

4. Technology action plan

According to the barriers and the possible solutions discussed above, the technology action plan for each selected technology option has been divided into three phases, namely short term (3 years), medium term (5 years) and long term (5 years). In addition, an estimation of the funding needed for each phase is also proposed as follows (Table 51-53):

Table 51 Technology action plan and activity timeline

Item	Barrier	Timeline Activity		
		Short-term	Mid-term	Long-term
Capacity	• Lack of skilled human resources	• Training and workshop	• Continuous human resource development (a series of training courses)	
	• Lack of the high performance hardware and central apparatus room	• Purchasing hardware	• Hardware maintenance and upgrade	
	• Lack of data for climate change modeling	• Collecting/purchasing relevant data including (but not limited to) GCMS, weather observation, climate, observation data from foreign institutions/data centers	• Improving the quality and quantity of the data to increase the capability for regional-scale modeling	
	• Lack of experience in using climate change models	• Support for Thai technical staff to train at foreign institutes which have technical assistantship agreements • Supporting a joint research effort between a Thai institute and a foreign technical partner	• Offering scholarships to support Thai staff to continue their higher education abroad, especially at foreign institutes which have technical assistantship agreements, in fields relevant to climate change modeling	
	• Highly sophisticated nature of the model for weather forecasting • Inadequacy of region-specific parameters needed for accurate and precise modeling, especially for tropical climate forecasting	• Promoting more study and calibration efforts to improve the precision and accuracy of the model	• Keeping up with the model's developments and advancements • Calibrating and configuring the model to suit Thailand's tropical climate	

Item	Barrier	Timeline Activity		
		Short-term	Mid-term	Long-term
Regulatory	<ul style="list-style-type: none"> • Unavailability of detailed operational policy • Lack of adequate governmental policy to support the center's establishment 	<ul style="list-style-type: none"> • Issuing policy to facilitate the data center's operation. • Establishing more governmental assistance 	<ul style="list-style-type: none"> • Developing and implementing the detailed operational policies 	<ul style="list-style-type: none"> • Evolved policy that fully supports the effective operation of the data center
	<ul style="list-style-type: none"> • Legal and administrative limitation on data disclosure and access 	<ul style="list-style-type: none"> • Proposing policy or legislation promoting data disclosure and cross-agency coordination • Preparing data transfer agreements with foreign agencies/institutes 	<ul style="list-style-type: none"> • Developing agreements and partnerships with foreign agencies/institutes 	
Institutional	<ul style="list-style-type: none"> • Lack of cooperation and communication between the involved institutions • Lack of data exchange among governmental agencies, private companies, academic institutions, and the nonprofit organizations 	<ul style="list-style-type: none"> • Improving integrated national data exchange and management protocols 	<ul style="list-style-type: none"> • Continuous development and refinement of integrated national data exchange and management protocols 	<ul style="list-style-type: none"> • Increasing institutional capacity, management and organizational experience through cooperation with international data centers
	<ul style="list-style-type: none"> • Lack of data storage 	<ul style="list-style-type: none"> • Establishing a national data center to collect information, both domestically and internationally 	<ul style="list-style-type: none"> • Developing the national data center by giving it the potential to support database expansion 	<ul style="list-style-type: none"> • Database expansion • Improving the quality and performance of the data center
	<ul style="list-style-type: none"> • Lack of effective data collection in Thailand 	<ul style="list-style-type: none"> • Coordinating with all the related governmental agencies to collect data domestically 	<ul style="list-style-type: none"> • Increasing the capacity of the coordination center by collecting data from both the public and private sectors 	<ul style="list-style-type: none"> • Integrating data collected from all sectors

Item	Barrier	Timeline Activity		
		Short-term	Mid-term	Long-term
Economic	<ul style="list-style-type: none"> Lack of the required budget for the establishment and operation of the national data center 	<ul style="list-style-type: none"> Coordinating with the government to support the data center infrastructure Recruiting support from the organizations holding primary responsibility such as the Thai Meteorological Department, National Disaster Warning Center and NSTDA Collaborating with international climate data centers such as NCDC, NCAR, and NCDC 	<ul style="list-style-type: none"> Recruiting support from secondarily responsible parties interested in climate and weather data collection such as Chiang Mai University and KMUTT Collaborating with both national and international organizations for data center development 	
	<ul style="list-style-type: none"> Lack of funding 	<ul style="list-style-type: none"> Applying for financial support from both domestic and foreign funding agencies 		<ul style="list-style-type: none"> Welfare for support. Climate change Adaptation in Thailand
	<ul style="list-style-type: none"> Lack of a budget for human resource development 	<ul style="list-style-type: none"> Each organization provides a budget for training of its staff 		

Table 52 Estimation of the funding needed for the technology action plan

Item	Barrier	Short-term Funding Plan (THB)		Mid-term and Long-term Funding Plan (THB)	
Capacity	• Lack of skilled human resources	• Training data center management • Training data management • Data center maintenance	1,000,000	• Continuous human resource development (a series of training courses)	2,000,000
		• Training and workshop with the WRF developer or domestic and international WRF experts: 1. Basic WRF 2. WRF-Var 3. MET	1,000,000	Continuous human resource development by keeping up with WRF upgrades and advancements	2,000,000
	• Lack of a central apparatus room	• Building server room	5,000,000	• Hardware maintenance and upgrade	5,000,000
	• Lack of data for climate change modeling	• Collecting/purchasing the relevant data including (but not limited to) GCMS, weather observation, climate, observation data from foreign institutions/data centers	10,000,000	• Improving the quality and quantity of the data to increase the center's regional-scale and global-scale modeling potential	5,000,000
	• Lack of experience in using climate change models	• Supporting Thai technical staff to train at foreign institutes which have technical assistantship agreements • Supporting a joint research effort between a Thai institute and a foreign technical partner	5,000,000	• Offering scholarships to Thai staff to pursue higher education abroad, especially at foreign institutes which have technical assistantship agreements, in fields relevant to climate change modeling	5,000,000
Institutional	• Lack of data storage	• Establishing a national data center to collect information, both domestically and internationally	10,000,000	• Developing agreements and partnerships with foreign agencies/institutes.	5,000,000

Table 53 Estimation of funding needed for purchasing/transferring data from various data centers around the world

Institution	Country	Data Collection	Conditions for Collecting Data	Required Funding (THB)
1. Beijing Climate Center	China	GCM data Climate data Weather data Observation	Partnership Data exchange	10,000,000
2. Canadian Center for Climate Modeling and Analysis	Canada			
3. National Centers for Environmental Prediction (NCEP)	USA			
4. National Center for Atmospheric Research (NCAR)	USA			
5. Korea Meteorological Administration	Korea			
6. Geophysical Fluid Dynamics Laboratory	USA			
7. Japan Meteorological Agency	Japan			
8. UK Met Office	UK			
9. The Bureau of Meteorology	Australia			