Quantification of Municipal Water Supply and Role of Metering in Large Indian Cities

Account **f**or **W**ater,
save water & money.

Dr. Pankaj Sampat
Associate Professor,

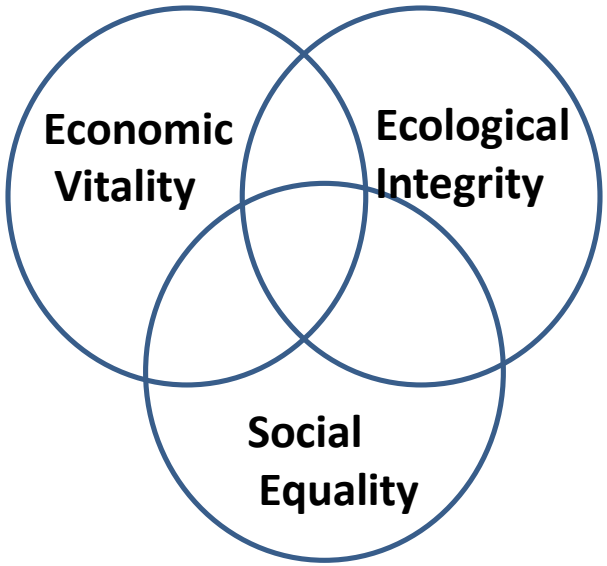
29th May 2017
Abstract-ID: 117

WWC XVI
Cancun

Centre of Excellence
Urban Development Area

Administrative Staff College of India
Leadership through Learning

Sustainability Model:



Sustainability Model

•Urbanisation is inevitable process, population and water demand trend shall be increasing with growing economy….results in increase in stress levels

•Balance among Domestic Water supply and other purposes is important- to run industry, agriculture, ecology.

• Domestic water supply is a matter of trust and service to the people and all living beings

Need & Solution

- Unaccounted for Water is in range of 40 to 60% in Indian cities.
- Wastage of water, loss of rupees in billions.
- Metering will solve all problems is a myth.
- Leak Detection, Prevention and Accountability.
- Low revenue & capax recovery, Pricing, Subsidy distribution.

3M	Map
	Measurement
	Monitoring

Failure to achieve
UN Sustainability goals.

Leakage Detection	Leakage Prevention
Quantification	Proper MIS

System Improvement Plan	
Immediate Action	Short & Long Term Action

United Nations

Governance:

❖Paradigm shift in Government approach:

Smart City program:

- water audit is declared mandatory. for all the cities selected under smart city mission.
- Efficient operations and Sustainable approach are at centre in the government programs.
- What government can offer to what people are expecting
- Citizen as a Customer or client, quality and time bound service are expected
- RTS act has improved accountability, transparency and timeliness in public service delivery

Save Every Drop!

Account Every Drop!

Save and Account Every Drop.

Case Study: Bangalore and Ahmedabad

This resear e approach.

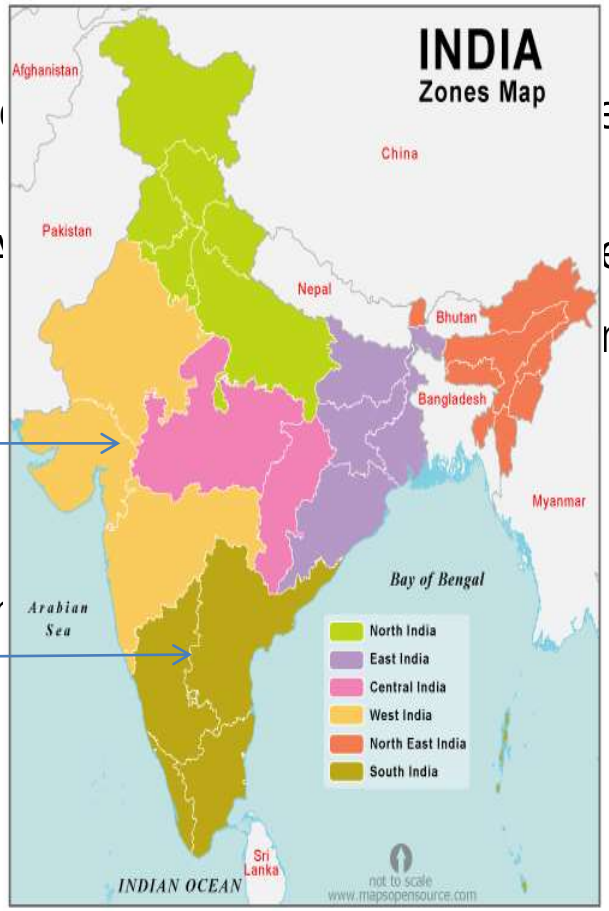
A e

to reduce water l nancial condition.

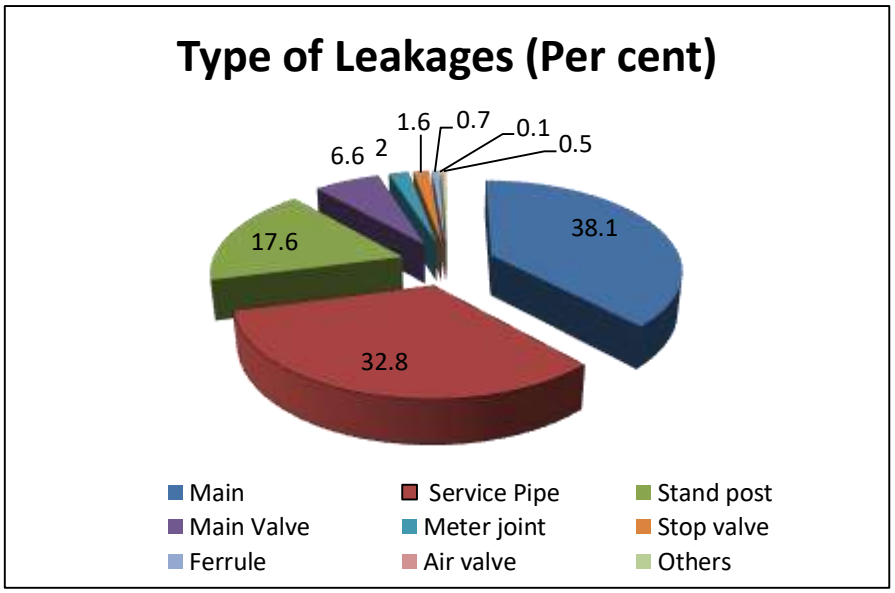
Ahmedabad
(Non-metered)

Much emphasis on Meterir ultimate and only solution.

Bangalore
(Metered)



Leakages, Role of Metering in System Efficiency:



Bangalore metered city: (2011-12)
Water supply 900 MLD
Service Connections 0.7 million
NRW 42%

Ahmedabad non-metered city :
Water supply 1100 MLD
Service Connections 0.55 million
NRW 40% estimated

Source: Scientific research report (SciRes December 2013 (http://www.scirp.org/journal/cus))

•main cause of leakages are **Main pipe-38.1%, Service Pipe-32.8 % and Stand post-17.6 %** which is the responsibility of the local authority. where the citizens are not responsible.

•Citizens resist on house hold metering because of cost.

•Major losses can be controlled by installing bulk water meters or using other modes of measurement.

100% metering is not a guarantee for an efficient system but it is important to stop water losses at minimal cost to have efficient water supply system.

Water Measurement:

Stock, Flow, Flow Rate:

Water on the earth is in motion through the hydrological cycle. The utilization of involves movement from the places where the stock is available, measured in terms of its flow rates.

Measurements, Accuracy Relationship with Value and Efficiency :

Parameters		
Measurement	MLD & KL	L & ML
Point of service	Not important	Important
NRW UFW AFW	in %, estimated	NIL
Timing & Quality	OK	Better
Pricing	Low , Free	High, Premium with the size

Leakage Detection:

•Fixing The Spot is difficult.

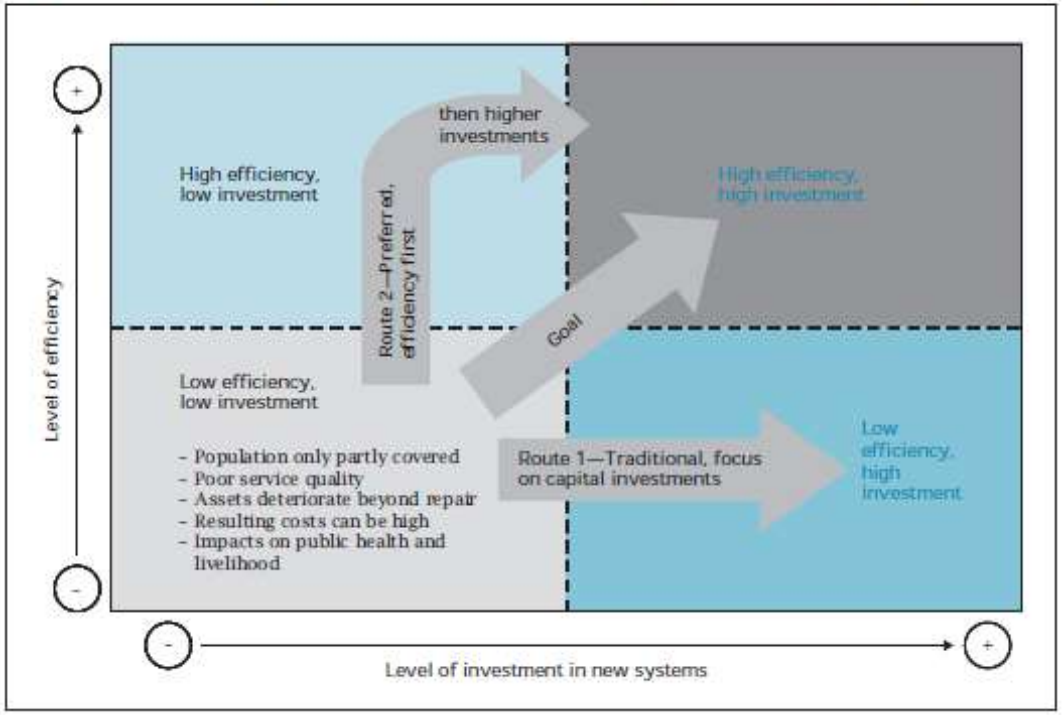
Leakage Prevention:

•Communication to take action, to the responsible persons.
•Monitoring up to the last mile.

Efficiency-Investment:

- Supply side is not a solution!

Figure 2 Balancing Investment and Efficiency in Water Supply Systems

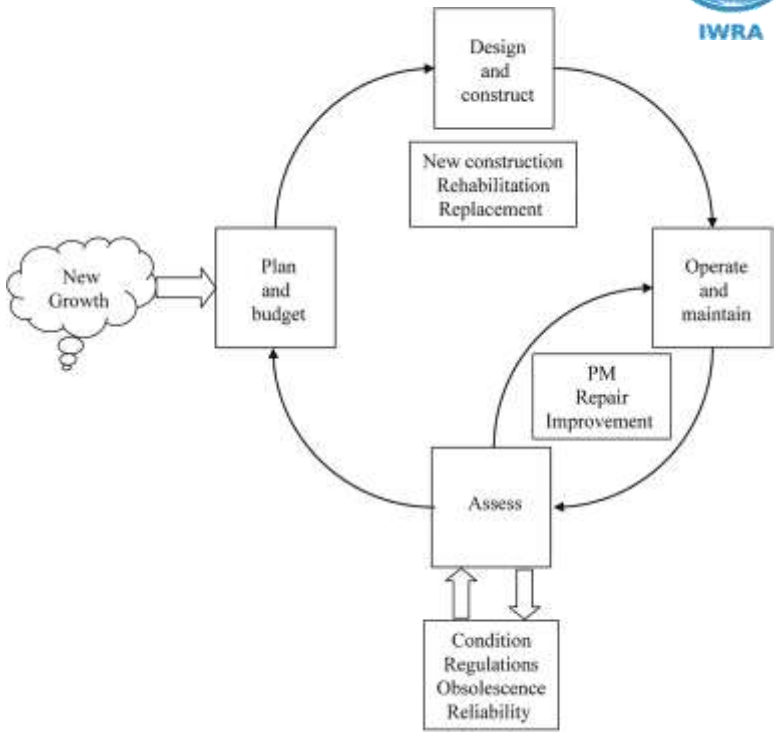


Source: Good Practices in Urban Water Management by Lee Kuan Yew, SPPP, NU-Singapore. ADB publication

BEST PAPER AWARD WINNERS:

2008: Neil S. Grigg

IWRA



Article: "Integrated water resources management: balancing views and improving practice"

(in Water international, Volume 33, Issue 3).

http://www.tandfonline.com/na101/home/literatum/publisher/tandf/journals/content/rwin20/2008/rwin20.v033.i03/025080/60802272820/production/images/large/rwin_a_327449_o_f0007g.jpeg

Quantification Methods:

(1) Tabulation (2) Water Accounting

Tabulation : Lambert & Hirner in 2000 has given the complete idea of water supply balancing in domestic sector and **Joerg Kolbel** made process mapping, defined data and variables both, at each stage and component wise, and **quantified water losses.**

It is understood that a balanced system is more transparent, clear and precise. So, reliability of Performance Indicator (PI) and quality of water management improves.

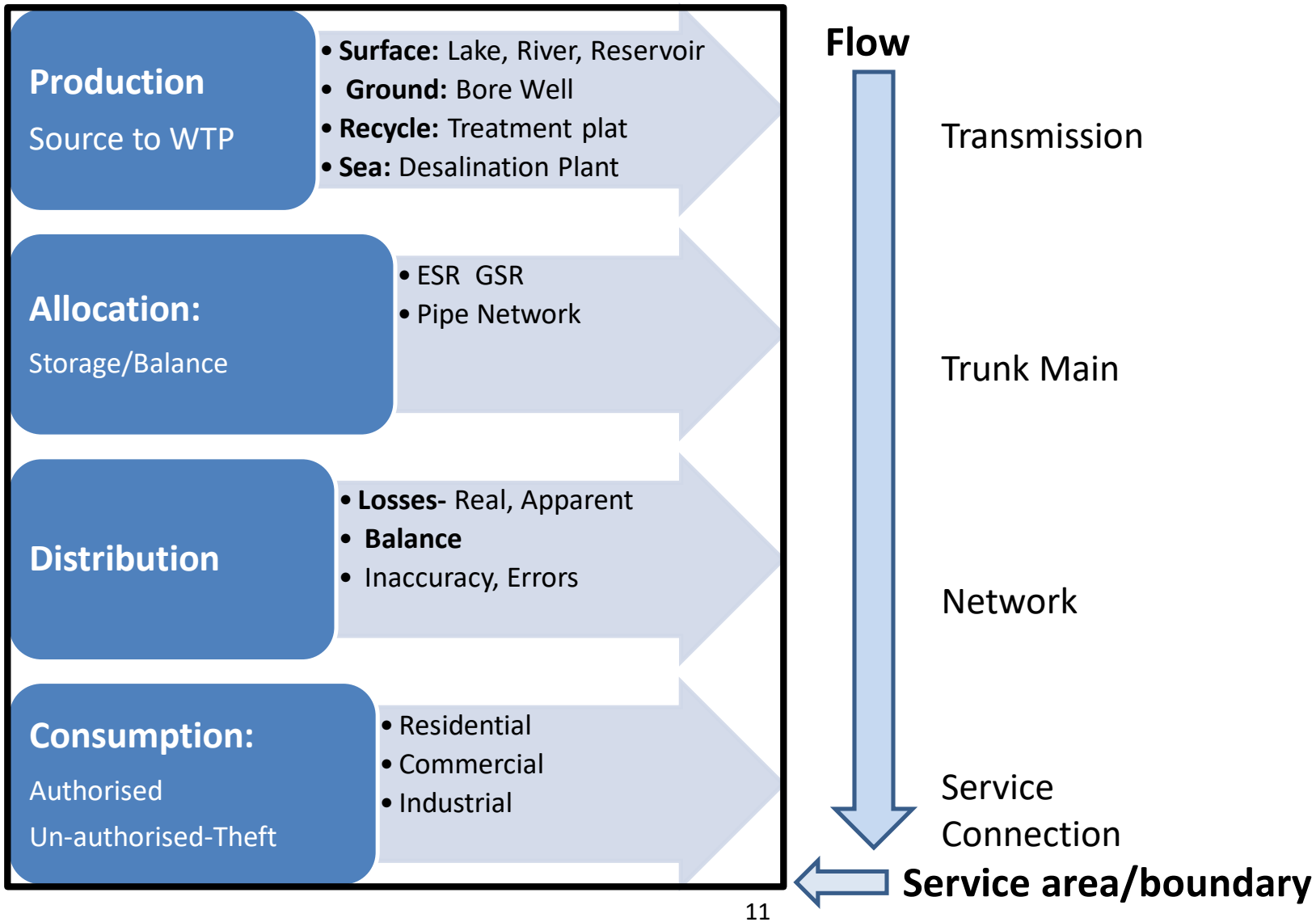
System Input Volume	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorised Consumption	Unbilled Metered Consumption	Non-revenue Water
			Unbilled Unmetered Consumption	
	Water Losses	Apparent Losses	Unauthorised Consumption	
			Customer Metering Inaccuracies	
		Real Losses (= Physical Losses)	Leakage on Transmission and/or Distribution Mains	
			Leakage and Overflows at Utility's Storage Tanks	
			Leakage on Service Connections up to Point of Customer Metering	

Note: All parameters in m^3 per year (m^3/year)

Chart:
CPHEEO & IWA
Water Balance Flow Chart

+ Data Handling errors

Urban Water Supply System Stages:



Quantification by Tabulation:

Water Table for the Day. (CEPTABAD- Non metered City)

Source Area		Production Center			Distribuition Center						Network Area			Consumers		
	Date	01-10-2013			All Figures are in Million Liter except LPCD. LPCD figures are in Liter.											
Source Type	Augmentation	Transmission Loss	Production-WTP	ESR-Balance	GSR-Balance	Zone	Zone-Allotment	Distribuition Center	Trunk Main Loss	DC-ESR-Balance	DC-GSR-Balance	Network Loss	Network Balance	Delivered	Consumers	LPCD	Connections 4 person/HH
Surface	500	9	500	20	30	North	225	1	6	0.05	0.2	8	2	40	400000	100	100000
Ground	10	1						2	6	0.05	0.2	8	2	40	400000	100	100000
Recycle								3	6	0.05	0.2	8	2	40	400000	100	100000
Sea								4	6	0.05	0.2	8	2	40	400000	100	100000
						South	225	1	6	0.05	0.2	8	2	40	400000	100	100000
								2	6	0.05	0.2	8	2	40	400000	100	100000
								3	6	0.05	0.2	8	2	40	400000	100	100000
								4	6	0.05	0.2	8	2	40	400000	100	100000
Surface	500	9	500	20	30	East	225	1	6	0.05	0.2	8	2	40	400000	100	100000
Ground	10	1						2	6	0.05	0.2	8	2	40	400000	100	100000
Recycle								3	6	0.05	0.2	8	2	40	400000	100	100000
Sea								4	6	0.05	0.2	8	2	40	400000	100	100000
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								2	6	0.05	0.2	8	2	40	400000	100	100000
								3	6	0.05	0.2	8	2	40	400000	100	100000
								4	6	0.05	0.2	8	2	40	400000	100	100000
Total	**1020**	**20**		**40**	**60**				96	**0.8**	**3.2**	**128**	**32**	**640**			

Important Points:

- Initian of accounting requires a disciplined approach
- Control is must for any change in distribution pattern; at Production, Zonal, Distribution center level
- Frequent Assesment of losses
- Monitoring on site is required for reading measurment, calculation for volume and reporting in time.

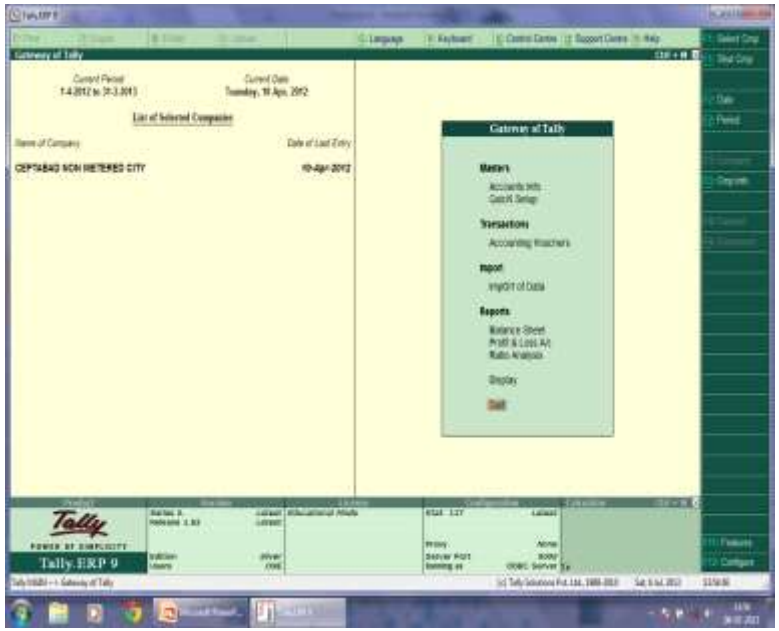
Check Table	
Augmentation	1020
Delivery	640
Total Loss	244
Total Balance	136

Check=Augmentation-Delivery-Total Loss-Total Balance=0

Check=	0

Water Accounting:

Water Account



- ✓ **Quantification-** Tabulation or Accounting
- ✓ **Tabulation** in spread-sheet has limitations!

- Similar to financial accounting
- Stock n Flow theory
- Double entry system
- Group and Sub-Group can be formed.
- Facilitate to narrow down identification of the water losses to the smallest transaction recorded.
- Generates useful reports- Water balance, Ledger a/c
- Water Audit can be carried out.
- U N methodology adopted.

- ✓ **Modular Design** to start simple, increasing stage wise to fully grown system
- ✓ **Proof of Concept-** hypothetical city, 4-5 million population, examined

IWAP- Integrated Water Accounting Platform :

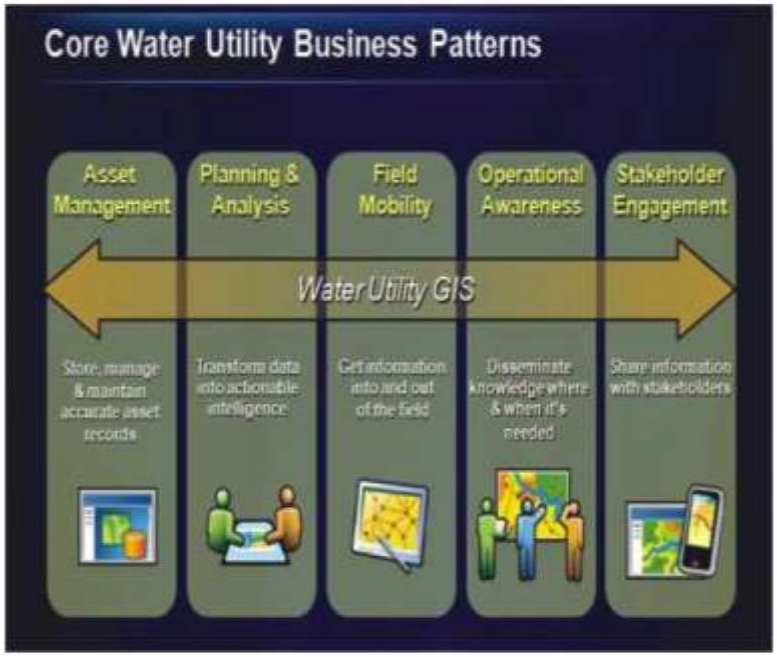
Leak Detection + Leak Prevention + Quantification

GIS + GPS + Water Accounting software.

Technology choice: (Transaction Processing System-TPS)	<u>Real time (online)</u> SAP HANA cloud platform e.g. Air ticket booking Stock market order	v/s	<u>Batch Processing</u> Conventional Software e.g. Retail shop Payroll

- **Infrastructure renewal and replacement (R&R) encompasses several issues**

GIS Platform:



Source: Arc India News, July-Sept. 2013, Vol. 7, Issue-2

Advantages:

1. GIS and SCADA synchronisation on real time basis
2. Graphical charts can be shown on the map with spatial references.
3. Query support by location
4. Layout view for report generation and ppt purpose.

➢GIS facilitate integration among core utility functions faster in a precise manner, which can play major role in optimisation of the urban water supply system.

➢ Simple and tailor made structure design should be adopted as per local need

GPS Platform:

Source: Aquarius You Tube Video

- Periodic general surveys are costly and time consuming.
- **Every 300-500 meter** there is a highly accurate GSM –equipped sensor with long battery life and GSM communication between them.
- Continuous **online multilayer detection**, the system pinpoints each leak on GIS systems or Google maps precisely.
- Sensitivity to smallest leaks.

Lessons from IoT early adopters:

(Baldwin's views)

Data deluge, Cross-functional collaboration, multiple vendors, Caught out too far

- Reliable data and low false positive rate
- Reports are quickly and easy generated
- The data can easily understood action based form
- Allowing ongoing historical comparison

Integrated platform facilitate-

1. Stage wise identification of water losses
2. Equity in distribution can be observed
3. Rationalization and subsidy can be worked out effectively.
4. Precision in data.
5. Dataset can be analyzed for better planning, administration, policy framing.
6. **Best way to workout the economic level of leakage (ELL), known to develop Economic Level of Water Conservation (ELWC).**
7. Pricing can be done precisely, making system transparent.

IWAP practice:

Capacity Building:

Adaptability:

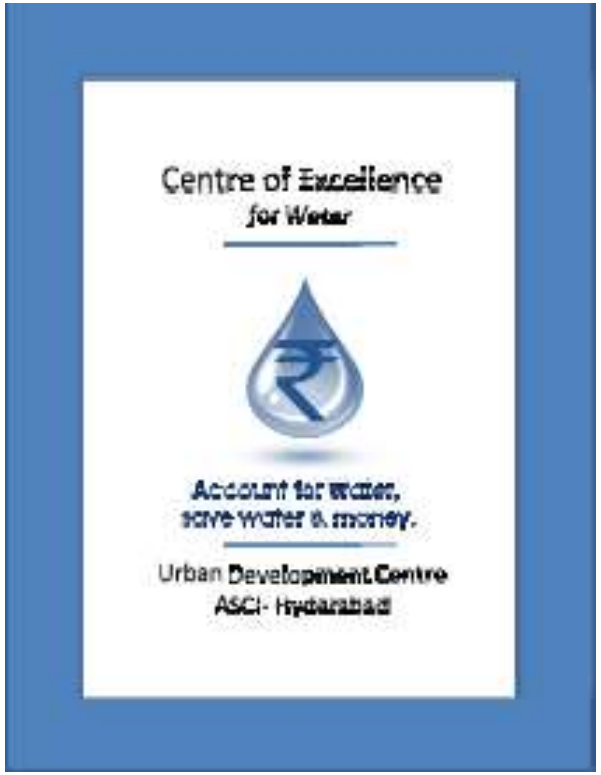
Reasons for non practicing-

- **Technical** - poor network, lack of know how
- **Financial** – lack of funding, no planning
- **Political** - lack of awareness, lack of willingness
- **Social** - lack of awareness, lack of willingness
- **Administrative** – lack of policy,

Implementation:

1. Check for acceptance at every stakeholder level
2. Set desirable level of accounting accuracy, target NRW% reduction and implement stage wise.

Way Forward:



- First Real Water Account For City Water Supply
- IWAP
- We also do capacity building and transaction advisory

- **Effective implementation results-**
  increase in overall system efficiency and improved Water Management.

Highlight:

Selected

May 2015

May 2017

Nov. 2016

WATER SECURITY AND CLIMATE CHANGE: CHALLENGES AND OPPORTUNITIES IN ASIA

Venue:

Funded By

Presented

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MACQUARIE University
SYDNEY·AUSTRALIA

Winner top 75.

PoI 2015

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

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Thank You.

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Fountains of Joy.