Impact of Climate Change on Water (In)Security: Towards Adaptive Water Management Policy

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TDRI

สถาบันวิจัยเพื่อการพัฒนาประเทศไทย

Issue : 1) One major policy challenge is how could Thailand achieve water security & resilience under the threats of climate change ?

2) My focus is on “adaptive” water management institution

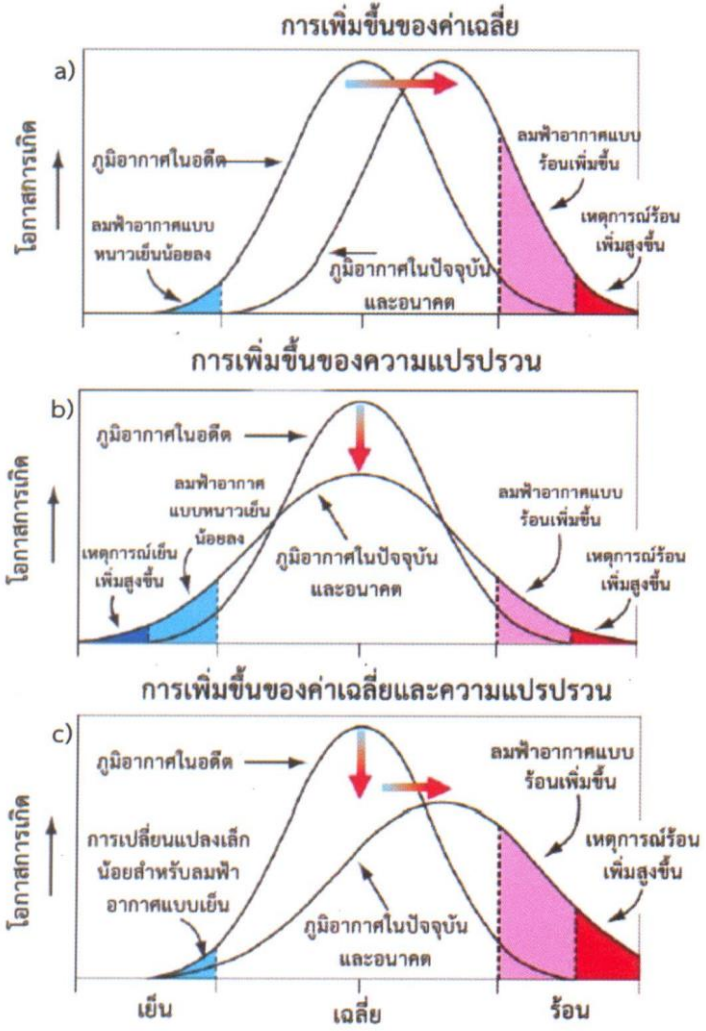
Topics of Discussion

- How climate change affects water security in Thailand
- The new water management governance and institution, and progress toward adaptive management
- What are the gaps and weakness of Thai water management policy to cope with the impact of climate change ?
- Conclusion and policy questions

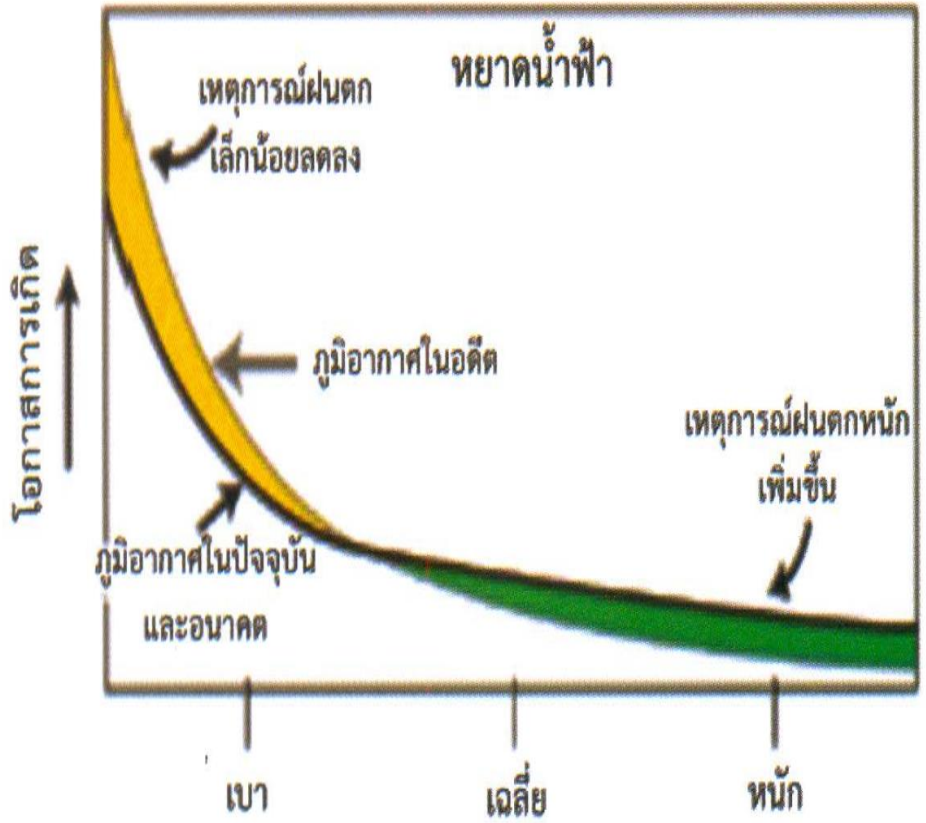
1. Impact of climate change on water security

- **Water is the primary medium through which climate change will affect people, economy and ecosystems (Sadoff & Muller 2009)**
  - **The overall climate change impact on fresh water resources is expected to be negative**
  - **Clear link between higher global temperature and changes in rainfall, particularly increasing incidence and severity of droughts and floods.**
    - **Changes of only a few degrees centigrade and the resultant changes in precipitation could increase average river flows and water availability by 10- 40% in some regions, and decrease by 10-30% in others (Sadof &Muller 2009)**
    - **A number of researchers have forecasted the impact for Thailand and agricultural production, e.g., Atsamon, Sujarit, Winai, Kanoksri & Sutat, Witsanu, Attachai, TDRI, etc.**
    - **Insert figures on cc from Atsamon**

Climate impact on temperature & distribution of rain



ที่มา: อัศมน Green Research, No 31.

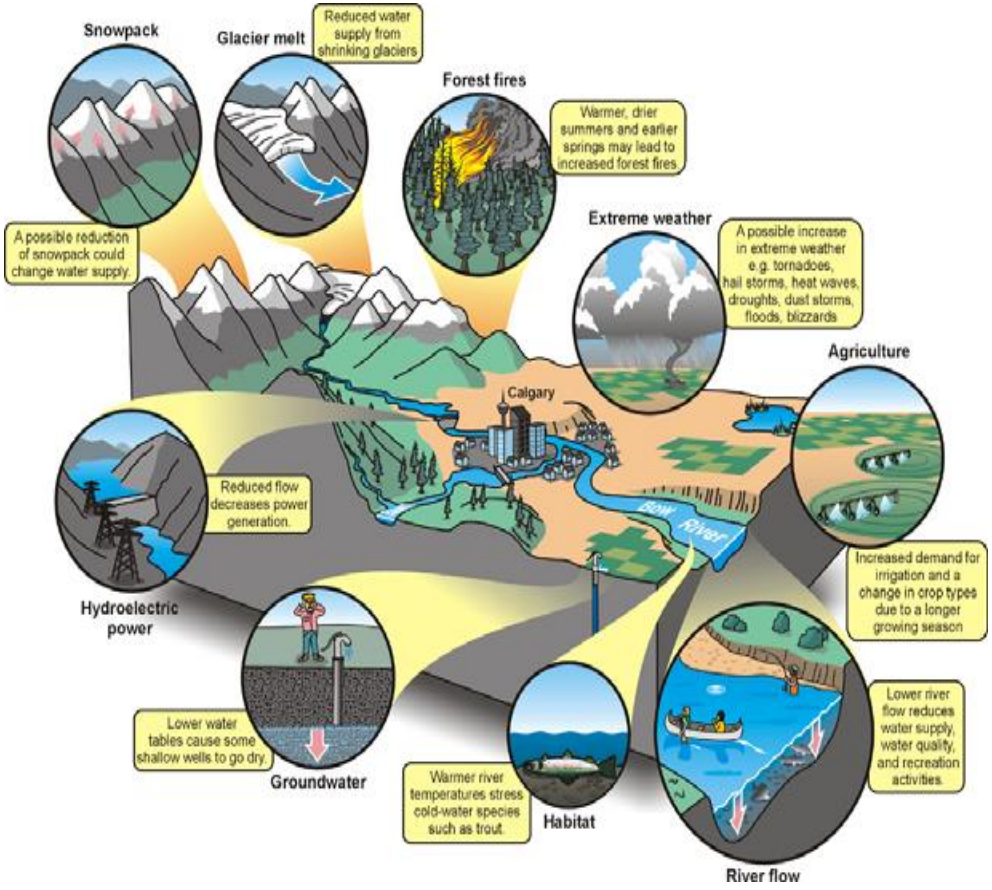


รูปที่ 2 การแจกแจงความถี่ของอุณหภูมิและตำแหน่งของเหตุการณ์สภาวะความรุนแรงซึ่งมักปรากฏอยู่บริเวณปลายของการแจกแจง และการเปรียบเทียบการเปลี่ยนแปลงของสภาวะความรุนแรงของฝนในกรณีที่การแจกแจงความถี่ของฝนเปลี่ยนแปลงภายใต้การเพิ่มขึ้นของอุณหภูมิโลก

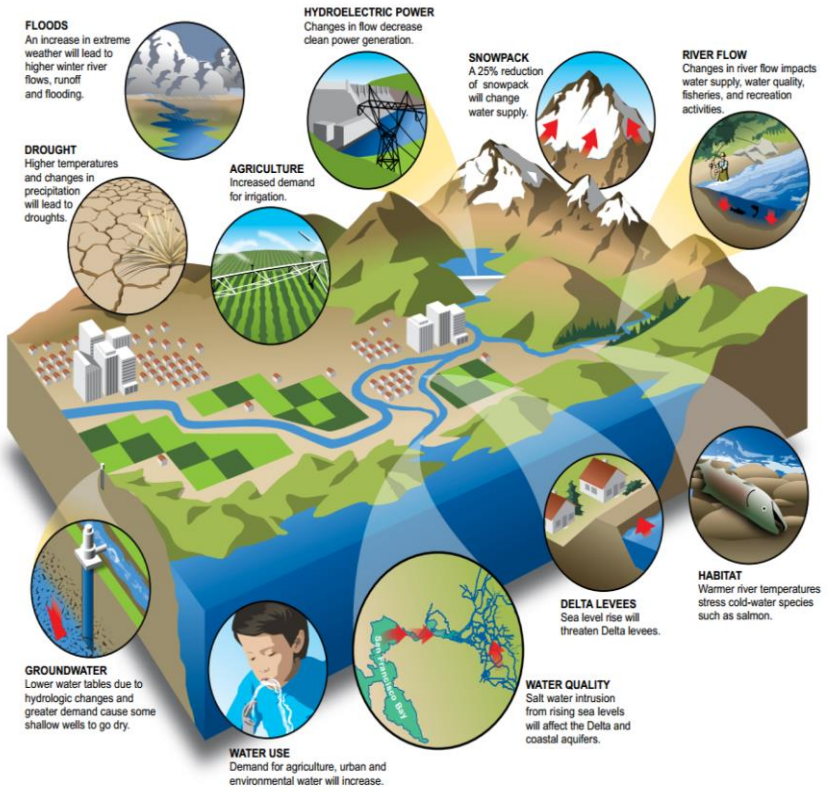
1. Impact of climate change on water security (cont.)

- **Water is the primary medium (cont.)**
  - **Yet the climate effect on river flows and recharge of underground waters is still not well understood**
    - **There are only a few studies of the climate impact on underground water in Thailand, e.g.,**
      - **Kewaree, Phayom, Vincent of Kriengsak (2019) on Huai Luang Basin in the NE**
      - **Pinit, Uma & Phayom (2018) and Korrakoch, Uma & Phayom (2018) on Lower Chao Phraya basin**
      - **Etc.**

Examples of potential climate change impacts on freshwater



Impacts in a river basin



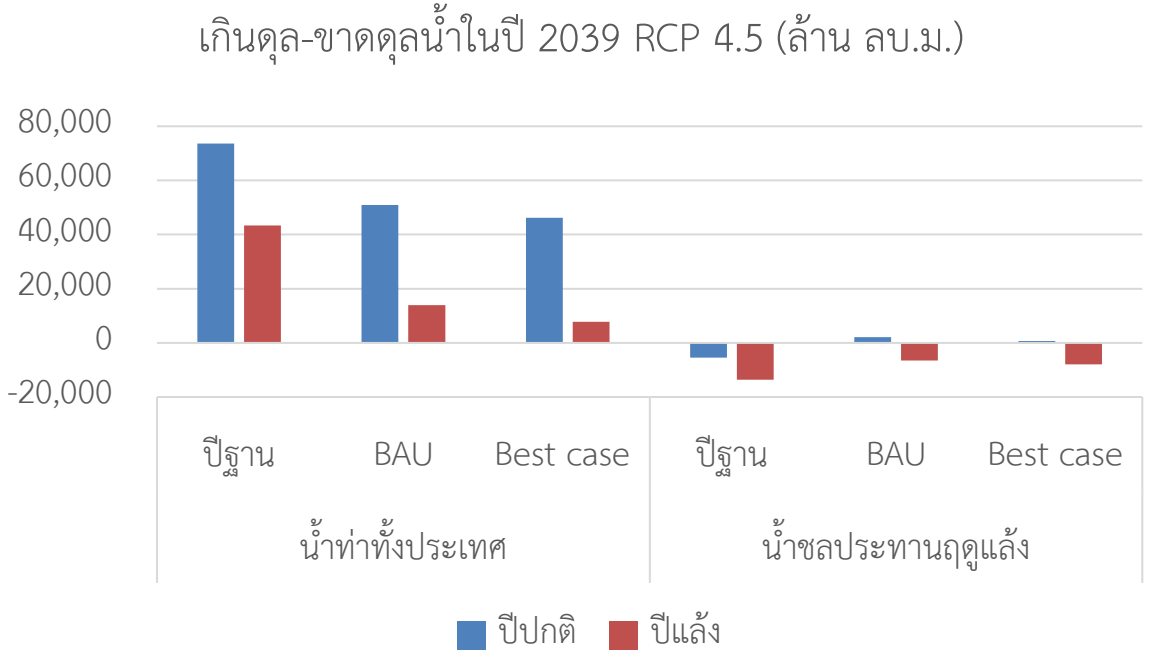
Source: Natural Resources Canada; in Moe, Jannicke et al. (2010); and S. Demuth

1. Impact of climate change on water security (cont.)

- **The combined effect will be higher risk of water security, particularly shortage of water for growing urban communities, and rendering much of agriculture and many industries that feed and supply them highly vulnerable, if not unsustainable**
  - **See figures: impact on water shortage & rice yield, (TDRI),**
  - **Moreover, the global climate will be characterized by more and intense floods and droughts**
    - **For example, the 2011 flood, which inundated 9.1% of total land are, resulted in the damage and loss worth 46.5 billion dollar and 680 deaths for Thailand (WB 2012)**

Forecast of water shortage of irrigated water during the dry seasons

- **Water net balance (surplus- blue; shortage - red) under different scenarios in 2039**

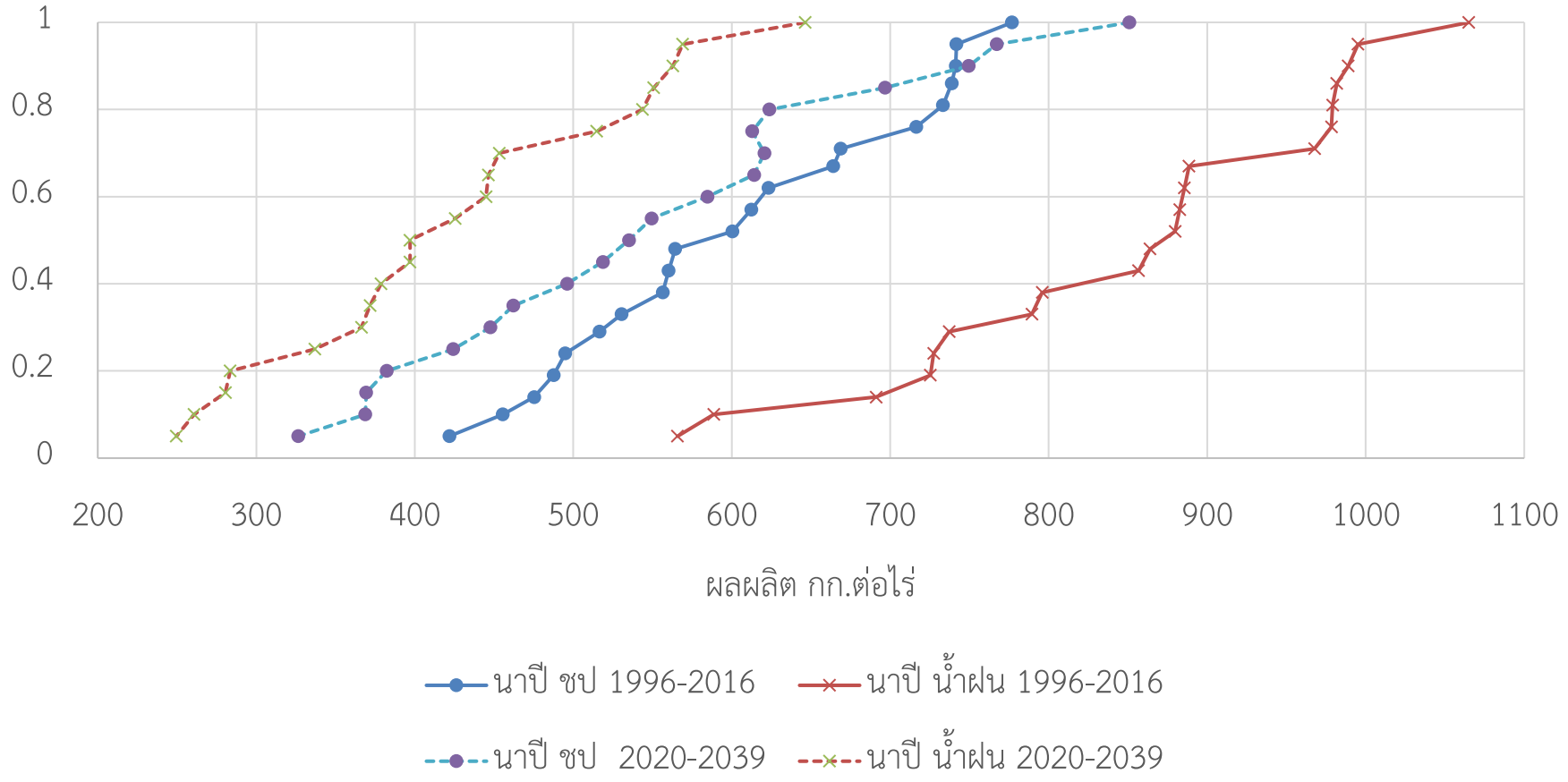


หมายเหตุ: การคาดคะเนด้านมหภาคพบว่าจะขาดแคลนน้ำชลประทานในฤดูแล้งทั้งปีปกติ และปีแล้ง

(นิพนธ์ และคณะ, 2561)

Forecasted impact of climate change on mean and average variance of rice (wet season under rainfed and irrigated systems)

- ผลผลิตข้าวต่อไร่ จะลดลง และผันผวนมากกว่าเดิม



(อรรถชัย, 2561. “การคาดคะเนผลผลิตต่อไร่ของน้ำชลประทานต่อผลผลิตข้าวและอ้อย ” ใน นิพนธ์ และคณะ, 2561)

1. Impact of climate change on water security (cont.)

- **Efforts to solve water problems that do not take into account climate change can compound its negative impact, e.g., engineered approach to flood protection (e.g., flood wall on the river banks) may protect cities from normal floods, but can leave them highly vulnerable to catastrophic infrastructure failure, e.g., 2008 Koshi floods in Nepal and India which affected & million people**
  - **Measures to tackle water scarcity, e.g., energy intensive desalination in the EEC (FS is being conducted) may aggravate change if applied on a large scale.**

1. Impact of climate change on water security (cont.)

- **Obviously, there is an urgent need to implement the robust water management, using the adaptation approach. Why ?**
  - **Understanding how the dynamics of climate change affect water supply and demand across all sectors will enable us to build the capacity to adapt to climate change, and thus strengthen resilience to climate challenge**
  - **What kinds of climate change adaptation ?**
    - **Adaptation will be addressed though a series of fundamental changes in the way societies manage end use water (and land) resources**
    - **Adaptation is similar to climate mitigation which is addressed through a series of fundamental changes in the way that societies produce and use energy**
  - **The most important adaptation strategy is "to achieve and sustain water security", which means harnessing water's productive potential and limiting its destructive potential**

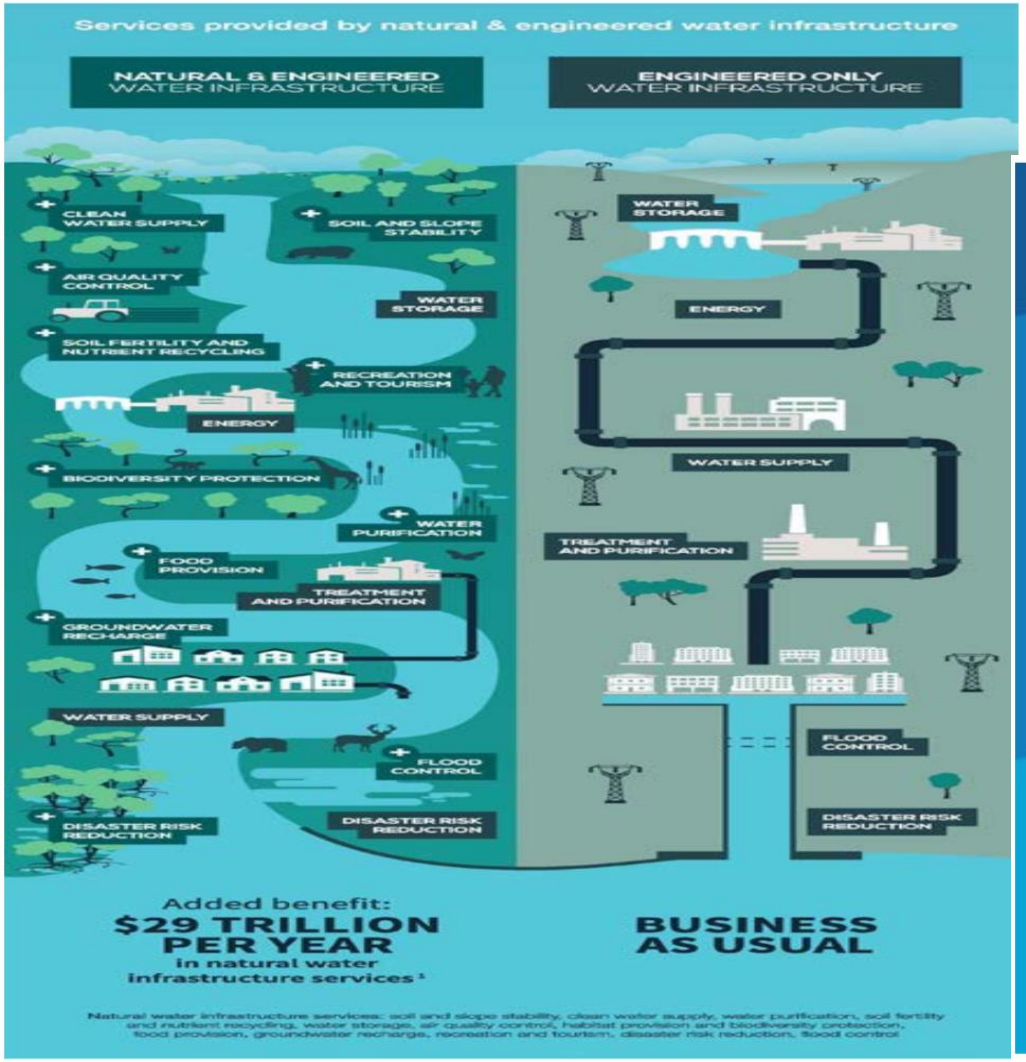
1. Impact of climate change on water security (cont.)

- **Why should we focus on water security as the top priority of adaptation strategies ?**
  - **It can deliver immediate benefits to vulnerable populations and majority of farmers, let alone the industries and tourism which are highly susceptible to climate variability**
  - **Thus it serves the politicians' interests of vote maximization**
  - **Water security also advances the UN-SDGs, and strengthens capacity for long term climate risk management.**
- **What is water security ?**
  - **"reliable access to sufficient (and safe) supplies of water" (World Food Summit Plan of Action, 1996)**
  - **"reliable availability of an acceptable quantity and quality of water for health, livelihoods and production, coupled with an acceptable level of water related risks" (Grey and Sadoff 2007)**

1. Impact of climate change on water security (cont.)

- **How do we achieve water security ? Investment in 3 Is**
  - **Investment in natural and man-made infrastructure to store and transport water : both hard & soft structure**
    - **See figure on nature& engineered infrastructure**
  - **Institution and governance of water management have to be stronger and more adaptable**
  - **Information and capacity to predict, plan for, and cope with climate variability**

Natural & engineered water infrastructure vs engineered only infrastructure



IUCN's 4 components to build climate resilience in practice

Diversity – more diverse economies, livelihoods and landscapes withstand shocks better and allow for a faster adaptation to uncertain futures

Capital and innovation – combining built with natural infrastructure optimises performance and financial benefits (see infographic)

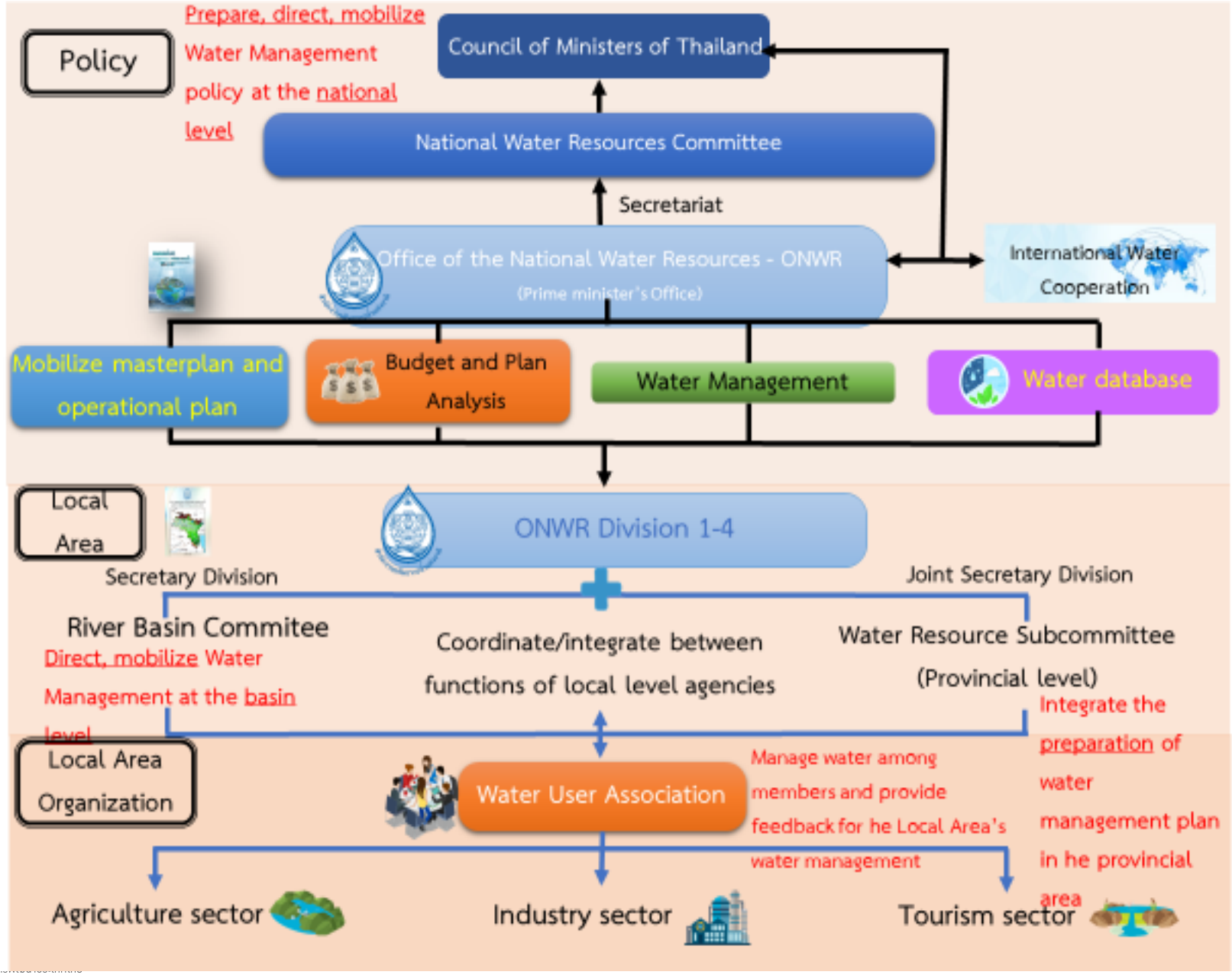
Self-organisation – through participatory governance and empowerment in adaptive institutions

Knowledge and learning – from improved climate information and capacity building, enabling people and institutions to recognise and adapt quickly to shocks and change

2. The new water management governance and institution and progress toward adaptive management

- **2.1 The new governance and institution**
  - **Law & plan**
    - **The Water Resource Act, BE 2561**
    - **The 20-year Water Mater Plan**
  - **Institutions**
    - **The National Water Resource Committee**
    - **Establishment of the Office of National Water Resource in 2018**
    - **22 River-basin committees**

The new water management governance and institution



2. The water management governance (cont.)

- **The first Water Resource Act was legislated in 2018 after several failed attempts, thanks to a decision to create a new planning & monitoring agency – the ONWR- under the PM office, thus eliminating the inter agencies conflicts**
  - **The law is in fact a formalization of the existing water management governance and the National Water Resources Commission (which was used to be appointed by the PM Office order)**
  - **The law has several sections dealing with climate adaptation, though climate change is not explicitly stated, e.g., flood & drought management, new water organizations & governance (e.g., ad hoc disaster committee, information & capacity building, participation of stakeholders**
  - **The law incorporates all functions regarding water rights, water allocation & use, development, maintenance and rehabilitation, conservation, and land use regulations, thus moving toward a concept of "integrated area-based water management"**

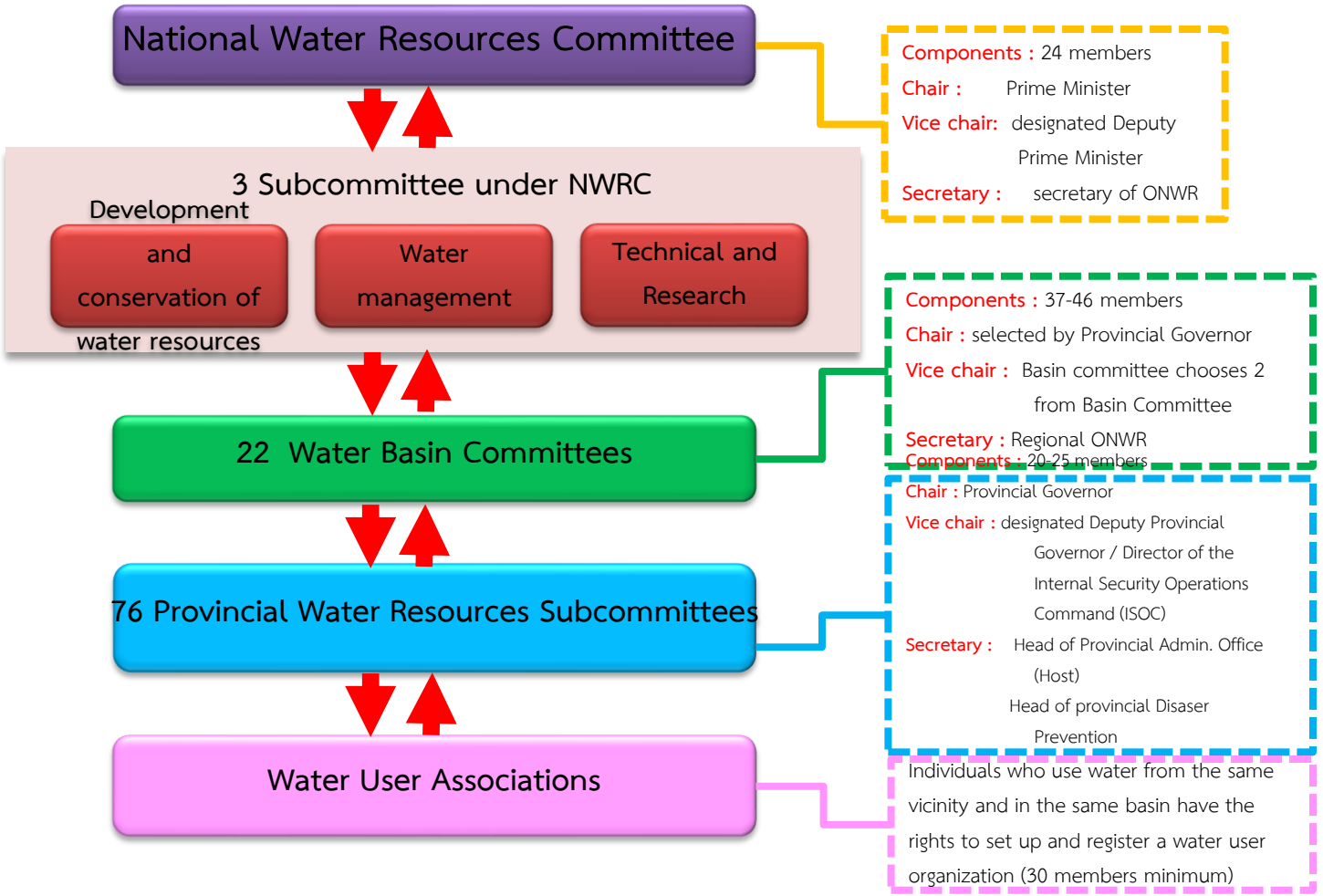
2. The water management governance (cont.)

- **A creation of the Office of National Water Resource to serve as the secretariat of the NWRC, with the main duties and powers of:**
  - **coordinating with the river-basin committees: improving governance**
  - **directing and supervising nationally important or urgent projects: governance**
  - **monitoring and assessing the operations of RBCs, state agencies and local government organizations that are concerned with water resource administration: governance**
  - **supervising and managing water resource information systems: new capacity building**
  - **promoting participation by stakeholders (section 23, WRA B.E.2561) : capacity building**

2. The water management governance (cont.)

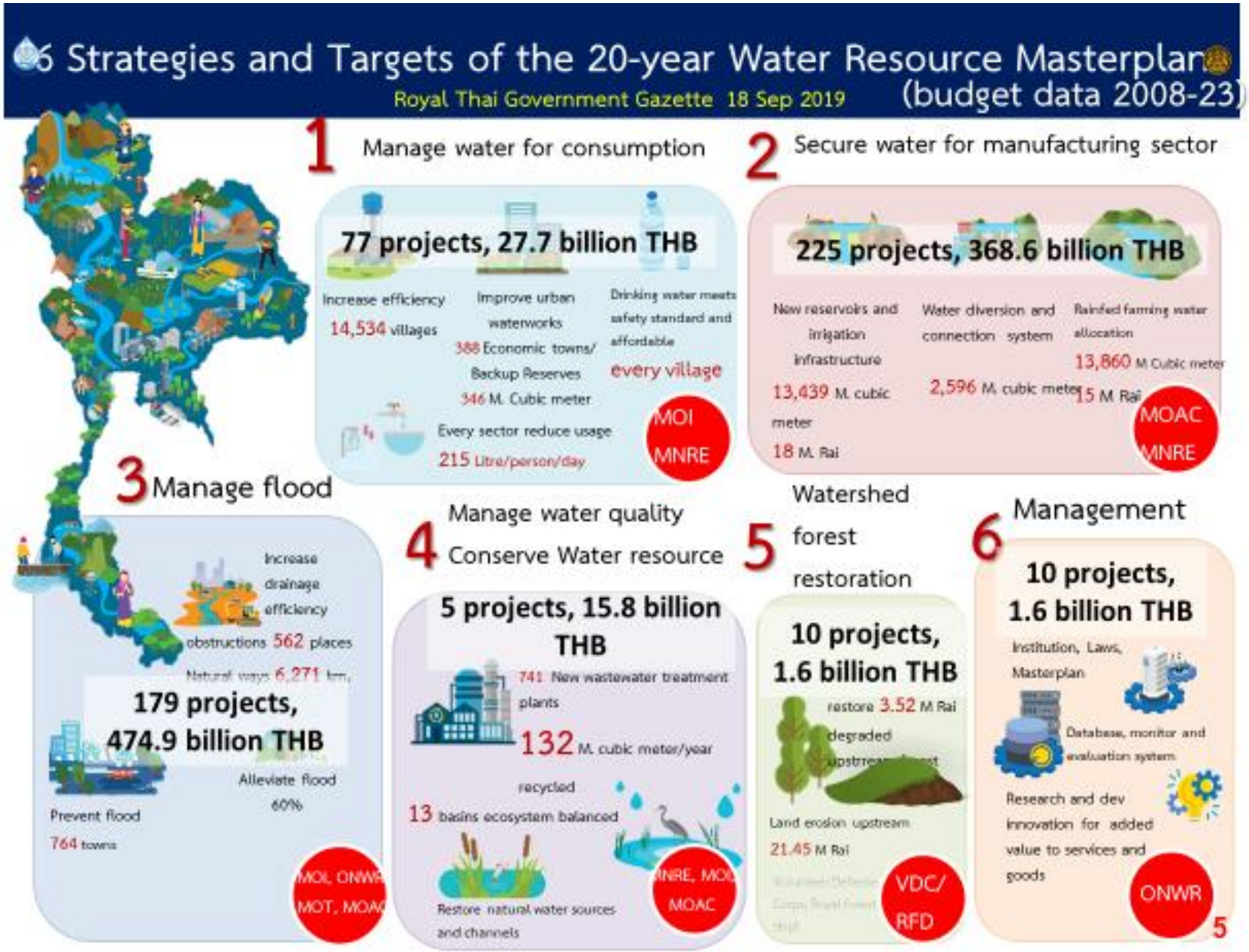
- **Formalizing and empowering the river basin committees, with the following duties and powers (section 3.5)**
  - water resource master plan, and flood/drought prevention & mitigation plans
  - Considering the quantity of water use, water location and prioritizing water use
  - Prescribing rules on water use, development management, etc.
  - Approving the permission for water use of Type Two
  - Submitting opinions on diversion of water amongst basins to NWRC, etc.
- **See diagrams of new organization structure of water management**

Organizational Structure for National and Basin Level Water Management



2. The water management governance (cont.)

- **The 20-year water master plan (20-2037), which is formulated as part of the 20-year National Strategy and the National Reform Agenda, has six agenda**
  - **Managing consumer water**
  - **Water security for production sectors**
  - **Flood management**
  - **Water quality and conservation management**
  - **Water shed forest conservation**
  - **Governance and information**
- **As a result, planned investment in infrastructure, information and capacity building have dramatically have surged in accordance with the targeted strategies**
  - **In 2022, budget share of water security for production & consumption is 58%, flood management 37%, information & management 2.4%**
  - **For the 2018-37 period, largest investment is "flood management (474.9 bil B), and "water security" (368.6 + 27.2 bil B)**
  - **(see the diagrams for investment)**


6 Strategies and Targets of the 20-year Water Resource Masterplan
Royal Thai Government Gazette 18 Sep 2019
(budget data 2008-23)
1 Manage water for consumption
77 projects, 27.7 billion THB
Increase efficiency
14,534 villages
Improve urban waterworks
388 Economic towns/ Backup Reserves
346 M. Cubic meter
Drinking water meets safety standard and affordable
every village
Every sector reduce usage
215 Litre/person/day
MOI
MNRE
2 Secure water for manufacturing sector
225 projects, 368.6 billion THB
New reservoirs and irrigation infrastructure
13,439 M. cubic meter
18 M. Rai
Water diversion and connection system
2,596 M. cubic meter
Rainfed farming water allocation
13,860 M Cubic meter
15 M Rai
MOAC
MNRE
3 Manage flood
Increase drainage efficiency
obstructions 562 places
Natural ways 6,271 km.
179 projects, 474.9 billion THB
Alleviate flood 60%
Prevent flood
764 towns
MOI, ONWR
MOT, MOAC
4 Manage water quality
Conserve Water resource
5 projects, 15.8 billion THB
741 New wastewater treatment plants
132 M. cubic meter/year
recycled
13 basins ecosystem balanced
Restore natural water sources and channels
MNRE, MOI
MOAC
5 Watershed forest restoration
10 projects, 1.6 billion THB
restore 3.52 M Rai
degraded
Land erosion upstream
21.45 M Rai
VDC/
RFD
6 Management
10 projects, 1.6 billion THB
Institution, Laws, Masterplan
Database, monitor and evaluation system
Research and dev innovation for added value to services and goods
ONWR
5

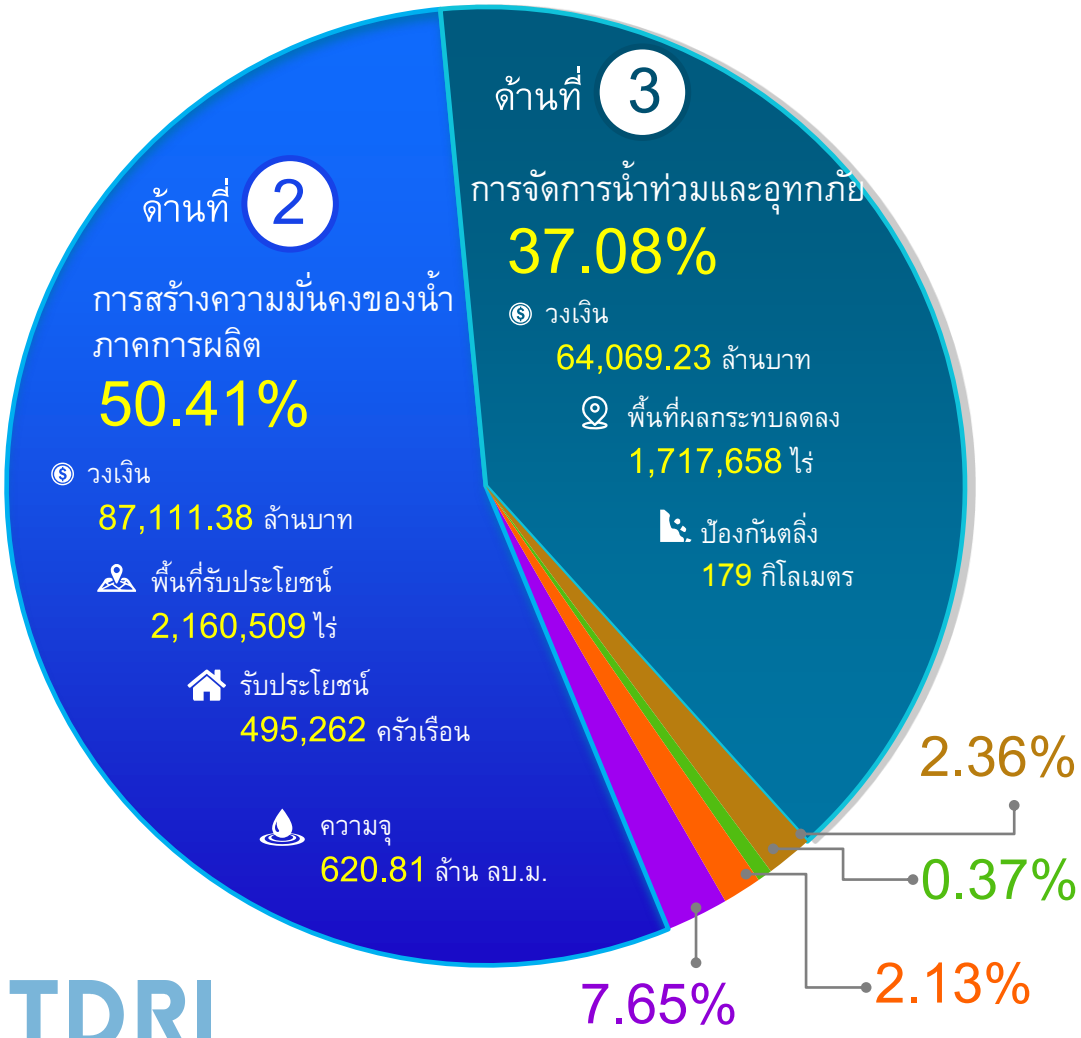
Source: ONWR

เป้าหมาย-ตัวชี้วัด แผนงานบูรณาการ
บริหารจัดการทรัพยากรน้ำ ปี'65

23 หน่วยงาน 9 กระทรวง

"วงเงิน 172,795.92 ล้านบาท"

คกก.จัดทำงบประมาณรายจ่ายบูรณาการ 2565 เห็นชอบเมื่อ วันที่ 8 ม.ค. 64



ด้านที่ 1 7.65%

การจัดการน้ำอุปโภคบริโภค

- วงเงิน 13,217.91 ล้านบาท
- ครัวเรือนนอกเขต กทม. เข้าถึงน้ำประปา 824,375 ครัวเรือน

ด้านที่ 4 2.13%

การจัดการคุณภาพน้ำและอนุรักษ์ทรัพยากรน้ำ

- วงเงิน 3,682.37 ล้านบาท
- แหล่งน้ำธรรมชาติได้รับการฟื้นฟูพื้นที่ได้รับการพัฒนาเพิ่มประสิทธิภาพการจัดการน้ำเสีย 97 แห่ง

ด้านที่ 5 0.37%

การอนุรักษ์ ฟื้นฟูสภาพป่าต้นน้ำที่เสื่อมโทรม และป้องกันการพังทลายของดิน

- วงเงิน 642.37 ล้านบาท
- พื้นที่ป่าได้รับการปลูกฟื้นฟูและปกป้องการชะล้างการพังทลายของดินในพื้นที่ต้นน้ำ 333,410 ไร่

ด้านที่ 6 2.36%

การบริหารจัดการ

- วงเงิน 4,072.66 ล้านบาท
- มีแผนการบริหารจัดการทรัพยากรน้ำครอบคลุมทุกลุ่มน้ำอย่างสมดุล 25 ลุ่มน้ำ

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2.2 Progress toward adaptive water management institution (cont.)

- **Infrastructural investment – some concrete examples**
  - **Most large scale infrastructural investments were in response to the 2011 flood, and are hard structure**
    - **Elevated highway in Thung Prapimol (western Bangkok)**
    - **Ayutthaya flood way**
    - **Flood walls around some industrial estates in Ayutthaya- build by the private sector with interest rate subsidy from government**
    - **Flood walls protecting some cities along Chao Phraya river**
  - **Raising the level of weirs in response to more intense rain**
  - **Soft structure investment**
    - **Bang Rakam model (Pitsanuloke province)**
    - **Food protections & flood forecast in some cities using both hard and soft structure, e.g., Pak Kred, Had Yai (TDRI 2017, ACCCRN 2018)**

2.2 Progress toward adaptive water management institution (cont.)

- **Information and capacity- some examples**
  - **Establishment of Smart Water Operation Center, Royal Irrigation Department to monitor the water emergency situation**
  - **ONWR: information system, daily report of water situation, and research**
  - **Research on water resource has increased as a result of the Targeted Research Initiatives and the major restructuring of research system in 2020**

2.2 Progress toward adaptive water management institution (cont.)

- **In summary**
  - **Except the investment in large – scale infrastructural projects, most projects in adaptive water management are initiated at the department level because the climate change issue is not yet the explicit objective of the National Strategic Water Plan, nor that of the Master Plan**
  - **The adaptive projects are still small, fragmented and may be difficult to produce significant impact**

3. The current water management institution: missing link and weakness

3.1 The current water management structure: flood & drought management are two sides of the same coin

-Flood Prevention/Flood Risk Management
-Management of Water Level in Dams
-Maintenance of Water Reservoir & canals,

Normal Situation

Emergency State

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3.1 The current water management structure: normal and emergency state

- **Water management under normal state**
  - **A) Centralized but fragmented**
    - **More than 50 laws &subordinate laws**
    - **30 agencies under 7 ministries**
    - **Overlapping of duties & power**
  - **Fragmentation is explained by the legal and administrative structure of Thai bureaucracy, i.e., each government agency is a legalistic body, vested with specific duties and powers**
  - **Good news is that the ONWR has actively tackled the problem of budget competition by issuing the guideline of budget formulation which is consistent with the master plan's strategy and targets**
  - **The result: 60.8-63.1% of water budget is allocated on the "integration" guideline**
  - **Unfortunately, it declines to 56.2% in 2021.**

สถิติงบประมาณด้านทรัพยากรน้ำ

ปีงบประมาณ	คำขอตั้ง (ล้านบาท)	งบประมาณ (ล้านบาท)				
		งบประมาณรวม	แยกมิติงบประมาณ			
			Function	บูรฯ น้ำ	บูรฯ อื่น ๆ เกี่ยวกับน้ำ	Area
พ.ศ. 2561		100,630 (100%)	12,056 (11.98%)	61,170 (60.79%)	2,723 (2.70%)	24,681 (24.53%)
พ.ศ. 2562		99,464 (100%)	10,619 (10.68%)	62,831 (63.16%)	3,589 (3.61%)	22,425 (22.55%)
พ.ศ. 2563	253,314	105,805 (100%)	18,207 (17.21%)	58,796 (55.57%)	3,526 (3.33%)	25,276 (23.89%)
พ.ศ. 2564	277,630	115,448 (100%)	20,681 (17.92%)	65,548 (56.78%)	4,520 (3.91%)	24,699 (21.39%)

หมายเหตุ : นอกแผนบูรณาการน้ำ วงเงิน ตามร่าง พ.ร.บ. งบประมาณประจำปี

ข้อมูล ณ วันที่ 8 มกราคม 2564

กรอบแผนงานบูรณาการบริหารจัดการทรัพยากรน้ำ ประจำปีงบประมาณ พ.ศ. 2565

แผนงาน บูรณาการบริหารจัดการทรัพยากรน้ำ ปี 2565

คกก.จัดทำงบประมาณรายจ่ายบูรณาการ 2565 เห็นชอบเมื่อ วันที่ 8 ม.ค. 64

23 หน่วยงาน **9** กระทรวง

11,524 รายการ

172,795.92 ล้านบาท

(กษ) วงเงิน 111,946.10 ล้านบาท

ชป.	110,784.89
ฝล.	734.78
พด.	249.53
กปม.	156.90
ปศ.	20.00

(ทส) วงเงิน 18,267.44 ล้านบาท

ทน.	12,684.15
ทบ.	4,981.33
อส.	197.01
ปม.	195.84
สป.ทส.	179.21
คพ.	29.90

(มท) วงเงิน 36,396.56 ล้านบาท

ยผ.	22,288.49
กปภ.	10,252.29
อจน.	3,602.53
ปภ.	253.25

(อว) วงเงิน 72.50 ล้านบาท

สทอภ.	35.00
สสน.	25.00
สวทช.	12.50

จท.	4,221.29
สทนช.	1,417.27
อต.	448.45
อน.	21.82
กพผ.	4.50

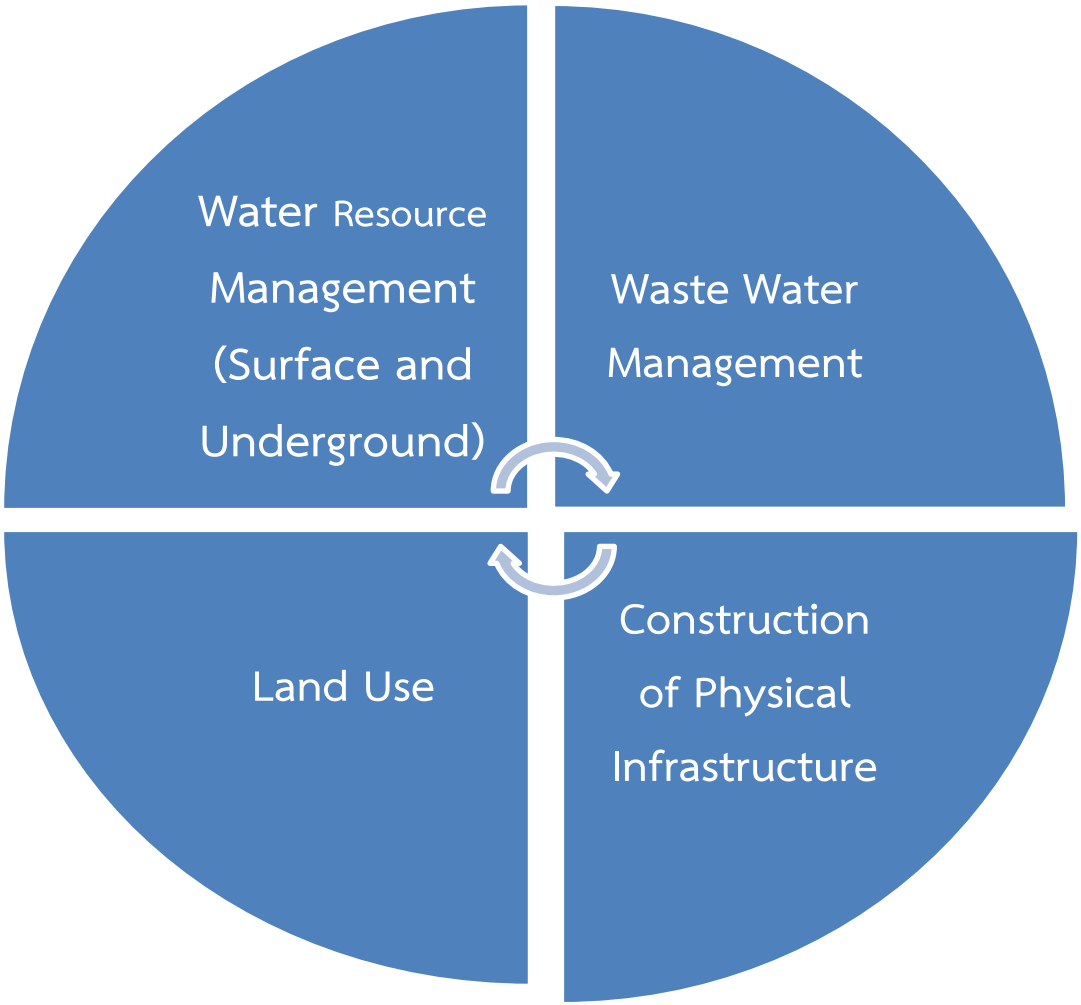
27

3.1 Water management under normal state (cont.)

- **B) Limited and half-hearted decentralization :**
  - Many local administrative organizations (3,000 out of 7,854) are too small
  - LAOs are responsible for the maintenance of small reservoirs and irrigation channels
  - 22 river (drainage) basin committees have limited powers, especially finance and legal power
  - Very small RID – initiated water use groups (45,515) and 216 Joint Management Groups (at provincial level)
    - Less than 5 % have strong capacity
    - The Division of Participation is not yet legally recognized
  - But the new law may gradually steer the water management direction toward “area-based”.

The water law and water master plan also have provisions and targets that may move the water management policy toward an "area-based" and to, some extent, "integrated" approach

Key Functions in an Area-based WRM



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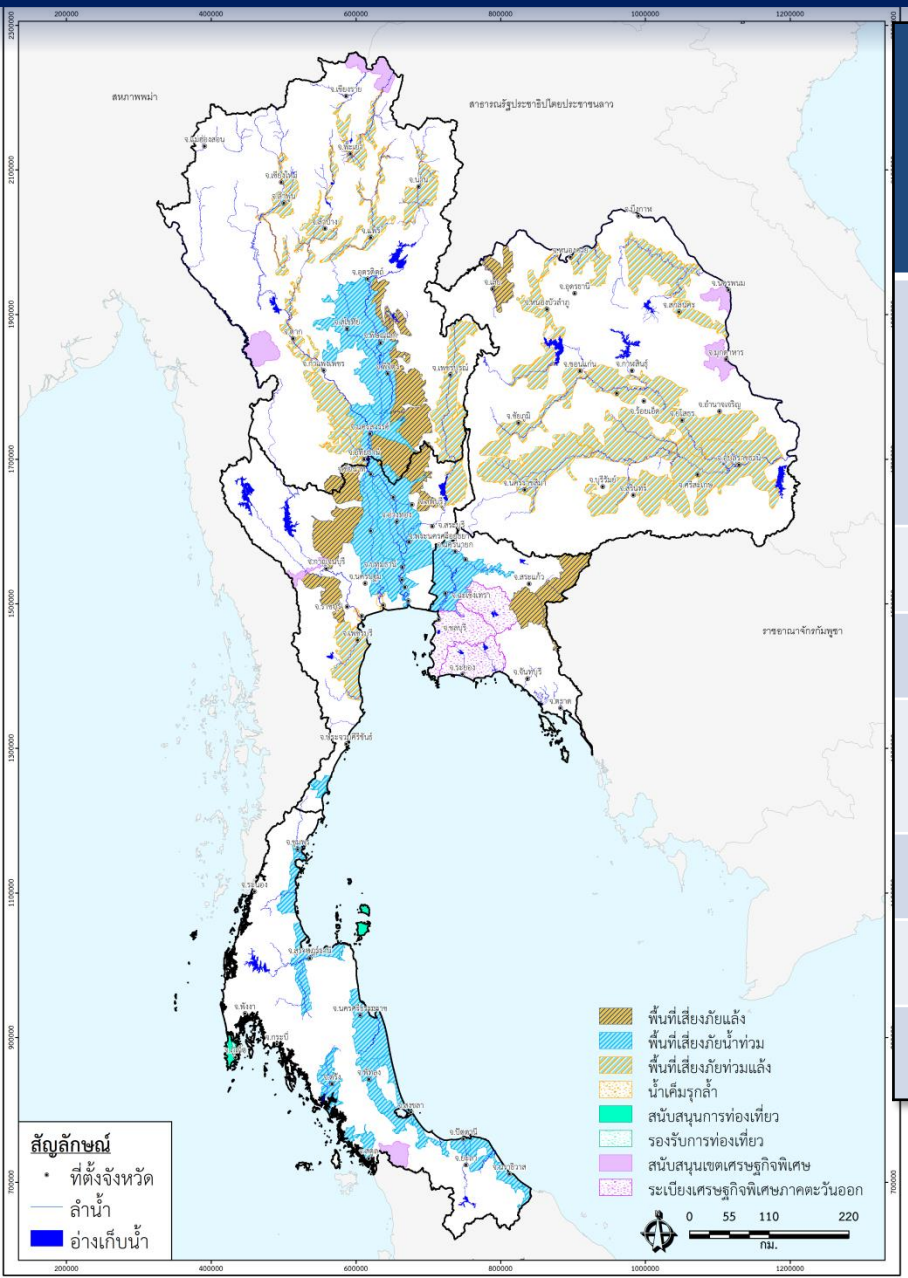
สถาบันวิจัยเพื่อการพัฒนาประเทศไทย

พื้นที่แก้ไขปัญหาอุทกภัยและภัยแล้งอย่างเป็นระบบ(Area Based)



รวมArea-Based (แห่ง/ล้านไร่)		พื้นที่ประสบปัญหาด้านน้ำ (แห่ง/ล้านไร่)		พื้นที่พัฒนา* (แห่ง/ล้านไร่)
ทั้งประเทศ	66	ท่วม 18 แล้ง 8 ท่วม+แล้ง 25 น้ำเค็มรุก 2	11.24 6.87 16.51 0.001	ศก.พิเศษ 10 ท่องเที่ยว 3
เหนือ	12	10	6.66	2
กลาง	15	14	12.81	1
ตะวันออกเฉียงเหนือ	16	14	11.81	2
ตะวันออก	8	3	2.05	5
ใต้	11	8	1.09	3
ใต้ชายแดน	4	4	0.19	-
			34.62	

*พื้นที่ที่ต้องพัฒนาเร่งด่วน เช่น พื้นที่เขตพัฒนาเศรษฐกิจพิเศษ แหล่งท่องเที่ยวสำคัญ

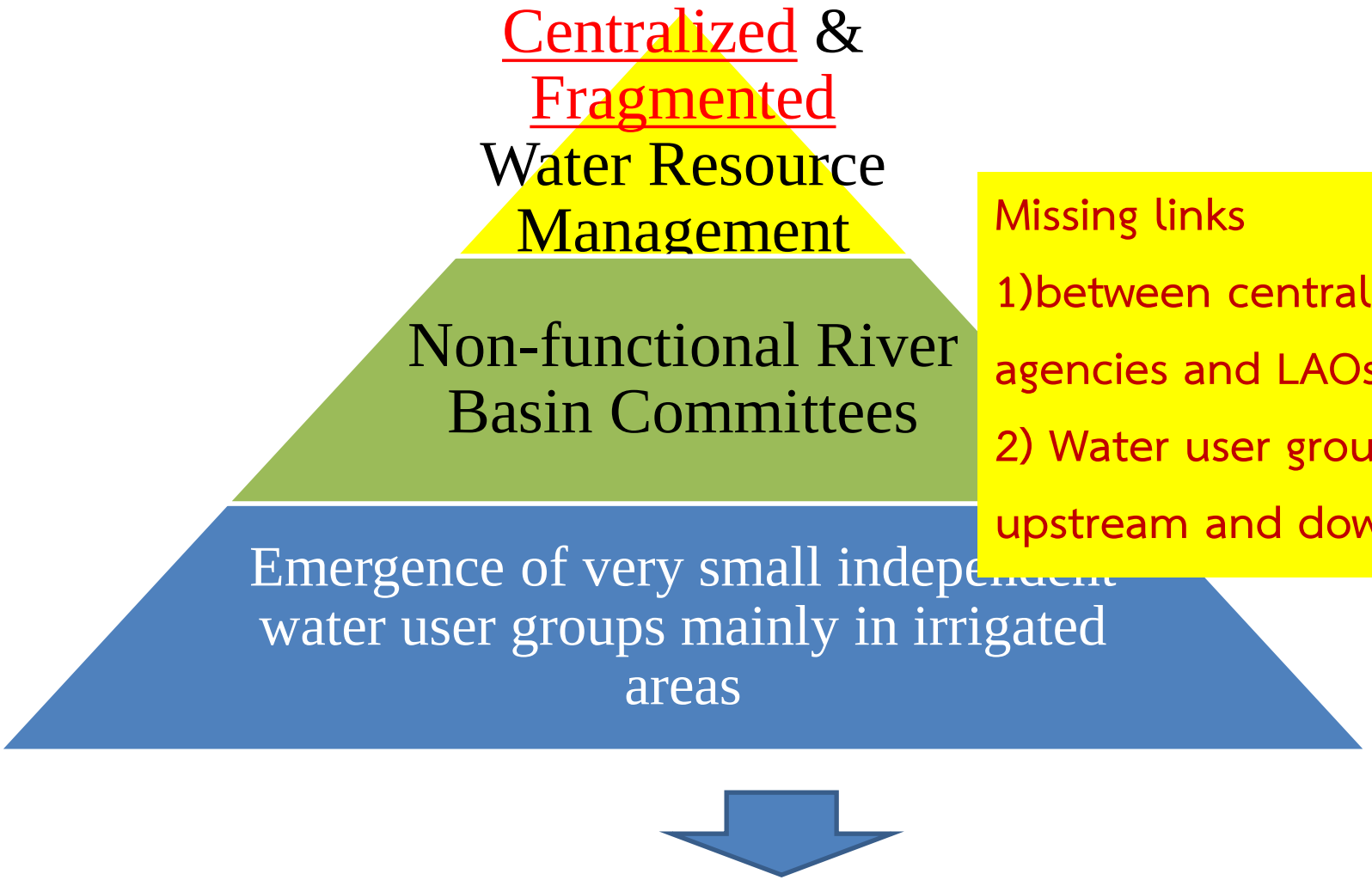
3.1 The current water management structure (cont.)

- **Water management under emergency state: 4 levels of disaster prevention & mitigation plan (DPM Act. BE. 2550).**
  - **Level 1 by LAOs**
  - **Level 2 by provincial governors**
  - **Level 3 by DG of Department of DPM**
  - **Level 4 by Prime Minister (consistent with section 24 of Water Act**

3.2 Gaps and weakness of the current water management institution: normal state

- **1) Missing link between the NWRC and the RBCs / water user groups (TDRI 2017)**
  - **Major problems are (a) water conflicts between upstream and downstream water users (from different provinces)**
  - **(b) RID has power to divert water across river basins, without participation of water users**
    - **RBCs are expected to fill the gap in the future: an issue to be studied**
  - **As a result, most water is stolen along the way, and there are conflicts among water users**
  - **Studies find that 1) diverting water across basins will result in higher GRP (TDRI 2018); 2) negotiation among water users, upstream vs downstream, or users from different basins result in more efficient and equitable water allocation and utilization (TDRI 2017)**

Gaps inWater Resource Management Structure



Missing links

1)between central government agencies and LAOs;

2) Water user groups in upstream and downstream

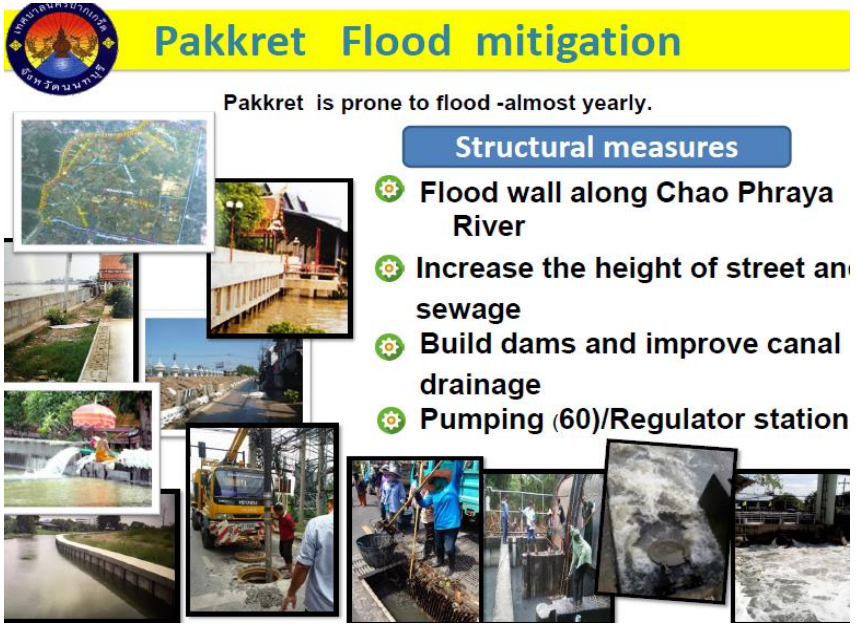
Sub-optimal Water Management

3.2 Gaps and weakness of the current water management institution: emergency state (cont.)

- **B) Lack of a single "professional" commander (CEO) and institutional memory during the emergency state (Nipon 2019, TDRI 2017; Sucharit, undated)**
  - **Existing structure consists of "an ad hoc command center" with the PM being its commander in-charge**
- **The operation is still carried out by government agencies and LAOs**
- **Two institutional changes:**
  - **a need for a "professional CEO" who has duty and power, as well as resources and dedicated team, delegated by the PM, to carry out the day-to day operation……remember Tum Luang rescue, Chiangrai !!!**
  - **Building institutional memory of the disaster management team: collecting data, information, feedback, analysis and evaluation for future planning**

3.2 Gaps and weakness of the current water management institution: emergency state (cont.)

- **C) City flood forecast, planning and prevention to cope with climate change**
  - **A few cities in Thailand have adopted the inclusive flood forecast, prevention, mitigation, and flood management planning, using the disaster management cycle approach**
  - **Pak Kret (Nanthaburi), and Hat Yai city (Songkla) – (see TDRI 2013, 2017; Nipon 2019; ACCCRN 2018)**



3.2 Gaps and weakness of the current water management institution: emergency state (cont.)

- **C) City flood planning and prevention to cope with climate change (cont.)**
  - **Unfortunately most cities still rely upon the "hard structural infrastructure" for flood prevention, especially building river bank walls, which are vulnerable to collapse and cause large damage in the future**
  - **The challenge is for ONWR to use the experience of Hat Yai and Pak-Kret to help other cities creating such institution and building their capacity to adopt the inclusive and resilient flood management planning**

3.2 Gaps and weakness of the current water management institution: new regulation (cont.)

- **D) Land use planning and water chart (ผังน้ำ) (section 17 (5), 56)**
  - **Section 56 of the WR Act stipulates that exploitation of land covered by the water ways system under the water chart shall not cause diversion of water ways/ currents or obstruct a flow of water**
  - **The ONWR is planning to finish the water chart for 8 river basins in September 2021**
  - **But the problem is that land use regulation, especially city planning is under the responsibility of the Department of Public Works and Town Planning, which is not part of the NWRC**
  - **Regulating urban land use, particularly private property land, requires a new concept and means such as exchanging rights of land exploitation, sponge city, etc. (TDRI 2017 and Apiwat 2017).**

3.3 One more major climate challenge in the water master plan : demand management & water security

- A TDRI study (2018) prepared for RID finds that climate induced droughts will cause major water shortage in the dry season
- The demand side factors, which are important explanation of excessive use of water, include
  - Free water for farmers
  - Tap water is underpriced because water supply companies pay only ฿0.50 per cubic meter to RID, comparing to the cost of ฿1.40 per cubic meter of raw water
  - Water users do not have to incur the cost of water treatment, thus inflicting externalities on others by dumping waste water into water ways

3.3 One more major climate challenge in the water master plan : demand management (cont.)

- **Outcome of excessive use of water**
  - Too much water is used in low value economic activities, such as rice
    - In Chao Phraya River delta, water demand exceeds supply during the dry season
  - Excessive use of water for rice production results in high carbon foot print
    - Over-expansion of paddy farms in the Chao Phraya delta
  - Negative externalities on other water users
  - The water shortage also result in political intervention and conflicts among water users

3.3 One more major climate challenge in the water master plan : demand management (cont.)

- **Though it is politically difficult to charge the farmers for agricultural use, experiments and survey confirm that mart farmers are willing to pay for water (TDRI 2017, 2018)**
  - **If and only if the fee goes to their water-user group and is used to finance the maintenance and rehabilitation of the canals**
- **Another promising approach is to create water rights and allocate rights quota water users groups consumers, and allowing them to trade the water rights; or allocating certain quantity of water and establishing a binding contract between farmers and RID (Molle 2001)**
  - **But there is a need for more studies and experiments on related several issues, such as the technical problems of defining base rights', measurement issues, trading platforms, equity issues, trial pilot projects, etc.**
  - **After that a new law and governance are needed**

4. Conclusion and policy questions

- **Since 2018, there have been two major changes in the water management policy:**
  - **Formalising water management governance and institution, i.e., water law, master plan, establishment of OWNR, and integrated approach to budget preparation according to the targeted strategies**
  - **Big increase in investment budget for water management from 68.87 bil B in 2016 to 115.45 bil B in 2021, an increase of 13.5 % pa.**

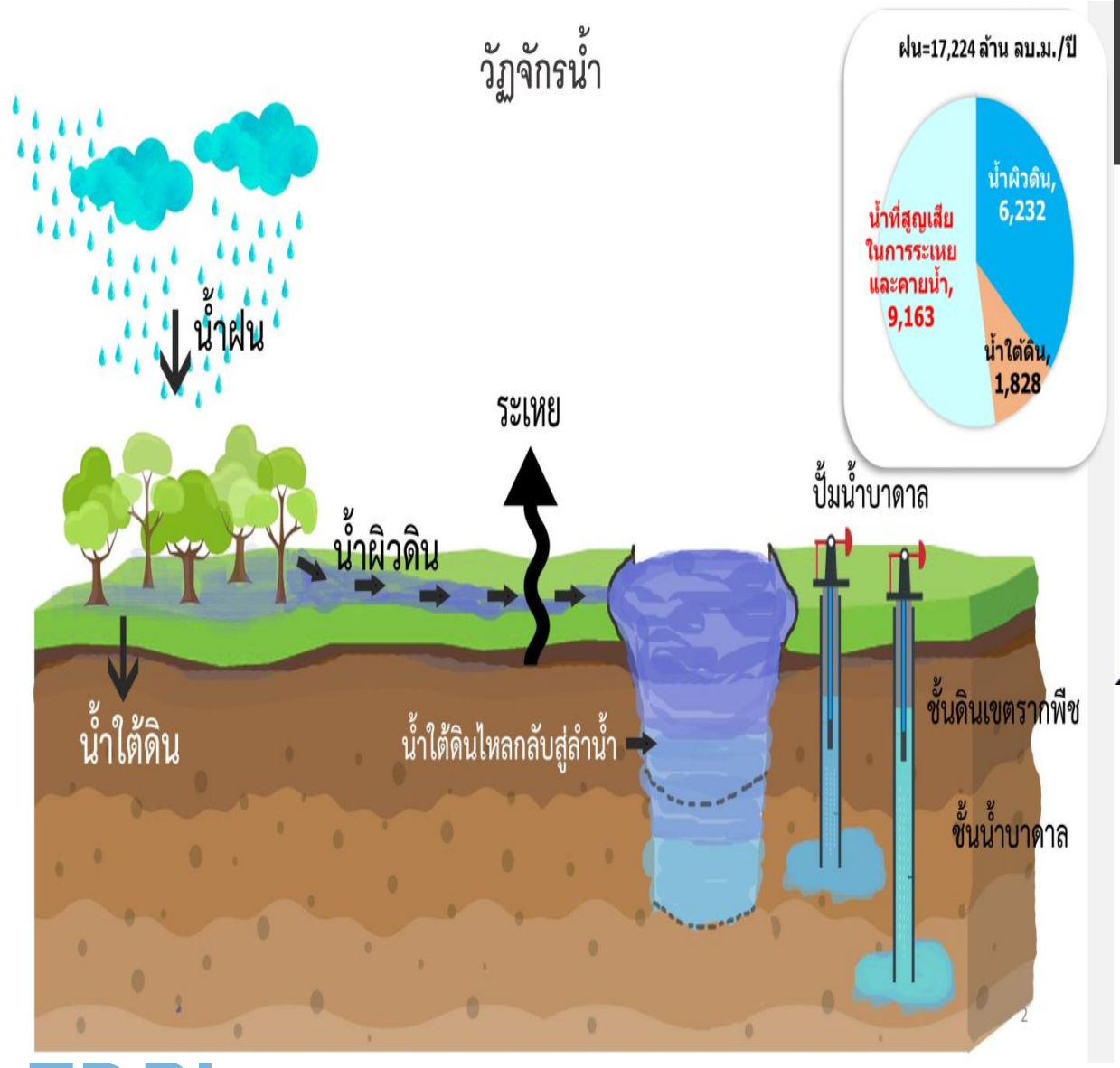
4. Conclusion and policy questions (cont.)

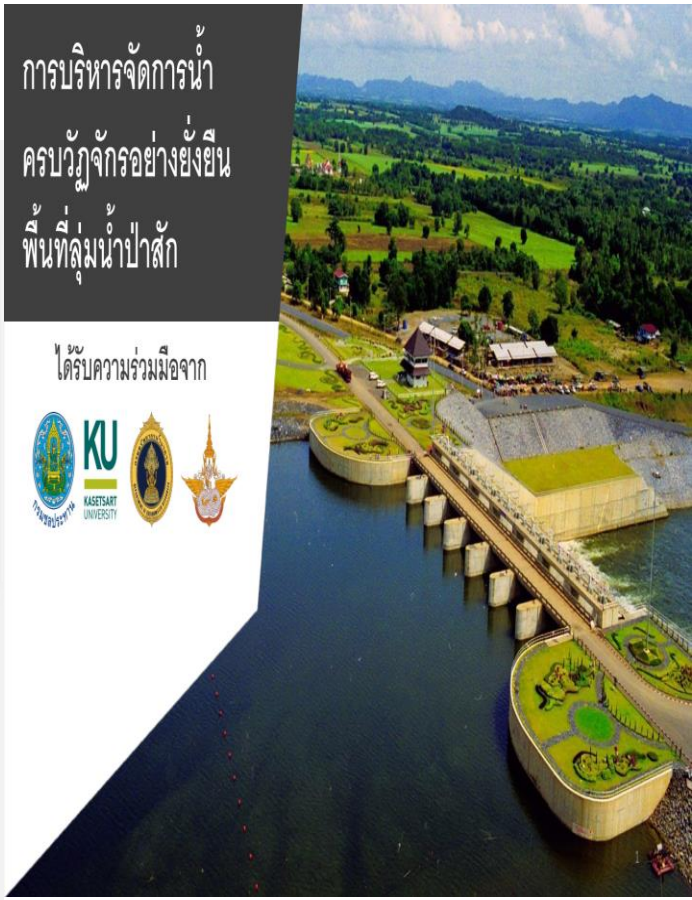
- **Yet the "de facto" water management structure remains the same, i.e., centralized and fragmented during the normal state**
  - **Such structure, together with legal rigidities with not provide incentive or pressure for government agencies to initiate "adaptive" water management, which is the necessary approach to cope with climate change**
- **During the emergency state, the use of an old concept of "ad hoc committee" will not enable us to successfully create a resilient and sustainable disaster planning and actions**
  - **No real "professional single commander (CEO)"**
  - **Ad hoc committee has no institution memory**
  - **Land use planning, one of the most important means to deal with flooding, has not yet been initiated**

4. Conclusion and policy questions (cont.)

- **Except the investment in the information system and capacity building of OWNR, very little investment in the adaptive capacity of both government agencies and water users**
  - **Existing capacity of officers in water management agencies is also very weak because most, if not all, projects, FS and EIA studies are contracted out to private consulting firms**
- **Moreover, most investment is in hard – structure & engineered infrastructure**
  - **Only a negligible investment is in the natural and man-made infrastructure, e.g., the Pasuk Full Hydraulic Cycle and Sustainable Water Management project by 4 agencies**
    - **See figure on Pasuk Hydrologic cycle Project**

Hydrologic cycle in Pasuk Project





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4. Conclusion and policy questions (cont.)

- **Take home policy research questions**
  - **A) Demand management and water security:**
    - **Why do many people still believe that the concepts and practices of water demand allocation and regulation, inherited from the situation of open-access resource, should continue to prevail? (Francois Molle 2001)**
      - **Should the water regime of "riparian rights" particularly the deficit basins such as Chao Phrya delta, be challenged and adapted in response to climate change?**
    - **What should be the priority policy research issues?**
      - **Water rights allocation and trading, water pricing and equity issues, or the wholesaling of water and a contractual binding between RID and water users, etc.?**
  - **B) Despite a popular call for "a single commander" to handle the crisis, why don't the government and decision makers adopt such an approach which is widely and successfully practiced in many countries? …is it cultural or politics or institutional issue?**

4. Conclusion and policy questions (cont.)

- **Take home policy questions (cont.)**
  - **C) What is the optimal institutional design for Thai climate adaptive water management?**
    - **More decentralized like the Dutch? More power at river basin like FRANCE?**
    - **Or mixed administration system like Japan?**
  - **One of the major pain-points in research and policy decision is the lack of and access to government data and information**
    - **What are the measures, incentive and disincentive that can effectively pressure the government agencies to streamline the information system and provide open access to the public?**
  - **Last but not least, given the difficulties and resistance to embrace the new adaptive and sustainable water management institution, there is a need for the innovative participatory research method and advocacy process:**
    - **Randomized controlled trial and participatory research, involving water users, and researchers from different disciplines working on the same issue in a program research**
    - **Gradual reforming and testing in pilot areas**
    - **Proactive advocacy process and in-depth awareness building**

ขอบคุณครับ

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