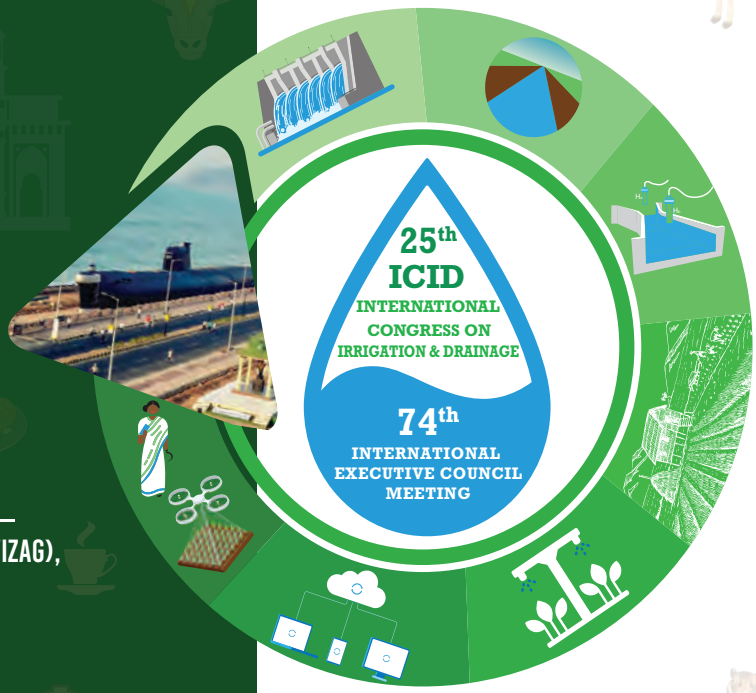
ICID•CIID
INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE

INCID
INDIAN NATIONAL COMMITTEE ON IRRIGATION AND DRAINAGE

25TH ICID INTERNATIONAL CONGRESS ON IRRIGATION AND DRAINAGE

1-8 NOVEMBER 2023, VISAKHAPATNAM (VIZAG), ANDHRA PRADESH, INDIA



12th N.D. Gulhati Memorial Lecture

International Cooperation in Irrigation and Drainage

Ensuring Water and Food Security through Climate Resilient Infrastructure

Sh. Gajendra Singh Shekhawat
Hon'ble Minister of Jal Shakti

INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE

COMMISSION INTERNATIONALE DES IRRIGATIONS ET DU DRAINAGE

12th N.D. Gulhati Memorial Lecture for International Cooperation in Irrigation and Drainage

on

"Ensuring Water and Food Security through Climate Resilient Infrastructure"

Sh. Gajendra Singh Shekhawat
Hon'ble Minister of Jal Shakti
Ministry of Water Resources, Government of India

Presented at:

25th International Congress on Irrigation and Drainage
2 November 2023, Visakhapatnam (Vizag), India

ICID•CIID

INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE


INTERNATIONAL COMMISSION ON IRRIGATION & DRAINAGE
SIXTH CONGRESS INDIA - 1966

Er. N.D. Gulhati

A Visionary Water Resources Engineer

(1904-1978)

Er. Niranjan Das Gulhati, popularly known as N.D. Gulhati, a visionary, was one of the forces behind India's march towards food self-sufficiency through Green Revolution. As the Chief of the Natural Resources Division in the Planning Commission, Government of India, he laid its foundation by initiating proposals relating to the development of irrigation and power, soil conservation and mineral development in the First Five-Year Plan. The notable positions he held in Government of India service includes Secretary, Central Board of Irrigation and Power (CBIP) from August 1945 to March 1949; Chief Engineer and Joint Secretary in 1953 and Additional Secretary to Government of India in 1958. While serving on these positions, he championed the cause of irrigation and drainage at national and global level.

As the Chief Representative of Government of India on the Indus Water Negotiations under the aegis of International Bank for Reconstruction and Development (IBRD), he played a key role in the successful conclusion of the historical Indus Water Treaty between India and Pakistan in 1960 (ratified in 1961). He represented India in many international engineering conferences and made immense contributions to India's agricultural, water and power sectors.

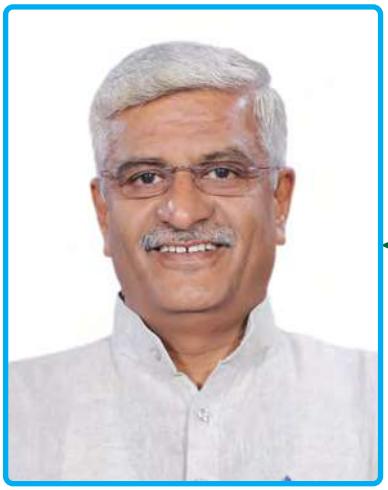
In recognition of his "distinguished services of a high order", Er. Gulhati was bestowed with one of India's highest civilian honours "PADMA BHUSHAN" by the President of India in 1961.

Late N.D. Gulhati dedicated his entire professional life to the development of irrigation engineering and conceived and implemented the concept of an 'International Commission' for ensuring international cooperation on advancing the world knowledge in the fields of irrigation, drainage, flood management and river training by pioneering the idea of setting up an International Commission to the Government of India in 1946. The Commission was set up in the year 1950 and Er. Gulhati was befittingly selected as its first Secretary General to lead its operations in its budding period. Later he led the Commission from the forefront holding positions of Vice President (1957-1960), and President (1960-1963) of ICID.

President Honoraire Gulhati was a globally renowned Water Resources Consultant, whose services were utilized by many State Governments in India and global organizations like IBRD (1963), International Development Association (1963-1973), and United Nations (ESCAP) in 1969.

Born on 15 November 1904 in Lahore, Pakistan, Er Gulhati completed his technical education from the Thomson Civil Engineering College, Roorkee in 1926 (later University of Roorkee and now IIT Roorkee) where he achieved honours. He was appointed to the Indian Service of Engineers in October 1927 and posted to the Irrigation Branch of the Public Works Department, Punjab. Er N.D. Gulhati passed away in December 1978.

Er. Gulhati was amongst the foremost supporters of ICID and did everything possible to promote the objects of ICID. His mature leadership, dynamic personality and diplomatic and adroit handling of all matters won him universal respect and endearment with all the members of the ICID fraternity. As the architect of the "International Commission" who laid a strong foundation for Commission's growth during its nascent years, Er. Gulhati has been aptly called the 'Father' of ICID.



Sh. Gajendra Singh Shekhawat

Hon'ble Minister of Jal Shakti, Ministry of Water Resources, Government of India

THE N.D. GULHATI MEMORIAL LECTURE
for International Cooperation in Irrigation and Drainage

Preserving the memory of the visionary Water Resource Engineer, ICID, in collaboration with Gulhati Trust has been organizing the 'N.D. Gulhati Memorial Lecture for International Cooperation in Irrigation and Drainage' at the time of its triennial Congresses. The memorial lecture aims at encouraging exchange of significant global developments relevant to irrigation and drainage engineering including all allied aspects like environment, sociology, economics etc. and fostering and enhancing international cooperation to meet ICID objectives. The lecture is delivered by an invited eminent person in a field related to ICID's mission. An honorarium of US $ 1000 is presented to the invited distinguished Lecturer as a token of appreciation.

N.D. Gulhati Memorial International Lectures held so far:

Hon Karlene Maywald, DUNIV, FTSE, GAICD
South Australian Water Ambassador and Chair of the Australian National Water Commission (Australia)
Delivered the eleventh lecture in 2022 at Adelaide, Australia on "Putting People at the Heart of What We Do".

Dr. Charles M. Burt
Professor of Irrigation and Chairman of the Irrigation Training and Research Center (ITRC), USA
Delivered the eighth lecture in 2011 at Tehran, Iran on "The Irrigation Sector Shift from Construction to Modernization: What is Required for Success?"

Dr. Felipe Ignacio Arreguín Cortés
Director General, Mexican Institute of Water Technology / Instituto Mexicano de Tecnología del Agua (IMTA), Delivered the tenth lecture in 2017 at Mexico City, Mexico on "Reforms in the Administration of Irrigation Systems: Mexican Experiences"

Prof. Dr. Chandra A. Madramootoo
Dean, Agricultural and Environmental Sciences
McGill Unviersity, Canada
Delivered the seventh lecture in 2008 at Lahore, Pakistan on "Irrigation in Context of Today's Global Food Crisis"

Mr. Jeremiah R.D. Lengoasa
Deputy Secretary-General
World Meteorological Organization, Switzerland
Delivered the ninth lecture in 2014 at Gwangju, Korea on "Climate Variability and Change: Impacts on Water Availability"

Er. Albert J. Clemmens
Founding Member and Director
American Academy of Water Resources Engineers, USA
Delivered the sixth lecture in 2005 at Beijing, China on "A Process-Based Approach to Improving the Performance of Irrigated Agriculture"

Dr. Marvin E. Jensen
National Program Leader, Water Management and Salinity Research, Agricultural Research Service, USDA, USA
Delivered the fifth lecture in 1993 at The Hague, Netherlands on "The Impacts of Irrigation and Drainage on the Environment"

Late W.R. Rangeley OBE
Independent Consultant, Water Resources Development, World Bank, UK
Delivered the fourth lecture in 1990 at Rio de Janeiro, Brazil on "Irrigation at a Crossroads"

Late Adriaan Volker
Professor Extra-Ordinarius in Hydrology
Delft University of Technology, The Netherlands
Delivered the third lecture in 1987 at Casablanca, Morocco on "Role of Failures and Negative S econdary effects in the Development of Irrigation, Drainage and Flood Control"

Late K.K. Framji
Chief Engineer and Joint Secretary
Ministry of Irrigation and Power, Government of India
Delivered the second lecture in 1984 at Fort Collins, USA on "Past and Likely Future Developments in Irrigation and Drainage and Flood Control Measures in Developing Countries"

Prof. Dr. M. Holy
Dean of Civil Engineering
Prague Technical University, Czechoslovakia
Delivered the first lecture in 1981 at Grenoble, France on "Irrigation Systems and their Role in the Food Crisis"

Prize winning papers of Young Professionals

Er. R. Rajkumar
Lecturer, Civil Engineering
Centre for Water Resouces Anna University, India
Winner of the Second N.D. Gulhati International Award in 1999 for the Best Paper contributed to an ICID Congress titled at Granada, Spain on "Controlled Water Saving Method for Paddy Cultivation - A Case Study"

Ms. Margreet Z. Zwarteveen
Gender Specialist, IWMI, Sri Lanka
Winner of the First N.D. Gulhati International Award in 1996 for the Best Paper contributed to an ICID Congress titled "A Plot of One's Own: Gender Relations and Irrigated Land Allocation Policies in Burkina Faso"

12th N.D. Gulhati Memorial Lecture for
International Cooperation in Irrigation and Drainage

"Ensuring Water and Food Security through Climate Resilient Infrastructure"

Sh. Gajendra Singh Shekhawat*

Hon CM Andhra Pradesh Shri Jahan Mohan Reddy ji, Chairman ICID Mr. Ragab Ragab, Secretary General ICID Mr. A.B. Pandya, my colleagues from Government of India and various state governments, Ladies and Gentlemen,

I am truly honoured to address this distinguished gathering at the 25th International Congress of ICID. First and foremost, I would like to express my gratitude and pay tribute to the late N.D. Gulhati, the father of ICID, a visionary who dedicated his entire professional life to the development of irrigation and drainage.

India truly believes in the concept of **'Universal Brotherhood & Collective Wisdom'**, and always contributed for betterment of humankind. India has always played an active role in such collaborative scientific endeavors. India has been hosting the **Secretariat and Headquarters of ICID in New Delhi** ever since its inception. And for many of Indian Governmental officials and experts, it has been a prestigious organization to work with.

The theme for this Congress, **"Tackling Water Scarcity in Agriculture"** addresses the pressing concern which affects us all and we are committed to address it through multi-faceted approach.

As we reflect on India's progress since independence, it is evident that we have come a long way in the water sector. As a founding member of ICID, **India has Actively Participated in Shaping the Global Discourse on Irrigation and Drainage Engineering.**

It is a well-established fact that irrigation can enhance agricultural productivity by increasing crop yields, improving crop quality, extending the growing season, reducing the risk of drought, and enabling crop diversification. However, unplanned irrigation also poses some inherent threats to agriculture such as increasing waterlogging, soil salinization, soil erosion, nutrient leaching, etc. Therefore, **proper planning, design, implementation and monitoring of irrigation infrastructure along with adopting best agricultural practices is essential to optimize its benefits.**

Due to complexities and challenges in legal, policy and technical framework of irrigation, it is essential to have comprehensive approach towards water sector as a whole rather than focus on irrigation alone. In 2019, our visionary Prime Minister Shri Narendra Modi has brought all aspects of water and various organisations

* Hon'ble Minister of Jal Shakti, Ministry of Water Resources, Government of India

working in water sector under one umbrella and created Ministry of Jal Shakti. This has given greater synergy and coherence to water management in India and we have committed investments of more than **US $ 140 Billion** by 2024 in water and sanitation sector.

Since independence in 1947, India has achieved monumental agricultural progress from being net importer and barely sufficient to one of the largest exporter of all kind of agriculture and horticulture produce today. **Irrigation Plays a Crucial Role in India's Journey Ensuring Water Availability and Boosting Crop Yields.** The total irrigation potential created in India so far is of the order of 114 million hectares from various sources of surface and groundwater which is over three-fold increase in last 75 years.

Storage plays a vital role in irrigation, as it effectively bridges the gap between the fixed duration supply of water and the ever-present demand throughout the year. Additionally, storage facilities play a pivotal role in mitigating the risks associated with droughts and floods, which have the potential to significantly impact the agricultural productivity and livelihoods of countless farmers. India's total live storage capacity now stands around 250 billion cubic meters, which is significant increase from 111.47 cubic meter in 1971.

However due to the requirement for a high capital investment and rehabilitation & resettlement cost, its becoming **More and More Challenging to Create New Storage Reservoirs.** In this context, its essential that we manage our storage in more prudent and efficient manner. Our government under the leadership of PM Modiji has adopted the approach of **Efficient Management and Utilisation of Existing Water Storage** with the active involvement of all stakeholders and integrated reservoir operations.

With the intent of enhancing physical access of water on farm, expand cultivable area under assured irrigation and improving on-farm water use efficiency, **Pradhan Mantri Krishi Sinchai Yojana (PMKSY)** was launched in 2015. It is an umbrella scheme with two major components :

- Firstly, **Accelerated Benefit Component Program (AIBP)** which focus on faster completion of Major and Medium irrigation projects for effective realisation of the irrigation benefits to farmers, **and**

- Secondly, **Har Khet Ko Paani (HKKP)** which literally means water to every field till the very end which encompasses our philosophy of **all inclusive development.** Under HKKP, we are promoting Command Area Development and water management. We are not just focusing on creating minor storage structures with lift irrigation schemes but also Repair, Renovation and Restoration of existing water bodies.

As of March 2013, PMKSY has created an additional irrigation potential of **25 hundred thousand hectares** by completion of 54 projects. The scheme has also benefited more than **twenty million farmers** across the country.

India's annual utilizable surface water resources are estimated at 690 billion cubic meters (BCM), while ground water resources stand at 431 BCM. However, due to the increasing population, escalating trends of urbanization and increasing water demand, per capita water availability in the country has witnessed a nearly 20% decline over the past two decades. Furthermore, it is projected to drop by another 20% by the year 2050, which will categorize India as a water-scarce nation. In light of this, it is imperative to implement measures that enhance water use efficiency, promote conservation, and ensure sustainability across various sectors and regions.

To achieve the improvement in water use efficiency, a **dedicated Bureau of Water use Efficiency (BWUE) has been set up under National Water Mission in 2022** to work on mission mode. The Bureau is acting as a facilitator for promotion of improving water use efficiency across various sectors like irrigation, drinking water supply, power generation, industries etc. in the country.

To tackle losses and improve conveyance efficiency in irrigation sector, Ministry of Jalshakti is actively promoting **Piped Distribution Network** instead of traditional open field canals in almost all new irrigation projects and command area works. Piped irrigation network has been developed in about **17.5 hundred thousand hectares** command area under PMKSY by constructing more than 48,500 km underground pipeline. **About 28,000 hectares of Land Acquisition is Successfully Avoided with this Initiative.**

Along with efforts towards efficiency improvement, we have launched **National Framework for Reuse of Treated Wastewater** in January 2023 aimed at formulating Reuse Water Policy by all state governments and promoting reuse of wastewater in domestic, industrial and agricultural sector. We all are aware about finite nature of water resources, **Every Drop of Water Reused is Effectively Creation of New Drop of Water.** The only barrier to effectively reuse our wastewater is not technical but psychological. I therefore appeal to this august gathering of water professionals that, let us coin and adopt the term of **New Water** whenever we want to use the phrase of treated wastewater. Effective use of new water in irrigation is the need of the hour.

Groundwater forms the backbone of irrigation in India. More than 65% of irrigation in India is by Groundwater. We are by far the largest user of groundwater in the world and today annually we are drawing more groundwater than US and China combined. With acute awareness of this challenge, **We Are Making Invisible Groundwater Visible and Creating Water Aware Communities through the Atal Bhujal Yojana.** This programme, being implemented in 81 water stressed districts of the country, heralds a change in the approach to the management of ground water. It is combination of demand and supply side interventions achieved through village-wise Water Security Plans. These plans inculcate **behavioral changes at the grass-root level.** Financing of these plans through incentives and convergence of existing programmes is already creating greater community ownership in the equitable management of water at the village level.

National Aquifer Mapping and Management Program (NAQUIM) of India is unique initiative which can help to prepare, implement and monitor the efficacy of various management interventions aimed at long-term sustainability of ground water. This will also help to achieve the source sustainability for drinking water, sustainable groundwater management and improved irrigation facilities. 2.4 million sq km of mapable area of country has been identified and mapped. These maps will provide valuable technical insights for creation of aquifer recharge structures and planning for sustainable use of groundwater for irrigation.

Water conservation will only be effective when people and communities will be at the centre of any program. To **Make Water Everyone's Business,** the Prime Minister of India launched the **Jal Shakti Abhiyan** in 2019. This was **a National Call to Action** that involved millions of people in water conservation and recharge. The overwhelming response that we received has encouraged us to make this an annual campaign prior to the rains. States, local bodies and communities are being encouraged and supported to take up restoration of traditional water bodies, rejuvenation of rivulets, water conservation & rainwater harvesting, reuse and recharge of bore wells, watershed development and intensive afforestation. So far **more than 10 million water conservation works have been completed** under Jal Shakti Abhiyaan since it's launch in 2019 all across country with the help of **convergence of government funds, CSR and community contributions.** This mission has certainly **Strengthened Participatory Management of Irrigation Infrastructures** in the country.

Indian climate is characterised by fixed duration precipitation pattern in the form of monsoonal rainfall during June to September. Moreover, the changing trend of climatic patterns has already started affecting the precipitation pattern adversely. Such situation calls upon a robust and climate resilient irrigation infrastructure. India has an **Ambitious River Linking National Program** aimed at inter basin transfer of water in ecologically sustainable way. **It is envisaged to reduce impact of floods from water surplus basins and simultaneously addressing water shortage in drought prone basins.** So far under National Perspective Plan of Interlinking, 30 links have been identified for execution. However, India being a federal country and water being a state subject, execution of such mammoth river interlinking projects, cutting across administrative and basin boundaries is very complex affair. In this context, I'm happy to mention that under guidance of hon PM Modiji, the states of UP and MP came together to sign MOU for Ken Betwa river interlinking project with central assistance of **more than $ 5 Billion** which will provide annual irrigation to more than **one million Ha** and drinking water to more **than 6 million people** in drought prone regions of Bundelkhand in central India.

Dams are the integral part of the irrigation system. History of dam building in India has a long and glorious past. India's first dam Grand Anicut was built on the Cauvery river by King Karikalan of the Chola dynasty around 2,000 years ago. The dam is still functional and irrigates millions of acres. India today boasts of over 6,000 large dams, making it the third country globally in terms of large dams. These dams and their dependant infrastructure were constructed with enormous financial investments, and also by displacement of the people affected by dam submergence.

Recently we witnessed tragedy of Derna dam failure in Libya claiming more than 10000 lives and bringing economy of the town to complete halt with irreparable ecological damages. India also witnessed 42 major dam failures. Friends, in this context, dam safety becomes the vital aspect of **Not Only Irrigation and Water Security but also of National Security.**

Recognising this fact, under the visionary leadership of hon Prime Minister Narendra Modiji, the **Dam Safety Act 2021** has been enacted which has strengthened our country's dedication and resolve to safeguard its dams. This progressive legislation underscores the nation's dedication to dam surveillance, inspection and maintenance by setting a benchmark for global dam safety standards. This legal framework is matched with equally important policy initiative of **Dam Rehabilitation and Improvement Program (DRIP).** DRIP is focused on enhancement of safety and operational performance of selected ailing dams along with strengthening of dam safety knowledge framework.

Under first phase of DRIP, 223 dams in seven states were covered addressing hydrological, structural and operational safety aspects. Phase 2&3 of DRIP started in 2021 with partnership of World Bank covering 19 states and 736 dams. This program is **prioritised by PM Modiji and unprecedented budget close to $1.2 Billion was made available for the same.** In order to develop robust knowledge support system for dam owning agencies in addressing the critical issues related to dam safety, Government of India has developed the International Centre of Excellence for Dams at IIT Roorkee and National Centre for Earthquake Safety of Dams at MNIT Jaipur. To create a large pool of experts in various domains of dam safety, first of it's kind Masters Program on Dam Safety & Dam Engineering have been started at IIT Roorkee & IISC Bengaluru. I appeal all distinguished members ICID to wholeheartedly support these initiatives in dam safety which have potential of becoming global standards in dam safety paradigm.

Climate change is posing serious threats to the entire world. Indian sub-continent is already facing huge temporal and spatial variability in respect of availability of water, and climate change further worsens the situation. **Climate change will make hydrologic events more unpredictable and lead to more frequent occurrence of hydrological extremities like floods and droughts.** Various studies indicate greater expected loss in the Rabi crop and every 1°C rise in temperature reduces wheat production by 4-5 Million Tonnes. Collectively the impact of climate change, continuous rise in population and deterioration in water quality due to various anthropogenic factors could affect the Indian irrigation sector. India being the second most populous country, seventh largest country by area and the fifth largest economy but having only 4% of freshwater resources of planet is acutely aware of our role in addressing the issue. Considering these potential threats, **Prime Minister's National Action Plan on Climate Change (NAPCC)** has been continuously making various mitigative and adaptive climate resilient interventions. National Water Mission and National Mission for Sustainable Agriculture are at the core of NAPCC.

Prime Minister Narendra Modi while addressing COP26 at Glasgow in November 2021 have introduced the concept of LiFE which stands for "Lifestyle for Environment."

Soon this concept was followed into action agenda with the joint launch of Mission LiFE by UN Secretary General Antonio Gutteres along with PM Modi in October 2022. Water sector is the heart of mission LiFE which aims at “Pro Planet People” and call for individual as well as community actions apart from Government interventions in addressing issues of Climate change.

Through various global initiatives and recently through G-20 engagement, India have demonstrated our dedication to sustainable water management practices. This 25th International Congress on Irrigation and Drainage provide unique platform for us to share significant developments in irrigation and drainage engineering. I urge all the participants and delegates that let us work towards tackling water scarcity in agriculture and ensuring a sustainable future for generations to come.

I extend my heartfelt gratitude to all the participants, organizers, and partners for their contributions in making this congress a resounding success.

Thank you, Jai Hind !!!

25È INTERNATIONAL DES IRRIGATIONS ET DU DRAINAGE

1-8 NOVEMBRE 2023, VISHAKHAPATNAM (VIZAG), INDE

Question 64: What alternative water resources could be tapped for irrigated agriculture?

Quelles ressources alternatives en eau pourraient être exploitées pour l'agriculture irriguée?

Question 65: Which on-farm techniques can increase water productivity?

Quelles techniques agricoles peuvent augmenter la productivité de l'eau?

Hosted by:

Indian National Committee on Irrigation and Drainage (INCID)
C/o Remote Sensing Directorate,
Central Water Commission, Department of Water Resources (RD and GR),
Ministry of Jal Shakti, Govt. of India
425(N), Sewa Bhawan, R.K. Puram,
New Delhi 110066, India

Email: incid-cwc@gov.in
Website: http://www.incid.cwc.gov.in/

USB flash drive included in this book contains full length papers.
Of no commercial value.

ICID Central Office:
48 Nyaya Marg, Chanakyapuri, New Delhi 110 021, India
Tel : +91 11 2611 6837, +91 11 2611 5679
E-mail : icid@icid.org, Website : https://icid.org

/icidat **/icidorg** **/icidonline**
/in/icidonline