

Knowledge Infrastructure for Maharashtra

The beginning of a Public-University-Private (PUP) Partnership

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The basic argument

Maharashtra's Development Demands
Water, Public Transport, SME, Energy



Need for Knowledge, New Practices, New Research
New Job Profiles, Avenues for Professionals.



The role of University and Higher Education
Knowledge Structures. Key Areas.



Mechanisms for a Partnership

Basic Well-being, Resources and Livelihoods



- Basic issues of water, food, health and *living!*
- Severe stress in natural resources. *Fodder, Firewood.*



The Data

Year-round drinking water availability.

Year	Rural	Urban
2012 per 1000 (69th NSSO)	858	896
Maharashtra	745	931
2008	862	911

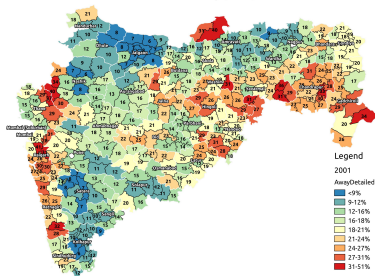


Also affecting livelihoods...

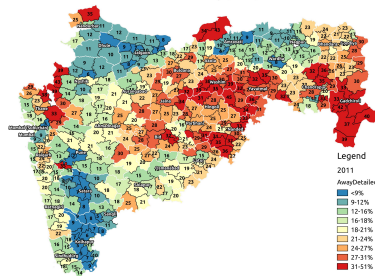
similarly about Milk, Electricity, Cooking Fuel.

Rural Maharashtra: 2001 and 2011

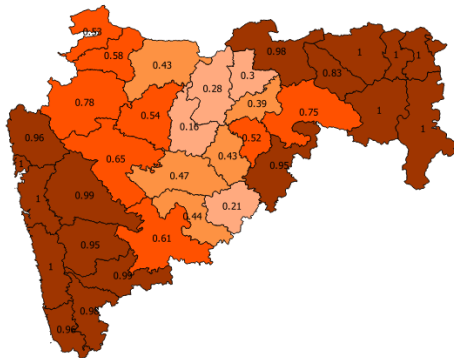
Percentage of Rural Households with Primary Source more than 500m away (2001)



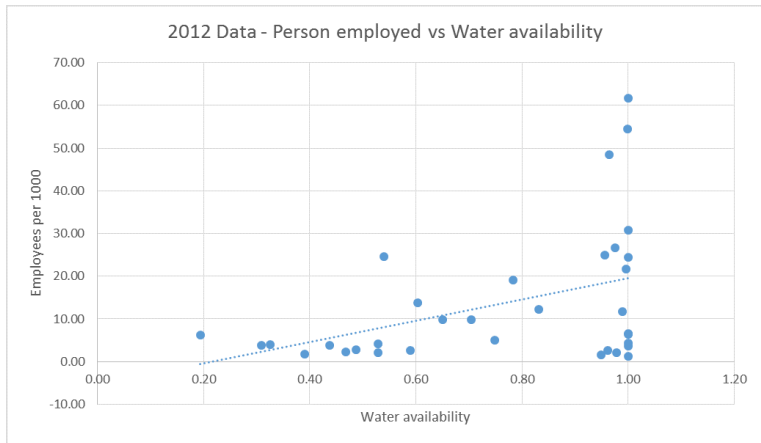
Percentage of Rural Households with Primary Source more than 500m away (2011)



Urban Drinking Water



Drinking Water and formal sector jobs



Transport and health also very important. [Also see Kelkar Committee report.](#)

Societal Outcomes

- Better nutrition for all, higher productivity in agriculture
- *sadak, bijlee, paani*
- More and cheaper buses, bridges.
- Better public transport, better sewage systems.
- Cheaper phones, better cars, less pollution.
- Quieter or more cultural *festivals* .
- More authors, better books, more olympic medals.
- A more equal society. Well being for all!

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Various Departments...But

Various needs-, but insufficient manpower, coordination and budgets.
Few knowledge inputs.

Analysis-The Governance Gap

- **Under-staffing.** Example: 2 rural water supply engineers and less than one field geologist per taluka.
 - ▶ delays, poor monitoring, no time for assessments.
 - ▶ **No expansion possible for current job description.**
- **Poor Data, Outdated procedures.** Example: Design of multi-village schemes, watershed treatment. Regional planning.
 - ▶ **MEETRA, MERI, Yashada, GSDA. State Statistical Board**
- **No new business models or space for professionals.** Disinterest of the private sector. Very little collaboration with institutions of learning and very little relevant research.



Basic Question : How do we generate and transmit new knowledge products? *What are knowledge products?*

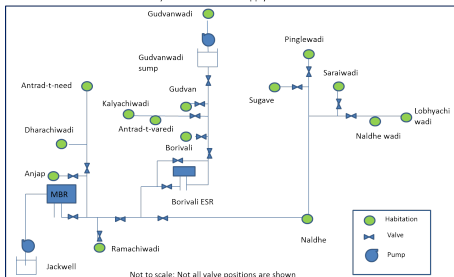
Knowledge Structures-Examples from CTARA

Water Supply

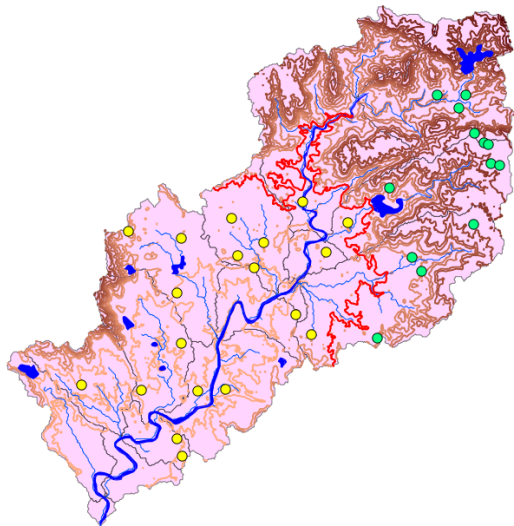
- **Monitoring and Execution:** Actual performance of programs. Taluka and district-level assessments of NRDWP. Assisting GPs and ULBs during execution. Testing. Organizing information, material and financial flows.
- **Evaluation and Assessment:** Evaluation of Groundwater quality, design of WTPs. Assessment of MSNA for Parbhani.
- **Planning and Designs:** Economic models, GIS, Optimization frameworks. Jalyukta shivar. Irrigation and Water-use efficiency.
- **Failure Analysis:** Failed rural regional schemes. Failed bandharas. Testing.
- **Feasibility Analysis and Innovative designs:** New watershed programs. Simulation and Modeling of GW. Bulk-water grids. Better Meters.

Anjap-Sugave Multi-village scheme analysis, 2011

Schematic of infrastructure currently used for seasonal supply



Regional Planning for villages in Shahpur



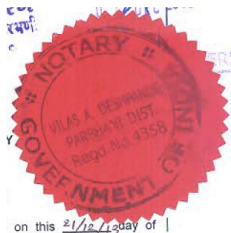
PUP Model: Parbhani Urban WS

MOU with Parbhani Municipal Corporation

- Energy and water losses.
- Overall system performance.
- Assisting in absorption of MSNA.

Research

Groundwater-Sanitation connection.



Watershed Planning for villages in Mokhada

- CSR consulting for Siemens and Aroehan.
- Livelihood, drinking and water for second-crop.
- 10-15 habitations, careful need assessment.
- Concrete structures, watershed treatment, well repairs
- Energy systems.



Also see:

www.gise.cse.iitb.ac.in/gsda

<http://www.gise.cse.iitb.ac.in/upload/thanedb.html>

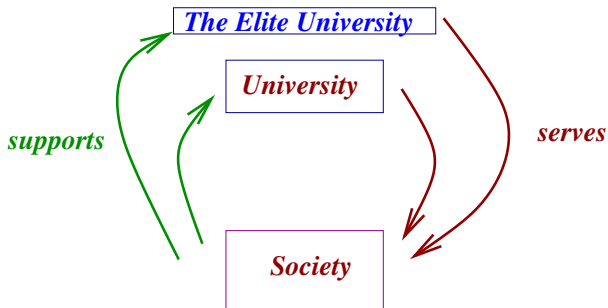
www.ctara.iitb.ac.in/water/

Structuring Knowledge Needs

Public Transport

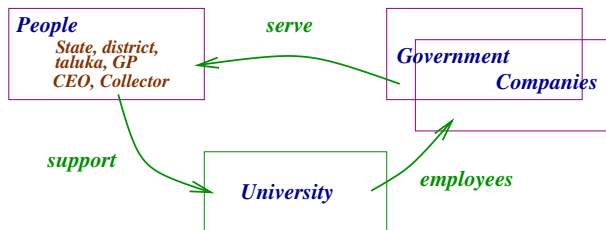
- **Monitoring and Execution:** Maintaining schedules. Executing standard procedures. Organizing information, material and financial flows.
- **Evaluation and Assessment:** On-time performance, Load analysis, Inventory utilization. Cost-benefit analysis. Customer satisfaction.
- **Planning:** Economic models, GIS, Optimization frameworks.
- **Failure Analysis:** Particular events. Under-performance in some localities. Cause analysis.
- **Feasibility Analysis:** New routes or new depots. New ticketing systems.

Society and the University-*a virtuous loop*



- **The University**
 - ▶ repository of knowledge and practices
 - ▶ training agents who deliver value
- **The Elite University**
 - ▶ thought leadership, the arts, long-term research, *destiny*
 - ▶ *symbolic of what a society values!*

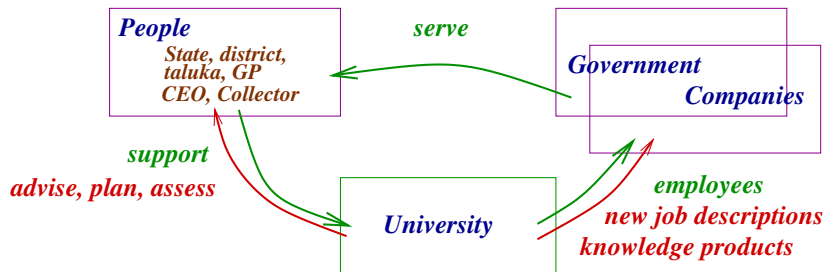
The Indian University



- Training role: Employees for traditional Industry and State.
- Disconnect between research and reality.
- Focus on placement and packages. IT dominance.

Research Papers since 2010			
Water Supply	87	Neural Networks	2467
Public Transport	25	Fuzzy Logic	759

The New Institution



New jobs!

- Energy expert. Drinking Water consultant.
- District Public Transport Manager. Taluka-level planner.
- **New research. New definition of rigour!**
- **Research which is accessible by society!.**

The areas of the future

- **SME and Informal Enterprises.** Bringing the benefits of technology, increasing efficiency, improving market access.
- **City and District Administration.** Improving planning, transport, infrastructure, logistics, optimization.
- **Core Sectors.** Water supply and sanitation, Electricity grid, Solar, Food, supply chains.

This would in turn create the demand for new instruments, gadgets, machines, tools for analysis and design, simulators ⇒ **better engineering, better efficiency, better value**

The University Re-defined

- **Objectives:** Prepare manpower, do applied and pure research. Keep up-to-date with social parameters and well-being.
- **strengthen civil society.** Comprehend the working of the state and the market and make it transparent. **Publicness** of outcomes.
- **Natural partner of the *civil and democratic* state.**

Avenues:

- **Most knowledge structures**-amenable to partnerships.
- access to innovation, labs and knowledge infrastructure.
- access to students and faculty through project and thesis work.
- **Should be happy to work on real problems and real data.**

The Way Ahead

Three Questions:

- How do we design the new role of Higher Education?
 - How do we incentivize and help them move to this new role?
What other entities need to be modified?
 - How do we measure progress and evaluate this?
-
- What are the short, medium and long-term action items?

TEQIP meeting-12 September 2014

Objectives : Water sector as a research area.

- Activities, case-studies, problems and solutions, curricula for development.

Highlights

- Participation from 17 colleges, TISS, Collector, Osmanabad, Unicef, WSSD, Meetra.
- Mechanisms of TDSL, TDSC for regional problems.
- **Standard Templates**: Rural DW security, water quality, MSNA as research areas.

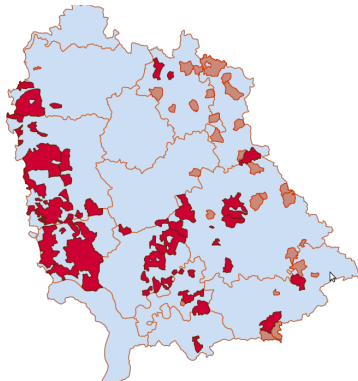
First Steps

- **Growing list of knowledge products.**: Taluka public transport analysis. Village JYS plan. Failed RR scheme. ULB water and energy balance. Municipal solid-waste plan.
- **Clear guidelines for district and state agencies, ZP, Collectorate for supporting research.** Access to data and access to funding. Liaison. Avenues for presenting research.
- **New engagements.** Internships and fellowships. District Research Cells. State Technical Agencies. University-based consultancy. Civil society participation and public-ness. Curriculum Development.
- **Empowered board.** Straddling Higher Education, Research, S&T, Development Outcomes. Designing curricula, vetting case-studies, organizing funding, liaisoning with departments and industry.

Concrete Suggestion 1: District Research Cell

Objectives

- Independent technical capacity.
- Assessment studies for the district-**public transport**, **energy efficiency**.
- Applied Research-**Basin level water budgets**.
- Geographical Information and response (GIS).



Organization

- Headed by **District Research Coordinator**, dedicated staff.
- **PUP-model**. Joint partnership between regional colleges, district administration and say, an IT major.
- 1% of program budget + CSR.

Suggestion 2: Design and Analysis for JYS

Objectives

- Improve the design and outcomes of *Jal-yukta Shivar*
- Bring together social, agricultural, water, natural resource data.
- Excellent tool for students and researchers.
- Provide platform for a variety of efforts and analysis.



Organization

- **District Level Coordination** by district agencies, colleges, NGOs, civil society.
- Academic design and vetting by key state institutions.

CTARA at IIT Bombay

- Set up in 1985. Since 2007, Masters and Ph.D. in Technology and Development.
- Creating the **Development Professional**
 - ▶ inter-disciplinary training for engineers.
 - ▶ field-work, core sectors, people-centric.
 - ▶ Projects in *sadak, bijlee, pani*
- Project-based course for students, consultancy for development
 - ▶ www.ctara.iitb.ac.in/tdsl,
www.ctara.iitb.ac.in/tdsc
- works with governments, cities, GPs, local bodies, citizen groups.

Solar-steam based *Istry* in Parbhani



Optimizing Irrigation in Shahpur, Thane



Processes at Ganapaty Factory in Pen



Thanks



Water at CTARA

Past, Present and Future



NCN, Puru, Om, Milind, Bakul, Priya

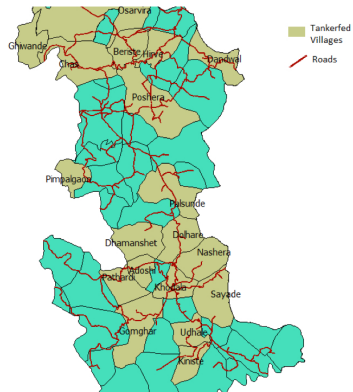
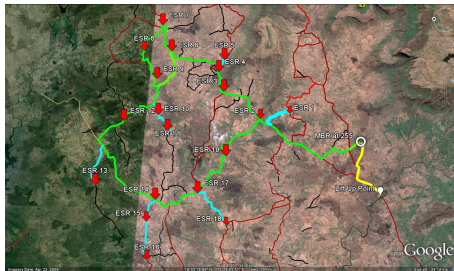
Areas of Research

- **Water Supply Schemes**
 - ▶ rural water supply, single vs. rural regional
 - ▶ SW vs. GW as drinking water sources
 - ▶ Bulk water systems, tariff
 - ▶ simulation and design software, standard protocols for analysis
- **Groundwater: regional and local**
 - ▶ GSDA data set of 5000+ wells. Trends, scarcity and uncertainty.
 - ▶ Thumbnail conceptual models. Primary and secondary data.
 - ▶ SWAT models and taluka/mini-watershed level water balance.
 - ▶ Watershed modelling, regional data models
- **Gol and GoM policy and programs**
 - ▶ NRDWP, Jalswarajya and now MSNA
 - ▶ Membership in Planning Comm. WG on GW regulation
 - ▶ Participation in working group on data.
 - ▶ BoG, MEETRA (GoM), meetings on RWS
 - ▶ Leadership in Ganga Action Plan on policy

Upcoming Areas

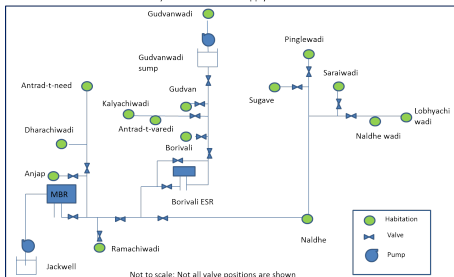
- Regional DW security
 - ▶ Taluka and district level analysis, linkages between various departments, DPC and its role.
 - ▶ Multi-sector GIS for Thane
- Rural planning.
 - ▶ Water and sanitation for small towns-(Manchar, Karjat) and large GPs. Maybe Parbhani
- Water quality and linkages
 - ▶ DW quality, the 1 cu.m. scheme, vending, agriculture linkages.
- Water and Energy
 - ▶ PWS and lift irrigation schemes and their energy demands.
- Urban water and water treatment
 - ▶ Decentralized STP and case studies, effluent treatment

2010: North Karjat/Mokhada rural regional scheme: Feasibility Study

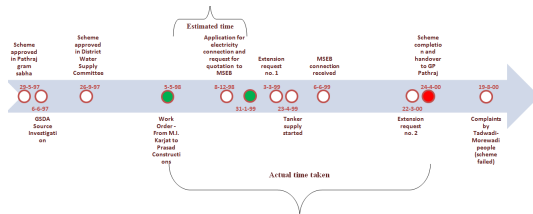


Anjap-Sugave Multi-village scheme analysis, 2011

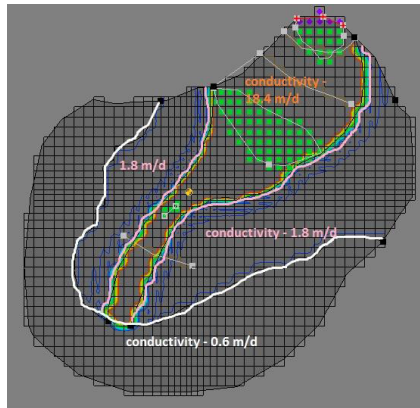
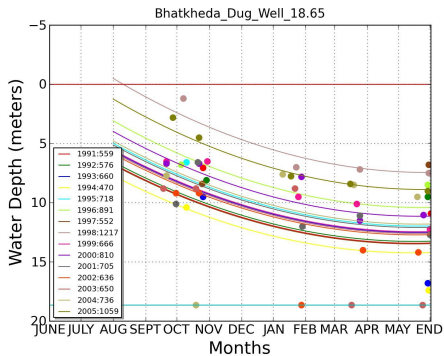
Schematic of infrastructure currently used for seasonal supply



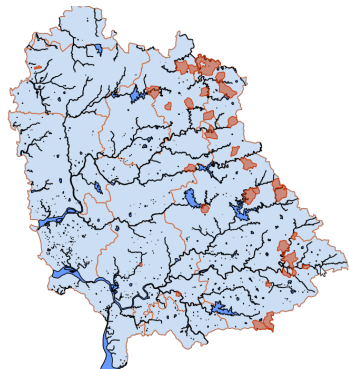
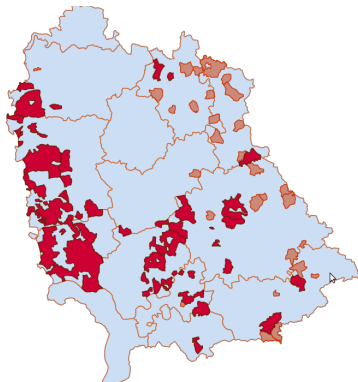
Failure analysis of the Tadwadi-Morewadi Single-Village Scheme, 2011



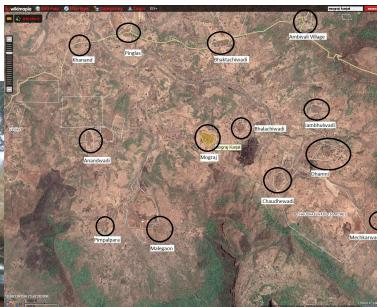
2012 onwards: Regional and Village Groundwater Models



Thane District regional analysis of drinking water, 2012



Mograj GP level study and NRDWP



VillageName	HabitationName	SchemeNameDP	SanctionYear	SchemeType	Estimated Cost	DateOfCommencement	sourceTypeCategory	TypeOf Source	InactionWater Source	Status as per CTARA survey as of March 2012	
1	AMBRVADI T	KOTMAL KHALATI	PWSS AMBRVALI	2008-2009	Piped Water Supply Scheme	25 00000	31/03/2009	Surface Water	River	Functional	
2	AMBRVADI T	KOTMAL KHALATI	PWSS AMBRVALI	2008-2009	Piped Water Supply Scheme	25 00000	31/03/2009	Ground Water	Openwell	near village	Repeated
4	DHAMNI	CHOLDHARWADI	Chowdhariwadi handpump	2000-2001	Hand Pump	0 35000	14/01/2000	Ground Water	Deep Tubewell	near field	Functional
5	DHAMNI	DHAMANI DUGWELL	2005-2006	DUG WELL	0 35000	01/09/2005	Ground Water	Openwell	in village	Functional	
6	MECHARWADI	MECHARWADI PWSS	2002-2003	Piped Water Supply Scheme	13 32000	30/05/2003	Ground Water	Openwell	NEAR VILLAGE	Functional	
7	MECHARWADI	MECHARWADI PWSS	2002-2003	Piped Water Supply Scheme	13 32000	30/05/2003	Ground Water	Openwell	near village	Failed for one wad	
8	PACHHADAKWADI	DHAMANI DUGWELL	2005-2006	DUG WELL	0 35000	01/09/2005	Ground Water	Openwell	near village	No data	
9	KHANAND	BHALAJYACHHWADI	BHALAJYACHHWADI DUGWELL	2005-2006	DUG WELL	2 21000	20/04/2005	Ground Water	Openwell	in wadi	Functional
10	KHANAND	Khanand pass	2008-2009	Piped Water Supply Scheme	12 61000	12/06/2008	Surface Water	Pond		Not working	
11	KHANAND	KHANAND VILLAGE TANK	2008-2009	DUG WELL	11 57000	07/12/2008	Ground Water	Openwell	near village	Seasonal	
12	MALEGAON T	JAMBHULWADI	JAMBHULWADI HANDPUMP	2005-2006	Hand Pump	0 35000	20/04/2005	Ground Water	Deep Tubewell	in village	Functional
13	MALEGAON T	malegaon pass	2007-2008	Piped Water Supply Scheme	4 06000	30/03/2008	Ground Water	Openwell		Failed	
14	MOGRAJ	ANANDWADI	MOGRAJ ANANDWADI PWSS	2003-2004	Combined Water Supply	8 27000	25/05/2003	Ground Water	Openwell	NEAR FIELD	Failed
15		BHAKTACHHWADI	BHAKTACHHWADI PWSS	2002-2003	Piped Water Supply Scheme	8 26000	30/05/2003	Ground Water	Deep Tubewell	NEAR VILLAGE	Failed
16		Mograj	2008-2009	Piped Water Supply Scheme	4 00000	30/03/2009	Ground Water	Openwell	near village	Failed	
17		MOGRAJ	MOGRAJ WELL	2008-2009	DUG WELL	0 08000	07/12/2008	Ground Water	Openwell	near village	Seasonal
18	PIMPALPADA	pimpalpada pass scheme	2008-2009	Piped Water Supply Scheme	4 44793	31/03/2008	Surface Water	Surface Water		Failed	
19	PIMPALPADA	PIMPALPADA WELL	2007-2008	DUG WELL	4 44000	31/03/2008	Ground Water	Openwell		No data	
20	PINGLAS	Pinglas WSS	1998-1999	Piped Water Supply Scheme	43 00000	26/04/2000	Surface Water	River		Failed	
21											
22											

Source: <http://indiawater.gov.in>

Course: TD 603-Water

Objectives

- to familiarize the student with water as a resource and key scientific variables
- to familiarize with some key policy issue-currently, large dams and water infrastructure
- to inculcate an operational approach to the sector

Contents

- Water and its uses and the water cycle, Ground Water, Watershed and interventions, and Water system principles, each 5 hours.
- Selected papers-20 hours.
- Field visit, typically PWS+GP+watershed interventions.

Project TITWI

Civil Society Collaboration

- District administration-DPC
- Interest groups.
- Regional Engineering and Research Institution (RI)
- CTARA and IIT Bombay.

Objective :

- year-round regional drinking water security
- medium, long-term and drought contingency

Key Knowledge Areas :

- design and analysis of DW schemes, bulk water
- integration of SW in regional DW planning
- Energy efficiency
- GW and watershed interventions
- GIS and planning dashboard
- Logistics, optimization, IT
- Socio-economic analysis
- District-specific Policy Design
- Ecology, History, Geography.

Publications and Reports

Water

- *The World Bank Urban Water report: Thinking Backward*, EPW, 2013.
- *Reforming Rural Water*, EPW, 2014, with Pooja, Vishal.
- *GW Assessments*, submitted to Current Science, with Rahul.
- *The Anjap-Sugave Rural Regional Scheme, Case Study*, with Pooja and others.

Science and Engg. for India

- *IITs: R&D and its impact on India's Development*, Current Science, 2012.
- *Knowledge and Practice for India as a developing country*, Seminar, 2014.
- *The Elite University*, under preparation, with Vinish and Maunik.
- *The University and the Development Agenda*, appeared in EPW.