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Water4Crops-India

Integrating bio-treated wastewater reuse with enhanced water use efficiency to support the green economy in EU and India

(India side)

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International Crops Research Institute for the Semi-Arid Tropics

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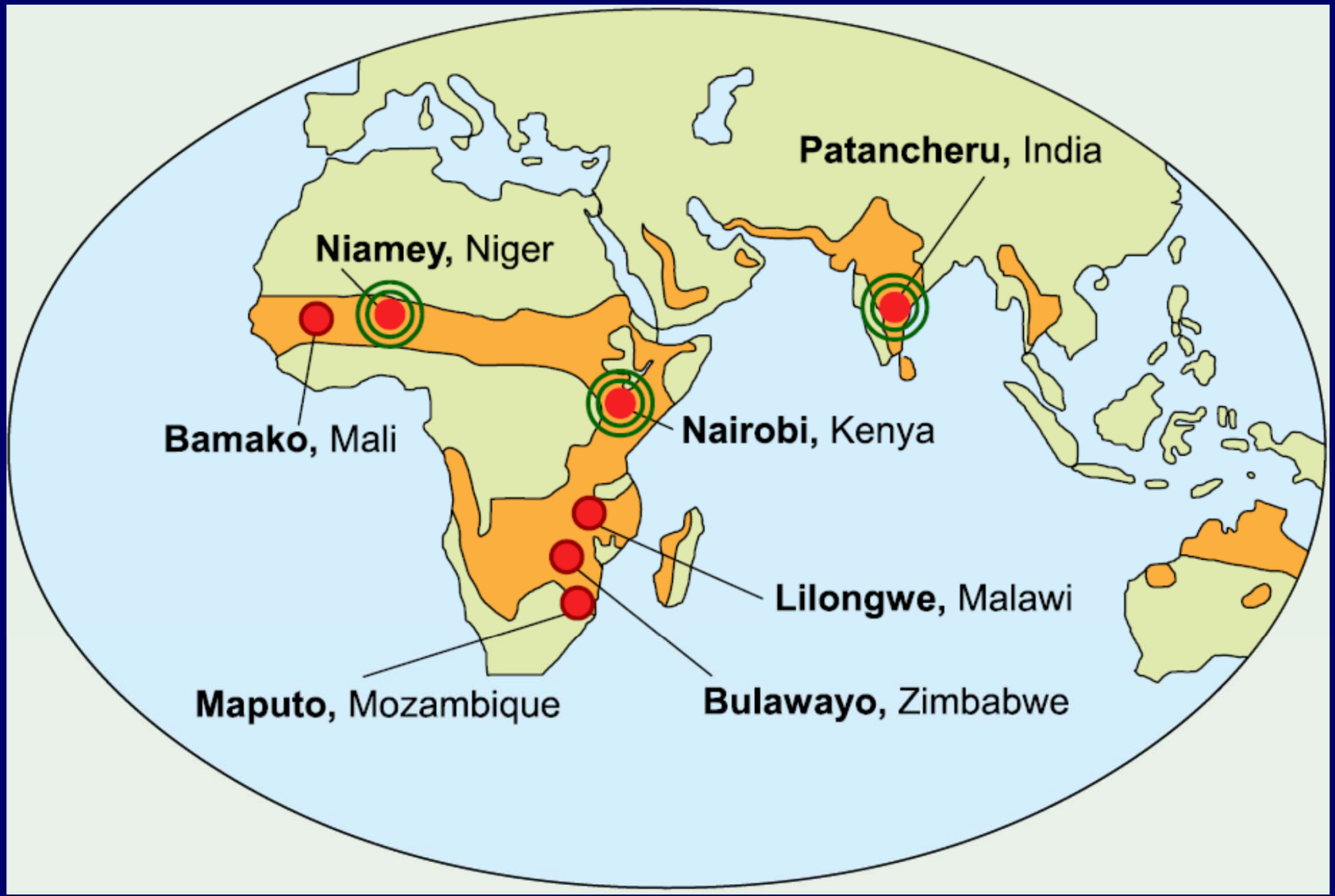
ICRISAT Locations in the SAT



ICRISAT Experimental Field Facilities

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Well-laid plots

Alfisols and Vertisols

Farm machinery

Linear irrigation

Furrow irrigation

Sprinkler irrigation

Challenges to Produce More Food with Limited Water

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A Water-Short World

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Projected Water Scarcity in 2025

- Vital, finite and scarce
- Essence that makes GREY - GREEN
- By 2025 1/3rd population will face water scarcity

Rainfed Agriculture in Need of Resource Conservation Technology

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Vulnerability of impacts of climate change

Water scarcity and drought

Land degradation

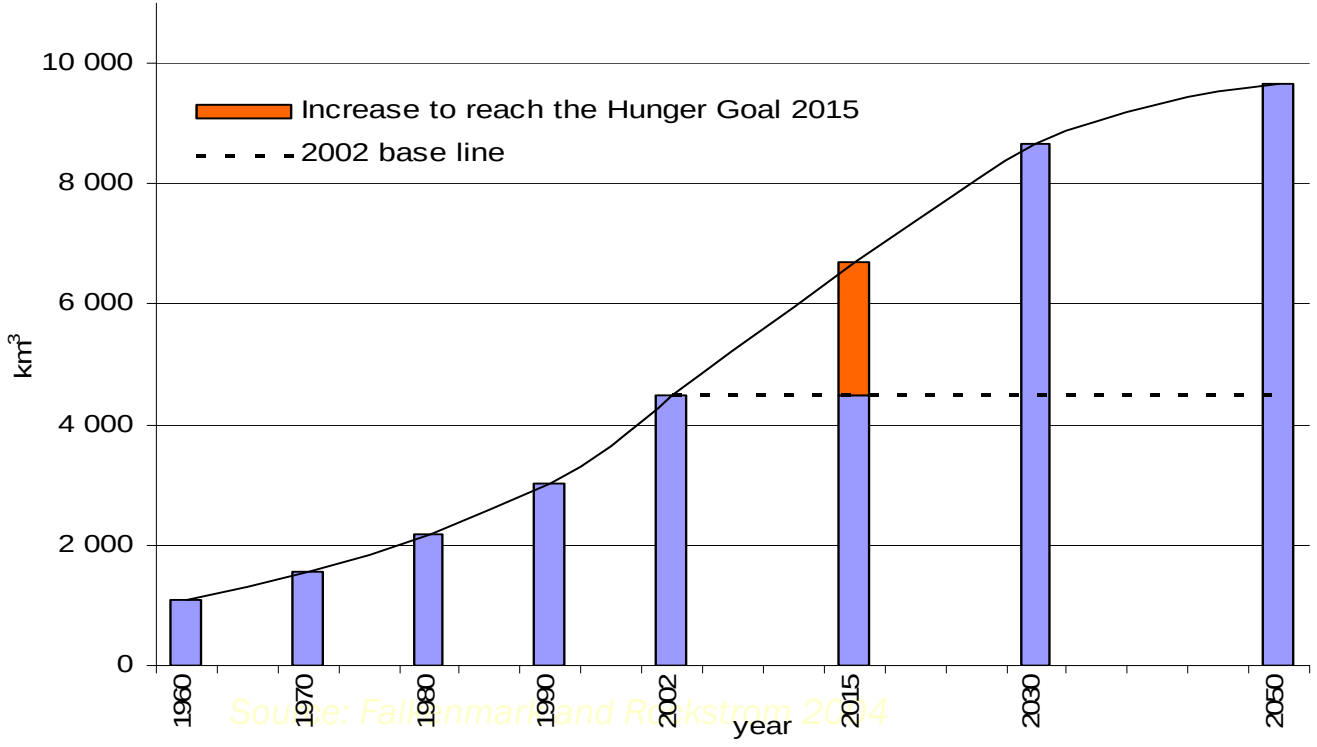
Low water use efficiency

Water Demand to meet MDG

With improved water productivity (1800 → 1200 m^3 t^{-1}) additional water demand will be:

By 2015 1815 km^3

By 2030 3000 km^3



Source: Falkenmark and Rockstrom 2004

Balanced diet will need 1300 m^3 $person^{-1}$ $year^{-1}$

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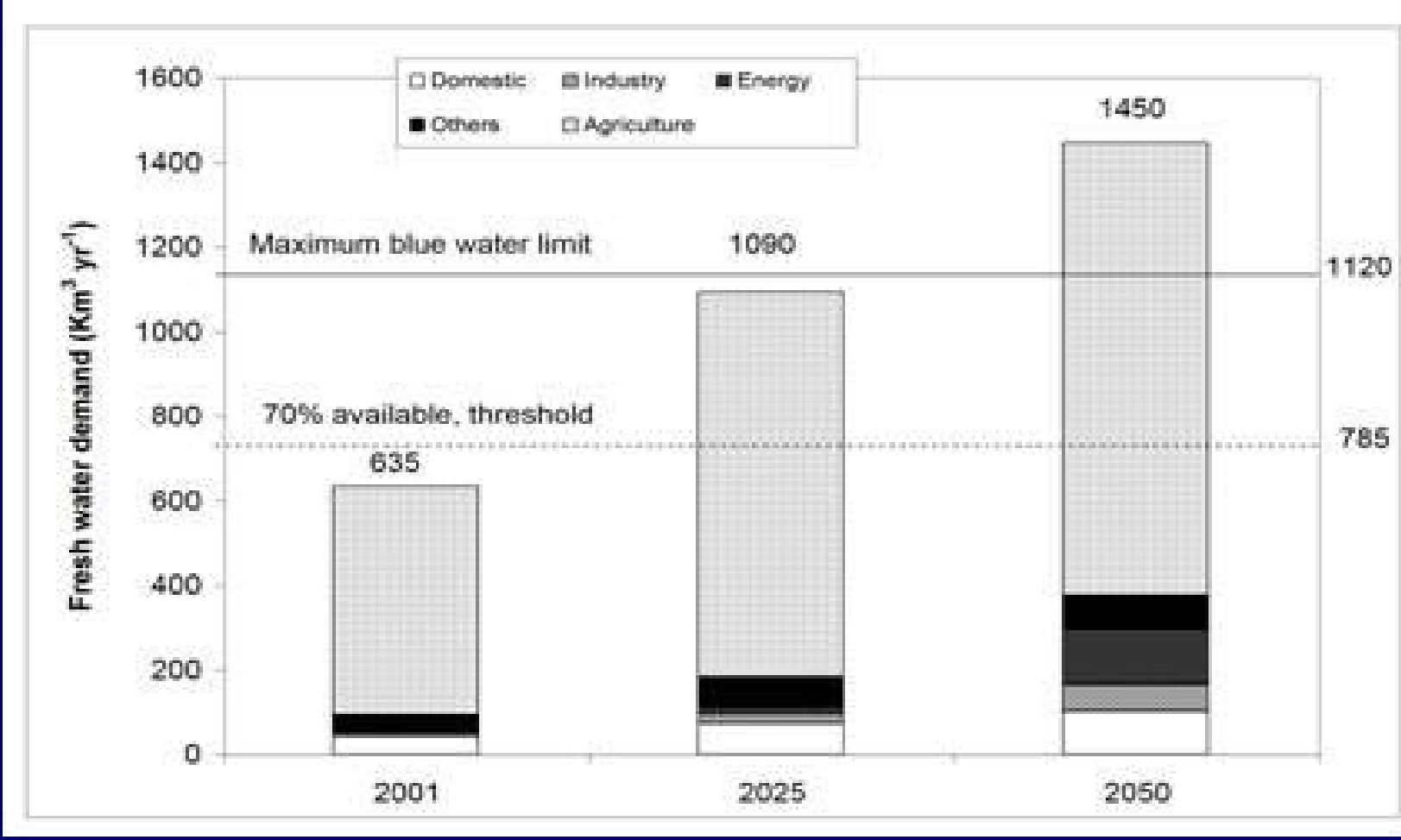
Present and Anticipated Future Fresh Water Demand for Food Production and Other uses in India



Source: Central water commission, 2005

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Per Capita Water Availability in India

Year	Population (Million)	Per capita water availability M^3/year
1951	361	5177
1955	395	4732
1991	846	2209
2001	1027	1820
2025	1394	1341
2050	1640	1140

Source: Govt. of India, Ministry of Water Resources, 2009

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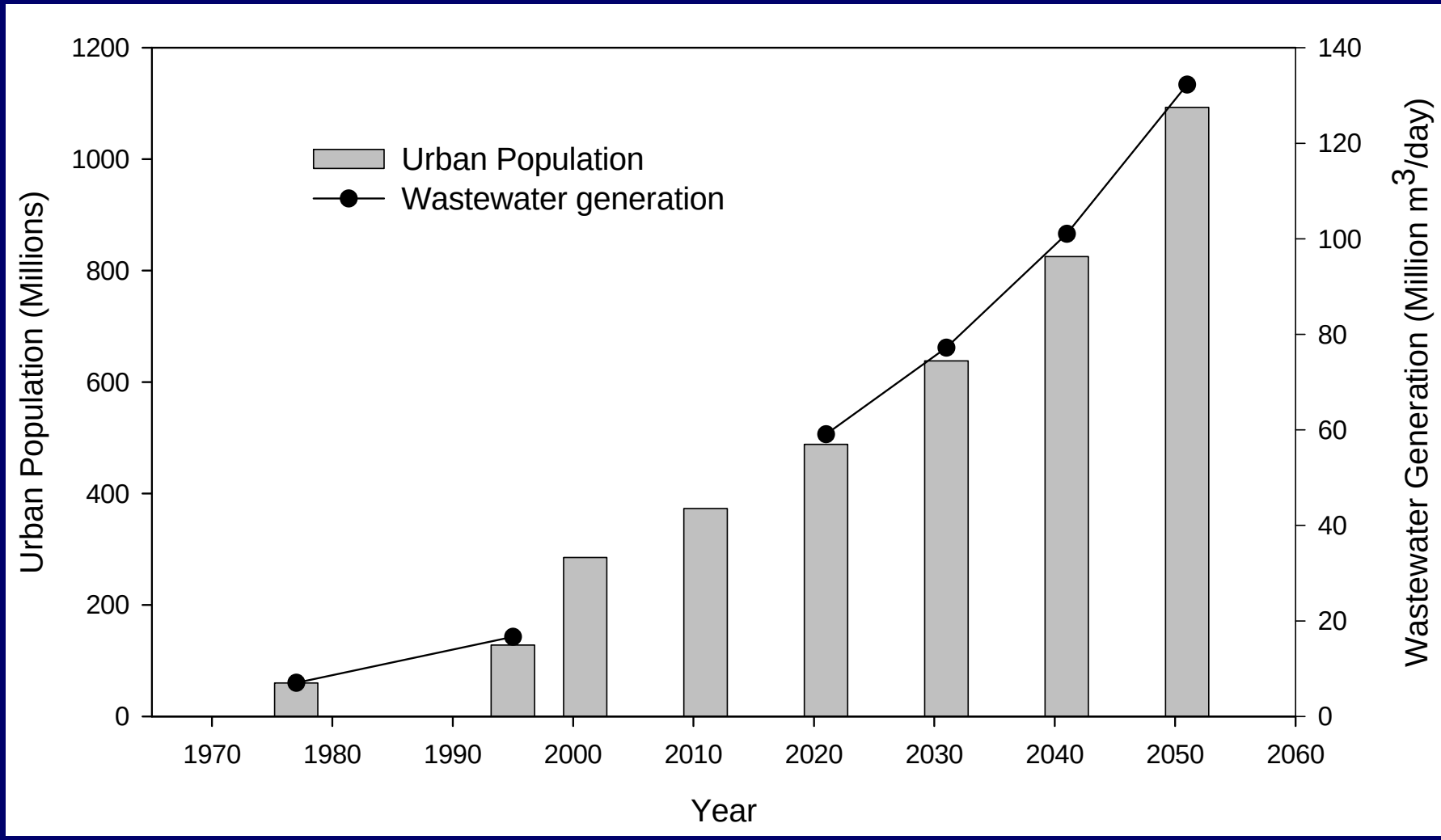
Present and Anticipated Future Urban Population and Wastewater Generation in India



Source: Ministry of Environment & Forests, 2007

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About the Project

Water4Crops-India	
Collaborative Projects	KBBE.2012.3.5-03: Biotechnological wastewater treatments and reuse in agronomical systems
Proposal Title	Integrating bio-treated wastewater reuse with enhanced water use efficiency to support the green economy in EU and India (India side)
Duration	48 months
Call identifier	FP7-KBBE-2012-6-Singlestage

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Sustainable Intensification of Agriculture

- To provide food for growing
- To produce biomass as population feed and resource to produce chemicals and energy
- Water availability and soil health are critical factors

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Water 4 Crops

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To provide sustainable solutions through

- Increasing water availability by developing new technologies to treat and reuse wastewater
- Using water more efficiently in irrigation
- Better management of water, land and crops to develop viable, stronger and green economy

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Objectives

- Develop and demonstrate integrated treatment processes for agro-food industry effluents targeted for recovery of economically useful components and recycling of water suitable for irrigation
- Selection and optimization of fungal consortium to remove contaminants from municipal wastewater for re-use in agriculture
- Enhancing water use efficiency through improved irrigation systems, agronomic practices and using validated simulation models
- Assess impacts of treated wastewater on soil, crop produce and groundwater quality
- Increasing sea water use efficiency through Integrated Mangrove-Fishery Farming System

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Objectives (Cont..)

- Mapping and characterization of quantitative trait loci (QTL) for drought tolerance related traits in maize, sorghum, pearl millet and chickpea
- Improving drought adaptation using marker-assisted breeding and trait-based selection approaches in maize, sorghum, pearl millet and chickpea, and transgenic approaches in chickpea
- Evaluate and optimize the proposed combinations of bio-treatment and wastewater reuse from a perspective of supporting green growth and to boost interaction between knowledge organisations and industries of the European and Indian parties

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Objectives of Water 4 Crops (EU Side)

- Production of water for irrigation from wastewater and return of nutrients and fertilizer to the land
- Recovery of specific high-value products from the wastewater
- Develop an easy and cheap microbial monitoring method to control irrigation water quality for pathogens
- Optimize domestic wastewater treatment, recycling and discharge via constructed wetlands
- Development of irrigation products, systems and strategies coupling with irrigation systems
- Modeling the impact of using poor quality water on crop and soil quality

Objectives of Water 4 Crops (EU Side) (Cont..)

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- Improved water use efficiency at field level through genomics and breeding
- Development of green economy by transdisciplinary co-creation of agribusiness opportunities and water bio-treatment
- Stimulate cross fertilization and knowledge transfer between the WPS and activities in Europe and India
- Disseminate the newly developed technologies, new economic concepts and local business demand

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Work Packages

Work package	Title
WP1	Agro-food industry wastewater valorization and reuse
WP2	Municipal wastewater bio-treatment and reuse
WP3	Agricultural water management
WP4	Development of water efficient crop varieties
WP5	Enabling green growth using water treatment and reuse innovations
WP6	Dissemination and technology exchange
WP7	Management & Coordination

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Consortium Partners

1	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
2	The Energy and Resources Institute (TERI)
3	Amity University Uttar Pradesh (AUUP)
4	University of Agricultural Sciences Dharwad (UASD)
5	MS Swaminathan Research Foundation (MSSRF)
6	National Environmental Engineering Research Institute (NEERI)
7	Jain Irrigation Systems Limited (JISL)
8	Euro India Research Centre (EIRC)
9	SABMiller (SABM)
10	University of Agricultural Sciences Bangalore (UASB)
11	PRAJ Matrix (PRAJM)
12	Ugar Sugar (UGSG)
13	Larsen & Toubro (L&T)
14	Ion Exchange

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Water 4 Crops: Strategy

- Consortium approach – Public Private Partnership
- Mirror case approach
- Innovative modular biotechnological process
- Co-learning and evolutionary
- Co-creation of new products leading to new business opportunities

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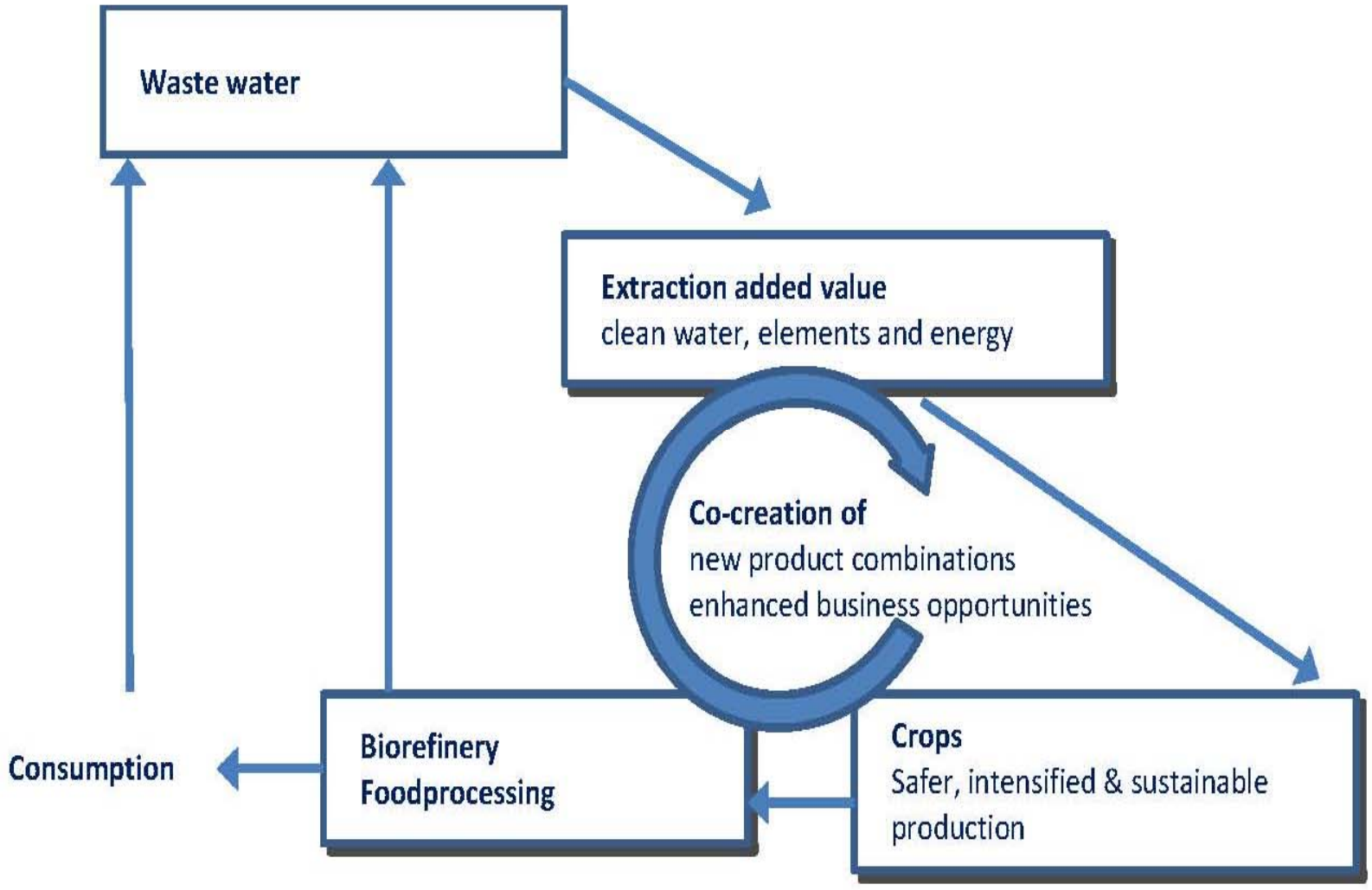
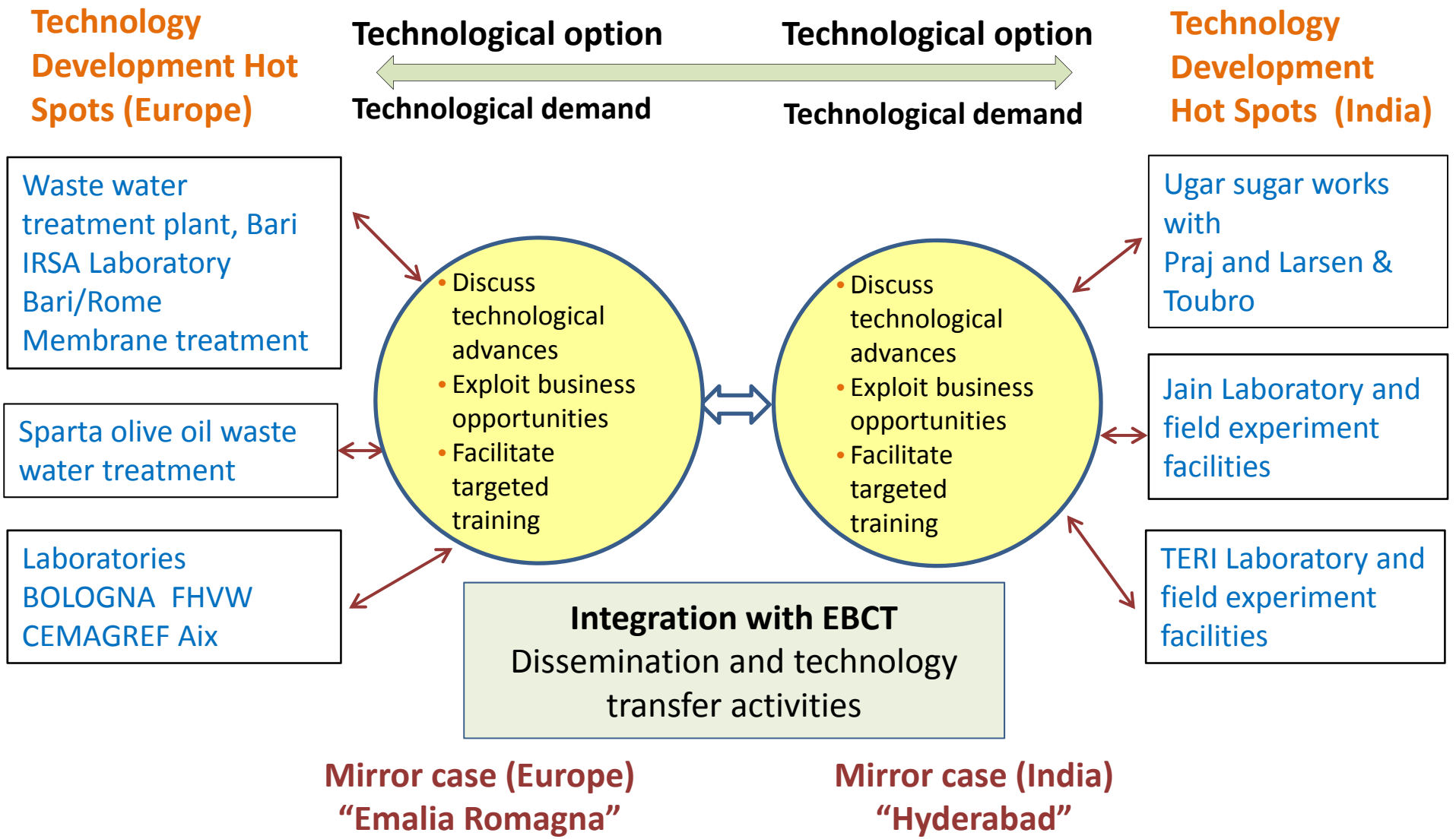
The Water4crops Principle



Concept of the Mirror Cases



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Distribution of Work Packages

Partners	WP1	WP2	WP3	WP4	WP5	WP6	WP7
ICRISAT	Y	Y	Y	Y	Y	Y	Y
TERI	Y				Y	Y	Y
AUUP		Y			Y	Y	Y
UASD			Y	Y	Y	Y	Y
MSSRF			Y	Y	Y	Y	Y
NEERI	Y	Y			Y	Y	Y
JISL	Y		Y		Y	Y	Y
EIRC					Y	Y	Y
SABMiller	Y		Y		Y	Y	Y
UASB				Y	Y	Y	Y
PRAJ Matrix	Y				Y	Y	Y
Ugar Sugar	Y				Y	Y	Y
Larsen & Toubro	Y				Y	Y	Y
Ion Exchange					Y	Y	

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WP1: Deliverables Agro-Food Industry Wastewater Valorization and Reuse

No.	Deliverable name	Nature	Months
1.1	Characterized samples of selected wastewater	R	12
1.2	CW and HRTS systems demonstrated	D	30
1.3	Demonstrated fungal decolourization system	D	42
1.4	Algal treatment system demonstrated	D	48
1.5	Carbons and membranes for the recovery of phenolics / pigments developed	R	48
1.6	Impact of treated and untreated wastewater use on soil, crop and groundwater quality assessed	R	48

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WP2: Deliverables for Innovations in Municipal Wastewater bio-treatment and Reuse

No.	Deliverable name	Nature	Months
2.1	Selected efficient strains for fungal consortium identified	R	12
2.2	Optimized fungal consortium for wastewater treatment developed	R, O	24
2.3	Trials with fungal consortium, P. indica, and nano-coated silver gravel for removal of contaminants from wastewater conducted	R, O	36
2.4	Fungal active ingredient within consortium developed Gel with	R, O	36
2.5	Impact of treated wastewater use in agriculture assessed	R	48

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WP3: Deliverables for Agricultural Water Management

No.	Deliverable name	Nature	Months
3.1	Benchmark sites characterized	R	12
3.2	Efficient irrigation system evaluated	R, D	36
3.3	Impact of wastewater on crops, soil and groundwater documented	R	48
3.4	Models for enhancing WUE at field and micro-watershed level validated	R	48
3.5	Increased land and sea water productivity	D	48
3.6	Replicable model demonstrated as integrated bioshield and livelihood option	D	48
3.7	Package of halophyte farming systemdeveloped	D	48
3.8	Enhanced capacity of community, other stakeholders and MSSRF staff on sea water farming	O	48
3.9	Availability of tool kit on IMFFS in print and multimedia format	P	48

WP4: Deliverables for Development of Water Efficient Crop Cultivars

No.	Deliverable name	Nature	Months
4.1	Information on the most adequate combinations of species/genotypes x environment x management for different drought scenarios in India and EU	R	36
4.2	Information on QTL (QTL combination) underlying the drought adaptation traits in maize, sweet sorghum and pearl millet at particular drought stress environments	R	36
4.3	Mechanisms for water use efficiency and salinity tolerance characterized across crop species	R	48
4.4	Chickpea breeding lines with improved drought adaptation	R	48
4.5	Well characterized DREB1A and P5CSF transgenic events of chickpea with improved drought tolerance	R	46
4.6	Transgenic tomato over expressing PgNHX1, AVP1 and co-expressing PgNHX1 and AVP1 genes for salt tolerance	R	48
4.7	Trained human resources in research on drought adaptation of crops and integrated breeding for drought adaptation	O	48

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Deliverables for WP5, WP6 and WP7

No.	Deliverable name	Nature	Months
WP5- Enabling Green Growth using water treatment and reuse innovations			
5.1	Database of stakeholders	R	12
5.2	Report of agribusiness opportunities	R	24
5.3	Position papers on wastewater topics	R	48
WP6-Dissemination and technology exchange			
6.1	Internal report on customer / entrepreneur demands and technological offer	R	12
6.2	Webpage and Public Dissemination material	R	6,12, 24, 36, 42
6.3	Report on training course including online curricula	R	36
WP7-Management & Coordination			
7.1	First year annual report to DBT	R	12
7.2	Second year annual report to DBT	R	24
7.3	Third year annual report to DBT	R	36
7.4	Fourth year annual report to DBT	R	48

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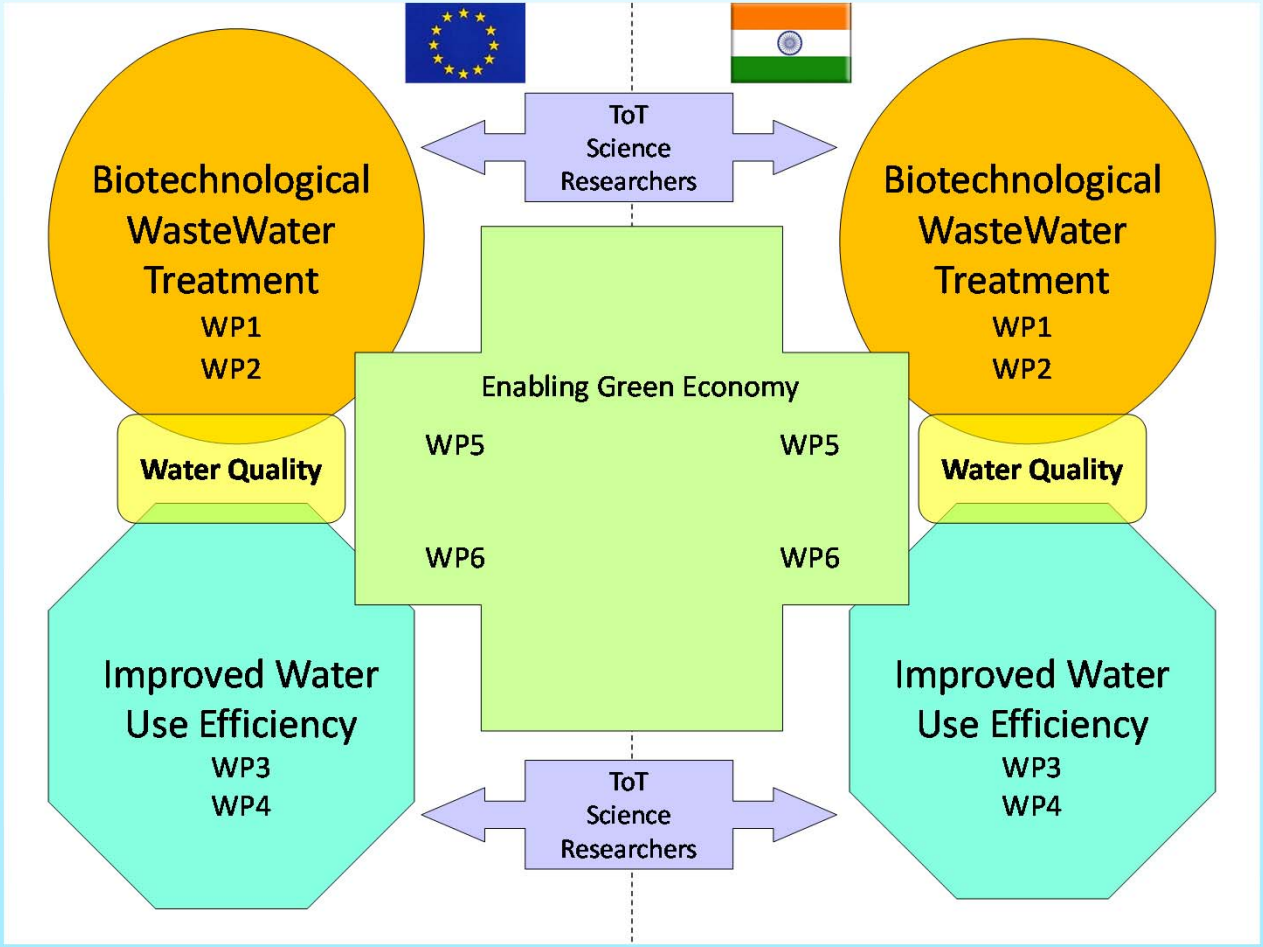
Similarity in Proposed Modules of Europe and India



Management Structure of the European and Indian WATER4CROPS project

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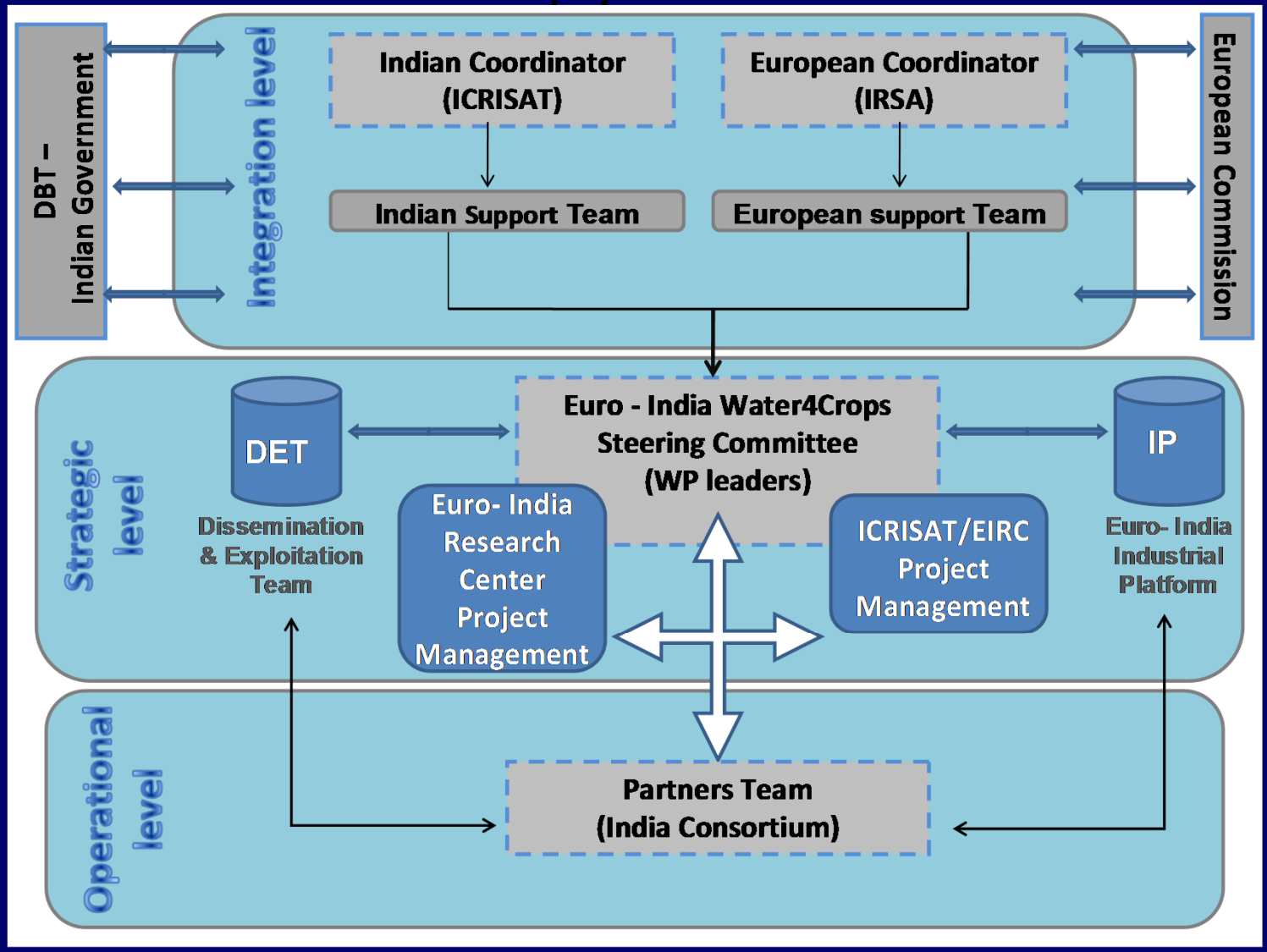

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Budget Proposed

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Organisation	Year1	Year2	Year3	Year4	Total
ICRISAT	511.37	321.12	306.12	310.62	1449.23
TERI	206.81	53.81	55.18	55.18	370.98
AUUP	69.40	60.40	35.40	35.40	200.60
UASD	65.01	55.56	52.85	52.85	226.27
MSSRF	182.55	98.99	94.27	92.57	468.38
NEERI	338.20	218.20	112.24	88.74	757.38
JISL	142.81	58.66	57.46	58.66	317.59
EIRC	37.36	35.56	35.56	36.16	144.64
SABM	49.28	36.29	35.09	36.29	156.95
UASB	29.46	15.66	14.81	14.81	74.74
Total	1632.25	954.25	798.98	781.28	4166.76

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Grey to Green Revolution by Greening the Drylands

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With your Help and Support, We can Make a Difference!

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Thank You

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