

12th International Workshop on Decentralized Domestic Wastewater Treatment in Asia
Organized by Ministry of the Environment, Government of Japan (MOEJ)

Progress of decentralized wastewater management in Vietnam and the expected testing system for decentralized wastewater treatment plants

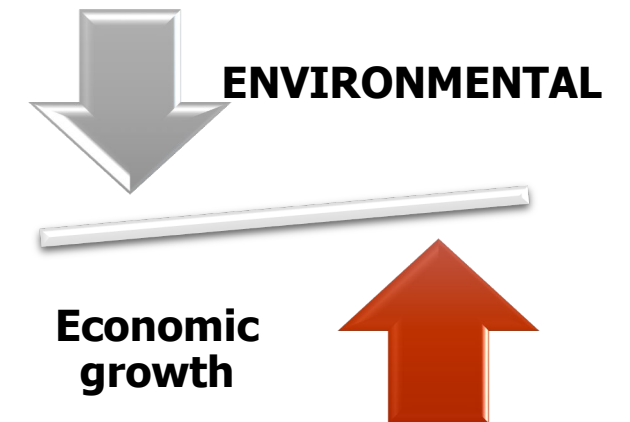
Tokyo, November 11th 2024

Country statistics

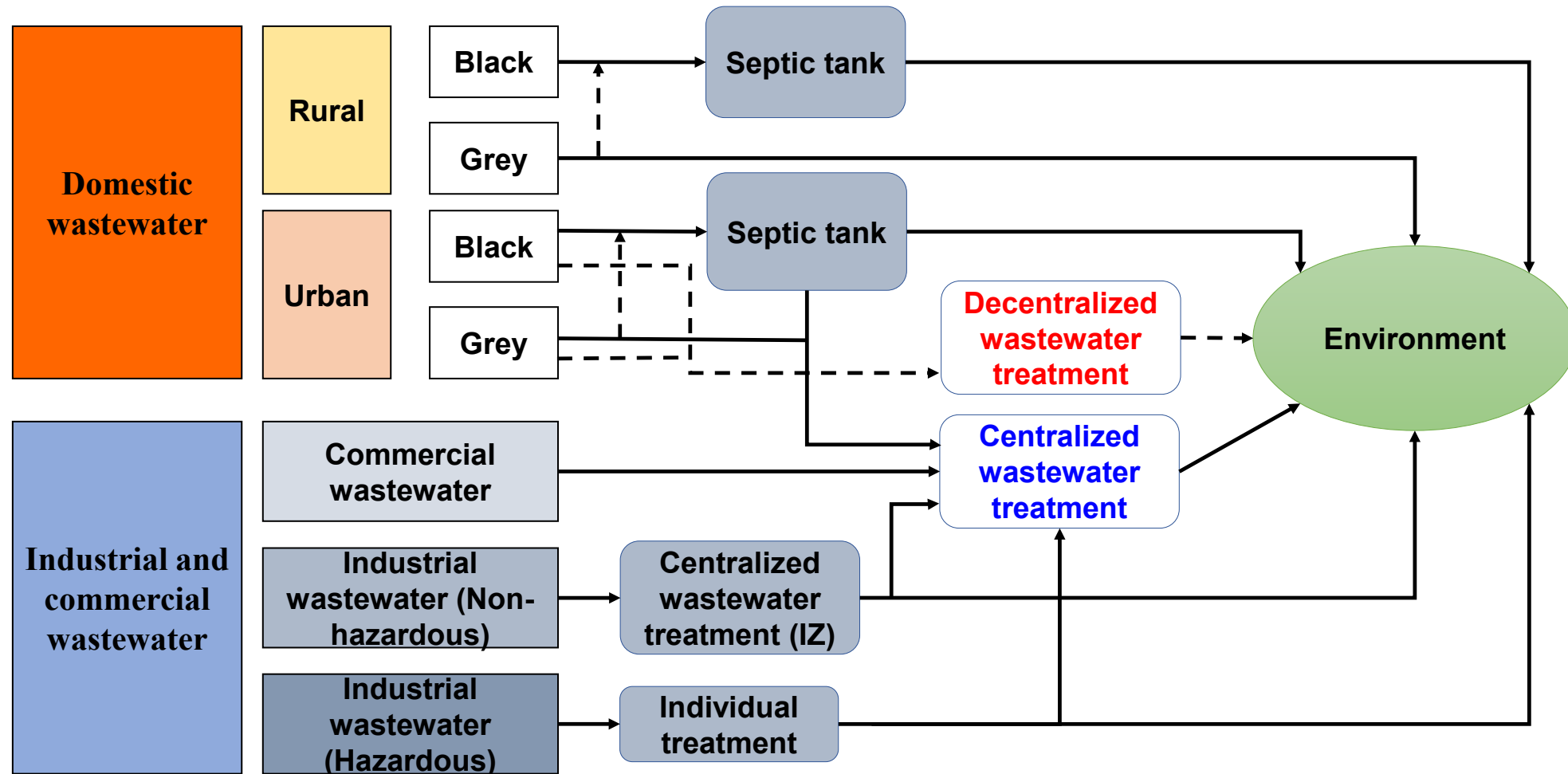
Area (km²)	331,210
Total population (GSO, 2023)	100,309,210
Rural population (GSO, 2023)	62,0605,200
Urban population (GSO, 2023)	38,248,690
GDP per capita, Atlas method (current US\$ per capita per year) (GSO, 2023)	US\$ 4,284.5
Access to clean water in rural areas (WB, 2022)	51%
Access to clean water in urban areas (WB, 2022)	93%
Wastewater collection rate (MoC, 2022)	60%
Wastewater treatment rate (MoC, 2022)	17%

Water environment

One of the main causes of WATER POLLUTION in Vietnam today is the issue of DOMESTIC WASTEWATER (**DWW**).



FACT FINDING - Wastewater flow and treatment process



FACT AND FIGURE Domestic wastewater generation

- **JICA (2019) Wastewater generation**

[Generated Wastewater] = [Population] x [Water consumption ratio (L/cap/day)]

9.5 millions m³/day

- **Safely Treated Wastewater**

Centralized wastewater system

a) **[Safety Treated by Centralized Wastewater Treatment Plant]**
= [Planned sewerage population] x [Water consumption ratio (L/cap/day)] OR

b) **[Safety Treated by Centralized Wastewater Treatment Plant]**
= [Designed capacity of centralized wastewater treatment plant]

907,950 m³/day

10%

Decentralised wastewater system

[Safety Treated by On-site Wastewater Treatment Plant] =
[Population connected on-site treatment system] x [Water consumption ratio (L/cap/day)]

- **MOC (2024)** Municipal wastewater collection rate: 64%
- **82 Centralized Wastewater treatment plant** with total capacity 1,466,999 m³/day (functioning **767,000 m³/day**) or **17% treated**

FACT FINDINGS - Decentralized system

Legal document	Terminology and Scope of DWW		
Circular No.04/2015/TT-MOC	On-site treatment	Cluster	Community
	Individual HH having ww capacity <50m ³ /day	A group of HHs having ww ca. 50-200 m ³ /day	An administrative community, ww ca. 200-1000 m ³ /day
A to Z of Decentralized wastewater treatment plant (GIZ, 2015)	<p>Consist of a minimum of two treatment systems including a secondary and a tertiary treatment step.</p> <p>An important aspect when selecting a DWWT system is energy consumption. “Close-to-nature” treatment solutions have the lowest energy consumption and should be a priority.</p>		
Customizing a Decentralized Sanitation Solution for Peri-urban Areas, ADB (2010)	<p>A decentralized approach, which treats the wastewater as close to the source as possible. The facility must be low maintenance and low energy.</p>		
Wastewater Review, World Bank (2013)	<p>The decentralized wastewater management concept is appropriate for areas where centralized systems are not currently viable. Over time, these decentralized systems may become part of an expanded centralized network as population density increases.</p>		
Decentralized DW in Asia – Challenges and opportunities, WEPA (2013)	<p>Decentralised system emphasizes on small-scale, on-site wastewater treatment and reuse, often at community.</p>		

FACT FINDINGS - Decentralized system

Decentralized wastewater system in Vietnam are divided into 03 categories (Circular 04/2015/TT-BXD)

On site Decentralized wastewater treatment

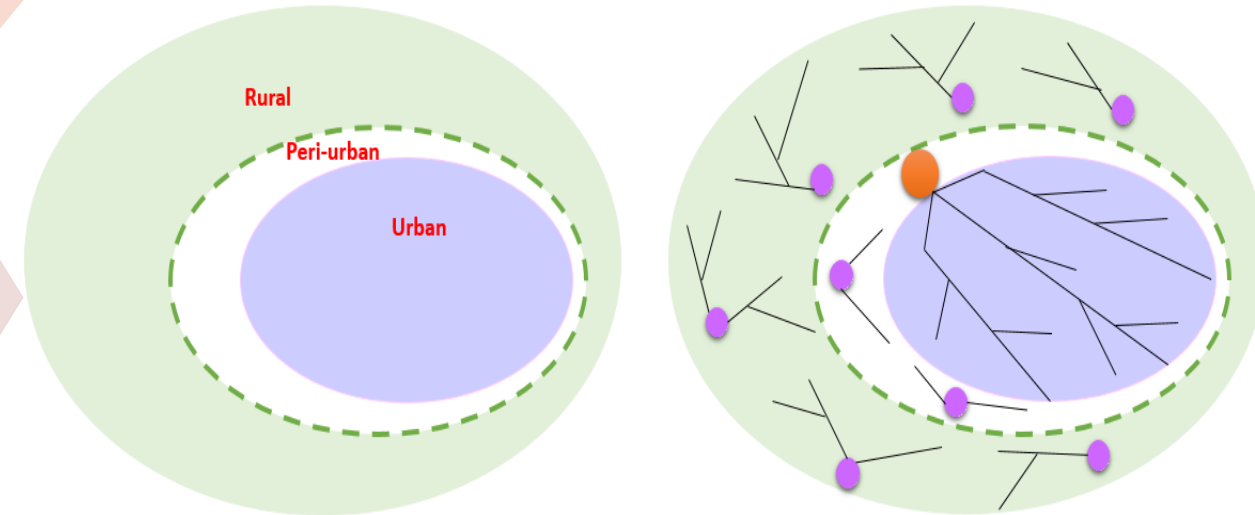
- Applies to individual drainage households.
- $Q < 50 \text{ m}^3/\text{day}$.

Decentralized wastewater treatment in clusters

- Apply to the drainage households near each other.
- $Q \text{ } 50\text{-}200 \text{ m}^3/\text{day}$.

Decentralized wastewater treatment by region

- Applied in an administrative boundary.
- $Q \text{ } 200\text{-}1000 \text{ m}^3/\text{day}$.



Wastewater system in urban, peri-urban and rural areas

FACT FINDINGS - Decentralized technology options

Currently, some of the technologies currently being guided by the Ministry of Construction in Circular 04/2015 / TT-BXD to apply decentralized wastewater treatment are as follows:

- 1 Septic tank
- 2 Anaerobic filter tank with partition
- 3 Improved septic tank with baffles and anaerobic filter compartment upstream
- 4 Anaerobic lakes, anaerobic lakes, stable lakes
- 5 Constructed wetlands
- 6 Batch reactor
- 7 Other technologies

FACT FINDINGS Decentralized wastewater system

Operating parameter

DWWP	Flow rate (m ³ /d)	Wastewater quality		Technology	Area (m ²)	Retention time (day)	De-sludging period	Type of WW
		BOD	COD					
Cai Khe market, Can Tho	20	1250	950	ABR + AF			Every 6-12 months	Market, slaughter
Pig husbandry farm, Nam Dinh	5	2902	6048	B - ABR - AF	40	4.68		Slaughter
Pig husbandry farm, Nam Dinh	10	3218	5227	B - ABR - AF - HGF	82	12.15		Slaughter
Viem Xa, Bac Ninh	40	304	761	ABR+AF+PP				Domestic
Thuan Thao restaurant, Ninh Thuan	300	-	-	ABR - AF - HGF	90	3.45	Every 6 months	Domestic
Cam Thanh primary school, Quang Nam	10	386	228	ABR - AF - HGF	75	1.74	Every 6 months	Domestic
Khac Niem noodle village, Bac Ninh	400	3197	1437	ABR - AF - PP	2,185	6.53		Domestic

WW: wastewater, ABR: Anaerobic baffled reactor, AF: Anaerobic filter HGF: Horizontal gravel filter (gravel filter + horizontal constructed wetland) B: biogas; PP: Polising pond, AO: Anoxic/oxic reactor, MBR: Membrane bio-reactor, MBBR: Moving bed biofilm reactor

FACT FINDINGS Decentralized wastewater system

Treatment performance

DWWP	Flow rate (m ³ /d)	Effluent quality					Discharge consent	Type of WW
		COD (mg/L)	BOD (mg/L)	SS (mg/L)	NH ₄ -N (mg/L)	PO ₄ (mg/L)		
Ha Phong, Quang Ninh	40						QCVN 40-2011	Slaughter
Bear rescue center, Vinh Phuc	22	63.3	28.7	39	26.74	2.66	TCVN 5945 – 2010, A level	Domestic
Viem Xa, Bac Ninh	40	103.6	53.4	45.9	80.7	27.99	QCVN14-2008	Domestic
Cam Thanh primary school, Quang Nam	10	50	24.5				QCVN14/2008	Domestic
Khac Niem village, Bac Ninh	400	89	46	64			QCVN124-2009	Domestic
Xom Cau 1 - Kieu Ky, Hanoi	40	34.89	22.1	8	12.1	3.1	QCVN14-2008	Domestic
Kim Bang hospital, Ha Nam	125	13	2	17	1.4	0.08	TCVN 5945 – 2010, B level	Domestic

FACT FINDINGS - Challenges



Collection network

- Patchwork, asynchronous
- The total length of the network is too short compared to the length of streets and alleys



Performance of centralized WWTPs

- The collection system is not complete, so many places only operate under designed capacity
- Inappropriate treatment process



Overloading urban drainage network

- The population density and waste standards in urban areas are much higher than in other areas and therefore often overloaded



Funds for Centralized WWTP investment

- Still too luxurious with 833 large and small cities in Vietnam
- Too difficult for rural, mountainous and other areas



Increasing pressure on the environment in the future

- Population growth
- High speed of urbanization
- Living standards and standards for water discharge have increased



Rural domestic wastewater collection network

- Most do not have a collection network

Man issues

Improper development of sewage collection system

- Network: mainly combined drainage system which collects sewage from household septic tanks
 - ✓ Septic tanks discharging into shallow drains
 - ✓ Drains also receive surface water
- Provision of “Centralized” sewage system
 - ✓ Huge investment, many factor anticipated, which make project delayed or operating under designed capacity.
 - ✓ Lesson learn experiences

Improper Design and management of drainage networks

- ✓ Flooding prone areas
- ✓ Clogging, odor problem from sewers

- Rural domestic wastewater: Most do not have a collection network

Main issues

Treatment technology selection

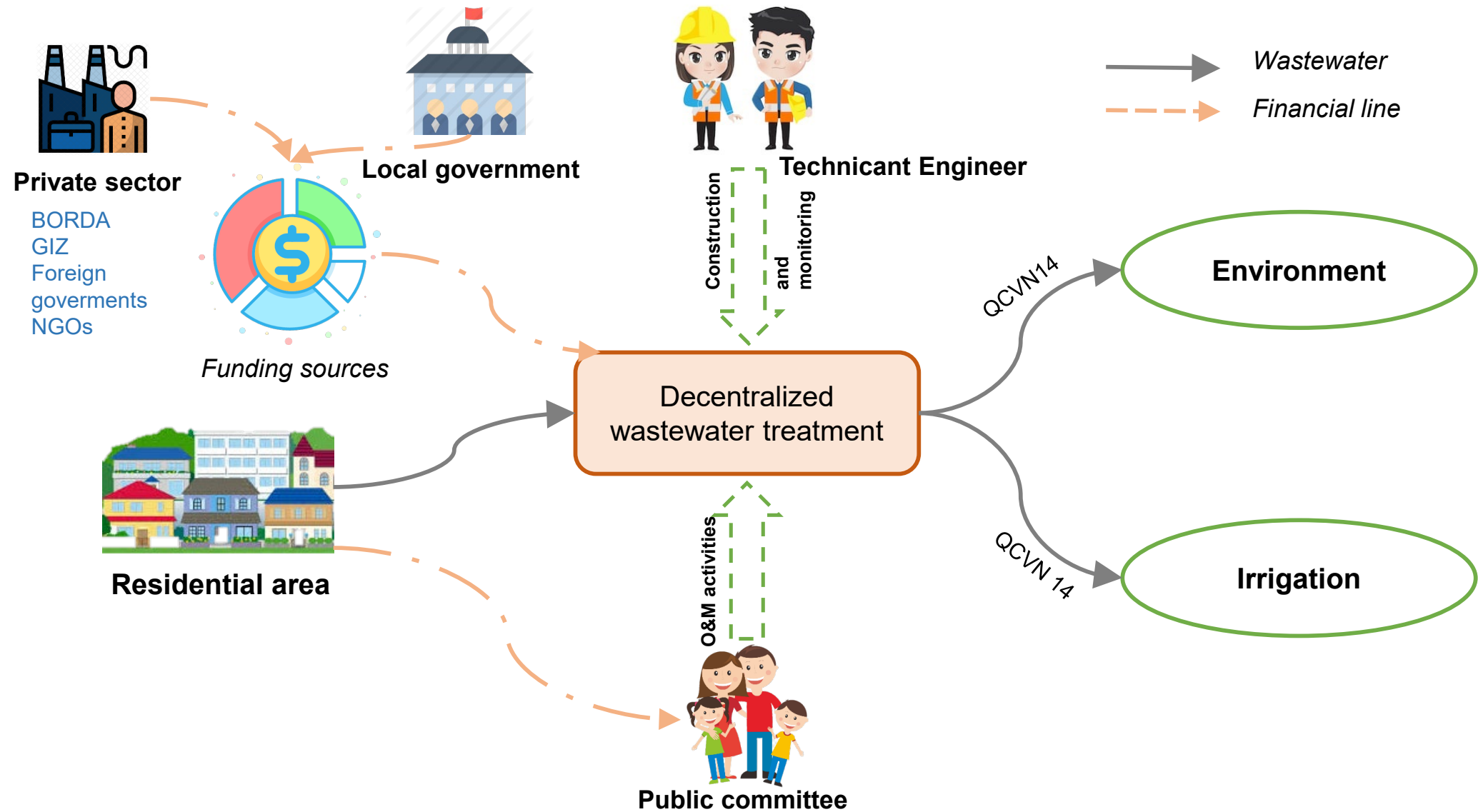
- Technology selection does not always agree with specific requirements, such as weak influent conditions
- Process design ignores the nature of the flows and loads
 - ✓ Lower BOD / TSS concentrations: Limit/no benefit to Primary tanks, large anoxic tank, co-settling of sludge.
- Frequently changing effluent standards have created uncertainty in terms of technology application
- Nitrogen content derives solution to aerobic capacity
 - ✓ Low BODs limited anaerobic or anoxic effectiveness
- Simple alternative technologies or applications considered for decentralized system in rural and peri-urban areas.
 - ✓ Reduced power and consumable demands

Wastewater characteristic

Type of sewage system	BOD (mg/L)	COD (mg/L)	TSS (mg/L)	NH4-N (mg/L)	T-N (mg/L)	T-P (mg/L)
Combined (urban and rural)	31 - 135	60 - 203	27 - 196	1.1 - 28	11 - 28.3	1.4 - 7.2
Separate (urban)	336 - 380	564 - 604	286 - 792	36.4 - 68	93.7 - 95	4.3 - 9

Water quality standard

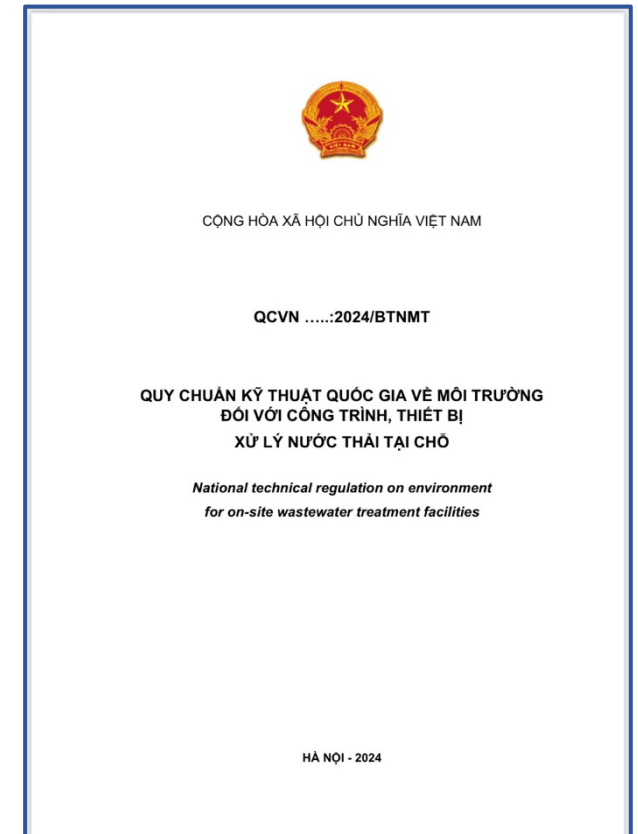
Parameter	Unit	Domestic decentralized		Domestic centralized and industrial	
		Class A	Class B	Class A	Class B
Total P	mg/L	6	10	4	6
Total N	mgN/L	30	50	20	40
Ammonium	mgN/L	5	10	5	10
BOD	mg/L	30	50	30	50
COD	mg/L	N/A	N/A	75	150
TSS	mg/L	50	100	50	100
Coliform	MPN/ 100mL	3,000	5,000	3,000	5,000
Discharge Std.		QCVN 14:2008	QCVN 14:2008	QCVN 40:2021	QCVN 40:2021



Necessity for a testing and evaluation system for decentralized wastewater treatment facilities ?

Legal and policy

- ***Commitment towards SDG6.3 and be driven by the resource recovery and reuse***
- **Formulation of laws/regulations**
 - MONRE - (Revised) **Law of Environmental Protection (from 1/2022)**: Wastewater should be separated with rain water, so decentralize discharge should be treated on-site
 - MONRE - (Revised) **Law of Water Resources (from 11/2023)**
 - MOC - (New) Law of Water Supply and Sewerage (draft)
 - MONRE - National technical regulation on environment for on-site wastewater treatment facilities (draft)
- **Improvement of laws/regulation for water quality**
 - MONRE - Updated National technical regulation for ambient water quality (Receiving water environment)
 - MONRE - Updated QCVN for Regulation of effluent water quality: Updated National technical regulation for treated wastewater quality (QCVN 40)



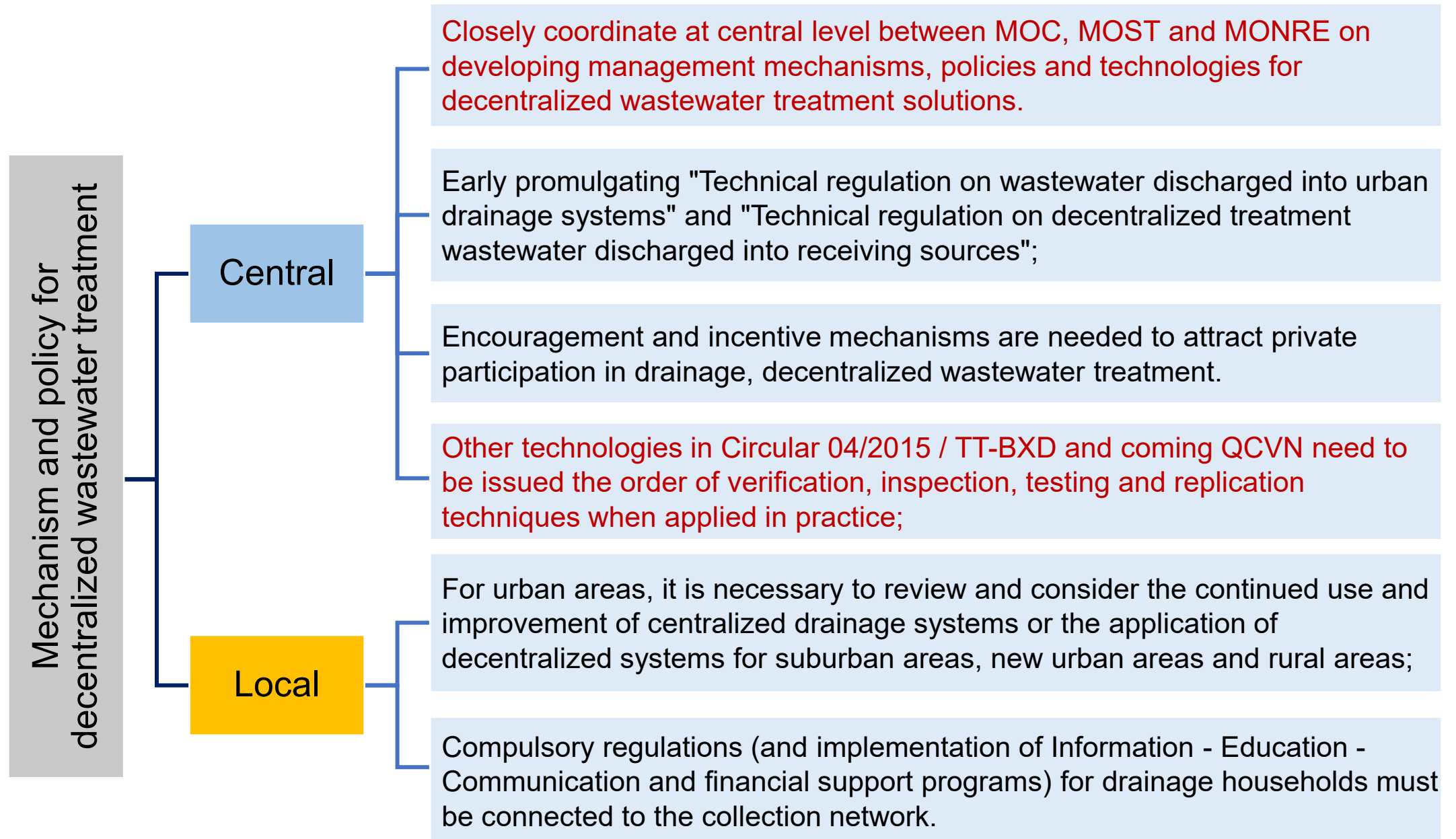
Technology Options: Wastewater treatment process, Reliable facilities and equipment, O&M measures

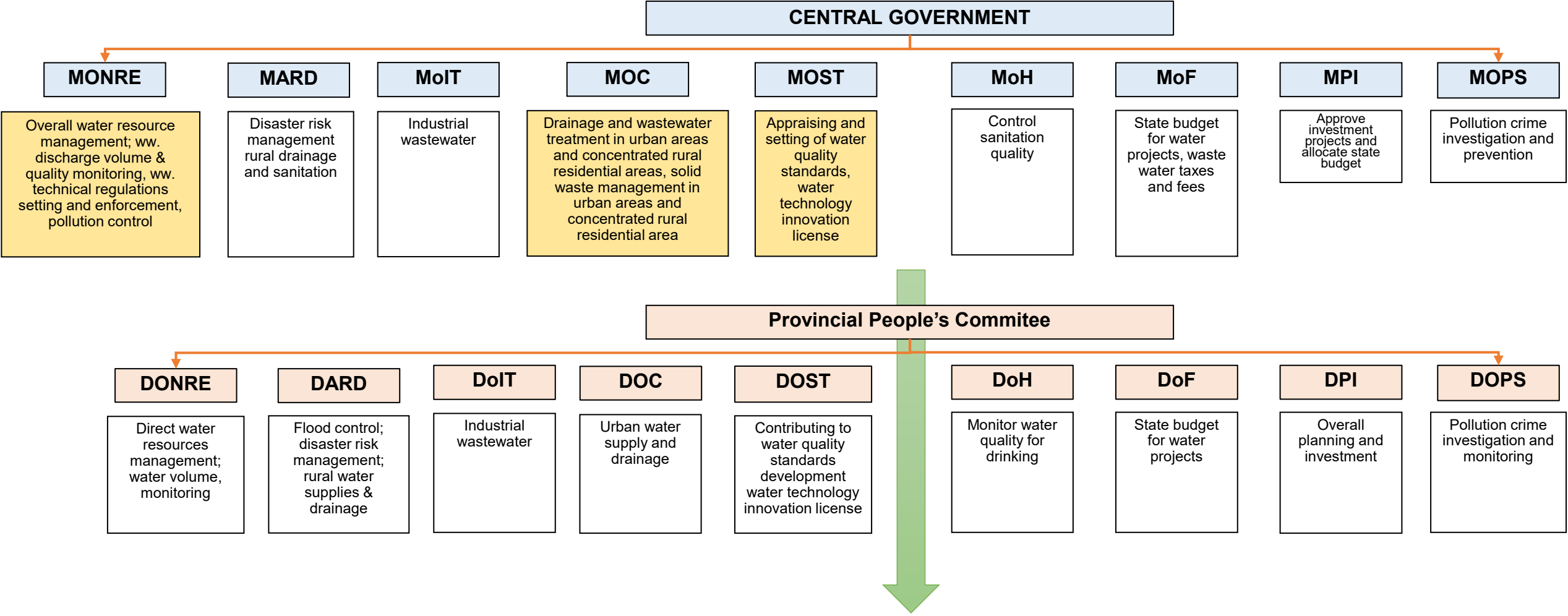
- **Formulation of Design and O&M manual** to enhance the selection of appropriate technology (Design guideline) considering the level of treatment required as well as influent wastewater nature, and for treating wastewater safely and steadily
 - **MOC On-site wastewater treatment facilities for households and residential areas - Design Standard**
 - **MOC Septic Tank – Design Standard**
- **Specific treatment process (technology)** to meet the effluent water quality standards is requested, and the performance of **technology** should be evaluated and examined.
 - **Need for a testing or appraisal center technologies/facilities ?**
- **Innovation of technology** to accelerate of the efficiency of wastewater treatment and management considering the local condition and existing systems



Planning and coordination

- **Closely coordinate at central level** between MOC, MOST and MONRE on developing management mechanisms, policies and technologies for decentralized wastewater treatment solutions.
- **Role and coordination** of Central/Local Government and Private Sector for planning, design, construction, O&M, assessment, ect.
- **Zonation** for centralized and decentralized scheme—short-term focus must be on decentralized scheme, long-term plan for transitioning to centralized scheme
- **Zonation** of the areas for different scheme with FSM, Decentralized scheme and Centralized scheme

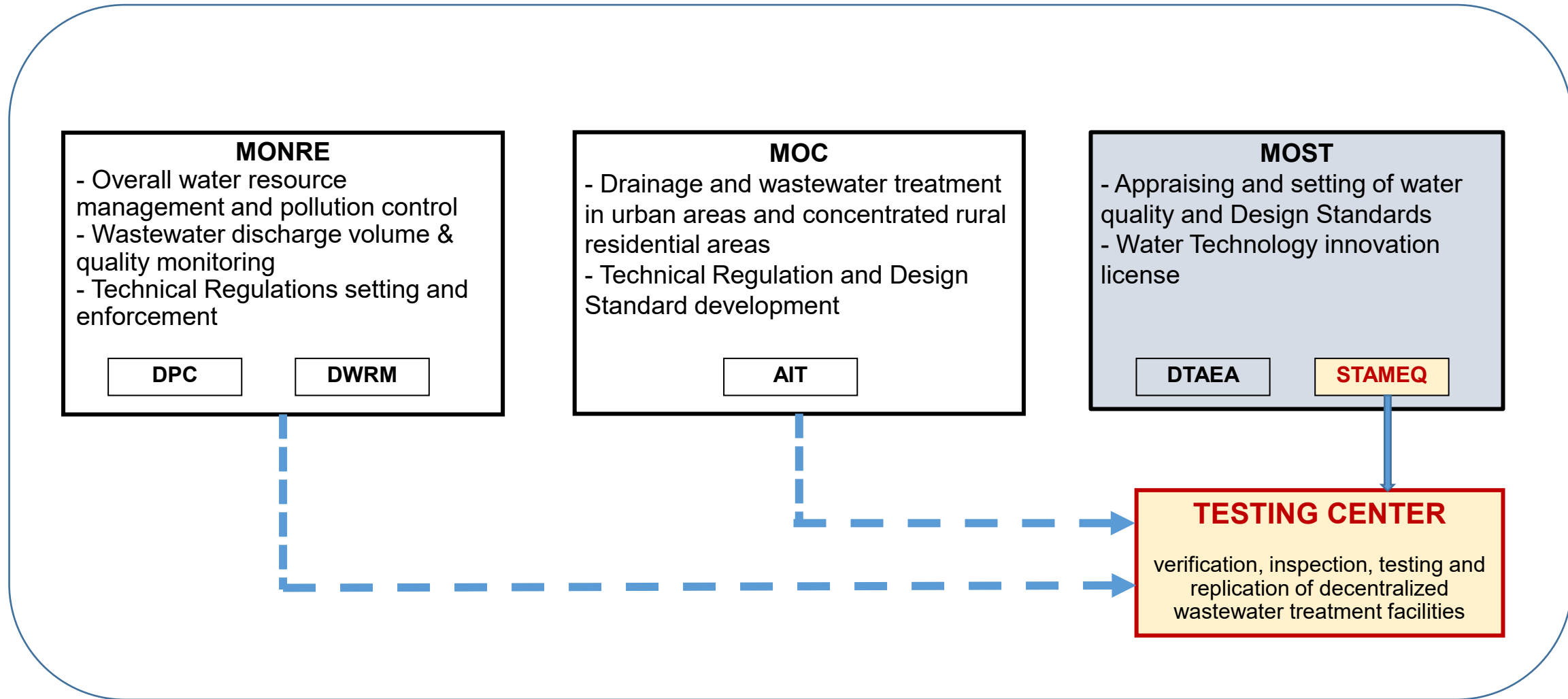




A testing and evaluation system for verification, inspection, testing and replication of decentralized wastewater treatment facilities

Institutional system for Domestic wastewater system

Task	Lead Agency	Other actors
Formulation of legal documents	MoC, MoNRE, MOST	
Programs, Plans, Project formulation	MoC, MoNRE	DoC, DoNRE (provincial level)
Budget allocation and management	MPI, MoF, MoNRE	DPI, DoF, DoNRE (provincial level)
Capital investment	People's Committee (Provincial, City level)	Investors
System management, operation and maintenance	Drainage, Sewerage, Env. Sanitation companies	Service and technology providers
Monitoring of services and environmental standards	MoC (wastewater collection and treatment service monitoring) MoNRE (environmental standards monitoring)	Related entities



Thank you very much!

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