments ensure upgradation of on- and off-farm infrastructure, expansion/rehabilitation/modernization of the systems, integration of modern equipment, automation, improved agricultural productivity, among other benefits to bring about resilience in the irrigation systems against climate variability, dynamic population growth and economic development scenarios.

The papers submitted in this sub-theme (ST3) will focus on the following topics:

- Investment by all levels of government
- Investment by the private sector and the banking sector
- Investment by the beneficiaries, such as farmers, WUAs, etc.
- Investments and revenue models for sustained asset management of irrigation systems for its operation and maintenance
- Investments for Asset Management of Irrigation Systems for improved services delivery

Sub-Theme 4: Performance Assessment of Irrigation systems

The ST-4 focuses on assessing the performance of the irrigation systems pre and post implementation of modernization to better understand the system's requirements. Periodic assessment of the performance of irrigation systems through pre-defined indicators provides insight into the success of the project and emerging needs over time. Furthermore, benchmarking additionally provides a framework for securing continual improvement through comparison with relevant and achievable internal or external norms and standards, which help analyze the performance of the irrigation systems (ICID, 2001). Broadly, modernization entails the improvement of infrastructure, services and other dependent factors which contribute to improved water efficiency and agricultural productivity. Benchmarking with pre-and post-modernization endeavors provides an assessment of change in the performance of the irrigation systems, including the stakeholders.

In general, the irrigation modernization policies focus on infrastructure and technologies. However, other factors such as energy costs, lack of irrigation and storage infrastructure, unfertile land, inaccessible water resources, impractical institutional, financial and legal mechanisms, water user associations, the response of the society to the changed systems and approaches, climate change, water quality etc. impact the performance of the irrigation systems. Many space-and ground-based technologies are being developed for the performance assessment at various levels, from the field to the command area as a whole. Leveraging emerging technologies is a vital aspect of modern performance assessment exercises.

Accordingly, the papers submitted in this sub-theme (ST4) will focus on the following topics:

- Assessment of physical infrastructures such as storage and diversion work, canal networks, pumping stations, water gates, drainage systems etc.
- Assessment of irrigated agriculture
- Assessing outcomes of modernization efforts in terms of delivery of water, agricultural outputs and stakeholders' participation
- Assessment of socio-economic, eco-environment and natural resources benefits for improved productivity

