SCB EIC

How would Thailand 's agricultural sector navigate through the erratic rainfall?

23 January 2024

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KEY SUMMARY

Thailand has grappled with both droughts and floods over the recent years.

Thailand witnessed a series of extreme weather events throughout the year in 2023. During Jan-Aug, many regions faced below-average rainfall attributed to the El Niño phenomenon. In contrast, the subsequent two months (Sep-Oct) experienced a considerable upswing in rainfall brought by the monsoon trough, which helped mitigate the impacts of El Niño. These unusual rainfall patterns resulted in a severe drought in early 2023, followed by substantial floods towards the end of last year.

"Droughts and floods" will result in agricultural loss of around THB 50,000 million, particularly in Central Thailand.

The agricultural sector is highly vulnerable to variations in water levels, as either insufficient (drought) or excessive (flood) water can disrupt overall plant growth and productivity. Based on SCB EIC assessment, the combined impact of "droughts and floods" in 2023 will result in agricultural loss of at least THB 51,700 million—comprising THB 19,300 million in 2023 and THB 32,400 million in 2024. Sugarcane will bear the most significant damage, followed by off-season rice, in-season rice, and cassava. In terms of regional impacts, the Central part will suffer the highest loss, followed by the Northern, Northeastern, and Southern regions.

Erratic weather menaces the Thai economy and exacerbates inflation risks.

The damage incurred to the agricultural sector in 2023 and this year affect Thailand's economic growth and inflation. SCB EIC assessed that direct impacts on Thai agriculture and indirect effects linked to other sectors will shrink Thailand's economic growth by -0.34 percentage points (pp) compared to the base-case scenario without "droughts and floods." This can break down to -0.13pp and -0.21pp in 2023 and 2024, respectively. Besides economic damages, extreme weather could also drive a surge in crop prices and heighten inflationary pressures in 2024. In particular, the escalating prices of sugar and rice will likely contribute to a 0.3pp increase in inflation this year through second-round effects from higher ready-made food prices (prepared food at home and food away from home).

2 Approaches and 3 Mechanisms to Enhance Water Security in the Agricultural Sector

Unprecedented damages caused by droughts and floods underscore the alarming threats of rising global temperatures. This year and beyond, Thailand will be at risk of further challenges from droughts and flooding. To proactively address such challenges, SCB EIC proposes 2 approaches along with 3 mechanisms to enhance water security for Thailand's agricultural sector. **1) Improve Water Supply Management Efficiency** by enhancing water infrastructure with a short-term focus on small-scale water storages such as ponds, and a long-term focus on large- and medium-scale reservoirs as well as water distribution systems. **2) Improve Water Use Efficiency (Demand)** through measures to conserve soil moisture, modify irrigation systems, and enhance crop cultivation practices, such as adjusting crop planting schedule—all of which can be implemented as immediate measures in the short term.

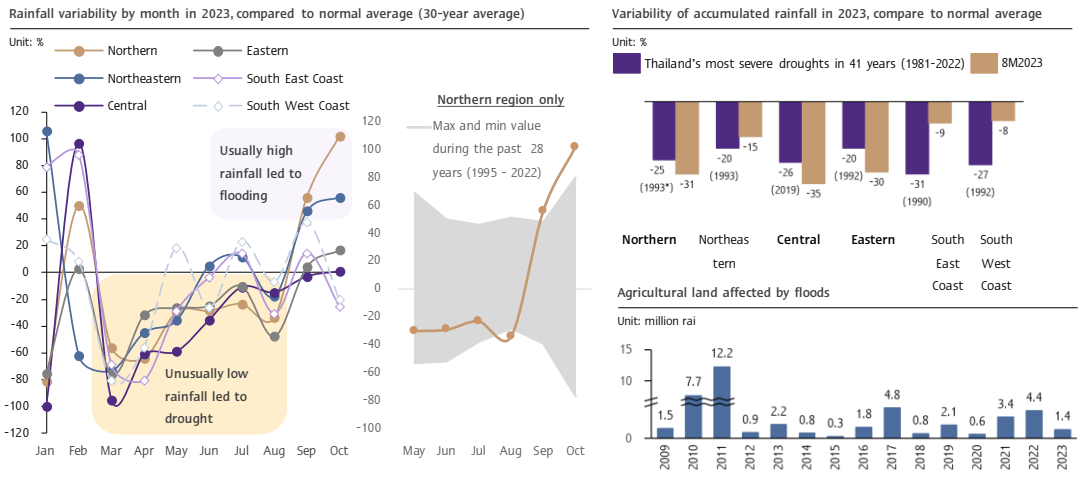
Successful implementation of the 2 approaches requires robust support from 3 mechanisms: (1) Policy Mechanism including the enforcement of the organic laws under the Water Resources Act, higher budget for water infrastructure development, and R&D funding in water technology; **(2) Financial Mechanism** such as facilitating credit access for farmers seeking to enhance water management and developing crop insurance systems; and **(3) Data Mechanism** by harnessing digital technologies for effective data collection, connection, and analysis to enhance water management efficiency**.**

The success of these approaches and mechanisms lies on collaborative efforts among stakeholders, including the government, private sector, civil society, and farmers. Active contributions from stakeholders to fortify water security will help Thailand's agricultural industry stay resilient and sustainably thrive in the face of intensifying climate change hazards.

Thailand faced the dual challenges of droughts and floods brought by erratic rainfall in 2023 (Figure 1). During Jan-Aug 2023, many regions across Thailand grappled with significantly **below**-average rainfall, notably the Central, Northern, and Eastern provinces. This sat in stark contrast to unusually **above**-average rain observed in the subsequent two months (Sep-Oct) over the Northern and Northeastern regions. For instance, Northern Thailand recorded a rainfall of 33.4% below the normal average during Jan-Aug and 79.1% above the average during Sep-Oct 2023—particularly in September when the rainfall volume marked its 28-year peak. This irregular precipitation resulted in a severe drought in the first eight months of 2023, as evident in accumulated rainfall dropping to its 41-year record low across the Central, Northern, and Eastern regions. Meanwhile, Thailand was hit by floods throughout the remainder of 2023, especially in the Northern and Northeastern parts, albeit with limited damage. According to the Ministry of Agriculture and Cooperatives, the cumulative flood

damage areas totaled 1.4 million rai (1 hectare is equal to 6.25 rai) as of Dec 2023—far below 4.4 million rai of damage recorded in 2022.

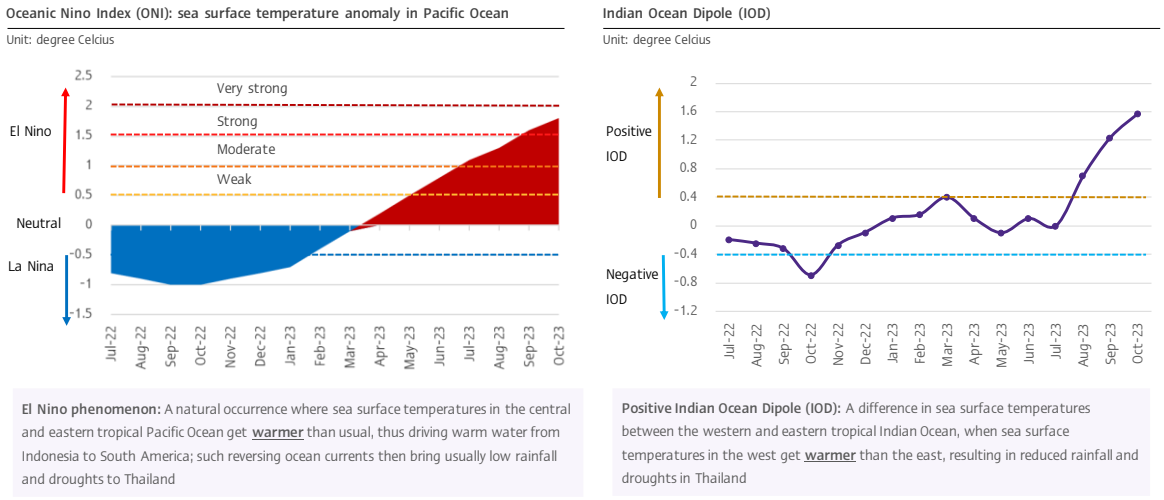
Figure 1: Thailand struggled with droughts and floods in 2023 due to highly erratic rainfall.



Source: SCB EIC analysis based on data from the Thai Meteorological Department and Ministry of Agriculture and Cooperatives

El Niño partly contributed to a below-average rainfall during May-Aug. Nonetheless, the monsoon trough brought heavy rain to Thailand in Sep-Oct, despite the influence of extreme El Niño and positive Indian Ocean Dipole (IOD) events. The Oceanic Niño Index indicates the onset of El Niño in May-Oct 2023 (which will likely last until mid-2024). The effects of the El Niño phenomenon brought drier weather and deficient rainfall to Thailand during May-Aug 2023. In contrast, the monsoon trough that traversed across the country in Sep-Oct resulted in unusually intense rainfall in many parts of Thailand, despite the influence of strong El Niño and positive IOD events—which typically lead to drier-than-average rainfall conditions s. This occurrence shows that the monsoon trough appears to offset the impacts of El Niño and positive IOD (Figure 2).

Figure 2: El Niño phenomenon led to reduced rainfall in Thailand during May-Aug. However, the influence of the monsoon trough contributed to heavy rain in Sep-Oct, offsetting the effects of El Niño and positive IOD.



El Nino phenomenon: A natural occurrence where sea surface temperatures in the central and eastern tropical Pacific Ocean get warmer than usual, thus driving warm water from Indonesia to South America; such reversing ocean currents then bring usually low rainfall and droughts to Thailand

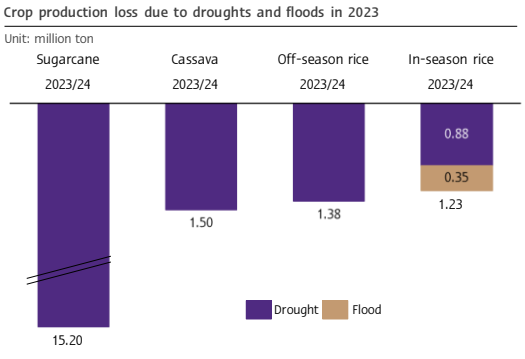
Positive Indian Ocean Dipole (IOD): A difference in sea surface temperatures between the western and eastern tropical Indian Ocean, when sea surface temperatures in the west get warmer than the east, resulting in reduced rainfall and droughts in Thailand

Source: SCB EIC analysis based on data from the International Research Institute for Climate and Society and Australia's Bureau of Meteorology

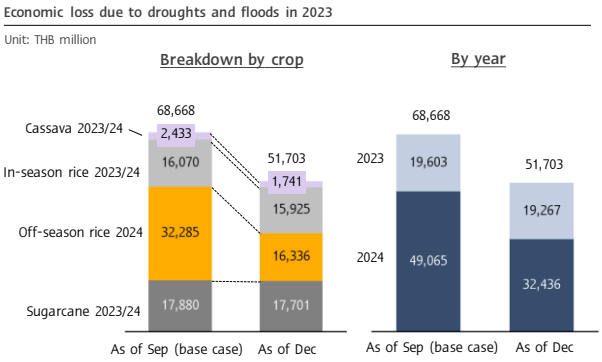
THB 50 billion in agricultural loss expected from "droughts and floods"

SCB EIC found that "droughts and floods" occurred in 2023 would result in over THB 51,700 million of agricultural loss. This can break down to THB 19,300 million in 2023 and THB 32,400 million in 2024. Deficient rainfall in 2023 will likely shrink sugarcane production for the 2023/2024 season (Oct 2023-Sep 2024) by 15.2 million tons compared to the base-case scenario (normal rainfall). This drought-induced decline equals an economic loss of THB 17,701 million (Figure 3). Sugarcane is among water-intensive crops often cultivated in upland fields, making it particularly vulnerable to water stress. Off-season rice production in 2024 is estimated to suffer 1.4 million tons of loss from droughts, equivalent to THB 16,336 million, as it is cultivated during the dry season and heavily relies on dam water from 2023. Meanwhile, in-season rice will likely incur less damage of around 0.9 million tons or THB 11,382 million during the 2023/2024 season, since most paddy fields are located in lowlands with abundant water. As for the drought-tolerant cassava, the production loss is expected to be around 1.5 million tons or THB 1,741 million in the 2023/2024 season, considerably less than the damages incurred by other crops. Regarding flood damage, SCB EIC assessment focuses on the impacts on in-season rice production due to significant damage and the availability of detailed data on flood-damange areas. According to the Ministry of Agriculture and Cooperatives data, around 0.9 million rai of in-season rice cultivation areas would be affected by floods, resulting in a production loss of around 0.4 million tons or THB 4,543 million. Based oncrop harvest calendar, we anticipate a 62% of total crop loss or THB 32,400 million to occur in 2024, with the remaining THB 19,300 million in 2023.

Figure 3: Sugarcane will incur the highest loss, followed by off-season rice, in-season rice, and cassava.



Estimated crop production loss vs. the base-case scenario (normal rainfall, no flood): The figure shows the potential impacts on crop production from droughts and floods in 2023; the calculation of flood-induced crop loss is based on affected farm areas, using actual data from the Ministry of Agriculture and Cooperatives.



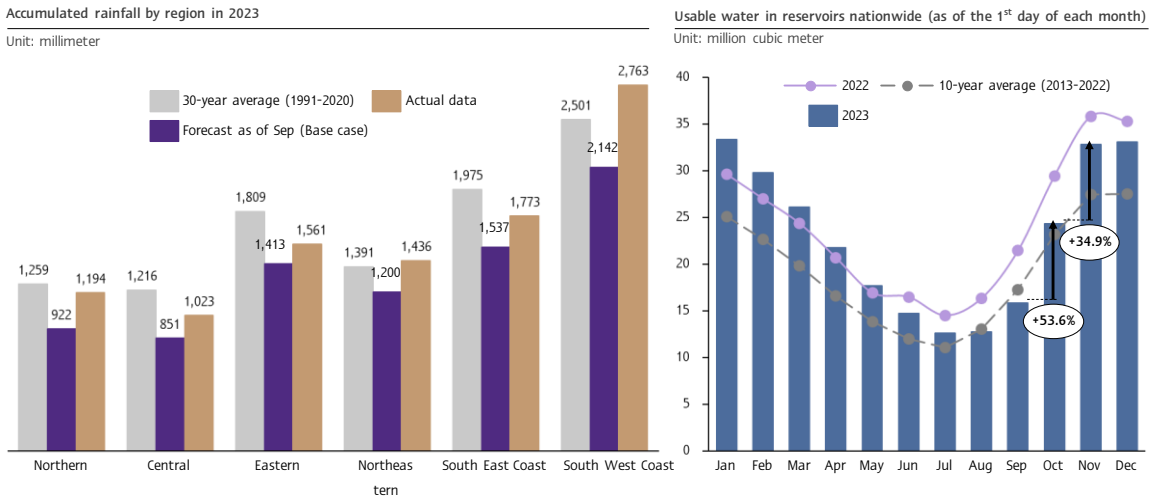
Estimated loss of each crop based on: the farm gate price of **off-season rice** in May 2023 (THB 11,844/ ton), the weighted average farm gate price of **in-season rice** in Aug 2023 (THB 12,949/ ton), most recent farm gate price of **sugarcane** (THB 1,162/ ton), the farm gate price of **cassava** in Aug 2023 (THB 2,780/ ton)

Source: SCB EIC analysis

The agricultural loss would be lower than our previous forecast in September, thanks to the monsoon trough that brought heavier-than-expected rainfall towards the end of 2023.

In Sep 2023, SCB EIC anticipated light rainfall for the remaining months of 2023 due to El Niño and positive IOD events. However, despite both natural occurrences, the data showed a significantly high rainfall in many regions induced by the unexpected influence of the monsoon trough. In our previous estimation, SCB EIC assumed that the effects of El Niño and positive IOD would not be entirely offset by the monsoon trough—a contrast to the actual developments. As a result, the rainfall observed during the end of 2023 exceeded our earlier forecast, leading to higher-than-expected water availability in reservoirs (Figure 4) and lower damages on off-season rice production in 2024.

Figure 4: Heavier-than-anticipated rainfall during the end of 2023 resulted in higher water availability in reservoirs.



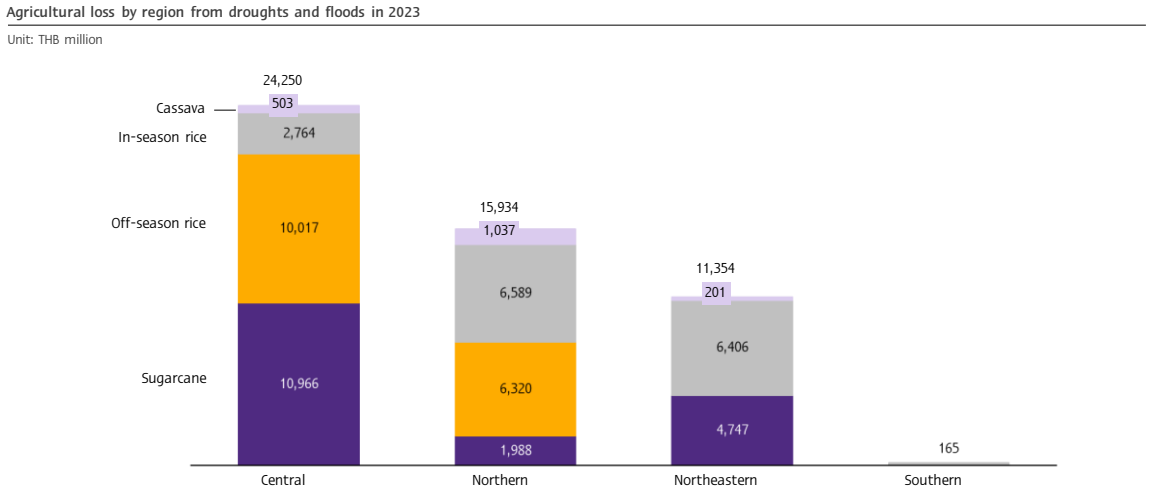
Source: SCB EIC analysis based on data from the Thai Meteorological Department and Ministry and National Hydroinformatics Data Center

The Central region to bear the brunt of agricultural loss.

Damages from droughts and floods will vary across regions. The Central region would face the most severe loss, followed by the Northern, Northeastern, and Southern regions.

The intensity of drought and flooding in each part also leads to varying degrees of damage severity. Central Thailand will likely incur the highest loss of around THB 24,250 million—primarily attributed to substantial damages to sugarcane and off-season rice production. Meanwhile, the Northern region would lose THB 15,934 million, mainly from damages to in-season and off-season rice yields. The Northeastern part will record around THB 11,354 million loss from significant damages to sugarcane and in-season rice production. Lastly, the Southern region is expected to incur a relatively modest impact of THB 165 million, primarily from damages to in-season rice production (Figure 5).

Figure 5: Drought and flood damages will vary across regions. The Central part will suffer the most severe agricultural loss, followed by the Northern, Northeastern, and Southern regions.



Source: SCB EIC analysis

Erratic weather menaces the Thai economy and exacerbates inflation risks.

SCB EIC estimates that the agricultural loss in 2023 and 2024 will impair Thailand's economic growth and accelerate inflation through direct effects from crop damages and subsequent indirect effects—including demand for agricultural inputs, such as chemical fertilizers and farm equipment. Indirect impacts also extend to sugar factories and rice mills, which primarily rely on farm crops as raw materials, as well as the sales of motorcycles and household appliances that are correlated with farmers' purchasing power. Based on SCB EIC assessment, the damage from droughts and floods will shrink the Thai economic growth by -0.34 percentage points (pp) in 2023 and 2024, compared to the base-case scenario without "droughts and floods." The contraction can break down to -0.13pp in 2023 and -0.21pp in 2024. Nonetheless, the estimated economic loss is -0.16pp lower than our forecast in Sep 2023, owing to higher-than-anticipated rainfall in late 2023. The increased availability of dam water will help cushion damages to off-season rice production this year.

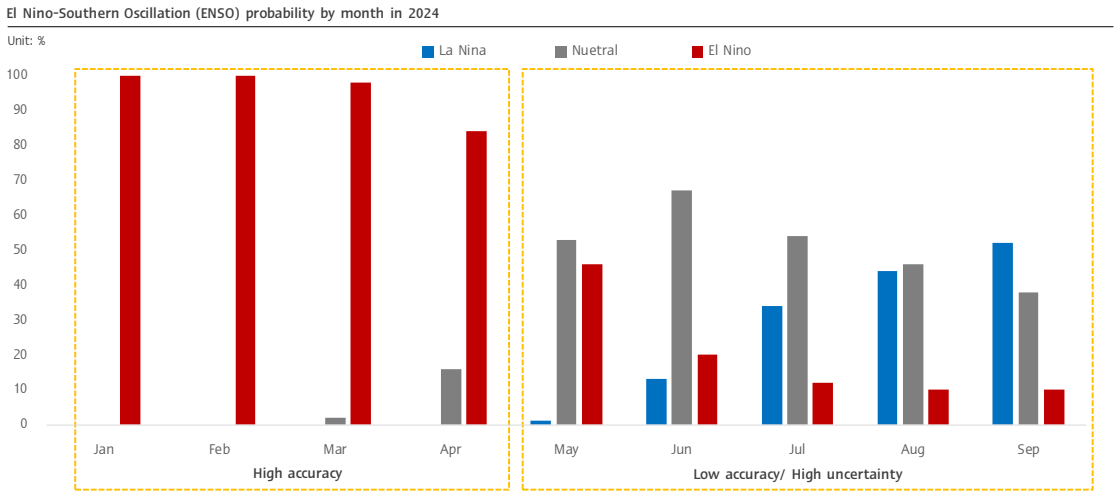
Aside from economic impacts and crop damages, volatile weather patterns also intensify inflation risks in 2024, driven by agricultural price surges—particularly rice and sugar. Both crops fall under the food and non-alcoholic beverage category, which make up around 5% of Thailand's inflation basket.[1] SCB EIC expects an increase in rice and sugar prices to elevate Thailand's headline inflation by approximately 0.3pp in 2024 through second-round effects from higher prices of ready-made food (prepared food at home and food away from home). Consequently, household expenses will become increasingly tightened in line with the rising prices of rice, sugar, and related food items.

Eyes on flood risk in the latter half of 2024

The prediction model of sea surface temperature suggests that the El Niño (drought) phenomenon will last until Apr 2024, followed by the onset of La Niña (excessive rainfall) around Sep 2024. Based on data from Columbia University's International Research Institute for Climate Society (IRI), the ongoing El Niño—which brought hot and dry weather to Thailand—is expected to conclude in Apr 2024. The probability of El Niño development stands at 84% in Apr before plummeting to 46% in May 2024. The latter figure falls below the ENSO-neutral state (53%), indicating a normal weather pattern across Thailand. These neutral conditions will likely persist until Aug, followed by the 52% chance of La Niña in Sep. Notably, this probability is higher than those of El Niño and ENSO-neutral states (Figure 6). The La Niña phenomenon will bring torrential rainfall to Thailand and potentially lead to flooding, a pattern observed previously in 2022 and during the severe flood in 2011. Nevertheless, it is important to note that long-range weather forecasts still carry a certain degree of uncertainty. The likelihood of La Niña will need further assessment in May 2024 for enhanced accuracy.

[1] SCB EIC analysis based on data from the Ministry of Commerce

Figure 6: El Niño phenomenon (drought) will conclude in Apr 2024, potentially followed by the onset of La Niña (excessive rainfall) in Sep 2024.

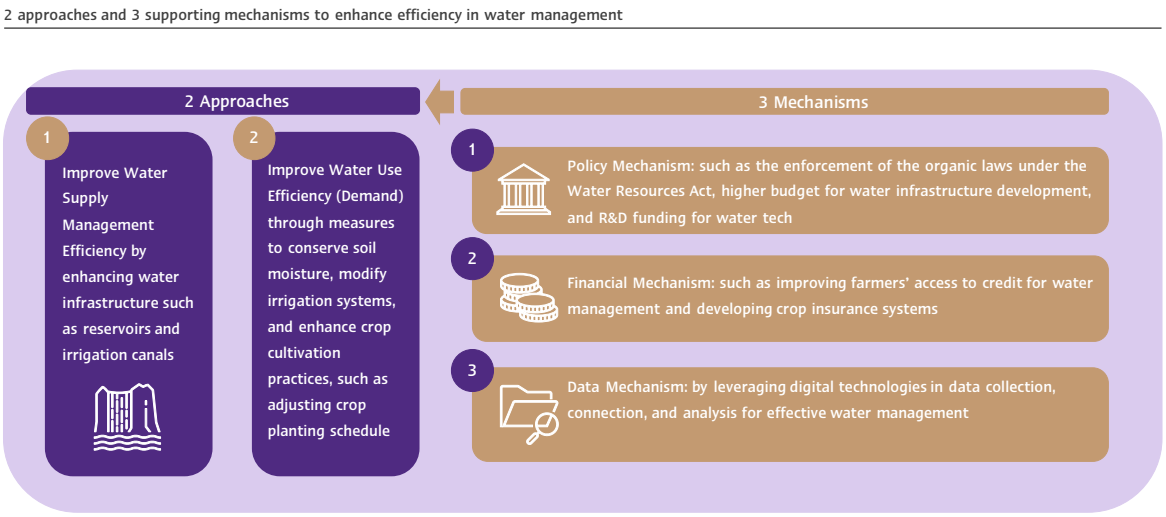


Source: SCB EIC analysis based on data from IRI

2 Approaches and 3 Mechanisms to Enhance Water Security in the Agricultural Sector

Agricultural losses caused by droughts and floods in 2023 underline the severity of global warming impacts. The rising global temperature has disrupted precipitation patterns, leading to erratic rainfall across Thailand. Over recent years, we faced torrential downpours during the wet season and scant rainfall during the dry season. Such inconsistent rainfall patterns will negatively impact water availability in each period and potentially entail more frequent droughts and floods. These challenges will also put agricultural crops under threat and imperil the overall Thai economy. Yet, the past year's severe droughts and flooding are just a prologue of what could unfold. Should the global temperature continue to get warmer, **rainfall across Thailand will become even more erratic, thus exacerbating the threats posed by persistent and recurring floods and droughts. To address such challenges, SCB EIC presents 2 approaches and 3 mechanisms to enhance agricultural water security.**

Figure 7: SCB EIC proposes 2 approaches 3 Mechanisms to enhance agricultural water security.



Source: SCB EIC analysis

Approach 1: Improve water supply management efficiency by accelerating the development of infrastructure for water storage and distribution

1.1 Water Storage: Investing in water storage facilities will tackle the imbalanced temporal distribution of water resources. Water storage facilities can hold excess water during the wet season and provide a consistent water supply when the rain is scant. The storage can take various forms, including small- to large-scale reservoirs, brooks, swamps, canals, marshes, ponds, rain basins, and water tanks. As for a short-term strategy, we recommend prioritizing investments in small-sized water storage such as ponds, before expanding to large- and medium-sized facilities. Based on data from the Royal Irrigation Department in 2023, the storage capacity of large and medium-sized reservoirs across Thailand made up only 10.1% of average rainfall during 2012-2021. This suggests an untapped potential for expanding water storage capacity in Thailand. Furthermore, the survey of agricultural households by the Department of Agriculture Extension in 2022 indicated that only 0.28 million agricultural households have their own water storages (groundwater wells and ponds), and merely 0.31 million households have access to public water systems (swamps/ ponds, irrigation canals, rivers, and artesian wells). These figures represent 13.5% and 15.0% of total agricultural households in the survey, respectively.

1.2 Water Diversion System to redistribute excess water to deficit areas: The water diversion system can address the imbalanced spatial distribution of water resources, as it helps transfer excess water accumulated in water-abundant areas to those facing scarcity—thus effectively mitigating the impacts of flooding and water shortage. Various structures, including water pipe systems and canals, can be employed to build water diversion systems and ensure a balanced distribution.

Approach 2: Improve Water Use Efficiency (Demand) through measures to conserve soil moisture, modify irrigation systems, and enhance crop cultivation practices.

2.1 Soil Moisture Conservation can help reduce crop water requirements. Various methods can be employed to conserve soil moisture, such as covering the soil with mulches (straws, dried grass) and planting cover crops (such as legumes). Tillage reduction or no-till farming are other effective techniques to retain soil moisture. All the methods mentioned can be implemented as immediate measures in the short term.

2.2 Modifying Irrigation System can minimize crop water use. For instance, switching to dip irrigation systems or laser-land leveling will help reduce water loss from runoff, thus optimizing crop water use.

2.3 Enhancing Crop Cultivation Practices is another approach to fortifying agricultural water use efficiency and building resilience against erratic rainfall. Effective cultivation practices include shifting to less water-intensive crops, adopting alternate wet and dry irrigation methods, and adjusting planting schedules in correspondence with changing rainfall patterns.

Successful implementation of the 2 approaches requires a firm stakeholder synergy, supported by 3 mechanisms:

1. **Policy Mechanism** is a crucial foundation to achieve efficient water management. The Thai government has already taken steps to initiate policy mechanisms aimed at improving the efficiency of water resource management. For instance, the Water Resources Act was enforced in 2018 to establish a comprehensive framework for effective and coherent water resource management. Nonetheless, a study from the Thailand Development Research Institute[2] highlighted the need for further legislation to address gaps in water management as some organic laws under the Water Resources Act remained unenforced. Therefore, it is necessary to **accelerate the enactment of organic laws**, such as water allocation and water use regulations, to foster a cohesive mechanism for inter-agency collaboration. Besides legislative mechanisms, other policies to enhance water management include **incentivizing farmers to improve water-use efficiency** through subsidy conditions**, allocating higher investment budgets for water infrastructure development, and providing R&D funding for water tech startups or research on drought- and flood-resistant crops.**
2. **Financial Mechanism** also plays a pivotal role in supporting good water management through **credit access for farmers** to invest in critical areas such as water storage or agricultural land leveling. **The crop insurance system** is another financial mechanism that

[2] More details in 'The Study on System Innovation, Infrastructure, and Mechanism of Thailand's Water Resource Management'

assists farmers in managing risks associated with erratic precipitation. A study by Sommarat Chantarat[3] emphasizes that Thailand exhibits potential and feasibility in developing an effective agricultural insurance system. This can be achieved through various measures, such as building agricultural risk data and nurturing insurance literacy among farmers.

3. **Data Mechanism** is fundamental to drive efficient water management. Technological and digital advancements have enabled the rapid collection, storage, connection, analysis, and transfer of water data—offering high-quality and detailed insights at the regional level. Below are cutting-edge data technologies that could enhance water management:

   I. **Data Collection Technology:** This encompasses water level sensors, drones used in monitoring water resources, and weather satellites. The satellites can capture detailed information about weather developments, such as the formation and movement of storms, and real-time conditions of water sources and cultivation areas across the country. Leveraging these technologies enables the identification of plot-level water budgets and disaster risks, including droughts and flooding.

   II. **Big Data Technology:** Big data is designed to handle large volumes of data at more cost-effective rates. This technology facilitates the collection of diverse data sets related to water management, including rainfall, water levels at various storage facilities, and soil moisture—all in a digital format. The digitized data can be readily utilized for fast and efficient analysis, allowing the timely implementation of water management strategies based on comprehensive insights.

   III. **Data Connectivity Technology:** Internet and mobile networks can link various electronic devices, thus allowing the seamless flow and transmission of data. For instance, water level data collected from sensors can be transferred to a central computer system, while weather data and flood alerts can be sent directly to farmers' mobile phones.

   IV. **Data Analysis Technology:** Data analysis technologies such as artificial intelligence (AI) are instrumental in analyzing water flows, developing highly accurate flood forecasting systems, and improving rainfall predictions. The analysis outcomes would enable Thai farmers to plan cultivation schedules efficiently, implement crop protection measures, and make more informed decisions in the face of erratic weather patterns.

[3] Sommarat Chantarat, A New Perspective on Agricultural Risk and Development of Sustainable Agricultural Insurance System

Climate change presents ongoing and unprecedented challenges that warrant close monitoring. With escalating damages from extreme weather, it is crucial for Thailand to establish proactive measures with all stakeholders onboard—from government agencies to the private sector, civil society, and farmers. Collaborative efforts to enhance water management will be pivotal in fostering resilience and paving the way towards the sustainable growth of Thailand's agricultural sector.

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