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ICID NEWS

MANAGING WATER FOR SUSTAINABLE AGRICULTURE

MESSAGE FROM THE PRESIDENT

Dear Colleagues,

During the seventies, the global food insecurity perception attracted the attention of many international entities, including the United Nation Agencies, concerned with water and food to embark on a global endeavour, which was hailed as the "Green Revolution". The challenge was to provide technical and financial support to the developing countries to meet their increasing demand for food and also improving their economic prosperity.

Irrigation development was at the core of the worldwide effort, particularly in Asia, where the development was mainly aimed at reducing the risk, due to frequent droughts and allocating more water resources towards irrigation. Crop productivity enhancement were mainly due to new varieties of seeds and use of chemical fertilizers etc. Hence, the program could be considered, by its virtue, the "Blue Revolution" rather than the "Green". Once again, the human consciousness strives to save the world from acute hunger, which is at the top of UN agenda on Sustainable Development Goals (SDGs).

However, fresh water scarcity, environmental awareness, socio-economic leverage, political impediment and many other crucial factors involved in global food production prospective would leave little elbow room for irrigated land expansion worldwide. We have to be prepared for the second "Green Revolution" at the global scale, further focusing on the developing countries, particularly in Africa and South America and this time, it should definitely be very "Green" from both crop productivity and environmental perspective.

By all means, ICID should actively facilitate a program by using all its experts' capability and potentiality and the network of National Committees to help and push forward such global commitments. This is an ambitious plan for us to be incorporated, through joint works with other international organizations and indeed other UN agencies active in the Water-Energy-Food-Environment sphere.

I had an opportunity to participate in the 16th World Water Congress which was organized by the International Water Resources Association (IWRA) in Cancun, Mexico from 29 May 2017 - 3 June 2017. In the event, ICID and IWRA acknowledged their mutual interest to closely work together for more deliberation on the Water-Energy-Food Nexus Approach concept within their concerned members and audiences. The objective of this collaboration is to develop strategies for ensuring water and food security, while duly recognizing the importance of Water-Energy-Food Nexus and how this approach supplements IWRM approach. A Memorandum of Understanding (MoU) was exchanged between these two major international water entities during the congress to facilitate this important collaboration. It is deemed to set up a Special Task Force at ICID or to assign one of our related WGs to put into practice the details of the action plan within their mandate.

In the past, I have already elaborated the importance of the World Water System Heritage (WSH) as a newly adopted ICID-WWC initiative, that aims at identifying and preserving the people-centred water management systems, organizations, regimes and rules as an intangible water heritage and is considered to be of outstanding value to humanity that creates coexistent social system for humanity and sound environment. I would like to emphasize to all ICID member countries to proceed and nominate their respective WSH potentialities to the Central Office acting at the Secretariat of WSH Program in the framework of the designed template. This will be an effective tool to attract global attention towards ancient water systems developed throughout past centuries providing the ground for their recognition and learning their lessons.

In addition, I would like to thank the Secretary General and all the Central Office technical staff, who have initiated ICID Webinar Series and also all the speakers and panelists, who brought up the state of the art of some very important issues of irrigation modernization to the attention of the audience worldwide. I, sincerely hope this well received initiative to be continued by contribution from all the Working Groups in an objective and planned manner.

With regards,

Dr. Saeed Nairizi
President, ICID

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Doubling Farmers' Income - A Reformative Research Based Strategy Needed for Agrarian Economies

Dr. A K Randev*

Persistent and strong efforts have been made by the Government of India (GoI) to bring about qualitative change in the life of farmers and rural India. During the last three years the government is implementing schemes in 'mission mode' and has been successful in bringing awareness about new initiatives amongst farmers in the agriculture sector.

Among the various schemes, a new vision is "doubling farmers' income". Though attainable, it needs scientific insight as food security must be accompanied by income security to make agriculture activity more 'sustainable'.

Doubling farmers' income is very much possible, if analysed in the light of productivity issue of agricultural crops. Desired results can be achieved with respect to overall inputs use in agriculture and subsequent outputs obtained in the light of input and output productivity. Crop productivity in agriculture is maximum affected by water use i.e. through Irrigation.

Time period during which farmers' income can be doubled is directly proportional to the speed of making the necessary inputs available to the farmer and their utilization on scientific lines.

Direct relationship between income and food security

Indian farmer needs income security to make agriculture a sustainable activity. This in turn will ensure food security to the entire population. A farmer's income needs to be understood from economic withstand i.e. "income earned by a farmer, per unit of time, from his entire resource structure, which is being used by him in producing his agricultural output." This mainly includes crops and livestock or major activities of growing crops and animal husbandry. This should not be confused or mixed with any other activity of the farmer.

Time required for doubling the income

Now, the question arises whether the income from crop or animal husbandry could be doubled? If yes, then what should be the time period - 5 years, less than 5 years or more than 5 years?

The income of a farmer can be doubled from the existing crops or animal husbandry enterprises that he owns. Though the time period range varies – for seasonal crops (say approximately 3 to 4 months) and perennial crops (say 1 year) - during which the farmers' income can be doubled.

This needs to be further understood on the basis of productivity issue of the crop (seasonal or perennial). Before quoting the real figures of productivity of various crops, it is pertinent to understand how the productivity will double the farmers' income in 3-4 months to one year period.

Suppose at the existing level of resource use, say a farmer is producing 10 tonnes of Apples (or say any selected crop) from one hectare of land and after meeting out all the expenses fetching say, Rs 12,000 (US$ 180). Then in case if productivity, in physical terms, of apple/selected crop is doubled through technological interventions, keeping use/price of all other resources/inputs/technology at constant levels, he will be capable of producing 20 tonnes of that crop fetching him double the amount.

Therefore, if productivity of seasonal/ perennial crop grown by a farmer is doubled, his income will also be doubled, but only when productivity issue of agricultural crop is fully taken care by segregating the resources available to the farmer. This can be done by setting priorities as per the budget for making the resources available to him for producing the agricultural output on scientific lines.

Table. Productivity of Crops Grown in India /HP vis-a-vis World's Most Productive Farms

No.	Crop	India / HP	World
1	Rice	3.3 / 1.74	10.8 (Australia)
2	Wheat	2.8 / 1.45	8.9 (Netherlands)
3	Mangoes	6.3	40.6 (Cape Verde)
4	Sugar Cane	66	125 (Peru)
5	Banana	37.8	59.3 (Indonesia)
6	Cotton	1.6	4.6 (Isreal)
7	Potatoes	19.9 / 12.35	44.3 (USA)
8	Fresh Vegetables	13.4 / 21.33	76.8 (USA)
9	Tomatoes	19.3	52.49 (Belgium)
10	Okra	7.6	23.9 (Isreal)
11	Beans	1.1	5.5 (Nicargua)

Productivity issue

The productivity levels of different agronomical and fruit crops grown in India / Himachal Pradesh (HP) and the world are shown in the Table. This reflects 2 to 6 times lower productivity in India indicating not only doubling the physical production, but expanding it upto 6 times from the same piece of land is feasible.

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AGRICULTURE GETS NEW LEASE OF LIFE WITH SOIL HEALTH CARDS

The Government of India in February 2015 has started a nationwide campaign under the Soil Health Card scheme to raise awareness amongst farmers for judicious use of fertilisers.

Farmers are issued cards (every two years) that gives them easy access to soil conditions and crop wise recommendations of nutrients and fertilisers for a healthy produce.

Benefits to Farmers:

- Soil Health Cards carry crop-wise recommendations of macro nutrients, secondary nutrients, micro nutrients and fertilisers to improve productivity of their crops and ensure food security of the country.
- It leads to optimum utilization of soil, water and natural resources and strengthening of soil and fertiliser testing facilities to provide soil test-based recommendations to improve soil fertility.
- The card suggests corrective measures to be adopted by a farmer to improve soil health and obtain a better and high yield. Emphasis is laid on farm-wise manure, rural and city compost and usage of green manure.

Physical production doubled or more leads to safe inference that at the prevailing prices of input and output and available technology , the value of money can also be doubled or increased to 6 times (possible upto attainable yields).

The existing strategic efforts have already been targeting crop productivity through supply of various farm related inputs and services by the research and development organization that is serving the farming community in Himachal Pradesh. Thus, the role of research and development organization including training to the farmers on related production and marketing issue forms the basis of the vision.

In addition to Soil Health Cards, expansion in irrigation facilities, low cost organic farming, national agriculture market, horticulture development, agriculture forestry, bee keeping, milk fish and egg production, as well as special emphasis on agricultural education, research and expansion have been given utmost priority.

Responsibility of input supplying and output disposing agencies in context of Irrigation water

On segregating inputs'use on a farmer's field it has been inferred that water is the most important amongst all affecting the productivity levels. Therefore, water must be given an in-depth and serious multi-disciplinary view on scientific lines, if vision of doubling the farmers' income is to be achieved.

Economic analysis on impact of irrigation on crop productivity has shown that if a crop gets adequate quantity of irrigated water at required intervals, its productivity can be enhanced by 2.43 times in the hills of Himachal Pradesh.

Similar analogy on other research study conducted globally have shown productivity on irrigated farms is about 5 to 6 times higher as compared to rain fed farms.

Pradhan Mantri Krishi Sinchayee Yojana – PMKSY (Prime Minister's Irrigation Scheme) has been formulated with the vision of extending the coverage of irrigation and improving water use efficiency in a focused manner to achieve 'More crop per drop'. Processes are strengthened so that farmers can get maximum benefit from the scheme.

In the year 2016-17, GoI has released Rs.1,991.17 crore (US$ 133 Billion) to states for 'More Crop Per Drop' and an area of 8.4 lakh ha (0.84 Mha) have been brought under micro irrigation. This is the largest area ever covered under micro irrigation during any year. In addition, 48,636 water harvesting structures were created during the year 2016-17 having 98,190 ha (0.09 Mha) potential for protective irrigation.

The mission mode of PMKSY targets to complete 99 big and medium irrigation projects at a cost of Rs 80,000 crore (800 billion) by December 2019. This will result in irrigation of about 76.03 lakh ha area. The target is to complete 17 projects by June 2017.

The above facts based on research have been supported by President Hon. Peter S. Lee in 2000 study entitled 'ICID Survey on Funding of Operation, Maintenance and Management of Irrigation and Drainage Projects' that quotes – "as we enter a new century of irrigation and water resources development, institutional performance will play a critical role in managing water for sustainable agriculture."

Strategic Efforts

1. Economic planning of water resource for expanding irrigation infrastructure

Macro and micro level planning by multi-disciplinary experts has been found to be the only way to sustain agriculture by ensuring water availability in the light of increasing population pressure.

2. Strengthening of technologies for rain fed areas

A simultaneous effort is needed for strengthening the ongoing input supply research and development organisations like Agriculture/Horticulture & Forestry Universities in the state along with the development departments like Agriculture, Horticulture, Forest, Environment and Climate Change, Rural development and most importantly, Irrigation and Public Health.

As each department/unit supplying input tries to minimize the negative environmental impact of one's contribution in any respective form directly or indirectly it leads to supplement the farmers' income. Development programmes need to follow research based synergistic approach so that overall efficiency of all the living and non-living resources, especially crop productivity becomes higher as compared to present levels.

3. Strengthening marketing infrastructure

Farmers' income is outcome of overall maximum production level with simultaneous support of marketing process. Marketing related activities need to be strengthened and upgraded on scientific lines based on the quantified information and data generated having research basis from the production and marketing survey i.e. strong infrastructure for main linking roads, storage and processing units, auction yards etc.

Therefore, production levels must be supported by marketing reforms, in the first instance, related with those marketing functions which restrict the farmers in getting remunerative prices.

At the same time, marketing indicators supported policies like price policy, taxation and tariff etc. also supplement the income levels of the farmers. For example, minimum support price of agricultural commodities also helps to sustain agricultural activity.

4. Off-farm activities

All off-farm income generating activities by the government needs to be disseminated through training and communication media. These activities supplement to the farm income of the farmer by providing employment during their off-farm hours.

Research and development programmes of the public and private sectors framed in the light of the above research based production and marketing related suggestions may lead to doubling or more than doubling the farmers' income within a time period range which is directly proportional to the speed of fulfilling the above stated requirements.

Practical Benchmarking for Improving Performance of Irrigation and Drainage Schemes

Dr. Martin Burton (UK)*

On 7 June 2017, ICID under its "ICID Webinar Services" hosted its third webinar in the series on the subject "Practical Benchmarking for Improving Performance of Irrigation and Drainage". Presented by Dr. Martin Burton, the webinar sought to introduce the use of benchmarking in the irrigation and drainage (I&D) sector by explaining the various process involved and the indicators to be used. Ten case studies from a number of countries were used to illustrate these processes and to provide lessons for practical application of benchmarking. The live recording of the webinar can be viewed from <http://www.icid.org/icid_webinar_3.html>

Purpose of benchmarking

The purpose of benchmarking is, very simply, to improve performance, be it of an organisation or a "system" such as abstraction and delivery of water to farmers for crop production. In the IPTRID/FAO guidelines for benchmarking performance in I&D sector (Malano and Burton, 2001) it is defined as "A systematic process for securing continual improvement through comparison with relevant and achievable norms and standards". Thus, benchmarking is about change, moving from one position to a better position by comparison of an I&D system or systems with other well performing systems. Though the origins of benchmarking are in the business sector the development in I&D sector lies within the work done by the International Water Management Institute (David Molden et al, 1998) and others in the 1980 and 90s on comparative performance assessment.

Benchmarking processes

The key principle of benchmarking, as shown in Figure, is a comparative performance between I&D systems or schemes[1]. Analysis of the performance of the system or scheme can identify performance gaps between the well performing and less well performing systems. Further investigation (diagnostic analysis) can then identify the cause(s) of the performance gap and measures to raise the performance of the less-well to the better performing systems or schemes.

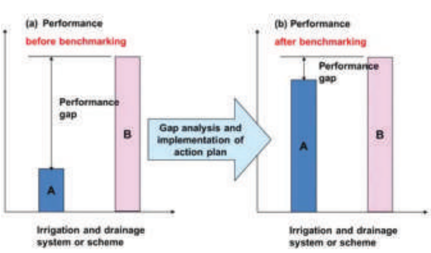

Figure. Key principle of benchmarking - Comparative performance

Thus, benchmarking identifies gaps in performance and ways to close the performance gap through diagnostic analysis. It sets achievable standards for which to aim by identifying "best practice". It is important to identify key processes, and key indicators for these processes, taking care to keep the indicators relatively simple, easy to use and understand. Allied to this the data collection should not be too difficult or onerous.

The basic stages of benchmarking are: (i) Identification and planning; (ii) Data collection; (iii) Analysis of the data and information obtained, identification of the gaps in performance, their causes and actions required to close them; (iv) Integration of the proposed remedial measures into management processes and gaining agreement from key stakeholders to take part in the process; (v) Taking action to implement the required measures; and finally (vi) monitoring and evaluation of the benchmarking process, whether it has being applied or has it produced the desired changes and results. In general, the first three stages are relatively simple, the problems generally arises in stage (iv) and (v) in trying to apply the identified improvement measures.

It is important, in Stage 1 to define the objectives of the benchmarking exercise, identify the key processes and the indicators to measure those processes and then identify the data to be collected and who will carry out the data collection and processing. Typical key processes to be benchmarked and associated indicators are shown in Table. It is important to be clear and consistent with the indicator terminology, for example there are significant differences in the values of an indicator measuring the total annual water abstracted (from the water source) per unit command area and one measuring the total annual water consumed per unit command area or total annual water consumed per unit irrigated area.

Defining the indicators define the data that are to be collected, and to a large extent the spatial and temporal boundaries of the data collection exercise. As well as the type of data, frequency and location of collection, it is important to decide on the collection (and processing) mechanisms. Increasingly remote sensing, SMS, web-based data entry, GIS, etc. are being used for data collection and processing.

Based on the findings of the data collection and analysis exercise, and any more detailed diagnostic analysis studies carried out, an Action Plan needs to be

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[1] The term "system" is used to refer to the canal and drain network while the term "scheme" is broader and includes the canal and drain network, the fields, the roads, the water users, villages, etc. The distinction is required as often an I&D agency is only interested in the performance of the water delivery and removal "system", while the impact of that water delivery and removal is experienced within the wider "scheme".

prepared and agreement reached with key stakeholders about its implementation. These stakeholders may include water users, WUAs, I&D agency staff, agricultural department staff, etc. Gaining agreement from politicians may be a key factor in implementing the changes required. Once the Action Plan is agreed then it can be implemented, with leadership being required from the key players to push the changes through.

The final stage is monitoring of progress with the Action Plan and evaluation of the impacts made. The indicators used in the initial benchmarking exercise can be used to measure changes in performance and progression to the identified targets.

Case studies and lessons learned

During the webinar, ten case studies were presented outlining the benchmarking processes and outputs, together with lessons to be learned from these studies. The case studies were from Egypt, Turkey, Australia, Albania, the Kyrgyz Republic, India (two states Maharashtra and Madhya Pradesh and one national benchmarking programme), the UK and IWMI. The case studies covered different forms of benchmarking – in Egypt benchmarking was carried out on six branch canals in order to trial the process and produce guidelines for wider application, while in Turkey five schemes were benchmarked using the IPTRID/FAO benchmarking indicators. The IWMI web-based benchmarking programme which commenced in 2003 also used the IPTRID/FAO benchmarking indicators, enabling users to enter data values for their schemes and compare their performance, in confidence, with data held for similar schemes in the database.

In Australia, a national benchmarking programme (starting in 1998 to date) was discussed covering around 50 schemes, whilst in Maharashtra benchmarking (starting in 2001-02 till date) has been carried out on over 260 schemes. The Albania and Kyrgyz Republic case studies benchmarked the performance of Water Users Associations (WUAs) and Federations of WUAs, while the case study for India outlined a national WUA benchmarking programme. The Madhya Pradesh study highlighted the use of benchmarking to identify and set performance targets and the integration of the benchmarking and performance management process into I&D agency's management practices. The process had notable success, increasing the dry season irrigated area from 0.94 million ha in 2010-11 to 2.91 million ha in 2015-16 (Julaniya et al, 2016). The final case study in the UK described a benchmarking programme for potatoes and strawberry crops, with data being entered online, processed and scorecards sent to the users for the 11 KPIs.

Each of these case studies had particular features from which lessons could be learned. These included: (i) Consider using "traffic light" colour coding to highlight values of key indicators (e.g. red for values which are of concern); (ii) Recognising that it is unlikely that one system or scheme will give the best results for all indicators, often determination of the "best" performing systems is more nuanced; (iii) It is important to compare "like with like", for example rice schemes will generally have higher water use than a scheme with dry foot crops; (iv) Don't use too many indicators, choose KPIs carefully; (v) If using several indicators to rank performance consider using weightings to recognize the relative importance of the indicators used; (vi) Benchmarking can identify significant differences in performance between schemes or users; (vii) Using simple presentations can often get the message across more effectively than complex ones; (viii) Use KPIs to drive performance improvement; (ix) Don't forget to reward good performance where the performance gap has been closed; (x) Recognize that performance assessment and benchmarking often needs champions to promote and sustain it; (xi) National and international benchmarking programmes need a secure hosting site and on-going technical support to sustain them.

Table. Typical key processes and indicators for benchmarking performance

Process	Possible indicators
Irrigation service delivery – Operation	• Irrigated area • Volume of irrigation water abstracted • Irrigation water abstracted (total & per unit command or irrigated area) • Irrigation water delivered (total & per unit command or irrigated area) • Relative irrigation water supply (abstraction/demand)
Irrigation service delivery - Maintenance	• Maintenance expenditure per unit area (MU/ha) MU = Monetary unit
Crop production	• Crop yields (kg/ha) and cropping intensity (%) • Value of crop production per unit command area (MU/ha) • Value of crop production per unit water abstracted (MU/m3) • Output per unit irrigation supply (MU/m3) • Output per unit water consumed (MU/m3)
Finance	• Cost Recovery Ratio • Total MOM expenditure per unit command area (MU/ha)
Institutions	• WUA membership ratio • WUA Annual General meeting attendance
Environment	• Water quality (Biological/chemical content) • Minimum flow levels

Summary and conclusions

In conclusion, it is clear that benchmarking can be a valuable tool to compare and improve I&D performance. It is important to identify key processes and be selective in the use of key performance indicators in order to be able to identify and analyse outputs of the system or scheme. In this context the use of remote sensing, GIS and IT will have an increasing role to play in future benchmarking programmes. Having compared performance of outputs further (diagnostic) analysis may be required to identify the causes of good or poor performance and measures to close the performance gap. At this stage, it is essential to categorize schemes and compare "like with like".

It is recognized that the integration and action phases are the most difficult; these phases require strong leadership and vision to achieve the desired objectives. The Madhya Pradesh, India case study showed the benefits of successfully implementing the identified changes and closing of the performance gap.

Mexico: Country Profile

Mexico is a country bordering the Caribbean Sea and the Gulf of Mexico, between Belize and the United States and bordering the North Pacific Ocean, between Guatemala and the United States. Mexico City is the capital city, densely populated (second-most-populous city in the Americas), and high-altitude city of Mexico <19°26'N 99°08'W / 19.433°N 99.133°W>. With a coastline of 9,330 km, the land border is 4,389 km with three different countries: Belize 276 km, Guatemala 958 km, and US 3,155 km. The terrain is comprised of high, rugged mountains; low coastal plains; high plateaus; and desert. The total territorial area is approximately two million square kilometers.

Climate

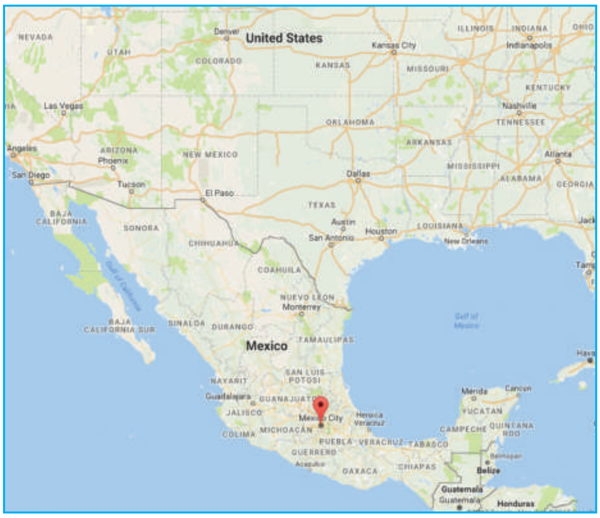
Mexico has an annual average rainfall of 777 mm, concentrated mainly in three months, from July to September. The spatial distribution of rainfall and temperatures produces a great variety of climates, that range from arid (31%) and semi-arid (36%) conditions in the northern region where the largest irrigation systems are located, to the humid tropic (33%) in the southeast. Nearly 27% of the rainfall, that is 410 billion cubic meters converts into superficial runoff that feeds 13 main rivers of the nation.

Demography

Mexico's population is approximately 123 million (July 2016 est.) with a median age of 28 years, making it a youthful country. Most of the population is found in the middle of the country between the states of Jalisco and Veracruz; approximately a quarter of the population lives in and around Mexico City, the national capital. About 30% of the population lives in rural areas according to the National Employment Survey, and of the rural population, 50% are below the age for work, and of the employed population, 39% are workers over 40 years of age. The rural population involved in agricultural activities has been estimated at 9.7 million of which 33% owned land, the 9% were landless producers and the 58% workers. With differences between regions, the role of woman in agricultural and livestock activities and in access to the land has become more important. Presently, 26% of the agricultural workers are women.

Agriculture

Corn (maize), one of the world's major grain crops, is thought to have originated in Mexico. Mexico, a classified arid and semi-arid country, has 12% arable land of the total land area of 2 million square kilometres and only 33% of arable land is equipped for irrigated agriculture. The agricultural sector plays an important role in the economic development of the country accounting for 8.4% of gross domestic product (GDP) and employing 23% of the economically active population. Irrigated agriculture contributes about 50% of the total value of agricultural production and accounts for about 70% of agriculture exports. Mexico's government initiated a number of structural reforms in the water sector aimed to introduce modern water management in irrigation.



The average irrigated plot size is relatively small, from 3 to 9 ha in irrigation districts and about 2.6 ha in irrigation units. At the same time, many landowners have farms larger than 50 ha and family farms, combining individual land holdings, may surpass 500 ha. There are wide disparities in the regional distribution of agricultural productivity. The northwest region presents the largest capability to produce crops with high added value in relation to the size of its economically active population and to the number of production units. In this region, the gross value of agriculture and livestock production per productive unit is three times larger than that of the central region and almost 12 times larger than those of the south and southeast regions. Productivity gaps show the feasibility to triple the yields in some very well identified regions in relation to the national average by introducing state of the art technology in irrigation, mechanization, use of improved seeds, fertilization, and weed control. Main factors that have influenced the limited performance of the agriculture sector include land degradation, policy-deficit issues, unfavourable urban-rural pricing, limited application of technology and scientific advances, and limited or declining financing in the sector among others.

Water Resources

Total internal renewable water resources are estimated at 457 BCM per year, plus 49 BCM/year inflows from neighbouring countries (average 1977-2001). The largest river on the Pacific coast is the Balsas River (24 BCM/year) and the largest river on the Atlantic Coast is the Grijalva–Usumacinta flowing from Guatemala to Mexico (115 BCM/year). The Rio Bravo is longest river (2018 km), called Rio Grande in the United States, and also the river with the largest basin (226,000 km²), half in the United States and half in Mexico.

Water is abundant in the relatively sparsely populated South and scarce in the more densely populated Center and North of the country. The Center and the North of the country where 77% of Mexico's population lives and 85% of its GDP is generated dispose of only 32% of the country's renewable water resources.

Rainfall is highly variable and droughts are frequent. The states most affected by drought, as measured by the agricultural area affected by drought, are Chihuahua, Mexico and Zacatecas. The renewable volume of groundwater is estimated at 31 BCM and non-renewable supplies, stored in aquifers, amount to 100 BCM. In the northern part of Mexico and in the highlands, representing more than a half of the national territory, runoff amounts to only 20%. In spite of the fact that in this region lives 76% of the total population where 70% of the industries are established and where 40% of croplands are located.

The southeastern part of Mexico, which is less than a fourth of the total land surface, with only 24% of the population of the country and very little industry, receives 67% of total runoff. The uneven rainfall distributions, in space and time, compelled government and private enterprises to develop water infrastructure, in order to regulate water availability. At present, Mexico has a hydraulic infrastructure that supplies a large part of water demand for urban centers, food production, the industry and generation of electric energy. Also, the majority of the largest rivers are partially or totally controlled by multiple-use dams.

Irrigation infrastructure and irrigated area

Supply Source	ID (%)	Area (%)	IU (%)	Area (%)	System (%)	Area (%)
Storage Dam	29	24	4	14	4	18
Diversion	31	22	11	25	11	24
Stream Pumping	3	2	8	10	8	7
Deep Well	7	5	74	47	74	29
Mixed (two or more sources)	30	47	3	4	3	22
TOTAL	86 IDs	32,852 km^2	53,058 IUs	43,178 km^2	53,144 systems	76,030 km^2

There are three main watersheds in Mexico: the Western or Pacific Watershed, the Eastern or Atlantic Watershed (Gulf of Mexico and Caribbean) and the Inland Watershed, where rivers do not empty out into the sea. Two thirds of the country's 146 rivers drain into the Pacific Ocean.

There are approximately 100 rivers in the Western or Pacific Watershed, the most important in terms of water flow being the Balsas, Colorado, Culliacan, Fuerte, Lerma-Santiago, Verde, and Yaqui rivers. The Eastern Watershed is made up of 46 main rivers, the most important being the Bravo, Coatzacoalcos, Grijalva, Pánuco, Papaloapan and Usumacinta Rivers. The Inland Watershed is made up of large closed basins. The Nazas-Aguanaval river system is the largest.

Irrigation in Mexico

Of the 76,030 square kilometres having irrigation infrastructure in Mexico (July 2017 est.), about 36,926 km2 (49%) are irrigated with surface water, 21,936 km2 (29%) are served by groundwater pumping and 17,168 (22%) are served by two or more supply sources. Approximately 32,852 km2 correspond to 86 larger systems, namely irrigation districts (Distritos de Riego – IDs). The remaining 43,178 km2 are distributed among more than 53 thousand small irrigation zones called irrigation units (Unidades de Riego – IUs).

The most important irrigation districts in Mexico are: Culiacán-Humaya, San Lorenzo, Yaqui River, Fuerte River, Colorado River Project, Lower Bravo River, Higher Lerma River, Lagunera Region, Guasave, Mayo River, Lazaro Cardenas, and Delicas. Only 20 IDs are greater than 50,000 ha but represent almost the 2/3 of national command area in Irrigation districts.

Food production requirements and the need to settle vast unpopulated areas in the northern region bordering the United States triggered the creation of the National Irrigation Commission and the enactment of the Irrigation Act of 1926. Water use was then low, even regionally and locally, so planning was undertaken project by project. Land reform, a stepping stone of post-Revolutionary governments, was closely related to irrigation projects.

In 1946, The Ministry of Water Resources took place of the National Irrigation Commission and, for the first time, responsibility for water development was concentrated within the realm of a single ministry. Water use increased substantially as a result of the economic development policies, especially for the industrial sector. During the 1940's and 1950's, River Basin Commissions were created to launch regional development programs sustained by water-related projects. In 1975, the first National Water Plan provided a framework for improving water resources management consistent with national and regional objectives. In 1976, the National Water Plan Commission was created to implement the plan and update it systematically. Also in 1976, the Ministries of Water Resources and Agriculture become the Ministry of Agriculture and Water Resources, mainly to unify governmental actions directed at solving the growing problems of the agricultural sectors. This institutional change however, caused a disintegration of water planning and management.

The economic crisis of the 1980's led to drastic changes in Mexico's irrigation policy. The National Development Plan (1989–1994) called for an increase in irrigation efficiency and the use of existent infrastructure. Under the National Program for Decentralization of Irrigation Districts, derived from the National Development Plan, Mexican government initiated the management transfer of irrigation districts to Water User Associations (WUA's). The National Program, implemented by CONAGUA, originally planned the transfer of operation and maintenance of 21 irrigation districts, comprising 1.98 million ha. To date, actual targets far exceed the target of 1.98 million ha of area during the 1990-1994 period.

Mexican irrigation zones have been institutionally divided in two broad types: irrigation units (IUs) and irrigation districts (IDs). The irrigation districts, covering 3.3 million ha (or 43% of the irrigated area), are large-scale irrigation schemes supplied mainly with surface water and some with groundwater. The responsibility for their operation and maintenance has been transferred to water users' associations (Asociaciones Civiles de Usuarios – WUAs) in the 1990's except for 1% of the area that is still operated by CONAGUA as well as some main hydraulics works such as dams and large canals.

The irrigation units, covering about 4.3 million ha (or 57% of the irrigated area), are smaller irrigation schemes, supplied from both surface and groundwater and operated and maintained from their inception by agricultural producers. These irrigation schemes are supplied primarily from groundwater as primary or secondary supply source. Agricultural producers carry out O&M. The National Federation of Users of Irrigation Water (Asociación Nacional de Usuarios de Riego), established in 1994, represents the interests of WUA's in negotiations with the Government. The transfer of the biggest irrigation systems or irrigation districts (43% of total irrigated area) from federal government to water users' associations (WUA's) is a key component of the new water policy.

MXCID and ICID

Mexico joined ICID in the year 1951 and ever since Mexico has been actively participating in the activities of the Commission. The Mexican National Committee of International Commission on Irrigation and Drainage (MXCID) has been actively participating in the events of ICID. At present, MXCID is hosted by the Comisión Nacional del Agua (CONAGUA) and its Director General Lic. Roberto Ramírez de la Parra is the MXCID President<https://www.gob.mx/conagua>. MXCID has successfully organised the 7th ICID Congress and 20th IEC meeting, Mexico, in 1969; 3rd Pan American Conference (PAC-3), Mazatlán, in 1992; and PAC-4, Yucatan, in 2000; 5th Pan American Regional Conference in 2006. The 23rd ICID Congress scheduled from 8-14 October 2017, Mexico on the theme: Modernizing Irrigation and Drainage for a New Green Revolution. Three of the members of MXCID have been the Vice Presidents of ICID in the past - Mr. Abelardo Amaya Brondo (1971-1974), Mr. Alberto Barnetche González (1964-1967), and Ing. Manuel Contijoch Escontria (2001-2004).

For more information visit http://icid.org/cp_country.php?CID=62

23rd ICID Congress
Modernizing Irrigation and Drainage for a New Green Revolution

ICID has been organizing its flagship triennial event, the International Congress on Irrigation and Drainage, since 1951. The 1st ICID Congress was held in 1951 at Delhi, and 22nd ICID Congress was held in Gwangju, Republic of Korea in September 2014.

The 23rd ICID International Congress on the theme "Modernizing Irrigation and Drainage for a New Green Revolution" is scheduled from 8-14 October 2017 in Mexico City, Mexico. The Mexican National Committee of ICID (MXCID) under the banner of Comisión Nacional del Agua (CONAGUA), an administrative and technical advisory commission of Mexico's Ministry of the Environment and Natural Resources (SEMARNAT) is the host National Committee.

The grand opening ceremony of the 23rd ICID Congress is scheduled on 9 October 2017 and is expected to be inaugurated by the Mexican President H.E. Enrique Peña Nieto. The event will be attended by more than 1200 participants, which includes Ministers, policy makers, international partners, etc. Dr. José Graziano da Silva, Director General, FAO; Prof. Benedito Braga, President, World Water Council (WWC); Mr. Guang Zhe Chen, Senior Director, World Bank are expected to deliver their keynote addresses. The 23rd ICID Congress also includes an International Exhibition, specially arranged to showcase the products and services, which will be inaugurated during the opening ceremony.

The 23rd ICID Congress will address two Questions, Special Session, Symposium, Seminar, Workshop and Training for Young Professionals.

The theme of the 23rd ICID Congress and all the topics are undoubtedly vital for the irrigation community and needs to be addressed in the 21st century. The concept of Green Revolution began in Mexico in the 1940's and many countries followed the practices and technologies to become a self-sufficient in food security.

Question 60. Water Productivity: Revisiting the concepts in light of water, energy and food nexus

Question 61. State of knowledge of irrigation techniques and practicalities within given socioeconomic settings

Special Session

The reuse of treated wastewater is one of the many solutions that can reduce the need to extract fresh water and promote a long-term sustainable development. However, the concept of reuse of treated wastewater does not lead to unconditional public support. To address this important issue, MXCID has taken a lead to organize a Special Session on 10 October 2017 and invited papers from experts and others to share their experiences.

Resource person: Ms. Jaime Collado, MXCID <collado.jaime@gmail.com>

Symposium

The ICID Working Group on Institutional and Organizational Aspects of Irrigation / Drainage System Management (WG-IOA), Chaired by Vice President Hon. Dr. Hafied A. Gany (Indonesia) has taken a lead to organize the Symposium on 8 October 2017. The main aim of the Symposium is to provide a platform for irrigation and drainage professionals and other stakeholders to share their knowledge and experiences related to sustainable agriculture water management with focus on institutional and organizational reforms in the irrigation sector, participatory irrigation management, water users' associations and other relevant issues.

Resource person: Vice President Hon. Dr. A. Hafied A. Gany (Indonesia), Chairman, WG-IOA <gany@hafied.org>.

Seminar

The Food and Agriculture Organization of the United Nations (FAO) will organize a seminar on 8 October 2017 to address water use in food value chain. The aim of the seminar is to highlight the water use in food value chain, from production to consumption, and discuss relevant concepts and approaches to address the issue.

The seminar includes keynote addresses by Mr. Olcay Ünver, Deputy Director, Land and Water Division, FAO and Presentations on the topics - Water use efficiency and productivity in production; Can food supply chain really be water neutral?; and How can consumer behavior be a game-changer?

Resource person: Mr. Olcay Ünver, Land and Water Division, FAO <Olcay.Unver@fao.org>.

Workshop

The International Geosynthetics Society (IGS) Technical Committee on Hydraulic Applications will organize a Workshop on 8 October 2017. The Workshop will allow attendees to learn the principles of Geosynthetics applications for irrigation canals, reservoirs, and flood management, covering the functions of water containment and barrier, water conveyance, reinforcement/stabilization, erosion control, and testing of Geosynthetics.

Resource Person: Mr. Timothy D. Stark, International Geosynthetics Society (IGS) - North America <tstark@illinois.edu>.

SUBJECTS OF DISCUSSION

Question 60. Water Productivity: Revisiting the concepts in light of water, energy and food nexus

Question 61. State of knowledge of irrigation techniques and practicalities within given socioeconomic settings

Special Session on Irrigation techniques for reuse of wastewater in agriculture and its impact on health and environment

Symposium on Global review of institutional reforms in irrigation sector for sustainable agriculture water management, including water users associations

Seminar on Water Use in Food Value Chains: A Challenge for a New Green Revolution?

Workshop on Applications of Geosynthetics to Irrigation, Drainage and Agriculture

Training Workshop for Young Professionals (YPs) on Value Engineering: An effective and efficient methodology for enhancing irrigation, drainage and flood management projects

Training

ICID Task Force on Application of Value Engineering (VE) in Irrigation and Drainage Projects (TF-VE) is organizing a Training Workshop for Young Professionals (YPs) on Value Engineering: An effective and efficient methodology for enhancing irrigation, drainage and flood management projects on 13 October 2017.

The objective of the Training is to promote the application of value methodology (value engineering, value analysis, value planning, value management, and value engineering change proposal (VECP)) in irrigation, drainage and flood management projects to increase benefits, reduce cost and ensure sustainable irrigated agriculture.

Resource Person: Dr. Kamran Emami (Iran), Chairman, TF-VE <kkemami@gmail.com>.

For more information on 23rd ICID Congress, please visit: **http://www.icid2017.org**

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International Commission on Irrigation and Drainage (ICID) was established in 1950 as a scientific, technical and voluntary not-for-profit non–governmental international organization.
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